As Administrator, one of my greatest concerns is pedestrian safety and reducing the number of pedestrian fatalities that occur on our roadway network each year. In 2018, pedestrian fatalities on MDOT SHA facilities increased over the previous year, continuing nationwide trends that date back to 2015. One death is one too many, and I am personally affected by every incident that occurs on the roadways we manage. While we cannot discount the roles of education and enforcement, there is always more that we can do as transportation practitioners. Nowhere is this truer than in our urban cores. Urban cores are one of MDOT SHA’s six identified context zones, and they are areas that often serve the dual functions of accommodating regional vehicle traffic and high volumes of pedestrian activity. This combination means that our state’s urban cores account for a disproportionate number of pedestrian crashes. The issue of pedestrian safety requires bold action. The status quo is no longer acceptable. I have empowered our MDOT SHA team to not only use nationwide best practices but to innovate and propose new solutions that ensure we are leaders in the industry. The data-driven approach outlined in this document represents an organizational shift to better respond to this context-based need. This new approach will ensure that our customers can make it to school, commute to work, and, most importantly, arrive safely at home each day.

ACKNOWLEDGMENTS

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CREATING GUIDANCE for today’s TRANSPORTATION CHALLENGES

The MDOT SHA Context Driven guide is a planning and design resource offering practitioners guidelines centered on establishing safe and effective multi-modal transportation systems.

The transportation challenges facing communities throughout Maryland today have changed significantly over the years, creating a need for new tools and processes for implementing effective solutions. Although the challenges are substantial, there is a growing opportunity to deliver safer and more efficient transportation alternatives to Maryland residents. The goal of this Context Driven guide is to bring awareness to MDOT SHA’s approach to these challenges through the incorporation of context into the project development process.

The primary design function of roadways over the last century has been auto-mobility, regardless of land-use context. This one-size-fits-all approach resulted in roadways in the densest urban areas that don’t meet the needs of the diverse set of users common to such areas, including pedestrians, bicyclists, and transit riders. This focus on speed and auto-mobility can create significant safety issues for bicyclists, and transit riders. This focus on speed and auto-mobility can create significant safety issues for bicyclists, and transit riders. This focus on speed and auto-mobility can create significant safety issues for bicyclists, and transit riders. This focus on speed and auto-mobility can create significant safety issues for bicyclists, and transit riders. This focus on speed and auto-mobility can create significant safety issues for bicyclists, and transit riders. This focus on speed and auto-mobility can create significant safety issues for bicyclists, and transit riders. This focus on speed and auto-mobility can create significant safety issues for bicyclists, and transit riders. This focus on speed and auto-mobility can create significant safety issues for bicyclists, and transit riders.

By developing tools and processes outlined in this guide, MDOT SHA is striking the appropriate balance between the access needs created by the surrounding land-use and the mobility needs of both local and regional travelers. Additionally, MDOT SHA is confronting the connectivity challenges found throughout Maryland.

Using the tools in this guide, MDOT SHA is identifying transportation issues, establishing goals for improvements, and developing solutions tailored to unique contexts throughout Maryland. Based on best practices, the Context Driven guide has been developed to introduce MDOT SHA’s ongoing efforts, establish the six context zones, and provide a process for implementing the new approach.

MDOT SHA believes that access and mobility can and should be balanced in all contexts, for all users—not just in the medium—to high-density areas. This balance will organize movement, enhance a sense of place, and above all, provide safe environments for Maryland’s residents and visitors.

“Enhance the quality of life for Maryland’s citizens by providing a balanced and sustainable multi-modal transportation system for safe, efficient passenger and freight movement.”

The overarching mission of the Maryland Department of Transportation

ROADWAYS IN CONTEXT

The conventional design approach relies on the Federal designation of urban versus rural as the primary context framework affecting design. This binary approach does not account for the diversity of urban areas and their unique needs. Recognizing this led many other leading transportation organizations to further stratify context beyond the Federal designation. These organizations include the Institute of Transportation Engineers (ITE), the American Association of State Highway Transportation Officials (AASHTO), and many State Departments of Transportation (DOTs).

The Maryland approach shares similarities with that of other organizations and includes sub-classifications within the conventional, federally-designated urbanized areas. Maryland’s context zones are defined using data inputs from the Short Trip Opportunity Area (STOA) assessment that was developed as part of the 2040 Maryland Transportation Plan. STOAs are places where non-motorized trips are more likely to

RESEARCH & DISCOVERY

THE IMPORTANCE OF CONTEXT AREAS IN TRANSPORTATION

To ensure this Context Driven guide is relevant to the various communities throughout Maryland, MDOT SHA began by examining Maryland’s existing transportation landscape. As noted previously, one of the primary transportation challenges facing communities today is safety. As development is becoming more intense in urbanized areas at the same time as suburban environments densify, the need for improved and safer access across all modes of travel is increasing. While these challenges exist throughout the United States, the solutions must consider the localized context. To provide safer roadways for Marylanders, it is clear that MDOT SHA must think differently.
be concentrated based on factors related to population, employment, zero-car households, transit, and schools. These short trips relate directly to the need for accessibility and are the basis for the development of the urban context zones. Four of the context zones constitute less than four percent of the state’s total land area yet contain over 60 percent of pedestrian crashes. While primarily concentrated along the I-95 corridor and around the Baltimore and Washington, D.C. metropolitan areas, STOAs are located within every county in the state.

After reaching a low point in 2009, pedestrian deaths in Maryland have risen 46 percent over the past decade. Most of these pedestrian fatalities occur at mid-block crossings or non-signalized intersections on multi-lane roadways. The data from Maryland reflect national trends in transportation safety. Studies have shown that over 70 percent of pedestrian fatalities occur in areas with similar characteristics to the STOAs analyzed by MDOT SHA. Roadway speed in these areas has been shown to be a critical factor in the severity of pedestrian crashes: while a pedestrian struck by a vehicle at 25 miles per hour (MPH) has a 25 percent risk of sustaining a serious or fatal injury, the risk jumps to 50 percent at 33 MPH and 75 percent at 41 MPH. These numbers demonstrate that the current design approach utilizing the federal functional classification has not sufficiently addressed safety issues.

Providing the right solution to the right context starts with establishing the context itself. While many alternative transportation context classifications already exist, MDOT SHA understands the distinctive characteristics of Maryland communities and has developed a unique set of context zones for the State that capture these characteristics. The six zones on the following pages were selected and refined based on the aforementioned STOA inputs, and further validated with crash statistics and a qualitative assessment of the surrounding land-use characteristics.

### Defining CONTEXT ZONES

#### Urban Core
Considered the typical downtown or central business district area, this zone is defined by a high diversity of uses including multi-family residential, office, retail, entertainment, civic, and cultural facilities, as well as a high density of development. Development includes high-rise structures with minimal setbacks, high street wall frontage, minimal building gaps, and off-street structured parking. Because of its development density and diversity of uses, this land-use pattern generates a high prevalence of non-motorized trips including walking, transit, and bicycling. While the need for mobility through these areas does exist, it is far exceeded by the need for internal circulation within the zone. The Urban Core represents less than 0.1% of the land area in the State. Examples: Baltimore, Bethesda, Friendship Village, Rockville, Silver Spring, Towson, and Wheaton Triangle.

#### Urban Center
Similar to Urban Core, this zone is characterized by a high diversity of uses—including multi-family residential, office, retail, entertainment, civic, and cultural facilities—while having a moderately high density of development. Urban center areas are typically characterized by mid-rise structures, varied setbacks, a variety of street wall frontages, and off-street parking. Urban centers may be either large commercial business districts in historic towns or newer, transit-oriented developments centered around a metro station. Because of its development density and diversity of uses, this land-use pattern generates a moderate to high volume of non-motorized trips. While the need for mobility through these areas does exist, it is far exceeded by the need of internal circulation within the zone. These areas represent less than 0.1% of the land area in the State. Examples: Annapolis, Hagerstown, Frederick, and Gaithersburg.

### Defining Context Zones

- Urban Core
- Urban Center
- Suburban Activity Center/
  Traditional Town Center
- Suburban
- Rural
Traditional Town Center

While smaller and less dense than either of the urban zones, the traditional town center is still characterized by a high diversity of use types, including residential, office, retail, civic, and cultural facilities. Structures are typically late 19th to early 20th century mid- to low-rise buildings and are oriented toward the street with minimal setbacks. Parking is often provided on-street along the main thoroughfare, with additional parking at the rear of the building accessible by alleys or other minor streets. Typically laid out before the advent of the automobile, these areas often serve the dual purpose of accommodating both short trips around the commercial corridor as well as longer pass-through trips. While the need for mobility through these areas exists, it is somewhat exceeded by the need for internal circulation within the zone. These areas constitute roughly 1% of the land area within Maryland. While they are not an explicitly identified area within the context zone maps, they fall within the Suburban Activity Center boundary. Examples: Ellicott City, Chestertown, Catonsville, and Easton.

Suburban Activity Center

Located outside of the major urban centers, the suburban activity center zones are typically found along or at the intersection of major arterials. They feature a medium diversity of uses, including residential (both multi-family and single-family), office, and retail facilities. Development is at a much lower density than that in the urban core, urban center, and traditional town center, and typically consists of detached low-rise structures with a range of setbacks. Off-street parking is typically located between the structures and the roadway. These areas often serve a variety of modes and trip types, requiring a balanced approach between access and mobility. These zones represent just over 2% of the land area of the State. Examples: Pasadena, Poolesville, Joppstown, and North Laurel.

Suburban

With a moderate to low diversity of uses, the suburban context typically contains primarily single-family residential development on lot sizes ranging from one-eighth of an acre to one acre. Office parks and small commercial strip retail are scattered throughout the zone, along with neighborhood-level civic and cultural facilities. Buildings are primarily oriented toward parking, which is usually provided off-street. This context represents approximately 21% of the land area of the State. Examples: Pasadena, Poolesville, Joppstown, and North Laurel.

Rural

The lowest density of the six context zones, rural areas are primarily a mix of agricultural uses and green space, with some scattered development in large-lot residential clusters. Trip distances are long as origins and destinations are few and far between. Mobility is the primary transportation need. This context zone represents the majority of the State’s land (approximately 76%) but only a fraction of the total population. Examples: Greenspring Valley, Hereford, Vienna, Norristown, and Emmitsburg.
Different land-use contexts require their own planning and design considerations when integrating the needs of the surrounding communities with the needs of the roadway and traveling public. Within each context zone, MDOT SHA is continuing to develop techniques to achieve safety and accessibility goals that are responsive to the needs of the surrounding community and framed by the land-use context in which that community resides. These tools are continually being developed, refined, and employed to solve these critical challenges, where context is key to appropriate roadway design.

**PURPOSE + NEED**
The first step in the project lifecycle involves determining the purpose and need. This involves stakeholder input and an evaluation of existing and future conditions to determine the transportation problems that are to be solved. To ensure MDOT SHA fulfills the project’s purpose, MDOT SHA documents areas of need for each project and notes if a project’s proposed elements ultimately fulfill its purpose.

**MEASURES OF EFFECTIVENESS (MOE)**
The context of a corridor informs the parameters for that roadway’s design and operations. For example, projects with a traffic operation need will likely have different need thresholds in different contexts. In a suburban activity center, where a balanced approach is required, Level of Service E is likely acceptable; whereas, in a rural area, where mobility is prioritized, Level of Service C is likely the minimum threshold.

**Innovative Elements**
Innovative elements may not be typical of projects in Maryland, but could address an area of need for safety or access within a project. Engineers are encouraged to seek out innovative design treatments, especially in areas where there are needs or challenges that cannot be easily addressed by standard elements. These innovative elements are required to go through an internal review and approval process documented by the MDOT SHA Context Toolbox. Innovative elements can be incorporated into projects within certain context zones.

**Proactive Elements**
MDOT SHA recognizes the common non-motorized accessibility needs in Maryland’s more densely developed land-use contexts. Continental striped crosswalks, lower speed limits, right turn on red restrictions, and leading pedestrian intervals are high-benefit, low-cost treatments which MDOT SHA is proactively seeking to include in projects within the Urban Core, Urban Center, Traditional Town Center, and Suburban Activity Center context zones. Because these treatments range from signal improvements to resurfacing to signing upgrades, they have a higher likelihood of fitting within a project’s scope of routine operational and maintenance activities.
Within each of the six context zones, the needs of multiple users must be considered. Balancing these needs and understanding how to select appropriate facilities can be challenging without established guidelines, support for innovation, and best-practices that provide adequate flexibility. MDOT SHA created this Context Driven guide to provide a combination of preferred best-practices and design treatments that will encourage the development of creative solutions. While this guide offers a library of useful tools and resources to address current transportation challenges, today’s design solutions may not be applicable for future challenges. Recognizing this, periodic updates to this guide will offer new information with regards to recent practices, case studies, and professional input.

Balancing Access and Mobility
Along with best practices and design tools, this context guide provides a process for balancing the needs of Maryland’s transportation system as a whole with the accessibility, mobility, and safety needs of individual communities. Each project can be approached through the newly-defined context lens with an understanding that innovation and creative thinking may lead to combinations of design treatments not previously implemented in Maryland. Although these solutions will still be grounded in established MDOT SHA policies and guidance in Chapter 1 of the AASHTO Green Book, they will be tailored to meet the specific transportation needs and address the specific challenges for the communities of Maryland.

Maintaining Flexibility
MDOT SHA recognizes the range of demands among transportation users throughout Maryland. MDOT SHA also understands that, in order to meet defined project goals and constraints, there will be trade-offs between accessibility and mobility. There is no one-size-fits-all formula for meeting these demands. Therefore, this Context Driven guide will enable flexibility in developing design solutions that address the major issues of pedestrian safety and accessibility while still considering the transportation needs of the motoring public.

Encouraging Innovation
Innovative elements require an internal review and approval process that is documented in the MDOT SHA Context Toolbox. This toolbox will serve as a repository for all requests, approvals, and denials of innovative treatments, as well as their effects on the roadway, as measured by key performance metrics. Specific lessons learned will be included to encourage additional innovation on future projects. While all innovative elements must still be approved within each project as a part of the development process, this new approach will encourage innovative thinking and allow design elements to be evaluated for use in Maryland independent of a specific project.

Our Commitment
The innovation and flexibility that develop from the implementation of this guide require time, experimentation, and collaboration across multiple stakeholder groups. From this guide’s direction, the resulting transportation solutions will be guided by context and developed with the surrounding community in mind. By providing this Context Driven guide and working with communities, MDOT SHA intends to demonstrate a dedication to prioritizing the accessibility and safety needs of communities while balancing the needs of the broader regional transportation system.

Additional Resources
Expanded narrative descriptions of innovative treatments, sample models, photography, and exemplary locations across Maryland will be published periodically as a supplement to this document. As this guide evolves, a volume of case studies will accompany the context summaries, along with typical tools that can be accompanied to achieve measurable results in safety, aesthetics, mobility, access, and economic vitality.

The Federal Highway Administration (FHWA) provides a large array of resources for automobile, pedestrian, bicycle, and Americans with Disabilities Act (ADA) facilities, treatments, and countermeasures. The resources cater to a roadway planning and design approach that recognizes different land-use intensities and roadway modal priorities. The FHWA Small Town and Rural Multi-modal Networks Report complements the National Association of City Transportation Officials’ (NACTO’s) work with guidance outside urban areas. Multi-modal safety and accessibility guidance for the suburban context remains limited. MDOT SHA intends to close this gap in suburban guidance with the introduction and future expansion of this guide and its accompanying tools.

At the international level, organizations such as NACTO are issuing guidebooks instructing planners and designers on how to use progressive methods to improve safety, multi-modal accessibility, and even sustainable stormwater management. NACTO’s guidebooks not only propose innovative techniques to achieve safety and accessibility goals, but also outline projects successfully completed by cities in North America. An annotated bibliography of resources for practitioners can be found at the end of this guide.
Exploring CONTEXT ZONES

This guide captures key characteristics and illustrative transportation treatments for different environments throughout the state of Maryland. While including extensive and proven strategies, this document is not intended to be a prescriptive manual of standards for each of the identified zones. Rather, it is an invitation to explore and better understand the opportunities and potential improvements that can be implemented based on the characteristics of the surrounding environment.

The pages that follow will present a framework for understanding each of the six Maryland context zones: Urban Core, Urban Center, Traditional Town Center, Suburban Activity Center, Suburban, and Rural. Each zone has a two-page summary sheet which includes the following components:

1. **Zone Name & Icon**
   - On each two-page spread, you’ll find the zone name at the top left, along with a corresponding icon to characterize that zone.

2. **Typical Characteristics**
   - To better understand the context, some typical characteristics are presented in the description. These characteristics include, but are not limited to, the following:
     - Development density and typical uses
     - Accessibility needs for different users
     - Trip origin statistics
     - A short description or statistic reveals the benefits of various treatments

3. **Proven Treatments**
   - Having established the typical look and feel of the context zone under consideration, the next component of each summary sheet is a collection of some proven transportation treatments that have been previously implemented to provide benefits to the community and typical users. While the treatments listed may be common tactics in the corresponding context zone, they represent only a portion of all potential treatments that can be implemented by MDOT SHA. The proposed solutions have been proven to succeed in the field, although the specific impact may vary significantly from one context zone to the next.

4. **Data-Driven Transformations**
   - To supplement the sampling of proven treatments, this section provides a description of a hypothetical community that has implemented treatments, along with specific data needs leading to those treatments, and how those treatments created positive transformations to address safety and livability issues.

5. **Context Access and Mobility Diagram**
   - This diagram suggests how a balance of access and mobility will vary between the context zones. It’s helpful in understanding the polarity and convergence of access and mobility required when fitting a roadway to its particular context.

6. **Need Areas**
   - The final section of each page highlights the greatest benefits of improvements relative to MDOT SHA’s typical areas of need:
     1. Traffic Operations
     2. Safety
     3. Accessibility
     4. Connectivity
     5. State of Good Repair
     6. Quality of Service (a brief description of the need areas is listed in the glossary).

The highlighted need areas ultimately drive the decision-making process when identifying and selecting potential treatments. Additionally, the need areas are used to determine the best measure of effectiveness for design elements. Identifying the major need areas sets priority guideposts to focus engineers on design elements that will best serve the transportation needs and community goals throughout the lifetime of a project.
AREAS of need
In the Urban Core, multiple modes of transportation and a compact road network help travelers reach points of interest located throughout the area.

DATA-DRIVEN TRANSFORMATIONS
The six-lane undivided section with a center turn-lane resulted in both a high vehicular and pedestrian crash rate. Community members didn’t feel comfortable crossing the street on foot or traveling to the metro station by bicycle. The roadway was reconstructed to reduce crashes by 30%, provide a bicycle level of traffic stress (LTS) of 1, and limit pedestrian route directness (PRD) to 1.5 between major generators.

PROTECTED INTERSECTION
Provides a higher degree of comfort and safety for bicyclists by keeping bicycles physically separated from motor vehicles at the intersection.

LEADING PEDESTRIAN INTERVAL
Reduces pedestrian crashes by 60% and can also provide prioritization to bicycles.

FLOATING BUS STOP
Confers the highest priority to transit operations at most signalized intersections.

CONTINENTAL CROSSWALK STRIPING
(For All Crosswalks In This Context)
Promotes the highest driver compliance and is the most visible of all crosswalk markings.

25-MPH SPEED LIMIT
Decreasing speed limits to 25 mph significantly reduces the possibility of a pedestrian fatality.

PROTECTED BICYCLE LANE
Has the lowest injury risk of all urban bicycle facilities.

25-MPH SPEED LIMIT
Reduces right-turn injury crashes by 38%.

URBAN CORE
Considered the typical downtown or central business district area, the Urban Core zone is defined by a high diversity of uses, including multi-family residential, office, retail, entertainment, civic, and cultural facilities, as well as a high density of development. Development includes high-rise structures with minimal setbacks, high street wall frontage, and minimal building gaps. Off-street parking is typically included. Because of its development density and diversity of uses, this land-use pattern generates a high prevalence of non-motorized trips, including walking, transit, and bicycling. While the need for mobility through these areas does exist, it is far exceeded by the need for internal circulation within the zone. The Urban Core represents less than 0.1% of the land area in the State.

Locations in Maryland
- Baltimore
- Bethesda
- Friendship Village
- Rockville
- Silver Spring
- Towson
- Wheaton Triangle

In the Urban Core, multiple modes of transportation and a compact road network help travelers reach points of interest located throughout the area.
DATA-DRIVEN TRANSFORMATIONS

The original five-lane typical section with a two-way left-turn lane was designed primarily for vehicular mobility. Despite being on a major bicycle route, bicycle facilities were limited to share the road, and a major mid-block pedestrian generator led to safety issues due to uncontrolled crossings. The roadway was re-purposed to reduce pedestrian crashes by 50%, provide a bicycle and pedestrian level of service (LOS) of C, and limit pedestrian route directness (PRD) to 1.5 between major generators.

URBAN CENTER

Similar to Urban Core, the Urban Center zone is characterized by high diversity of uses—including multi-family residential, office, retail, entertainment, civic, and cultural facilities—while having a moderately high density of development. Urban center areas are typically characterized by mid-rise structures, varied setbacks, a variety of street wall frontages, and off-street parking. Urban centers may be either large commercial business districts in historic towns or newer transit-oriented developments centered around a metro station. Because of its development density and diversity of uses, this land-use pattern generates a moderate to high volume of non-motorized trips. Additionally, while the need for mobility through these areas does exist, it is far exceeded by the need of internal circulation within the zone. These areas represent less than 0.1% of the land area in the State.

Example Locations in Maryland
- Annapolis
- Hagerstown
- Frederick
- Gaithersburg

DESTINATIONS IN THE URBAN CENTER

1. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
2. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
3. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
4. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
5. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
6. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
7. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
8. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
9. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
10. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
11. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
12. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%
13. Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%

RIGHT-ON-RED RESTRICTION

Reduces right-turn injury crashes by 38%.

30-MPH SPEED LIMIT

Decreasing speed from 40 mph to 30 mph reduces possibility of a severe injury or fatality by 25%.

ON-STREET BIKE LANE

- Maryland crash data demonstrates a reduction in on-street bicycle crashes by 77%

RAISED CROSSWALK

- Reduces pedestrian crashes by 66%

CONTINENTAL CROSSWALK STRIPING

(For All Crosswalks In This Context)

Promotes the highest driver compliance and is the most visible of all crosswalk markings.

PEDESTRIAN HYBRID BEACON

- Reduces pedestrian crashes by 69%

CURB EXTENSION

Narrows the roadway both visually and physically to shorten the crossing distance for pedestrians and improve visibility.

LEADING PEDESTRIAN INTERVAL

Reduces pedestrian crashes by 60% and can also provide prioritization to bicycles.

MOUNTABLE CURB

Slows turning passenger vehicles while accommodating the turning movements of larger trucks.

DESTINATIONS IN THE URBAN CENTER

- Annapolis
- Hagerstown
- Frederick
- Gaithersburg

EXAMPLE LOCATIONS IN MARYLAND

- Annapolis
- Hagerstown
- Frederick
- Gaithersburg
TRADITIONAL TOWN CENTER

While smaller and less dense than either of the urban zones, the Traditional Town Center zone is characterized by a high diversity of uses types, including residential, office, retail, civic, and cultural facilities. Structures are typically late 19th to early 20th century mid- to low-rise and oriented toward the street with minimal setbacks. Parking is often provided on-street along the main thoroughfare, with additional parking at the rear of the building accessible by alleys or other minor streets. Typically laid out before the advent of the automobile, these areas often serve the dual purpose of accommodating both short trips around the commercial corridor as well as longer pass-through trips. While the need for mobility through these areas exists, it is somewhat exceeded by the need for internal circulation within the zone. These areas constitute roughly one percent of the land area within Maryland and while they are not an explicitly identified area within the context, zone maps, they fall within the Suburban Activity Center boundary.

DATA-DRIVEN TRANSFORMATIONS

The original two-lane typical section with a two-way left-turn lane was in a state of disrepair, largely due to underground drainage issues. Sidewalks were not ADA compliant and a new shopping center lacked pedestrian connectivity, causing both operational and safety issues. Improvements were designed to provide vehicular level of service (LOS) of D, return fixed assets to a state of good repair, reduce crashes by 15%, and provide full pedestrian connectivity between major generators.

CONCEPT EXTENSION

Narrows the roadway (both visually and physically) to shorten the crossing distance, improve visibility for pedestrians, and slow turning speeds.

CONTINENTAL CROSSWALK STRIPING

(For All Crosswalks In This Context)
Promotes the highest driver compliance and is the most visible of all crosswalk markings.

RECTANGULAR RAPID-FLASHING BEACON (RRFB)

Increases vehicle yielding compliance from 18% to 81% and can reduce pedestrian crashes by 47%.

MID-BLOCK CROSSING

Facilitates safer crossings to places people want to go but that are not well served by the existing traffic network.

PEDESTRIAN-SCALE LIGHTING

Lower than street lamps, pedestrian-scale fixtures cast light on the sidewalks.

Example Locations in Maryland

- Easton
- Ellicott City
- Chestertown
- Catonsville

There are many points of interest in Traditional Town Centers, mostly clustered in significant areas. These destinations are easily accessed, while a layered roadway network provides mobility.
The seven-lane roadway had one of the highest crash severity indexes in the state. Existing bicycle facilities were narrow and only utilized by the most confident users while transit riders often crossed at an uncontrolled, mid-block location to reach their stop. Improvements were designed to reduce the crash severity index by 50%, provide a bicycle level of service (LOS) of C, and ensure a pedestrian route directness (PRD) of 1.5 between major origins and destinations.

Suburban context zones see a higher mobility supported by vehicular trips as a significant means to reach less-centralized destinations.

**CONTINENTAL CROSSWALK STRIPING**
(For All Crosswalks In This Context)
Promotes the highest driver compliance and is the most visible of all crosswalk markings.

**NARROW LANE**
Narrower lane widths correlate to lower travel speeds reducing the severity of crashes.

**BUFFERED BIKE LANE**
Provides greater distance between motor vehicles and bicycles, improves feeling of comfort for cyclists, and encourages use by cyclists of all levels and ages.

**MID-BLOCK CROSSING**
Facilitates safer crossings to places people want to go but that are not well served by the existing traffic network.

**HAWK BEACON**
Reduces pedestrian crashes by 69%.

**35-MPH SPEED LIMIT**
Decreasing speed limits significantly reduces the possibility of a pedestrian fatality.

**ELIMINATE FREE RIGHT TURN**
Reduces vehicle and pedestrian conflicts at high-traffic intersections.

**Example Locations in Maryland**
- US 40 - Howard County
- Laurel
- Owings Mills
- Timonium
- Hyattsville

**SUBURBAN ACTIVITY CENTER**
Located outside of the major urban centers, the **Suburban Activity Center** zone is typically found along or at the intersection of major arterials. They feature a medium diversity of uses, including residential (both multi-family and single-family), office, and retail facilities. Development is at a much lower density than that in the Urban Core, Urban Center, and Traditional Town Center. It typically consists of detached low-rise structures with a range of setbacks. Off-street parking is typically located between the structures and the roadway. These areas often serve a variety of modes and trip types, requiring a balanced approach between access and mobility. These areas represent just over 2% of the land area of the State.
SUBURBAN

With a moderate to low diversity of uses, the Suburban context zone typically contains primarily single-family residential development on lot sizes ranging from one-eighth of an acre to one acre. Office parks and small commercial strip retail are scattered throughout the zone, along with neighborhood-level civic and cultural facilities. Buildings are primarily oriented toward parking, which is provided off-street. This context represents approximately 21% of the land area of the State.

DATA-DRIVEN TRANSFORMATIONS

The four-lane roadway had both operational and safety issues due to vehicle demand generated from a new mixed-use development located directly east of the corridor. The section of roadway was also the missing segment in a regional trail system. Improvements were designed to reduce crashes by 10%, improve traffic operations to level of service (LOS) of E, and improve shared-use path LOS to C while providing full connectivity to the trail system.

Example Locations in Maryland
- Pasadena
- Fallston
- Joppetowne
- North Laurel

The configuration of the roadway network offers increased mobility in Suburban context zones, while these areas are typically less accessible by foot or by bike.
The lowest density of the six context zones, **Rural** areas are primarily a mix of agricultural uses and green space, with some scattered development in large-lot residential clusters. Trip distances are long as origins and destinations are few and far between. Mobility is the primary transportation need. This context represents the majority of the State area-wise at approximately 76%, but only a fraction of the total population.

**DATA-DRIVEN TRANSFORMATIONS**

Operational and safety issues during school drop-off and pick-up times were observed based on the configuration of the center-turn lane in front of the school. Additionally, instances of run-off road crashes within this segment were significantly higher than the statewide average and the pavement section was rated poor. Treatments were designed to provide vehicular level of service (LOS) of D during peak hours, reduce crashes by 25%, and ensure a state of good repair.

**CONTINUOUS GREEN T-INTERSECTION**

Innovative intersection treatments can reduce turning maneuver conflicts and facilitate safe merges. Restricted left-turn intersections see a 54% reduction in injuries and fatal crashes.

**HIGH-FRICTION SURFACE**

52% reduction in wet road crashes and 24% reduction in curve crashes

**LEFT TURN LANE WITH CHANNELIZATION ISLAND**

Left turn lanes provide a 28% to 48% reduction in total crashes

**CONTINENTAL CROSSWALK STRIPING**

(For All Crosswalks In This Context)

Promotes the highest driver compliance and is the most visible of all crosswalk markings.
Citations


Additional References


The Green Book presents an updated framework for geometric design that is more flexible, multimodal, and performance-based than in the past – providing guidance to engineers and designers who strive to make unique design solutions that meet the needs of all highway and street users on a project-by-project basis.


The new guide will provide industry leading sight distance guidance for conflict points along Separated Bike Lanes. It is expected to be available in the near future.


The Manual on Uniform Traffic Control Devices for Streets and Highways, or MUTCD defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.


Installing bicycle facilities during roadway resurfacing projects is an efficient and cost-effective way for communities to create connected networks of bicycle facilities. This workbook provides recommendations for how roadway agencies can integrate bicycle facilities into their resurfacing program. The workbook also provides methods for fitting bicycle facilities onto existing roadways, cost considerations, and case studies. The workbook does not present detailed design guidance, but highlights existing guidance, justifications, and best practices for providing bikeways during resurfacing projects.


The Separated Bike Lane Planning and Design Guide outlines planning considerations for separated bike lanes (also sometimes called “cycle tracks” or “protected bike lanes”) and provides a menu of design options covering typical one and two-way scenarios. It highlights different options for providing separation, while also documenting mid-block design considerations for driveways, transit stations, truck crossings, and other common conflicts.
stops, accessible parking, and loading zones. It provides detailed intersection design information covering topics such as turning movement operations, signalization, signage, and on-road markings. Case studies highlight best practices and lessons learned throughout the document.


This publication is a resource for practitioners seeking to build multi-modal transportation networks. The publication highlights ways that planners and designers can apply the design flexibility found in current national design guidance to address common roadway design challenges and barriers. It focuses on reducing multi-modal conflicts and achieving connected networks so that walking and bicycling are safe, comfortable, and attractive options for people of all ages and abilities.


The Small Town and Rural Multi-modal Networks report is a resource and idea book intended to help small towns and rural communities support safe, accessible, comfortable, and active travel for people of all ages and abilities. It provides a bridge between existing guidance on bicycle and pedestrian design and rural practice, encourage innovation in the development of safe and appealing networks for bicycling and walking in small towns and rural areas, and show examples of peer communities and project implementation that is appropriate for rural communities.


The ePrimer provides a review of current traffic calming practices and contains the information needed to understand the basics of the field. The ePrimer has eight modules which include the following topics:

- A definition of traffic calming, its purpose, and its relationship to other transportation initiatives (like complete streets and context sensitive solutions);
- Illustrations and photographs of 22 different types of traffic calming measures;
- Considerations for their appropriate application, including effects and design and installation specifics;
- Research on the effects of traffic calming measures on mobility and safety for passenger vehicles; emergency response, public transit, and waste collection vehicles; and pedestrians and bicyclists;
- Examples and case studies of both comprehensive traffic calming programs and neighborhood-specific traffic calming plans;
- Case studies that cover effective processes used to plan and define a local traffic calming program or project and assessments of the effects of individual and series of traffic calming measures.


The ePrimer provides a review of speed-related safety issues facing rural communities, along with the basic elements required for data collection, information processing, and countermeasure selection by rural transportation professionals and community decision makers. The ePrimer has six modules which include the following topics:

- A definition of speeding and speed management, its importance, and its relationship to the goals and challenges (e.g., resource constraints) faced by many rural communities;
- Illustrations and photographs of 14 types of speed management countermeasures, particularly suited for rural transition zones and town centers;
- Considerations for their appropriate application, including effects and design and installation specifics;
- Research on the mobility and safety effects of speed management countermeasures for passenger cars and commercial trucks, pedestrians and bicyclists, and agricultural vehicles which frequent roadways in and around many rural communities;
- Case studies that cover effective processes used to plan and define a rural community speed management program or project, and assessments of the effects of individual and series of speed management countermeasures.


Transportation agencies face growing demand for an integrated transportation network that safely and efficiently move people. Motorists, freight, transit passengers, bicyclists, and pedestrians, including individuals with disabilities, have unique needs, and infrastructure is being adapted to the multi-modal nature of travel. The project development process for multi-modal projects - those intended to serve bicyclists and pedestrians - can experience delays and challenges as projects move from one phase to the next. This Workbook is intended to help transportation agencies and practitioners identify top strategies for accelerating multi-modal infrastructure delivery. This Workbook describes thirteen (13) key strategies that have been used effectively to accelerate multi-modal projects and provides examples and case studies for each.


The Crash Modification Factors Clearinghouse provides a search-able online database of CMFs along with guidance and resources on using CMFs in road safety practice.


This report is for practitioners and stakeholders involved in planning and designing urban thoroughfares for walkable communities. Report users are encouraged to consider the principles and guidelines in this report in conjunction with applicable local policies and manuals.
The purpose of the guide is to provide guidance on best practices for curb space allocation policy and implementation. It presents a framework and toolbox for analyzing and optimizing curb space with the aim of prioritizing and maximizing community values and safety.


The Urban Street Design Guide focuses on the design of city streets and public spaces. While other national manuals, such as AASHTO’s A Policy on Geometric Design of Highways and Streets, provide a general discussion of street design in an urban context, the Urban Street Design Guide emphasizes city street design as a unique practice with its own set of design goals, parameters, and tools.

For each treatment in the Guide, the reader will find three levels of guidance:

- Required: elements for which there is a strong consensus that the treatment cannot be implemented without.
- Recommended: elements for which there is a strong consensus of added value.
- Optional: elements that vary across cities and may add value depending on the situation.


The purpose of the NACTO Urban Bikeway Design Guide (part of the Cities for Cycling initiative) is to provide cities with state-of-the-practice solutions that can help create complete streets that are safe and enjoyable for bicyclists.

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- Recommended: elements for which there is a strong consensus of added value.
- Optional: elements that vary across cities and may add value depending on the situation.


The Transit Street Design Guide provides design guidance for the development of transit facilities on city streets, and for the design and engineering of city streets to prioritize transit, improve transit service quality, and support other goals related to transit. The Guide provides street transportation departments, transit operating agencies, leaders, and practitioners with the tools to actively prioritize transit on the street.

Schlossberg, M., Rowell, J., Amos, D., & Sanford, K. (2013). Rethinking Streets: An Evidence-Based Guide to 25 Complete Streets Transformations. This guide highlights completed projects as case studies of high-quality street retrofit projects that prioritize bicyclist transportation. The guide focuses on different complete street types and case studies of the areas and conditions in which they were implemented and of the outcomes.


The report provides a flexible framework, which helps interpret the existing functional classification scheme in order to facilitate optimal geometric design solutions that consider context, road functions, and user needs. This builds upon existing efforts from state Departments of Transportation (DOTs) that have found new methods to use the classification system to address contextual multi-modal deficiencies of the existing classification system.

Transportation Research & Education Center at Portland State University. (2017). Manual on Pedestrian and Bicycle Connections to Transit. This manual provides best practices to help transportation professionals improve pedestrian and bicycle safety and access to transit, including information on evaluating, planning for, and implementing improvements to pedestrian and bicycle access to transit. In addition to covering key concepts such as access sheds, connected networks, and station area comfort, safety, and legibility, the manual covers needs specific to pedestrians, such as complete sidewalks and safe, convenient crossings, and to bicyclists, such as bicycle parking and on-transit accommodations.
**Acronyms**

- **AASHTO**: American Association of State Highway and Transportation Officials
- **ADA**: Americans with Disabilities Act
- **CFR**: Code of Federal Regulations
- **CMF**: Crash Modification Factor
- **DOT**: Department of Transportation
- **FHWA**: Federal Highway Administration
- **HAWK**: High-Intensity Activated Crosswalk Beacon, a Pedestrian Hybrid Beacon
- **ITE**: Institute of Transportation Engineers
- **LOS**: Level of Service
- **LTS**: Level of Traffic Stress
- **MDOT SHA**: Maryland Department of Transportation State Highway Administration
- **MPH**: Miles Per Hour
- **MUTCD**: Manual on Uniform Traffic Control Devices
- **NACTO**: National Association of City Transportation Official’s
- **PHB**: Pedestrian Hybrid Beacon
- **PRD**: Pedestrian Route Directness
- **RRFB**: Rectangular Rapid Flash Beacon
- **STOA**: Short Trip Opportunity Area

**Glossary**

- **ACCESS**: How many places you can get to in a given amount of time.
- **COMPLETE STREETS POLICIES**: A transportation policy and design approach that requires streets to be planned, designed, operated, and maintained to enable safe, convenient and comfortable travel and access for users of all ages and abilities regardless of their mode of transportation.
- **CONNECTIVITY**: The degree to which the transportation system provides access to destinations.
- **CONTEXT**: The unique character of an area determined by land-use and development.
- **DENSITY**: The number of units (i.e. commercial, housing) in a given amount of space.
- **LAND-USE**: The characterization of land based on what is built on it and what the land can be used for.
- **LAND-USE INTENSITY**: A measure of the extent to which a land parcel or area is developed.
- **MAINTENANCE AND OPERATION**: The process of maintaining the roadway system in a state of good repair.
- **MEASURE OF EFFECTIVENESS**: Standards or quantities that correspond to the achievement of desired results from transportation projects.
- **MOBILITY**: How far you can go in a given amount of time.
- **MODE**: The manner in which an individual is traveling.
- **MULTI-MODAL**: The combination of two or more modes within a transportation network.
- **PERFORMANCE MEASURE**: A numeric description of an entity’s work and the results of that work.
- **PRACTITIONER**: An expert who uses that knowledge as part of a profession.
- **QUALITY OF SERVICE**: The degree to which a provided entity promotes customer satisfaction.
- **SETBACK**: The minimum distance which a building or other structure must be located from a roadway.
- **SHORT TRIP OPPORTUNITY AREAS (STOAS)**: Geographic areas in the state of Maryland whose score reached a certain threshold in an analysis using population, employment, zero-car household, transit, and school data.
- **STAKEHOLDER**: An individual who has in interest or concern in something and is affected by the outcomes of a given action.
- **STATE OF GOOD REPAIR**: A condition sufficient for the entity to operate at a full level of performance.
- **TOOLBOX**: The source where MDOT SHA aggregates and monitors different types of roadway treatments.
- **TREATMENT**: A specific roadway modification or modification type that can be included in a project.
- **URBANIZED**: Becoming more city like in characteristic.
- **USER CONFLICTS**: When two modes of transportation come into conflict with one another while both operating in a legal and responsible manner.