US 1 Safety Evaluation on Bicyclists and Pedestrian Safety

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Executive Summary

Crash trends show a recent and abrupt increase in pedestrian related crashes and fatalities occurring along US 1 in Howard County. In response, the Howard County Office of Transportation undertook a safety evaluation specifically focusing on traffic hazard conflicts for pedestrians and bicyclists. US 1's roadway configuration in conjunction with abutting development makes pedestrian travel challenging and even unsafe in certain segments. Limited roadway right of way due to narrow building setbacks limits availability for pedestrian infrastructure, such as sidewalks; however, retail establishments and land uses with direct access to US 1 draws pedestrians to walk. The roadway's curvature, hills, width, and posted speed limit can lead to segments with vehicle speeds that are incompatible with pedestrian comfort. Higher vehicle speeds increases the probability of a pedestrian fatality if struck. Additionally, there is a population of surrounding residents with low household vehicle ownership, and one that relies on local bus transit or walking. While improvements in pedestrian facilities is evident through recent redevelopment along the corridor, there are obstacles, gaps, and unsafe conditions for pedestrians and bicyclists in a corridor where traveling by such modes was observed.

The corridor safety issues were identified through a field evaluation conducted during daylight and dark hours. A toolbox of strategies to alleviate safety concerns was developed and supported by a review of industry best practices on pedestrian safety and a comparison of similar studies on peer corridors to select the most appropriate strategies from a comprehensive review.

Since the US 1 corridor in Howard County stretches for eleven miles, four focus areas were selected based on historical crash trends and need of improvement in pedestrian facilities to concentrate resources. These are: 1) the Laurel area south of Whiskey Bottom Road, 2) the Jessup area around Guilford Road, 3) the Elkridge area north of MD 175, and 4) the northern Elkridge area around Montgomery Road. Application of the toolbox to the four focus areas included identifying priority gaps in the sidewalk, implementing a context sensitive speed limit, installing roadway lighting, providing for additional designated and controlled pedestrian crossings, and aligning bus stops with designated pedestrian crossings. From the general recommendations, five were selected for prioritization and concept development. These included:

1. Institute a road diet in the couplet section of US 1 in Laurel repurposing the outer travel lanes in each direction for a buffered, one-way bike lane.
2. Install a pedestrian-activated traffic signal at Brewers Court.
3. Upgrade the intersection at Guilford Road with pedestrian signals and crosswalks across all four legs as well as construct connecting sidewalks.
4. Upgrade the intersection at Rowanberry Drive with pedestrian signals and crosswalks across all four legs as well construct connecting sidewalks.
5. Install additional roadway lighting, sidewalk connections and a pedestrian-activated traffic signal at Doctor Patel Drive.

It is anticipated that the improvements identified at these locations will provide targeted safety countermeasures to address specific pedestrian crash patterns experienced in the corridor, and will serve as a foundation for further roadway redesign and safety improvements in the corridor as development and land use along US 1 continues to evolve.

Acknowledgements

Maryland State Highway Administration

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Howard County Department of Planning and Zoning

Howard County Police Department

Howard County Multimodal Transportation Board

Howard County Bicycle Advisory Group

Howard County Commission on Disability Issues

Transit and Pedestrian Advisory Group

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Introduction

In response to a recent increase in pedestrian fatalities, the Howard County Office of Transportation conducted a safety evaluation of the eleven-mile segment of US 1 corridor between the Baltimore County line and Prince George's County line. The evaluation primarily focused on current, recently observed, or documented safety concerns, especially those affecting pedestrians and bicyclists, in order to identify and implement short term safety improvements. As the corridor transforms from a traditionally commercial and industrial area to residential and mixed-use, the evaluation also identifies long-term recommendations that help envision a corridor better suited to walking, bicycling, and multi-modal travel. While the evaluation incorporates aspects of a traditional road safety audit as defined by Maryland Department of Transportation State Highway Administration (MDOT-SHA) and/or Federal Highway Administration (FHWA) standards, the study was purposefully not conducted as a road safety audit as the approach included additional elements such as:

- A review of previous studies that focused on US 1 needs and design
- A review of best practices on pedestrian safety and comfort
- An analysis of the corridor's transportation characteristics
- A peer corridor comparative analysis
- Public outreach
- Daytime and twilight field evaluations and observations

The challenges of enhancing pedestrian and bicycle safety in the corridor can be connected to its history. Officially designated as US 1 around 1926, the route was constructed from various existing trail segments and newly built sections. It served as the primary north-south route along the eastern seaboard from Florida to Maine until it was superseded by the creation of US Interstate System, specifically by the completion of I-95 around 1970. As the roadway construction pre-dates the publication of modern highway design standards, the adjacent buildings often have little setback, utilities are located within the roadway clear zone, limited right-of-way exists beyond the edge of pavement, and geometric design including horizontal and vertical curvature are not adequate for modern vehicle speeds. The adjacent structures make roadway width expansion very challenging and the slopes of the roadway often create sight distance concerns for vehicle ingress and egress from side streets and driveways as well as pedestrian crossing.

The segment of US 1 in Howard County is not unlike other similar stretches of US 1 in Maryland and other states where the geometric design, limited right-of-way, numerous uncontrolled access points, and increasing redevelopment pressures require innovative design and operational solutions to retrofit the roadway to provide a more complete street and enhance safety for all roadway users. This study was initiated in response to an increasing trend in pedestrian crashes and is intended to initiate a working partnership with local, regional, and State transportation, law enforcement, and safety advocate stakeholders. The study identifies key safety issues and develops a toolbox of engineering design, operation, enforcement, and educational strategies to be implemented in the short-term to balance pedestrian and bicycle safety needs and accessibility; access to transit, and commuter traffic. It also supports economic development and land use plans and sets forth a long-term transportation vision.

Previous Studies Along the Corridor

The US 1 corridor in Howard County has been studied numerous times over the past two decades. These studies were reviewed for context and identification of recommendations for pedestrian, bicycle, automobile, and transit access improvements. Approximately fifty individual improvement recommendations have been made along US 1 through prior studies, many of which are directly related to specific industrial, residential, and commercial development plans along the corridor. **Appendix A** includes a matrix of all recommendations.

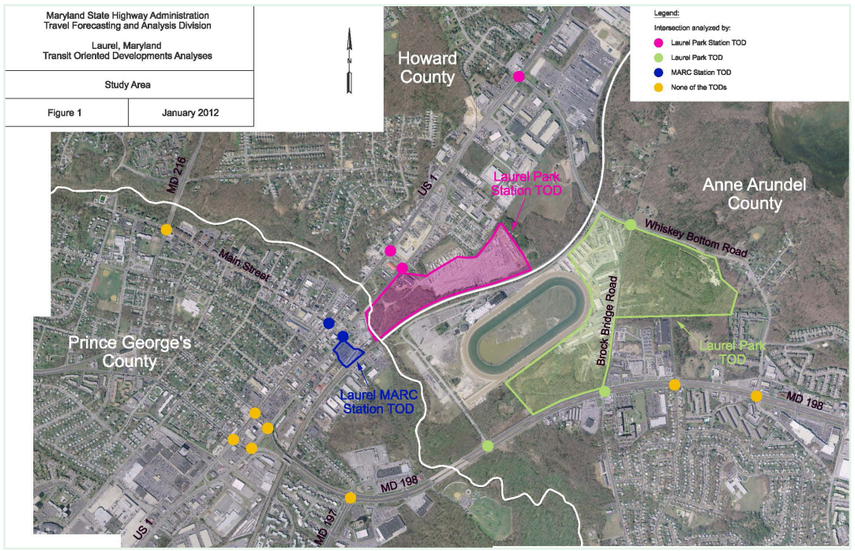
In 2001 and 2002, Howard County Department of Planning and Zoning developed two reports on revitalizing the Route 1 corridor. These two plans, **Howard County Route 1 Revitalization Study Phase 1 and 2**, provided recommendations for the Route 1 corridor that focused on improving transportation, enhancing the roadway appearance, addressing environmental quality, and addressing community needs to enhance the corridor's future. The studies identify the need for traffic safety and mobility improvements. Specific pedestrian and bicycle focused recommendations include:

- Constructing new sidewalk
- Improve access for pedestrians and bicyclists around rail stations and bus stops to encourage more ridership
- Providing adequate shoulders and/or shared use paths
- Upgrading pedestrian infrastructure at existing traffic signals within the corridor such as US 1 and Guilford Road
- Creating vibrant pedestrian-oriented centers
- Using traffic calming devices, sign placements, and street furniture to promote walking and enhance pedestrian safety

In 2006, the **US 1 Corridor Improvement Strategy Reconnaissance Survey** provided guidance for developing transportation infrastructure improvements as well as new policies and design standards. This State and County document defined agency actions at various scales to make changes strategically on US 1. The survey recognized the lack of connectivity for pedestrians and bicyclists and identified the need for initiatives to increase transit use in the corridor. The survey verified that intersections in the area are approaching traffic capacity and road widening projects may be necessary to help resolve the issue. Additionally, the survey noted that land use along the corridor is not consistent and the corridor lacks aesthetic appeal and safety. Specific pedestrian improvements recommended include:

- Provide more sidewalks
- Enhance aesthetics/urban design for a pedestrian scale in key locations
- Improve crossing locations and opportunities for pedestrians

Several traffic impact studies were also conducted as part of site development applications, including the **Laurel Park Station Transit Oriented Development** shown in the map on page 3. These five studies were conducted between 2008 and 2012. To meet State and County traffic operations standards, the studies recommended several roadway and intersection improvements along US 1 in Howard County between Prince George's County Line and Whiskey Bottom Road. Strategies included modifying traffic signal operations, adding new traffic signals, and revising lane assignment to improve Level of Service. Geometric improvements to add additional traffic capacity, primarily in the form of turn lanes, were recommended at US 1 and Whiskey Bottom Road and US 1 at the new site access point.

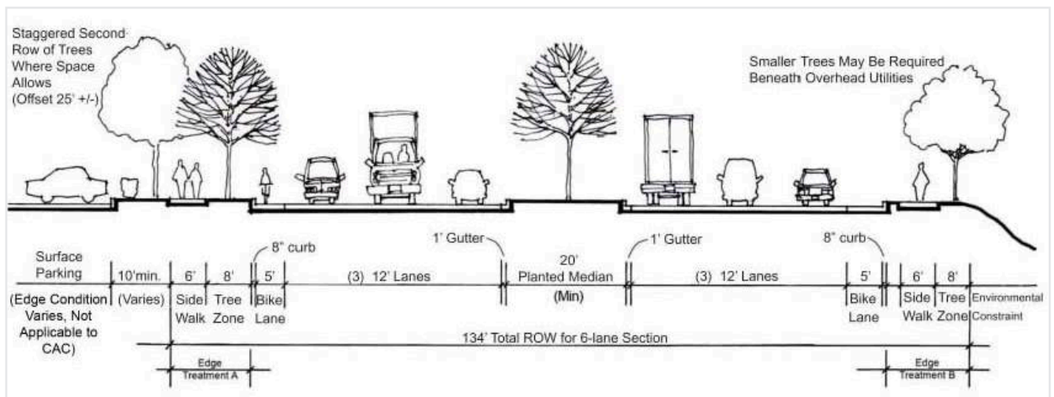


Laurel Park Station TOD Site Plan

In 2009, Howard County developed the **Route 1 Manual** to provide cohesive and corridor-level technical guidance for zoning regulations, preparing subdivision and site development plans, and streetscape/urban design. The Manual also identified several unique 'districts' along the corridor where different roadway, streetscape, and urban design treatments would better reflect local communities and neighborhoods. The Manual includes specific recommendations to increase safety for pedestrians and bicycles and enhance pedestrian and bicycle accessibility and connectivity in the corridor. These recommendations include:

- New pedestrian infrastructure to fill gaps, access to and enhancement of bus stops
- Enhance visibility of pedestrians at existing crosswalks
- Expand bike infrastructure including lanes, shared use paths, and bike parking

A standard preferred cross-section from the Manual is included below, envisioning US 1 as a divided roadway with a landscaped median, on-road bike lanes, sidewalks along both sides, and zones for vegetation and landscaping.



Route 1 Manual - Standard Cross Section- Figure 3.5

Since 2009 various properties along the corridor and in the area have been redeveloped and have provided frontage improvements such as new sidewalks, pedestrian lighting, and shared use paths. Example redevelopments are Mission Place north of Mission Road and Penske Truck Rental north of Guilford Road. While beneficial, these piecemeal improvements do not often connect to other existing pedestrian and bicycle infrastructure. Site plan and frontage improvements for current pending development applications are discussed in more detail later in the report.

Lastly, the County and MDOT State Highway Administration have conducted several roadway and pedestrian facility improvement studies, including:

- » US 1/MD 175 intersection improvements including potential grade separation/interchange construction
- » US 1 and Selnick Drive Extension
- » New sidewalk construction between Cedar Avenue and Assateague Drive, and Prince George's County Line to North Laurel Road
- » North Laurel Connections Bike Route Signing/Wayfinding
- » Countywide Bicycle Master Plan which identifies US 1 as a designated bike route

A chronology of historical and recent US 1 studies and development activity is shown on page 5.

ROUTE 1 TIMELINE

1928
Designated as US 1 and reconstructed to a four-lane road with shoulders

1971
I-95 in Howard County Completed

2001
Howard County Rt 1 Revitalization Study Phase 1

2002
Howard County Rt 1 Revitalization Study Phase 2

2006
US 1 Corridor Improvement Strategy Reconnaissance Survey

2009
Route 1 Manual
1 US 1 at Selnick Drive Extension Traffic Study

2010
2 MD 175 Corridor Feasibility Study
3 US 1 at Assateague Sidewalk Improvements

2011
4 Market Analysis and Strategic Implementation Analysis: US Route 1 and Snowden-River Pkwy / Dobbin Rd Corridors
5 Laurel Transit Oriented Development, PG County, MD *(mixed use)*

2012
6 Elementary School #41 *(school)*
7 Grosvenor House *(residential; 250 units)*
8 Gaulin Property *(industrial)*
9 Howard Square *(residential; 1,000 units)*
10 North Laurel Wastewater Pumping Station *(industrial)*

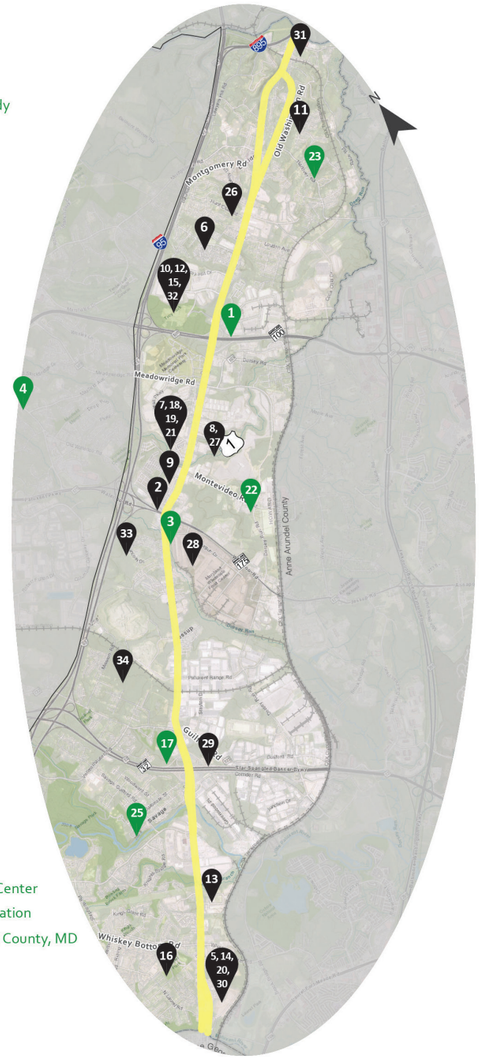
2013
11 Pecoraro Property (Augustine Valley) *(residential; 20 units)*
12 Troy Park *(recreational)*
13 Victory Temple - Laurel *(religious)*

2014
14 Duval Property Traffic Impact Analysis
15 Troy Sports Park Traffic Impact Analysis
16 Park Overlook *(residential; 30 units)*

2015
Bike Howard, Howard County Bicycle Master Plan
17 Crossroads Town Centre Traffic Impact Study
18 Blue Stream Towns *(residential; 90 units)*
19 Brompton House *(residential; 160 units)*
20 Coastal Sunbelt Produce *(industrial)*
21 Morris Place *(residential; 200 units)*

2016
22 Adequate Road Facilities Test Evaluation for Dorsey Run Center
23 Florey Road Property Adequate Road Facilities Test Evaluation
24 Laurel Park Station Phase II Traffic Impact Study, Howard County, MD
25 The Settlement at Savage Mill Traffic Impact Study
26 HCLS Elkridge Branch & Senior Center *(public library)*
27 CVS/Pharmacy *(commercial)*
28 Maryland Food Center Authority *(industrial)*
29 Day Resource Center *(residential; 35 units)*
30 Napa Washington *(industrial)*

2017
31 Patuxent Engineering *(retail, restaurant)*
32 Troy Hill Corp Center *(retail)*
33 The Cedars Extended *(residential; 6 units)*
34 Mission Road School (office)



Legend

Blue - Corridor Studies and Manuals
Green - Traffic Studies and Evaluations
Black - Developments

Stated dwelling units are approximate

Route 1 Studies and Development Activity Timeline

Best Practices Literature Review

A literature review of industry standards and state department of transportation design guidelines was undertaken to identify a 'best practice' set of pedestrian and bicycle-friendly roadway design and traffic operational treatments that may serve as a tool box to for the US 1 corridor. The reviewed source documents are shown in the inset to the right.

The selected treatments and practices are suitable for implementation on arterial roadways such as US 1. This section summarizes selected key pedestrian operational and design treatments. A full list is in **Appendix B.**

The selected best practice pedestrian and bicycle treatments provide methods to reduce speed of motor vehicles, improve sight distance and visibility for motor vehicles and pedestrians, reduce exposure for pedestrians, improve pedestrian access and mobility, and encourage walking by improving aesthetics.

Literature Review Sources

- AASHTO Guide for the Development of Bicycle Facilities
- FHWA Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations
- ITE Alternative Treatments for Pedestrians at At-Grade Intersections
- ITE Recommended Practice Design and Safety of Pedestrian Facilities
- ITE Recommended Practice for Designing Walkable Urban Thoroughfares: A Context Sensitive Approach
- MDOT SHA Accessibility Policy & Guidelines for Pedestrian Facilities along State Highways, 2010
- MDOT SHA Bicycle Policy and Design Guidelines, 2013
- NACTO Urban Street Design Guide, Transit Street Design Guide, and Urban Bikeway Design Guide
- NCHRP 07-17, Pedestrian and Bicycle Transportation along Existing Roads
- NCHRP 562 Improving Pedestrian Safety at Unsignalized Crossings
- TCRP Report #19 Guidelines for the Location and Design of Bus Stops

Treatments and Practices for Enhancing Safety of Non-motorized Modes

Pedestrian Countdown Signals

Intersections with pedestrian countdown typically have a symbol of either a person walking or a hand combined with a timer that counts down to the red light. This provides more information for pedestrian regarding how much time they have to pass the street.

Accessible Pedestrian Signals

Providing louder locator tones during the flashing DON'T WALK period of a pedestrian signal will provide more accuracy for pedestrians who are blind in completing crossing within the crosswalk.

Rectangular Rapid Flashing Beacon (RRFB)

Set of flashing lights that may be used as a supplement to a pedestrian or school crossing warning sign with a diagonal downward arrow plaque to warn vehicular traffic of pedestrian presence unsignalized marked crosswalk.

HAWK (High-Intensity Activated crossWalk) Beacon

This traffic control device, also known as Pedestrian Hybrid Beacon, is used to stop road traffic and allow pedestrians to cross safely. A push-button activated traffic signal pushed by a pedestrian stops traffic with a red signal, allowing pedestrians to cross with a WALK signal. At some locations, the signal can automatically detect the presence of pedestrians waiting to cross and will activate the signal.

Raised Median/ Refuge Island

Raised curbed islands facilitate ease of pedestrian crossings at wide or high volume intersections by providing a resting area part way through a crossing. AASHTO and FHWA encourage use of refuge islands due to their positive impact on pedestrian and vehicle safety at intersections. All study state DOTs have provisions for raised medians. Most state DOT guidelines call for using refuge islands where pedestrians cross four or more lanes of traffic and islands should be a minimum six feet wide to accommodate queuing pedestrians. To achieve the minimum width, some states uses angled cut through, which also increases pedestrian safety by encouraging people to look towards traffic. NACTO and ITE guidelines include extending the nose of the median into the intersection.

High Visibility Crosswalk

These crosswalks consist of colored or contrasting pavement treatments utilized to enhance visibility and emphasize high pedestrian traffic areas

Advanced Stop Bar/ Yield Line

The stop bar or yield pavement markings is placed at an increased distance from the edge of the crosswalk markings. These advanced yield lines decrease pedestrian-vehicle conflicts and increase driver yielding at greater distances from crosswalk.

Treatments and Practices for Enhancing Safety of Non-motorized Modes Continued

Remove Channelization

To reduce intersection complexity and removing an unimpeded vehicle movement that can create high vehicle turning speeds, channelization removal is recommended. Alternatively, tighter curb radii can help alleviate the same issue.

Overpass/ Underpass

This tool is most warranted at locations where there is a moderate to high demand to cross a freeway/ expressway, where large number of schoolchildren must regularly cross a high speed/ volume roadway, where extreme hazards exist for pedestrian. However, this technique should not take a significantly longer time to cross on overpass rather than crossing at street level. In fact, the Highway Safety Manual notes that if the ratio of time it takes to cross at street level over time it takes to cross on overpass is equal to one then 95% of pedestrians will use the overpass. If overpass/ underpass route is longer or perceived to be unsafe, few will use it.

Shared-use Path

Creating a shared-use path provides recreation and transportation opportunities for a variety of user groups including pedestrians and bicyclists. While separation from motor vehicles provided by shared-use paths reduces the risk of some crash types, the safe interaction among the different path users should be considered when proposing this tool.

Buffered Bike Lane

These bike lanes are conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane.

Existing Corridor Characteristics

Existing land use, roadway geometrics, traffic operations, and safety characteristics of the US 1 corridor were compiled, inventoried, and mapped. A full set of corridor maps are in **Appendix C**. Key highlights include:

- Above average percentages of trucks along US 1 as compared to other similar state arterial highways due to the industrial land uses
- Lack of any uncontrolled or midblock marked pedestrian crossings, and significant distances between existing signalized marked pedestrian crossings
- Significant gaps in the existing sidewalk network
- Variation in the posted speed limits, sharp transitions between higher, and lower speed limits in key segments with limited warning or visual context; and, overall speed limits in excess of those that would be comfortable for pedestrians and bicycles in a more developed urban environment
- Multiple bus stops lacking connections to pedestrian facilities
- Low pedestrian volumes outside of the North Laurel, Jessup, and Elkridge core areas

Land Use & Zoning

Commercial/industrial land uses directly about the corridor for over 80% of its length. Residential land uses are increasing as redevelopment along the corridor occurs.

Planned Developments

There are concentrated pockets of planned development along the corridor: a) between the southern county line and Whiskey Bottom Road, b) to the north and south of the intersection at MD 175, and c) to the north of Montgomery Road. The majority of the planned developments are residential, followed by an equal amount of industrial, office, and retail development projects; see the inset pie chart on this page. Several new proposed traffic signals are recommended or are under design, which will provide new crosswalks and pedestrian signals. The Route 1 Manual sets forth policies for new developments to include sidewalks along their frontage.

Land Area by Type of Planned Development

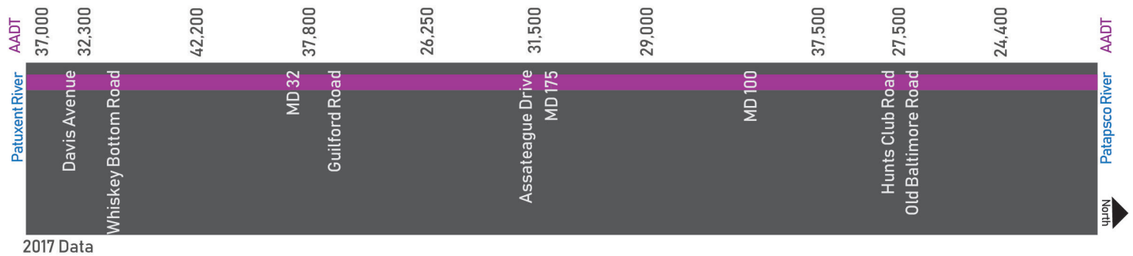
Proposed Pedestrian & Bicycle Infrastructure

The 2016 Howard County Bike Master plan calls for US 1 to serve as a north-south bike route. The plan recommends protected on-road bike lanes for the length of US 1; however, current thinking is to focus on an adjacent off-road facility such as a shared-use path, along with developing low-stress on-road bike routes on parallel County roads in key segments. There are eight proposed east-west bicycle facilities crossing US 1, mostly as on-road facilities. The crossing locations from south to north include: 1) Laurel Road, 2) Whiskey Bottom Road, 3) Guilford Road, 4) Meadowridge Road, 5) Ducketts Lane, 6) Loudon Avenue, 7) Rowanberry Drive, and 8) Montgomery Road. The average spacing between crossings is three-quarters of a mile, except for a 3.75 mile stretch between Guilford Road and Meadowridge Road in the Jessup area. Specific locations for proposed pedestrian infrastructure including sidewalks and designated crossings are not identified in the Bike Master Plan.

Example of a Shared Use Path from Bike Howard- Bicycle Facilties Visual Glossary page 35

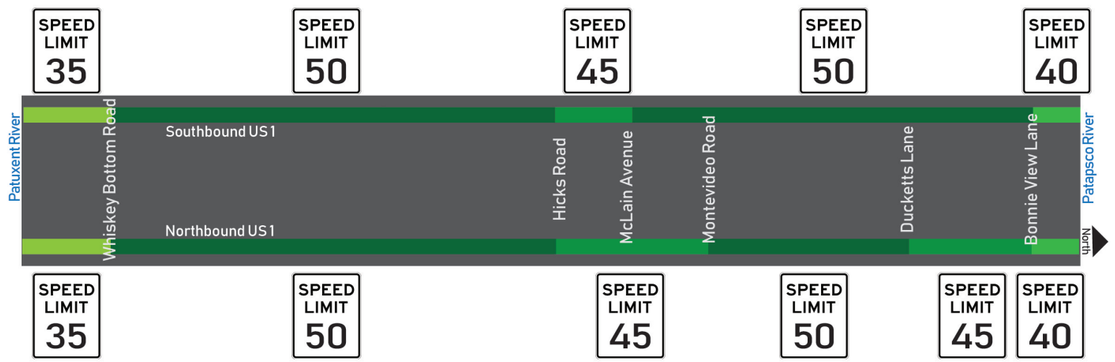
Average Annual Daily Traffic & Truck Percentages

The average annual daily traffic (AADT) along US 1 ranges between 18,000 and 42,000 with a corridor-wide average of 29,000. Segments of higher AADT occur to the south of MD 32 and to the north of MD 100. Truck percentages range between 6% and 12% with the highest truck percentage occurring in Jessup. Due to the industrial land uses along the corridor, truck percentages are higher than what is typical of state-maintained arterial roadways. Data sourced from MDOT SHA (http://www.roads.maryland.gov/Index.aspx?PageId=792).



Posted & Average Travel Speeds

The posted speed limit changes along the corridor several times. Entering the corridor from Prince George's County a 35 MPH speed limit is posted and increases to 50 MPH north of Whiskey Bottom Road. The speed limit is reduced to 45 MPH between Guilford Road and Patuxent Range Road, and again through Jessup between Hicks Road and Montevideo Road. Approaching Elkridge, the speed limit reduces to 45 MPH and then to 40 MPH entering Baltimore County. Average travel speeds during peak hours are generally at or below the posted speed due to higher levels of traffic congestion. However recent MDOT SHA speed studies indicate that excessive speeding is prevalent in off-peak hours (e.g. 57 MPH 85th percentile in Elkridge north of Bonnie View).



Relative Length Segment of Posted Speed Limit to the Corridor's Length

Intersection Vehicle & Pedestrian Volumes

Afternoon peak period vehicle volumes are higher than morning peak period volumes, as is typical in any corridor with significant retail and commercial land uses. The highest volume intersection is MD 175 with over 5,000 entering vehicles in the afternoon peak hour. Pedestrian counts were compiled for twenty-one intersections along the corridor. Intersections that see greater than fifty pedestrian daytime crossings (i.e. 6 AM to 7 PM) include Ducketts Lane and Montgomery Road, both of which are in the Elkridge area between MD 100 and I-695. North Laurel Road in North Laurel exceeds 30 pedestrian crossings per day.

Transit Routes

The Regional Transportation Authority (RTA) operates four routes along the corridor (Purple/409, Brown/408, Green/409B, and Silver/501) while the MDOT Maryland Transit Administration (MDOT MTA) operates one commuter bus line (Route 320). The Purple/409 route and Green/409B route are north-south routes serving US 1, while the Brown/408 and Silver/501 routes are east-west connections crossing the corridor at MD 175 and MD 100, respectively. The RTA routes operates seven days a week, typically on one hour intervals, and covers the entire corridor with the exception of a two mile segment between Corridor Road (just south of MD 32) and Patuxent Range Road. The highest ridership bus route is Silver/501 which carried 194,000 riders (total unlinked trips) in 2017. The corridor is also served by the parallel MARC Camden line rail service with stops in Dorsey, Jessup, Savage, and at the Laurel Racetrack.

Bus Stops

There are thirty-six existing bus stops along US 1 with another twenty located in close proximity to US 1 along intersecting roadways. Bus stop locations are generally concentrated into three general segments that cover about 40% of the corridor: 1) in North Laurel and Savage between Prince George's County line and MD 32, 2) in Jessup between MD 175 and Meadowridge Road, and 3) in Elkridge between Troy Hill Drive and Loudon Avenue. The breakdown of bus stop attributes is as follows:

- 67% have a landing/waiting pad
- 61% have an accessible connection to a sidewalk
- 14% have lighting
- 11% have a shelter and/or a bench
- 6% are located adjacent to a controlled pedestrian crossing
- 20% of the stops consist of solely a flag sign

Pedestrian Infrastructure

There are twelve designated pedestrian crossings along the corridor, all located at signalized intersections. Many of the signalized intersection are not up to current ADA standards lacking either fully marked crosswalks, ADA ramps, pedestrian signal indications, and/or pushbuttons. The distance between controlled crossings is significant with an average spacing of three-quarters of mile. Accounting for both sides of US 1, sidewalks exist along one-third of the corridor but are often not continuous, resulting in an average length of just 300 linear feet per sidewalk segment.

Crash History

Between 2012 and 2016, a total of fifty-four pedestrian related crashes occurred along US 1, six of which resulted in seven pedestrian fatalities. The majority of pedestrian crash locations along the corridor occurred 1) in the North Laurel area between Prince George's County line and Whiskey Bottom Road, 2) in Jessup within a half mile of MD 175, and 3) in Elkridge near Montgomery Road. The growth in annual pedestrian related crashes that resulted in an injury or a fatality is shown in Chart 1. The maps on the following pages show the location of pedestrian related crashes that occurred within the four focus areas (reference the Field Evaluation section for an explaination on the focus areas). Detailed crash information and maps are available in **Appendix F**.

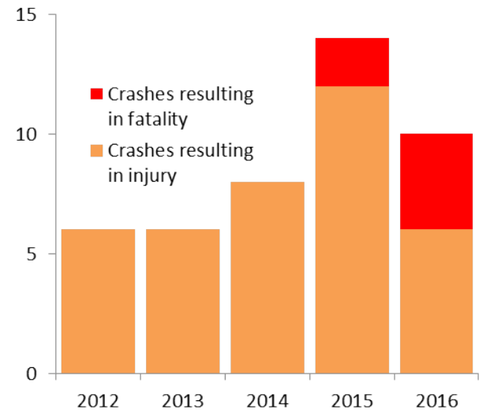
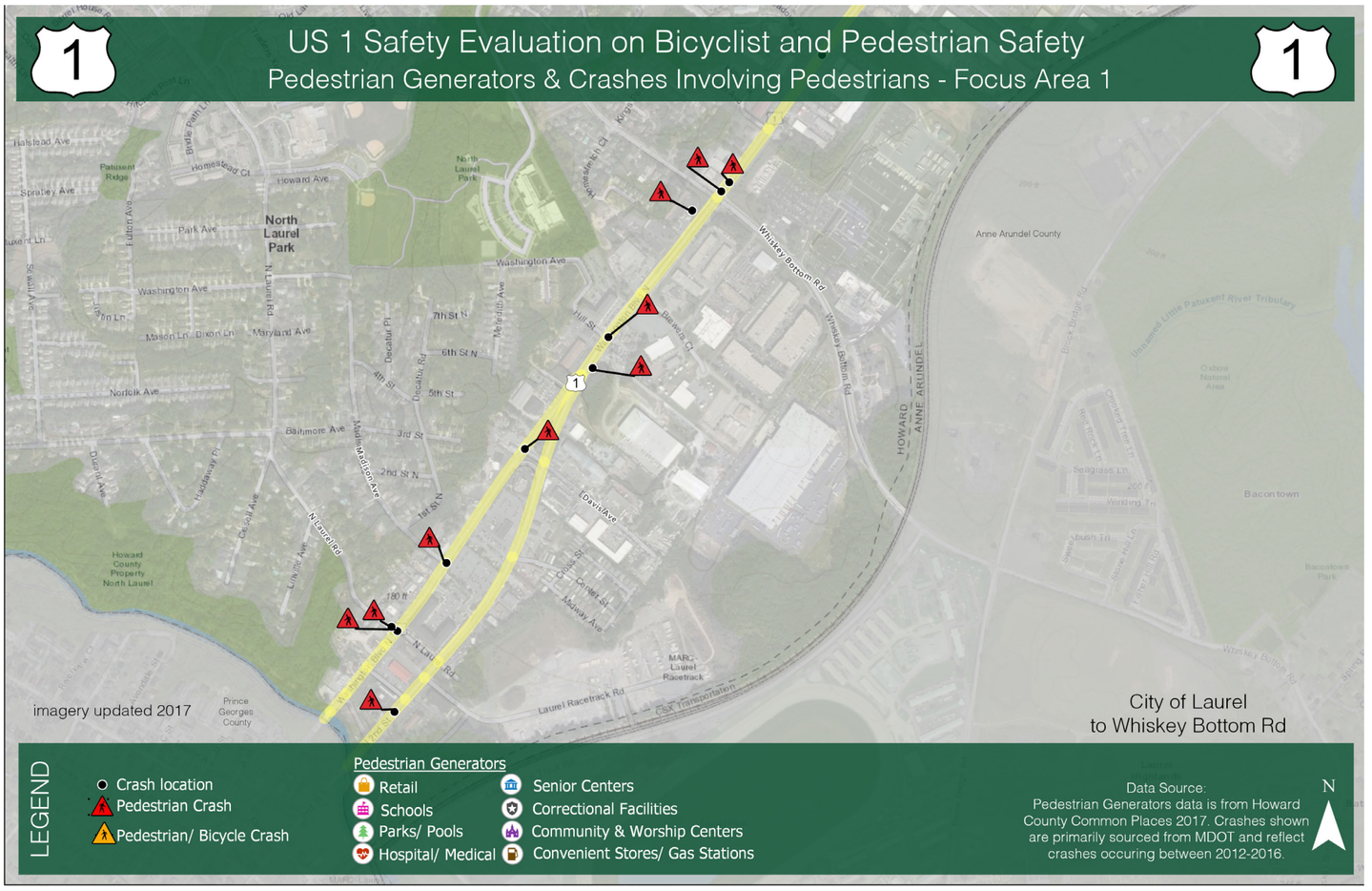
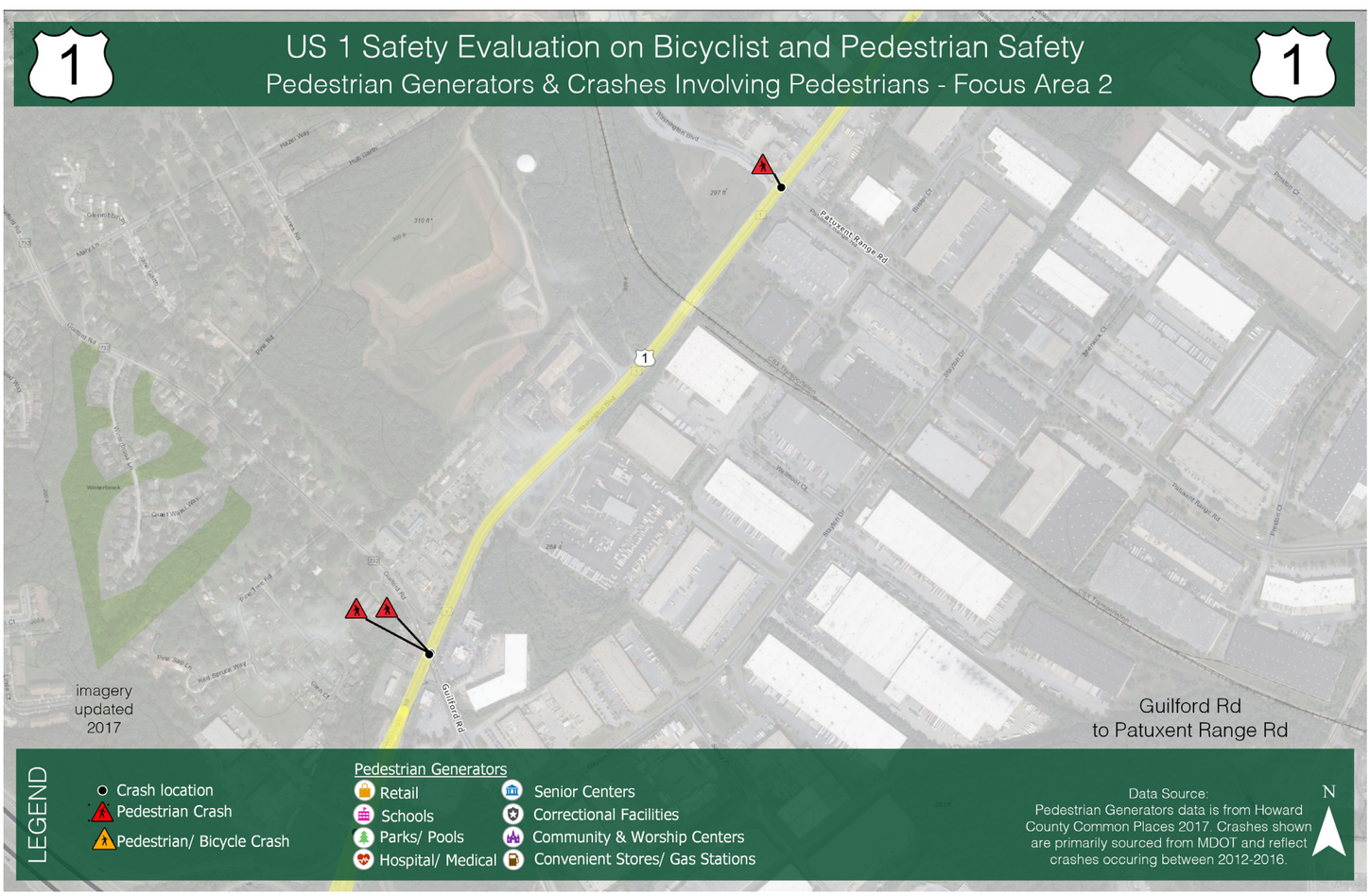


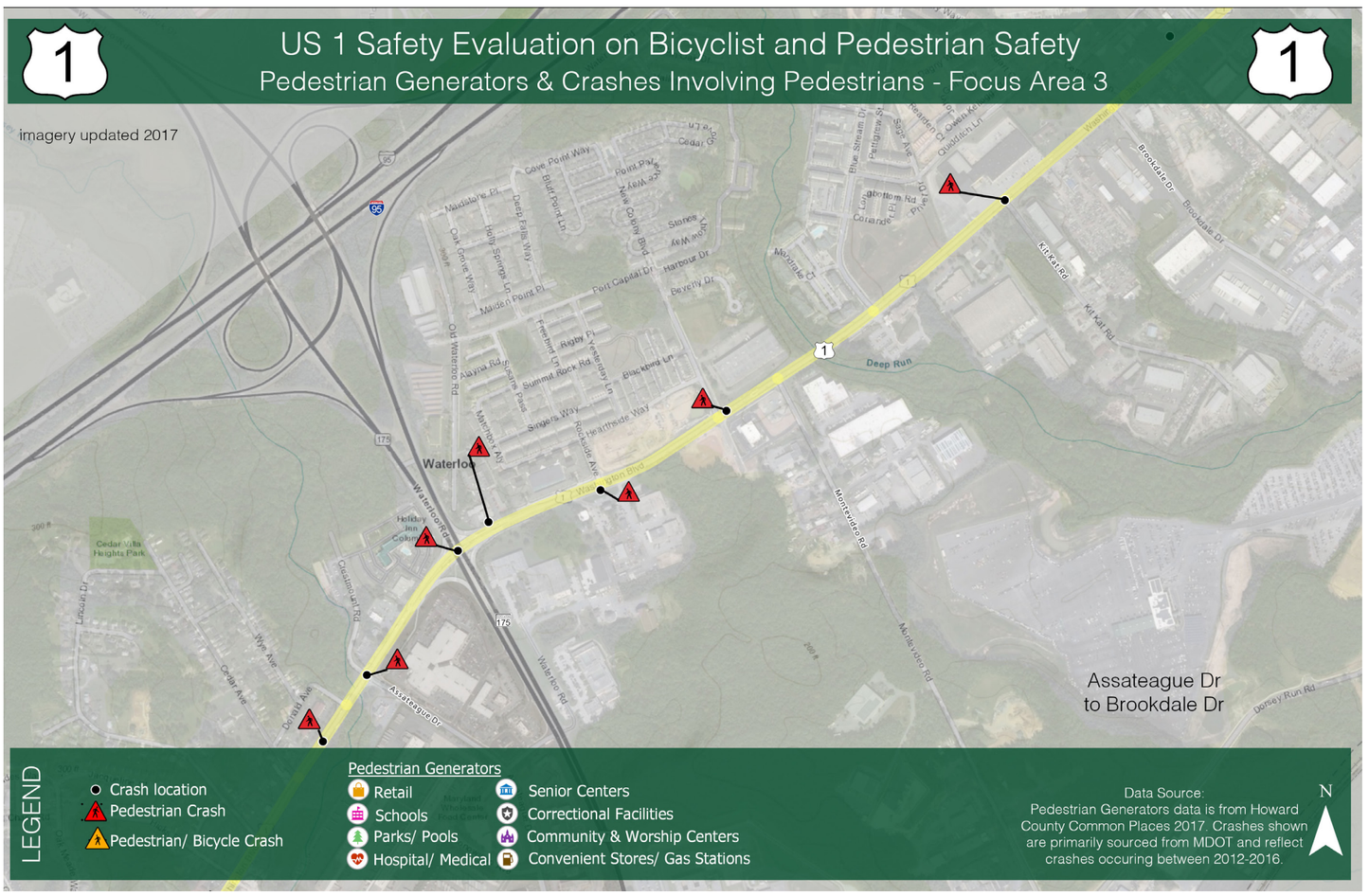
Chart 1. Annual Pedestrian Crashes on US 1
This graphic does not include 10 Property Damage Only crashes



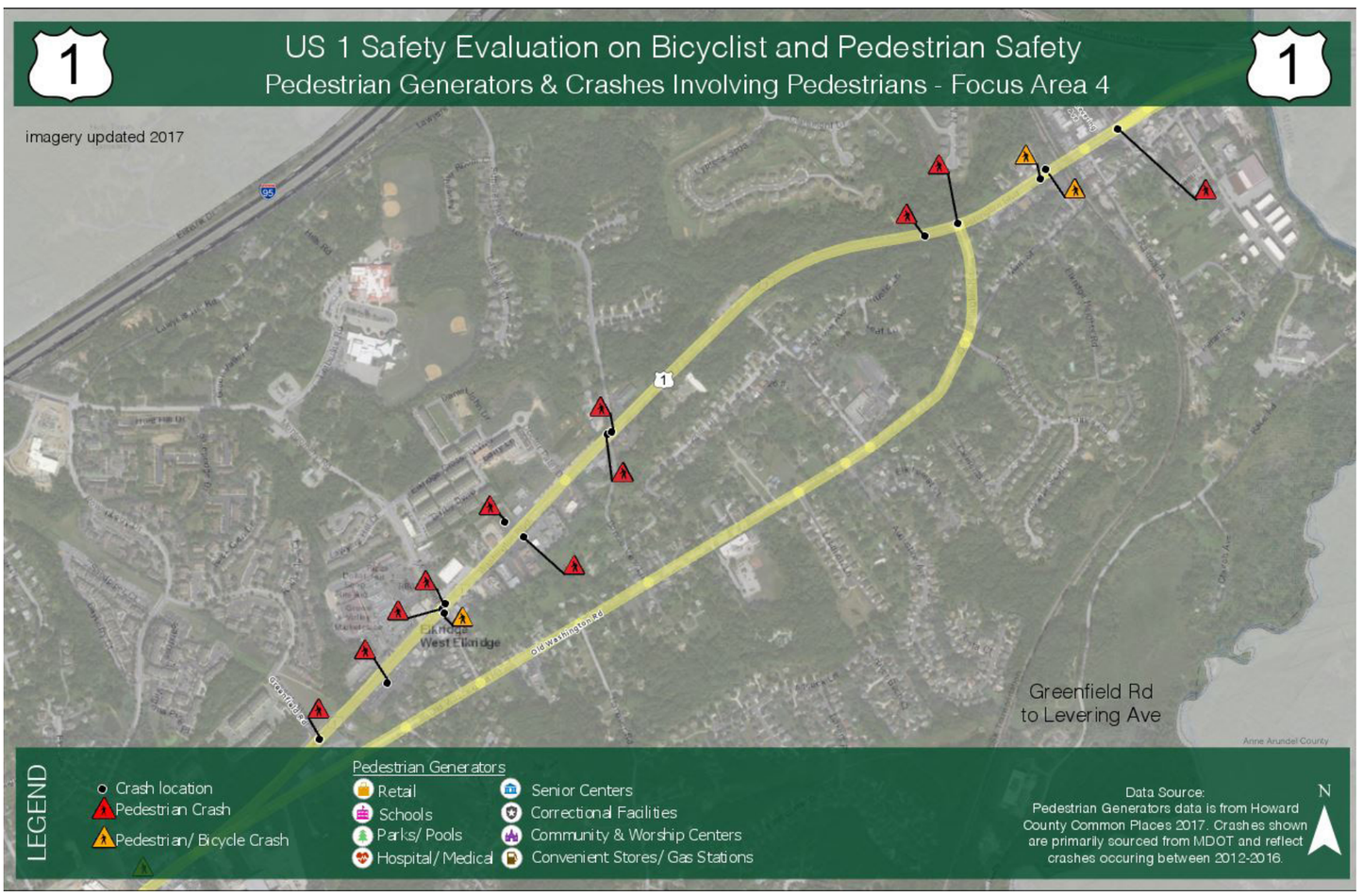
Map 1. Area 1 Pedestrian Crashes & Generators Overlay



Map 2. Area 2 Pedestrian Crashes & Generators Overlay



Map 3. Area 3 Pedestrian Crashes & Generators Overlay



Map 4. Area 4 Pedestrian Crashes & Generators Overlay

Peer Corridors

A series of peer corridors with similar traffic characteristics experiencing comparable pedestrian safety issues were selected to serve as examples of how other jurisdictions have tackled analogous safety issues. Selected peer corridors include: Georgia State Route 13 (Buford Highway) in Atlanta, Georgia; US 1 in Stafford, Virginia; Delaware State Route 1 in Sussex County, Delaware; and Maryland State Route 26 (Liberty Road) in Baltimore County, Maryland. A comparison of these corridors to US 1 is shown in Table 1 and a brief summary of each follows. Table 2 on page 20 depicts various methods each peer corridor used to address the safety concerns and roadway geometry that do not accommodate all modes of transportation. Detailed information on each peer corridor is in **Appendix D**.

	US 1 Howard Co., MD	SR 13 Atlanta, GA	US 1 Stafford, VA	DE 1 Sussex Co., DE	MD 26 Baltimore Co., MD
Number of Lanes	Four with turn lanes	Six with turn lanes	Four with turn lanes	Four with turn lanes	Four with turn lanes
AADT	30,000 vehicles	25,000 vehicles	21,000 vehicles	60,000 vehicles	35,000-40,000 vehicles
Posted Speed Limit	35-50 mph	35-45 mph	35-45 mph	45-55 mph	35 mph
Transit	Bus	Bus	Bus	Bus	Bus
Length	11 miles	6 miles	10 miles	12 miles	5 miles

Table 1. Peer Corridor Comparison

Buford Highway, Atlanta, Georgia

Buford Highway, also known as State Route 13, is a six lane undivided highway with an AADT between 20,000 to 45,000. The road has a posted speed limit between 35 to 45 MPH. The study segment is six miles in length. Identified key issues include lack of sidewalks, lack of bicycle facilities, numerous uncontrolled access points such as driveways and entrances, limited pedestrian crossings, and high vehicle operating speeds. The corridor serves a mix of commercial and residential land uses, It is served by a bus route with high volume stops (up to 400 daily boardings and alighting). With the high number of pedestrians using the bus system and a crash rate that is two to three times higher than the statewide average for similar highways, the corridor has experienced a recent increase in the number of pedestrian and bicycle fatalities. In response, Buford Highway became the focal point of a 2016 grant to create a master plan to address connectivity, affordable housing, and pedestrian safety.

Street View of Route 13, Georgia

The Master Plan focused on improving alternatives to driving by providing new and safer pedestrian, bicycle, and transit infrastructure. Specific recommendations included:

- Providing enhanced bus stops to create transit stations/plazas
- Constructing new sidewalks
- Widening existing sidewalks
- Providing connecting sidewalks between existing shopping centers' parcels and brand the route with public art, lighting, active spaces, and wayfinding
- Providing shared use paths and landscaped buffers
- Installing median refuges and new mid-block designated pedestrian crossings
- Improving access management and consolidating driveways and entrances
- Converting the outside curb lane to a bus and right-turn only lane
- Lowering the posted speed limit throughout the corridor
- Replacing the center turn lane with a raised median

It was recommended to phase in the improvements focusung on improving transit service and passenger amenities along with pedestrian and bicycle infrastructure prior to reducing the roadway capacity for traffic. Additionally, the Master Plan envisioned encouraging redevelopment and mixed land uses along the corridor.

US 1, Stafford, Virginia

US 1 in Stafford County and the City of Fredericksburg, Virginia is primarily a four lane undivided roadway, with an AADT between 20,000 to 40,000, posted speed limits varying between 35 and 50 MPH, and local bus service along the ten miles evaluated in the 2008 Route 1 Multimodal Corridor Study. Key issues include significant development pressure and growth, over-capacity intersections and traffic congestion, lack of sidewalks, lack of bicycle facilities, numerous uncontrolled access points, inaccessible bus stops, over-capacity park and ride lots, limited pedestrian crossings, and high vehicle operating speeds. Additionally, the corridor serves as a detour route for I-95 when incidents or weekday and seasonal traffic volumes causes delays on I-95.

Street View of US 1 in Stafford, VA

The study recommend numerous physical and operational improvements including:

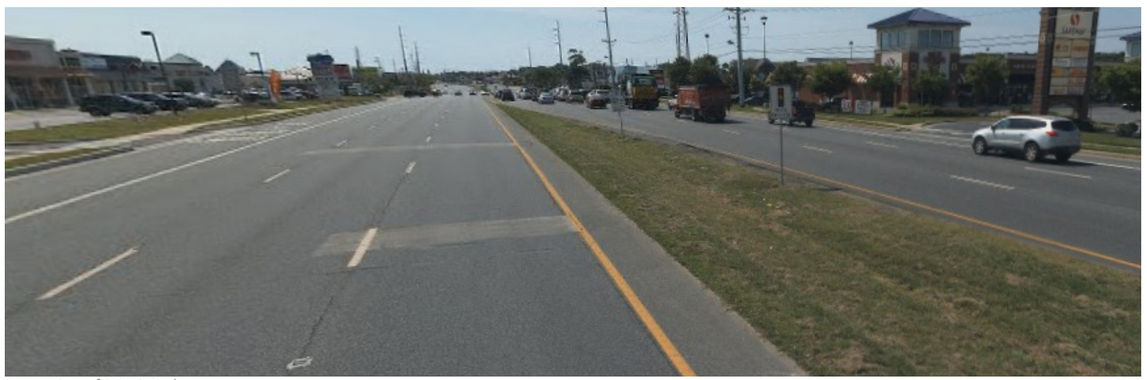
- Widening US 1 from four lanes to six in order to improve traffic operations
- Providing a raised median for traffic safety, access management and pedestrian refuge
- Modifying traffic signal phasing to enhance traffic safety
- Retrofitting signalized intersections with up-to-date pedestrian infrastructure and pedestrian-friendly designs such as ADA ramps, pedestrian signal indications and pushbuttons, reduced curb radii, increased lighting levels, and median refuges
- Providing mid-block crossings with pedestrian-activated traffic controls
- Improving access to bus stops
- Increasing transit service and installing new bus stops
- Creating a network of on-road and off-road (shared use path) bicycle facilities and bike route wayfinding signage

DE 1, Sussex County, Delaware

DE 1 in Sussex County, Delaware serves the coastal communities of Lewes, Rehoboth, and Dewey Beach in southern Delaware. The roadway geometry varies along the twelve mile study segment from a four lane divided highway in the southern section through Dewey Beach and Rehoboth to an eight lane divided highway in the commercial northern section near Lewes. Speed limits range from 30 MPH in the downtown blocks of Dewey Beach to 45 MPH in the commercial areas north of Rehoboth to 55 MPH through the Delaware Seashore State Park. The AADT peaks in the summer season to 60,000 to 80,000, serving both local residential and business traffic as well as through traffic from the Wilmington, Philadelphia, and other metro areas of Maryland and Virginia to other southern beach destinations. Fourteen pedestrian crashes resulting in five fatalities were reported in the recent three year period. Key issues found include over-capacity intersections and traffic congestion, lack of sidewalks, lack of bicycle facilities, numerous uncontrolled access points such as driveways and entrances, inaccessible bus stops, limited pedestrian crossings, and high vehicle operating speeds. Local bus transit service is provided, but the high vehicle travel speeds and lack of pedestrian amenities contribute to fatal accidents along the corridor and an overall unsafe area for non-driving transportation users.

The 2014 Route 1 Pedestrian Safety Task Force in Sussex County, worked with the Delaware DOT to perform a roadway safety audit and develop short-term pedestrian safety improvements including:

- Constructing eight new ADA compliant marked mid-block crosswalks
- Constructing two new mid-block HAWK pedestrian-activated traffic signals
- Constructing new sidewalks and pedestrian lighting to connect the existing sidewalk gap in the most heavily pedestrian trafficked segment
- Relocating bus stops to existing and planned designated pedestrian crossings
- Installing bicycle compatible rumble strips in conflict areas where vehicles enter right-turn lanes and cross on-road bike lanes
- Installing amenities at bus stops such as benches and shelters
- Constructing channelization barriers in the median to prohibit pedestrian crossings in select locations
- Reducing posted speed limits in high pedestrian activity areas
- Reconstructing sidewalks s shared use paths where right-of-way exists
- Reducing the number of existing commercial access points and not allowing new ones
- Implementing traffic and pedestrian safety education and outreach campaigns



Street View of DE 1 in Delaware

MD 26, Baltimore County, Maryland

MD 26, also known as Liberty Road, is an east-west, state-owned, four lane arterial that connects Baltimore City and the City of Frederick. The study segment stretches from Baltimore City line to Randallstown, approximately five miles long and is surrounded by medium density suburban land uses primarily comprised of a commercial strip malls, single-use commercial parcels with individual driveways, and a few blocks with single family detached homes. The roadway geometry provides primarily a five lane undivided cross-section. The AADT ranges between 35,000 and 40,000. The current posted speed limit of 35 MPH was implemented as a result of several recent safety studies and audits. Local bus service is provided along the corridor.

The MD 26 corridor outside of Baltimore City has been a focus area for the State over the past decade to address highway and pedestrian safety concerns as well as traffic congestion concerns. Twenty-eight percent of corridor crashes occurred at signalized intersections and seventy mid-block pedestrian crashes occurred over a five year period. MD 26 has been studied several times including through the Smooth Operator Crash-Crime Enforcement Program (2008), as a pilot corridor for the Maryland Strategic Highway Safety Program (2012), under the Pedestrian Roadway Safety Audit PRogram (2014), and for the Arterial Congestion Management Program (2015). These studies identified several key issues including traffic congestion, high vehicle operating speeds, low illumination levels, narrow sidewalks, bus stops not aligned with crossings, and high frequency of driveways and curb cuts. A variety of tools have been implemented along the corridor ranging from infrastructure improvements to enforcement and education. Measures included:

Median Pedestrian Refuge Implemented on MD 26

- Traffic signal operations changes to improve vehicle safety
- Roadway resurfacing to improve vehicle braking friction
- Sidewalk reconstruction to ensure ADA compliant facilities
- Construction of new mid-block crosswalks with median treatments and pedestrian warning beacons. These crossings, shown in the picture above, include a high visibility crosswalk marking, pedestrian crossing warning signs in the median supplemented by yellowing flashing beacons, and a raised curbed island
- Bus stop relocation to better align bus stops with designated and marked crosswalks
- Implementing a Street-Smart multi-agency and multi-media education and enforcement campaign about safe walking and driving through radio broadcast and outdoor advertising, media relations, digital media, and outreach events

	Recommendations	SR 13 Atlanta, Georgia	US 1 Stafford, Virginia	DE 1 Sussex Co., Delaware	MD 26 Baltimore Co., Maryland
	Consolidate Curb Cuts	X	X	X	--
	Designated Mid-block Crossings	X	X	--	X
	Enhanced Bus Stops (e.g. landing pad, seating, shelter, real-time info)	X	X	X	--
	Relocating bus stops to align with designated crossing	X		X	X
	High Visibility Crosswalks	--	X	X	--
	Inter-parcel walking connections	X	X	X	--
	Intersection Retro-fit (e.g. ADA ramps, ped signals, curb extensions)	X	X	X	X
	Landscaped Buffers	X	X	X	--
	Landscaping & Amenities	X	X	X	--
	Median Refuge Island	X	X	--	X
	New signals/beacons	X	--	X	X
	Pedestrian Level Lighting & Crosswalk Illumination	X	X	X	--
	Sidewalk Widening	X	X	X	--
	Multi-Use Paths	X	X	X	--
	Share the Lane/Sharrows	--	X	--	--
	Shoulder Improvements (e.g. widening, resurfacing)	--	X	X	--
	Wayfinding & Signage Improvements	X	X	X	--
	Rumble Strips			X	
	Widen Curb Lanes	--	X	X	--
	Access Management	X	X	--	--
	Improved Signal Timing / Phasing	--	X	X	X
	Travel Speed (i.e. Reduced Posted Speed Limit)	X	X	--	--
	Enforcement Efforts	--	--	X	--
	Task Force	X	--	X	--
	Education Campaign Initiatives	X	--	X	X
	Mixed-use zoning	X	X	--	--
	Tactical Urbanism (e.g. Parklets, Public Art Installations)	X	--	--	--
	TDM Strategies	X	X	--	--

Table 2. Summary of Peer Corridor Strategies
Recommendations in the color green are found in three or more studies.

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Public Open House Comments

Howard County Office of Transportation held two full-day public open houses in Fall 2017. These meetings were held in opposite ends of the study corridor (Elkridge on 09/25/17 and Laurel on 10/03/17). The public was invited to stop by, discuss their input with Howard County staff, provide written comments on comment cards or on a printed aerial of the corridor. Follow-up comments were also taken by email.

A total of 102 comments were received inlcuding 13 via email. The two open houses attracted 36 attendees, who provided 41 comment forms and 89 specific comment locations. The breakdown of comments by area of concern is shown below.

Approximate Segment (South to North)	Comment Dots	Emailed Comments	Total
Prince George's County Line to Whiskey Bottom Road	24	1	25
Whiskey Bottom Road to Gorman Road	5	0	5
Gorman Road to Guilford Road	10	1	11
Guilford Road to Gatewood Drive	2	1	3
Gatewood Drive to Crestmount Road	2	0	2
Crestmount Road to Kit Kat Road	13	1	14
Kit Kat Road to MD 100	3	0	3
MD 100 to Loudon Avenue	6	4	10
Loudon Avenue to Bonnie View Lane	12	2	14
Bonnie View Lane to Baltimore County Line	12	3	15

Number of Comments by Area of Concern

The 75 words most commonly mentioned in public comments about the US 1 Evaluation, from the US 1 Safety Study Website [https://www.howardcountymd.gov/US1Safety]

Chief Issues Noted:

Access to Transit	» Many bus stops do not have sidewalk access, so bus riders must wait in the grass, mud, or snow. » Many paired bus stops do not have a safe or convenient crossing across US 1, so that if someone boards the bus on one side and alights on the other, they must cross US 1 at a location without a convenient or safe crossing.
Crossing US 1	» Residents desired more safe crossings of US 1, particularly in North Laurel and in Elkridge to provide access from neighborhoods west of US 1 to the more pedestrian-friendly Old Washington Road and Main Street.
Pedestrian Tunnel in Elkridge	» The existing railroad bridge over US 1 in Elkridge directly abuts the edge of the paved roadway and restricts the ability to provide sidewalks along US 1 or allow any right-of-way for pedestrian travel. Therefore the connection between Old Washington Road and Main Street are critical for providing pedestrian routes through the east side of Elkridge.
Sidewalks	» Residents agreed that sidewalks are desirable, and specific desire for sidewalks was indicated in North Laurel between where US 1 becomes separate northbound and southbound roadways and the Prince George's County line, as well as along the west side of US 1 between Country Meadows Lane and Maier Road, and along the segment of Montgomery Road between Old Washington Road and US 1.
Traffic Signal at Blue Stream Drive	» Residents of the neighborhood, as well as the management of the Lorien Health nursing home opposite Blue Stream Drive, expressed concerns about the safety of this intersection absent a traffic signal. Specifically, the nursing home management noted that people desiring to make a left turn out of their facility must turn right and drive north until they can safely make a U-turn. » In addition, they commented that their employees who live in the Bluestream neighborhood do not have a safe way to cross to their facility, and that they serve as overflow parking for the flea market, causing customers to cross at that location.

Many Elkridge residents had opinions about the potential re-opening of the existing tunnel between Main Street/Old Washington Road north and south of the CSX tracks. The tunnel had previously been closed due to concerns about loitering and illcit activites, but bicyclists and pedestrians are resorting to trespassing across the CSX tracks at grade in order to reach the center of Elkridge.

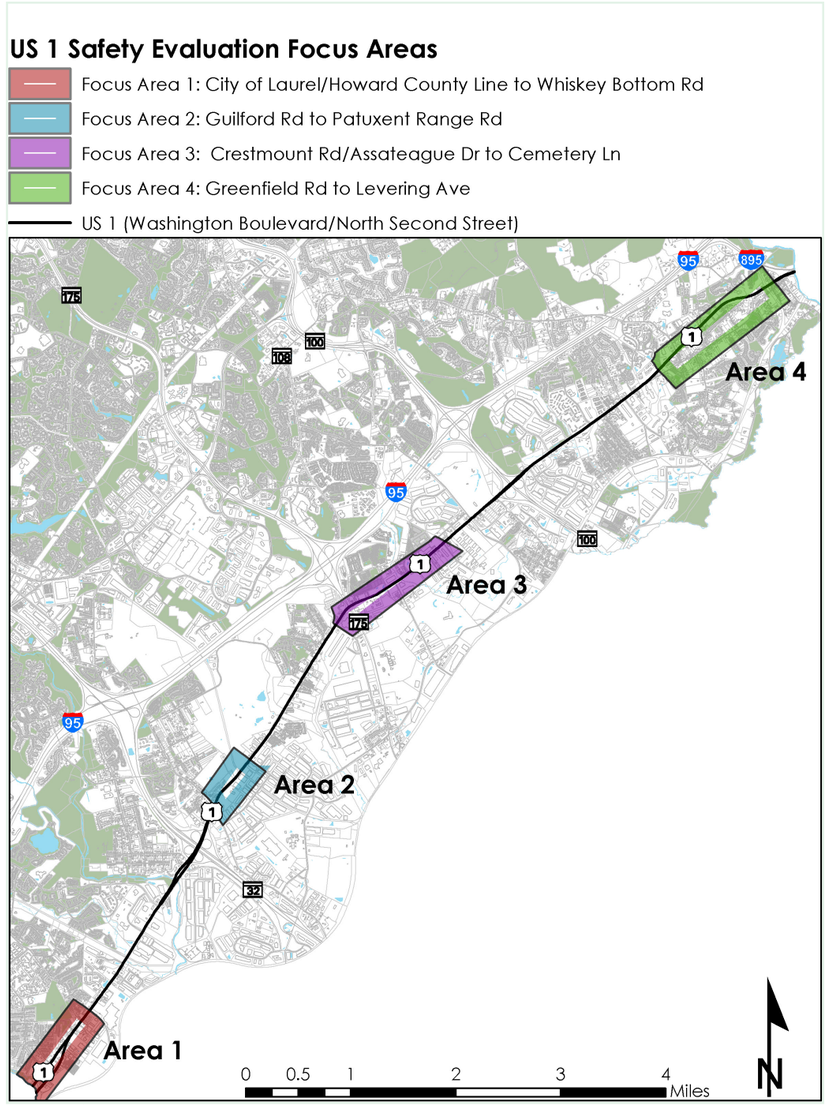
Public Open Houses

Field Evaluation

In order to achieve the level of detail appropriate for this study and to meet project schedules, four critical focus areas of half mile to one mile in length were identified for field evaluation and a deeper review. (The typical length of a traditional roadway safety audit segment is around one mile.) Shorter segments enable a more efficient investigation of safety issues and potential solutions. At a stakeholder meeting held on October 10th 2017, the four segments were selected on pedestrian crash history, pedestrian generators, and public feedback. The four segments are shown in Map 5.

Area	Length
1.	0.9 miles
2.	0.6 miles
3.	1.3 miles
4.	1.4 miles

The first field evaluations were held in October and were conducted by representatives from Howard County Office of Transportation, Howard County Department of Public Works, and MDOT State Highway Administration. The field team walked the four focus segments (where sidewalks were present) over two days observing pedestrian activity and traffic operations, experiencing the corridor as a pedestrian, evaluating pedestrian scale infrastructure, and reviewing hot spot pedestrian crash areas for possible contributing factors. Raw field notes are in **Appendix E.**



Map 5. Evaluation Focus Areas

Summary of Field Observations

Focus Area 1

» There is a lack of pedestrian facilities; specifically, continuous sidewalks and mid-block marked crosswalks.

» Pedestrians were observed walking in the road and crossing undesignated locations (i.e. midblock).

» Pedestrain crossings between the opposing bus stops at Brewers Court are of a concern due to the seven lane wide crossing, high vehicle operating speeds, and roadway curvature limiting sight distance.

» Minimal roadway lighting and lack of ambient lighting from adjacent land uses yields a dark section just south of Whiskey Bottom Road.

Focus Area 2

» Noted absence of pedestrian infrastructure (crosswalk, ADA ramps, and pedestrian signals) at Guilford Road.

» The intersection at Guilford Road had two pedestrian related crashes in the past five years including one fatality; several pedestrians were observed crossing during the field visit and were hesitant or unable to follow the traffic signal indications to find a safe time to cross.

» There are sidewalk gaps along the west side of US 1 north of Guilford Road; filling these gaps would provide connectivity between the adjacent shopping centers.

Focus Area 3

» There are sidewalk gaps on both sides of US 1; the short gap between MD 175 and the Howard Square development is a critical link to connect the residential development on the northwest corner of US 1 and MD 175 with the shopping center on the southwest quadrant of the intersection due to the short distance (approximatley 130 feet).

» There is an increase of pedestrian activity and mid-block crossings of US 1 around Kit Kat Road during the Flea Market hours of operation. MDOT SHA representatives commented that a signal is scheduled to be installed at US 1 and Kit Kat that will give pedestrians a controlled crossing.

Focus Area 4

» There is a lack of marked or controlled pedestrian crossings although there are numerous generators.

» There is limited existing roadway lighting, specifically to the south of Montgomery Road and near Bonnie View Lane; this is congruent with history of pedestrian related crashes during dark conditions.

» Minimal roadway lighting and lack of ambient lighting from adjacent land uses yields a dark section of US 1 north of Montgomery Road.

» The railroad tracks running through Elkridge serve as a pedestrian barrier between residences and destinations on Main Street and those to the south along Old Washington Road. The existing railroad bridge over US 1 abuts the edge of paved roadway and does not accommodate any right-of-way or safe passage of pedestrian traffic.

Field Evaluators

Howard County Office of Transportation
- Chris Eatough
- Albert Engel

Howard County Department of Public Works
- Kris Jagarapu

MDOT SHA District 7
- George Miller

Sabra, Wang and Associates, Inc.
- Paul Silberman
- Randy Burks
- Elisa Mitchell
- Frances Green
- Katie Masetti

Howard County Commission on Disability Issues

Howard County Office on Aging

Howard County Department of Community Resources and Services

Greater Elkridge Community Association

Howard County Bicycle Advisory Group

Howard County Multimodal Transportation Board

Howard County Council

Howard County Office of Transportation

Corridor-Wide Key Observations

- There is a lack of sidewalk access to numerous bus stops, a lack of bus stop infrastructure such as benches, lighting or shelters, and the locations of bus stops are often not aligned with a controlled pedestrian crossing.
- Excessive distances exist between controlled (signalized) pedestrian crossings, which results in pedestrians crossing at undesignated locations.
- Existing vertical roadway curvature results in limited sight distance for several mid-block undesignated locations where existing pedestrian crossing activity was observed. This sight distance issue will need to be addressed should these locations be recommended as designated marked and/or controlled pedestrian crossings.
- The highest observed pedestrian activity during field visits occurred in North Laurel (Focus Area 1); pedestrian activity was also observed at the MD 175 intersection.
- Posted speed limits and vehicle operating speeds present a danger to pedestrian safety. Discussions with SHA and County law enforcement noted that seed limit changes and enforcement alone will not be as effective in reducing vehicle operating speed without geometric changes, streetscape/urban design changes or traffic calming measures.
- Existing signalized intersections lack up-to-date pedestrian infrastructure to provide ADA accessibility including marked crosswalks, countdown and audible pedestrian signal indication, ADA compliant curb ramps and push-buttons.
- There is a lack of roadway lighting in commercial areas where pedestrian crashes have occurred and where pedestrian generators exist such as the Elkridge area north of Montgomery Road.

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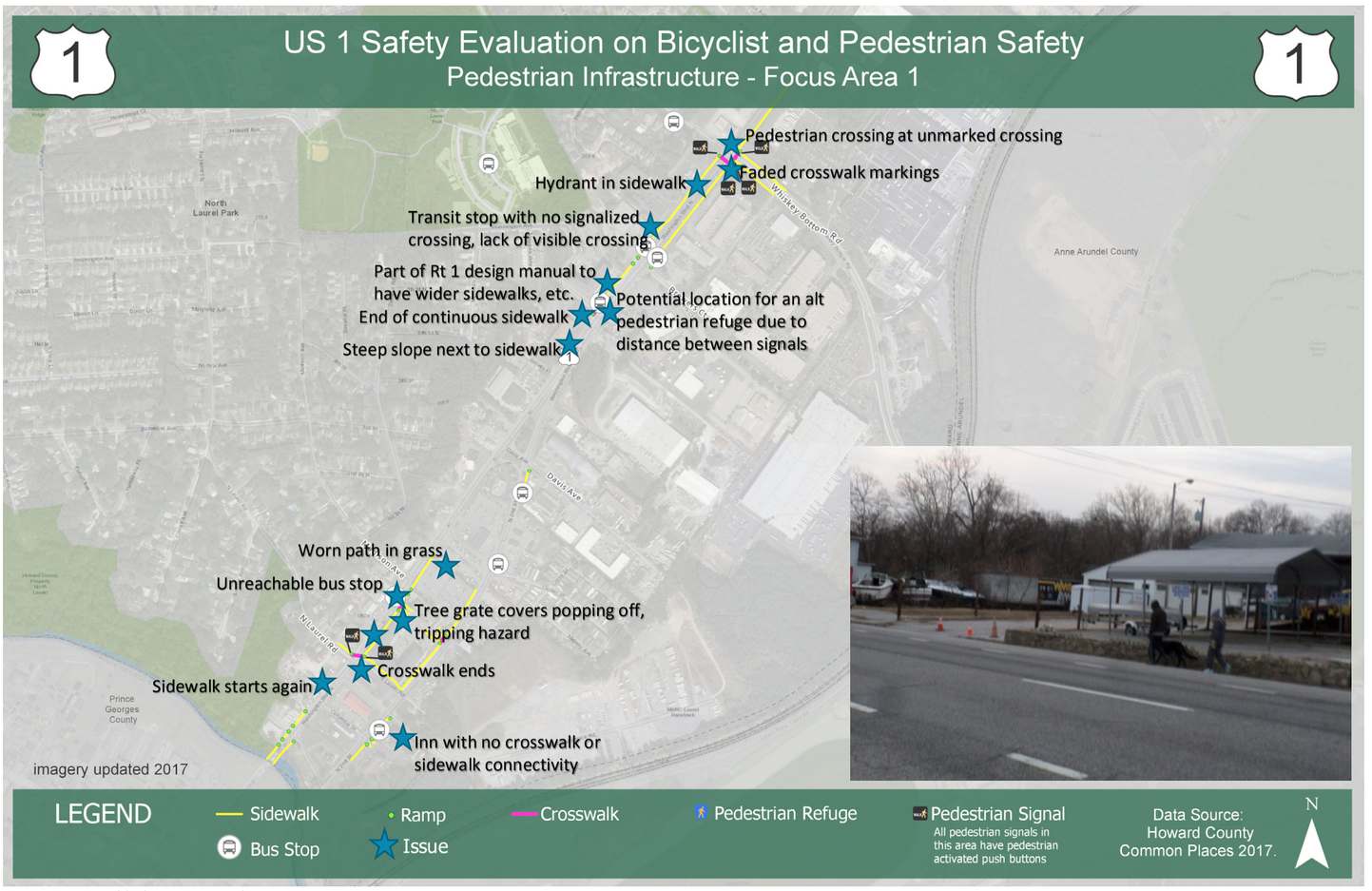
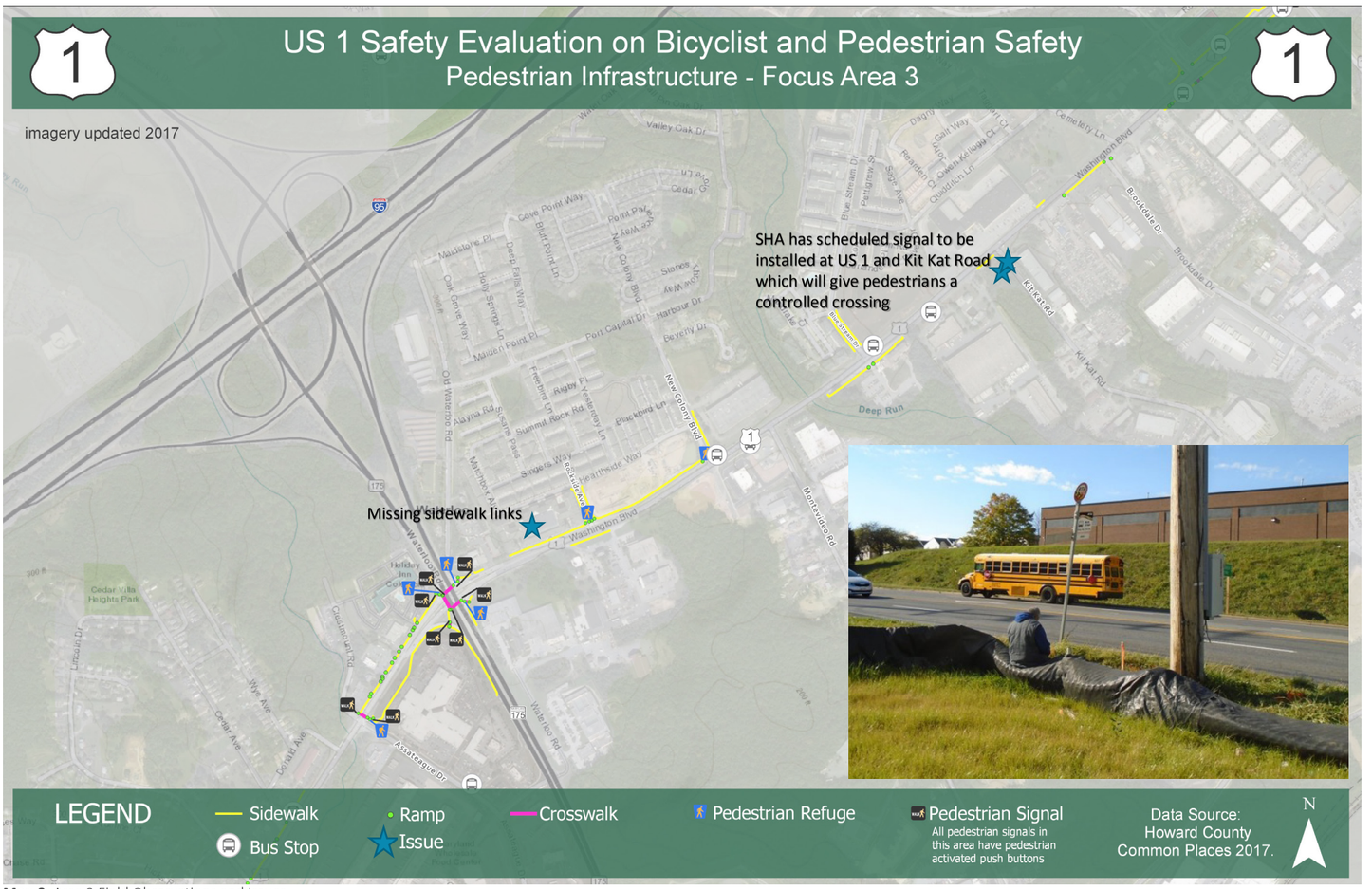
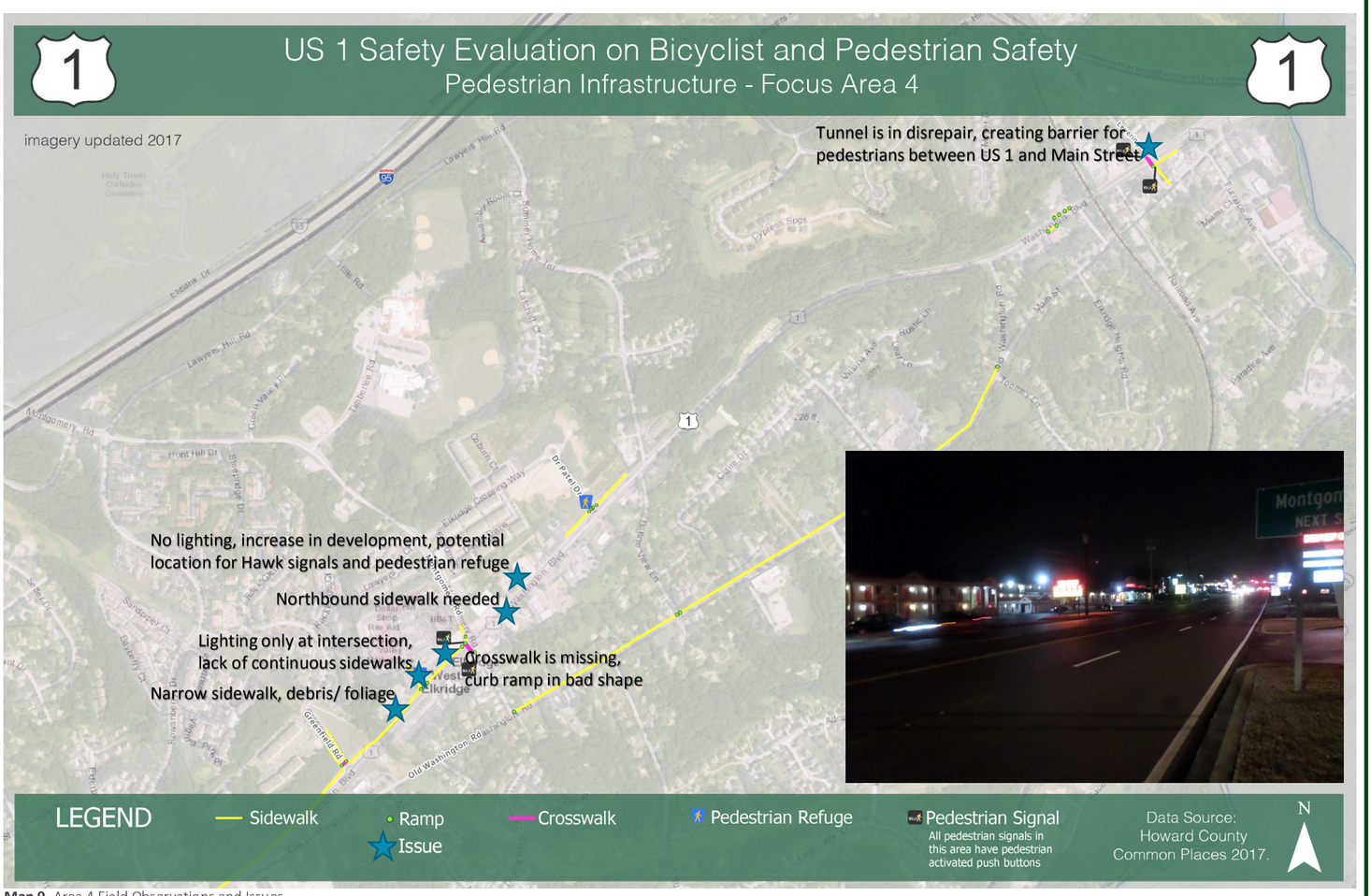


Map 6. Area 1 Field Observations and Issues

Map 7. Area 2 Field Observations and Issues



Map 8. Area 3 Field Observations and Issues



Map 9. Area 4 Field Observations and Issues

Planned Improvements

Identified as a growth and revitalization area in the PlanHoward 2030 Comprehensive Plan, the corridor has numerous development projects in various stages of the development review and site plan approval process in addition to several State and County capital projects. Many of the planned developments will result in frontage improvements along US 1 that may support the pedestrian and bicycle safety goals of this study. To gain a complete understanding of impending improvements to US 1, all pipeline developments as well as State and County Capital Improvement Programs were compiled and their anticipated frontage improvements mapped. A summary table of the planned improvements to US 1 by development or project is shown in Table 3 along with a sample image from the mapping as depicted below. The full mapping set is in **Appendix G**.

There are fifteen pipeline projects along US 1, including five in each of the following areas: Laurel, Jessup, and Elkridge. Sidewalk or shared use path construction account for a majority of the improvements. One project is the installation of a new traffic signal at US 1 and Kit Kat Road in Jessup. Four of the development and capital projects include sidewalk construction along intersecting roadways such as Whiskey Bottom Road, Kitkat Road, and Montevideo Road. The developments and projects will add approximately 4,380 linear feet of new shared used path and 4,090 linear feet of new sidewalk along the corridor. This equates to a 20% increase in pedestrian or bicycle friendly infrastructure along US 1.

Example of Planned Improvement Drawings- Site Plan for Roberts Property 6785 Washington Blvd

Name	Type	US 1 Frontage Improvements?	Improvement Description	Land Use	Location
Beechcrest Apartments	Development	Yes	5' Concrete Sidewalk	Residential	Laurel
Best Western	Development	Yes	5' concrete and asphalt sidewalk	Hotel 5 Stories (First floor retail)	Laurel
Laurel Park Station, Phase 1	Development	Yes	Construct a 5' concrete sidewalk between the Patuxent River Bridge and the entrance to Laurel Park Station development (900 LF); 5' Sidewalk	Residential (64 APT / 156 Stacked Townhouse Condo)	Laurel
Whiskey Bottom Road Sidewalk Improvements	Howard County Sidewalk Project	No	5' Sidewalk	N/A	Laurel
Columbia Junction (Section 3- Lot 'A'-2)	Development	Yes	540 LF of 5' Concrete Sidewalk	Undeveloped, Commercial	Jessup
Storage USA Parcel B and Parcel A of A.H. Smith	Development	Yes	427 LF of 5' Concrete Sidewalk, and Asphalt Sidewalk	Commercial	Laurel
US 1 Sidewalk Improvements	MDOT Sidewalk Project	Yes	675 LF of 5' Concrete Sidewalk	N/A	Jessup
Blue Stream Drive	Development	Yes	335 LF of 5' Sidewalk	Residential	Elkridge
CVS Pharmacy	Development	No	Plan shows no frontage improvements for CVS development, but does show proposed sidewalk for Montevideo relocation project	Commercial	Jessup
Signal at Kitkat	MDOT Signal Project	No	1167 LF of 5' Concrete Sidewalk; Installation of a New Traffic Signal	N/A	Elkridge
MD 175 to Montevideo Road Shared Use Path	Howard County Shared Use Path Project	Yes	3903 LF of 10' Northbound & Southbound Shared Use Path with 5' Grass Buffer	NB: Government and Institutional; SB: Commercial, Residential	Jessup
Royal Farms #230	Development	No	45' NB roadway widening. Plans show existing s/w along US1 NB to be maintained and tied into, but th aerial show it already demolished.	Commercial	Jessup
Roberts Property	Development	Yes	750 LF of Concrete Sidewalk (Assumed 5' wide)	Proposed Residential (Existing Commercial)	Elkridge
Cube Smart Storage	Development	Yes	Current plan shows 5' Concrete Sidewalk; however, there is an agreement to build a shared use path.	Commercial	Elkridge
Taco Bell	Development	Yes	179 LF 10' Wide Concrete Multi-Modal Path with Minor Landscaping	Commercial	Jessup

Table 3. Summary of Development and Capital Improvement Program Projects

Observed Issues & Toolbox

The field observations can be synthesized into four main issues:

- » High vehicle speed incompatible with pedestrian activity
- » Inadequate visibility of pedestrians
- » Lack of pedestrian crossings
- » Lack of sidewalks or bike facilities creating a connected non-motorized network

A toolbox of strategies geared towards addressing these issues was developed and catered to the US 1 corridor. The toolbox of strategies is shown in Table 4. The strategies encompass a variety of improvements from physical and geometric corridor wide improvements to isolated, intersection or traffic control and operational improvements. The strategies not only represent best practices in pedestrian and bicycle safety, but are also suitable for an arterial roadway like US 1 and are used on other state owned and maintained roadways. The established compatibility of these treatments with state roadways will help facilitate implementation. The table also shows suggested application of the strategies indicated by the X markers under each of the four focus areas. For example, three strategies are provided to address inadequate visibility concerns which include 1) installation of additional roadway lighting, 2) aligning or connecting opposing bus stops with an active or controlled pedestrian crossing, and 3) installing a high visibility crosswalk. As further described in the following section, Recommendations for the Four Focuse Areas, installation of additional roadway lighting is recommended in areas 1 and 4.

Issue	Toolbox		Area 1	Area 2	Area 3	Area 4
High vehicle speed incongruent with pedestrian activity		Implement a context sensitive speed limit		X	X	X
		Reconfigure existing roadbed cross-section to better accommodate bike lanes	X			
Inadequate visibility		Install additional roadway lighting	X			X
		Align/connect opposing bus stops with an active/controlled pedestrian crossing	X		X	X
		Install High Visibility Crosswalk	TBD			
Lack of pedestrian crossings		Install new signal with pedestrian facilities	X		X	
		Update/retrofit signalized intersection for pedestrian facilities		X	X	X
		Install pedestrian-activated traffic signal	X			X
Lack of sidewalks or bike facilities and a connected non-motorized network		Ensure sidewalk connection to bus stops	X		X	X
		Install a shared use path		X	X	
		Install on-road bike facilities	X			
		Designate on-road low stress bicycle facility			X	
		Prioritize sidewalk completion in areas with observed pedestrian activity and in commercial areas (i.e. new construction)	X	X	X	X
		Install new ped-bike connections parallel to US 1 (i.e. where an on-road or adjacent facility is not feasible due to geometric or environmental constraints)			X	

Table 4. Toolbox of Strategies

Recommendations for the Four Focus Areas

The US 1 pedestrian and bicycle safety treatment toolbox in Table 4 was applied to each the four focus areas. The following maps (Map 10 - Map 13) shows the application of the toolbox strategies as recommendations to address safety issues. While the recommendations can be implemented in the short term, some of the improvements are considered interim conditions, with the Route 1 Design Manual providing the ultimate condition as facilitated by redevelopment. When developing the recommendations the following elements of safer pedestrian design were considered:

- Minimize crossing distance
- Improve visibility
- Separate from traffic
- Minimize exposure
- Provide safe, frequent crossings
- Reduce vehicle speeds to reflect context of levels of pedestrian activity
- Consider comfort, safety, & ease of mobility

Area 1 Recommendations:
The City of Laurel/Howard County line to Whiskey Bottom Road

- A **road diet** is recommended along northbound and southbound US 1 from the Laurel Park Entrance Road to Davis Avenue to allow for repurposing of existing roadway space for other modes. A road diet of US 1 from the Prince George's County Line to Whiskey Bottom Road was previously evaluated for traffic operations in 2014 by MDOT SHA Office of Highway Development and was found to provide acceptable traffic performance. This recommendation expands on the concept by proposing a higher quality bike facility. Specifically, the outside lane in each direction, which currently operates as an auxiliary lane for right turns into and out of properties along US 1, is recommended to be repurposed as **buffered one-way bike lanes**. The proposed bike facility will provide a five foot northbound and five foot southbound bike lane each buffered by a five foot hatched area. The existing properties and side streets along this segment of US 1 are low traffic generators but it is recommended to reduce the speed limit to 30 MPH in this segment to further enhance traffic safety. Such an operational change is consistent with this segment's designation in the Route 1 Manual as a corridor activity center district.
- While sidewalks are recommended for all curbside in segments currently lacking, a **priority new sidewalk completion** segment is recommended between Columbia Street and Madison Avenue (1,000 feet) to support observed pedestrian activity.
- The roadway segment between Hill Street and Whiskey Bottom Road (1,250 feet) does not have marked or controlled pedestrian crossings. Field observations showed pedestrian activity in this segment. The danger of crossing the six lane roadway is compounded by the dark conditions at night due to limited ambient lighting from adjacent businesses and limited roadway lighting. **A pedestrian-activated traffic signal and a marked crosswalk** is recommended at Brewer's Court to provide a controlled crossing along this segment. Additional **roadway lighting** is also recommended along the segment between Brewers Court and Whiskey Bottom Road to improve pedestrian visibility.
- To decrease the distances between pedestrian controlled crossings, this report carries forward the planned **new traffic signal** at US 1 northbound and North Laurel Road.
- To improve access to bus stops, this report recommends constructing new **sidewalk connections to three bus stops**.

Map 10. Area 1 Recommendations: The City of Loarel/ Howard County line to Whiskey Bottom Road

Area 2 Recommendations: Guilford Road to Patuxent Range Road

» To provide for bicycle facilities in this focus segment, this report recommends establishing a **shared use path** along the east side of US 1. This recommendation may include the construction of a new path and/or widening of the existing sidewalk. Such a facility would connect the county proposed bike lane along Guilford Road to the shared use path proposed in the County's Bicycle Master Plan along the CSX railway corridor west of US 1 and south of Patuxent Range Road.

» While sidewalks are recommended for all segments currently lacking sidewalks, a **priority sidewalk completion segment** is recommended along the west side of US 1 from Guilford Road traveling north along the Columbia Junction center connecting to the existing sidewalk in front of the Extended Stay America hotel (600 feet), as well as along the eastern side of US 1 between Guilford Road and the existing sidewalk 230 feet north of the intersection. This would complete the sidewalk network in this area and provide a pedestrian path between Guilford Road and the destinations in the Columbia Junction shopping center.

» To safely accommodate the observed pedestrian activity at the intersections of US 1 with Guilford Road and Patuxent Range Road, this report recommends **upgrading these intersections for pedestrian crossing facilities including pedestrian signals, curb ramps, and marked crosswalks.** Pedestrian activity was observed walking to and from the surrounding commercial land uses.

Map 11. Area 2 Recommendations: Guilford Road to Patuxent Range Road

Area 3 Recommendations:
Assateague Drive to Brookdale Drive

» To provide for bicycle facilities along this segment, this report recommends installing a **shared use path** between MD 175 and Brookdale Drive. Alternatively or additionally **a low-stress signed bike route** could be developed between Old Waterloo Road and Meadowridge Road along parallel local County streets including Port Capitol Drive, Blue Stream Drive, Quidditch Lane, and Roosevelt Boulevard with the construction of a **new pedestrian bridge** over Deep Run.

» While sidewalks are recommended for all segments currently lacking, a **priority sidewalk completion segment** is recommended to fill in the 130 foot gap between existing sidewalk segments just north of MD 175. Pedestrian demand is evident by the well-worn path.

» To increase the frequency of pedestrian controlled crossing, this report is carrying forward the planned capital improvement project by MDOT SHA to construct a **new traffic signal** with pedestrian signals, curb ramps, and marked crosswalks at US 1 and Kit Kat Road. This crossing will support the increased pedestrian activity during the Flea Market.

» It is recommended to provide a **sidewalk connection to four bus stops** along the corridor. This may include either a mainline sidewalk path parallel to US 1, or a perpendicular branch connection to the bus stops in areas where the existing sidewalk is set back from the curb.

» To improve access to bus stops, **relocating the existing bus stop** at Montevideo Road to the proposed signal at Port Capital where the bus stop will align with the proposed controlled crossing is recommended.

Map 12. Area 3 Recommendations: Assateague Drive to Brookdale Drive

Area 4 Recommendations:
Greenfield Road to Levering Avenue

- While sidewalks are recommended for all segments currently lacking, a **priority sidewalk completion segment** is recommended 1) between Rowanberry Drive and Old Washington Road (430 feet) to provide a connection to the library, 2) between Montgomery Road connecting to the existing sidewalk at Doctor Patel Drive (650 feet), and 3) for the 150 gap from the existing sidewalk north of Doctor Patel Drive to Bonnie View Lane. This completes the sidewalk network in key pedestrian generator land use areas including from residential areas to food or shopping destinations.
- The roadway segment between Montgomery Road and Bonnie View Lane (1,750 feet) does not have marked or controlled pedestrian crossing despite the pedestrian generating adjacent land uses of overnight lodging and food establishments. Field observations and crash reports showed pedestrian activity in this segment. The hazard of crossing the five lane roadway is compounded by the dark conditions at night due to limited ambient lighting from adjacent businesses and limited roadway lighting. A **pedestrian activated traffic signal and a marked crosswalk** is recommended at Doctor Patel Drive to provide for a controlled pedestrian crossing along this segment. To increase pedestrian visibility, additional **roadway lighting** is recommended between Montgomery Road and Doctor Patel Drive.
- To provide for a controlled pedestrian crossing in the small commercial segment in northern Elkridge, **upgrading the existing traffic signal** at US 1 and Levering Avenue with pedestrian infrastructure including ADA compliant curb ramps and marked crosswalks is recommended.
- To complete the pedestrian connection to the library, **upgrading the existing traffic signal** at US 1 and Rowanberry Drive with pedestrian infrastructure including pedestrian signals, ADA compliant curb ramps, and marked crosswalks is recommended.

Map Legend

Map 13. Area 4 Recommendations; Greenfield Road to Levering Avenue

Corridor Wide Recommendations

Implement a Context Sensitive Speed Limit

The posted speed limit along the US 1 study corridor ranges between 35 MPH and 50 MPH, with several locations where the speed limit quickly changes by up to 15 MPH between higher and lower speed limits. Some of the posted speeds, and resulting average travel speeds, are not compatible with a pedestrian oriented environment. Changes in speed limits require a more thorough traffic engineering study; therefore this study recommends a review of the speed limits with the aim of capping the speed limit to 45 MPH, implementing a lower speed limit in pedestrian designated areas, and reducing the magnitude of the change in posted speed limit along the corridor. Any impact to overall corridor travel times with these speed limit change recommendations is expected to be minimal.

In consideration of current usage and traffic flow characteristics of the US 1 study corridor from a broad perspective of traffic safety and traffic operations now and in the envisioned future, as a first recommendation a consistent maximum speed limit along the entire eleven miles is appropriate in light of the current safety and operational issues documented in this report. A consistent speed limit would be expected to reduce the operating speed of the vehicles traveling along US 1 and reduce the speed differentials between cars and trucks, which is particularly of concern in segments with warehouse/industrial land uses and numerous driveways and turning movements. About 30% of the corridor is currently posted at 45 MPH, which is our recommendation for the entire eleven miles, except for the end point transitions into the Laurel and Elkridge areas which should remain at lower speed limits. Providing a uniform speed limit will improve driver expectancy and awareness, and removing the leading number '5' from all speed limit signs will help reinforce the fact that US 1 should not be driven at the same speeds as freeways.

An additional benefit for reducing the posted speed limit to 45 MPH is that it would allow for the appropriate and regulated transition to lower speed limits in the designated areas such as Laurel and Elkridge. The Manual of Uniform Traffic Control Devices recommends a transitional difference not greater than ten miles per hour between adjacent speed zones.

Traffic Signal Phasing

It is recommended to consider the implementation of pedestrian friendly signal timing plans at select locations with pedestrian activity. Specifically, this may include instituting a leading pedestrian interval at the intersections of Laurel Road, Assateague Drive, Rowanberry Drive, and Levering Avenue.

Long Term Vision

While this report focuses on short-term safety retrofits for pedestrian and bicycle infrastructure, there is a need to consider the context of a longer-term corridor planning vision and potential roadway improvements. The County is set to initiate a land use and economic study of potential zoning and market demand along the US 1 corridor with supporting transportation footprint analysis and typical roadway cross-sections. This information is intended to become an amended part of the County's Comprehensive Plan and an updated Route 1 Manual in order to reflect the updated vision for short and long term pedestrian and bicycle accommodations. US 1 serves many functions - an arterial roadway, a local connector, and a bypass for interstate traffic - with diverse cross-sections and adjacent conditions that lead to an incomplete and inconsistent pedestrian and bicycle network. In addition, because properties are set back away from the main roadway with parking lots abutting the roadway, there is little sense of place or enclosure along the corridor. The land use along the corridor varies considerably including industrial, residential, convenience retail, auto services, motels, or other similar uses.

A longer-term need for the corridor is to provide continuous pedestrian and bicycle infrastructure for its entire length such as sidewalks and a shared use paths, improve accessibility to all bus stops and nearby rail stations, provide medians and protected turn lanes in key segments, provide more frequent and safer pedestrian crossings, and provide enhancements to the public realm at key gateways.

The short-term recommendations set forth in this report should serve as a foundation for identifying a complete street typical section with accessible and connected pedestrian and bicycle infrastructure, key activity areas, multimodal nodes with enhanced transit stop infrastructure and lighting, areas of focus for public realm enhancements, and to guide mixed-use and transit-oriented redevelopment and developer improvements in a manner consistent with the emerging long-term vision.

Recommended Concepts & Costs for Key Locations

Five of the recommendations were selected by the study and stakeholder team to develop preliminary design concept drawings. The concept drawings help illustrate the recommendations and enable the development of construction cost estimates to support capital programming and final engineering design efforts. The concept drawings and a description are included at the end of the report.

Raw planning-level construction cost estimates were developed based on MDOT SHA Construction Cost Estimating Guidelines. Unit costs for each improvement type and design element were developed for each of the five concept plans but do not include contingencies for right-of-way, utility impacts, environmental mitigation, or professional engineering design. Table 5 summarizes the planning level costs.

The five concepts are:

1. Road diet lane repurposing for a buffered bike lane from Prince George's County Line to Davis Avenue
2. Pedestrian activated signal at Brewers Court
3. Signal upgrade retrofit for pedestrian signals at Guilford Road and new sidewalk
4. Signal upgrade retrofit for pedestrian signals at Rowanberry Avenue and new sidewalk
5. Pedestrian activated signal at Doctor Patel Drive and new sidewalk

Concept		Pavement Markings - Bike Lane	Signage	Curb Ramps	New Traffic Signals	Retrofit Pedestrian Signals	Crosswalk Markings	Sidewalk	Leased Lighting Heads	Concept Total
Concept 1	Lane Repurposing for Bike Facility	$20,000	$10,000	$10,000	$230,000	$10,000	$5,000	-	-	**$285,000**
Concept 2	Pedestrian Activated Signal	-	$5,000	$20,000	$150,000	-	$5,000	-	-	**$180,000**
Concept 3	Signal Upgrade Retrofit for Pedestrian Signals	-	$2,500	$40,000	-	$25,000	$10,000	$100,000	-	**$177,500**
Concept 4	Signal Upgrade Retrofit for Pedestrian Signals	-	-	$15,000	-	$25,000	$10,000	$75,000	-	**$125,000**
Concept 5	Pedestrian Activated Signal	-	$5,000	$15,000	$150,000	-	-	$100,000	$30,000	**$300,000**
	Element Sum	$20,000	$22,500	$100,000	$530,000	$60,000	$30,000	$275,000	$30,000	-
									Sub-Total Costs	**$1,067,500**
									100 % Contingency for design fee, environmental mitigation, utilities, and right of way acquisition	**$1,067,500**
									Total Costs	**$2,135,000**

Table 5. Planning Level Cost Estimates for Concepts

Programming & Prioritization

Possible fundings sources are outlined in this section. Identifying funding sources will help facilitate turning the recommendations into projects. Funding sources include MDOT SHA funding programs and grants backed by state or federal sources.

MDOT SHA Funding Programs

- Fund 77 focuses on **resurfacing** projects
- Fund 85 focuses on **traffic control** projects
- Fund 74 focuses on improvements to **ADA standards** and general **sidewalk** projects
- Fund 76 focuses on **general safety** improvements, such as lighting
- Fund 87 focuses on **congestion** studies and projects

Table 6 correlates the recommendations to a possible state or county funding program.

Concept		Description	Location	Cost	Implementation Time Line	Funding Source
Concept 1	Lane Repurposing for Bike Facility	Repurpose outside travel lanes for a bufferred, one-way bike lane	Laurel: From City of Laurel/Howard County line to merge of US 1 north/ southbound flow	$285,000	1 to 2 years	Fund 77
Concept 2	Pedestrian Activated Signal	Install a pedestrian-activated signal with a marked crosswalk	Laurel: North of Brewer's Court	$180,000	1 year	Fund 85
Concept 3	Signal Upgrade Retrofit for Pedestrian Signals	Install pedestrian crossing infrastruture at the signalized intersection and install sidewalks along US 1 approaching the interserction	Jessup: At Guilford Road	$177,500	1 to 2 years	Fund 74 / Fund 76 or Safe Routes to School
Concept 4	Signal Upgrade Retrofit for Pedestrian Signals	Install pedestrian crossing infrastruture at the signalized intersection and install sidewalks along US 1 approaching the interserction	Elkridge: Hanover Road to Old Washington Boulevard	$125,5000	1 to 2 years	Fund 74 / Fund 85 or County fund CO285
Concept 5	Pedestrian Activated Signal	Install a pedestrian-activated signal with a marked crosswalk	Elkridge: Between Montgomery Road and Doctor Patel Drive	$300,000	1 year	Fund 74 or County fund CO285

Table 6. Concept Implementation Summary

Howard County Funding Sources

- CO285 focuses on pedestrian, bicycle, transportation, streetscape, and public green space improvements on public propperty in the US 1 corridor

Government Grant & Other Funding Sources

- Surface Transportation Block Grant program by US DOT Federal Highway Administration
- Maryland Department of Transportation Consolidated Transportation Program
- Transportation Alternatives Program
- Private funding (i.e. developer improvements)

Bicycle and Pedestrian Focused Funding Programs

New bicycle and pedestrian enhancements and infrastructure costs may require stand-alone projects and necessitate federal funds as detailed below, or a combination of the state programs, or be smaller parts of other routine maintenance projects.

Transportation Alternatives Program (TA)

The TA Program spends approximately $10 million annually, with applications due every spring. Implementing TA eligible projects and requires a local match of 20%.

Bicycle Retrofit Program

The Bicycle Retrofit Program's primary purpose is to upgrade existing facilities along state highways to promote connectivity to existing bicycle facilities. The program can also be used to retro-fit roadways where there is an established safety concern for bicycling. For this program, a "bicycle retrofit" means an on-road or off-road improvement to bicycle access. Funds can be utilized for bicycle route signage, replacement of drainage grates that are not bicycle-compatible, roadway restriping to accommodate bicycle lanes, shoulder rehabilitation, and off road pathway or trail connections where feasible.

Sidewalk Retrofit Program

Fund 79 Sidewalk Retrofit is a capital program fund administered by MDOT SHA. The program provides funding for construction of sidewalks along state highways and reconstruction of/replacement of existing sidewalks if it is a part of a revitalization effort in an officially designated urban revitalization area. For this program, a "retrofit sidewalk" means a sidewalk that is constructed along a state route (Maryland or U.S. routes other than an expressway). The reconstruction or replacement of sidewalks, for the purpose of repair or maintenance, is covered under this program only if it is an essential part of a revitalization effort in an officially designated revitalization area. Local government must acquire the necessary right-of-way and accept maintenance and legal liability. The projects must be justified by a demonstrated public safety concern. All improvements must be ADA compliant. Within a prirority area, the cost for retrofit shall be shared by a 75% and 25% distribution between MDOT SHA and the local government. Within designated revitalization areas, a local jurisdiction may request reimbursement for up to 100% of the cost to construct sidewalks.

ADA Compliance Program

Fund 33 ADA Retrofit is a Capital Program Fund administered by MDOT SHA. The program addresses existing non-compliant elements of the sidewalk system along state roadways not addressed under other programs. The goal is to provide accommodations for persons with disabilities through a commitment to remove barriers that impede free movement for all pedestrians along state roadways.

Community Enhancement Program

Fund 84 Community Safety and Enhancement (CSE) is a Capital Program Fund administered by MDOT SHA. The program provides funding for improvements where the emphasis is on enhancing the existing infrastructure to promote economic revitalization using means such as resurfacing, reconstructing drainage, curb and gutter, landscaping, signing, parking bays, and lighting. CSE program projects are initiated by a community contacting MDOT SHA requesting assistance addressing traffic issues concerning pedestrians, transit riders, bicyclists, and motorists. Projects are selected on technical criteria and ranked by technical need, but part of the eligibility criteria is in the hands of the community as well. The CSE program gives priority to roadway improvements on state highways located in Designated Neighborhoods within Priority Funding Areas, where the improvement will spur economic revelation, contribute to other revitalization activities, and, as the name implies, promote neighborhood conservation.

Safety and Spot Improvement Program

Fund 76 Safety and Spot Improvement Program addresses projects that improve safety and highway locations with geometric deficiencies. Fund 76 is one component of Maryland's Highway Safety Programs whose main objective is to reduce the number and severity of crashes in Maryland to the lowest attainable levels. Although the Safety and Spot Improvement Program has a relatively small budget compared to the entire Statewide Transportation Fund, the program is extremely cost-effective in terms of reducing injury and fatality involved crashes on Maryland's highways.

Conclusion

This study documented existing conditions along US 1 in Howard County for pedestrian and bicycle safety and accessibility. The comprehensive evaluation included extensive investigation of roadway geometric conditions, traffic characteristics, land use, and crash experience. A collaborative engagement of key stakeholders including Howard County Office of Transportation, Planning and Zoning, Public Works, Schools, Law Enforcement; MDOT SHA Office of Traffic & Safety, District 7, Office of Planning and Capital Programming; Regional Transportation Agency of Central Maryland; Baltimore Metropolitan Council; and, public input, bicycle and ADA advisory groups.

Prior to developing a toolbox of pedestrian and bicycle safety recommendations, a literature review and case studies of best practice for pedestrian focused roadway design and traffic operations were performed.

The study team identified four focus segments of the corridor to prioritize for short-term recommendations: Laurel (Prince George's County Line to Whiskey Bottom Road), Guilford Road to Patuxent Range Road, Jessup (Crestmount Road to Cemetery Lane), and Elkridge (Greenfield Road to Levering Avenue). Specific recommendations for new pedestrian and bicycle infrastructure including new sidewalks, signing upgrades, marked crosswalks, bus stop adjustments, traffic signal upgrades, new traffic signals, bike lanes, shared paths, and roadway lighting were identified. Concept plans and cost estimates were developed.

It is anticipated that the improvements identified in the four focus areas will provide targeted safety countermeasures to address specific pedestrian crash patterns experienced in the corridor, and will serve as a foundation for further roadway redesign and safety improvements in the corridor as development and land use along US 1 continues to evolve.

Suggested Next Steps

- Project development and programming with MDOT SHA District 7 including design requests for traffic control changes such as signal retrofits, pedestrian signals, and lighting, and submittals to the MDOT SHA Office of Traffic & Safety
- Follow up traffic engineering studies on roadway lighting and speed limit reduction
- Design plan development for new sidewalks and traffic signal upgrades
- Solicit final public comments
- Incorporate findings into US 1 Land Use Study
- Monitor future pedestrian and bicycle volumes and safety trends

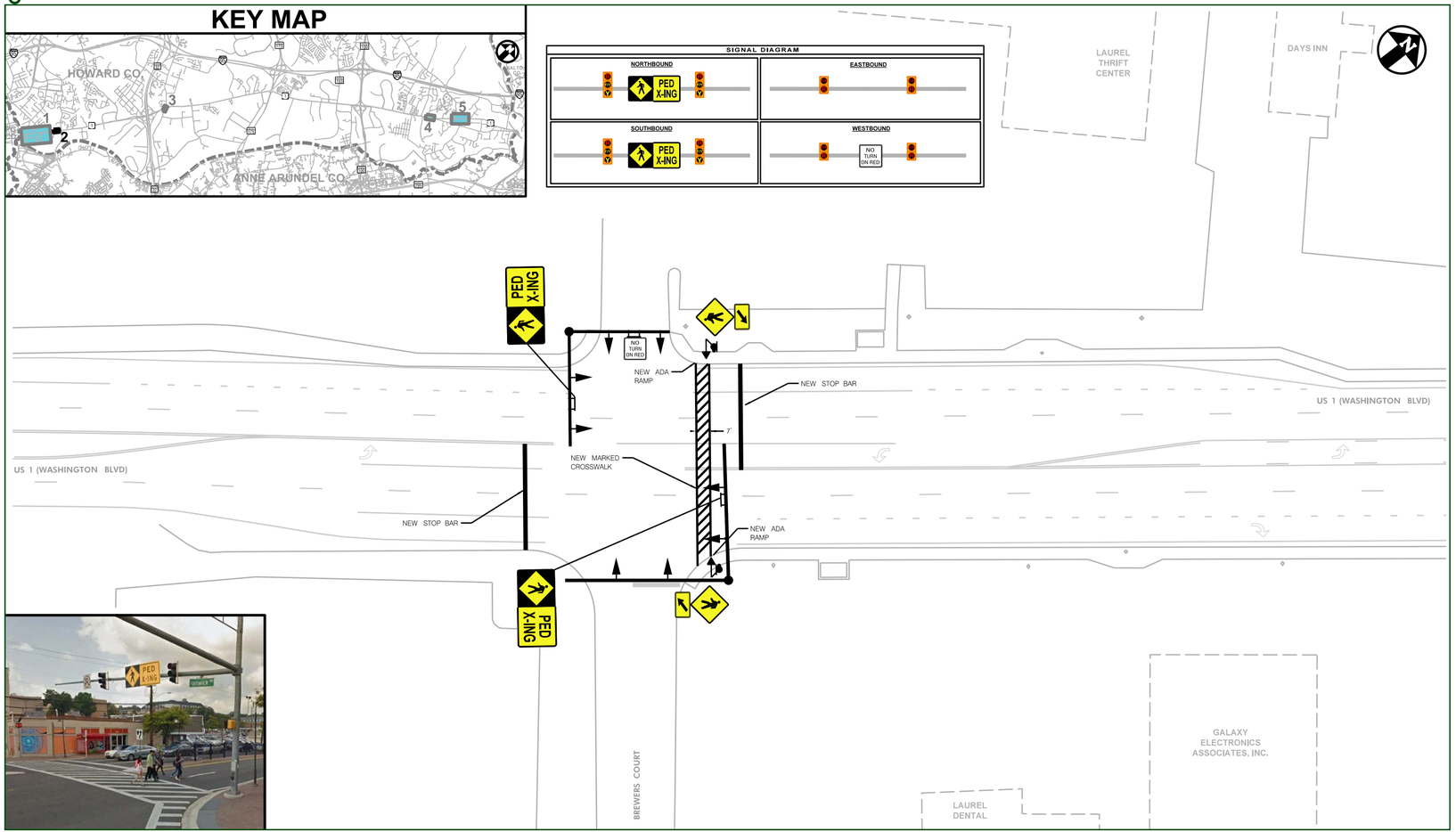
Concept 1 - Area 1

US 1 between the Prince George's County Line and Davis Avenue: Repurpose outside lanes to provide for buffered one-way bicycle facilities

In this concept, the outside travel lane in each direction is repurposed for a five foot one-way bike lane buffered by a five foot hatched area. The buffer is temporarily suspended in short segments where a right turn lane is needed such as in the northbound direction approaching Columbia Street at the entrance to the Laurel Racetrack . All existing access points are maintained. At the southern terminus, the bike facility will transition to the bike lane from the shoulder. At the northern terminus, the facility will end where the US 1 northbound and southbound roadways merge.

Although a detailed traffic operations analysis has not been conducted to assess the resulting impacts of repurposing a travel lane, an assessment of the average daily traffic, low traffic generating land uses, side street volumes, and 35 MPH speed limit in this segment significant traffic operations or safety impacts are not anticipated.

Concept 1. Lane Repurposing to provide for a bicycle facility



Concept 2. Pedestrian crossing north of Brewer's Court

Concept 2 - Area 1

Pedestrian-Activated Traffic Signal at Brewers Court

This concept includes a new pedestrian activated signal at Brewer's Court to provide a controlled crossing in a stretch where designated pedestrian crossings are infrequent but pedestrian generators are common. The design includes a diagonally hatched marked crosswalk along the north leg accompanied by pedestrian crossing warning signage. The traffic signals are located on overhead mast arms with pedestrian push buttons at each curb. In non-activated state, the mainline signal heads continuously flash yellow. Upon activation, the yellow ball transitions to a steady yellow followed by a steady red to stop mainline traffic as the pedestrians cross. The non-activated state for the side street signal heads is flashing red transitioning to a steady red upon activation.

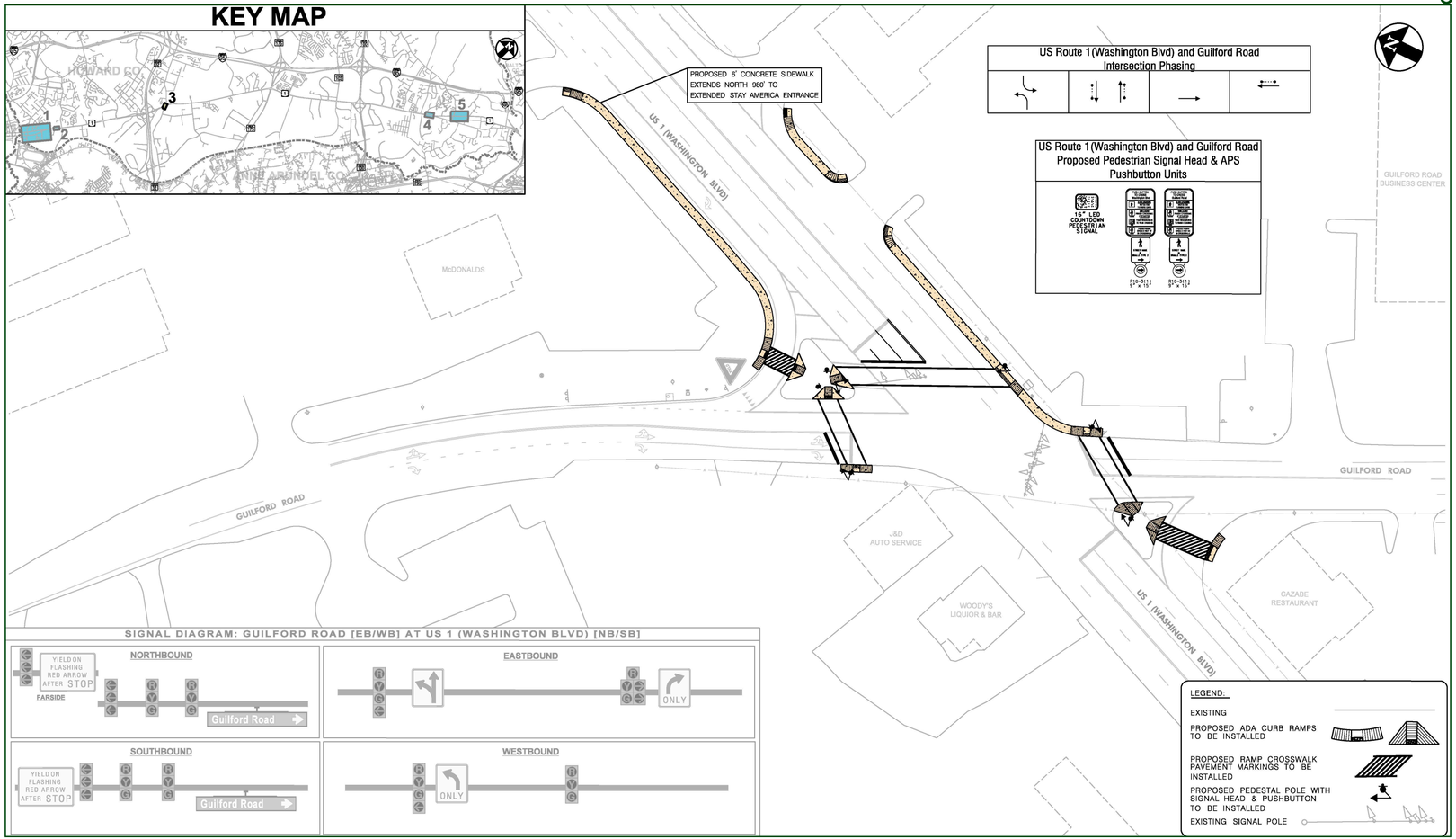
The design is focused on provided a legal, accessible, and safe crossing in an area with pedestrian activity but lacking in designated crossing facilities. The design warns drivers of a pedestrian presence through the signage, and stops traffic to provide a right-of-way for pedestrians.

The crossing will serve the adjacent commercial and retail uses which include the County's MultiService Center, a medical clinic, and thrift store as well as the adjacent RTA bus stops. The design of the crossing is consistent with pedestrian-activated traffic signals on state arterial roadways of similar geometry and traffic volumes.

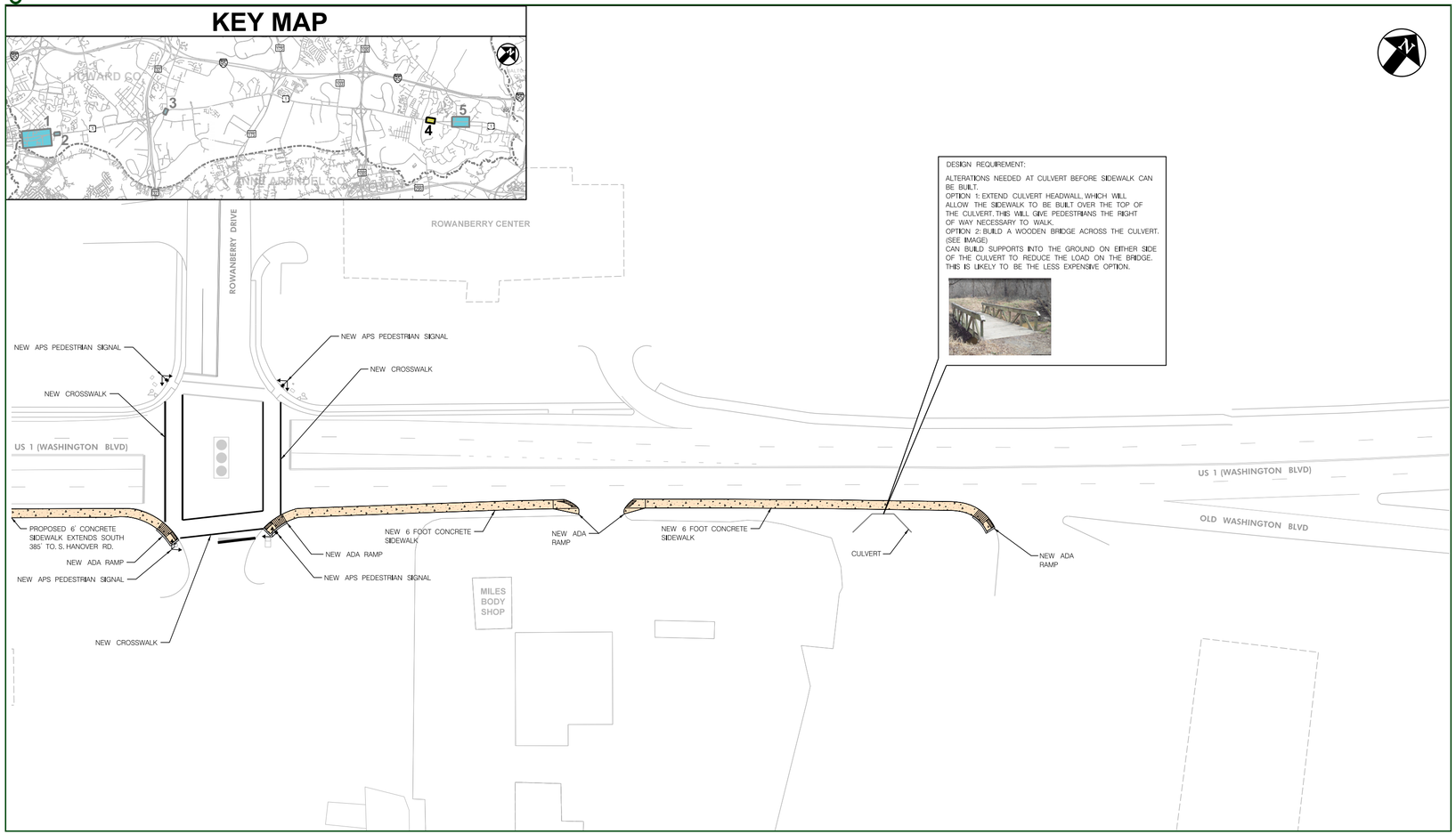
Concept 3 - Area 2

Pedestrian Improvements at Guilford Road

The signalized intersection of US 1 and Guilford Road currently lacks pedestrian facilities across any of its four legs. The recommended design includes installation of marked crosswalks across three legs, plus marked crosswalks over the right turn slip lanes; pedestrian countdown and audible signals across the marked three legs; standard pedestrian crossing signage; and new sidewalks along the block north of the Guilford Road. These improvements will bring the intersection up to MDOT SHA standards, support the observed pedestrian activity and demand to cross US 1 at this location, and connect with future planned sidewalks by the County along Guilford Road to the east of US 1.



Concept 3. Pedestrian improvements at the intersection of US 1 and Guilford Road



Concept 4. Pedestrian improvements at Rowanberry Drive

Concept 4 - Area 4

Pedestrian Improvements at Rowanberry Drive

The signalized intersection of US 1 and Rowanberry Drive currently lacks pedestrian facilities to aid in crossing US 1. In close proximity to a public library and to a residential neighborhood, this intersection is key in providing a connected pedestrian network. The proposed concept includes pedestrian countdown and audible signals across all legs currently lacking, marked crosswalks across all legs currently lacking, and the construction of sidewalks along the east side of US 1 extending north to Old Washington Boulevard.

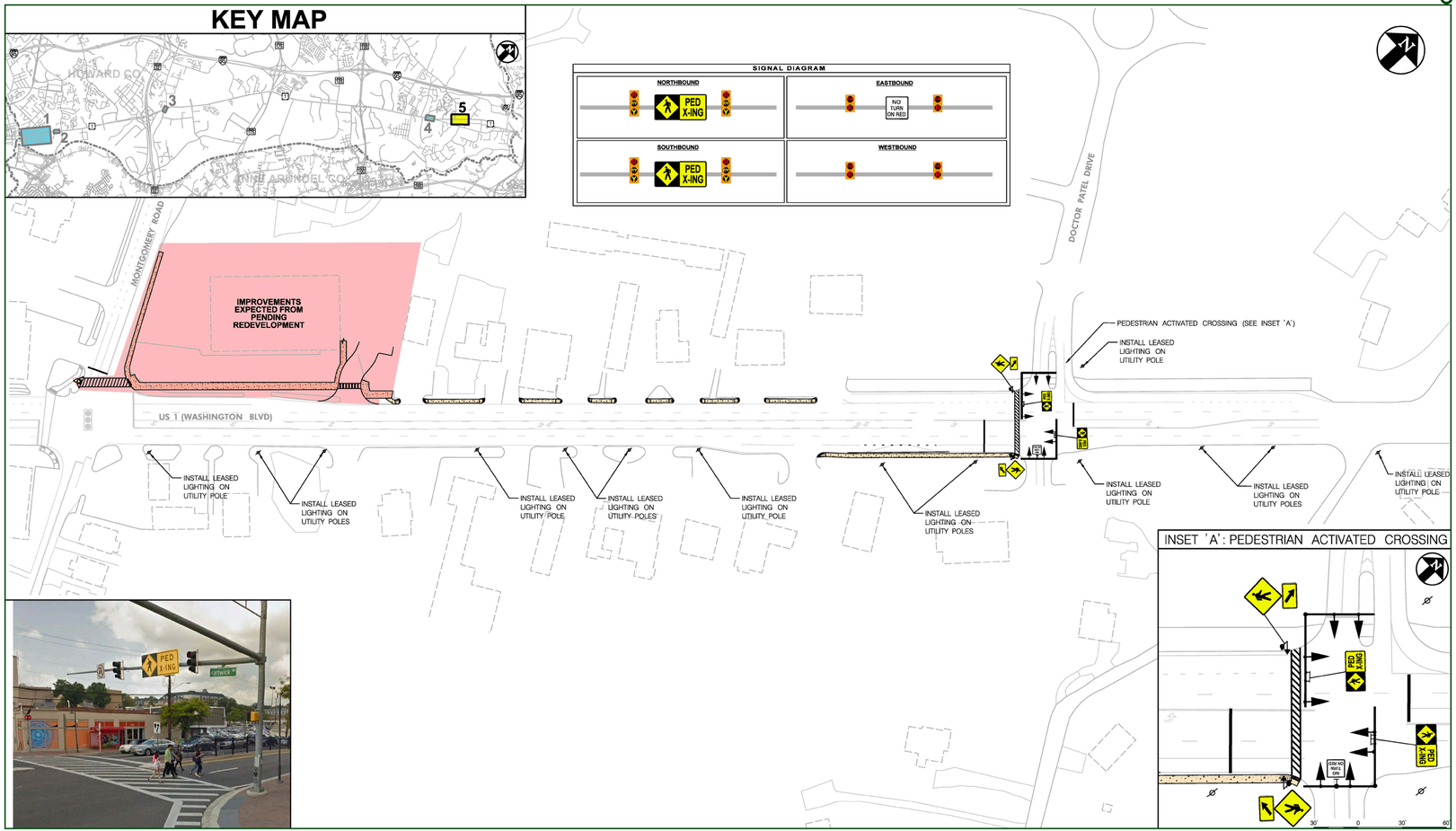
Concept 5 - Area 4

Pedestrian-Activated Signal at Doctor Patel Drive

This concept includes a new pedestrian activated signal at Doctor Patel Drive to provide a controlled crossing in a stretch where designated pedestrian crossings are infrequent but pedestrian generators are present. The design includes a diagonally hatched marked crosswalk along the south leg accompanied by pedestrian crossing warning signage. The traffic signals are located on overhead mast arms with pedestrian push buttons at each curb. In non-activated state, the mainline signal heads continuously flash yellow. Upon activation, the yellow ball transitions to a steady yellow followed by a steady red to stop mainline traffic as the pedestrians cross. The non-activated state for the side street signal head is flashing red transitioning to a steady red upon activation. Mainline stops bars are included in the design. The design of the crossing is consistent with pedestrian-activated traffic signals on state arterial roadways of similar geometry and traffic volumes.

The design is focused on provided a legal, accessible, and safe crossing in an area with pedestrian activity but lacking in designated crossing facilities. The design warns drivers of a pedestrian presence through the signage, and stops traffic to provide a right-of-way for pedestrians.

The adjacent land uses including food establishments, lodging facilities, and residential communities are observed to generate pedestrian crossings. Crash history shows the safety concern resulting from the lack of designated crossing facilities as numerous pedestrian related crashes occurred along this segment, specifically at night. Therefore, the concept also includes the installation of roadway lighting along existing utility poles (leased lighting) and new sidewalk connections on the west side of US 1 between Montgomery Road and the existing sidewalk south of Doctor Patel Drive.



Concept 5- Pedestrian crossings between Montgomery Road & Doctor Patel Drive

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