Pedestrian Safety and Potential High-Risk Groups in Large Central Cities: Issues, Tools, and Policy

Task 1 – Literature Review
FINAL

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1. INTRODUCTION: PEDESTRIAN CRASHES AND HIGH-RISK POPULATION GROUPS IN LARGE CENTRAL CITIES

Walking is a basic part of our daily activity. We are pedestrians during at least a portion of every trip – whether we walk to work, move from a parking lot to an office, transfer from a train to a bus, or walk as a way of exercising. As a result of substantial efforts aimed at improving safety in recent years, there has been a marked decline in the number of pedestrian fatalities and injuries over the past few decades. According to Traffic Safety Facts 2006, the number of pedestrians killed from pedestrian-vehicle crashes in the United States decreased by roughly 12 percent (from 5,449 in 1996 to 4,784 fatalities in 2006).

During this same ten-year period, pedestrian injuries declined from 82,000 to 61,000 (a 26 percent decrease).

These figures seem to suggest that the efforts of federal, state and local governments to improve pedestrian safety have been effective. However, while a multitude of efforts has been instituted, evaluation has been sparse. As a result, it is not clear that this decrease in pedestrian fatalities and injuries resulted eventually from these safety initiatives. It is also true that the level of pedestrian exposure to traffic has also decreased by a large margin since more people are now driving. The 2007 National Transportation Statistics showed that the number of pedestrian trips to work fell by 26 percent, from 3.9 million in 1997 to 2.9 million in 2005; by contrast, vehicle miles traveled (VMT) increased by 17 percent, from 2.6 million to 3 million miles during the same period.

In addition, at least one study indicates that the decrease in pedestrian fatalities could be attributable to improvements in pre-hospital and emergency medical care. Likely, the decrease in pedestrian fatalities and injuries is related to a combination of these factors, and possibly others as yet unidentified.

Whatever the causes, and despite the decline in pedestrian fatalities and injuries, walking as a mode of transportation is still one of the more dangerous modes. A study by the Surface Transportation Policy Partnership (STPP) estimated that in 2001, the fatality rate per 100 million miles walked was 20.1 for pedestrians, compared to only 1.3 fatalities per 100 million miles traveled for personal cars/trucks, and 0.8 for public transit.

1.1. Pedestrian Safety in Large Central Cities

With their large populations, higher densities, and greater tendency toward walking as a key mode of transportation, large central cities must struggle daily with how to ensure the safety of their pedestrians. Pedestrians in large central cities continue to have a higher risk of being involved in pedestrian-vehicle crashes than other areas of the country. While the combined population of the 31 cities in the United States with populations exceeding 500,000 in 2006 accounted for roughly 12.7 percent of the total U.S. population, their share of pedestrian fatalities was approximately 17.4 percent. The overrepresentation of large cities in pedestrian fatalities and injuries has not changed much in over a decade. In addition, in 2006, 27 of the 31 largest central cities in the United States were in the top 100 cities with respect to pedestrian fatality rates. Phoenix, AZ showed the highest (3.9) among those 31 largest cities, followed by Albuquerque, NM (3.6), Detroit, MI (3.2), and Washington, DC (2.9). (Indianapolis, IN (1.3), Columbus,

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2 Ibid.


6 USDOT, NHTSA, NCSA, Traffic Safety Facts 2006, Table 121 Persons Killed, Population, and Fatality Rates by City, pp. 174 – 177. Fatality rates and ranks were calculated based on this table.

7 Ibid.
OH (1.2), Boston, MA (1.2), and El Paso, TX (0.7) were the four cities with populations over 500,000 that were not on the top 100 list.8)

1.2. Pedestrian Safety and High-Risk Groups
Just as people in large central cities are overrepresented in pedestrian fatalities and injuries, some groups are at higher risk as well. A 2006 study conducted by the NYU Wagner Rudin Center for Transportation Policy & Management, in conjunction with the National Association of City Transportation Officials, Inc. (NACTO), found that among the pedestrian groups that have been identified as having a potentially higher risk than the broader population are older adults (aged 65 and over), children, and the disabled, as well as Hispanics and African Americans.9 However, whether those population groups are truly at higher risk and why this risk exists are not entirely clear in some cases. The risk may be the result of higher exposure as pedestrians. Moreover, high-risk groups are not necessarily the same in different cities. In some cases, risk may be related to higher exposure because certain groups walk more than others. In other cases, there may be specific design issues that make certain groups more prone to being involved in pedestrian-vehicle crashes.

In this context, the goal of this study is to identify accurately these potential high-risk groups and describe the tools for reducing their risk as well as the means for increasing safety among the broader population. The specific objective of Task 1 is to review the relevant documents on pedestrian safety published through various venues, and build a foundation for Task 2 – Qualitative Information Collection on Pedestrian Safety. A number of documents, including government agency reports, research studies by academic and nonprofit organizations, educational materials and other relevant papers were reviewed for Task 1, and are summarized in the remainder of the document.

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2. HIGH-RISK POPULATIONS – IDENTIFICATION AND POTENTIAL FACTORS

The term “high-risk population” in this study is defined as a segment of the population which is overrepresented in pedestrian-vehicle crashes. While the term “high-risk population” is not often used in pedestrian safety-related studies and discussions, a substantial amount of work has determined that some population groups are more at risk than others. In general, the studies reviewed point out that children (15 years and younger), older adults (65 years of age and older), people with disabilities, and certain races and ethnicities are overrepresented in pedestrian-vehicle crashes.

Throughout the literature review, high-risk groups generally fall into three different areas that overlap: (1) those associated with age; (2) those associated with disabilities; and (3) those associated with race and/or ethnicity. In the following sections, studies on such population groups are presented in order of the amount of information found: children, older adults, people with disabilities, Hispanics, African Americans, and Native Americans. Some researchers consider impaired pedestrians (i.e., alcohol-impaired, drug-impaired) to also be a high-risk population. While data does indeed demonstrate that impaired pedestrians are more often involved in crashes than non-impaired individuals, alcohol and drug use span age groups, and race and ethnicity. While important, impairment as a result of drug or alcohol consumption is therefore a transient contributing factor and is discussed as a contributing factor related to the other high-risk populations identified, rather than as a separate category.

2.1. Children

For children (those between 5 and 15 years old), the number of pedestrian fatalities and injuries declined dramatically (by about 48 percent) between 1996 and 2006. This decrease was much greater than the average across all age groups (25 percent) during the same period. Despite this decrease in the number of fatalities and injuries, children are still considered to be at higher risk in the literature as a result of continued overrepresentation in pedestrian-vehicle crashes. Indeed, children between the age of 5 and 15 still accounted for 20 percent of all pedestrian fatalities and injuries in 2006, even though as a group they represented only 15 percent of the total U.S. population. In addition, the share of pedestrian fatalities from total traffic fatalities is higher for children. Roughly 20 percent of children under the age of 9 who were killed in traffic crashes were pedestrians, which is much higher than the national average for all ages (11 percent).

Further disaggregation of this population group by age and gender yields interesting findings, suggesting that it may be specific groups of children who are at higher risk. For example, when dividing the age groups into younger children (5 – 9 years old) and older children (10 – 15 years old), it was found that the injury rate per 100,000 population in 2006 for older children was roughly twice as high as that of younger children. An analysis using the same data set also found that fatality and injury rates of male children between 5 and 9 years old are three times as high as those of female children. Why male children are more likely to be involved in crashes is not clear. One possible explanation can be found in a study by Granié: after interviewing 162 children, she found that girls are more compliant of rules than boys. However, there may be other factors that are not yet identified. Indeed, according to Hoffrage et al., many studies have found no significant differences between boys and girls when controlling their exposure time to traffic.

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10 USDOT, NHTSA, 2006 Traffic Safety Fact Sheets: Pedestrian (Washington, DC: US Department of Transportation, 2007), Table 1 Pedestrians Killed and Injured by Age Group, p. 4.
12 USDOT, NHTSA, NCSA, Traffic Safety Facts 2006, Table 95 Persons Killed or Injured and Fatality and Injury Rates per 100,000 Population, by Age and Sex, p. 129.
14 USDOT, NHTSA, NCSA, Traffic Safety Facts 1996, Table 95. Persons Killed or Injured and Fatality and Injury Rates per 100,000 Population, by Age and Sex, p. 129.
15 Ibid.
Race and ethnicity appear to be associated with increased risk for children. Using national data from 1993 to 2003, a study by Safe Kids Worldwide found that the pedestrian fatality rate for African American children was higher (1.69) than all other groups, followed by American Indian/Alaskan Natives (1.35), and then Hispanics (1.24) (Table 1). A higher fatality rate among African American children was also found from a descriptive analysis by Hilton.\(^\text{18}\) When considering gender and race at the same time, the same study found that African-American boys, ages 14 and under, had the highest fatality rate between 2001 and 2003, while White girls showed the lowest rate.\(^\text{19}\)

### Table 1. Child (age 14 and under) Pedestrian Fatalities in the United States, 1999 to 2003

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Deaths</th>
<th>Population</th>
<th>Fatality Rates (deaths per 100,000 persons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American</td>
<td>842</td>
<td>49,710,579</td>
<td>1.69</td>
</tr>
<tr>
<td>American Indian/Alaskan Natives</td>
<td>56</td>
<td>4,169,126</td>
<td>1.35</td>
</tr>
<tr>
<td>Hispanic</td>
<td>677</td>
<td>54,581,490</td>
<td>1.24</td>
</tr>
<tr>
<td>White</td>
<td>2,350</td>
<td>235,252,351</td>
<td>1.00</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>90</td>
<td>12,927,827</td>
<td>0.69</td>
</tr>
</tbody>
</table>


#### 2.1.1. Potential Risk Factors

As observed in the previous section, even in the same age group, some children may be at higher risk than others. Similarly, causal factors associated with this risk also vary. The studies reviewed in the following paragraphs examine various factors associated with child pedestrian-vehicle crashes.

**Reasoning Abilities/Temperament.** While many factors affect child pedestrian-vehicle crashes, some studies suggest that children are more likely to be at higher risk due to the fact that children’s decision making abilities are not fully developed. Indeed, as early as 1970, Piaget noted that children between the ages of 5 and 7 years old are unable to effectively problem-solve when presented with multiple variables simultaneously.\(^\text{20}\) Yet, as pedestrians, individuals are constantly faced with such situations (i.e., crossing streets requires simultaneous judgment on vehicle speed, gaps between vehicles, the surrounding physical environment, etc.). Since children’s reasoning abilities vary by age, Connelly et al. examined children grouped by age (5 – 6 years, 8 – 9 years, and 10 – 11 years old) to assess the relationships between their street-crossing decision-making behavior and age.\(^\text{21}\) Not inconsistent with Piaget’s findings, Connelly et al. found that the majority of participating children “did not consistently make safe crossing decisions” in terms of selecting appropriate gaps (that is, the spacing between vehicles) to cross streets.\(^\text{22}\) Interestingly, the study found that the youngest age group showed much more conservative gap selection behavior (i.e., selecting longer gaps) than other groups did.\(^\text{23}\)

Contradicting these findings, however, is another study, by Yong and Lee, which found that with repetitive and guided practice in crossing streets and in selecting proper gaps, 5-year-old children showed improvements in their capability to select appropriate gaps – even attaining results similar level to adults.\(^\text{24}\) Barton and Schwebel’s review suggests many studies have found that children between the ages of 5

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\(^{22}\) Ibid.

\(^{23}\) Ibid.

and 10 display “adult-like” abilities in handling “multiple stimuli.” Such contradictory findings suggest that there other factors might be causing children’s higher exposure risk.

One possibility may relate more to children’s individual temperaments than to their reasoning abilities. Indeed, Hoffrage et al., examined “the individual differences in children’s risk proneness.” Examining 44 boys and girls between the ages of 5 and 6, Hoffrage and his colleagues classified them as risk-takers or risk-avoiders. The study concluded that regardless of age, risk-takers tend to make more risky decisions by, for example, selecting smaller gaps when crossing. A similar result was found by Barton and Schwebel who examined 120 children, ages 6, 8, and 10. They found children with lower impulse control are more likely to make risky street crossing decisions, again regardless of age.

**Neighborhood Environmental Factors.** Several studies have identified neighborhood environment and socioeconomic factors as contributing to higher risk among children. For example, LaScala examined environmental factors related to child pedestrian crashes in four communities in California. The study found that higher rates of child pedestrian-vehicle crashes are associated with higher youth population densities, higher unemployment, lower household income, and higher traffic flow. This result implies that socioeconomic characteristics and the built environment of neighborhoods are important factors to include when assessing the risk of certain groups of children.

Even though it did not examine actual risk or exposure, a study by Safe Kids Coalitions compared differences in the perception of neighborhood environments between high-risk and low-risk children. The study, conducted in ten U.S. metropolitan areas (Chicago, IL; Dallas, TX; Memphis, TN; Milwaukee, WI; New York City, NY; Oakland, CA; Oklahoma City, OK; Orlando, FL; St. Louis, MO; and Tampa, FL), surveyed two focus groups (African-American boys and their parents as a high-risk population group; and White girls and their parents as a low risk population group). It then compared “the attitudes, beliefs, and behavior patterns,” of the two groups. The study revealed that more negative perceptions of their neighborhoods could be found among high-risk children and their parents. In particular, it was noted that they felt they lacked pedestrian-friendly facilities. More data will be needed to determine whether this perception is, in fact, a reality. If it is, then one reason for the higher risk among these children is poor investment in pedestrian facilities in their neighborhood. Moreover, if the higher risk stems from lower investments, the risk may be related more to socioeconomic status than to these children by virtue of their age group.

**2.1.2. Mechanisms to Address Child Pedestrian Safety**

**Multi-faceted Approach at the Neighborhood Level.** Together, the studies suggest that addressing child pedestrian safety likely requires a multifaceted approach. While education may help in some cases, dealing with neighborhood environments may be needed in others. Moreover, the community environment may need more than a transportation engineering approach. The study by Safe Kids Worldwide resulted in a stark finding. Many African American boys and their parents/caregivers pointed out that “crime” influences their walking behavior. A number of children in the focus group said that they would rather cross the street at mid-block, even knowing it is not as safe as crossing at the intersection, than have eye-contact with and/or pass by groups of people on the street to get to the corner. In other words, the children in crime-ridden neighborhoods who were surveyed were more afraid of possibly becoming victims of crime than possibly being hit by an oncoming car. Pedestrian safety measures alone may not counter such behaviors. Instead, such situations might necessitate a multi-agency approach to address safety issues beyond transportation.

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25 Barton and Schwebel, op. cit.
26 Hoffrage et al., op. cit.
27 Ibid.
28 Barton and Schwebel, op. cit.
30 Ibid.
32 Ibid., p. 2.
33 Ibid., p. 6.
34 Ibid., p. 6 – 7.
35 Ibid., p. 4.
36 Ibid., p. 6 – 7.
Role of Safety Education. As a means for improving child pedestrian safety, some have suggested education programs for school-age children. Education programs targeted at children appear to be prevailing in most states and local municipalities around the country. For example, Safe Routes to School (SRTS) is a federally sponsored program that has resulted in initiatives in each of the 50 states and the District of Columbia. The program has provided funding for a variety of activities, including education programs, engineering solutions, enforcement, and encouragement strategies. However, the effectiveness of SRTS has not been well studied yet (it has only been federally supported in the United States since 2005, although the first program was introduced in the Bronx, New York City in 1997). For example, a study by Boarnet et al., found that the SRTS program in California increased walking and biking to school substantially. Although this study measured the effects of street design changes and SRTS education programs on child pedestrian and bicycling activities, it did not specifically address whether the programs increased child pedestrian safety.

In a report by Dragutinovic and Twisk, the authors reviewed studies that evaluated pedestrian safety education programs. While safety education has often been employed as a measure for improving child pedestrian safety, few studies actually assessed their effectiveness on reducing the number of pedestrian-vehicle crashes. Instead, most studies focused on the performance of participants in terms of knowledge they gained.

Even among those studies examining the performance of students who have participated in safety education programs, findings are contradictory.

Berry and Romo evaluated the efficacy of a pedestrian education program called “Cyrus the Centipede” on children’s pedestrian safety knowledge and self-reported engagement in safe pedestrian behaviors. They found that, in general, the level of safety knowledge of students in classes taking the education program was higher than students in classes not taking the program. However, the study also found that one of the groups not taking the program also showed increased knowledge in their test results and the performance of one class taking the program did not change. After surveying participating students, the authors found that the program itself may not have been a factor in increasing the safety knowledge of participating students. Instead, the performance of students appeared to be related to who delivered the classes.

Although there are several studies suggestive of safety education having improved children’s safety behaviors, Schieber and Vegega argue that the results of these studies are not convincing. In many cases, other external variables may have been involved (e.g., engineering countermeasures and legal enforcement), and were not factored in when analyzing the effectiveness of the education programs. Thus, it is difficult to say for certain that receiving safety education training positively influences children’s street crossing behavior. In other words, children’s knowledge of safety does not necessarily translate into them behaving more safely. Of concern, Campbell et al., suggest that child pedestrian safety education may even do more harm than good since it often gives parents a false sense of security by

39 Ibid.
42 Boarnet et al., “Evaluation of the California Safe Routes to School Legislation.”
44 Ibid., p 3.
45 Ibid.
46 Berry and Romo, op. cit.
47 Ibid.
48 Ibid.
49 Schieber and Vegega, op. cit.
50 Ibid.
boosting their perception that “their children have better pedestrian skills and habits than they actually have.”51

Finally it is important to consider how an education program is conducted. Educational activities that use videos, games, workbooks and other classroom-like activities may provide increases in knowledge but very few behavioral changes. Research shows that the way to achieve behavioral change is to incorporate practice and reinforcement of the targeted behaviors into the curriculum, much as Yong and Lee described in discussing the 5-year old children who showed improvements in street crossing abilities after guided and repetitive practice.52

2.2. Older Adults

In 2006, older adults (age 65 and over) accounted for 20 percent of total pedestrian fatalities, the highest among all age groups.53 Older adults are clearly overrepresented in pedestrian fatalities, considering their population share is only 12 percent.54 Moreover, older adults are more likely to die from crash injuries than “younger adults might survive.”55 Indeed, 2006 data shows that the fatality rate per 100,000 population for older adults age 65 and over was 60 percent higher than the national average for all ages, while their injury rate was 20 percent lower than the national average.56 When only considering older adults over 75 years old, the fatality rate was 80 percent higher than the national average; worse yet, the fatality rate of older adult men over 75 years old was 2.5 times as high as the national average.57

Pedestrian safety for older adults is a particularly important issue in large central cities. The older adult population is expected to grow to roughly 20% of the total U.S. population by 2029, and almost 77% of all older adults lived within metropolitan areas in 2000 (an increase from 1990), and the share is expected to continuously grow.58 For example, Nicaj et al., compared pedestrian deaths in New York City to the national data between 1998 and 2002 and found that: (1) older adults (65 years and older) accounted for 38 percent of pedestrian deaths in New York City, compared to the national average of 22 percent; and (2) the death rate for the oldest age group (over 85 years old) was 2.5 times higher in New York City than the national average.59

2.2.1. Potential Risk Factors

Several studies have pointed to a combination of risk factors for older adults, including slower walking speeds, diminished sensory perception, lag in reflexive responses, and lowered physical resilience. Oxley et al., points out that the deterioration of executive function, which is often associated with increasing age, can affect walking in several ways: (1) slower walking speed; (2) deteriorated balance and agility; (3) narrower angle of foot movements; (4) slower reaction time; (5) decreased ability of quick visual scanning; (6) age-related changes in decision making abilities; and (7) hearing problems.60

Among these factors, slower walking speed is one of the more troublesome for older adults. A survey by Langlois et al., of 1,231 people between the ages of 72 and 105 in New Haven, Connecticut, showed that most older adults have difficulty crossing streets: approximately 81 percent of the survey participants reported that they felt the time provided for pedestrian signals was insufficient for them to cross streets,

52 David S. Young and David N. Lee, op. cit.
53 USDOT, NHTSA, NCSA, Traffic Safety Facts 2006, Table 95 Persons Killed or Injured and Fatality and injury Rates per 100,000 Population, by Age and Sex, p. 129.
54 Ibid.
55 Campbell et al, op. cit., p. 49.
56 USDOT, NHTSA, NCSA, Traffic Safety Facts 2006, Table 95 Persons Killed or Injured and Fatality and injury Rates per 100,000 Population, by Age and Sex, p. 129.
57 Ibid.
65 percent said that they had difficulty dealing with right-turning vehicles, and 78 percent stated that they needed help to cross streets.\textsuperscript{61}

In addition to their walking speed, the cognitive ability of older adults may influence their behavior when crossing streets. Oxley et al., conducted experiments to examine how age affects safe road crossing decisions when selecting appropriate gaps – that is, the perceived distance of an oncoming car from a participant and the perceived speed of an oncoming car.\textsuperscript{62} Three groups of participants (younger: 30-45 years, young-old: 60-69, and old-old: over 75 years) were tested in a simulated road-crossing environment.\textsuperscript{63} Findings were consistent with past studies, indicating that age is associated with an increase in risky decisions to cross roads. That is, the oldest group (>75 years) most frequently made unsafe decisions (i.e., selected smaller gaps) when crossing streets, especially considering their slower walking speed (more than twice as slow as the young group) and slower reaction-times to oncoming traffic (about 80 percent as slow as the young-old group). By contrast, individuals in the young-old group (60-69 years) made more conservative decisions than the old-old group (> 75 years).\textsuperscript{64}

However, a study by Lobjois and Cavallo contradicts the findings from Oxley’s study. When they conducted a similar experiment with a different classification of age groups (20-30, 60-70, and 70-80 years old), no association between unsafe decisions and age was found.\textsuperscript{65} Instead, elderly participants made safe decisions by selecting larger gaps to compensate for their slower walking speed, thereby ensuring enough time to cross streets.\textsuperscript{66} It is possible that the different grouping of the participants made a difference (> 75 in Oxley et al., vs. 70-80 in Lobjois and Cavallo).

Of note, both studies agreed that most participants made street crossing decisions based on the perceived distance from an approaching car, not the speed of the car. It seems a common perception that “the further the car is away from me, the safer it is to cross.”\textsuperscript{67} Interestingly, the perception of speed is also affected by age. A study by Scialfa et al., for example, found that there are age differences in estimating vehicle speeds between age groups (young adult: 20-27 years, middle age: 40-54 years, and older adults: 55-74 years); however, the study pointed out such differences were not indicative of older adults being at higher risk.\textsuperscript{68} That is, older adults overestimated lower speeds (15 mph), resulting in more conservative estimation than other age groups. In addition, older adults underestimated higher speeds (65 mph), but their estimations were more accurate than those made by younger age groups.\textsuperscript{69} Again, this finding suggests that the cause for the overrepresentation of older adults lies elsewhere.

### 2.2.2. Mechanisms to Address Older Adult Pedestrian Safety

As mentioned earlier, walking speed is one of the most critical problems for older adults when making decisions to cross the road. Thus, potential countermeasures that can compensate for their slower walking speed could be of help. According to Langlois et al., the extension of curb space, more walk signal time and/or the installation of pedestrian islands could be good engineering countermeasures.\textsuperscript{70}

Addressing other cognitive and physical challenges experienced by older adults, such as slow reaction times under complicated circumstances and inconsistent safety decisions when crossing roads, may require other measures. Effective education programs designed for older adults might help improve “the awareness of declining abilities” and provide them with strategies for measuring safety.\textsuperscript{71} However, again there is little proof that such programs translate from knowledge to usage.


\textsuperscript{62}Jennifer A. Oxley et al., “Crossing Roads Safely: An Experimental Study of Age Differences in Gap Selection by Pedestrians.” \textit{Accident Analysis and Prevention} 37, 5 (2005): 962-971.

\textsuperscript{63}Oxley et al., op. cit.

\textsuperscript{64}Ibid.

\textsuperscript{65}Ibid., p. 969.

\textsuperscript{66}Ibid.

\textsuperscript{67}Ibid.


\textsuperscript{69}Ibid.

\textsuperscript{70}Langlois et al., op. cit.

2.3. People with Disabilities

There are 43 million people in the United States with disabilities. Of particular importance, while children are generally overrepresented in pedestrian crashes, children with disabilities are even more at risk. According to Xiang et al., children with disabilities who walk or bicycle are more than five times more likely to be hit by a motor vehicle than children without disabilities.

While there are many types of disabilities, most literature on pedestrian safety for people with disabilities focuses on visually impaired pedestrians (those who are blind or have low vision). The American council of the Blind notes that “the blind and visually impaired are disproportionately represented in pedestrian crashes.” Though visually impaired individuals can walk around familiar streets with few problems, real challenges are often experienced when they need to travel on unfamiliar streets.

Complex traffic situations in large cities pose more inherent dangers to visually impaired pedestrians. According to the Association for Education and Rehabilitation of the Blind and Visually Impaired (AER), visually impaired pedestrians are generally educated to make a decision when to cross a road based on several criteria, including: the geometry of curbs, the sound of cars running parallel to crosswalks, and/or identification of the availability of accessible signal (e.g., pushbutton and audible signal with pushbutton). However, high traffic volumes in most urban areas, complex designs at intersections, and traffic signals geared toward automobiles can make it particularly difficult for visually impaired pedestrians to make good decisions when crossing streets in an urban environment. Furthermore, it is often difficult to distinguish the movement of parallel traffic as a result of the mix of noises on streets in urban areas. In particular, the existence of exclusive left turn lanes and uncontrolled right turn lanes have been identified as increasing risk for visually impaired pedestrians, since listening to parallel traffic, in such cases, does not provide an accurate assessment of danger. Lastly, the emergence of hybrid vehicles that are quieter than other vehicles poses new challenges for visually-impaired pedestrians, particularly in urban environments.

2.3.1. Mechanisms to Address Safety for People with Disabilities

The Americans with Disability Act mandates that all persons with disabilities have “a civil right to access to information provided to other pedestrians.” Nevertheless, the built environment in which we live is often not easily accessible for the disabled.

The AER surveyed its members who teach visually impaired people strategies for crossing streets, and summarized the nature and causes of difficulties in crossing roads at signalized intersections. The respondents pointed out that the existence of curb ramps made them difficult to recognize the boundary between the road and the walkway and the complexity of modern intersections only adds to their difficulty crossing the road. The study noted that some traffic control devices aimed at helping the visually impaired do not do so. For example, 94 percent of respondents responded that they have difficulty finding pushbuttons either because they do not have information on the signals with pushbuttons and/or the pushbuttons are located too far from the crosswalk. In addition, audible signals may not be helpful in noisy urban environments. Sometimes signal sounds are too quiet to hear; in other cases, people do not know in which direction they should walk. These studies suggest that in some cases, a design that makes sense for the general population may not necessarily function well for specific groups.

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76 Ibid.
77 Ibid.
78 Ibid., p. 32.
79 Ibid.
80 Bentzen et al., “Addressing Barriers to Blind Pedestrians at Signalized Intersections, p. 32.
81 Ibid., p. 33.
82 Ibid.
A study by Barlow et al., also supports the notion that pushbutton signals may not be effective tools for visually impaired pedestrians. Field tests conducted in three cities (Portland, OR; Cambridge, MA; and Charlotte, NC) showed that only 16.3 percent of visually impaired pedestrians could find pushbuttons and cross the road; none in Charlotte found pushbuttons. Of greater concern, the study found that 45.5 percent of those who found the pushbutton could not finish crossing the road before the light changed. Barlow et al., pointed out two problems:

- First, because of the location of the pushbuttons, visually impaired pedestrians spent a longer time finding the pushbutton;
- Second, once they found the pushbutton, they needed to take time to realign themselves back with the crosswalk to cross the road.

In other words, visually impaired pedestrians needed to divert from their initial alignment to find the pushbuttons, which then reduced the time they had for the walk signal.

The aforementioned studies imply that the location of signals with pushbuttons should be moved closer to the marked crosswalk and provide additional information regarding the location of pushbutton-actuated signals for visually impaired persons. However, other design and technology measures may still be needed to help visually impaired individuals locate the pushbuttons more quickly.

According to a report by the National Cooperative Highway Research Program, there are four types of accessible pedestrian signals (APS) that can be found.

- Pedhead-mounted signals. The most commonly used APS in the United States, these devices have speakers attached near the top of the signal. However, they are not easily heard unless one is immediately under the speakers.
- Pushbutton-integrated APS. Not as common in the United States, this APS features a speaker that is integrated with the pushbutton in the same area. Sound is more easily heard from this device, and a raised arrow points in the direction of the signal, further enabling visually impaired individuals to find the pushbutton and know which way to walk.
- Signal with vibration. Found in Europe, this type of APS. A raised arrow on the signal (may be with a pushbutton) vibrates for the Walk signal.
- Receiver-based technologies. Such technologies, which transmit Walk signal information to a personal individual receiver, are not in widespread use at this time.

While proper installation and use of appropriate signaling devices may be of help in preventing crashes between vehicles and people with disabilities, it should be noted that attention also needs to be given to the collection of quality data on the involvement of disabled persons in vehicle-pedestrian crashes. The 2002 National Transportation Availability and Use Survey, for example, provides information on the use of transportation and types of difficulties encountered by people with disabilities. However, the survey does not provide information on specific needs for certain types of disability. Indeed, the survey treats all disabilities as a singular challenge, even though there are multiple types of disabilities and needs vary

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84 Barlow et al., op cit., p. 594
85 Ibid.
86 Ibid., pp. 594 – 596.
89 Ibid.
90 Ibid.
across them. More importantly, there are no data sources that address the exposure of pedestrians with disabilities to vehicle-pedestrian crashes.

2.4. Hispanics

A 2004 study found that Hispanics accounted for 16.3 percent of all pedestrian fatalities nationwide, a higher share than expected since they only account for 12.5 percent of the total population.94 Similar trends were found by the Surface Transportation Policy Partnership (STPP).95 Further, while in 2001, the fatality rate for Whites was 1.78 per 100,000 population, for Hispanics it was as high as 2.88.96 However, the actual magnitude of the pedestrian safety risk for Hispanics may be greater than what has been formally reported in documents and studies. Participants in a focus-group study by Knoblauch et al., noted that crashes are likely underreported for Hispanic pedestrians because of fear of the police and illegal immigration status.97 Interestingly, while there has been increased focus in the literature on Hispanics as a high-risk group, many in the Hispanic communities around the country are unfamiliar with the statistics demonstrating their overrepresentation in pedestrian-vehicle crashes.98

The risk for Hispanic pedestrians may be higher in cities which typically have larger and more concentrated Hispanic populations. For example, Beck et al., found that in 2000 and 2004, Hispanics had pedestrian fatality rates in the Atlanta Metropolitan Statistical Area that were higher than the national average for the same period.99 Supporting results were found from the studies focusing on areas with higher Hispanic populations such as San Francisco and Los Angeles.100

2.4.1. Potential Risk Factors

While causal factors of higher fatalities and injuries are not clear yet, several possible reasons were identified in the literature review. First, socioeconomic characteristics may play a role in higher pedestrian fatalities and injuries among Hispanics. Loukaitou-Sideris et al., found that Hispanics were 60 percent more likely to be involved in pedestrian-vehicle crashes and higher fatalities were observed in areas with high-density and low income areas.101 According to this study, Hispanics tend to have lower incomes, show lower vehicle ownership, live in high-density areas with high traffic volumes, and walk more. As a result, they have much higher rates of pedestrian exposure to vehicles.102 Similarly, Voas et al., argues that economic status is important here; that is, Hispanics are more likely to be poor and are therefore less likely to own cars, resulting in higher rates of walking and public transit use.103 The National Household Survey (NHTS) supports their reasoning: in 2001, walking was a primary means for transportation for 11.8 percent of Hispanics, compared to 8.6 percent of Whites.104 Knoblauch et al., suggests that the issue may not really be related to Hispanics as a group at all, but may be more correlated to low socioeconomic status.105 Complicating the matter is that not all studies are able to or are careful about delineating among Hispanic Americans and recent immigrants.

96 Knoblauch et al., op. cit., p. 2
97 Ibid.
102 Toni Gantz et al., op. cit.
105 Traffic Safety Center, “Lives Still at Risk: A Look at the Groups that Traffic Safety Has Left Behind,” Online Newsletter 1, 4 (Fall
A second factor mentioned in the literature relates to cultural dimensions. One study pointed out that cultural differences, language barriers, lack of familiarity with traffic regulations in the United States, and lack of safety information (e.g., booklet, guides, advertising, etc.) may play a role. According to a focus group study conducted in Miami, FL; Los Angeles, CA; New York City, NY; and Washington, DC, some participants said that some signs are confusing, since they do not use international symbols. However, these studies appear to focus on Hispanic immigrants so again, the question must be asked in terms of whether the higher risk is related to something about the Hispanic population or to immigrant status.

A third factor noted in the literature relates to alcohol consumption. Leaf and Pressuer found that roughly 45 percent of Hispanic pedestrians were alcohol-impaired at the time of pedestrian-vehicle crashes (almost twice as high as White pedestrians (27 percent)). The reasons for higher alcohol involvement in pedestrian-vehicle crashes involving Hispanics are unclear, though several studies have found a higher cultural tolerance for heavy alcohol consumption among Hispanics. Hilton, for example, conducted a study based on the fatality data between 1999 and 2004 and showed that 47.5 percent of Hispanic drivers and 49 percent of Hispanic non-occupants (including primarily pedestrians and bicyclists) who were involved in crashes (including all types) were alcohol-impaired. These figures compare with 35.2 percent for Non-Hispanic White drivers and 39 percent for Non-Hispanic White non-occupants (Table 2).

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Drivers</th>
<th>Non-occupants*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Hispanic Whites</td>
<td>35.2</td>
<td>39.0</td>
</tr>
<tr>
<td>Hispanics</td>
<td>37.5</td>
<td>49.0</td>
</tr>
<tr>
<td>African Americans</td>
<td>38.4</td>
<td>47.0</td>
</tr>
<tr>
<td>Native Americans</td>
<td>57.5</td>
<td>69.4</td>
</tr>
</tbody>
</table>

Table 2. Percentage of Fatally Injured Persons Who Were Drinking (16 and over)

However, one still needs to be careful in making a causal link here as there are other reasons that Hispanics are more likely to be involved in alcohol-related crashes. First, Hispanics walk more in general (Table 3). Thus, they tend to have higher rates of exposure whether or not they have been drinking.

<table>
<thead>
<tr>
<th>Modes</th>
<th>Whites</th>
<th>Hispanics</th>
<th>African Americans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobile</td>
<td>87.6</td>
<td>83.1</td>
<td>78.9</td>
</tr>
<tr>
<td>Walk</td>
<td>8.6</td>
<td>11.8</td>
<td>12.6</td>
</tr>
<tr>
<td>Transit</td>
<td>0.9</td>
<td>2.4</td>
<td>5.3</td>
</tr>
<tr>
<td>Other</td>
<td>2.9</td>
<td>2.7</td>
<td>3.2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3. Mode Choice by Race/Ethnicity

The results of a national survey published by USDOT appear to support this possibility. When asked whether they had driven within two hours of drinking alcohol during a defined twelve-month period, 22

102 Knoblauch et al., op. cit.
104 Leaf and Preusser, op. cit; Traffic Safety Center, op. cit.
percent of survey participants said they had done so.\textsuperscript{111} Of note, while 25 percent of White participants responded with an affirmative to this question, only 13 percent of Hispanic respondents did so, suggestive of the possibility that Hispanics were more likely to find alternate travel modes like walking after drinking.\textsuperscript{112} Additional data is needed to more accurately assess this correlation.

\section*{2.5. African Americans}

African Americans are also frequently cited as experiencing higher rates of pedestrian injuries and fatalities. According to Ernst, between 1994 and 2003, 19 percent of pedestrian fatalities were experienced by African Americans, while their share of total U.S. population was only 12.7 percent.\textsuperscript{113} Higher concentrations of African Americans in certain areas may, as with Hispanics, influence their apparent overrepresentation.\textsuperscript{114} In San Francisco, for example, between 2001 and 2003, pedestrian injury rates for African Americans were two to three times as high as for other races and ethnicities.\textsuperscript{115}

\subsection*{2.5.1. Potential Risk Factors}

Again, in some cases higher risk may be the result of African Americans walking more. Roughly 12.6 percent of African Americans walk as a primary means for transportation, compared to only 8.6 percent of Whites who travel by walking (Table 3). Like Hispanics, alcohol involvement has been cited in the literature. As shown in Table 2, 47 percent of African Americans were alcohol-impaired when involved in pedestrian-vehicle crashes. Unlike Hispanics, however, the frequency of drinking and driving among African Americans was similar to that of Whites.\textsuperscript{116}

\section*{2.6. Native Americans}

Using data for Arizona from 1990 to 1996, Campos-Outcalt et al., computed the relative risk (RR) for pedestrian fatalities among different races and ethnicities.\textsuperscript{117} The RR is a measure of fatality risk when a risk for White is set 1. That is, if the relative risk for a certain race or ethnicity is 2, the fatality rate for that group is twice as high as for Whites.

According to Campos-Outcalt et al., the RR for Native Americans was 6 to 13 times as high as that of Whites, depending on location and gender.\textsuperscript{118} Interestingly, the RR for rural Native Americans was about twice as high as their urban counterparts.\textsuperscript{119} What is more striking is that the data showed that the fatality rate per 100,000 population for Native Americans in Arizona between 1990 and 1996 was 18.07; worse yet, the fatality rate for male Native Americans between the ages of 55 and 64 years old during the same period in Arizona was an astonishing 107.14.\textsuperscript{120}

\subsection*{2.6.1. Potential Risk Factors}

Most studies reviewed pointed to alcohol as the key risk factor for Native Americans.\textsuperscript{121} Table 2 shows the severity of the problem – roughly 60 percent of drivers and 70 percent of Native Americans pedestrians were alcohol-impaired at the time of pedestrian-vehicle crashes. While specific numbers and the locations of the studies varied, similar findings were found throughout the literature.\textsuperscript{122} Moreover, the frequency of drinking and driving among Native Americans was also high (average 39.3 times a year per person), suggesting that drinking may be an issue beyond pedestrians for Native Americans.\textsuperscript{123}

\begin{thebibliography}{99}
\bibitem{112} Ibid.
\bibitem{113} Ernst, op. cit., p. 20.
\bibitem{115} Scirtono and Chiapello, op. cit., p. 2.
\bibitem{116} Royal, op. cit., p. 99.
\bibitem{117} Campos-Outcalt, op. cit.
\bibitem{118} Ibid., Table 1. Annualized pedestrian fatality rates by gender, residence, and race/ethnicity, Arizona, 1990 - 1996, p. 131.
\bibitem{119} Ibid., Table 2. Urban and rural pedestrian fatality rates by race/ethnicity, Arizona, 1990 – 1996, p. 131.
\bibitem{120} Ibid., Table 3. Pedestrian fatality rates by age and race/ethnicity, Arizona, 1990 – 1996, p. 132.
\bibitem{123} Royal, op. cit., p. 99.
\end{thebibliography}
3. TOOLS AND PRACTICES FOR IMPROVING SAFETY FOR HIGH-RISK POPULATIONS

The previous section discussed the literature associated with high-risk populations. This section reviews several documents that touch upon design guidelines for pedestrian facilities as well as pedestrian planning activities and programs. This section does not provide detailed information, as that is the purpose of later tasks in this study; however, it does provide a brief synopsis of some of the relevant literature.

3.1. Design Guidelines for Pedestrian Safety Improvements

A number of documents have been published related to design guidelines aimed at improving pedestrian safety, though finding specifics related to high-risk groups is more difficult. Although in many cases these documents specify specific and formal design standards and/or requirements aimed at all pedestrians, some documents also provide guidelines for facilities for the disabled, but mostly for visually impaired pedestrians.124 For example, chapter 4E of the Manual on Uniform Traffic Control Devices (MUTCD) provides some specifications related to accessible pedestrian signals (APS) for the visually impaired and pedestrians using wheelchairs.125

Other supporting documents are published by groups like the Institute of Transportation Engineers. Their Design and Safety of Pedestrian Facilities is a compendium of 15 papers written by practitioners and academics.126 The papers describe various designs related to sidewalks, signals, pedestrian refugees, barriers, and transit stops. Of interest, one of the papers introduces information on types of facilities specifically aimed at people with disabilities, emphasizing that facility design should consider the special needs of people with disabilities.127 For example, sidewalks and signals need to be properly provided so that visually impaired pedestrians can locate signals easily; in addition, it notes that street furniture needs to be located so that it does not interfere with the movement of people with disabilities.128

In addition to these formal design and engineering documents, the literature review also identified several additional documents and websites that provide useful information for selecting countermeasures for addressing increased risk. USDOT’s Federal Highway Administration, for example, has a website that provides information on pedestrian planning, design standards, and guidelines, as well as additional links to other sites and documents.129 Harkey and Zegeer created a guidebook, PEDSAFE: Pedestrian Fatalities User Guide – Providing Safety and Mobility, sponsored by US Department of Transportation’s Federal Highway Administration (FHWA).130 Based on the guidebook, a website was created which includes the report and a user-friendly engineering countermeasure selection system for pedestrian safety improvements. Though it does not specifically address potential high-risk groups, the website does include 49 engineering, education, and enforcement countermeasures regarding design guidelines associated with pedestrian facilities, roadways, and intersections, and traffic calming, signals, and traffic management.131

The website of the National Center for Safe Routes to School is one of the best resources specifically aimed at a high-risk pedestrian population; in this case, it is designed for child pedestrians and bicyclists.132 As noted earlier, Safe Routes to School (SRTS) is a national and international program, which focuses on school-aged children. In the United States, SRTS is an FHWA Federal-Aid program, created by Section 1404 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users Act (SAFETEA-LU).133

125 Ibid.; The proposed revisions to the MUTCD currently open for public comment (as of April 29, 2008) are available at http://mutcd.fhwa.dot.gov/resources/proposed_amend/index.htm.
126 Institute of Transportation Engineers (ITE), Design and Safety of Pedestrian Facilities (Washington, DC: Institute of Transportation Planners, 1998).
127 Ibid.
129 Ibid.
According to FHWA, the SRTS programs need to incorporate the “5 E’s” of safety:

- **Engineering** to provide pedestrian-friendly facilities around schools and routes to school, which can improve walking and bicycling environments by reducing conflicts with cars;
- **Education** to teach children about safe behaviors when walking and bicycling, and to improve skills;
- **Enforcement** to maintain strict law enforcement on streets near schools and to foster “community enforcement such as crossing guard programs;”
- **Encouragement** to promote walking and bicycling through special events that attract children; and,
- **Evaluation** to monitor the efficacy of programs.\(^{134}\)

What the literature shows is that there has been attention to the first four E’s of safety, but program evaluation is in the early stages.

### 3.2. Examples of Pedestrian Safety Programs in Large Central Cities

Few published documents regarding pedestrian safety programs in large central cities are available, but information can be found on the websites of various city Departments of Transportation or equivalent units. The literature review began with the largest cities in terms of population. However, not every city maintains quality information on pedestrian safety in general, and on high-risk populations in particular. Thus, the summary of only a few cities are presented here. The order of the cities summarized in the following paragraphs is based on the quality of information available on their websites.

#### 3.2.1. New York City, NY

**Safe Routes to School.** New York City has implemented several education programs as well as engineering countermeasures. It has an extensive education and engineering program targeted at school-age children in its SRTS program.\(^ {135}\) New York City was the first city in the United States to implement SRTS in 1997.\(^ {136}\) As with the international and national programs, the purpose of this effort is to improve the walking and bicycling environments for school-age children. For this program, the City identified 135 priority school zones based on historical data and completed studies on potential countermeasures in each of them.\(^ {137}\) In addition, the City created several education materials, including maps, a safety guide, and a curriculum guide for educators.\(^ {138}\)

**Safety City.** Another program designed for children in New York City is “Safety City.” First launched in 1990, the program targets school children between the ages of 5 and 14 years old.\(^ {139}\) The purpose of the program is to reduce injuries and fatalities among child pedestrians.\(^ {139}\) Safety City offers a mix of classroom education and outdoor practice on simulated streets, and it teaches children how to safely cross streets in a variety of situations.\(^ {140}\) According to a study by the Columbia University School of Public Health, over the initial three-year period after the inception of the program, motor vehicle related child pedestrian injuries in the initial location the program was offered were reduced by 55 percent.\(^ {141}\)

**Safe Streets for Seniors.** To address the overrepresentation of the older adults in pedestrian crashes in New York City, a pilot program was begun in Brighton Beach. The City intends to expand this program across the City.\(^ {142}\) Additional information could not easily be found through the literature review.

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\(^ {137}\) Ibid.


\(^ {139}\) Ibid.

\(^ {140}\) Ibid.

\(^ {141}\) Ibid.


3.2.2. Chicago, IL

Chicago has a number of pedestrian safety-related programs. While most programs are targeted at the general population, at least one is particularly focused on children.

**Mayor Daley’s Safe Routes Ambassadors.** This is an education program targeted at child pedestrians and bicyclists. The Ambassadors meet with thousands of Chicago children each year and discuss both safe traffic behavior and the benefits of active transportation. The program consists of in-class lectures, on-foot training, and workshops for organizers. Together with education, this program also includes an enforcement and encouragement program, called *Drive Slowly, School Zone Yard Sign Campaign.* The campaign is designed to remind drivers that they are passing a school zone and need to follow a reduced speed limit of 20 mph.

**Safe Streets for Chicago.** In cooperation with the Chicago Police Department, the Chicago Department of Transportation and the Office of Emergency Management and Communications have a program to increase traffic and pedestrian safety more broadly in Chicago. The program includes a public awareness campaign about crosswalks, the creation of a pedestrian advisory council which discusses issues related to pedestrians, and the deployment of new police teams to enforce speed limitations.

3.2.3. Los Angeles, CA

**Watch the Road Program.** Aimed at reducing risky behaviors among all roadway users (drivers, bicyclists and pedestrians) through public education and awareness, this program is a multi-agency effort that includes: the Los Angeles School Police Department (LASPD), Los Angeles Police Department (LAPD), Los Angeles County Sheriff’s Department (LASD), California Highway Patrol (CHP), Los Angeles Department of Transportation (LADOT), Los Angeles County Superior Court Juvenile Traffic Division, Los Angeles City Council, Office of the Los Angeles City Attorney, and various Police Departments in the cities where Los Angeles Unified School District (LAUSD) schools are located. The program includes strict enforcement of traffic rules in order to reduce crashes by 10% over 5 years (the program began in May 2005).

**Straight Talk-Smart Walk.** Run by the County of Los Angeles, this program focuses on improving the safety of children between the ages of 5 and 18, as well as safety for seniors. The program includes education programs for promoting safe behavior as pedestrians and drivers. In addition, the website provides safety tips for the target population groups. In consideration of a high Hispanic population, program brochures are also provided in Spanish.

3.2.4. Boston, MA

**Access Boston 2000-2010.** A pedestrian safety plan developed in 2001, Access Boston has guidelines for residential streets and projects related to children and older adults are incorporated. Access Boston includes the description of pedestrian safety-related programs implemented in the past. One of the examples is the “Walk This Way” campaign, led by the Boston Public Health Commission and Boston’s Pedestrian Task Force. This was an educational campaign to encourage safe behaviors when crossing the streets. A before-and-after study showed that during the period, November 1999 to October 2000, the city’s number of pedestrian injuries decreased by 11 percent. Although the time period for comparison was short, the results were encouraging. However, no program specifically targeted for certain high-risk

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144 Ibid.
147 Ibid.
149 Ibid.
151 Ibid.
152 Ibid.
population groups was identified. The current status of the “Walk This Way” campaign could not be found from the literature review.

3.3. Summary
There are many causal factors for pedestrian-vehicle crashes, and in some cases high-risk populations share similar patterns and characteristics with the general population. In such cases, countermeasures aimed at the general population will also be of help for high-risk pedestrian groups. For example, curb extensions on busy streets can shorten the time for street crossings, helping slower walkers (older adults and people with disabilities), but also helping others as well. On the other hand, some countermeasures need to be tailored specifically to high-risk groups (e.g., like the pushbutton systems for the visually impaired). The information gathered during the initial literature review indicates that some countermeasures may not be as effective if the reasons for the higher risk (e.g., children in low income neighborhoods crossing mid-block because of fears related to crime), and/or the specific needs of the high-risk groups (e.g., pushbuttons in locations that compel the visually impaired to deviate from their initial approach to a crosswalk) are not well understood or addressed.
4. CONCLUSION AND NEXT STEPS

4.1. Conclusion
Task 1 reviewed a number of existing documents on pedestrian safety, with particular attention to potential high-risk population groups already identified in the literature. By definition, a high-risk group is one that is overrepresented in pedestrian injuries and/or fatalities. However, which groups are characterized as being at high-risk may vary to some degree across the nation, and may vary from city to city as well. Thus, which groups should be considered as being at higher risk specifically in large central cities will be addressed in Task 2.

When reviewing the available documents related to high-risk groups, it quickly became apparent that there is little consistency to how these groups are delineated. With respect to older adults, for example, the age ranges for the groups evaluated in several studies were not consistent. In other cases, as with Hispanics and persons with disabilities, the data is often not sufficiently disaggregated. For Hispanics, it is often unclear whether immigrants are being included in the datasets and whether there might be significant differences between immigrants and Hispanics born in the United States. Similarly, for people with disabilities, most studies are dedicated to visually impaired pedestrians. However, they only constitute one segment of this potential high-risk population, and their needs may be markedly different than others in this same broad grouping (e.g., paraplegics, developmentally delayed). The Rudin Center team hopes that discussions with representatives from large central cities may provide some insights into these shortcomings in the data.

With respect to potential countermeasures, the literature review demonstrated that there are a number of studies which focus on the identification of causal factors related to pedestrian-vehicle crashes, and several studies identified particular countermeasures (though primarily aimed at the general population). However, of note, few studies evaluate these countermeasures; more often, they are descriptive and even when they do demonstrate a reduction in fatalities or injuries, it is rarely clear whether there is clear causality related to the countermeasures.

Finally, no studies were identified in the literature review that specifically compared pedestrian safety for high-risk populations in large central cities. This highlights the uniqueness of this project and the value for practitioners of the expected outcomes from this study.

4.2. Next Steps
While further refining the literature review results, the Team will proceed to Task 2 – Qualitative Information Collection on Pedestrian Safety, the purpose of which is to collect information on pedestrian safety in large central cities. The Team will randomly select up to 9 large cities which have populations of 500,000 or more and will conduct a series of discussions. The purpose of this exercise will be to solicit input from public sector officials to identify: (1) issues related to pedestrian safety and data collection, and to initiating, implementing and evaluating pedestrian safety policies for high-risk populations; (2) tools – existing programs associated with public outreach/education, law enforcement, qualitative/quantitative data analysis, standardized guidelines – that cities have used and consider of value; (3) alternative policies that cities recommend for improving pedestrian safety for high-risk populations; and, (4) any other relevant suggestions and recommendations.

The Team will obtain input from the project’s Steering Committee, which consists of NACTO members from Chicago, New York City, and Washington, DC, and FHWA before formally conducting the interviews.
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