



NJ 2020 SHSP

Other Vulnerable Road Users Emphasis Area

Completed Priority Action 1.A.1.a.

A technical memorandum reporting mature traveler infrastructure best practices.



October 28, 2022





Disclaimer

The New Jersey Department of Transportation makes no guarantees as to the accuracy, completeness, or content contained in this document. This document does not contain or imply use of required practice(s), technique(s), or standard(s). This document is subject to update.

The New Jersey Department of Transportation, its officers, employees, or agents shall not be liable for damages or losses of any kind arising out of or in connection with the use or performance of information, including but not limited to, damages or losses caused by reliance upon the accuracy or timeliness of any such information, or damages incurred from the viewing, distributing, or copying of the materials contained in is document.

The materials and information provided herein are provided "as is." No warranty of any kind, implied, expressed, or statutory, including but not limited to the warranties of non-infringement of third-party rights, title, merchantability, fitness for a particular purpose, and freedom from computer virus, is given with respect to the contents of this document or its hyperlinks to other Internet resources.



NJDOT SHSP

Date: Friday, October 28, 2022

Project: **NJ 2020 SHSP Other Vulnerable Road Users**

To: **NJDOT**

From: Richard Storm, PE (HDR)
Patricia Ott, PE, RSP2I (MBO Engineering)
Oliva Polinsky, EIT (HDR)

Subject: Mature Traveler Infrastructure Best Practices Technical Memorandum

The purpose of this technical memorandum is to report research findings on mature traveler infrastructure best practices to the Other Vulnerable Road Users (OVRU) Emphasis Area Workgroup as a part of the New Jersey 2020 Strategic Highway Safety Plan (NJ 2020 SHSP). The technical memorandum will document the findings obtained in the Research White Paper submitted on February 25th, 2022, as well as recommendations of the Workgroup. The recommendations outlined in this report are intended for use on public right of way however, many recommendations may apply to other shared spaces such as schools and parks.

*A comprehensive list of referenced material in this report is provided in Section 6.
Links are included for quick access to all references.*



Table of Contents

1. Background & Motivation	3
2. Research Approach	5
2.1 Local Research Approach	5
2.2 National Research Approach	5
3. Research Key Findings	6
3.1 Local Research Key Findings	6
3.1.1 New Jersey Age-Friendly State Advisory Council.....	6
3.1.2 New Jersey Metropolitan Planning Organizations (MPOs)	7
3.1.3 New Jersey Future [24]	10
3.1.4 NJDOT Pedestrian and Bike Infrastructure Applications.....	10
3.2 Mature Traveler Infrastructure Resources.....	11
3.2.1 FHWA 2014 Handbook for Designing Roadways for the Aging Population [30].....	11
3.2.2 FHWA Proven Safety Countermeasures [32]	14
3.2.3 2014 FHWA North American Conference on Elderly Mobility (NACEM) Noteworthy Practices Guide [33].....	15
3.2.4 National Highway Traffic Safety Administration (NHTSA) Identifying Countermeasure Strategies to Increase Safety of Older Pedestrians [3]	15
3.2.5 Michigan DOT Evaluation of Engineering Improvements for Older Drivers [34].....	15
3.3 Peer Programs	16
3.3.1 New York City Safe Streets for Seniors Program [35]	16
3.3.2 Florida DOT Safe Mobility for Life Program [36]	17
3.3.3 Georgia Governor's Office of Highway Safety Older Driver Safety Program [39].....	18
3.3.4 Michigan DOT Senior Mobility Program [40].....	19
4. Next Steps & Recommended Implementation Strategies	20
5. Summary Matrix.....	21
6. References	22



List of Figures

Figure 1: Fatal or severe injury crashes involving age 64+ in the NJTPA region of New Jersey between 2017-2019.	4
Figure 2: AARP’s Eight (8) Domains of Livability [14].	6
Figure 3: Signal retroreflective backplates [30].	12
Figure 4: Diagram that demonstrates mixed-case lettering and arrow-per lane signing [30].	12
Figure 5: LEFT - Retroreflective sign (“ALL WAY”) versus non-retroreflective signs (“STOP” and Street Name Sign) [31]. RIGHT – Diagram of active warning sign [30].	13
Figure 6: Portable changeable message sign sample messaging and layout [30].	14
Figure 7: Sample layout of post-mounted delineators at an at-grade rail crossing [27].	14
Figure 8: Florida Safe Mobility for Life Resource Center Roundabout Tip Card [36].	18



1. Background & Motivation

According to the NJDOT 2022 Highway Safety Plan, mature travelers (defined in this report as those 65 and older) were involved in 18% of total crashes and made up nearly 26% of 2020 driver fatalities in New Jersey (NJ) [1]. The North Jersey Transportation Planning Authority (NJTPA) compiled a map of fatal or severe injury crashes between 2017-2019 involving those aged 64 and older in the NJTPA region of New Jersey to illustrate that this is a critical issue that requires action at the state level. Though the map is NJTPA-specific as of November 2022, NJTPA will work to update the map to include all of New Jersey. This map is shown in **Figure 1**. It is estimated that by 2030, one in five Americans will be 65 and older [2]. As the population continues to age, it is expected that mature traveler crash and fatality rates will continue to climb as well.

Though the mature driver population is climbing, many mature travelers opt for alternatives to driving, such as walking, biking, and transit options, as available to them. Mature pedestrians are also more susceptible to serious injuries or fatalities if involved in a crash compared to the general population. As of 2010, though mature persons only accounted for 13% of the U.S. population, they made up 19% of pedestrian fatalities, demonstrating the need to design pedestrian and bike facilities to better protect the aging population [3]. Lack of accessibility historically has been a barrier for mature travelers to utilize public transit, and the COVID-19 pandemic has added another barrier for mature users concerned for their health in shared spaces that don't allow for social-distancing [4].

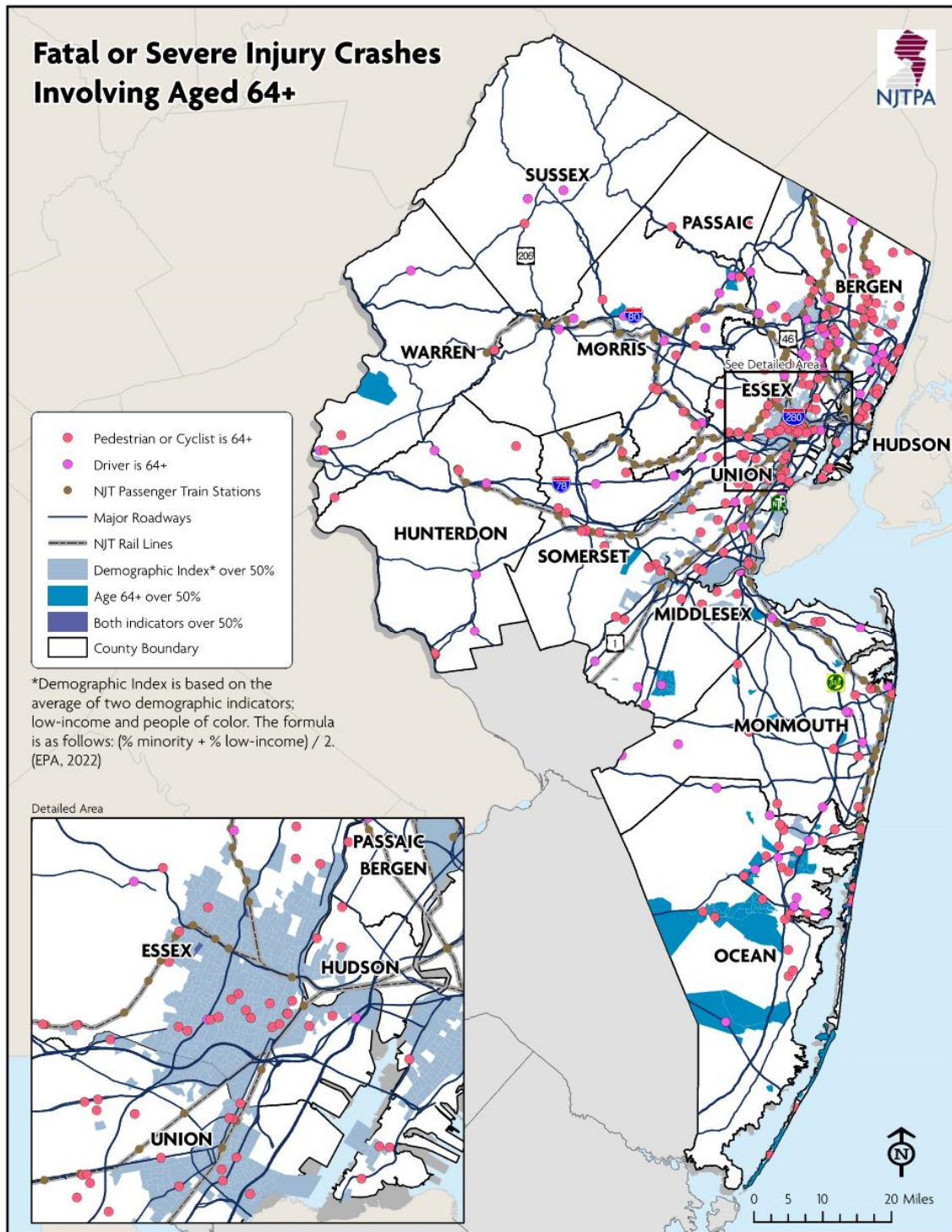


Figure 1: Fatal or severe injury crashes involving age 64+ in the NJTPA region of New Jersey between 2017-2019.



2. Research Approach

The following section discusses the approach for researching mature traveler infrastructure best practices both locally and nationally.

2.1 Local Research Approach

The project team utilized New Jersey's three (3) Metropolitan Planning Organizations (MPO) Unified Planning Work Program (UPWP) [5] documents to search for any mature traveler related programs and projects. Additionally, outreach was made to the Delaware Valley Regional Planning Commission's (DVRPC) Regional Safety Task Force (RSTF) to ascertain whether the organization had any specific infrastructure related projects in its Transportation Safety Action Plan (TSAP). The TSAP includes an analysis of Older Road User involved crashes as well as a set of strategies coordinated with Safe System Approach (SSA) categories. The DVRPC also has an initiative called Age-Friendly Communities, which provides data analysis, partnerships, and resources for the aging community [6].

While drafting the NJ 2020 SHSP, a review of other NJ agency plans was conducted to ascertain whether there were any transportation related programs and/or projects that could be coordinated with the SHSP. This document was reviewed for any relevant information.

The team conducted internet searches for NJ programs for mature travelers. NJ's Department of Human Services, Division of Aging Services [7], Aging and Disability Resource Connection, NJ Advocates for Aging Well [8], and NJ Future Working for Smart Growth: More Livable Places and Open Spaces [9] websites were all reviewed.

Additionally, NJ is home to eight (8) Transportation Management Associations (TMAs) that provide a variety of alternative transportation services such as ridesharing, shuttles, carpools and vanpools, and concierge ride hailing services. The TMAs promote pedestrian, bicycle, senior traveler programs, as well as administer the Safe Routes to School (SRTS) program statewide. Some of the TMA programs are senior-specific such as the Ryde4Life program with EZRide, Ride Provide from the Greater Mercer TMA, and TRANSCEND with the Hudson TMA. It should be noted that each TMA promotes the Street Smart Campaign developed through NJTPA and Complete Streets, both aimed at keeping the most vulnerable travelers safe.

The team identified New York City Safe Streets for Seniors Program as a local peer program and met with a representative to learn more about the program. Additional interviews were held with national peers, as outlined in section 2.2.

2.2 National Research Approach

The team conducted internet searches on the Federal Highway Administration's (FHWA) Older Road Users [10] and the National Highway Traffic Safety Administration's (NHTSA) Older Drivers [11] websites as well as general searches on Google and the Transport Research International Documentation (TRID) website [12] to gather available documents and resources regarding mature travelers. Additionally, the team met with representatives of both FHWA and the Transportation Research Board (TRB) to gain additional insight into available resources on mature traveler infrastructure. The conversation with Guan Xu and Mark Doctor of FHWA's Older Road Users program included discussion of mature traveler infrastructure best practices and potential peer program recommendations. From the conversation with John Campbell of TRB, the team received a literature review on the topic of mature road users conducted by TRB in 2021.

After identifying national peer programs in Florida, Georgia, and Michigan, the team met with representatives from the Florida DOT Safe Mobility for Life Program and Georgia Governor’s Office of Highway Safety Older Driver Safety Program to gain additional insight into program strengths and difficulties. The team attempted to meet with a representative from the Michigan DOT Senior Mobility Program but received no response from the program.

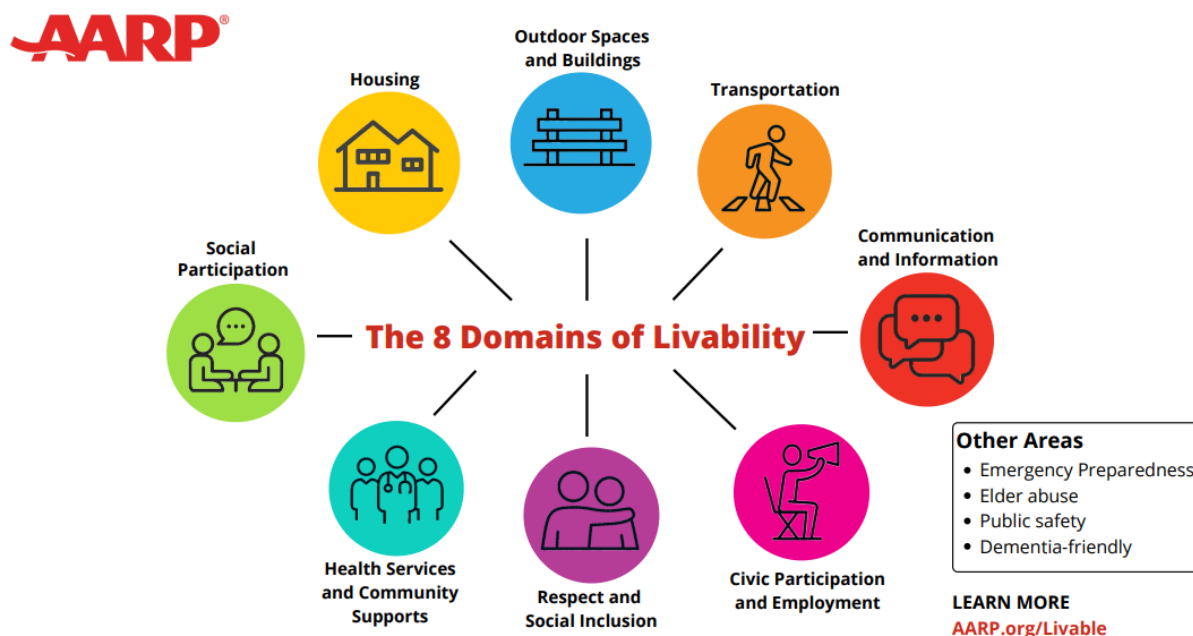
3. Research Key Findings

The following section summarizes the key findings of local and national research on mature traveler infrastructure best practices.

3.1 Local Research Key Findings

3.1.1 New Jersey Age-Friendly State Advisory Council

On March 2, 2022, New Jersey Governor Phil Murphy signed Executive Order No. 227 to create the Age-Friendly State Advisory Council [13]. This makes New Jersey only the ninth state to be accepted into AARP’s network of age-friendly communities. AARP’s ‘Eight (8) Domains of Livability’ are illustrated in **Figure 2**.



Illustrations from iStock

© AARP 2020 | All rights reserved | Questions? Contact AARP Livable Communities by email at Livable@AARP.org.

Figure 2: AARP’s Eight (8) Domains of Livability [14].

New Jersey’s Age-Friendly State Advisory Council’s mission is to develop a plan over the next 18 months focused on creating age-friendly communities. The report will cover the key facets of age-friendly communities, including transportation, housing, inclusivity, and community support and health services. The transportation best practices outlined by this advisory council’s report are anticipated to heavily overlap with the infrastructure best practices detailed in this technical memorandum.



3.1.2 New Jersey Metropolitan Planning Organizations (MPOs)

New Jersey has three (3) MPOs covering the entire state who sponsor and conduct studies, assist county planning agencies, and monitor compliance with national air quality goals. Each of the MPOs prepare a Transportation Improvement Program (TIP) which is a schedule of funding for various phases of work on selected projects and programs. The TIP generally contains a variety of infrastructure improvement activities, such as redesigning intersections, upgrading traffic signals, constructing new bicycle/pedestrian paths, as well as rehabilitating bridges, resurfacing roadways, and adding trains and buses.

The highest priority for each of the MPOs is safety of their travelers. Of the many programs in the TIP, is the Local Safety Program provides the counties and select cities under their jurisdiction, the opportunity to apply for Highway Safety Improvement Program (HSIP) funding to implement important safety improvements. There is a common application process where applicants provide justification for the need for the improvement, with assistance from the MPO if needed. Approved applications are then sent to the NJDOT for approval.

Each of the three MPOs have developed and implemented a Coordinated Human Services Transportation Plan (CHSTP). These coordinated plans identify the transportation needs of individuals with disabilities, older adults, and people with low incomes, provide strategies for meeting these needs, and prioritize transportation services for funding and implementation. Links to each respective MPO's plan can be found below.

While each MPO has developed and implemented a variety of safety programs, each TIP did not reveal specific infrastructure projects/programs aimed at mature travelers but did outline funding sources for resources for senior/older adults.

North Jersey Transportation Planning Authority (NJTPA): The NJTPA's CHSTP can be found here at:

https://www.njtpa.org/NJTPA/media/Documents/Planning/Plans-Guidance/Regional-Human-Services-Transportation-Plan/NJTPA_2017_CHSTP_Final-101217.pdf?ext=.pdf

New Jersey's eight (8) transportation management associations are funded by the TMA Program to implement the non-infrastructure recommendations of the CHSTP. Activities include:

- Coordinating or delivering door-to-door trips for mature travelers and other human services populations, both independently and in partnership with senior services agencies, hospital systems, paratransit providers, transportation network companies, and volunteer programs.
- Providing travel training to mature travelers and other human services populations on how to use transit, paratransit, and private transportation. This includes classroom instruction, one-one-one training, and the maintenance of online and printed guides.
- Providing planning assistance and mapping to senior or human services agencies responsible for mature traveler transportation.

The NJTPA's Long-Range Transportation Plan, Plan 2050 [16], outlines its vision for safety infrastructure improvements for all travelers throughout the region. The NJTPA invests a



considerable amount of HSIP funding to its subregions to install improvements such as roundabouts, left turn lanes, bicycle lanes, pedestrian signal upgrades, pedestrian refuge islands, and high visibility crosswalks. While mature travelers are not specifically mentioned, the noted improvements benefit all travelers.

The NJTPA's FY 2022 Unified Planning Work Program (UPWP) [17] outlines a variety of safety programs conducted statewide by the state's Transportation Management Associations (TMAs). These programs generally include education and outreach efforts about safe driving, assisting with mobility alternatives and options, and supporting human services transportation. Additionally, the UPWP outlines other programs such as the Active Transportation Plan that assists subregions and communities to develop a safe and connected network of pedestrian and bicycle facilities. The Local Safety Program provides the following services:

- Safety engineering assistance
- Road safety audit support
- Analysis assistance for the Local Safety Program application for funding
- Evaluation of trail crossings
- Assistance with collecting and evaluating pedestrian volumes for improving pedestrian accommodations

Another successful program developed by the NJTPA is the **Street Smart NJ** Pedestrian Safety campaign [18]. It is a public education campaign that aims to raise awareness of pedestrian and motorist laws and change the behaviors that lead to pedestrian and cyclist crashes and fatalities. More than 200 communities throughout NJ have participated. NJTPA has developed a variety of resources such as campaign materials, videos, how-to guides, and press materials to assist communities in implementing the safety campaign. The NJTPA also led a priority action to implement the Strategic Highway Safety Plan to implement Street Smart NJ statewide.

Delaware Valley Regional Planning Commission (DVRPC): The DVRPC has been operating the Regional Safety Task Force (RSTF) since 2005, developing and implementing a Transportation Safety Action Plan (TSAP) that mirrors both SHSPs in New Jersey and Pennsylvania. The DVRPC's current Plan (2018) includes an analysis of mature driver statistics as well as two strategies related to engineering. These strategies are:

- Senior-safe roadway design, such as clear, concise messaging and highly legible design elements; and
- Promoting senior housing in walkable communities through municipal land use regulation and education to the public (particularly seniors and adult children/caretakers) about housing choices that enable a wider range of transportation options that are close to services and resources [19].

In addition, the TSAP provides a sample of existing engineering programs and/or policies that help promote older driver safety:

- Sign improvements including larger and higher advance warning signs - Pennsylvania DOT, Burlington County Engineering Department
- Customized Community Transportation (CCT) Connect Services – Southeastern Pennsylvania Transportation Authority (SEPTA)
- Senior ID cards, senior discounts, shared-ride program - SEPTA



- Reduced transit fare program - NJ TRANSIT, The Port Authority Transit Corporation (PATCO), SEPTA
- Courtesy transportation for seniors - NJ TRANSIT
- Transportation Resources to Aid the Disadvantaged and Elderly (TRADE) demand-responsive transit for seniors funded by the Senior Citizen and Disabled Resident Transportation Assistance Program - Mercer County
- Ride Provide personal transportation for seniors, transit travel training program at senior centers - Greater Mercer Transportation Management Association (TMA)

The DVRPC also adopted its Long-Range Plan, Connections 2050, Plan for Greater Philadelphia, in September 2021 [20]. The Plan adopts the Vision Zero philosophy which aims to end fatal and serious injury crashes by protecting all roadway users through equitable engineering, education and enforcement, while prioritizing speed control. The Plan also outlined some broad infrastructure improvements as noted below:

- Rebuild and modernize the Region's transportation assets to achieve and maintain a State of Good Repair (SGR), including full Americans with Disability Act (ADA) accessibility.
- Achieve Vision Zero.
- Integrate existing and emerging transportation modes into an accessible multimodal Mobility as a Service (MaaS) network.
- Implement advanced integrated traffic signal and transit management services.
- Identify HSIP eligible pedestrian and bicycle safety projects.

The DVRPC's CHSTP can be found at <https://www.dvrpc.org/coordinatedhumanservices>

South Jersey Transportation Planning Organization (SJTPO): The SJTPO's Regional Transportation Plan 2050: Moving South Jersey Forward [22], serves as the regional transportation plan (RTP) for the SJTPO region and guides the region's transportation decision-making for the next 30 years.

Goal 7 of the RTP is devoted to improving transportation safety and outlines some of the SJTPO's ongoing initiatives for both infrastructure and behavior. Like the other MPOs in NJ, SJTPO utilizes the federally funded Local Safety Program to guide its counties and municipalities to implement safety improvements on its roadways. While not specifically calling out mature travelers, SJTPO's strategies as noted below will benefit all travelers:

- Promote and Advance FHWA's Proven Safety Countermeasures
- Safety incorporated into all Projects
- Bicycle and Pedestrian safety project prioritization
- Alignment with the NJSHSP

A review of the latest SJTPO's UPWP [23] outlines its commitment to Towards Zero Deaths by focusing on both infrastructure and behavioral safety programs. Through a grant from the NJ Division of Highway Traffic Safety (DHTS), SJTPO's Education and Outreach Program has safety programs/presentations for mature drivers along with teen driver safety, occupant protection, pedestrian/bicyclist safety and defensive driving training. In addition, the SJTPO works with the



American Association of Retired Persons (AARP) to deliver the Car Fit program for mature drivers, ensuring a proper fit within their vehicles and increasing safety awareness for all occupants.

The SJTPO's CHSTP can be found at <https://www.sjtpo.org/accessforall>.

3.1.3 New Jersey Future [24]

NJ Future is a non-profit advocacy organization that promotes equitable growth and redevelopment for healthy strong and resilient communities, including age friendly communities. A 2014 report by New Jersey Future, "Creating Places to Age in New Jersey" [25], provides data and insight on which communities, at that time, were the most mobility friendly for mature/older adults. Interestingly, a majority of seniors were shown to be located throughout the municipalities in NJ that lack the infrastructure to support mobility for this population. There was a focus on smart growth principles for the older population with a discussion on pedestrian facilities (sidewalk connectivity, signal timings, enhanced lighting, pavement marking improvements) that promote safe and healthy walking and cycling.

While the recommendations were not solely infrastructure related, the report pointed to many factors to consider when developing new or retrofitting communities to accommodate mature travelers. Some of these include considering the compactness of the area, focusing on mixed-uses, and providing readily available access to public transportation.

A completed research project conducted the NJDOT's Bureau of Research, titled "Understanding the Transportation Mobility Needs for an Aging New Jersey Population" in May 2021 [26], outlined many recommendations for training, coordination, policy, and geography, but did not venture into the infrastructure area. This report provides a lot of insight into the current older traveler challenges and gaps in the different geographic areas of the New Jersey.

3.1.4 NJDOT Pedestrian and Bike Infrastructure Applications

NJDOT has published Bicycle [27] and Pedestrian [28] Planning and Design Guidelines as a part of its prioritization of infrastructure and design practices that enhance pedestrian and bicycle safety. Additionally, in 2016 NJDOT published the New Jersey Bicycle and Pedestrian Master Plan [29] to outline visions, goals, and strategies to implement pedestrian and bicycle safety improvements throughout the state. NJDOT bicycle and pedestrian design guides follow the Manual on Uniform Traffic Control Devices (MUTCD). Though these resources are intended for the general population, the application of these measures especially improve safety for vulnerable populations which includes mature travelers.

Mohammad Islam, a NJDOT engineer in the Bureau of Safety, Bicycle and Pedestrian Programs, shared a few DOT applications of infrastructure best practices for pedestrian crosswalks for the general population that apply to mature travelers:

- *Crosswalk size and type* – NJDOT Design Manual and MUTCD minimum of six-feet wide and two-line crosswalk. Wherever possible, to accommodate two wheelchairs, the preferred minimum crosswalk width is eight-feet wide. Additionally, crosswalks must be retro-reflective and ladder crosswalks are preferred over two-line crosswalks to enhance visibility.



- *Crosswalk Location at Channelizing Islands* – Adding designated crosswalks is strongly recommended at a channelized island. Though the ideal location is in the middle of the island, crosswalks are also allowed at the beginning or end of a channelized island.
- *“State Law STOP for Pedestrian in Crosswalk” Signing* – New Jersey Statute 39:4-36¹ requires drivers to stop for pedestrians in crosswalks. The “State Law STOP for Pedestrian in Crosswalk” sign may be permanently post mounted 25’ in advance of the crosswalk. This advanced warning allows drivers additional time to slow down and come to a complete stop when necessary.

3.2 Mature Traveler Infrastructure Resources

The majority of available resources regarding mature traveler infrastructure are driver- and pedestrian- focused. Throughout the literature review, there were no bicycle infrastructure practices found that were specific to mature travelers. Similarly, reports on transit and transportation alternatives (such as door-to-door transit services used amongst mature adults and people with disabilities) focus on the policies and fleet requirements for such services, rather than infrastructure needs.

3.2.1 FHWA 2014 Handbook for Designing Roadways for the Aging Population [30]

The most comprehensive document regarding infrastructure and design for mature travelers is the FHWA 2014 Handbook for Designing Roadways for the Aging Population. The handbook is

For additional information on any of the infrastructure discussed, refer to the FHWA Handbook online at: https://safety.fhwa.dot.gov/older_users/handbook/

broken down into best practices for intersections, interchanges, roadway segments, construction and work zones, and highway-rail grade crossings. FHWA has more recently published a Desk Reference for the 2014 Handbook which is a more easily digestible version of the full handbook and makes references to pages in the handbook where more detailed explanations are available. For the purposes of this technical memorandum, the infrastructure best practices have been separated into three categories: geometric improvements, intersection traffic control, and other. Below are some examples of topics covered regarding infrastructure best practices.

Intersections

- *Geometric Improvements*: Adjust intersection angle/skew to as close to 90 degrees as possible based on site conditions and control type, increase widths of and/or channelize or offset turn lanes, design simple curb radii of 25 to 30 feet and evaluate need for compound curves, offsets, or tapers to accommodate heavy vehicles turning, provide pedestrian crossing islands where conditions allow

¹Assembly Bill 1329 -

[https://www.state.nj.us/transportation/commuter/pedsafety/responsibility.shtm#:~:text=\(39%3A4%2D36\),of%20their%20half%20of%20roadway.](https://www.state.nj.us/transportation/commuter/pedsafety/responsibility.shtm#:~:text=(39%3A4%2D36),of%20their%20half%20of%20roadway.)

- *Traffic Control:* Clearly delineate edge lines and curves, use larger fonts on high visibility signs, provide advanced signing, evaluate need for protected versus permissive left turn movements
- *Other:* Incorporate roundabout or reduced-conflict intersection (RCI) design wherever possible, provide ample sight distance, install fixed lighting systems, high visibility crosswalks, and accessible pedestrian signal (APS) treatments, increase walk time to accommodate slower walking speeds, provide signal retroreflective backplates at signalized intersections (**Figure 3**).



Figure 3: Signal retroreflective backplates [30].

Interchanges

- *Geometric Improvements:* Provide adequate acceleration and deceleration lanes for entrance and exit ramps
- *Traffic Control:* Implement signing improvements including larger letter size, mixed-case lettering, retroreflective sheeting, and arrow-per-lane signing (shown in **Figure 4**) rather than diagrammatic signs, provide clear delineation including post delineators and object markers, and use of raised pavement markings at exit points



Figure 4: Diagram that demonstrates mixed-case lettering and arrow-per lane signing [30].

- *Other:* Install complete interchange lighting systems where feasible and partial lighting systems where full systems are not feasible.

Roadway Segments

- *Geometric Improvements:* Provide at least 18 feet of pavement for one direction (lane plus shoulder) for two-lane rural roads with a radius less than 1900 feet throughout the entire duration of the curve, provide minimum passing sight distance along all vertical curves
- *Traffic Control:* Install retroreflective pavement markings and post-mounted delineators along horizontal curves, utilize retroreflective signs to indicate beginning and ending of no passing zones (example of retroreflective signing provided in **Figure 5**), provide active and passive warning signs where horizontal and vertical curves restrict sight distance (example of active warning sign provided in **Figure 5**).

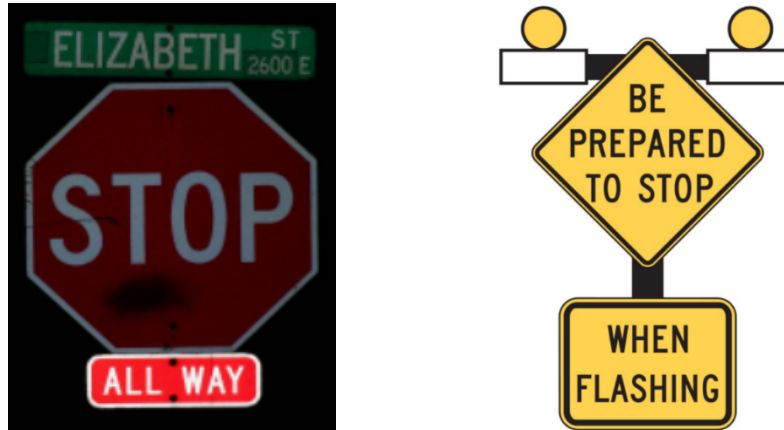


Figure 5: LEFT - Retroreflective sign (“ALL WAY”) versus non-retroreflective signs (“STOP” and Street Name Sign) [31]. RIGHT – Diagram of active warning sign [30].

- *Other:* Implement road diets where feasible, utilize high friction surface treatments on horizontal curves

Construction and Work Zones

- *Traffic Control:* Implement advanced warning signs such as flashing yellow arrows for lane closures and portable changeable message signs (shown in **Figure 6**), utilize temporary raised pavement markings, increase letter heights for action words on temporary work zone signs to a minimum of eight inches

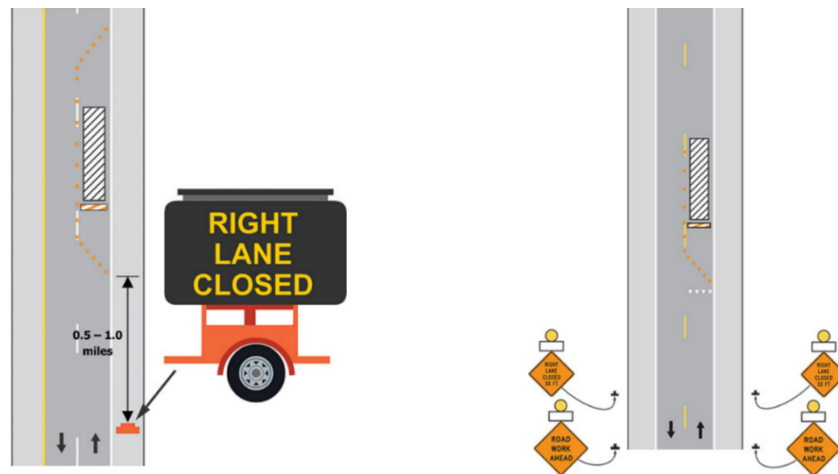


Figure 6: Portable changeable message sign sample messaging and layout [30].

Highway-Rail Grade Crossings

- *Traffic Control:* Install post-mounted delineators spaced at 50 feet for non-illuminated rural crossings (shown in **Figure 7**)

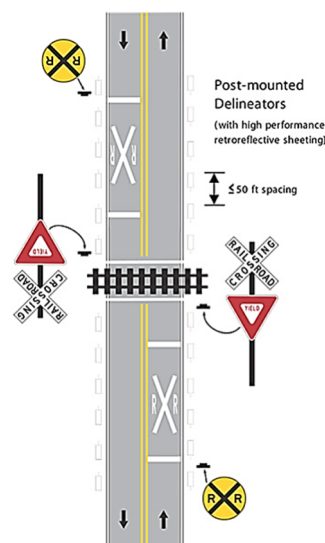


Figure 7: Sample layout of post-mounted delineators at an at-grade rail crossing [27].

- *Other:* Install lighting at all crossings wherever feasible.

3.2.2 FHWA Proven Safety Countermeasures [32]

FHWA has published a Proven Safety Countermeasures document [32] which includes 28 safety countermeasures that offer “significant and measurable impacts to improving safety.” Though these are not targeted directly at the mature population, there is significant overlap between the 28 proven safety countermeasures and the design measures discussed in the FHWA Handbook for Designing Roadways for the Aging Population. This overlap makes the FHWA Proven Safety Countermeasures document a great resource to identify the infrastructure best practices that have



resulted in the most measurable safety improvements. Additionally, the infrastructure practices listed in the FHWA Handbook for Designing Roadways for the Aging Population are divided between those that are “proven” and those that are “promising.”

3.2.3 2014 FHWA North American Conference on Elderly Mobility (NACEM) Noteworthy Practices Guide [33]

In 2014, FHWA published the North American Conference on Elderly Mobility (NACEM) - Noteworthy Practices Guide [16]. The guide documented national and international practices in elderly mobility, some describing infrastructure practices. The first relevant infrastructure practice was a side-by-side comparison of old and new traffic control devices (TCDs) produced by Michigan DOT (MDOT) in partnership with FHWA and the American Automobile Association (AAA). The comparison of old and new TCDs allowed attendees to see the changes designed to “enhance visibility and increase safety by being easier to read, notice, or understand by older road users.” Some of the improvements showcased by MDOT included:

- *Signing*: Install fluorescent yellow sheeting for warning signs, enhance borders on regulatory signs, utilize arrow-per-lane highway guide signs rather than diagrammatic guide signs
- *Signals*: Install retroreflective borders on traffic signal backplates, use LED signal lenses, provide pedestrian countdown signals
- *Pavement Markings*: Install wider edge and lane lines to increase visibility, add additional markers where lanes merge

Another relevant infrastructure practice discussed in the NACEM Noteworthy Practices Guide was the New York City Senior Pedestrian Focus Areas. The program began in 2008 identifying areas with high senior pedestrian crashes and improving safety using various solutions such as installing or replacing pedestrian ramps, adding curb or median extensions, implementing leading pedestrian intervals, and road dieting. This active program has led to notable safety improvements for mature pedestrians. In its first four years from 2008 to 2012, annual pedestrian fatalities decreased by 19%. The program is discussed in more detail in **Section 3.4.1**.

3.2.4 National Highway Traffic Safety Administration (NHTSA) Identifying Countermeasure Strategies to Increase Safety of Older Pedestrians [3]

NHTSA published a pedestrian-specific document in 2013 called Identifying Countermeasure Strategies to Increase Safety of Older Pedestrians [3]. This report reinforced the pedestrian-related infrastructure practices listed in the FHWA 2014 Handbook for Designing Roadways for the Aging Population. Some of the additional infrastructure practices discussed include curb extensions, clearly labeling pedestrian routes, and adding amenities like benches, greenery, and brick walkways that encourage mature travelers to choose walking over other travel methods when possible. This report also discussed slower average walking speeds of older travelers and the importance of utilizing APS treatments to extend pedestrian crossing time.

3.2.5 Michigan DOT Evaluation of Engineering Improvements for Older Drivers [34]

In 2015, Michigan DOT evaluated the benefits of various infrastructure practices aimed at improving safety for mature drivers [34]. The evaluations looked at crash reductions as well as a



benefit-cost ratio for each infrastructure improvement. Some of the methods noted that proved to increase safety and reduce crashes significantly:

- *Arrow-per-lane signing (compared to diagrammatic signs)*: Crashes among those 65 and older reduced up to 68%, benefit-cost ratio of 1440:1
- *Pedestrian countdown signals*: Fatal/injury crashes among those 65 and older reduced by 55%, benefit-cost ratio of 459:1
- *Fluorescent yellow sheeting*: Benefit-cost ratio of 4107:1 for freeways, 4064:1 for urban non-freeways, and 581:1 for rural non-freeways

3.3 Peer Programs

Based on research and a conversation with Guan Xu and Mark Doctor of FHWA's Older Road Users Program, the team identified four promising peer programs in New York City, Michigan, Georgia, and Florida. The team met with representatives from the New York City program on April 25th, a representative from the Florida program on May 4th, and a representative from the Georgia program on May 12th. The team was unable to meet with the Michigan program representatives, but information was gathered through research on this program. The meeting notes from conversations with New York City, Georgia, and Florida are provided in **Appendix A**.

3.3.1 New York City Safe Streets for Seniors Program [35]

NYC DOT has addressed senior pedestrian safety issues in 41 Senior Pedestrian Focus Areas in the five boroughs since launching the program in 2008. Annual senior pedestrian fatalities have decreased 17% citywide, from an average of 65 fatalities per year between 1999 and 2008 to an average of 54 fatalities per year between 2009 and 2018. Since 2009, 227 Street Improvement Projects (SIPs) have been implemented within the Senior Areas citywide.

The team met with Rob Viola, the Director of Safety Policy and Research, and Julia Kite-Laidlaw, the Director of Safety Policy from NYC DOT, on April 25th, 2022, to learn more about the NYC program. The key program strength identified based on this conversation was that the NYC Safe Streets program emphasized a data-driven approach to prioritize improvements. The senior zones are developed through senior population data and normalized injury data to find an over-representation of senior crashes. An equity component is built into this analysis as well.

Some of the infrastructure practices that NYC has found to be most impactful on the reduction of mature traveler fatalities and serious injuries include road diets, bike lanes (protected and not), bump outs, left turn calming treatments, leading pedestrian intervals, citywide speed reduction from 30mph to 25mph, automated speed safety cameras in school zones, citywide no turn on red, raised crosswalks in Senior Zones, and ongoing citywide curb ramp improvements. The city is in the process of seeking state approval for 24/7 use of automated speed safety cameras to expand upon the current 6:00AM to 10:00PM use (currently only in school zones). The program has received some pushback due to the loss of parking spaces and the addition of bike lanes but has found success in safety education via outreach programs at city-run senior centers.



The NYC Safe Streets for Seniors Program is in the process of completing a large study of the program that analyzes the results of its efforts and will be sharing the results with the medical community in hopes to have them better understand the challenges faced by mature travelers.

3.3.2 Florida DOT Safe Mobility for Life Program [36]

Florida DOT has implemented a Safe Mobility for Life Coalition with interdisciplinary partners spanning the entire state. This coalition has not only established an easily accessible webpage with resources and information on mature road users, but it also publishes an annual report to keep people informed on the programs and projects the coalition is supporting and includes updated community partner lists. Additionally, in 2017, FDOT published a comprehensive Aging Road User Strategic Safety Plan [37]. This document contains focus areas with specific objectives related to mature road users as well as strategies in place to meet these objectives and performance measures to track progress. Each objective falls under one of six focus areas:

- *Program Management, Data, and Evaluation*: Lead coalition programs and activities using a data-driven approach
- *Transition from Driving*: Establish easy driving alternatives for those transitioning away from driving
- *Prevention and Assessment*: Promote driver fitness
- *Licensing and Enforcement*: Educate law enforcement and licensing personnel on mature road users
- *Aging in Place*: Promote infrastructure that improves safe mobility options
- *Outreach and Advocacy*: Provide readily accessible resources

On May 4th, 2022, the team met with Gail Holley, the FDOT Safe Mobility for Life Program and Research Manager to learn more about the program. One of the standout program strengths Gail discussed was education on highly technical infrastructure that is easily digestible for all road users with graphics. These graphics and “tip cards” are shared via social media, handouts at program-partnering senior living facilities, and on the program’s Online Resource Center [38]. The graphics are colorful and provide the key information for road users to learn how to safely navigate less familiar infrastructure. These materials are all available in Spanish in addition to English, to make the resources more accessible for the Florida population. For example, the roundabout tip card is shown in **Figure 8**.

Figure 8: Florida Safe Mobility for Life Resource Center Roundabout Tip Card [36]

The program also plans to add additional resources for engineers and designers in the Online Resource Center by providing links to where FDOT has design guidance for the infrastructure practices that improve safety for mature travelers.

3.3.3 Georgia Governor’s Office of Highway Safety Older Driver Safety Program [39]

Georgia Governor’s Office of Highway Safety has implemented an Older Driver Safety Program with interdisciplinary partners spanning the entire state. The Older Driver Safety Program has six program activities, each with specific assigned goals:

- *Georgia Older Driver Task Force*: Implement the five E’s (Education, Engineering, Enforcement, EMS, and Evaluation)
- *Education*: Programs for professionals, mature adults, and families about driving safety
- *Alternative Transportation*: Improve access to mobility options for mature adults



- *Department of Driver Services Partnership*: Provide safe driving information to mature adults
- *Engineering – Older Driver Safety Workshops*: Train engineers in infrastructure best practices to improve safety for mature adults
- *CarFit Program*: Training for mature adults on how to correctly and safely sit in their vehicles

On May 12th, 2022, the team met with Elizabeth Head, the Georgia Older Driver Safety Program’s Deputy Director for Injury Protection to learn more about the program. One of the standout program strengths Elizabeth discussed was its partnership with Mark Doctor of the FHWA Safety and Design Team, who holds engineering workshops focused on teaching engineers and designers how to successfully implement the infrastructure recommendations from the FHWA Handbook for Designing Roadways for the Aging Population. The program aims to emphasize the importance of infrastructure safety countermeasures. Part of the training involves explaining program activities to help engineers understand the effects of the infrastructure designs on a personal level. Additionally, the trainings include demonstrations to help engineers better understand what experiencing limited mobility may be like. For example, participants are encouraged to try on varying glasses that simulate eyesight difficulties and astigmatism, and a neck brace to simulate limited head-turning abilities. Since the onset of the ongoing COVID-19 pandemic, these trainings have been offered virtually with materials being sent to participants in the mail. The virtual versions of these trainings have led to increased participation throughout Georgia and allowed this training to be offered multiple times a year rather than once a year.

3.3.4 Michigan DOT Senior Mobility Program [40]

Michigan DOT (MDOT) has formed the Senior Mobility Action Team. This interdisciplinary team includes representatives from MDOT, the office of the Michigan Secretary of State, Michigan Department of Health and Human Services, Office of Services to the Aging, Office of Highway Safety Planning, various consultants, Traffic Improvement Association of Michigan, Southeast Michigan Council of Governments, and AAA Michigan. The Senior Mobility Action Team works to gather resources and funding to support programs throughout the state striving to improve mobility among the older population. Additionally, as discussed in **Section 3.3**, MDOT is a leader in not only investing in infrastructure improvements to benefit mature travelers, but also in evaluating which infrastructure improvements yield the best results.

Michigan’s Senior Mobility and Safety Action Plan for 2019-2022 [41] outlines three specific goals to reduce the number of senior driver-involved fatal, serious injury, and total crashes. The action plan then goes on to describe the eight strategies set to meet these goals. The infrastructure-specific objective states MDOT aims to “Promote the design and operation of Michigan roadways with features that better accommodate the special needs of older drivers and pedestrians.” One of the ongoing activities outlined to meet this goal is continually reviewing the 2014 FHWA Handbook for Designing Roadways for the Aging Population to determine what infrastructure is best suited to be adopted in Michigan. MDOT also released an update to the 2019-2022 Action Plan at the end of the 2019 fiscal year to note progress made toward the Action Plan between 2018-2019 [42].



4. Next Steps & Recommended Implementation Strategies

Based on the team's research presented here and discussion of the Workgroup, the following next steps and implementation strategies are recommended regarding infrastructure enhancements to benefit mature travelers:

- a. Communicate best practice findings to NJDOT design groups in a peer exchange format to present opportunities to enhance the practices outlined within the NJDOT Design Manual. While not a comprehensive list, widespread infrastructure strategies for mature travelers are summarized in **Section Error!** Reference source not found..
2. Contact FHWA to discuss a partnership between NJDOT and FHWA to begin training for engineers and designers on infrastructure best practices for mature travelers.
3. Maintain ongoing coordination with the New Jersey's Age-Friendly State Advisory Council so infrastructure strategies and best practices recommended by the Transportation Committee compliment the recommendations of the NJ 2020 SHSP OVRU Action Team.
4. Throughout the research process for this report, there were gaps identified where research is lacking and/or non-existing regarding mature traveler infrastructure. Additional research on infrastructure improvements is recommended for the following areas:
 - a. Bicyclists
 - b. Transit-users
 - c. Motorcyclists



5. Summary Matrix

This matrix is not intended to be fully comprehensive, but rather to serve as an overview and reference guide of the infrastructure best practices outlined in this technical memorandum. Bracketed numbers [##] refer to the corresponding references in Section 6.

	Resources					Programs								
	FHWA 2014 Handbook [26]	FHWA Noteworthy Practices Guide [28]	NHTSA Identifying Countermeasure Strategies [3]	FHWA Proven Safety Countermeasures [29]	Evaluation of Michigan's Engineering Improvements [30]	NJTPA [15-18]	DVRPC [19-21]	SJTPO* [22-23]	New Jersey Future [24-25]	New Jersey Age-Friendly State Advisory Council** [13]	New York City Safe Streets for Seniors Program [31]	Florida DOT Safe Mobility for Life Program [32-33]	Georgia Office of Highway Safety Older Driver Safety Program* [35]	Michigan DOT Senior Mobility Program* [36-38]
Driver Infrastructure														
Geometry Improvements (such as Intersection Skew, Curbs, Curves and Tapers, or Lane Layouts)	X		X	X		X	X	X				X	X	X
Retroreflective Signing and/or Larger Signing Font Sizes	X	X			X	X	X	X					X	X
Active Warning Signs	X			X		X	X	X					X	X
Arrow-per-lane Signing	X	X			X								X	X
Raised and/or Retroreflective Pavement Markings	X	X				X	X	X	X				X	X
Roundabouts or Reduced Conflict Intersections	X		X	X		X	X	X					X	X
Road Diets	X			X		X	X	X					X	X
Lighting Improvements	X			X		X	X	X	X				X	X
Pedestrian/Bicyclist Infrastructure														
High Visibility Crosswalks	X			X		X	X	X	X		X	X	X	X
Accessible Pedestrian Signal (APS) Treatments, Leading Pedestrian Interval	X	X	X	X	X	X	X	X			X	X	X	X
Pedestrian Crossing Islands	X		X	X		X	X	X			X	X	X	X
Bike Lanes				X		X	X	X	X		X	X		
Transit Infrastructure														
Improve Bus Stops (Such as Benches, Shelters, or Sidewalks)			X			X	X	X	X		X	X		

*Programs that directly reference following FHWA 2014 Handbook and/or Proven Safety Countermeasures

**New Jersey Age-Friendly State Seniors Program was established on March 2, 2022 and has not yet published any documents regarding infrastructure best practices. The recommendations report is anticipated in 2023.



6. References

- [1] Murphy, P., Oliver, S., Grewal, G., & Heitmann, E. (2021). *NJ DOT 2022 Highway Safety Plan*. <https://www.nj.gov/oag/hts/downloads/2022-Highway-Safety-Plan.pdf>
- [2] Stamatiadis, N., & Kirk, A. (2020). Use of Technology-Based Strategies for Older Driver Risk Mitigation. *Transportation Research Procedia*, 45, 651–658. <https://doi.org/10.1016/j.trpro.2020.03.045>
- [3] Levi, S., De Leonardis, D. M., Antin, J., & Angel, L. (2013). *Identifying Countermeasure Strategies to Increase Safety of Older Pedestrians*. Office of Behavioral Safety Research. <https://www.nhtsa.gov/sites/nhtsa.gov/files/811798.pdf>
- [4] Ravensbergen, L., & Newbold, B. (2020). “I wouldn’t want to get on the bus”: Older Adult Public Transit Use and Challenges during the COVID-19 Pandemic. *Transport Findings*. <https://doi.org/10.32866/001c.18202>
- [5] *Work Program (UPWP) | NJTPA | North Jersey Transportation Planning Authority*. (n.d.). www.njtpa.org. <https://www.njtpa.org/upwp.aspx>
- [6] *Age-Friendly Communities | DVRPC*. (n.d.). <https://www.dvrpc.org/aging>
- [7] *Department of Human Services | Aging & Disability Resource Connection/Area Agency on Aging (ADRC/AAA)*. (n.d.). <https://www.state.nj.us/humanservices/doas/home/saaaa.html>
- [8] *NJAAW – New Jersey Advocates for Aging Well – njaaw.org*. (n.d.). New Jersey Advocates for Aging Well. <https://www.njaaw.org/>
- [9] *Creating Great Places To Age | New Jersey Future*. (2018, April 27). Working for Smart Growth: More Livable Places and Open Spaces. <https://www.njfuture.org/issues/development/creating-great-places-to-age/>
- [10] *Older Road Users - Safety | Federal Highway Administration*. (2022). https://safety.fhwa.dot.gov/older_users/
- [11] *NHTSA | Older Drivers*. (n.d.). <https://www.nhtsa.gov/road-safety/older-drivers>
- [12] *Home - Transport Research International Documentation - TRID*. (n.d.). <https://trid.trb.org/>
- [13] New Jersey Office of the Governor. (2022, March 2). *Governor Murphy Joins New Jersey’s Age-Friendly Statewide Leadership Summit to Highlight Key Investments for Senior Citizens in Fiscal Year 2022 Budget Proposal* [Press release]. <https://www.nj.gov/governor/news/news/562021/20210302a.shtml>
- [14] *The 8 Domains of Livability: An Introduction*. (2021, February). AARP. <https://www.aarp.org/livable-communities/network-age-friendly-communities/info-2016/8-domains-of-livability-introduction.html>
- [15] *Coordinated Human Services Transportation Plan*. (2017). NJTPA & Rutgers University. https://www.njtpa.org/NJTPA/media/Documents/Planning/Plans-Guidance/Regional-Human-Services-Transportation-Plan/NJTPA_2017_CHSTP_Final-101217.pdf?ext=.pdf
- [16] *Plan 2050 | NJTPA | North Jersey Transportation Planning Authority*. (2021). NJTPA. <https://www.njtpa.org/Plan2050>



- [17] *Work Program (UPWP) | NJTPA | North Jersey Transportation Planning Authority.* (2022). NJTPA. <https://www.njtpa.org/upwp.aspx>
- [18] *Home | Street Smart | NJ.* (2022). Street Smart. <https://beststreetsmartnj.org/>
- [19] *Transportation Safety Action Plan.* (2018). DVRPC. <https://www.dvrpc.org/Products/18021>
- [20] DVRPC. (2021, September). *Connections 2050 Plan for Greater Philadelphia Policy Manual.* <https://www.dvrpc.org/Reports/21027.pdf>
- [21] *Transportation Improvement Program (TIP) | DVRPC.* (2021). DVRPC. <https://www.dvrpc.org/tip/>
- [22] *Regional Transportation Plan 2050: Moving South Jersey Forward.* (2021). SJTPO. https://www.sjtpo.org/wp-content/uploads/2021/12/Final-RTP-2050_1.25.2021.pdf
- [23] *Unified Planning Work Program Fiscal Year 2022.* (2021). SJTPO. <https://www.sjtpo.org/wp-content/uploads/2021/03/FY-22-UPWP.pdf>
- [24] New Jersey Future. (2022). *New Jersey's Smart Growth and Sustainable Development Advocacy Organization.* <https://www.njfuture.org/>
- [25] *Creating Places to Age in New Jersey.* (2014). New Jersey Future. <https://www.njfuture.org/research-reports/places-to-age-nj/>
- [26] Deka, D., & Alexander, K. (2021). *Understanding the Transportation Mobility Needs for an Aging New Jersey Population.* NJDOT Bureau of Research. <https://www.njdottechtransfer.net/wp-content/uploads/2021/06/FHWA-NJ-2021-005.pdf>
- [27] *NJDOT Bicycle Compatible Roadways and Bikeways - Planning and Design Guidelines.* (n.d.). NJDOT. <https://www.state.nj.us/transportation/commuter/bike/pdf/bikepedmasterplan2016.pdf>
- [28] *NJDOT Pedestrian Compatible Roadways- Planning and Design Guidelines.* (n.d.). NJDOT. <https://www.state.nj.us/transportation/about/publicat/pdf/PedComp/pedintro.pdf>
- [29] *New Jersey Bicycle & Pedestrian Master Plan.* (2016). NJDOT. <https://www.state.nj.us/transportation/commuter/bike/pdf/bikepedmasterplan2016.pdf>
- [30] *Handbook for Designing Roadways for the Aging Population.* (2014). FHWA. https://safety.fhwa.dot.gov/older_users/handbook/
- [31] *Minimum Sign Retroreflectivity Requirements - Safety | Federal Highway Administration.* (2013, January 13). FHWA. https://safety.fhwa.dot.gov/roadway_dept/night_visib/policy_guide/sign_15mins/
- [32] *Making Our Roads Safer | One Countermeasure at a Time.* (2021). FHWA. https://safety.fhwa.dot.gov/provencountermeasures/pdf/FHWA-SA-21-071_PSC%20Booklet.pdf
- [33] *North American Conference on Elderly Mobility Noteworthy Practice Guide.* (2014). FHWA. https://safety.fhwa.dot.gov/older_users/noteworthy/
- [34] *Evaluation of Michigan's Engineering Improvements for Older Drivers.* (2014). MDOT. https://www.academia.edu/80418606/Evaluation_of_Michigan_s_Engineering_Improvements_for_Older_Drivers
- [35] *NYC DOT - Safe Streets for Seniors.* (n.d.). <https://www1.nyc.gov/html/dot/html/pedestrians/safeseniors.shtml>



- [36] *Safe Mobility for Life*. (n.d.). FDOT.
<https://www.fdot.gov/traffic/trafficservices/safemobilityforlife.shtm>
- [37] *2017 Aging Road User Strategic Safety Plan*. (2017). FDOT.
http://safemobilityfl.com/pdfs/FDOT_Aging_SafetyPlan_FINAL.pdf
- [38] *Safe Mobility for Life - Resource Center*. (2021). Safe Mobility for Life - ResourceCenter. <http://safemobilityfl.com/resourcecenter.htm>
- [39] *Older Driver Safety Program | Georgia Governor's Office of Highway Safety*. (n.d.).
<https://www.gahighwaysafety.org/campaigns/older-drivers/>
- [40] *Senior Mobility and Safety*. (2022). Michigan State Police.
<https://www.michigan.gov/msp/divisions/ohsp/gtsac/action-team-information/senior-mobility-and-safety>
- [41] *Michigan Senior Mobility and Safety Action Plan 2019–2022*. (2018).
https://www.michigan.gov/msp/-/media/Project/Websites/msp/ohsp/pdfs4/Action_PlanSMSFinal20182.pdf?rev=465183da3c604c19af412a4e512e7674&hash=1BB946A5614E76C7266E2FA1B1FF7565
- [42] *Senior Mobility and Safety Action Team 2018–2019 Accomplishments*. (2019, June).
https://www.michigan.gov/msp/-/media/Project/Websites/msp/ohsp/pdfs5/senior_mobility_2019_accomplishments.pdf?rev=c9f460f45db241fdbbd8c48ee93fc117&hash=13D78622BB29CC5DE87235C869B494F5



Appendix A:
Peer Program Meeting Notes