U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

NHTSA

DOT HS 813 747

May 2026

Low-Cost Pedestrian Safety Zone Case Study

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Suggested APA Format Citation:

Blomberg, R. D., Gelinne, D., Pullen-Seufert, N., Wright, T. J., Van Houten, R., Figueroa, A., Shahum, L., & Rosenthal, K. (2026, May). *Low-cost pedestrian safety zone case study* (Report No. DOT HS 813 747). National Highway Traffic Safety Administration. doi.org/10.21949/f53c-3t84

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
DOT HS 813 747			
4. Title and Subtitle Low-Cost Pedestrian Safety Zone Case Study		**5. Report Date** May 2026 **6. Performing Organization Code** 373	
7. Author(s) Richard D. Blomberg and Timothy J. Wright, Dunlap and Associates, Inc.; Dan Gelinne, Nancy Pullen-Seufert, and Alessandro Figueroa, University of North Carolina Highway Safety Research Center; Ron Van Houten, Western Michigan University; Leah Shahum, Vision Zero Network; and Kristin Rosenthal, NHTSA.		**8. Performing Organization Report No.** 373-1	
9. Performing Organization Name and Address Dunlap and Associates, Inc. 125 Edinburgh South Drive Cary, NC 27511		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** 693JJ921D000032/693JJ923F000223	
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration 1200 New Jersey Avenue SE Washington, DC 20590		**13. Type of Report and Period Covered** Final **14. Sponsoring Agency Code**	
15. Supplementary Notes Ruth Esteban-Muir and Kristin Rosenthal were the NHTSA project managers and contracting officer's representatives for this project. Digital Object Identifier: https://doi.org/10.21949/f53c-3t84			
16. Abstract A previous study by Blomberg and Cleven (1998) developed a pedestrian safety zone approach in Phoenix, AZ and Chicago, IL, focusing on pedestrian safety countermeasures in subsets of the cities that had experienced a high number of crashes involving people 65 and older. It proved efficient deploying countermeasures, significantly reducing the targeted pedestrian crashes in Phoenix. This original zone process, however, still needed significant resources to address the entire city, and required a relatively long time to plan and implement. The primary objectives of the present study included adapting the previous zones approach to be implementable quickly by cities using their resources and demonstrating the resulting low-cost pedestrian safety zones approach in several cities. Three cities—Gainesville, Florida; Kalamazoo, Michigan; and Saint Paul, Minnesota—agreed to demonstrate the low-cost zones approach. Each site prepared a case study report documenting the activities reported here. The approach showed to be flexible and effective in all three cities. The discussion section of this report includes ideas for supporting more widespread use of the technique.			
17. Key Words pedestrian safety, safety zones, case studies, low-cost safety zone, demonstration		**18. Distribution Statement** Document is available to the public from the DOT, BTS, National Transportation Library, Repository & Open Science Access Portal, https://rosap.ntl.bts.gov.	
19. Security Classif. (of this report) Unclassified	**20. Security Classif. (of this page)** Unclassified	**21. No. of Pages** 64	**22. Price**

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

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Acknowledgments

The authors appreciate the excellent support from other study team members. Thanks go to Mike Vann of the University of North Carolina Highway Safety Research Center (HSRC), who conducted much of the extensive GIS analyses that led to zone identifications at the three study sites. We are also grateful to Jonathon Weisenfeld, HSRC design services manager, who developed the excellent graphic design of the *Low-Cost Pedestrian Zone Eight-Step Handbook and Countermeasure Selection Guide* and video production.

The three demonstrations provided an excellent exercise of the low-cost pedestrian safety zones technique. The authors are grateful to the following people at each site with whom they interacted and to the others at the sites who supported the study.

- City of Gainesville Department of Transportation—Debbie Leistner, transportation planning and parking manager; Karla Rodrigues-Silva, Vision Zero coordinator; and Scott Wright, planner I.
- Kalamazoo, Michigan—Dennis Randolph, Kalamazoo public works manager; Ron Ridnour, traffic signal technician; and Matt Ampersee, traffic sign technician. Also, Jacob Engle, a doctoral student at Western Michigan University, collected data in supporting the project.
- Saint Paul, Minnesota—Jeremy Ellison and Kathleen Brown, police commanders; and Randy Newton, traffic engineer.

Although the study would not have been possible without the assistance of these and other people, groups, and agencies, the findings and opinions expressed in this report are those of the authors and not necessarily those of these contributors.

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Introduction

This report presents three case studies documenting the processes and outcomes in three cities that implemented a low-cost pedestrian safety zone approach, and it describes the background leading to the initiation of the demonstration study, the approach taken by the study, and the three case study reports. The final section discusses the lessons learned from applying the low-cost pedestrian safety zone approach in the three cities and their implications for future use.

Background

Much effort has been focused on analyzing the causes of pedestrian crashes and developing countermeasures to prevent them (Cleven & Blomberg, 2007). Many countermeasures, such as mass media education, are intended to be applied to an entire jurisdiction and, therefore, can be quite costly. Planning and implementation for countermeasure deployment on a wide scale, regardless of the countermeasure type, can also take significant time. Moreover, large-scale deployment is often not cost-efficient because the countermeasures may reach some areas and population groups not at high risk for the particular crash problem being addressed, while the most high-risk areas may be undertreated.

Many countermeasures, such as traffic calming, placement of traffic signs, and enforcement, can only be deployed at specific locations of high crash risk or previous high crash incidence. If these countermeasures can be accurately focused on known areas of high risk for the types of pedestrian crashes they are designed to counter, the result should be a significant localized crash reduction in a shorter time and at a lower cost—an efficient and cost-effective approach to add to the tools available to local safety practitioners. This is the philosophy behind the concept of low-cost pedestrian safety zones. The zone approach also aligns well with the Safe System Approach,[1] going beyond just "hot spot" treatment to offer a proactive, systemic strategy when applied across several zones.

Blomberg and Cleven (1998) first researched using zones to focus pedestrian countermeasure deployments cost-effectively in a study of pedestrian crashes among the older population (65 and older) in Phoenix and Chicago. They identified zones and deployed countermeasures in both cities but only conducted a complete crash-based evaluation in Phoenix. Data from Phoenix showed a statistically significant 46-percent reduction in crashes involving older (65+) pedestrians in the treated zones over a period when the city's population and overall pedestrian crashes increased. The Blomberg and Cleven (1998) study also produced a *Zone Guide for Pedestrian Safety* designed to assist programs in other cities in defining zones and applying the zone process to their pedestrian safety problems.

The zone approach to countermeasure deployment is a multi-step process intended to increase the efficiency of safety programs by focusing attention on locations with histories of crash problems or the existence of known crash risks, such as high vehicle speeds or the absence of adequate street lighting at night. The first step in the process is selecting the zone's crash focus. In the Blomberg and Cleven (1998) study, it was pedestrian crashes involving pedestrians 65 and older, but any subset of pedestrian crashes or the entire population of crashes could serve as the focal point of the process. The second step involves mapping the locations of the selected crash

[1]A list of terms with special meanings in the context of this report, including Safe System, is included in a section titled Important Terms after the case studies.

types and looking for clusters that can constitute potential zones in which appropriate countermeasures will reach the problem of interest. Step three involves selecting those zones identified in the second step that will be treated and selecting the countermeasures to be deployed. The availability of resources largely determines the number of zones selected, and the criteria for individual zone selection depend on the nature of the local problem and local considerations such as other planned safety activities. Step four involves planning, including the commitment of financial, personnel, and other resources, the development of a timetable, and the definition of process and product evaluation measures. The last step is implementation, including evaluation measures and feedback to assess the effectiveness of the zone approach and to guide improvements for future implementations.

Properly designed and implemented pedestrian zone programs have been proven effective in reducing crashes and injuries for older pedestrians (Blomberg & Cleven, 1998), for impaired pedestrians (Blomberg & Cleven, 2000), and for child and adult pedestrian crashes in Miami Dade County (Zegeer, Blomberg, et al., 2008; Zegeer, Henderson, et al., 2008). Nevertheless, the technique of defining pedestrian safety zones and applying countermeasures in them was not widely adopted by locales seeking to initiate pedestrian safety countermeasure programs in the years following the study's publication. One possible reason this technique did not gain traction may have been the cost and time involved in attempting to treat as many identified zones as possible to achieve a city-wide effect. To overcome this issue, the zone approach might be modified to focus on applying low-cost countermeasures that can be more easily supported in a jurisdiction’s budget and implemented in a relatively short time and limited area.

Objectives

The first objective of this study was to modify the original zone approach and identify low-cost education, enforcement, and engineering approaches to reducing pedestrian injuries or fatalities that cities can fund in their current budgets and implement in brief time frames. Although the basic zone concept is largely independent of the size of its application area, the procedures developed by Blomberg and Cleven (1998) focused on city-wide implementations. Project staff, therefore, examined the technique to determine if the more limited scope required any changes.

The second project objective involved demonstrating the developed low-cost zones approach in several jurisdictions as a proof of concept. The demonstrations would also serve as feedback to fine-tune the approach and as case studies to inform other interested sites.

The third study objective involved documenting the case studies in sufficient detail to capture the full range of implementation alternatives experienced and any variation across sites in processes, costs, implementation times, and the extraneous factors that affected these.

Approach

This study's objectives required three main activities. The first involved updating the original safety zone approach to focus on low-cost, rapid-deployment countermeasures. The project accomplished this by analyzing the requirements dictated by the change in zone scope, identifying required revisions to the original zone processes used by Blomberg and Cleven (1998), and developing new resource material to use.

Once the material was developed, the second activity involved selecting sites to implement demonstrations of the low-cost zone approach and preparing case studies of their activities and

results. The third activity involved project personnel maintaining liaisons with the sites throughout the project to assist with data collection and analysis, consult on countermeasure selection, and prepare the site's case study report.

Throughout the study process, the sites had sole responsibility for all decision-making, including the use of funds provided to them by the project. Project personnel made every attempt possible to ensure that activities related to the use of the zones process were representative of what other sites could accomplish without the direct intervention of the specialists from this project.

Update of the Zone Approach and Development of Material

The project staff reviewed the material from the Blomberg and Cleven (1998) study to determine their applicability to the revised approach, focusing on low-cost, rapid countermeasure deployment pedestrian safety zones. Available items included in the Blomberg and Cleven final report, that detailed its methods, material, and results, and a brochure describing the zone process as it emerged from the study (NHTSA & Federal Highway Administration [FHWA], 1998).

After careful analysis, researchers determined that the basic process for defining zones developed by Blomberg and Cleven (1998) was applicable with only minor updating and could be readily implemented by current geographic information system (GIS) platforms and spatial analysis tools using a variety of inputs in addition to pedestrian crash data (e.g., census data). The main difference would involve the number of zones selected for treatment after the analyses and the countermeasures chosen for application. The overall zone process was refocused on low cost and rapid deployment so that an implementing agency in a jurisdiction (e.g., a traffic engineering department) could move forward using its resources without the delays associated with obtaining external funding.

As part of developing the low-cost zones approach, the research team considered the principles of the Safe System Approach. With a focus on preventing deaths and injuries, the Safe System approach emphasizes making system-wide improvements that address factors that have an outsized impact on crash outcomes, such as motor vehicle speed, separation of road users, and the inherent vulnerability of humans involved in crashes. Including these concepts in the low-cost zones approach should permit transportation agencies to deploy systemic treatments in proactive ways to solve identified problems consistent with the Safe System framework (Goughnour et al., 2021).

To support the demonstration projects and to promote the approach more widely, the project team produced three resources that explained the low-cost pedestrian zones approach and guided potential users.

- A YouTube video titled Pedestrian Zones: Using low-cost countermeasures where they are needed most (UNC Highway Safety Research Center, 2023) that introduces the low-cost zones process and its benefits (Figure 1).
- A handbook titled *Low-Cost Pedestrian Safety Zones: An Eight-Step Handbook* (Dunlap and Associates et al., 2023a) that guides users how to design and implement a low-cost pedestrian safety zone project (Figure 2).
- A guide titled *Low-Cost Pedestrian Safety Zones: Countermeasure Selection Resource* (Dunlap and Associates et al., 2023b) that details how different low-cost countermeasures can be combined and deployed in an identified "zone" in support of the pedestrian zone approach (Figure 3).

Figure 1. Video title card

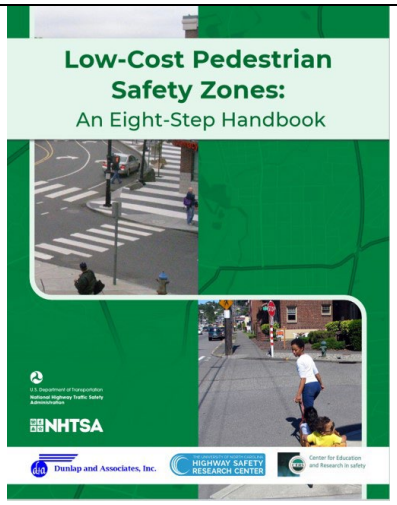

Figure 2. Handbook

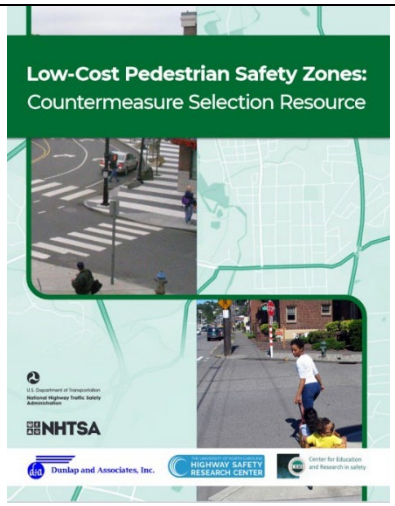

Figure 3. Selection resource

Recruitment of Sites

The next study step involved recruiting sites that would agree to use the low-cost zone process while permitting this project team to observe and assist in documenting activities. Researchers selected three (Gainesville, FL; Kalamazoo, MI; and Saint Paul, MN) based on the available budget and the desire to study several implementations.

Starting with the original zone study (Blomberg & Cleven, 1998), the zoning approach was intended for use by sites that have acknowledged their pedestrian crash problem and are actively trying to reduce it. Candidate sites had to have prior involvement in pedestrian safety activities.

Researchers chose sites distributed around the country with populations of about 100,000 to 300,000 people. Using cities this size kept the scope of the zone demonstrations manageable. Second, the project planned to give each selected site a stipend of $90,000 to support participation in the demonstration. Third, researchers suggested some of the measures found to be effective in cities of this size could have implications for both larger and smaller jurisdictions; however, these findings should be interpreted with caution, as crash problems can vary significantly between small, medium, and large cities.

Finally, project staff recognized the potential benefits if one or more team members had prior professional experience or collaboration with personnel at the selected sites. Such familiarity could help streamline recruitment discussions, support the efficient preparation of agreements, and enable productive interactions to begin promptly.

Gainesville, Florida; Kalamazoo, Michigan; and Saint Paul, Minnesota, agreed to serve as the case study sites. The project executed a memorandum of agreement with each site and paid each one $75,000 on initiating zone activities. The sites received the remaining $15,000 on preparation of the case study reports presented later in this document.

Liaison with Sites

After site selection, project researchers worked with site personnel to assist in executing the eight steps shown in the Low-Cost Pedestrian Safety Zones: An Eight-Step Handbook (Dunlap and

Associates et al., 2023a). These included GIS analyses of crashes and various other socioeconomic and demographic data, problem assessment and countermeasure selection in the identified zones, and documentation of zone activities. The zone identification activity involved combining the mapping of data that reflects safety priorities (e.g., traffic counts, speed profiles, and population density) with crash data to better understand crash patterns and the presence of risk factors. This was done not only in places with crash experience, but also in locations undergoing development where risk might increase in the future.

Once the sites, assisted by the project team, identified potential zones, the sites selected one or more candidate zones to treat as part of the study. Thereafter, the focus changed to identifying the nature of the problems or risks in the selected zones that likely caused the observed crash rates. These included speeding, inadequate street lighting, and poor crosswalk marking. The sites then selected appropriate countermeasures from inside and outside the Countermeasure Selection Resource (Figure 3 and Dunlap and Associates et al., 2023b). Site personnel developed implementation plans, and work began as soon as possible.

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The Case Studies

The following three sections present the case studies for Gainesville, Kalamazoo, and Saint Paul. Project personnel prepared a case study outline for the sites to use as a guide in preparing these reports. Site and project personnel worked together to complete the various topics in the outline to the extent they applied to the activities undertaken at each site.

The case studies cover the processes that each site defined its zones and selected appropriate countermeasures. They include hyperlinks to external references where applicable and footnote citations for cited documents. The studies also describe countermeasure implementations (or plans for deployment), evaluation approaches, and measures. None of the countermeasures were fielded for long enough time when the sites prepared the studies to permit including more than initial anecdotal reports of effectiveness.

The case studies are followed by a discussion section that provides commentary on similarities and differences among the sites and possible lessons learned across them.

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Gainesville Case Study – Pedestrian Crossing Improvements in Gainesville

Background and Overview

Gainesville, located in the north central part of the State, has a population of 145,812 (U.S Census Bureau, 2024c). It is home to the University of Florida, the third-largest university in Florida and one of the country's largest campuses (in terms of student population). The project team worked with Gainesville staff, including Debbie Leistner, Karla Rodrigues-Silva, and Scott Wright, throughout the project.

Community Description and Context

Gainesville's City Commission adopted its Vision Zero Policy in 2018, setting a goal of eliminating traffic fatalities by 2040 (City of Gainesville, 2024c). This commitment was followed by the development of a Vision Zero Framework and Action Plan, that was adopted in 2020 (City of Gainesville, 2020). The Framework and Action Plan is based on an analysis of crashes from 2015 to 2019, specifically focused on pedestrians, bicyclists, and other vulnerable road users. These plans provided the basis for a Safe Streets and Roads for All (SS4A) grant the city received in 2023 to improve University Avenue, a primary corridor through the city.

City of Gainesville Profile (U.S Census Bureau, 2024c)

- Population: 145,812
- Population density: 2,234 people per square mile
- Median household income: $43,783
- Per capita income: $27,414
- 29.0% living in poverty
- Gainesville Vision Zero Framework and Action Plan (City of Gainesville, 2020)

Goals and Objectives

The recommendations in the city's Framework and Action Plan reflect a motivation to make aggressive changes to reduce the risk of total traffic deaths and injuries, including pedestrians, and improve mobility, access, and safety citywide. City staff expressed immediate interest in piloting the low-cost pedestrian safety zone methodology to tackle pedestrian safety problems and do so in areas of the city that had been traditionally high-risk. Though the city had established an overall zero target area as a zone where investment would be focused (Figure 4), they recognized that the "disproportionate burden of traffic fatalities and serious injuries" among specific populations, along with other economic challenges, were located outside of this target zone. The city expressed interest to the project team in examining safety issues beyond the core target area related to motor vehicle speeds, pedestrian crossings, and transit access in a separately identified zone where those are at higher-risk with traffic fatalities and serious injuries such as low-income households, older adults and youth, people with disabilities, and households with limited vehicle access.

Figure 4. Bicycle and Pedestrian Crashes (2015-2019)

Zone Identification, Data Analysis, and Findings

Zone identification is a process of mapping crash data and other data that reflects safety priorities to understand better crash patterns and the presence of risk factors in locations that may have safety problems but have not (yet) experienced crashes, such as near misses. City staff were especially interested in examining safety issues related to pedestrian crossings, vehicle speed, and lighting. Using data provided by the city and data gathered by the project team, researchers from HSRC analyzed pedestrian crashes and other identified risk factors between 2015 and 2021, and the team documented several notable findings when comparing pedestrian crashes citywide to those occurring in their specified zone.

Data Sources Used in Analysis

- Reported pedestrian crashes (2015–2021).
- Specified zone.
- Roadway network.
- Transit routes and passenger boarding data.
- Presence of roadway lighting.

- Injuries resulting from pedestrian crashes were more severe in the specified zone than in the city as a whole.
- Pedestrian injuries in the specified zone were more likely to occur during dark/nighttime hours than in the city overall.
- Pedestrian injuries in dark conditions with no lighting present were twice as likely to occur in the specified zone than in the city as a whole.
- Two pedestrian crash types with the most severe injury outcomes, crossing roadway and pedestrian dart/dash, occurred at higher rates in the specified zone than the city overall.

These findings confirmed that pedestrian crossings, especially in dark or nighttime conditions, led to pedestrian deaths and injuries in the specified zone. After mapping these data (Figure 5), potential countermeasure zones emerged that represented either high-crash or high-risk locations. Of the six potential zones identified, several were located along or near Waldo Road (zone numbering was for convenience and should not be considered an indication of priority or problem severity):

- Zone 1: Intersection of Waldo Road and 39th Avenue: A mostly industrial/rural area with centers that provide services to unhoused people, some of whom have been killed in pedestrian crashes nearby.
- Zone 2: Waldo Road between NE 12th Avenue and NE 16th Avenue: A fairly high-speed and high-volume corridor with a high concentration of pedestrian activity and nighttime safety issues, with few crossing points such as crosswalks and intersections.
- Zone 3: E. University Avenue between Waldo Road and 15th Street: A multilane corridor with commercial development and few crossings.
- Zone 4: SE Williston Road: A low-density residential area with bus stops and moderate high volume traffic flow and limited crossing opportunities.
- Zone 5: NE 15th Street from NE 28th Avenue to NE 31st Avenue (and surrounding areas): A lack of lighting with high crash numbers distributed throughout the zone without a consistent pattern.
- Zone 6: NW 13th Street at NW 23rd Avenue: A commercial area anchored by two intersecting high-volume streets, with known nighttime safety issues and transit stops.

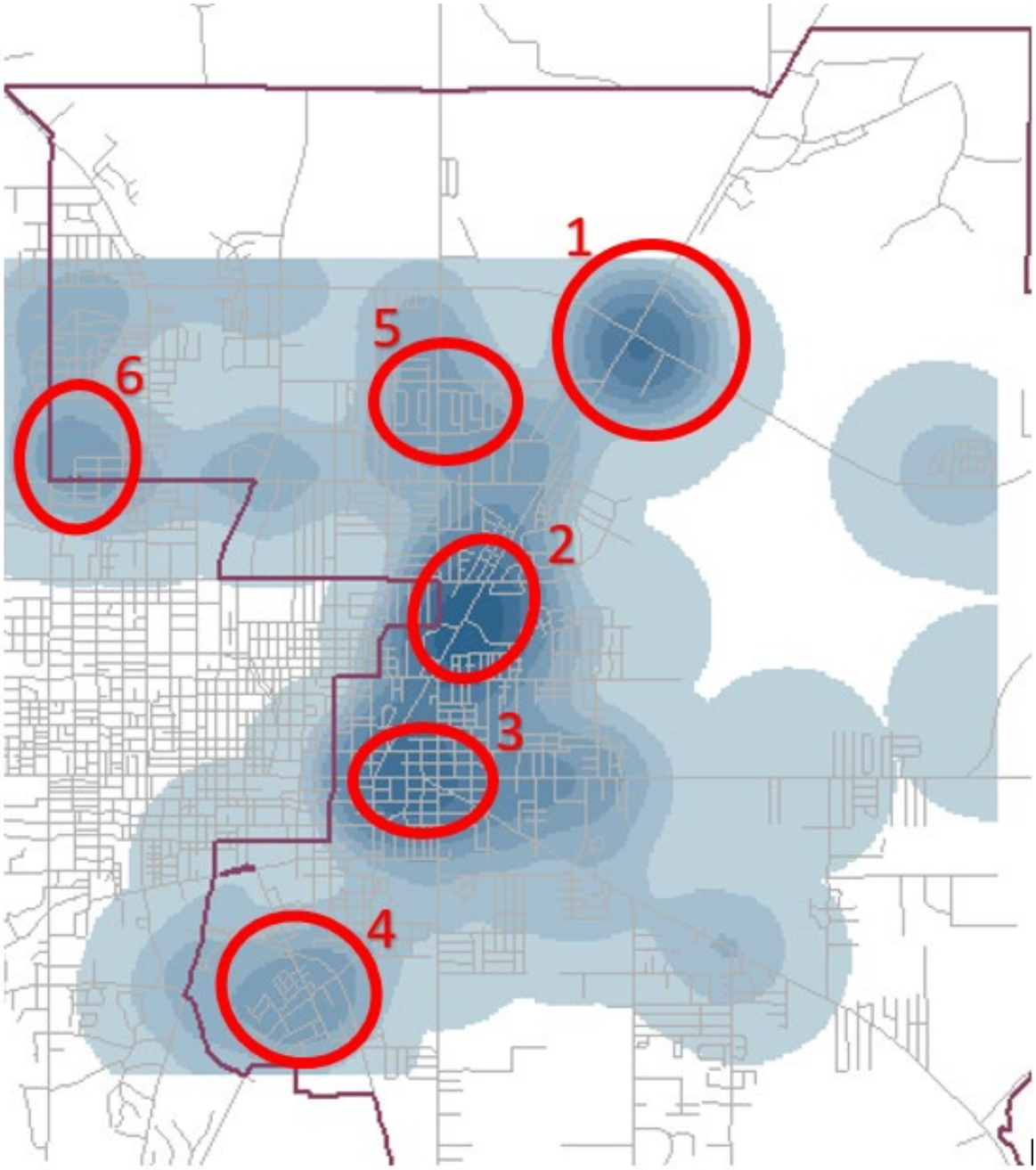

Figure 5. Pedestrian crash density map and identified potential zones

Candidate and Final Zones

After deliberating and discussing the zones, the city identified Zones 2 and 5 as having the most potential for low-cost safety improvements. These zones were ultimately selected due to the safety improvement potential of projects in these areas, and other funded projects were likely to address problems in other zones. For example, Zone 1 was the focus of a separate crossing improvement project. Zone 3 overlapped somewhat with an ongoing SS4A implementation grant with a longer timeline but included substantial design changes and safety improvements. Maps of the selected zones are in Figure 6.

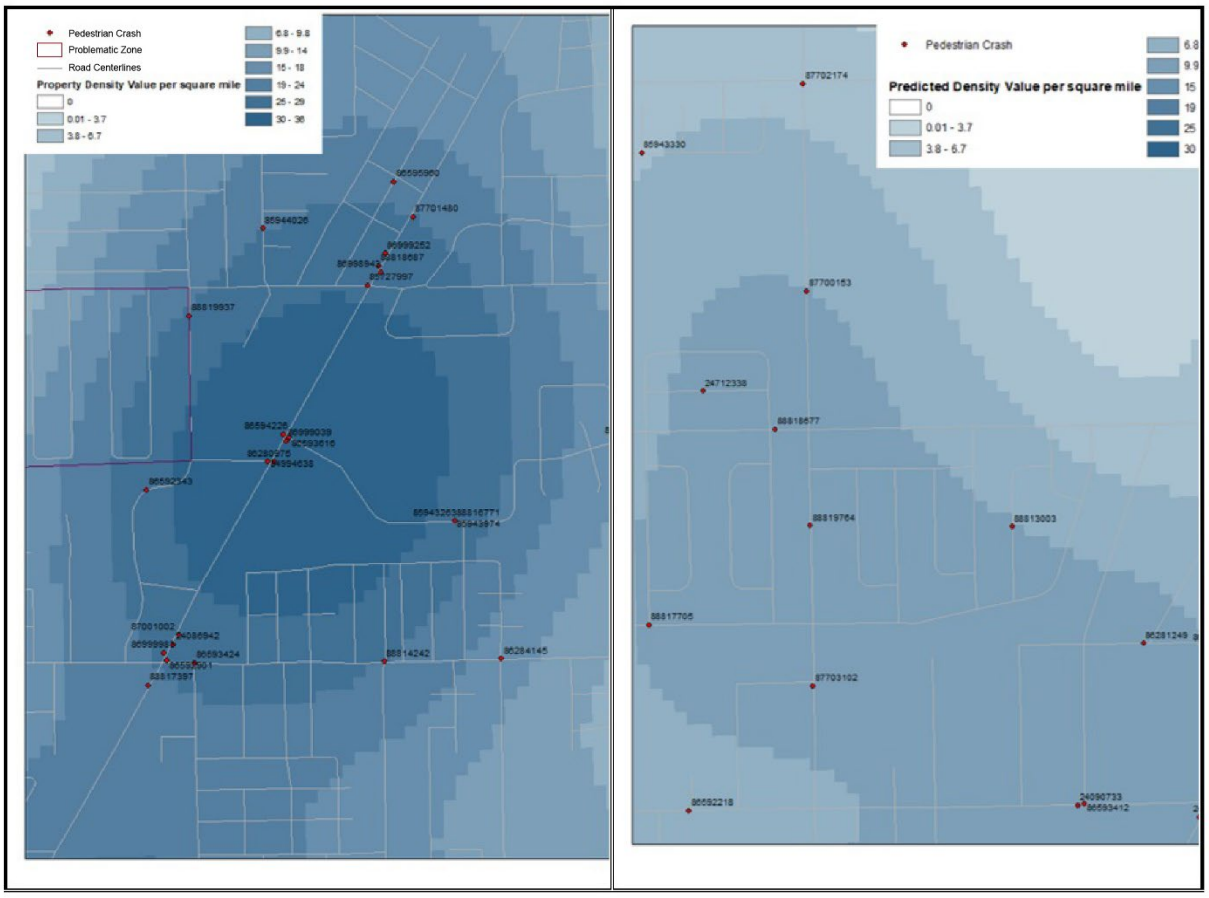

Figure 6. Pedestrian crash density maps of Zones 2 (left) and 5 (right)

Selection and Implementation of Countermeasures

Zone Assessment and Investigation

City staff and project team members performed field reviews of the selected zones in fall 2022. The focus of these visits was on Zones 2 and 5, but the field teams made additional observations along Waldo Road during both the daytime and nighttime to observe issues related to lighting. Site visits confirmed many of the issues identified from the data analysis (Figure 7). In Zone 2, there was a lack of both lighting and pedestrian crossing opportunities, especially at transit stop locations. Both sidewalks and multi-use trails run along the corridor, but pedestrians have few crossing opportunities, and those that do exist are, in some places, more than half a mile apart. Speed limits are marked at 45 mph along this corridor, with vehicles likely traveling faster under normal conditions.

Figure 7. Waldo Road north of NE 16th Avenue intersection, where several pedestrian crashes occurred (Source: Google Streetview)

In Zone 5, the team observed high pedestrian activity but a lack of crossing opportunities, especially near transit stop locations. These are relatively low-volume and low-speed streets compared to Waldo Road, which has a speed limit of 45 mph. However, lighting is inconsistent, and intermittent tree canopies may block lighting from illuminating pedestrians crossing or walking along the road. This is primarily a residential area with some sidewalk availability (on one side of most streets).

Selected Interventions

Based on the results of the analysis, the city focused on countermeasure strategies that would improve pedestrian visibility and make crossings safer in the identified zones. Project implementation began in the summer of 2023 and was completed by the summer of 2024.

In Zone 2, near NE 8th Avenue, city staff from the transportation and public works departments implemented improvements at intersections and crossings to increase safety and accessibility. This included upgraded signage, crosswalk, and stop bar pavement markings. Additionally, new curb ramps were installed at three crossings in this area (Figure 8).

Figure 8. Crosswalk markings and signs installed in Zone 2 (Source: City of Gainesville)

During the project, challenges were encountered when attempting to advance several countermeasures proposed for the Waldo Road corridor. Since the city did not own the road, it required approval from the Florida Department of Transportation (FDOT) for the proposed countermeasures. Several lighting recommendations, pedestrian crossing enhancements, and other proposed countermeasures were not implemented based on FDOT's feedback. Despite this, FDOT has plans to resurface Waldo Road in the near future, and they said that some of the changes, including lighting, could be made at that time.

Additional evaluation of intersections along Waldo Road is funded by the city in association with adjacent redevelopment efforts and through the Metropolitan Transportation Planning Organization, extending from East University Avenue to NE 39th Avenue. The city plans to address some of the safety issues identified in Zone 5 with a larger project to develop the NE 31st Avenue trail. Countermeasures that will be considered include additional lighting, high-visibility crosswalk markings, upgraded high-visibility signage, and bus stop improvements (Figure 9).

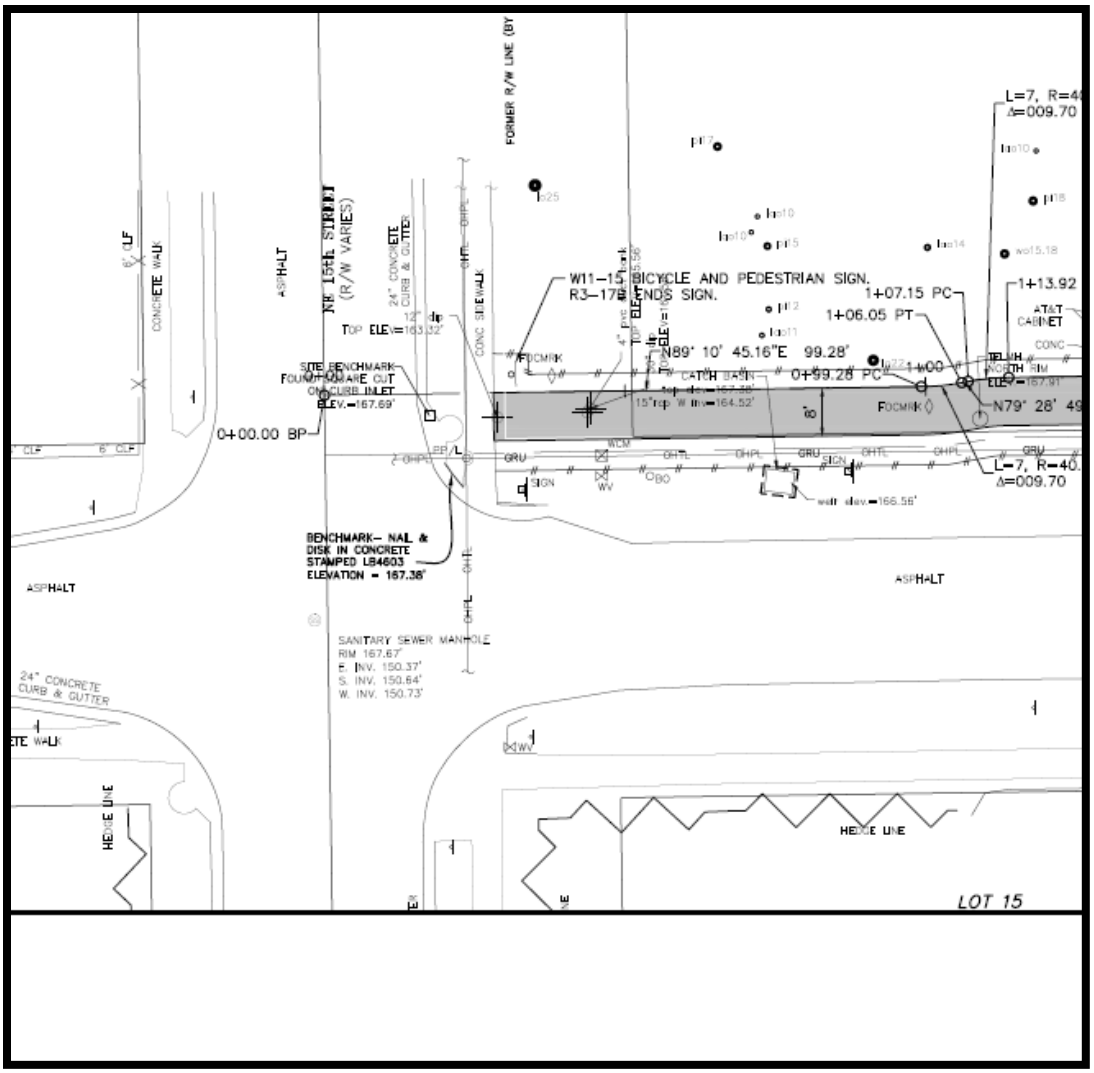

Figure 9. Plans for NE 31st Avenue trail, including some of the crossing and bus stop enhancements (Source: City of Gainesville)

One of the city's quarterly project updates (City of Gainesville, 2024c), shown in Figure 10, included project plans and implementation details.

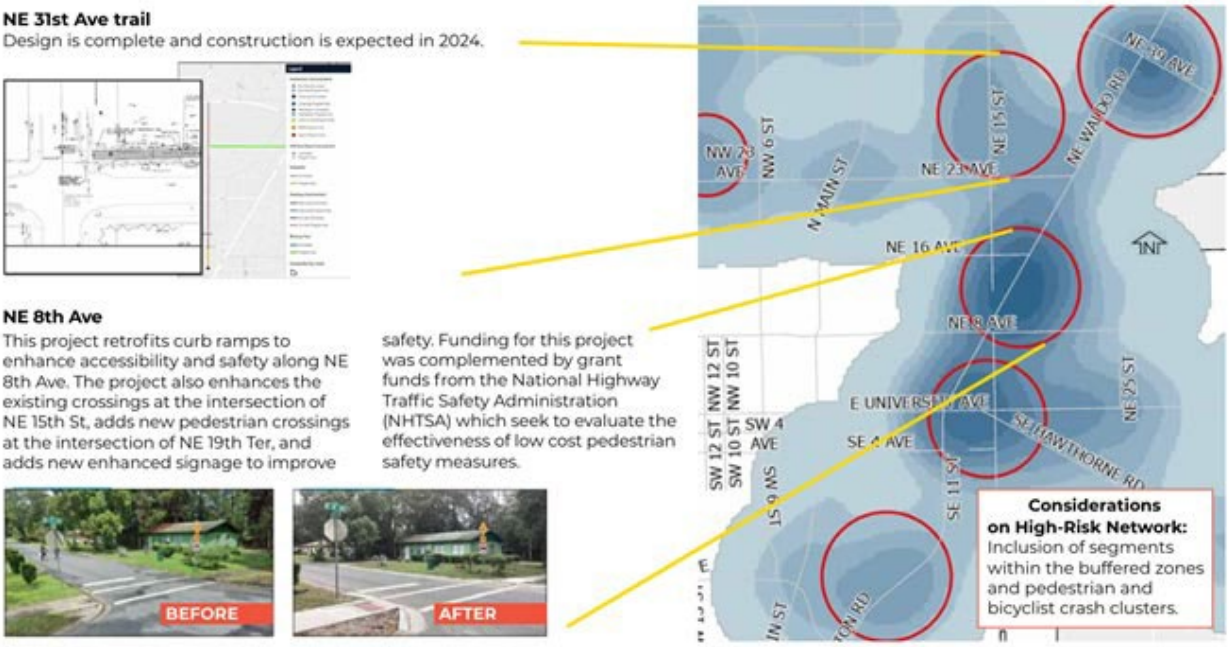

Figure 10. Map of safety improvements implemented and planned for Zones 2 and 5 (Adapted from: City of Gainesville)

In addition to the projects described in Zones 2 and 5, the city and its partners (especially FDOT) were able to make progress treating sites in several of the other zones identified in the project. For example, the city implemented changes at the originally identified Zone 1 location. The city designed and funded the construction of upgrades to the bus stop on the south side of the road to make it more inclusive and ADA-compliant. A multi-agency effort to enhance safety for all road users resulted in FDOT's installation of a pedestrian hybrid beacon (PHB) in 2023 at the crossing of NE 39th Avenue to the Santa Fe Work Release Center (Figure 11).

Before

After

Figure 11. Upgraded bus stop, ADA accessibility, and pedestrian hybrid beacon on NE 39th Avenue (Source: City of Gainesville)

In Zone 4, on SE Williston Road, FDOT added a PHB to improve pedestrian safety and mobility in coordination with Gainesville. The PHB controls pedestrian and vehicle movements to provide protected crossings for pedestrians at this location (Figure 12).

Before

After

Figure 12. Improvements at SE Williston Road (Source: City of Gainesville)

In Zone 6 (NW 13th Street at NW 23rd Avenue), the city programmed funding in FY24/FY25 for bus stop improvements in the area to enhance accessibility and safety for pedestrians.

Program Evaluation, Outcomes, and Impact

Project Outcomes

Following implementation, the city plans to examine the impact of the projects using several data sources. One involves collecting speed and traffic count data to determine whether the changes impacted speeds or volumes. Crashes will also be examined, especially those occurring during nighttime hours. However, evaluation is challenging for the city, as limited resources and staff are available to conduct evaluations and systematically collect data.

Impact of Zone Approach

Applying the low-cost pedestrian zone approach in Gainesville is helping the agency address safety concerns citywide. In ongoing work to update their High Injury Network (HIN), that drives safety investment, they are using the zone methodology applied by the project to identify

candidate zones and looking for some of the risk factors uncovered in the project analyses (e.g., lighting, crossing crashes away from intersections, and transit boarding/alighting). The city also secured an SS4A implementation grant to make improvements along University Avenue, including portions of candidate Zone 3. This demonstrates the value of using the zone approach to inform broad, network-wide improvements by leveraging funding from numerous sources and applying the methodology citywide.

The process also helped facilitate communication and collaboration between various entities and departments involved in transportation safety in Gainesville. This included the city's Department of Transportation and Mobility, the Department of Public Works, and FDOT. Some recommended solutions were not advanced because they did not receive full support from all parties. However, this process helped lay the groundwork for future road safety investments, particularly pedestrian safety improvements, and the recommendations may be included in future work. As mentioned, the city was able to work closely with FDOT to make needed improvements at several of the other candidate zones, demonstrating the ability of this approach to foster broad impacts across several safety projects.

Kalamazoo Case Study – Leveraging the Approach

Background and Overview

Kalamazoo has a population of 73,598 (U.S. Census Bureau, 2024b) and comprises 24.7 square miles with a median age of 25.6 years. The Kalamazoo metropolitan area has a population of over 325,000 people (Western Michigan University, 2025). Since city traffic crash records show that pedestrians were six times more likely to die in or receive an incapacitating injury in Kalamazoo than motorized road users, the city wanted to focus on reducing serious crashes involving pedestrians and bicyclists. There was strong support among city officials to implement zone-based countermeasures as most of the crashes occurred in areas of low income.

City of Kalamazoo Profile

- Population: 73,598
- Population density: 2,981 people per square mile
- Median household income: $48,659
- Per capita income: $27,191
- 24.9% living in poverty.
- Kalamazoo Complete Streets Policy (City of Kalamazoo, 2019)

Kalamazoo was committed to improving pedestrian and bicycle safety citywide. A significant concern throughout the city was speeding, which became an emphasis area for low-cost pedestrian safety zone activities. Sixty percent of the drivers passing Kalamazoo speed feedback signs were speeding. Many of the serious pedestrian crashes involving speeding vehicles occurred along roads in high-risk communities. The city wanted to address these issues even before this project was proposed. To implement the city's safety initiative, it formed an experienced team headed by its newly hired city traffic engineer, including senior project managers and technicians.

Community Description and Context

Kalamazoo is the home of several colleges and universities, including Western Michigan University (WMU) and Kalamazoo College, making it a "college town" with issues typically associated with a large student population, including a high frequency of nighttime walking and alcohol consumption by drivers and pedestrians. Involvement in the Low-Cost Pedestrian Safety Zones project aligned well with the city's Complete Street Policy. It helped leverage investments in areas where severe and fatal pedestrian crashes are most common. The city is reducing speeding along major corridors and increasing safety and accessibility for low-income populations. Low-cost innovative solutions were required in the vicinity of higher speed roads where severe and fatal pedestrian and bicycle crashes occur with a higher probability. The NHTSA-sponsored project allowed the city to identify target zones and implement effective, low-cost countermeasures.

Goals and Objectives

The Kalamazoo traffic engineer immediately saw that participation in the Low-Cost Pedestrian Safety Zones project would provide a relevant initial step in the city's efforts to reduce serious pedestrian crashes. Participation also aligned well with the city's commitment to focus countermeasures in historically high-risk areas where severe and fatal pedestrian crashes occur. The city manager, city commissioner, and director of public works also supported the project.

Zone Identification

The city and the project team conducted extensive data analyses to determine candidate zones and describe the identified zones' crash and demographic characteristics. The crash experience was arrayed according to the following parameters to generate maps and identify zones: disproportionate impacts; traffic volumes and speeds; existence and type of road lighting; availability of sidewalks; the presence of schools and parks; existing or planned speed management projects; traffic signals; bus routes; bus stops; and transit ridership. Zones with disproportionate impacts were emphasized when making the final selection of zones for treatment. The analyses identified four major corridors or linear zones: two corridors included high-risk areas, one crossed university housing and one traversed a residential community.

- Zone 1: High number of pedestrian and bicycle crashes and speeding in an area disproportionately burdened with traffic fatalities and serious injuries, such as low-income households, older adults, youth, people with accessibility issues, and households with limited vehicle access
- Zone 2: College community, where several university students have been killed in high-speed crashes
- Zone 3: Area with high crash rates and excessive speeding
- Zone 4: Major corridor dividing a residential neighborhood

Data Analysis and Findings

The NHTSA Pedestrian Safety Zones project helped Kalamazoo to identify target zones and choose and implement appropriate low-cost countermeasures. An analysis of pedestrian crashes involving motor vehicles in Kalamazoo from 2012 to 2021 was carried out in the spring of 2022. The city also examined a report from the College of Civil Engineering at WMU. Kalamazoo based the zones on the results of these analyses. In determining census tracts to create geographic focus areas, the city looked at communities that faced negative impacts such as weather changes, lack of access to clean energy, limited transportation, unaffordable housing, pollution, unsafe water, health risks, or lack of access to job training and skills. The city overlayed these with defined micromobility zones with access limitations compared to other areas. The two geographies nearly overlapped completely (the city merged the two shapefiles to capture all the zones).

The Low-Cost Pedestrian Safety Zones project coordinated with the city’s Complete Street Policy and focused investments in areas where severe and fatal pedestrian crashes were most common. Funds provided by the NHTSA project were added to the available resources for safety countermeasures to increase the overall budget available. Participation in the project provided additional impetus to focus on pedestrian safety. The city is investing in implementing solutions to reduce speeds and increase safety and accessibility for populations along major corridors identified by the zone analysis. Low-cost innovative solutions are particularly applicable to zones characterized by high travel speeds, high-speed-limit roads, and areas that have experienced previous crashes resulting in severe injury and fatalities to pedestrians and bicyclists. The NHTSA zones project prompted the city to identify target zones and select and implement low-cost countermeasures previously shown to be effective.

Kalamazoo's challenged communities near WMU had a high incidence of severe pedestrian crashes. When a particular zone, like the one identified here, includes both a high crash rate and excessive speed, the crashes in that zone are likely to have more severe outcomes for pedestrians. Reducing speeding was the initial countermeasure in this zone that experienced several previous student fatalities in a relatively short road segment.

Candidate and Final Zones

The following methods and criteria were used to evaluate each of the identified zones and finalize the selection of Zone 1 and Zone 2 as the areas to be treated (Figure 13).

- Field meetings with community stakeholders and elected officials
- Outreach efforts in the community programmed as part of roadway projects in each of the zones, including
    - Web surveys
    - Radio announcements
    - Follow-up web updates on the city's web pages
    - Meetings with neighborhood groups by Kalamazoo's neighborhood activator to discuss their concerns
- Evaluation of programmed road investments and plans in the areas for potential enhancements and inclusion of additional countermeasures. The city's Street Design Manual (City of Kalamazoo, 2022) was used to guide new development and the city's street improvements. The Street Design Manual complements the Complete Streets Policy.
- Review of crash reports and narratives, and site visits to crash sites where light level appeared to be a factor in night pedestrian crashes. Relevant crash reports were reviewed at the crash sites. Visits were made during the day and at night, at least 1 hour after sunset. This analysis was completed in both zones.

The final zones were chosen using police crash reports to identify areas with high numbers of fatal and serious pedestrian crashes. The city found that using a publicly available tool to identify safety-challenged communities helped select zones with the greatest need.

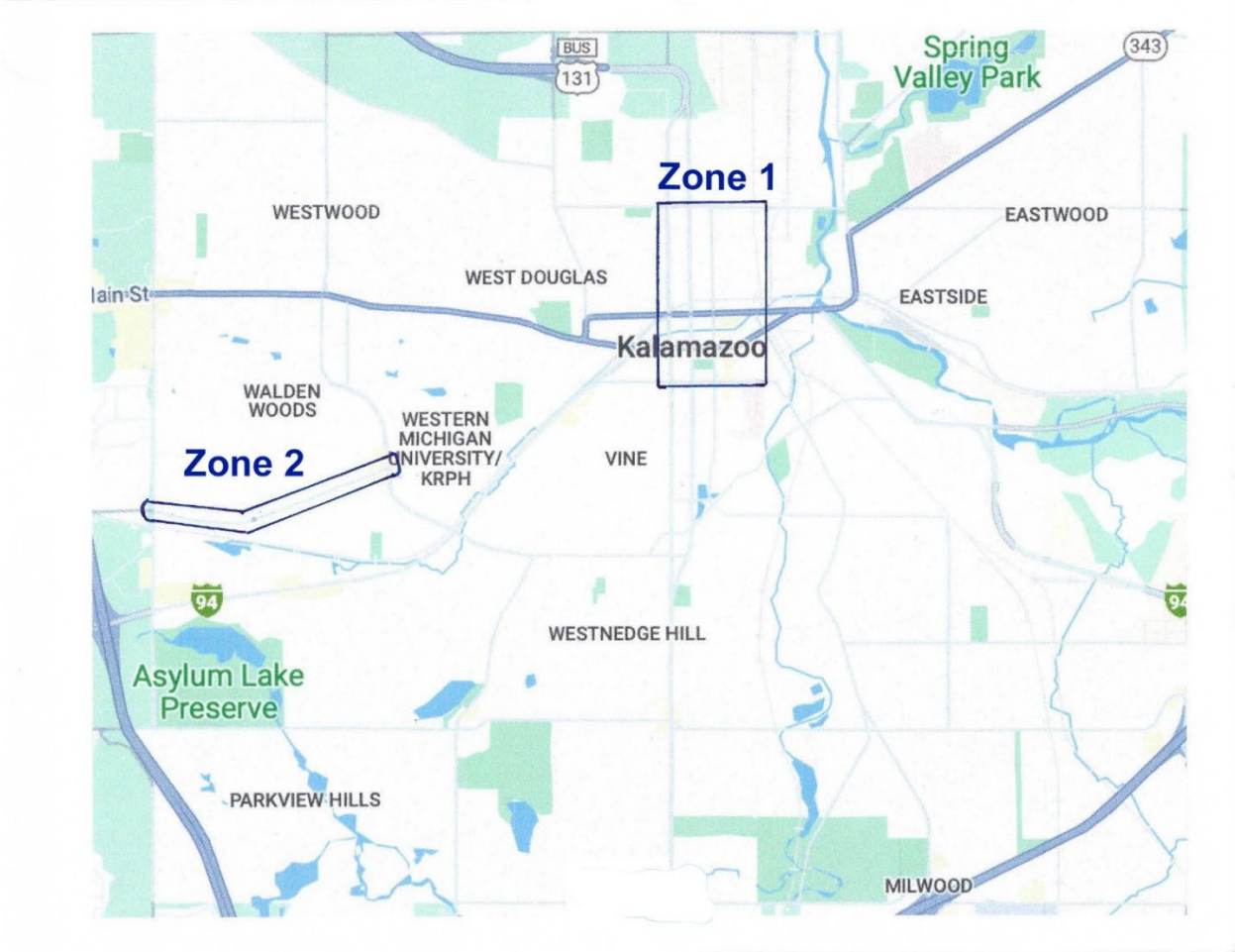

Figure 13. Selected zone locations in Kalamazoo
(Adapted from Google Maps)

Zone 1 – The Northside Kalamazoo Zone

This zone begins north of the railroad tracks that run east/west through the northern part of the city. Its boundaries are Westnedge Avenue (west boundary), Porter Street (east boundary), Patterson Street (north boundary), and Lovell Street (south boundary). Pedestrian crashes in the area are predominantly north of the tracks. Speed and low lighting are significant issues for this zone, leading to numerous serious injury or fatal pedestrian crashes. Installation of improved street lighting on Lake Street and Mill Street and installation of light bars on East Paterson Street were the selected low-cost countermeasures. These areas are characterized by low nighttime lighting, making a driver's task of detecting a pedestrian at night particularly difficult. Bicycle lanes with bollards were installed on Rose Street, Westnedge Avenue, and Park Street to reduce speeding for improving both pedestrian and bicycle safety. Figure 14 shows a map of pedestrian crashes from 2012 to 2021 in Zone 1.

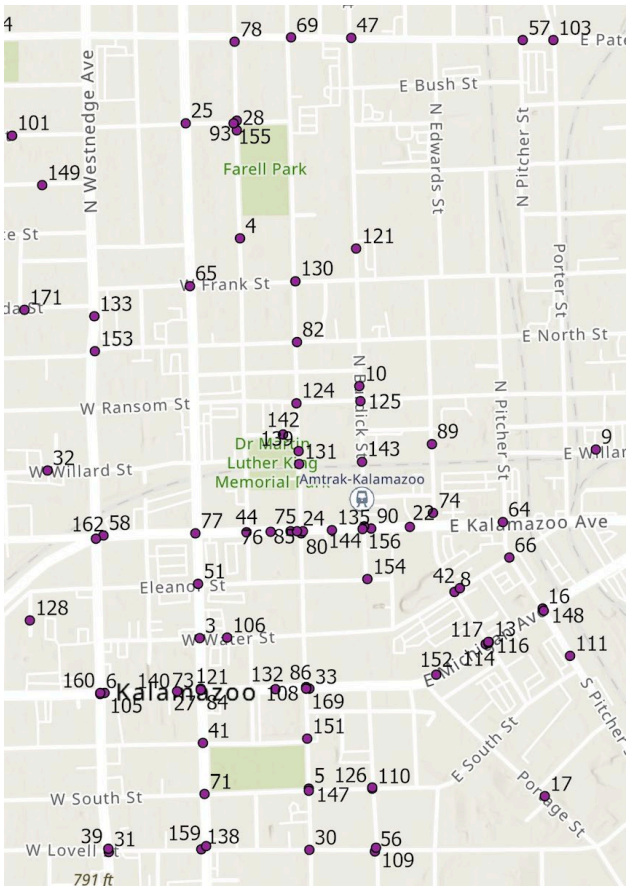

Figure 14. Zone 1 pedestrian crash map

Zone 2 – West Michigan Avenue Between Drake Road and Howard Street

This stretch of West Michigan Avenue has two lanes in each direction and a center turning lane. The speed limit along this corridor is 35 mph. An extra turn lane exists at the intersection of Howard Street at the entrance to WMU. Citywide, 70 percent of combined fatal and serious injury crashes occurred at night, and all fatal crashes in this zone occurred at night. Eighty-six percent of the night crashes occurred at spots listed as "lighted locations" on the police crash report. A sample of light readings at these crash sites taken by staff showed that the illumination level at these locations was very low (between 0.3 lux and 12.9 lux), with most of the crash sites in the zone having light readings below 5 lux. Research supports lighting levels of at least 20 lux to improve safety.[2] This specification is based on research conducted during the development of FHWA's *Informational Report on Lighting Design for Midblock Crosswalks* (Gibbons et al., 2008). Many students live in this area. Four students were killed in the past 5 years along this corridor, all of whom were struck by young drivers. Many of these crashes also involved excessive speed. The striking motorists in these crashes typically said they did not see the pedestrian in time to avoid the crash. Figure 15 shows a map of pedestrian crashes from 2012 to 2021 in Zone 2.

[2] The Illuminating Engineering Society RP-8-18 recommends a vertical illuminance of at least 20 lux (1.9 fc), measured at a height of 1.5 m (5 ft) with the light meter orientated toward the approaching vehicle.

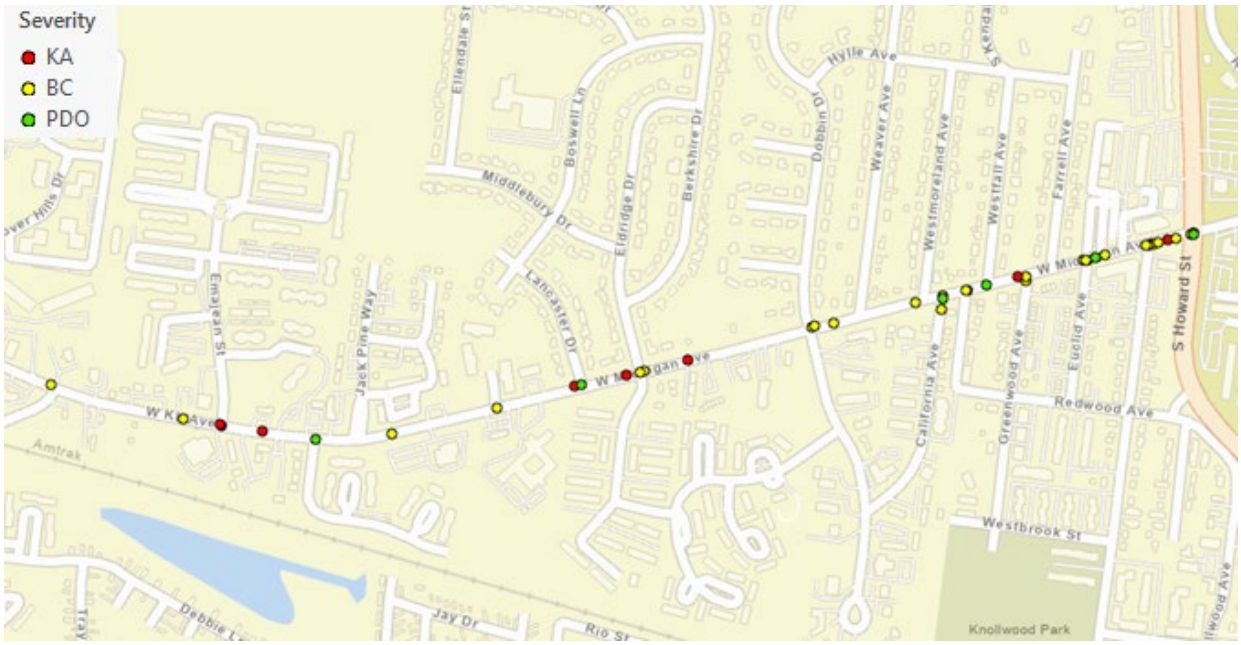

Figure 15. Zone 2 pedestrian crash map

Selection and Implementation of Countermeasures

Dark conditions, poor lighting and speed were apparent causal issues for serious pedestrian and bicycle crashes in both zones. Thus, enhanced lighting and other conspicuity-enhancing countermeasures listed in the Countermeasure Selection Resource (Dunlap and Associates et al., 2023b) were considered. Selected lighting solutions included using new LED smart lighting for crosswalks with rectangular rapid flashing beacons (RRFBs) and LED light bars to better illuminate entire crosswalks. The city's plans included implementing speed management measures and roadway improvements to address crash patterns and design. This includes road diets that reduce the number and width of travel lanes. City traffic engineers used wide bike lanes with delineators to discourage cars from intruding into the bike lanes. Officials planned to enhance infrastructure, enforce speed limits, and launch educational initiatives with WMU and local businesses. The city's plans included distributing high-visibility materials in key zones to improve pedestrian visibility at night. The Kalamazoo Police Department also plans to increase speed enforcement in these areas. Since the city routinely collects lighting and speed data, the impact of these countermeasures would be measured as they progress. In addition, adding stop signs and speed feedback signs for speed control were planned for these zones. The city is also installing innovative signs, high-visibility crosswalk markings, larger, brighter traffic signs, and several signs in a gateway configuration. The city did not encounter any barriers to implementing these countermeasures.

Implementing this combination of low-cost engineering countermeasures in Kalamazoo with other strategies, such as public education and enforcement, is an example of a low-cost pedestrian zone approach.

Zone Assessment, Investigation, and Selected Interventions

The city, with the project team, conducted field reviews to augment data analysis as the basis for countermeasure selection. Resource needs were identified and compared with resource availability to address shortfalls in time to support implementation schedules.

Zone 1

1. Because most crashes occur at night in poorly lit areas, Kalamazoo planned to install LED light bars at the signalized intersections of East Paterson Street and N. Rose Street and East Paterson Street and N. Burdick Street by the end of summer 2024.
2. Not all crosswalks in the zone have high-visibility markings. Therefore, Kalamazoo planned to install high-visibility markings at all crosswalks by the end of summer 2024.
3. Because speed is a factor in many of the crashes in this zone, low-cost speed management interventions were installed on major corridors, including Rose Street, South Westnedge Avenue, and South Park Street. Targeted speed enforcement was also conducted in this zone.

Zone 2

1. Most crashes in this zone occurred in poorly lit areas at night, so Kalamazoo installed LED lighting at intersections along this corridor. The signalized intersection at Emajean Street, the site of one of the fatal crashes, already has signal mast arms, and the city considered installing light bars under the mast arm at this location. They considered installing light bars at the signalized intersections of Eldridge Drive, Dobbin Drive, Greenwood Avenue, and other intersections with deficient lighting. Implementation was planned for completion by the end of summer 2024. The final number of installations in the timeframe depended on budgets and installation crew availability.
2. As in Zone 1, Kalamazoo planned to install high-visibility markings at all crosswalks by the summer of 2024.
3. Several crashes occurred at night at the signalized intersection of West Michigan Avenue and Howard Street. Because this intersection has span wires, Kalamazoo is considering installing luminaires at each corner of the intersection at this location in 2025.
4. Kalamazoo planned to install RRFBs with smart lighting and refuge islands at two locations where students cross the road. These installations will also include advance yield markings and signs. These treatments are still in the planning phase.
5. Low-cost outreach efforts, including educational approaches, are planned in coordination with WMU and local merchants. High-visibility materials to improve pedestrians' conspicuity at night are also being acquired for dissemination to students.
6. Because speed is a factor in many of the crashes in this zone, radar speed feedback signs have already been installed on West Michigan Avenue near previous serious and fatal pedestrian crashes. A photo of one of the two radar speed signs is shown in Figure 16. Targeted speed enforcement is also being conducted in this area.

Figure 16. Radar speed feedback sign

Program Evaluation and Impact

Project Evaluation Measures

- Night Light Level - The city took sample light level readings before and after installation at several sites where improved lighting has been installed. The data will be collected an hour after sunset to ensure they measure the actual lighting levels in darkness before and after improved lighting has been installed. The data will be collected in both selected zones.
- Speed - The city took before-and-after speed measures on roads with a high number of serious crash experiences in each zone. Good speed data exists back to 2017. These measures will enable the city to determine whether the speed feedback signs, enhanced speed limit signs, and traffic calming solutions have reduced speeds. These measures will be recorded and analyzed in both zones.
- Crashes - The city will examine all crash types over time to determine whether pedestrian crashes decline after the installation of countermeasures. The data will require a longer period to determine whether the situation has improved.

Impact of Zone Approach

- This project aligns well with the city's Complete Street Policy and helps leverage investments in areas where severe and fatal crashes are most common. The city is investing in implementing speed management solutions to reduce speeds along major corridors and increase safety and accessibility. Low-cost innovative solutions are required along and in the vicinity of higher speed roads where there is a higher probability of severe and fatal pedestrian and bicycle crashes. This project has allowed the city to identify target zones and implement effective, low-cost countermeasures. It is hypothesized that the collected measures will show an improvement in pedestrian safety in the selected zones.
- Kalamazoo leveraged the initial $75,000 provided by the NHTSA project for the zone approach to apply for and receive an SS4A grant. Kalamazoo believed that participating in the NHTSA project and citing the zone approach assisted the city in obtaining $70 million more in funding for traffic safety. The city's master plan and strategic vision, *Imagine Kalamazoo 2025*, prepared by the Community Planning and Development Program, discusses downtown revitalization and transportation for the community. It includes neighborhood activators who meet with neighborhood residents to ensure residents are aware of current and future efforts.

Kalamazoo Advice for Other Cities

Other cities attempting to replicate what Kalamazoo did might have difficulty applying the low-cost zone approach if they do not have someone on staff with experience solving pedestrian crash problems. Dennis Randolph, the public works manager, believes many cities may benefit from project experts who are more familiar with the zone approach. One possibility would be a consultant to help map zones and select appropriate low-cost countermeasures.

More Information

Public Works Manager
415 E Stockbridge Avenue
Kalamazoo, MI 49001
City of Kalamazoo, Public Services Department
Phone: 269-337-8604

Additional Relevant Website

Imagine Kalamazoo: www.kalamazoocity.org/Government/Programs-Initiatives/Imagine-Kalamazoo

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Saint Paul Case Study – Shifting the Traffic Culture in Saint Paul

Background and Overview

As the State's capital, Saint Paul is home to approximately 304,000 residents in its 56 square miles (U.S. Census Bureau, 2024a). The median household income measures approximately 9 percent below the national median household income (U.S. Census Bureau, 2023, 2024a). Key staff committed to this project include Saint Paul police commanders Jeremy Ellison, Kathleen Brown, and city traffic engineer Randy Newton.

City of Saint Paul Profile (U.S. Census Bureau, 2024a)

- Population: 303,820
- Population density: 5,994 people per square mile
- Median household income: $69,919
- Per capita income: $39,726
- 16.7% living in poverty
- Saint Paul Transportation Safety Action Plan

Community Description and Context

The Saint Paul City Council adopted a Vision Zero resolution, and the city completed its Safe Streets for All Transportation Safety Action Plan in June 2023. The plan's analysis outlined both a high-injury network for all modes and a high-injury network for pedestrians and bicyclists. Figure 17 shows a heat map of Saint Paul showing hot spots based on all fatal and serious injury crashes for the 5 years from 2018 to 2022.

Goals and Objectives

Traffic safety is a top priority for city leadership. Transportation safety for pedestrians is a growing area of interest in the city. The city's recently completed Transportation Safety Action Plan states that "while traffic safety affects all people, certain communities are disproportionately impacted by transportation-related injuries and fatalities" and describes those groups (City of Saint Paul, 2023a). Two major emphasis areas are speeding and aggressive driving, with a desire to make Saint Paul "a place where people don't speed." The low-cost pedestrian zone approach fits into the city's broader actions for road safety, including pedestrian redesigns, traffic calming treatments, and the Transportation Safety Action Plan (City of Saint Paul, 2023a). There is also a focus on reducing night crashes by improving lighting in high pedestrian crash locations. One issue that needs to be overcome to make improved lighting viable is the theft of copper wiring to the lights that has negated the installation of better lighting at some high-crash locations.

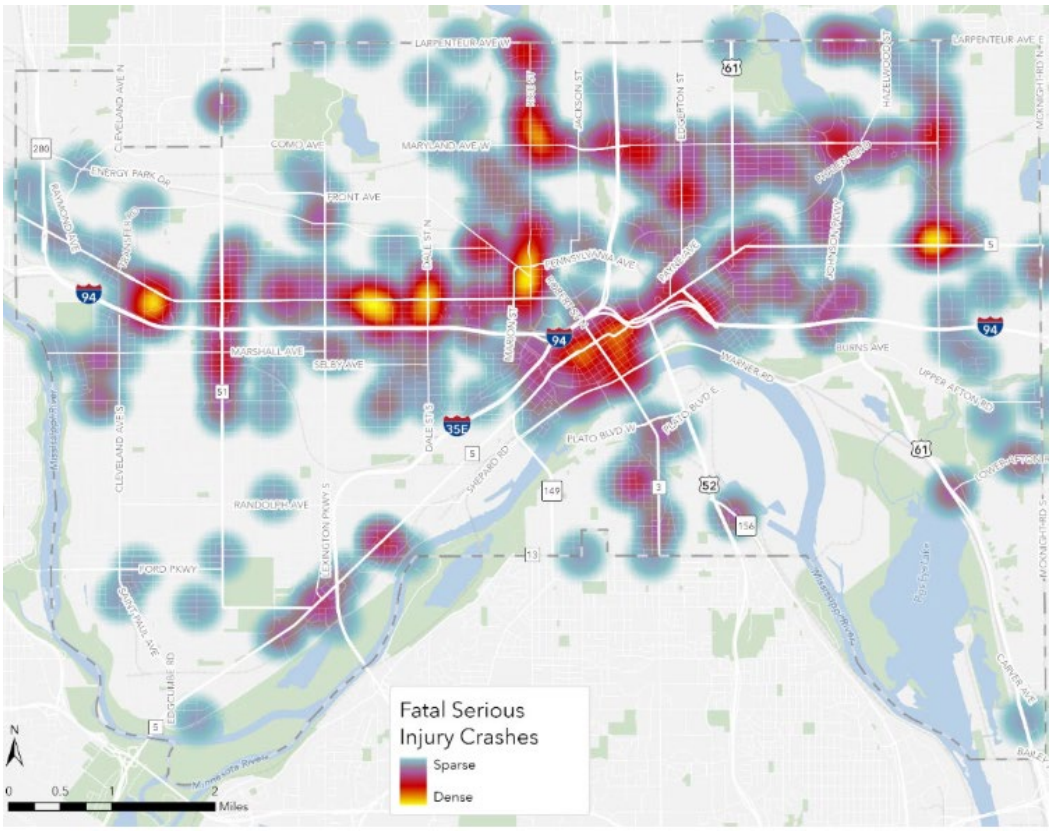

Figure 17. Heat map of all fatal and serious injury crashes, 2018–2022 (City of Saint Paul, 2023b)

Zone Identification – Data Analysis and Findings

Data Sources Used in Zone Identification Analysis

The city chose speed reduction as its priority. The city examined 5 years of recorded fatal and serious crash data, resident complaints, and areas of concentrated poverty where 50 percent or more are high-risk (City of Saint Paul, 2019). Figure 18 summarizes the density of fatal and serious injury crashes in defined Areas of Concentrated Poverty (ACP) in Saint Paul. Public works and the police department have a history of successful collaboration, and they wanted to work together to implement the pedestrian-focused project.

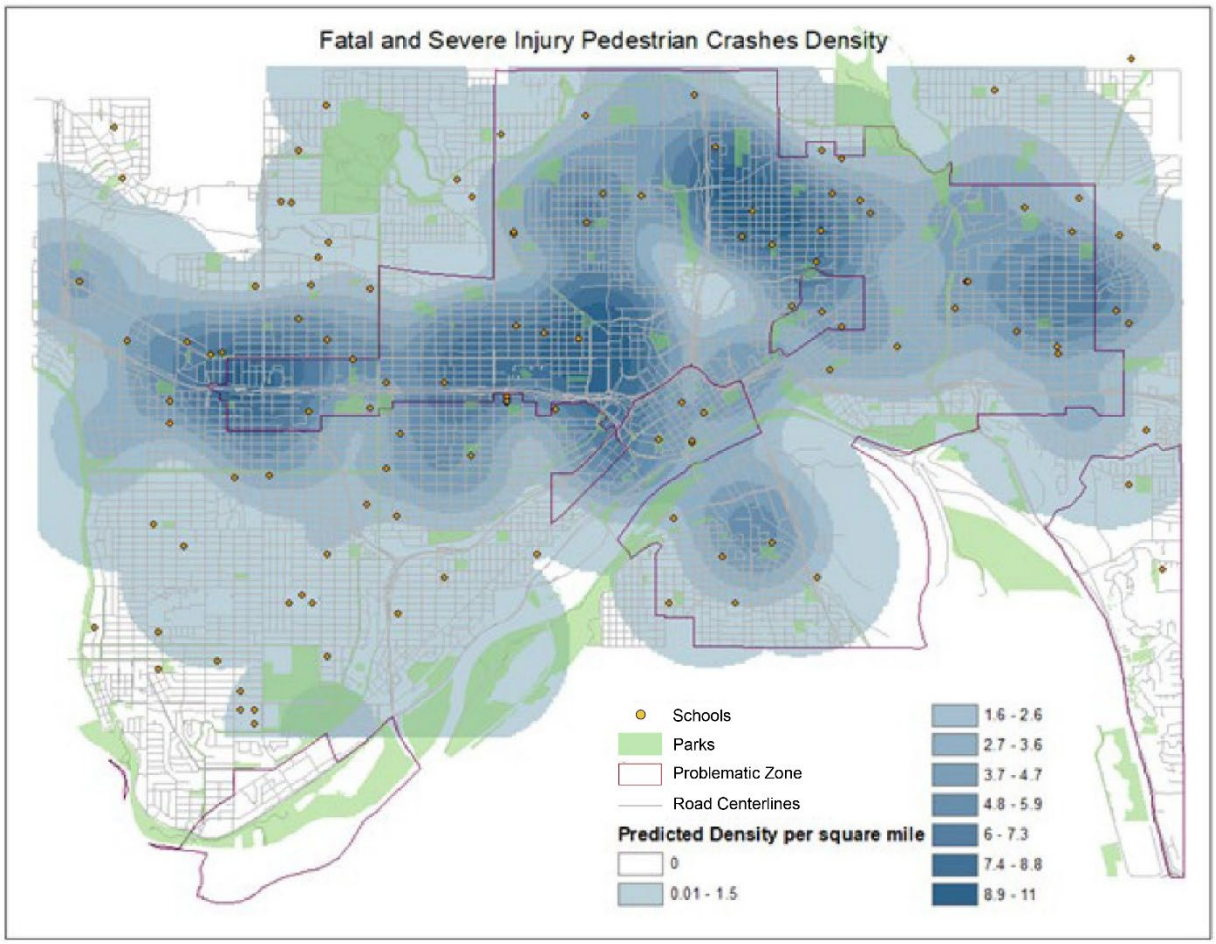

Figure 18. Density of ACP pedestrian crashes involving motor vehicles resulting in deaths or serious injuries (Source: HSRC)

Candidate and Final Priority Locations

In consultation with the city, HSRC researchers analyzed pedestrian crashes and other risk factors, including Figure 18. This information spurred discussion among the project team members. Ultimately, the city decided to focus on high-priority road segments based on crash and speed histories and entry points to the city where emphasizing the speed limit would set the tone that "we don't speed in Saint Paul." The team excluded Dale Street because of a planned improvement project, including lane reduction, turn lane, and median islands (Ramsey County, n.d.). University Avenue was also removed from consideration because the existing light rail running down the middle of the street did not lend itself to low-cost strategies.

The final three road segments of interest, as shown in Figure 19, included Cretin Boulevard, that sits south of an I-94 exit on a high-volume city street where it passes through a residential area to the University of St. Thomas.

The second road segment was on White Bear Avenue, a county-owned road with public housing and concentrated areas of older pedestrians. The original boundaries began at Larpenteur Avenue, stretching south to just shy of Ames Avenue. However, due to construction underway in Spring 2024, the team pivoted to a different segment: Nevada Avenue East to 4th Street East.

This would allow for the inclusion of some of the originally envisioned road segments as well as an additional segment where speeding is also frequent.

The third identified road was Rice Street from Maryland to Sycamore. While a planned major reconstruction came to light after selection, it was still identified as a potential candidate for additional changes. Saint Paul Police visited all the locations to collect speed data.

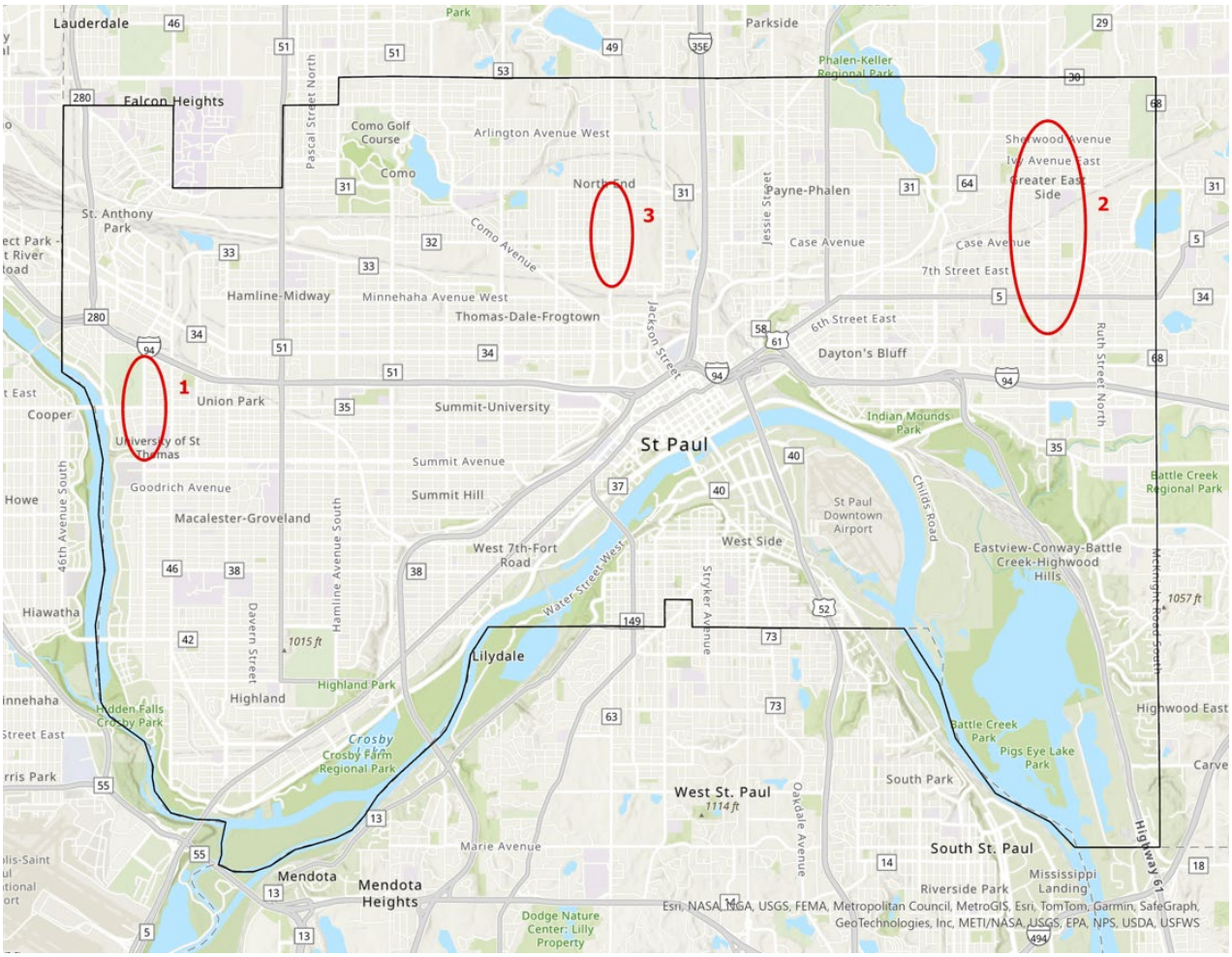

Figure 19. Selected road segments—1 is on Cretin Boulevard; 2 is on White Bear Avenue; and 3 is on Rice Street (Source: HSRC)

Selection and Implementation of Countermeasures

Zone Assessment and Investigation

Saint Paul police conducted an initial field review for potential locations for signage and pavement markings. They also examined crashes in each corridor, measured the speeds, and examined speed distributions. These analyses showed that existing signs were not particularly visible and that a high percentage of drivers in each road segment were traveling 10 to 15 mph over the speed limit.

Selected Interventions

The project team wanted to choose strategies to help change the driving culture. Leveraging their positive history of collaboration, the team chose to use a combination of enhanced speed limit signage, speed limit pavement markings, high visibility, educational enforcement, and social media outreach. Project implementation began in May 2024 and was completed by June 2024.

Commander Jeremy Ellison of the Saint Paul Police Department noted, “I don’t see us ever not collaborating or using our education tools or education partners … I think we’re always going to tap into more than one strategy. We know we are more successful when we collaborate.” The traffic engineer was committed to using countermeasures that would not be temporary. The project team saw the countermeasures as test applications that could be replicated in similar conditions. Carefully defining the conditions was important to being ready to address requests from the public.

The planned speed limit signage would be oversized (36 in by 48 in) and located on both sides of the street facing approaching traffic to form a speed limit gateway sign configuration that drivers would unlikely miss. Pavement markings would state the speed limit. A dynamic speed feedback sign would give drivers an additional indication to attend to their speed.

Educational enforcement would include a high volume of traffic stops in a short period of time to draw public attention and enlist drivers' assistance in slowing down traffic speeds and becoming a safety “pace car.”

A script, social media, and driver flyer were developed with language that focused on noting the history of life-changing crashes on that particular roadway segment and asking drivers for help in slowing down speeds (Figure 20). Officers also informed judicial counterparts about the planned enforcement so that everyone was prepared with the plan that drivers traveling 6 mph over the speed limit would receive a warning, and drivers traveling a larger margin over the speed limit would receive a citation. Community engagement included social media messages and participation in community meetings by both police and public works.

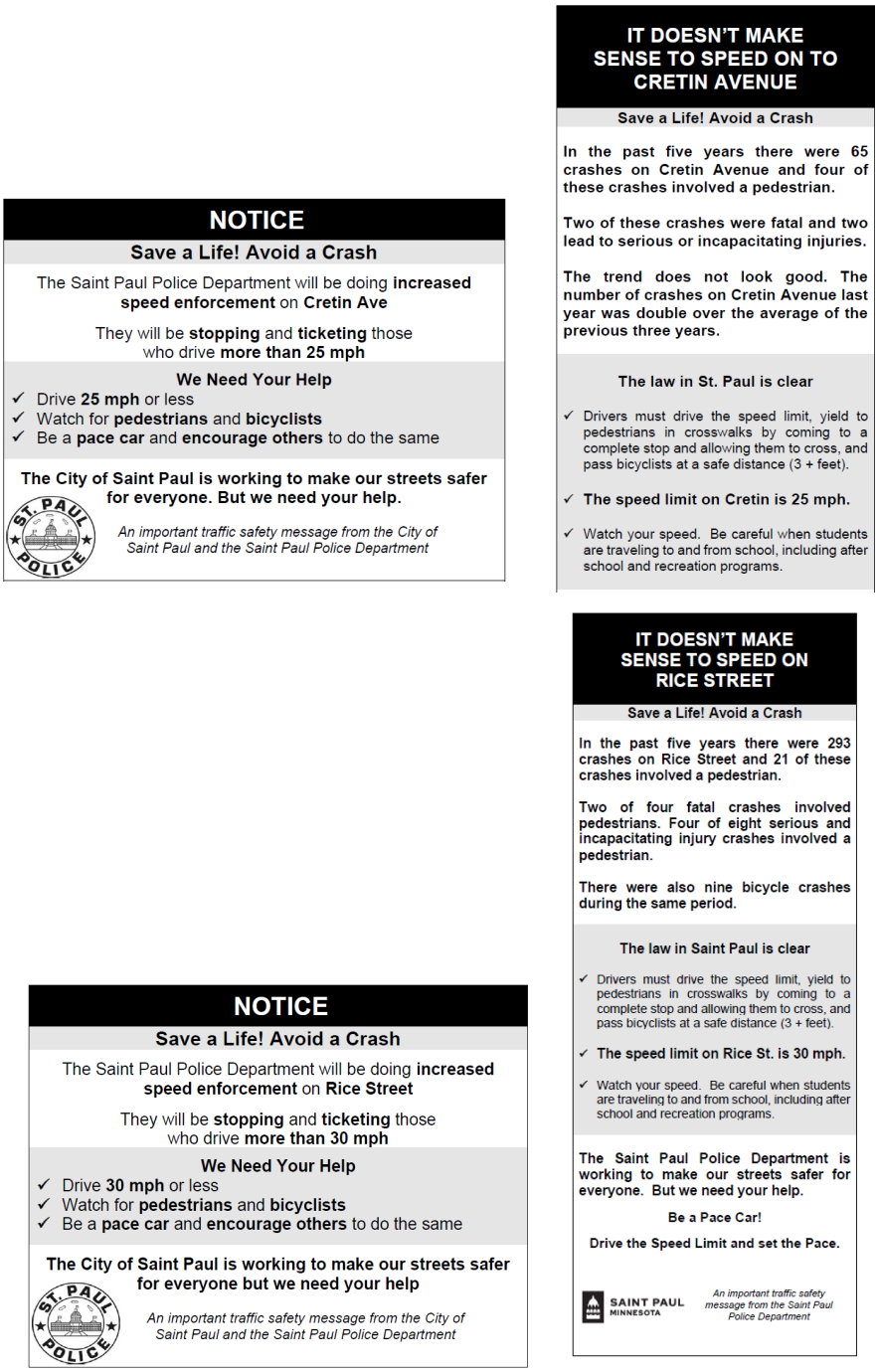

Figure 20. Cretin Boulevard and Rice Street public education material customized to reflect the road segment's crash history

Cretin Boulevard

Signage was installed along Cretin Boulevard in June 2024 with social media messaging and enforcement actions. Signage included two sets at each end and one at the mid-point of the road segment. While there was already a southbound speed feedback sign, an additional, temporary northbound sign was added. Officers conducted 3 weeks of enforcement along the road segment, Monday to Friday from 10 a.m. to 8 p.m., making more than 800 stops. A shift in the plan was required almost immediately when officers found the number of speeding drivers to exceed officer capacity for stops. They revised to stopping vehicles exceeding the speed limit by 15+ mph and also added a spotter role. The spotter used a laser speed detection device to identify the vehicles officers should stop, increasing the efficiency and allowing officers to focus just on the stop. Figures 21 to 23 show some of the signs and enforcement activity.

Figure 21. Oversized speed limit signs on both sides of the road greet drivers on Cretin Boulevard heading north

Figure 22. Heading south, drivers see two signs on Cretin Boulevard south of I-94: One at the roadside and one at the median

Figure 23. Officers stop several vehicles south on Cretin Boulevard during an enforcement operation

White Bear and Dale Street

Improvements on White Bear will occur after discussions with county traffic engineers and after the completion of unrelated construction in spring 2024. Tailored public education materials are ready. Dale Street, the third high-priority segment, will be assessed after the planned construction.

Resources

Implementation required police and public works involvement. Police used their State Highway Safety Office (SHSO)-provided Toward Zero Deaths funding for officer time to draft the public communications (including driver education material), develop and conduct training, and plan and conduct the enforcement actions. Police department funds were used to print driver education material. Saint Paul currently runs without a traffic enforcement unit due to staffing issues. The funding used during these special details was equivalent to three full-time officers' positions.

Public works special-ordered the oversized speed limit signs and installed them using the city's traffic safety funding. The city noted the importance of including clearly defined responsibility for accomplishing tree-trimming to make the new signs visible. The project recognized the benefits of increasing the use of more conspicuous pavement markings and the need for supporting market research to determine what applications could perform and survive best in Saint Paul's cold weather.

Program Evaluation, Outcomes, and Impact

Project Outcomes

In keeping with speed reduction as the key priority, post-implementation speeds will be compared with pre-implementation speeds. Police officers noted their social media posts received positive replies, including one driver who shared the experience of being stopped by an officer and then encouraged their neighbors to slow down. Residents also came out of their homes to thank officers for their efforts.

An unplanned result came from the District Council Transportation Committee, where Cretin Boulevard is located. The committee voted to send a formal thank you to the city for the new signage and enforcement. As a process measure and part of the Toward Zero Death grant funds, police have shared data on stops and citations from the area. They noted that it helps show that "speed is still a problem" and to share good practices with other cities around the State.

Impact of Zone Approach

The Transportation Safety Action Plan informed the implementation (City of Saint Paul, 2023a). For cities with a Safety Action Plan or other road safety plan, the assessment results can be used to identify candidate road segments, and a separate analysis is not necessary.

Saint Paul police and public works already had a close working relationship. For cities looking for opportunities to combine engineering and enforcement efforts, the low-cost pedestrian zone approach can build new cross-departmental relationships or leverage existing ones.

This project, in conjunction with the city's work on the Transportation Safety Action Plan (City of Saint Paul, 2023a), has made clear the need for more traffic safety/engineering capacity, so the traffic engineer has requested an additional full-time traffic safety engineer position.

Police received positive feedback and appreciation from community groups, city council leadership, and individual community members throughout the process, from the communications phase to enforcement. Moreover, Commander Kathleen Brown noted, "We gained buy-in and respect from the public through the public messaging and communication." The group also mentioned the value of consulting with the research project team when developing the plan.

Overall, the project helped advance the city's efforts to shift the driving culture to slowing down. As traffic engineer Randy Newton noted, "We're always going to take the safety lens…it's part of every conversation."

More Information

Saint Paul Police Commander

Additional Relevant Website

City of Saint Paul has developed a Transportation Safety Action Plan: www.stpaul.gov/departments/public-works/transportation-and-transit/transportation-safety-action-plan

Discussion

This study demonstrated a low-cost, rapid-development pedestrian safety countermeasure deployment technique at three sites, Gainesville, Kalamazoo, and Saint Paul. Project staff successfully adapted the original pedestrian safety zones approach (Blomberg & Cleven, 1998) into the low-cost pedestrian safety zones technique used by the three sites. Project staff also developed a video, a handbook, and a countermeasure guide to support site recruitment and use of the technique.

All three sites successfully executed low-cost safety zone approaches based on the material prepared by this project. As hoped, all three began the process with GIS analyses to better understand their problems and provide a basis for selecting specific locations to treat with countermeasures. Experts from HSRC assisted with these analyses in the interest of time because the site's required personnel were backlogged. Given sufficient time, each site could perform this type of analysis independently. The three sites also found the *Countermeasure Selection Resource* report (Dunlap and Associates et al., 2023b) helpful in selecting treatments or general classes of countermeasures to implement.

All three sites made productive use of the project stipend. The funding helped site staff make the demonstration project a higher priority in their safety operations. All three, however, did not limit their expenditures to the stipend. Each added funds as necessary to bring the budgets for their zone improvements up to what the selected countermeasure approaches required. They felt the funds showed NHTSA’s strong interest in the low-cost zones technique and gave them leverage to implement it.

Although countermeasures were individually selected to address the problems in the identified zones, none of the three sites kept track of individual countermeasure costs. Countermeasures were typically combined into “projects” that were costed and paid for out of general funds from various sources. This is consistent with the sites' decisions to put funds from this project into the general pool for countermeasures and treat the low-cost zones approach as a tool rather than a discrete, budget-limited activity.

Although all three sites productively used the low-cost zones approach, their methods for integrating the technique into their regular operations differed. Gainesville already had some large-scale safety projects in the planning or implementation stages. It coordinated its safety zone activities to get things started while the larger projects were under development or to address specific problem spots quickly.

Kalamazoo also used the zones approach to address two troubling areas more rapidly than they could accomplish with their standard approaches. In addition, Kalamazoo leveraged its participation in this project and the availability of the funds from it as a catalyst for seeking out and successfully acquiring additional safety project funding sources, including an SS4A grant. As mentioned in their case study, it raised more than $70 million in funding, that helped its involvement in the low-cost zones work.

Saint Paul treated its low-cost zone efforts like a discrete, high-intensity countermeasure focused on zones identified by project-inspired analyses. The low-cost zones project helped focus on the type of countermeasures used and the application areas. The choice of enforcement and public education countermeasures for immediate implementation is consistent with how many familiar countermeasure efforts, such as *Click It or Ticket*, are traditionally implemented.

Despite somewhat different approaches to the use of low-cost zones, all three sites said it was a beneficial technique and likely to result in safety benefits. This response and documented crash reduction findings in the Blomberg and Cleven study (1998) support the inclusion of the zones technique in the standard "toolbox" used by safety practitioners for large-scale use and as a low-cost, quick implementation approach to deploying countermeasures.

The different ways the sites used the zone approach also highlight its inherent flexibility and argue against promoting strict adherence to any type of use. Jurisdictions vary along many relevant parameters such as budget size, involvement with State and county agencies, local and State laws and regulations, and experience with pedestrian safety in general and specific countermeasures. It seems logical to promote low-cost safety zones as an adaptable approach rather than as a fixed set of procedures to follow.

All three sites also recognized that using low-cost zones approaches to apply countermeasures fit well with concern for areas of disproportionate safety impacts. The low-cost zones approach provided a quick-response tool to address identified crash problems, inquiries, and complaints from city residents. The tool's availability assisted the missions of the safety agencies involved.

The activities at the three sites and their accomplishments in the limited time available for this project suggest that other sites would be able to employ the developed low-cost zones technique. The three sites appreciated the availability of the developed video, handbook, and resource guide, that are easily accessed from the NHTSA and PBIC websites. Other cities should likewise find them helpful and easy to use. The sites also benefited from the analytical help the research team gave conducting the analyses to identify potential zones, selecting the zones to be treated, identifying specific problems in the zones, and picking and implementing countermeasures.

These results are credible testimonial encouraging other sites to adopt the approach. It should be remembered, however, that the three sites in these case studies had previously worked with one or more project team members and received stipends of $90,000 for participating. These factors likely facilitated acceptance of low-cost zones technique and participation in the demonstration.

Encouraging other cities to use the low-cost zones technique would likely benefit from the development and availability of several resources. Promoting the approach with SHSOs at safety conferences such as Lifesavers and the Transportation Research Board Annual Meeting, and frequently mentioning it in NHTSA publications and website would help build initial interest.

Given the positive role of this project team's assistance to each of the three sites, developing an ongoing and easily accessible source of assistance to interested sites may stimulate the use of the low-cost zones approach. This assistance could take many forms, including an interactive website, email support staffed by experts, on-site consulting, or detailed tutorials. Experience from this project suggests that GIS analyses to identify potential zones, select zones to be treated, and analyze root cause problems in the selected zones would be technical support areas of likely value to prospective users.

Sites such as these three cities depend on external funding sources to support much of their safety efforts. State highway safety funds and grants, such as those from SS4A, encourage new and continuing safety programs. The available funds specifically earmarked for low-cost zone applications would likely generate significant interest in using the technique, especially if the grant process was streamlined.

In summary, this study adapted the concept of safety zones developed and tested by Blomberg and Cleven (1998) to apply to low-cost countermeasures in high-impact locations. Three cities of varying sizes and geographic locations implemented the developed low-cost zones approach with support from this project, including technical assistance and funding. These implementations demonstrate that the approach can be applied in various settings. The results showed that the technique is productive, adaptable, and acceptable to its intended users. If promoted in a supportive framework of technical assistance and limited funding, the low-cost safety zones approach should gain traction as a countermeasure application method for pedestrians and any highway safety problem that clusters geographically. An extension of the approach to other crash types, such as bicycles or motor vehicle, would necessitate the development of relevant countermeasure research guides modeled after the one developed by this project for pedestrian crashes. Adapting the material for pedestrians produced by this project so they would apply to another crash type (e.g., bicycles or motor vehicle) should not require extensive effort.

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Important Terms

Below are some important terms and program names used throughout this report. A brief description for each term is presented with a hyperlink to obtain additional information.

Complete Streets	
Description	**Link to Additional Information**
• Transportation projects planned and designed to enable safe mobility for all road users, including motorists, pedestrians, bicyclists, and transit users.	U.S. DOT Complete Streets portal https://highways.dot.gov/complete-streets/complete-streets-resources

High Injury Network	
Description	**Link to Additional Information**
• An evaluation method that demonstrates where the most traffic deaths and severe injuries occur in a set geographic location. Identifying High Injury Networks can inform transportation safety professionals throughout the policy, design, and implementation processes and highlight problem areas for the public to help build buy-in for change. It is best practice to overlay the High Injury Network with demographic data to identify other relevant factors for consideration in prioritization and planning (e.g., high concentrations of communities of color, low-income residents, seniors, and youth)	Smith, T. (2023, May 12). *Developing a robust Vision Zero prioritization process*. Vision Zero Network.

Safe Streets and Roads for All Action Plan	
Description	**Link to Additional Information**
• A Safe Streets and Roads for All, or Vision Zero Action Plan are programs that lay out actionable, measurable strategies, emphasizing design and policy solutions. Each strategy should identify the lead agency responsible, along with supporting/partner agencies, a projected timeline, and budget needs. Work on the plans and their components should be guided by ongoing community engagement and commitment to addressing the needs of all road users, particularly those historically at higher risk.	Safe Streets and Roads for All (SS4A) www.transportation.gov/grants/SS4A FHWA Vision Zero Toolkit

Safe Streets and Roads for All (SS4A) Grant	
Description	**Link to Additional Information**
• Safe Streets and Roads for All grants are funded by the Infrastructure Investment and Jobs Act (IIJA) (2021). They are designed to fund "regional, local, and Tribal" initiatives to prevent roadway deaths and injuries.	Safe Streets and Roads for All (SS4A) Grant Program

Safe Systems	
Description	**Link to Additional Information**
• FHWA defines the "Safe System" as an approach that "aims to eliminate fatal and serious injuries for all road users. It does so through a holistic view of the road system that first anticipates human mistakes and second keeps impact energy on the human body at tolerable levels. Safety is an ethical imperative of the designers and owners of the transportation system."	FHWA The Safe System Approach

Vision Zero Policy; Vision Zero Framework and Action Plan	
Description	**Link to Additional Information**
• Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries while increasing safe, healthy, mobility for all. It employs a Safe System approach. System designers and policymakers are expected to improve the roadway environment, policies (such as speed management), and other related systems to lessen the likelihood and severity of crashes. A growing number of communities in the United States are setting these goals and using the Safe System approach to advance the goal, as is the U.S. DOT.	Vision Zero Network

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DOT HS 813 747
May 2026

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of Transportation

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16661-050526-v7a