Montgomery Planning

PREDICTIVE SAFETY ANALYSIS FINAL REPORT

Draft for Planning Board Review (July 2022)

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EXECUTIVE SUMMARY

Between 2015 and 2019, there were over 59,000 crashes in Montgomery County, resulting in over 1,200 severe injuries and nearly 150 fatalities. There is an element of randomness to where these individual crashes occur, but there is much less randomness to the types of streets and intersections where these crashes occur. As part of Montgomery County's Vision Zero goal to eliminate traffic deaths and severe injuries by 2030, Montgomery Planning is using a new strategy to improve road safety for drivers, bicyclists and pedestrians called the Predictive Safety Analysis. This proactive data-driven approach works to prevent severe and fatal crashes before they happen.

The Predictive Safety Analysis estimates the expected number of crashes at a given roadway segment or intersection through Safety Performance Functions (SPFs). Safety Performance Functions (SPFs) are equations (or models) that predict the number of crashes on roadway segments and at intersections based on exposure, roadway characteristics, and other variables. This analysis then allows the county to prioritize where and how to most effectively invest in safety improvements through capital projects, development approvals, and master planning.

Key Findings

Through this analysis, a few key findings emerged:

- **Prioritization needs to look beyond crash history.** In the past, Montgomery County has sometimes taken a reactionary approach to transportation safety, implementing site-specific improvements in the aftermath of a fatal crash. The results of this analysis show that prioritizing safety treatments based solely on locations with a history of severe injury and fatal crashes could result in unmitigated crash risk. From 2015 to 2019, only 55% of fatalities and 46% of severe injuries occurred in top 200 locations identified in the Predictive Safety Analysis.
- **As a suburban county, much of Montgomery County's crash risk is in the suburbs.** The county's suburban areas and the high-speed, high-volume suburban Boulevards that run through them have the highest concentration of crash risk in the county for most crash types. To reach Vision Zero, safety improvements must address these locations.
- **Yet Downtowns and Town Centers have the highest average crash risk.** On a per-intersection or per-roadway segment basis, crash risk is highest in the county's urban areas, particularly for pedestrian and bicycle crash types. Systemic improvements on Downtown Boulevards and Town Center Boulevards – and more broadly in Downtown and Town Center areas – would yield the greatest benefits per location improved.
- **Safety improvements in Equity Emphasis Areas (EEAs) should be prioritized.** Across all metrics, crash risk is disproportionately concentrated in EEAs. More than half of the top 200 locations for pedestrian crash types are located within EEAs (even though only 16% of county intersections are in EEAs), and the average crash risk in EEAs far exceeds that for non-EEAs for five of the six crash types. Focusing investments in EEAs can mitigate this disparity and balance crash risk in the county.

Based on these findings, this report does not provide a prescriptive recommendation of capital improvements to address the areas and street types with high crash risk; it does not recommend which safety treatments should be implemented at which locations. Instead, the project provides a countermeasure evaluation tool for planners, engineers, and decisionmakers to assess different investment scenarios based on their goals and priorities. The tool can be used to determine which countermeasures to implement and how may locations to improve, and it evaluates the effectiveness of different countermeasures in several ways: potential crash reduction, potential crash reduction per location, cost per crash reduced, and percent of locations in Equity Emphasis Areas.

Each countermeasure is associated with a ranked list of locations for systemic implementation.

Applications

The Predictive Safety Analysis is the first step towards implementing a proactive approach to safety. It is now incumbent upon planners, engineers, and decisionmakers to apply the findings of this analysis. There are several uses of the results of the Predictive Safety Analysis:

- **Apply Data-Driven Planning:** The Predictive Safety Analysis provides the data, analysis, and tools to shift the county's approach and implement improvements where they are needed and more equitably. This data can combat the "squeaky wheel" by distributing resources equitably and to where they are most needed. In addition, the data can support funding requests, both as part of the local or state budgeting process as well as through grant applications.
- **Identify Locations with High Crash Risk:** The results can be used to identify location types that are likely to experience a high number of crashes. This data can be used to inform Capital Improvement Program (CIP) project prioritization, prioritization of off-site mitigation for new development, a focus for transportation improvements within master planning areas, and Mandatory Referral comments.
- **Prioritize Safety Improvements:** The tools allow implementing agencies to prioritize where to implement systemic safety treatments as well as to assess which safety treatments may be the most effective at reducing crashes. This information can make the case for additional funding for CIP level-of-effort programs, inform master plan recommendations, and support updates to the Growth and Infrastructure Policy.
- **Determine Locations with Similar Conditions:** The databases developed include hundreds of variables related to the transportation, land use, and demographic context in which the crash occurred. In the wake of future severe or fatal crashes, these data can help identify other locations similar to the crash location and inform a more systemic response to the incident.

The Planning Department, Montgomery County Department of Transportation, and the County Council can use this information in a variety of ways to inform future recommendations, priority projects, and funding allocations. Taking a more proactive, data-driven approach to transportation safety impacts all facets of the transportation planning process.

1. OVERVIEW

Between 2015 and 2019, there were over 59,000 crashes in Montgomery County, resulting in over 1,200 severe injuries and nearly 150 fatalities. There is an element of randomness to where these individual crashes occur, but there is much less randomness to the types of streets and intersections where these crashes occur. When a fatality or severe injury occurs at a particular location, decisionmakers and the public tend to galvanize around addressing the causes of that specific crash to ensure it will never happen again. Yet in largely taking a reactive approach that focuses on where crashes have occurred in the past, we are overlooking where crashes may happen in the future.

As part of Montgomery County's Vision Zero goal to eliminate traffic deaths and severe injuries by 2030, Montgomery Planning is using a new strategy to improve road safety for drivers, bicyclists and pedestrians called the Predictive Safety Analysis. This is a proactive data-driven approach that identifies future problem areas and works to prevent severe and fatal crashes before they happen.

The Predictive Safety Analysis estimates the expected number of crashes at a given roadway segment or intersection through Safety Performance Functions (SPFs). Safety Performance Functions (SPFs) are equations (or models) that predict the number of crashes on roadway segments and at intersections based on exposure, roadway characteristics, and other variables. This analysis then allows the county to prioritize where and how to most effectively invest in safety improvements through capital projects, development approvals, and master planning. This approach is more proactive than crash hotspot approaches and recognizes the uncertainty about where crashes and injuries will occur next.

The Predictive Safety Analysis uses the context and characteristics of locations that have a history of crashes to understand what may have contributed to these events. To inform this analysis, Montgomery Planning developed a formula that estimates the number of bicycle, pedestrian, and vehicle crashes for common crash types at intersections and roadway segments throughout the county. This formula looks at several variables, including land use context (urban, suburban, and rural), roadway characteristics (speed limits, traffic signals, and presence of sidewalks or bikeways, etc.), and the level of travel activity (the number of pedestrians, bicyclists, and motorists using a roadway or intersection). The Predictive Safety Analysis was completed with consultant support from the University of North Carolina Highway Safety Research Center and Safe Streets Research & Consulting, LLC and is generally based on the approach outlined in the National Highway Cooperative Research Program (NCHRP) Report 893: Systemic Pedestrian Safety Analysis.

Montgomery County is one of the first jurisdictions of its size and land use mix to undertake a predictive analysis with this level of rigor and detail. This marks a shift from a transportation safety approach that focuses on locations where high rates of severe injuries or fatalities have occurred to one that proactively identifies and treats locations with similar high-risk characteristics.

Report Organization

This report documents the process used to conduct the Predictive Safety Analysis. Each section summarizes a distinct step in the analysis, listed below:

- Compile Data
- Develop Volume Estimates
- Identify Key Crash Types
- Develop Safety Performance Functions
- Summarizing Crash Risk
- Pair Crash Types with Countermeasures

The report closes with a section (8. Applications) focused on how the results of the analysis can be used in future planning and engineering efforts throughout Montgomery County.

2. COMPILE DATA

The first step of the analysis was to create two databases: an intersection database and a roadway segment database. Crash data and context data – including transportation, land use, and demographic data – are assigned to each intersection and roadway segment.

Intersections and roadway segments represent the two "units of analysis" for the Predictive Safety Analysis. This means that the analysis evaluates crash trends associated with roadway segments and intersections, rather than some other unit or geography.

The databases include the entire county, with a few exceptions. The databases exclude interstates and their associated ramps, private streets, streets constructed during the study period (2015-2019), and streets along county borders (e.g., Eastern Avenue). Streets within municipalities are included.

Crash Data

The Predictive Safety Analysis includes crash data from 2015 to 2019, downloaded from the Montgomery County Vision Zero website. Montgomery Planning made a few edits to the crash data:

- **Revised Mode of Transportation:** The database identifies the modes of transportation (pedestrian, bicyclist, motorist) that were involved in the crash, but in some instances these data needed to be revised. The most common reason for revisions of these data was when the mode of transportation was stated as "unknown," but further investigation revealed the mode was pedestrian or bicyclist.
- **Revised Crash Location:** The geospatial crash data locates crashes at the X-Y coordinates provided in the crash database. However, this often represents where the crash report was filed by a police officer, rather than the location of the crash itself. Montgomery Planning created an automated approach to relocate crashes based on the description provided in the

crash database, specifically whether the crash was at an intersection or intersection-related, the name of the street and cross-street, and the distance and direction from the intersection defined through the street and cross-street.

Each crash is assigned to a roadway segment or an intersection, based on its location. During this process, some crashes were removed from the crash database. This generally occurred when a crash was located along an intersection or roadway segment removed or not included in the databases, such as crashes on interstates. Of the removed crashes, the vast majority are motor vehicle crashes; very few crashes including bicyclists and pedestrians were removed.

Context Data

TRANSPORTATION DATA

Transportation data describe the roadway network, accounting for street characteristics related to motor vehicles as well as transit service and bicycle and pedestrian infrastructure. Examples of included transportation data include:

- Speed limit
- Number of lanes
- Roadway slope
- Presence and type of crosswalk
- Presence and type of bicycle facility
- Roadway classification
- Presence of signals and stop signs
- Lighting
- Transit service

While the included transportation data are expansive, they are not comprehensive. Some characteristics of the transportation network were not included for one of two reasons:

1) **Countywide data are not available.** Without available data throughout the entire county, an attribute of the transportation environment cannot be analyzed. For example, there is not a countywide dataset for signalized intersections with protected left turn phases. Creating these datasets were beyond the scope of the analysis.
2) **The transportation characteristic occurs very infrequently**. The county has started to implement a wide range of bicycle and pedestrian treatments, such as pedestrian hybrid beacons, floating transit islands, and leading pedestrian intervals. While national research associates these treatments with safety improvements, there are too few instances of these treatments in the county to draw statistically valid conclusions. The analysis included over 16,000 intersections and 30,000 roadway segments in the county. Including variables only relevant to a few dozen locations were not expected to impact the results of the study.

Montgomery Planning worked with the cities of Rockville and Gaithersburg to acquire transportation data for roadways within the municipalities.

Incorporating Recent Projects

The analysis period runs from 2015-2019. During that time, many capital improvements were completed throughout the county, changing the transportation attributes of individual intersections and roadway segments. These transportation projects added a time element to the context database, including a "before" and "after" condition for some intersections and roadway segments where conditions changed during the study period. This allows for crashes to be associated with the intersection or roadway characteristics that existed at the time of the crash.

Montgomery Planning worked with the Montgomery County Department of Transportation (MCDOT) and Maryland Department of Transportation State Highway Administration (MDOT SHA) to inventory county and state-funded transportation projects. In addition, Montgomery Planning worked with Montgomery County Department of Permitting Services (DPS) to document changes to the transportation network completed as part of private development construction during the study period. The incorporated changes primarily focused on speed limit reductions and construction of sidewalks, crosswalks, and bicycle facilities.

LAND USE DATA

In addition to transportation data, land use variables are included in the databases. These variables generally capture the density of different land use types within different distances from the intersection or roadway segment (generally within one tenth, quarter, and half mile buffers). Examples of included data are listed below:

- Parks
- Hospitals
- Gas stations
- Parking lots
- Schools
- Government facilities
- Shopping centers
- Alcohol-serving locations
- Population density
- Employment density

DEMOGRAPHIC DATA

Lastly, context data include demographic information related to income, race and ethnicity, and an aggregate Equity Emphasis Areas variable. Equity Emphasis Areas, developed by the Metropolitan Washington Council of Governments (MWCOG), are a composite measure for Census tracts in the region with high concentrations of lower-income households and people of color.

Appendix A includes an inventory of all collected variables.

3. DEVELOP VOLUME ESTIMATES

While the first step of the Predictive Safety Analysis compiled crash data and context variables, one key set of variables was missing: exposure. Exposure represents the number of daily pedestrians, bicyclists, or motorists using a given intersection or roadway segment. These variables are important, as crash trends are often related to exposure; more walking, bicycling and driving often mean more crashes involving these modes. In addition, more driving is often associated with more bicycle or pedestrian crashes.

As these variables are not available countywide, a major task in the Predictive Safety Analysis was to create these variables by developing volume estimation models to capture the number of daily pedestrians, bicyclists, and motorists on each intersection and roadway segment countywide.

This task uses the existing pedestrian, bicyclist, and motor vehicle counts throughout the county to estimate the daily number of pedestrians, bicyclists, and motor vehicles at intersections and roadway segments where counts are not available. Between counts compiled by Montgomery Planning, MCDOT, and SHA, there are about 600 short-duration (between 2 hours and 7 days) counts on a range of different roadway types in different contexts throughout the county, including both intersection counts and counts on roadway segments. In 2020, Montgomery Planning contracted with Toole Design Group to evaluate if additional counts were needed to develop volume estimation models. Their assessment states: "While Montgomery County's count dataset is not perfectly representative, and [sic] it is sufficiently large and varied that exposure models could be successfully estimated. Expanding the available count dataset to fill gaps in location types such as unsignalized intersections on local roads in low density areas outside of Bicycle/Pedestrian Priority Areas will help to improve modeling efforts, but the lack of this data should not preclude Montgomery Planning from proceeding with their crash analysis, particularly in light of current disruptions to normal travel patterns." As a result of this evaluation, no additional counts were conducted. The full memo is included in Appendix B.

For the purposes of this analysis, all the counts are evaluated as roadway segment counts, meaning that the intersection turning movement data are translated to roadway segments counts.[1] This is simple for motor vehicle and bicycle counts, where the intersection data show where the motor vehicle starts and ends its movement. For example, a northbound right starts on the northbound roadway segment and ends on the roadway segment east of the intersection (the westbound segment), and vehicles or bicyclists making this movement would be counted on both roadway segments. In contrast, pedestrian counts are usually documented based on how many pedestrians use a given crossing. For the Predictive Safety Analysis, it is assumed that all pedestrians travel

[1] The results of the volume estimation models for roadway segments are later translated back to intersections by summing the volumes on each approach and then dividing by two, as each vehicle, pedestrian, or bicyclist traverses two roadway segments when passing through the intersection (entering the intersection on one roadway segment and departing the intersection on another roadway segment).

straight through the intersection. For example, a pedestrian walking eastbound on the south crosswalk would have walked on the westbound and eastbound intersection approaches. This is an imperfect assumption, but it is a reasonable course of action given the available data.

Developing the volume estimates included two primary steps: annualizing existing counts and developing volume estimation models.

Annualizing Existing Counts

Existing short-duration counts were originally conducted at a variety of different times – they represent different times of day, days of the week, months of the year, and different years (spanning 2015-2019). In order to use these data to estimate exposure at other locations, all of the counts must be translated to a consistent measure. For this analysis, that measure is average annual daily volume. This does not represent a specific day, but instead represents the average daily usage across the entire time period.

To annualize the counts, unique factors were developed to account for how travel differs based on the time of day, day of the week, etc. as well as for the roadway type (rural or urban, primarily used for commute or other travel). These factors were created based on locations with continuous count data, such as continuous bicycle and pedestrian counters along trails, as well as based on month and day-of-the-week factors provided by SHA. This approach is generally based on the Federal Highway Administration's Traffic Monitoring Guide[2] and American Association of State Highway and Transportation Officials' Guidelines for Traffic Data Programs.[3]

Developing Volume Estimation Models

Once the counts were annualized, they were used to develop volume estimation models. Essentially the 600 existing counts were used to estimate the daily volumes at locations without counts.[4] Each model was essentially a combination of context data that best estimated existing counts. Two models were developed for bicyclists, with distinct variables used to estimate bicycle volumes on roadway segments with and without separated bikeways (separated bike lanes or sidepaths).

Of the list of over 200 context variables, each was first evaluated using a Conditional Random Forest model, which determined if the individual context variables have a statistical relationship to the annualized count data. For each model, this generally limited the context variables to about 20% of the original variables. Those remaining variables were then used to create a model that best fits the count data. The models were then used to calculate an average annual daily volume for pedestrians,

[2] Federal Highway Administration. (2016). Traffic Monitoring Guide. Washington, D.C.: FHWA, U.S. Department of Transportation). https://www.fhwa.dot.gov/policyinformation/tmguide/

[3] AASHTO. (1992). Guidelines for Traffic Data Programs. Washington, D.C.: Joint Task Force on Traffic Monitoring Standards of the AASHTO Highway Subcommittee on Traffic Engineering.

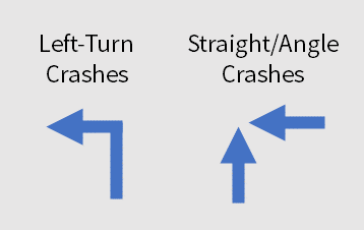
[4] This is referred to as a "direct demand model", as described in NCHRP 770: Estimating Bicycling and Walking for Planning and Project Development – A Guidebook.

bicyclists, and motorists for each roadway segment in the county. The volume estimation models are included in Appendix C.

4. IDENTIFY KEY CRASH TYPES

The Predictive Safety Analysis includes an analysis of specific crash types; it does not analyze all crashes countywide. Six crash types were selected to cover a large number of crashes, severe injuries, and fatalities but also be specific enough to point to specific safety treatments. The six crash types are described below:

- **Pedestrian crashes after dark at intersections** could also be considered "evening" or "nighttime" crashes. Given that sunset time varies throughout the course of the year, this crash type is defined based on the crash data's description of lighting conditions when the crash occurred.[5]
- **Pedestrian crashes on roadway segments with vehicles going straight** capture pedestrians crossing midblock and pedestrians walking along a roadway segment that are hit by a motor vehicle going straight.
- **Bicycle crashes at intersections** include all bicycle crashes at intersections.
- **Left-turn crashes at intersections (all modes)** represent crashes with left-turning vehicles that involve motorists as well as bicyclists and pedestrians.
- **Motor vehicle straight/angle crashes at intersections** are crashes that involve two (or more) vehicles traveling straight. Some examples of where these crashes can occur include when a motorist does not stop at a red light or does not yield to crossing vehicles at a stop-controlled intersection.



- **Single vehicle crashes along roadway segments** are crashes that only involved one vehicle (and do not involve a pedestrian or bicyclist). These can be run-off-the-road crashes, collisions with debris in the road, or collisions with animals.

Table 1 summarizes the selected crash types. Crash types involving motor vehicles include a higher number of crashes and people killed or severely injured (KSI), yet these crash types are less severe, with lower percentages of crashes resulting in a severe injury or fatality.

[5] This crash type includes pedestrian crashes at intersections where lighting is defined as "dark lights on," "dark no lights" or "dark – unknown lighting."

Table 1. Predictive Safety Analysis Crash Types (2015 - 2019)

Crash Type	# Crashes	# KSI	% KSI	% in EEAs
Pedestrian crashes after dark at intersections	496	86	17%	49%
Pedestrian crashes on roadway segments with vehicles going straight	418	103	25%	40%
Bicycle crashes at intersections	456	44	10%	25%
Left-turn crashes at intersections (all modes)	4,647	167	4%	34%
Motor vehicle straight/angle crashes at intersections	6,680	178	3%	31%
Single vehicle crashes along roadway segments	3,989	199	5%	16%

Equity was also a consideration in selecting crash types. Equity Emphasis Areas (EEAs) are a regional planning concept adopted by the Metropolitan Washington Council of Governments (MWCOG) to inform future growth and investment decisions. EEAs are Census tracts with high concentrations of low-income individuals and/or racial and ethnic minorities. EEAs comprise less than 20% of intersections and roadway segments, yet 32% of crashes and 29% of KSI occurred in Equity Emphasis Areas between 2015 and 2019. Three of the selected crash types exceed this average, with a higher percent of crashes occurring in Equity Emphasis Areas.

It should be noted that EEAs represent locations, not people. These are areas in Montgomery County with a high concentration of residents with specific demographics. Data are not available about the race or income of individuals involved in crashes.

There is overlap in the crashes included in some of the crash types. For example, a pedestrian intersection crash after dark may also be a crash involving a motor vehicle turning left. Accounting for this overlap, overall these crash types capture 31% of crashes and 49% of crashes resulting in a severe injury or fatality (KSI), but much higher shares of pedestrian and bicycle crashes and KSI (Table 2).

Table 2. Crash Types Summary (2015 - 2019)

Crash Type	% Crashes	% KSI
Pedestrian Crashes	63%	73%
Bicycle Crashes	74%	65%
Motor Vehicle Crashes	29%	41%
Overall Crashes	31%	49%

Appendix D provides a diagram of crash types by mode, including both those crash types selected for analysis as well as other crash types associated with each mode.

Relationship to Vision Zero

The crash types address crashes of all severities, rather than focusing on severe injuries and fatalities. This approach was taken to provide a large sample size of locations with crashes to inform the analysis. While Vision Zero focuses on eliminating severe injuries and fatalities, the approach taken in the Predictive Safety Analysis is consistent with Vision Zero for the following reasons:

- **Selected crash types have high injury rates.** Only 2% of crashes in Montgomery County result in a severe injury or fatality. All six of the selected crash types have higher injury rates

than the countywide average, and this is particularly pronounced for bicycle and pedestrian crash types (Table 1).

- **The severity of bicycle and pedestrian crashes is somewhat random.** Given the vulnerability of bicyclists and pedestrians, very minor changes in how a crash occurred – or who the crash victim was – can result in a dramatic difference in crash severity. As a result, using all severities is a reasonable approach for the bicycle and pedestrian crash types (three of the six crash types).
- **The county's High Injury Network provides similar coverage.** The draft High Injury Network using crash data from 2015 to 2019 accounts for 41% of severe injuries and fatalities, while the six crash types used in the Predictive Safety Analysis cover 49% of severe injuries and fatalities. Primary metrics for tracking implementation of Vision Zero in Montgomery County include the number of severe injuries and fatalities along the High Injury Network, as well as the percentage of High Injury Network streets with new traffic safety improvements.

5. DEVELOP SAFETY PERFORMANCE FUNCTIONS

This step used the context and characteristics of locations that have a history of crashes to understand what may have contributed to these events. This was accomplished through the development of Safety Performance Functions (SPFs), which are equations (or models) that predict the number of crashes on roadway segments and at intersections based on exposure, roadway characteristics, and other variables.

Developing SPFs

To develop SPFs for each of the six crash types, a list of over 200 context variables was first evaluated using a Conditional Random Forest model, which determines if the individual context variables have a statistical relationship to the crash data. For each model, this generally limited the context variables to about 20% of the original variables. Those remaining variables were then used to create a model that best fits the crash data for each crash type, and generally fit into five categories: exposure, roadway/infrastructure, land use, transit, and demographics.[6]

One crash type was modified during the Safety Performance Functions (SPFs) development process because the data for these crash types did not lead to an intuitive model that effectively explained the crash trends. **Motor vehicle straight/angle crashes at intersections** was revised to only include crashes at four-legged intersections (excluding three-legged and five-legged intersections).

[6] This approach was informed by NCHRP 893: Systemic Pedestrian Safety Analysis.

Crash Analysis Metrics

The Predictive Safety Analysis was developed based on observed crashes, but the outputs of the SPFs led to additional measures to understand how many crashes occurred or could occur at a given location. Overall, this project uses three different metrics to develop and review the crash analysis:

- **Observed Crashes** are the historical crashes that occurred at an intersection or along a roadway segment. These data can be used to identify high-crash locations. Observed crashes are the basis of most crash analysis, but they are biased by the random nature of crashes. Even though one intersection has no crashes, and another has one or two, the underlying crash risk at both may be the same. This can be overcome to some extent by studying longer time periods, but longer periods increase the potential for changes to roadways, population or other characteristics. Over reliance on observed crash data is a particular problem for bicycle crashes, which are relatively rare compared to other crash types.
- **Predicted Crashes** are the outcome of the SPFs and account for the location-specific characteristics quantified in the SFP equation. They are useful for identifying sites which may not currently have many observed crashes but have the potential to be high-crash sites based on the characteristics of the location. Predicted crashes are also used in estimating potential future crash reductions from countermeasures. Especially for SPFs with poor model fit, analysis or rankings based on predicted crashes alone may be misleading. Estimates can only be made at locations where all predictor variables are available.
- **Empirical-Bayes (EB) Crashes** weighs both observed and predicted crashes based on 1) how well the SPF predicts crashes and 2) the number of predicted crashes at the specific location. EB crashes can be considered the most reliable estimate of the underlying crash frequency at a given location based on all available information. Because the EB crashes combines observed and predicted crashes, it cannot be used to create estimates for the future. Throughout this report, the EB value is generally referred to as "crash risk."

Results

For each of the crash types, the SPFs are largely a function of exposure. Vehicle, pedestrian, or bicycle volumes are often positively correlated with the predicted number of crashes. In addition, transportation, land use, and demographic variables associated with more people, activity, and travel, are also often positively associated with crashes. For example, traffic signals are typically installed at intersections with high traffic volumes, and traffic signals are positively correlated with predicted crashes for some crash types. Similarly, population density and the number of bus routes through a community indicate a large number of residents and travelers, and these variables are generally both associated with more predicted crashes. **While these correlations exist, this is not to say that the county should avoid installing traffic signals, eliminate transit service, or discourage dense development.** These equations are intended to point us to where improvements

are most needed. Strategies to improve safety are identified in a subsequent section (7. Pair Crash Types with Countermeasures) and are based on national research on crash reduction.

For some crash types, demographic variables related to race, income, and age are statistically related to the number of predicted crashes. These findings do not indicate that people of a certain age walk less safely than other age groups, or that drivers from a certain racial background are safer drivers than drivers of another background. The significance of these variables is likely associated with a transportation or built environment factor not captured in the analysis. While the SPFs help explain the factors associated with crashes, they are not a perfect predictor of crash risk.

In the following sections, each crash type is summarized through a table, listing each of the statistically significant variables and their direction of correlation with predicted crashes. A plus sign indicates a positive correlation, demonstrating that as that variable is present or increases, so does the number of predicted crashes (e.g., more vehicle travel is associated with more predicted crashes). A minus sign indicates a negative correlation, indicating that as the variable is present or increases, the number of predicted crashes decreases (e.g., roadway segments that are dead ends are associated with fewer crashes than through streets).

Some variables are noted with two plus signs or two minus signs. These variables are some of the strongest indicators of the predicted crashes; changing one of these variables has a large impact on the number of predicted crashes. Each of these key variables are summarized following the table of variables.

Appendix E includes the SPF equations for each crash type.

PEDESTRIAN CRASHES AFTER DARK AT INTERSECTIONS

Table 3. Variables Associated with Pedestrian Crashes after Dark at Intersections

Statistically Significant Variables		Relationship to Crashes
Exposure	Pedestrian traffic	++
	Motor vehicle traffic	++
Transportation	Number of intersection legs	++
	Maximum number of through lanes	++
	Speed limit	+
	Number of marked crosswalks	++
	Presence of a traffic signal	++
	Transportation points of interest (e.g., transit, bikeshare)	+
	Bus routes	+
	Metro stations	+
Demographics	Population density	+
	Household income	-

Key variables:

- **Pedestrian traffic:** increasing daily pedestrian volumes from 10 to 100 pedestrians increases predicted crashes by 190%. Increasing daily pedestrian volumes from 100 to 1,000 pedestrians further increases predicted crashes by 110%.
- **Motor vehicle traffic:** increasing motor vehicle volumes from low (0-5,000 daily vehicles) to medium (5,001-10,000 daily vehicles) increases predicted crashes by 350%. Increasing from medium to high (greater than 10,000 daily vehicles) increases predicted crashes by only 5%.
- **Number of intersection legs:** increasing the number of legs at the intersection from three to four legs or from four to five legs is associated with an approximately 60% increase in crashes.
- **Maximum number of through lanes:** increasing from two to four lanes or from four to six lanes is associated with increasing predicted crashes by about 40%.
- **Number of marked crosswalks:** increasing from zero to two or from two to four marked crosswalks is associated with an increase in predicted crashes of approximately 50%.
- **Presence of a traffic signal:** intersections with traffic signals have nearly triple the number of predicted crashes as unsignalized intersections.

PEDESTRIAN CRASHES ON ROADAWY SEGMENTS WITH VEHICLES GOING STRAIGHT

Table 4. Variables Associated with Pedestrian Crashes on Roadway Segments with Vehicles Going Straight

Statistically Significant Variables		Relationship to Crashes
Exposure	Pedestrian traffic	+
	Motor vehicle traffic	++
Transportation	Block length	++
	Dead end	--
	Street class (state road, major road)	++
	Parking lots	+
	Number of marked crosswalks	+
	Bus routes	+
Land Use	Alcohol establishments	+
	Recreational points of interest	-
	Business points of interest	-
Demographics	Household Income	--

Key variables:

- **Motor vehicle traffic:** increasing motor vehicle volumes from low (0-5,000 daily vehicles) to medium (5,001-10,000 daily vehicles) or from medium to high (greater than 10,000 daily vehicles) increases predicted crashes by 100%.

- **Block length:** increasing block length from 0.1 miles to 0.5 miles increases predicted crashes by 36%, and increasing block length from 0.5 miles to 1.0 miles increases predicted crashes by 47%.
- **Dead end:** the number of predicted crashes is 75% lower on dead end streets than streets that are not a dead end.
- **Street classification:** the number of predicted crashes is 140% higher on state roads and arterials than local, residential streets.
- **Household income:** Increasing the portion of households making greater than $100,000 within a quarter mile of the intersection from the median (64%) to 80% results in a 40% reduction in crashes.

BICYCLE CRASHES AT INTERSECTIONS

Table 5. Variables Associated with Bicycle Crashes at Intersections

Statistically Significant Variables		Relationship to Crashes
Exposure	Bicycle traffic	++
	Motor vehicle traffic	++
Transportation	Number of legs	++
	Number of legs with a median	++
	Number of marked crosswalks	++
	Presence of a stop sign	+
	Presence of a traffic signal	++
	Proximity to a sidepath	+
	Proximity to a bike lane	-
	Bus Stops	+
Land Use	Proximity to parks	+
Demographics	Concentration of Latino residents	+

Key variables:

- **Bicycle traffic:** increasing daily bicycle volumes from 10 to 100 bicyclists increases predicted crashes by approximately 90%. Increasing daily bicycle volumes from 100 to 500 bicyclists increases predicted crashes by 58%.
- **Motor vehicle traffic:** increasing motor vehicle traffic between different volume categories has varying impacts depending on the categories. The greatest impact on predicted crashes is between streets with < 2,000 daily vehicles and 4,000 and 9,999 daily vehicles (an increase in predicted crashes of 680%).

AADT Category 1	AADT Category 2	Change in Predicted Crashes
< 2,000	4,000 to 9,999	680% more crashes
4,000 to 9,999	10,000 to 19,999	40% more crashes
10,000 to 19,999	>= 20,000	10% more crashes

Note: AADT 2,000-3,999 was not statistically significant.

- **Number of intersection legs:** increasing the number of legs at the intersection from three to four legs or from four to five legs is associated with an approximately 45% increase in crashes.
- **Number of legs with a median:** intersections with a median on two legs have 60% more crashes than intersections with a median on zero or one leg. Intersections with a median on three legs have 36% more predicted crashes than intersections with a median on two legs.
- **Number of marked crosswalks:** increasing from zero to two or from two to four marked crosswalks is associated with an increase in predicted crashes of approximately 40%.
- **Presence of a traffic signal:** intersections with traffic signals have nearly triple the number of predicted crashes as unsignalized intersections.

LEFT-TURN CRASHES AT INTERSECTIONS (ALL MODES)

Table 6. Variables Associated with Left-Turn Crashes at Intersections (All Modes)

Statistically Significant Variables		Relationship to Crashes
Exposure	Motor vehicle traffic	++
	Pedestrian traffic	-
Transportation	Number of legs	++
	Number of lanes	++/- (non-linear)
	Speed limit	+
	Street classification	++
	Presence of a traffic signal	++
	Number of high-visibility crosswalks	+
	Presence of a bikeway	+
	Parking lots	+
	Bus stops	+
Land Use	Rural context (relative to suburban and urban)	++
Demographics	Household income	--

Key variables:

- **Motor vehicle volumes:** increasing motor vehicle traffic between different volume categories has varying impacts depending on the categories. The greatest impact on predicted crashes is between streets with 2,000-3,999 daily vehicles and 4,000 and 9,999 daily vehicles (an increase in predicted crashes of 320%).

AADT Category 1	AADT Category 2	Change in Predicted Crashes
< 2,000	2,000 to 3,999	100% more crashes
2,000 to 3,999	4,000 to 9,999	320% more crashes
4,000 to 9,999	10,000 to 19,999	70% more crashes
10,000 to 19,999	>= 20,000	25% more crashes

- **Number of intersection legs:** increasing the number of legs at the intersection from three to four legs or from four to five legs is associated with an approximately 70% increase in crashes.
- **Number of lanes:** intersections where all legs have three or four lanes have 150% more predicted crashes where all legs have two lanes. Intersections where any leg has more than four lanes has 30% fewer crashes than intersections where all legs have three or four lanes.
- **Street classification:** intersections including at least one state road have twice as many predicted crashes as intersections only including county roads.
- **Presence of a traffic signal:** intersections with traffic signals have the number four times as many predicted crashes as unsignalized intersections.
- **Land use:** predicted crashes in urban and suburban areas are 50% and 35% lower, respectively, than in country areas.

MOTOR VEHICLE STRAIGHT/ANGLE CRASHES AT FOUR-LEGGED INTERSECTIONS

Table 7. Variables Associated with Straight/Angle Crashes at Four-Legged Intersections

Statistically Significant Variables		Relationship to Crashes
Exposure	Motor vehicle traffic	++
Transportation	State roads	++
	Speed limit	++
	Number of marked crosswalks	++
	Bus routes	+
	Metro stations	+
Land Use	Located within a municipality	-
	Recreational points of interest	-
Demographics	Located within an Equity Emphasis Area	++
	Household income	-

Key variables:

- **Motor vehicle traffic:** increasing motor vehicle volumes from 5,000 daily vehicles to 10,000 daily vehicles or from 10,000 to 20,000 increases predicted crashes by 46%.
- **State roads:** crash risk is 225% higher on state roads relative to county roads.
- **Speed limit:** increasing the speed limit by 5 miles per hour increases crash risk by 15%, and increasing the speed limit by 10 miles per hour increases crash risk by 32%.
- **Number of marked crosswalks:** increasing from zero to two or from two to four marked crosswalks is associated with an increase in predicted crashes of approximately 45%.
- **Located within an Equity Emphasis Area:** intersections within an Equity Emphasis Area (EEA) have 31% more predicted crashes than intersections not within an EEA.

SINGLE VEHICLE CRASHES ALONG ROADWAY SEGMENTS

Table 8. Variables Associated with Single Vehicle Crashes along Roadway Segments

Statistically Significant Variables		Relationship to Crashes
Exposure	Motor vehicle traffic	++
	Pedestrian traffic	--
Transportation	Roadway segment length	+
	Street classification	+
	Presence of a traffic signal at adjacent intersection	++
	Maximum street slope	+
	Dead end	-
	Street light density	+
	Driveway density	-
	Bus stops	+
Land Use	Population density	-
	Proximity to parks	+
	Business points of interest	-
Demographics	Concentration of African American residents	+
	Household income	-
	Concentration of youth (< 18 years)	-
	Concentration of seniors (> 65 years)	-

Key variables:

- **Motor vehicle traffic:** increasing daily vehicles from 1,500 to 3,000 daily vehicles increases predicted crashes by 200%, while increasing from 3,000 to 12,000 daily vehicles increases predicted crashes by 40% and increasing from 12,000 to 24,000 daily vehicles results in a 1% reduction in predicted crashes.
- **Pedestrian traffic:** increasing pedestrian traffic from 10 to 100 daily pedestrians and from 100 to 1,000 daily pedestrians decreases predicted crashes by 21%.
- **Presence of a traffic signal at adjacent intersection:** when one traffic signal is located adjacent to the roadway segment, predicted crashes increase by 30% relative to no traffic signal. When there is a traffic signal at both ends of a roadway segment (two signals), predicted crashes increase by 30% relative to one traffic signal.

6. SUMMARIZING CRASH RISK

In this section, crash risk is evaluated in three ways to better understand the implications for land use planning, street classification and equity using the Empirical Bayes crash assessment:

- **Total Crash Risk** looks at how crash risk is distributed by summing the crash risk for each crash type. This assessment determines which areas have the greatest overall crash risk. In the tables summarizing total crash risk, each cell represents the number of annual crashes for that crash type and location type.
- **Hot Spot Analysis** looks at the locations with the highest crash risk, generally the top 200 intersections or roadway segments for a given crash type.[7] This analysis determines the specific locations with the greatest safety challenges and can inform stand-alone capital projects. Given the extent of the crash risk at these locations, improving safety may require high-cost treatments. In the tables summarizing the hot spot analysis, each cell represents the number of locations within the top 200 that fall within the noted crash type and location type.
- **Average Crash Risk** applies a broader lens to understanding crash risk by dividing the number of crashes by the number of locations for each crash type. This analysis determines type of locations with the greatest safety challenges and can inform systemic improvements. In the tables summarizing average crash risk, each cell represents the average crashes per location for each crash type and location type.[8]

[7] Two hundred intersections represent 1.2% of all intersections and 200 roadway segments represents 0.6% of all roadway segments.

[8] While the average crash risk is the total crash risk divided by the number of locations within a given context, the values in the table summarizing crash risk (Tables 11, 14, and 17) do not always equal the noted total crash risk (Tables 9, 12, and 15) divided by the noted number of locations. In a small number of locations, missing data meant that a predicted crash value could be calculated, and these locations were excluded from the average calculation.

No one approach to understanding crash risk provides a complete picture of transportation safety – each of the three measures are needed to comprehensively understand crash risk in Montgomery County.

Appendix F includes the top 50 locations for each crash type, and Appendix G includes additional tables showing the total crash risk, hot spot analysis, and average crash risk for additional context characteristics, including land use, number of lanes, and signalization.

Crash Risk by Area Type

The Complete Streets Design Guide (CSDG) identifies five land use contexts within unincorporated Montgomery County:

- **Downtowns** are envisioned as Montgomery County's highest intensity areas including central business districts and urban centers. They are envisioned to have dense, transit-oriented development and a walkable street grid (existing or planned).
- **Town Centers** are similar to Downtowns but generally feature less intense development and cover a smaller geographic area. While the Town Center area type includes a mixture of uses, it is commonly envisioned as high-to-moderate intensity residential development, including multifamily buildings and townhouses, and retail (existing or planned).
- **Suburban** areas are envisioned as low-to-moderate intensity residential development.
- **Industrial** areas are unique areas where employment and industrial uses are the primary activities. These areas often have higher densities of development but maintain lower to moderate levels of bicycle and pedestrian activity. Given how few industrial areas there are in Montgomery County, these are grouped with suburban areas for the analysis.
- **Country** areas comprise the least dense portions of the county, with land uses of low intensity residential and agriculture.

Montgomery Planning does not have planning authority over seven jurisdictions in Montgomery County, including Rockville, Gaithersburg, Laytonsville, Brookville, Poolesville, Washington Grove, and Barnesville. For this analysis, these jurisdictions are grouped together and defined as **Other** areas.

Table 9, Table 10, and Table 11 summarize the crash risk by CSDG area type. Given that the majority of the county is suburban in nature, the highest areas for total crash risk occur in the county's Suburban communities, as shown in Table 9.

Table 9. Total Crash Risk by CSDG Area Type (Annual Crashes)

CSDG Area Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
Downtown	372	32	12	87	87	786	13	42
Town Center	810	20	11	132	132	1,722	17	83
Suburban**	12,187	37	49	340	474	22,602	39	430
Country	1,027	0	2	22	20	1,898	3	155
Other***	2,297	17	14	154	119	4,067	12	77

Highlighted cells have the highest value for any column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

** Suburban includes Industrial areas.

*** Other includes municipalities with independent planning authority.

The findings indicate that the top 200 intersections and segments with the greatest crash risk also tend to be in Suburban areas, with two exceptions. As shown in Table 10, eighty-eight of the top 200 intersections for pedestrian crashes after dark occurred in Downtowns. And 75 of the top 200 segments for pedestrian crashes along segments occurred in Town Centers.

Table 10. Hot Spot Analysis by CSDG Area Type (# of Top 200 Intersections and Segments)

CSDG Area Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
Downtown	372	88	47	22	27	786	53	3
Town Center	810	45	36	42	43	1,722	75	20
Suburban**	12,187	40	87	87	97	22,602	34	95
Country	1,027	0	0	1	4	1,898	1	67
Other***	2,297	27	30	48	29	4,067	37	15

Highlighted cells have the highest value for any column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

** Suburban includes Industrial areas.

*** Other includes municipalities with independent planning authority.

Average crash risk is highest in downtowns for four crash types (pedestrian crashes after dark, bicycle crashes at intersections, left-turn crashes, and pedestrian crashes along segments), in Town Centers for four-legged intersection angle crashes, and Country areas have the highest average crash risk for single-vehicle crashes. Given the vast number of residential intersections and segments in Suburban areas, it is not surprising that Suburban areas have the lowest average crash risk.

Table 11. Average Crash Risk by CSDG Area Type (Annual Crashes per Location)

CSDG Area Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
Downtown	372	0.09	0.03	0.24	0.73	786	0.02	0.06
Town Center	810	0.03	0.01	0.18	0.75	1,722	0.01	0.05
Suburban**	12,187	0.00	0.00	0.03	0.17	22,602	0.00	0.02
Country	1,027	0.00	0.00	0.02	0.16	1,898	0.00	0.08
Other***	2,297	0.01	0.01	0.07	0.23	4,067	0.00	0.02

Highlighted cells have the highest value for any column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

** Suburban includes Industrial areas.

*** Other includes municipalities with independent planning authority.

Crash Risk by Street Type

In addition to defining area types, the CSDG defines street types for different roadway classes throughout the county. They are listed below, in order of intensity (higher speeds, lanes, and vehicle volumes towards the top):

- **Major Highways** are limited/controlled access roads that are primarily designed for vehicle safety and mobility. Transit and heavy vehicles are common and pedestrian and bicycle activity is often low (and in some cases, not permitted).
- **Boulevards** are critical roadways that typically connect employment and entertainment centers, civic, commercial, and institutional land uses and may also provide cross-county and regional connections. Some buildings are positioned close to the street, while others are set back. These streets are currently dominated by motor vehicle traffic.
- **Downtown Boulevards** are Montgomery County's highest intensity streets – with a bustling mix of vehicle traffic, dense development, walking, bicycling, and transit. Downtown Boulevards are located in central business districts and urban centers.
- **Town Center Boulevards** are located in smaller activity centers. Whereas Downtown Boulevards are compact places with continuous building frontages along the street, Town Center Boulevards are more likely to have some buildings close and others set back from the street behind lawns or planted areas.
- **Downtown Streets** are also found in bustling, mixed-use and commercial areas; however, the building heights tend to be lower than on Downtown Boulevards. Downtown Streets are often the side streets in busy commercial areas that connect to Downtown Boulevards.
- **Town Center Streets** are located in areas that have or are planned to have small- and medium-sized businesses, restaurants, civic buildings, or residences. These streets have significant pedestrian and bicycle activity and typically offer on-street parallel parking.

- **Neighborhood Connectors** are residential through streets. While the land uses are predominately medium- or low-intensity residential development, some businesses may be present.
- **Country Connectors** provide important connections through low-density rural areas of Montgomery County. They are surrounded by very low-scale development set back from the road, or undeveloped/agricultural areas.
- **Country Roads** occur in low-density areas of the county. Compared to Country Connectors, Country Roads feature more development activity (most often large lot single-family residential), more frequent driveways, and lower vehicle speeds.
- **Industrial Streets** serve industrial corridors and are built to accommodate commercial trucks in addition to passenger vehicles, bicyclists, and pedestrians. While there may be fewer pedestrians and bicyclists in these locations, these streets may also serve as destinations for maker space, retail, or other public-serving uses that may attract foot or bicycle traffic.
- **Neighborhood Streets** serve predominantly residential areas with low volumes of motor vehicle traffic. Pedestrian and bicycle activity are common along these streets.
- **Rustic Roads and Exceptionally Rustic Roads** are historic and scenic roads that reflect the agricultural character and rural origins of the county. If a road is designated as a Rustic Road or Exceptional Rustic Road, certain physical features of the road must be retained, and special right-of-way maintenance procedures may apply to keep speeds low and retain road safety.

Table 12, Table 13, and Table 14 summarize crash risk by CSDG street type. Where intersections include more than one street type (e.g., the intersection of a Downtown Boulevard and a Downtown Street), the intersection is designated based on the higher-intensity street type. Streets in municipalities with independent planning authority are excluded from this analysis.

While most locations are Neighborhood Streets (63% of intersections and 79% of segments), the four intersection crash types have the greatest amount of crash risk along Boulevards. This is not surprising given the low-speed and low-volume nature of Neighborhood Streets. Neighborhood Streets do have the highest total crash risk for analyzed segment crash types.

Table 12. Total Crash Risk by CSDG Street Type (Annual Crashes)

CSDG Street Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
Major Highway	18	1	1	11	13	12	0	13
Boulevard	1,191	29	33	334	359	1,145	15	145
Downtown Blvd	134	20	6	57	58	161	7	14
Town Center Blvd	225	13	6	70	89	272	9	26
Downtown Street	210	13	4	26	26	339	5	10
Town Center Street	138	1	1	11	12	186	2	8
Neighborhood Conn	2,825	8	14	64	132	2,956	9	100
Country Conn	280	0	1	14	13	213	1	47
Country Road	90	0	0	1	1	60	0	4
Industrial Street	50	0	0	5	1	58	0	2
Neighborhood Street	9,132	9	6	21	55	21,357	23	311
Rustic Road**	183	0	0	2	4	317	1	36

Highlighted cells have the highest value for any column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

** Includes Exceptionally Rustic Roads

For intersection crashes, the trends from total crash risk hold for the hot spot analysis; all four intersection crash types have the highest number of top 200 locations along Boulevards. For segment crash types, the most pedestrian segment hot spots are along Town Center Boulevards, while single vehicle crashes have the most hot spots along Neighborhood Streets.

Table 13. Hot Spot Analysis by CSDG Street Type (# of Top 200 Intersections and Segments)

CSDG Street Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
Major Highway	18	1	0	2	5	12	2	7
Boulevard	1,191	50	109	109	104	1,145	35	37
Downtown Blvd	134	48	29	18	16	161	32	0
Town Center Blvd	225	35	21	22	25	272	51	3
Downtown Street	210	40	8	3	5	339	18	0
Town Center Street	138	0	0	2	3	186	5	1
Neighborhood Conn	2,825	2	7	5	17	2,956	5	3
Country Conn	280	0	0	2	2	213	0	23
Country Road	90	0	0	0	0	60	0	0
Industrial Street	50	0	0	2	0	58	0	0
Neighborhood Street	9,132	1	6	1	1	21,357	16	101
Rustic Road**	183	0	0	2	0	317	0	10

Highlighted cells have the highest value for any column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

** Includes Exceptionally Rustic Roads

Note: Location totals are less than 200 because intersections and segments within municipalities within independent planning authority do not have designated street types per the CSDG.

The results for average crash risk differ from the other analyses, with the highest crash risk for pedestrian crashes in the dark and bicycle crashes at intersections along Downtown Boulevards, left-turn crashes at intersections along Major Highways and motor vehicle straight / angle crashes in Town Center Boulevards. Pedestrian crashes along segments also have their highest average crash risk along Downtown Boulevards. In contrast, single-vehicle crashes have their highest crash risk along Major Highways. While Major Highways is much higher than the other values, there are very few segments designated as this street type. Other high values for this crash type include Boulevards, Country Connectors, and Rustic Roads.

Table 14. Average Crash Risk by CSDG Street Type (Annual Crashes per Location)

CSDG Street Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
Major Highway	18	0.05	0.03	0.60	1.08	12	0.02	1.06
Boulevard	1,191	0.02	0.03	0.28	0.81	1,145	0.01	0.13
Downtown Blvd	134	0.16	0.05	0.43	1.09	161	0.04	0.09
Town Center Blvd	225	0.06	0.03	0.31	1.33	272	0.03	0.10
Downtown Street	210	0.06	0.02	0.12	0.33	339	0.01	0.03
Town Center Street	138	0.01	0.01	0.08	0.32	186	0.01	0.05
Neighborhood Conn	2,825	0.00	0.00	0.02	0.15	2,956	0.00	0.03
Country Conn	280	0.00	0.00	0.05	0.22	213	0.00	0.22
Country Road	90	0.00	0.00	0.01	0.12	60	0.00	0.06
Industrial Street	50	0.01	0.01	0.10	0.28	58	0.01	0.04
Neighborhood Street	9,132	0.00	0.00	0.00	0.03	21,656	0.00	0.02
Rustic Road**	183	0.00	0.00	0.01	0.26	317	0.00	0.12

Highlighted cells have the highest value for each column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

** Includes Exceptionally Rustic Roads

Crash Risk by Equity Emphasis Areas

Table 15, Table 16 and Table 17 summarize crash risk based on whether or not a segment is located within an EEA, Census tracts with high concentrations of low-income individuals and/or racial and ethnic minorities. Given that EEAs comprise just 18% of intersections and 16% of segments, it is not surprising that total crash risk is higher in non-EEA areas in Montgomery County.

Table 15. Total Crash Risk in EEAs vs. Non-EEAs (Annual Crashes)

Equity Area Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
EEA	3,087	49	25	253	280	5,049	32	125
Non-EEA	13,606	58	62	482	595	26,033	51	663

Highlighted cells have the highest value for any column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

In looking at the top 200 crash locations, EEAs are overrepresented relative to the number of intersections and segments in EEAs. This is most extreme for the pedestrian crash types, where more than half of the top 200 locations are within EEAs. Addressing this disparity requires focusing pedestrian improvements in the low-income communities and Communities of Color within Montgomery County.

Table 16. Hot Spot Analysis in EEAs vs. Non-EEAs (# of Top 200 Intersections and Segments)

Equity Area Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
EEA	3,087	107	67	80	75	5,049	133	26
Non-EEA	13,606	93	133	120	125	26,033	67	174

Highlighted cells have the highest value for any column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

The disparity between EEAs and non-EEAs is most apparent in the evaluation of average crash risk, where EEAs have higher values for all but one crash type. At intersections in EEAs, the average crash risk is higher than non-EEAs by 270% for pedestrian crashes after dark, 75% for bicycle crashes at intersections, 130% for left-turn crashes, 82% higher for angle crashes at four-legged intersections, and 226% higher for pedestrian crashes along segments. The outliner is single vehicle crashes, yet this is unsurprising given these crashes are less prevalent in urban areas, while EEAs tend to be focused in the dense parts of the county.

Table 17. Average Crash Risk in EEAs vs. Non-EEAs (Annual Crashes per Location)

Equity Area Type	# Ints.*	Intersection Crash Types				# Segs.	Segment Crash Types	
		Ped Dark	Bike	Left Turn	Angle		Ped Seg	Single Veh
EEA	3,087	0.02	0.01	0.08	0.36	5,049	.007	.025
Non-EEA	13,606	0.00	0.00	0.04	0.20	26,033	.002	.026

Highlighted cells have the highest value for any column.

* As the angle crash type only includes four-legged intersections, the number of intersections for this crash type would only include a fraction of the intersections noted here. Countywide, 23% of intersections have four legs.

Relationship to Observed Severe and Fatal Crashes

The crash risk summaries on the previous pages provide a new lens with which to look at where safety issues are concentrated and where safety improvements may be most beneficial. This approach can also be used to review historic severe injuries and fatalities. Between 2015 and 2019, there were 1,267 crashes that resulted in a severe injury and 152 crashes that resulted in a fatality. The context trends associated with these serious crashes are similar to those presented in the tables above:

- While most severe injuries and fatalities occur in Suburban areas, the average rates for these types of crashes are highest in urban areas (Town Centers for fatalities and Downtowns for severe injuries).

- Boulevards have the highest history of severe injuries and fatalities, but the average crash rate along Boulevards is lower than that of Downtown Boulevards and Major Highways.
- Equity Emphasis Areas have fewer severe and fatal crashes overall, but the average rate of these crash types is substantially higher in EEAs than in other parts of the county (fatalities are 160% higher while severe injuries are 90% higher).

A hot spot analysis is not conducted as part of this review, as there are few locations with more than one severe injury or fatality. Appendix H presents the severe and fatal crash analysis in more detail.

Key Findings

The results summarized on the previous pages provide the total crash risk, hot spot analysis, and average crash risk for the county's area types, street types, and EEAs. This analysis reveals a few high-level findings that can inform where safety improvements are needed and should be prioritized in the future:

- **Prioritization needs to look beyond crash history.** In the past, Montgomery County has sometimes taken a reactionary approach to transportation safety, implementing site-specific improvements in the aftermath of a severe or fatal crash. The results of this analysis show that prioritizing safety treatments based solely on locations with a history of severe injury and fatal crashes could result in unmitigated crash risk, due to the randomness of severe and fatal crashes. In fact, between 2015 and 2019 in Montgomery County, only 55% of fatalities and 46% of severe injuries occurred in top 200 intersections and roadway segments.
- **As a suburban county, much of Montgomery County's crash risk is in the suburbs.** The county's suburban areas and the high-speed, high-volume suburban Boulevards (like Georgia Avenue or Middlebrook Road) that run through them have the highest concentration of crash risk in the county for most crash types. To reach Vision Zero, safety improvements must address these locations.
- **Yet Downtowns and Town Centers have the highest average crash risk.** On a per-intersection or per-roadway segment basis, crash risk is highest in the county's urban areas, particularly for pedestrian and bicycle crash types. Systemic improvements on Downtown Boulevards and Town Center Boulevards – and more broadly in Downtown and Town Center areas – would yield the greatest benefits.
- **Safety improvements in Equity Emphasis Areas should be prioritized.** Across all metrics, crash risk is disproportionately concentrated in EEAs. More than half of the top 200 locations for pedestrian crash types are located within EEAs, and the average crash risk in EEAs far exceeds that for non-EEAs for five of the six crash types. Focusing investments in EEAs can mitigate this disparity and balance crash risk in the county.

7. PAIR CRASH TYPES WITH COUNTERMEASURES

Once the predicted crashes for each crash type is identified for all intersections and segments in the county, countermeasures, or strategies to reduce crashes, can be applied to each location. This analysis uses crash modification factors (CMFs) to estimate reductions in the number of predicted crashes. CMFs essentially provide a percentage of crashes that would still occur if the countermeasure was implemented, and they are based on research evaluated by the Federal Highway Administration and are inventoried in the CMF Clearinghouse.[9] For example, a specific stop-controlled intersection could be expected to experience 10 crashes per year. One countermeasure for improving safety at this stop-controlled intersections could be installing a traffic signal, which has a CMF of 0.56. The expected total crashes after installing the signal would be 10 x 0.56 = 5.6 crashes per year.

The Predictive Safety Analysis generally looks at the impact of implementing one countermeasure at a location. However, in reality, multiple safety treatments may be appropriate at a given intersection or segment. If more than one treatment is applied, the expected crash reduction is greater than just one treatment alone, however, the expected crash reduction is less than the sum of each CMF. The analysis here presents the benefits of individual countermeasures, but it does not estimate the combined effect should multiple safety treatments be used at the same location.

Countermeasures Overview

Roadway improvements are often categorized in two ways, as systemic or spot safety improvements. Systemic countermeasure implementation is a common Vision Zero approach that identifies many locations throughout the county for rapid application. These treatments are generally considered well-suited for widespread implementation because of their safety effectiveness, cost effectiveness, and because they may be implemented with limited study and design. In contrast, spot safety treatments use traditional site-based analysis at a specific location.

> [The systemic approach to safety] provides a more comprehensive method for safety planning and implementation that supplements and complements traditional site analysis. The approach also helps agencies broaden their traffic safety efforts and consider risk as well as crash history when identifying where to make low-cost safety improvements.[10]

The countermeasure analysis in the Predictive Safety Analysis includes 15 systemic countermeasures, summarized on the following pages. These countermeasures improve safety through several mechanisms, including speed management, pedestrian crossings, intersection control, signal timing, and other means.

[9] https://www.cmfclearinghouse.org/
[10] FHWA. Systemic Safety Project Selection Tool. https://safety.fhwa.dot.gov/systemic/fhwasa13019/chap1.cfm#chap111

The systemic improvements analyzed for this project are not comprehensive, and potentially applicable countermeasures are excluded from this analysis for two reasons:

- **Data Availability:** In order to analyze the potential crash reduction associated with a countermeasure, data must be available about where that countermeasure currently exists in the county, as well as data about where that countermeasure would be appropriate for implementation. For example, while eliminating channelized (or "free") right turn movements could improve safety, our database does not include an inventory of intersections that currently have a channelized right-turn.
- **Existing Research:** There are many countermeasures that may offer safety benefits but have not yet been evaluated and inventoried in the CMF Clearinghouse, or because the previous research was not deemed conclusive or reliable. These countermeasures are excluded from this analysis, as crash reduction cannot be estimated without a CMF value. One example is "No Right Turn on Red" restrictions at signalized intersections; because there is no CMF for this safety treatment, its benefit cannot be evaluated.

Additional countermeasures and additional information about the countermeasures summarized below are included in the county's Vision Zero Community Toolkit.

SPEED MANAGEMENT

Automated Enforcement – Speed Cameras automatically issue fines for speeding

CMFs: along urban arterials, 0.46 for all crashes (54% reduction) and 0.37 for single-vehicle crashes (63% reduction)[11]

Lower Speed Limit by 5 MPH decreases the posted speed limit and can decrease crashes and crash severity.

CMF: 0.44 for all crashes in rural areas (56% reduction)[12]

Speed Humps are paved ramps measuring 3- to 4-inches high that extend the full width of the street

CMF: 0.55 for all crashes (45% reduction)[13]

[11] Shin, K., Washington, S., van Schalkwyk, I., "Evaluation of the Scottsdale Loop 101 automated speed enforcement demonstration program." Accident Analysis and Prevention, Vol. 41, No. 3, Oxford, N.Y., Pergamon Press, (2009) pp. 393-403.
[12] Gayah, V.V., E.T. Donnell, Z. Yu, and L.Li. "Safety and operational impacts of setting speed limits below engineering recommendations". Accident Analysis and Prevention, Vol. 121, (2018) pp. 43-52.
[13] Elvik, R. and Vaa, T., "Handbook of Road Safety Measures." Oxford, United Kingdom, Elsevier, (2004)

PEDESTRIAN CROSSINGS

High-Visibility Crosswalks use parallel markings that motorists see more easily compared with traditional crosswalk markings located perpendicular to the motor vehicle path of travel.

CMF: 0.63 for pedestrian crashes in urban areas (37% reduction)[14]

Raised Pedestrian Crosswalks are crossings elevated at least three inches above the roadway, up to the sidewalk level.

CMFs: 0.64 for all severe injury crashes on 2-lane roads (36% reduction) and 0.55 for mid-block, severe-injury pedestrian crashes on 2-lane roads (45% reduction)[15]

Pedestrian Hybrid Beacons are signals at major street crossing locations that remain dark until pedestrian activates via a pushbutton. Also called High Intensity Activated Crosswalks, or HAWKs.

CMFs: 0.883 for all crashes (11.7% reduction) and 0.54 for mid-block pedestrian crashes (46% reduction)[16]

[14] Feldman, M., J. Manzi, and M. Mitman. "An Empirical Bayesian Evaluation of the Safety Effects of High-Visibility School Crosswalks in San Francisco." TRB 89th Annual Meeting Compendium of Papers CD-ROM. Washington, D.C. 2010.
[15] Elvik, R. and Vaa, T., "Handbook of Road Safety Measures." Oxford, United Kingdom, Elsevier, (2004)
[16] Fitzpatrick, K., M.J. Cynecki, M.P. Pratt, E.S. Park, and M.E. Beckley. "Evaluation of Pedestrian Hybrid Beacons on Arizona Highways." Report No. FHWA-AZ-19-756. Arizona Department of Transportation. Phoenix, Arizona. (September 2019).

INTERSECTION CONTROL

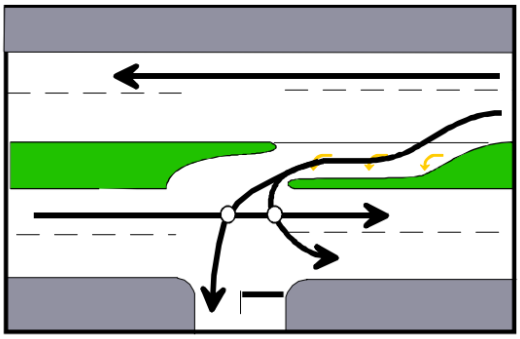
All-Way Stop Control includes a stop sign on all intersection approaches. All vehicles are required to stop and yield to pedestrians, bicyclists, or other vehicles before continuing through the intersection.

CMFs: 0.319 for all crashes (68.1% reduction),[17] 0.57 for pedestrian crashes in urban areas (43% reduction), and 0.25 for angle crashes in urban areas (75% reduction)[18]

Traffic Signals are used to assign vehicular and pedestrian right-of-way, promoting the orderly movement of traffic through the intersection while preventing excessive delay.

CMFs: 0.614 and 0.716 for all crashes at 4-leg and 3-leg intersections, respectively (38.6% and 28.4% reductions)[19] and 0.46 and 0.45 for angle crashes at 4-leg and 3-leg intersections, respectively (54% and 55% reductions)[20]

"Left-In-Only" Median permits vehicles turning off the major street to make a left onto the minor street, while vehicles on the minor street can only make a right turn onto the major street.



CMFs: 0.95 for all crashes (5% reduction) and 0.55 for left-turn crashes (45% reduction)[21]

[17] Simpson, C.L. and Hummer, J.E., "Evaluation of the Conversion from Two-Way Stop Sign Control to All-Way Stop Sign Control at 53 Locations in North Carolina." Journal of Transportation Safety and Security, Vol 2, No. 3, (2010) pp. 239-260.
[18] Lovell, J. and Hauer, E., "The Safety Effect of Conversion to All-Way Stop Control." Transportation Research Record 1068, Washington, D.C., Transportation Research Board, National Research Council, (1986) pp. 103-107.
[19] Srinivasan, R., B. Lan, and D. Carter. "Safety Evaluation of Signal Installation With and Without Left Turn Lanes on Two Lane Roads in Rural and Suburban Areas." Report No. FHWA/NC/2013-11. North Carolina Department of Transportation. Raleigh, North Carolina. (October 2014).
[20] Abdel-Aty, M.A., C. Lee, J. Park, J.Wang, M. Abuzwidah, and S. Al-Arifi. "Validation and Application of Highway Safety Manual (Part D) in Florida." Florida Department of Transportation. Tallahassee, Florida. (May 2014).
[21] H. Zhou, J. Zhao, P. Hsu and J. Huang, "Safety Effects of Median Treatments Using Longitudinal Channelizers: Empirical Bayesian Before After Study", Journal of Transportation Engineering, Vol.139,No.12,American Society of Civil Engineers,(2013)pp. 1149-1155

SIGNAL TIMING

Increase All-Red Clearance Interval increases the period in which no vehicles are permitted to travel through the intersection, reducing the likelihood of crashes associated with red-light running.

CMF: 0.798 (20.2% reduction) for all crashes in urban areas[22]

Protected/Permissive Left Turn provides green-signals to restrict motorist turning left, allowing pedestrians and bicyclists to use crossings without interactions from turning vehicles and reducing left-turn conflicts between vehicles.

CMF: 0.862 for left-turn crashes at four-legged intersections (13.8% reduction)[14]

Fully Protected Left Turn provides a separate phase for left-turning traffic and allows left turns only to be made on a green left arrow signal.

CMF: 0.58 for urban and suburban crashes (42% reduction)[23]

Leading Pedestrian Intervals are adjustments to traffic signals to give pedestrians a three-to-seven-second head start before motorists enter the intersection.

CMFs: 0.83 for all crashes (17% reduction) and 0.81 for pedestrian crashes (19% reduction)[24]

[22] Srinivasan, R., et al. "NCHRP Report 705: Evaluation of Safety Strategies at Signalized Intersections.", Washington, D.C., Transportation Research Board, National Research Council, (2011)
[23] Davis, G.A. and Aul, N., "Safety Effects of Left-Turn Phasing Schemes at High-Speed Intersections", Minnesota Department of Transportation, Report No. MN/RC-2007-03, (2007)
[24] Goughnour, E., et al. "Safety Evaluation of Protected Left-Turn Phasing and Leading Pedestrian Intervals on Pedestrian Safety." Report No. FHWA-HRT-18-044. Federal Highway Administration. (October 2018)

OTHER COUNTERMEASURES

Centerline Rumble Strips alert drivers through vibration and sound that their vehicle has drifted from the travel lane towards the oncoming travel lane.

CMFs: 0.86 for all crashes in rural areas (14% reduction)[25] and 0.808 for single-vehicle crashes in rural areas (19.2% reduction)[26]

Lighting improves visibility for all road users. Pedestrian-scale lighting illuminates sidewalks and crossings and light fixtures are shorter than roadway-scale light fixtures.

CMFs: 0.881 for all nighttime crashes (11.9% reduction) at intersections with 2-4 lanes per leg[27]

[25] Persaud, B. N., Retting, R. A., and Lyon, C., "Crash Reduction Following Installation of Centerline Rumble Strips on Rural Two-Lane Roads." Arlington, Va., Insurance Institute for Highway Safety, (2003)
[26] Rys, M., D. Karkle, and E. Russell. "Study of KDOT Policy on Lane and Shoulder Minimum Width for Application of Centerline Rumble Strips." Report No. K-TRAN:KSU-10-7. Kansas Department of Transportation. Topeka, Kansas. (August 2012).
[27] Donnell, E.T., R.J. Porter, and V.N. Shankar. "A Framework for Estimating the Safety Effects of Roadway Lighting at Intersections." Safety Science, Vol. 48(10), pp. 1436-1444, 2010.

Countermeasure Analysis Approach

For each of the analyzed crash types, one or more countermeasures are identified as strategies to reduce that specific type of crash. For example, lighting is identified as a countermeasure for reducing pedestrian crashes after dark at intersections. Beyond pairing countermeasures with crash types, some countermeasures are evaluated through several different contexts in order to understand where the countermeasure would be most effective. The summary of scenarios by crash type and countermeasure are summarized in Table 18. Additional context considerations for each scenario are included in Appendix I.

Table 18. Countermeasure and Contexts by Crash Type

Crash Type	Countermeasure	Context (if applicable)
Pedestrian crashes after dark at intersections	High-Visibility Crosswalk	Signalized Intersections with some High-Visibility Crosswalks
		Signalized Intersections with Only Standard Crosswalks
		Unsignalized Intersections with Only Standard Crosswalks
		Signalized Intersections with No Crosswalks
	Lighting	Signalized Intersections
		Unsignalized Intersections
Pedestrian crashes along segments with vehicles going straight	High-Visibility Crosswalk	
	Raised Crossing	
	Pedestrian Hybrid Beacon	
	Speed Humps	
Bicycle crashes at intersections	Leading Pedestrian Interval	Downtown Boulevards
		Town Center Boulevards, Boulevards, and Major Highways
Left-turn crashes at intersections (all modes)	Traffic Signal	
	Protected/Permitted Signal Phase	
	Fully Protected Left Turn	
Motor vehicle straight/angle crashes at four-legged intersections	Increase All-Red Clearance Interval	Boulevards, Downtown Boulevards, Town Center Boulevards, Major Highways
		All Other Street Types
	Mini-Roundabout	
	All-Way Stop Control	
	Traffic Signal	
	Restrict to Left-In Access	
Single vehicle crashes along segments	Centerline Rumble Strip	
	Reduce Speeds by 5 MPH	
	Automated Speed Enforcement	

The crash reduction is then calculated for all intersections and roadway segments for each countermeasure and its associated contexts. The crash reduction is the sum of two parts: crash

reduction for the identified crash type (one of the six crash types noted above) and crash reduction for other crashes at that location.

- **Crash Reduction for the Identified Crash Type:** The analysis is focused on six crash types, and the selected countermeasures are focused on specifically reducing those types of crashes. The first piece of assessing crash reduction assesses the countermeasure's impact on the identified crash types. In some cases, this means applying a specific CMF for that crash type, though it may also entail applying a more general CMF (e.g., a CMF for all crashes or for all crashes of a certain mode) to the predicted number of crashes.
- **Crash Reduction for Other Crashes at that Location:** While some number of crashes at each location is associated with the six crash types, there are other types of crashes that happen at these locations as well, and those crashes could also be reduced through the implementation of safety countermeasures. This analysis subtracts the observed crashes of the identified crash type from the total observed crashes at a given location to understand the "other" crashes at that location. CMFs are then applied to the other crashes. There is no predicted crash metric for other crashes, so the observed metric must be used for this calculation.

Applying Countermeasures based on Location Rank

Safety improvements should be prioritized in the places where they are most needed. As a result, the countermeasure analysis applies the countermeasures to the top ranked locations for each countermeasure. Table 19 and Figure 1 summarize how crash risk is distributed across different locations, demonstrating the benefit of focusing on top-ranked locations for improvements.

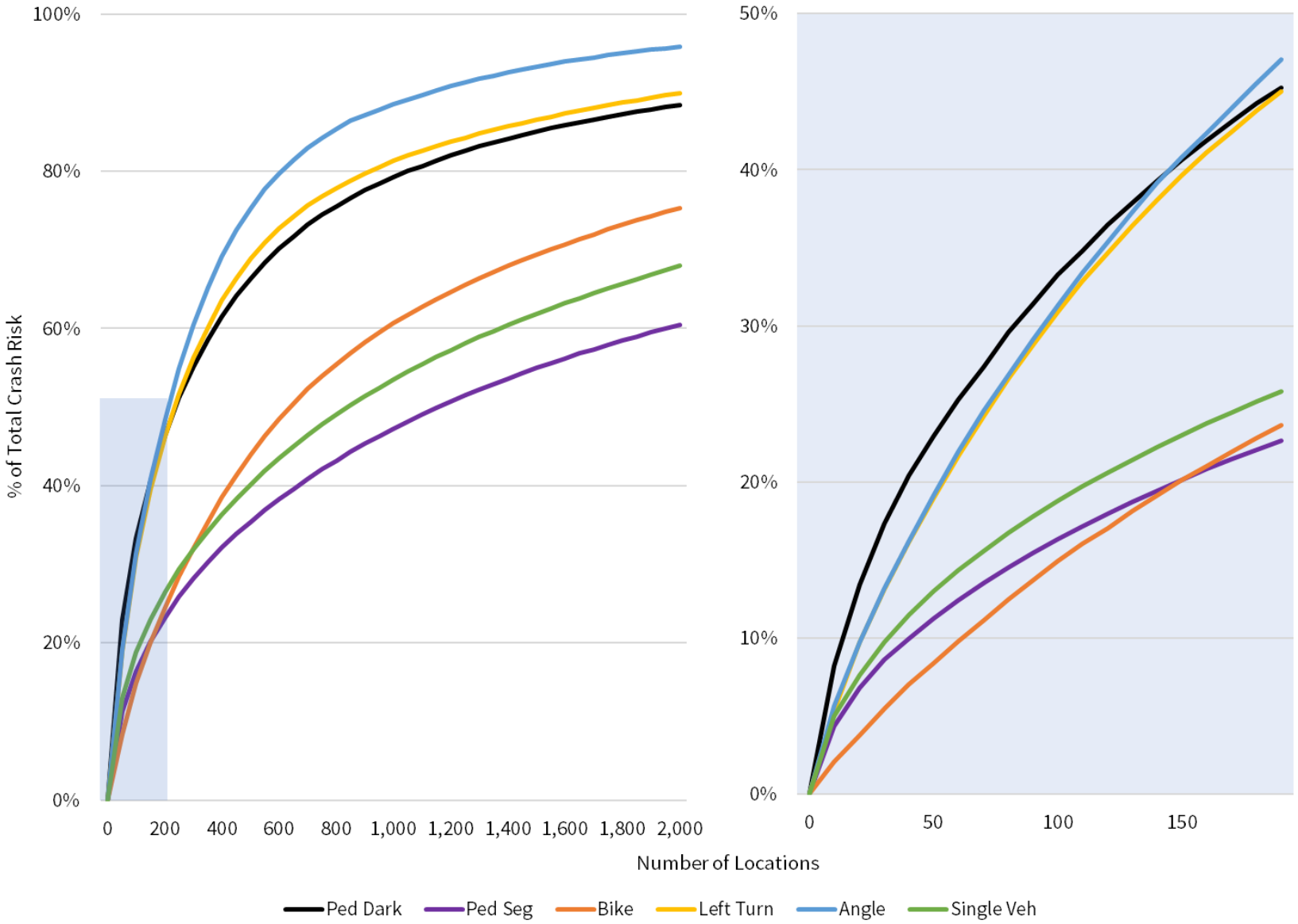
For three crash types, almost half of the county's crash risk is concentrated in the top 200 locations, and 80 to 90% of crash risk is concentrated in the top 1,000 locations, suggesting that targeted improvements at these locations could have a substantial impact at reducing crash risk[28]. For the other crash types, risk is more diffused, with a higher percent of crashes outside of the top 1,000 locations. Appendix J includes a list of the top 50 ranked locations for each countermeasure.

Table 19. Portion of Total Annual Crash Risk included in Top 200 Locations

Crash Type	Total Crash Risk	% Crash Risk in Top 200	% Crash Risk in Top 1,000
Pedestrian crashes after dark at intersections	106	47%	80%
Pedestrian crashes on roadway segments with vehicles going straight	83	23%	47%
Bicycle crashes at intersections	86	25%	61%
Left-turn crashes at intersections (all modes)	734	46%	81%
Motor vehicle straight/angle crashes at four-legged intersections	875	48%	88%
Single vehicle crashes along roadway segments	787	27%	54%

[28] The top 200 locations comprise just 1.2% of intersections and 0.6% of roadway segments, and the top 1,000 locations comprise 6.0% of intersections and 3.2% of roadway segments.

Figure 1. Cumulative Crash Risk by Location Rank and Crash Type



Countermeasure Evaluation Tool

This report does not provide a prescriptive recommendation of capital improvements; it does not recommend which countermeasures should be implemented at which locations. Instead, the project provides a countermeasure evaluation tool for planners, engineers, and decisionmakers to assess different investment scenarios based on their goals and priorities.

The tool evaluates the effectiveness of different countermeasure scenarios in several ways.

- **Potential Crash Reduction:** the number of crashes that could be mitigated with implementation of the countermeasure. This measure summarizes the total or aggregate benefit of implementing the countermeasure, and it rises with the more locations that are improved.
- **Potential Crash Reduction per Location:** the potential crash reduction divided by the number of locations. This measure provides the per-location benefit of the countermeasure, and it generally decreases with the more locations that are improved (because the highest-risk locations are improved first).
- **Cost per Crash Reduced:** the total estimated cost divided by the potential crash reduction. This measure provides insight into the cost effectiveness of the countermeasure, and it generally rises with the more locations that are improved (again, because the highest-risk locations are improved first). Appendix K includes countermeasure costs.
- **% of Locations in Equity Emphasis Areas:** what portion of locations are within an EEA. This assesses the equity benefit of a countermeasure, and it generally decreases with the more locations that are improved (as many of the highest-risk locations in the county are within EEAs, and these locations are improved first).

Generally, the CMFs are applied to the number of annual predicted or observed crashes, yet the benefits of safety improvements extend beyond one year. The tool allows the user to input their desired timeline for analysis, which could coincide with the budget cycle (6 years) or the lifecycle of a given type of infrastructure (e.g., stop signs last 10+ years). Extending the analysis time period increases the potential crash reduction and potential crash reduction per location while decreasing the cost per crash reduced.

Two examples below show how the tools can be used to determine which countermeasures to implement and how may locations to improve.

Example 1: Determining which countermeasures to implement

The first example allows the user to determine the best way to spend $350,000 to decrease straight/angle crashes at four-legged intersections. Assuming a 10-year analysis period, Table 20

shows the one-year and long-term benefit of increasing all red clearance time on selected street types, implementing all-way stop control, and installing traffic signals.

As countermeasures vary in their costs, how many locations can be addressed with $350,000 differs across the countermeasures. Updating signal timing is far less costly than a new traffic signal, so many more locations could be updated with this treatment (116 locations vs. 1 location). Given the number of locations addressed, the potential crash reduction for increasing all red clearance far exceeds the other treatments, yet the per-location crash reduction is lower than that of installing a traffic signal.

Table 20. Example Scenarios for Reducing Straight/Angle Crashes with $350,000

Scenarios		Increase All Red Clearance*	All-Way Stop	Traffic Signal
	Number of Locations	116	70	1
	Total Estimated Cost	$348,000	$350,000	$350,000
One-Year Impact	Potential Crash Reduction	256	31	5
	Potential Crash Reduction per Location	2.2	0.4	4.7
	Cost per Crash Reduced	$1,400	$11,300	$73,800
Long-Term Impact (10 Years)	Potential Crash Reduction	2,557	311	47
	Potential Crash Reduction per Location	22.0	4.4	47.4
	Cost per Crashes Reduced	$140	$1,130	$7,380
	% of Locations in Equity Emphasis Areas	47%	21%	0%

* on Boulevards, Downtown Boulevards, Town Center Boulevards, Major Highways

EXAMPLE 2: ASSESSING HOW MANY LOCATIONS TO IMPROVE

The second example allows the user to determine how many signalized intersections should be recommended for improving lighting to reduce pedestrian crashes after dark. While the cost increases with the addition of new locations, the total potential crash reduction increases as well. The crash reduction per location declines slightly with additional locations, and the cost per crash reduced increases.

Table 21. Examples Scenarios for Improving Lighting at Signalized Intersections

Scenarios		20 Locations	40 Locations	60 Locations
	Total Estimated Cost	$100,000	$200,000	$300,000
One-Year Impact	Potential Crash Reduction	5	9	11
	Potential Crash Reduction per Location	0.2	0.2	0.2
	Cost per Crash Reduced	$20,900	$23,100	$27,400
Long-Term Impact (10 Years)	Potential Crash Reduction	48	87	109
	Potential Crash Reduction per Location	2.4	2.2	1.8
	Cost per Crashes Reduced	$2,090	$2,310	$2,740
	% of Locations in Equity Emphasis Areas	55%	48%	38%

CANDIDATE LOCATIONS

Each of the countermeasures are associated with a ranked list of candidate locations for systemic implementation. However, given the countywide nature of this analysis, individual site reviews are needed to confirm that the identified locations are context-appropriate for the selected countermeasures. Appendix J includes the top 50 locations for each countermeasure and its associated contexts.

8. APPLICATIONS

The Predictive Safety Analysis is the first step towards implementing a proactive approach to safety. While additional study could further the benefits of this work (see Appendix L), the Predictive Safety Analysis provides Montgomery County with a solid foundation for proactive safety planning. Based on the findings and tools developed as part of this project, the Planning Department, Montgomery County Department of Transportation, and the County Council can use this information in a variety of ways to inform future recommendations, priority projects, and funding allocations.

There are several uses of the results of the Predictive Safety Analysis:

- **Apply Data-Driven Planning:** Historically, much of transportation planning has been reactive, through improving locations with a recent severe or fatal crash or making investments in response to vocal community members. The Predictive Safety Analysis provides the data, analysis, and tools to shift the county's approach and implement improvements where they are needed and more equitably. This data can combat the "squeaky wheel" by distributing resources equitably and to where they are most needed. In addition, the data can support funding requests, both as part of the local or state budgeting process as well as through grant applications.
- **Identify Locations with High Crash Risk:** The results included in the section 6. Summarizing Crash Risk identify the types of locations with high crash risk. The findings in this section can be used to identify location types that are likely to experience a high number of crashes. This data can be used to inform Capital Improvement Program (CIP) capital project prioritization, prioritization of off-site mitigation for new development, a focus for transportation improvements within master planning areas, and can inform Mandatory Referral comments.
- **Prioritize Safety Improvements:** The tools summarized in the Section 7. Pair Crash Types with Countermeasures) allow implementing agencies to prioritize where to implement systemic safety treatments as well as to assess which safety treatments may be the most effective at reducing crashes. This information can make the case for additional funding for

CIP level-of-effort programs, inform master plan recommendations, and support updates to the Growth and Infrastructure Policy focused on motorist safety.[29]

- **Determine Locations with Similar Conditions:** The databases developed as part of the Predictive Safety Analysis include hundreds of variables related to the transportation, land use, and demographic context in which the crash occurred. In the wake of future severe or fatal crashes, this data can help identify other "like" locations to the severe or fatal crash and inform a more systemic response to the incident (rather than just improving the location here the crash occurred).

These broad uses can be applied to several aspects of transportation planning, engineering, funding, and implementation in Montgomery County, as listed in the examples above. Over the longer term, a systemic approach to crash prediction can also help facilitate redesign of the entire transportation network, by identifying road designs, populations, and land use patterns, that are associated with risk and mitigating that risk through new policies and systematic designs. Taking a more proactive, data-driven approach to transportation safety will impact all facets of transportation planning process.

[29] The 2020 Growth and Infrastructure Policy already addresses pedestrian and bicycle safety through its adequacy tests. The Predictive Safety Analysis provides a quantitative approach to evaluating motorist safety not currently addressed in the Growth & Infrastructure Policy.

GLOSSARY

Correlation: A statistical measure that expresses the extent to which two variables are linearly related.

Countermeasure: Strategies effective at reducing roadway crashes, severe injuries, and fatalities.

Crash Modification Factor (CMF): A percentage of crashes that would still occur if the countermeasure was implemented, based on research evaluated by the Federal Highway Administration.

Crash Risk: The number of expected crashes at a location, accounting for both a safety performance function and crash history. Also referred to as Empirical-Bayes (EB) crashes.

Empirical-Bayes (EB) Crashes: Crash estimate that weighs both observed and predicted crashes based on 1) how well the SPF predicts crashes and 2) the number of predicted crashes at the specific location. Also referred to as crash risk.

Equity Emphasis Areas (EEAs): Census tracts in the DC region categorized by high concentrations of lower-income households and people of color. The EEAs were developed by the Metropolitan Washington Council of Governments.

High Injury Network: Identifies roadways with the highest rates of severe and fatal crashes.

Observed Crashes: The historical crashes that occurred at an intersection or on a roadway segment.

Predicted Crashes: The number of expected crashes at a location, this is the outcome of the safety performance function.

Safety Performance Function (SPF): A regression model used to predict the expected number of crashes based on several factors.

Severe Injury: An injury that results in one or more of the following:

- Severe laceration resulting in exposure of underlying tissues/muscle/organs or resulting in significant loss of blood
- Broken or distorted extremity (arm or leg)
- Crush injuries
- Suspected skull, chest or abdominal injury other than bruises or minor lacerations
- Significant burns (second and third degree burns over 10% or more of the body)
- Unconsciousness when taken from the crash scene
- Paralysis

Systemic Safety: A common Vision Zero approach that identifies many locations throughout the county for rapid application of countermeasures because of their safety effectiveness, cost effectiveness, and because they may be implemented with limited study and design

Vision Zero: A proven approach to preventing roadway-related deaths and severe injuries. It represents a fundamental change in how we plan and design our roads, shifting from a focus on maximizing motor vehicle efficiency to ensuring that our roads are safe.

APPENDICES

APPENDIX A. INTERSECTION AND SEGMENT VARIABLES

INTERSECTION VARIABLES

Category	Description
ID	Intersection ID
Transportation	
Enforcement	Presence of red-light camera at int. (0=no, 1=yes)
Bike/Ped	Highest category of bikeway w/in 100 feet of the int.
Bike/Ped	Highest category of bikeway w/in 500 feet of the int.
Bike/Ped	int. has a trail crossing w/in 100 ft (0=no, 1=yes)
Bike/Ped	Total bikeway length w/in 100 feet of the int.
Bike/Ped	Total bikeway length w/in 500 feet of the int.
Bike/Ped	Total number of crosswalks with median island near the int.
Bike/Ped	Total number of high visibility crosswalks near the int.
Bike/Ped	Total number of marked crosswalks near the int.
Bike/Ped	Total sidewalk length w/in 100 feet of the int.
Bike/Ped	Total sidewalk length w/in 500 feet of the int.
Bikeshare	Density of Bikeshare Stations per sq. mile w/in 1/10 mile of the int.
Bikeshare	Density of Bikeshare Stations per sq. mile w/in 1/2 mile of the int.
Bikeshare	Density of Bikeshare Stations per sq. mile w/in 1/4 mile of the int.
Parking	Density of Parking Garages and Lots per sq. mile w/in 1/10 mile of the int.
Parking	Density of Parking Garages and Lots per sq. mile w/in 1/2 mile of the int.
Parking	Density of Parking Garages and Lots per sq. mile w/in 1/4 mile of the int.
Parking	Percent of area w/in 100 ft of int. comprised of parking lots
Parking	Percent of area w/in 500 ft of int. comprised of parking lots
Segment-Based	Highest road class among all legs at the int.
Segment-Based	Maximum number of through lanes on any leg at the int.
Segment-Based	Minimum number of through lanes on any leg at the int.
Segment-Based	Number of legs with no lane data at the int.
Segment-Based	Total number of legs among all segments at the int.
Segment-Based	Total through lanes on all legs at the int.
Traffic Control	int. has stop signs
Traffic Control	Number of stop signs at the int.
Traffic Control	Signalized traffic control at int. (0=no, 1=yes)
Transit	Density of MARC Train Stations per sq. mile w/in 1/10 mile of the int.
Transit	Density of MARC Train Stations per sq. mile w/in 1/2 mile of the int.
Transit	Density of MARC Train Stations per sq. mile w/in 1/4 mile of the int.
Transit	Density of Metro Stations per sq. mile w/in 1/10 mile of the int.
Transit	Density of Metro Stations per sq. mile w/in 1/2 mile of the int.
Transit	Density of Metro Stations per sq. mile w/in 1/4 mile of the int.

Category	Description
Transportation	
Transit	Density of Park and Ride Lots per sq. mile w/in 1/10 mile of the int.
Transit	Density of Park and Ride Lots per sq. mile w/in 1/2 mile of the int.
Transit	Density of Park and Ride Lots per sq. mile w/in 1/4 mile of the int.
Transit	Number of bus stops w/in 1/10 mile of int.
Transit	Number of bus stops w/in 1/2 mile of int.
Transit	Number of bus stops w/in 1/4 mile of int.
Transit	Number of commuter rail stops w/in 1/10 mile of int.
Transit	Number of commuter rail stops w/in 1/2 mile of int.
Transit	Number of commuter rail stops w/in 1/4 mile of int.
Transit	Number of metro stations w/in 1/10 mile of int.
Transit	Number of metro stations w/in 1/2 mile of int.
Transit	Number of metro stations w/in 1/4 mile of int.
Transit	Number of routes at all stops w/in 1/10 mile of int.
Transit	Number of routes at all stops w/in 1/2 mile of int.
Transit	Number of routes at all stops w/in 1/4 mile of int.
Land Use	
Aircraft Facilities	Density of Aircraft Facilities per sq. mile w/in 1/10 mile of the int.
Aircraft Facilities	Density of Aircraft Facilities per sq. mile w/in 1/2 mile of the int.
Aircraft Facilities	Density of Aircraft Facilities per sq. mile w/in 1/4 mile of the int.
Alcohol	Density of Liquor Stores per sq. mile w/in 1/10 mile of the int.
Alcohol	Density of Liquor Stores per sq. mile w/in 1/2 mile of the int.
Alcohol	Density of Liquor Stores per sq. mile w/in 1/4 mile of the int.
Alcohol	Density of off-premise alcoholic beverage locs per sq. mile w/in 1/10 mile of the int.
Alcohol	Density of off-premise alcoholic beverage locs per sq. mile w/in 1/2 mile of the int.
Alcohol	Density of off-premise alcoholic beverage locs per sq. mile w/in 1/4 mile of the int.
Alcohol	Density of on/off-premise alcoholic beverage locs per sq. mile w/in 1/10 mile of the int.
Alcohol	Density of on/off-premise alcoholic beverage locs per sq. mile w/in 1/2 mile of the int.
Alcohol	Density of on/off-premise alcoholic beverage locs per sq. mile w/in 1/4 mile of the int.
Alcohol	Density of on-premise alcoholic beverage locs per sq. mile w/in 1/10 mile of the int.
Alcohol	Density of on-premise alcoholic beverage locs per sq. mile w/in 1/2 mile of the int.
Alcohol	Density of on-premise alcoholic beverage locs per sq. mile w/in 1/4 mile of the int.
Alcohol	Density of unknown alcoholic beverage locs per sq. mile w/in 1/10 mile of the int.
Alcohol	Density of unknown alcoholic beverage locs per sq. mile w/in 1/2 mile of the int.
Alcohol	Density of unknown alcoholic beverage locs per sq. mile w/in 1/4 mile of the int.
Apartments	Density of Apartments per sq. mile w/in 1/10 mile of the int.
Apartments	Density of Apartments per sq. mile w/in 1/2 mile of the int.
Apartments	Density of Apartments per sq. mile w/in 1/4 mile of the int.
Area Type	Activity center in which the int. falls
Area Type	Complete Streets area type in which the int. falls

Category	Description
Land Use	
Area Type	Municipality in which the int. falls
Area Type	Policy area category (G, O, R, Y) in which the int. falls
Area Type	Policy area in which the int. falls
Business Parks	Density of Business Parks per sq. mile w/in 1/10 mile of the int.
Business Parks	Density of Business Parks per sq. mile w/in 1/2 mile of the int.
Business Parks	Density of Business Parks per sq. mile w/in 1/4 mile of the int.
Cemeteries	Density of Cemeteries per sq. mile w/in 1/10 mile of the int.
Cemeteries	Density of Cemeteries per sq. mile w/in 1/2 mile of the int.
Cemeteries	Density of Cemeteries per sq. mile w/in 1/4 mile of the int.
Cultural Facilities	Density of Cultural Facilities per sq. mile w/in 1/10 mile of the int.
Cultural Facilities	Density of Cultural Facilities per sq. mile w/in 1/2 mile of the int.
Cultural Facilities	Density of Cultural Facilities per sq. mile w/in 1/4 mile of the int.
Fire Stations	Density of Federal Fire Stations per sq. mile w/in 1/10 mile of the int.
Fire Stations	Density of Federal Fire Stations per sq. mile w/in 1/2 mile of the int.
Fire Stations	Density of Federal Fire Stations per sq. mile w/in 1/4 mile of the int.
Fire Stations	Density of Fire Stations per sq. mile w/in 1/10 mile of the int.
Fire Stations	Density of Fire Stations per sq. mile w/in 1/2 mile of the int.
Fire Stations	Density of Fire Stations per sq. mile w/in 1/4 mile of the int.
Gas Stations	Density of Gas Stations per sq. mile w/in 1/10 mile of the int.
Gas Stations	Density of Gas Stations per sq. mile w/in 1/2 mile of the int.
Gas Stations	Density of Gas Stations per sq. mile w/in 1/4 mile of the int.
Gov't Facilities	Density of Federal Facilities per sq. mile w/in 1/10 mile of the int.
Gov't Facilities	Density of Federal Facilities per sq. mile w/in 1/2 mile of the int.
Gov't Facilities	Density of Federal Facilities per sq. mile w/in 1/4 mile of the int.
Gov't Facilities	Density of MC Government per sq. mile w/in 1/10 mile of the int.
Gov't Facilities	Density of MC Government per sq. mile w/in 1/2 mile of the int.
Gov't Facilities	Density of MC Government per sq. mile w/in 1/4 mile of the int.
Gov't Facilities	Density of Regional Services Centers per sq. mile w/in 1/10 mile of the int.
Gov't Facilities	Density of Regional Services Centers per sq. mile w/in 1/2 mile of the int.
Gov't Facilities	Density of Regional Services Centers per sq. mile w/in 1/4 mile of the int.
Gov't Facilities	Density of State and Muni per sq. mile w/in 1/10 mile of the int.
Gov't Facilities	Density of State and Muni per sq. mile w/in 1/2 mile of the int.
Gov't Facilities	Density of State and Muni per sq. mile w/in 1/4 mile of the int.
HHS Facilities	Density of HHS Facilities per sq. mile w/in 1/10 mile of the int.
HHS Facilities	Density of HHS Facilities per sq. mile w/in 1/2 mile of the int.
HHS Facilities	Density of HHS Facilities per sq. mile w/in 1/4 mile of the int.
Hospitals	Density of Hospitals per sq. mile w/in 1/10 mile of the int.
Hospitals	Density of Hospitals per sq. mile w/in 1/2 mile of the int.
Hospitals	Density of Hospitals per sq. mile w/in 1/4 mile of the int.

Category	Description
Land Use	
Libraries	Density of Libraries per sq. mile w/in 1/10 mile of the int.
Libraries	Density of Libraries per sq. mile w/in 1/2 mile of the int.
Libraries	Density of Libraries per sq. mile w/in 1/4 mile of the int.
Lodging	Density of Lodging per sq. mile w/in 1/10 mile of the int.
Lodging	Density of Lodging per sq. mile w/in 1/2 mile of the int.
Lodging	Density of Lodging per sq. mile w/in 1/4 mile of the int.
Places	Density of Places per sq. mile w/in 1/10 mile of the int.
Places	Density of Places per sq. mile w/in 1/2 mile of the int.
Places	Density of Places per sq. mile w/in 1/4 mile of the int.
Police	Density of Police Facilities per sq. mile w/in 1/10 mile of the int.
Police	Density of Police Facilities per sq. mile w/in 1/2 mile of the int.
Police	Density of Police Facilities per sq. mile w/in 1/4 mile of the int.
Police	Density of Police Stations per sq. mile w/in 1/10 mile of the int.
Police	Density of Police Stations per sq. mile w/in 1/2 mile of the int.
Police	Density of Police Stations per sq. mile w/in 1/4 mile of the int.
Polling	Density of Polling Places per sq. mile w/in 1/10 mile of the int.
Polling	Density of Polling Places per sq. mile w/in 1/2 mile of the int.
Polling	Density of Polling Places per sq. mile w/in 1/4 mile of the int.
Post Office	Density of Post Offices per sq. mile w/in 1/10 mile of the int.
Post Office	Density of Post Offices per sq. mile w/in 1/2 mile of the int.
Post Office	Density of Post Offices per sq. mile w/in 1/4 mile of the int.
Recreation	Density of Golf Courses per sq. mile w/in 1/10 mile of the int.
Recreation	Density of Golf Courses per sq. mile w/in 1/2 mile of the int.
Recreation	Density of Golf Courses per sq. mile w/in 1/4 mile of the int.
Recreation	Density of Park Facilities per sq. mile w/in 1/10 mile of the int.
Recreation	Density of Park Facilities per sq. mile w/in 1/2 mile of the int.
Recreation	Density of Park Facilities per sq. mile w/in 1/4 mile of the int.
Recreation	Density of Recreation Centers per sq. mile w/in 1/10 mile of the int.
Recreation	Density of Recreation Centers per sq. mile w/in 1/2 mile of the int.
Recreation	Density of Recreation Centers per sq. mile w/in 1/4 mile of the int.
Recreation	Density of Swimming Pools per sq. mile w/in 1/10 mile of the int.
Recreation	Density of Swimming Pools per sq. mile w/in 1/2 mile of the int.
Recreation	Density of Swimming Pools per sq. mile w/in 1/4 mile of the int.
Recreation	Density of YMCAs per sq. mile w/in 1/10 mile of the int.
Recreation	Density of YMCAs per sq. mile w/in 1/2 mile of the int.
Recreation	Density of YMCAs per sq. mile w/in 1/4 mile of the int.
Recreation	Percent of area w/in 100 ft of int. comprised of park land
Recreation	Percent of area w/in 500 ft of int. comprised of park land
Religious	Density of Places of Worship per sq. mile w/in 1/10 mile of the int.

Category	Description
Land Use	
Religious	Density of Places of Worship per sq. mile w/in 1/2 mile of the int.
Religious	Density of Places of Worship per sq. mile w/in 1/4 mile of the int.
Schools	Density of Colleges or Universities per sq. mile w/in 1/10 mile of the int.
Schools	Density of Colleges or Universities per sq. mile w/in 1/2 mile of the int.
Schools	Density of Colleges or Universities per sq. mile w/in 1/4 mile of the int.
Schools	Density of Elementary Schools per sq. mile w/in 1/10 mile of the int.
Schools	Density of Elementary Schools per sq. mile w/in 1/2 mile of the int.
Schools	Density of Elementary Schools per sq. mile w/in 1/4 mile of the int.
Schools	Density of High Schools per sq. mile w/in 1/10 mile of the int.
Schools	Density of High Schools per sq. mile w/in 1/2 mile of the int.
Schools	Density of High Schools per sq. mile w/in 1/4 mile of the int.
Schools	Density of K-12 schools per sq. mile w/in 1/10 mile of the int.
Schools	Density of K-12 schools per sq. mile w/in 1/2 mile of the int.
Schools	Density of K-12 schools per sq. mile w/in 1/4 mile of the int.
Schools	Density of Middle Schools per sq. mile w/in 1/10 mile of the int.
Schools	Density of Middle Schools per sq. mile w/in 1/2 mile of the int.
Schools	Density of Middle Schools per sq. mile w/in 1/4 mile of the int.
Schools	Density of Private Schools per sq. mile w/in 1/10 mile of the int.
Schools	Density of Private Schools per sq. mile w/in 1/2 mile of the int.
Schools	Density of Private Schools per sq. mile w/in 1/4 mile of the int.
Schools	Density of Special Schools per sq. mile w/in 1/10 mile of the int.
Schools	Density of Special Schools per sq. mile w/in 1/2 mile of the int.
Schools	Density of Special Schools per sq. mile w/in 1/4 mile of the int.
Schools	Distance, in feet, from the int. to the nearest university or college
Senior Centers	Density of Senior Centers per sq. mile w/in 1/10 mile of the int.
Senior Centers	Density of Senior Centers per sq. mile w/in 1/2 mile of the int.
Senior Centers	Density of Senior Centers per sq. mile w/in 1/4 mile of the int.
Shopping Centers	Density of Shopping Centers per sq. mile w/in 1/10 mile of the int.
Shopping Centers	Density of Shopping Centers per sq. mile w/in 1/2 mile of the int.
Shopping Centers	Density of Shopping Centers per sq. mile w/in 1/4 mile of the int.
Demographics	
Age	Older Adult Concentration Relative to Regional Average
Age	Older Adult Population
Age	Percent of the population 65 years of age and up w/in 1/10 mile of the int.
Age	Percent of the population 65 years of age and up w/in 1/2 mile of the int.
Age	Percent of the population 65 years of age and up w/in 1/4 mile of the int.
Age	Percent of the population under 18 years of age w/in 1/10 mile of the int.
Age	Percent of the population under 18 years of age w/in 1/2 mile of the int.
Age	Percent of the population under 18 years of age w/in 1/4 mile of the int.

Category	Description
Demographics	
Disabilities	Percent Persons with Disabilities
Disabilities	Persons with Disabilities
Disabilities	Persons with Disabilities Concentration Relative to the Regional Average
Employment	Employment density (people per sq. mile) w/in 1/10 mile of the int.
Employment	Employment density (people per sq. mile) w/in 1/2 mile of the int.
Employment	Employment density (people per sq. mile) w/in 1/4 mile of the int.
EEAs	Located w/in an Equity Emphasis Area
Income	Low Income Concentration Relative to Regional Average
Income	Low Income Population
Income	Median household income w/in 1/10 mile of the int.
Income	Median household income w/in 1/2 mile of the int.
Income	Median household income w/in 1/4 mile of the int.
Income	Percent of households with income of $100,000 or more w/in 1/10 mile of the int.
Income	Percent of households with income of $100,000 or more w/in 1/2 mile of the int.
Income	Percent of households with income of $100,000 or more w/in 1/4 mile of the int.
Income	Percent of households with income of $150,000 or more w/in 1/10 mile of the int.
Income	Percent of households with income of $150,000 or more w/in 1/2 mile of the int.
Income	Percent of households with income of $150,000 or more w/in 1/4 mile of the int.
Income	Percent of households with income of $200,000 or more w/in 1/10 mile of the int.
Income	Percent of households with income of $200,000 or more w/in 1/2 mile of the int.
Income	Percent of households with income of $200,000 or more w/in 1/4 mile of the int.
Income	Percent of the pop with income less than 1.5x the poverty level w/in 1/10 mile of the int.
Income	Percent of the pop with income less than 1.5x the poverty level w/in 1/2 mile of the int.
Income	Percent of the pop with income less than 1.5x the poverty level w/in 1/4 mile of the int.
Language	Limited English Proficiency Concentration Relative to Regional Average
Language	Limited-English Proficiency Population
Language	Percent Limited English Proficiency
Population	Population density (people per sq. mile) w/in 1/10 mile of the int.
Population	Population density (people per sq. mile) w/in 1/2 mile of the int.
Population	Population density (people per sq. mile) w/in 1/4 mile of the int.
Race/Ethnicity	African American Concentration Relative to Regional Average
Race/Ethnicity	African American Population
Race/Ethnicity	Asian Concentration Relative to Regional Average
Race/Ethnicity	Asian Population
Race/Ethnicity	Latino Concentration Relative to Regional Average
Race/Ethnicity	Latino Population
Race/Ethnicity	Percent African American
Race/Ethnicity	Percent Asian
Race/Ethnicity	Percent Latino

SEGMENT VARIABLES

Category	Description
ID	Segment ID
Transportation	
Bike/Ped	Bike facility length (ft) associated with the left side of the seg.
Bike/Ped	Bike facility length (ft) associated with the right side of the seg.
Bike/Ped	Bike facility length (ft) associated with the road centerline
Bike/Ped	Highest category of bikeway along the seg.
Bike/Ped	Percent of seg. length represented by all bike facilities
Bike/Ped	Percent of seg. length represented by all sidewalks
Bike/Ped	Percent of seg. length represented by centerline bike facilities
Bike/Ped	Percent of seg. length represented by left-side bike facilities
Bike/Ped	Percent of seg. length represented by left-side sidewalks
Bike/Ped	Percent of seg. length represented by right-side bike facilities
Bike/Ped	Percent of seg. length represented by right-side sidewalks
Bike/Ped	seg. has a trail crossing (0=no, 1=yes)
Bike/Ped	Sidewalk length (ft) associated with the left side of the seg.
Bike/Ped	Sidewalk length (ft) associated with the right side of the seg.
Bike/Ped	Total bike facility length (ft) associated with the seg.
Bike/Ped	Total number of crosswalks with median island along the seg.
Bike/Ped	Total number of high visibility crosswalks along the seg.
Bike/Ped	Total number of marked crosswalks along the seg.
Bike/Ped	Total sidewalk length (ft) associated with the seg.
Bikeshare	Density of Bikeshare Stations per sq. mile w/in 1/10 mile of the seg.
Bikeshare	Density of Bikeshare Stations per sq. mile w/in 1/2 mile of the seg.
Bikeshare	Density of Bikeshare Stations per sq. mile w/in 1/4 mile of the seg.
Direction	Whether a seg. is one-way or two-way
Driveways	Percent of area w/in 75 ft of seg. comprised of driveways
Elevation	Maximum slope along the seg., based on 500-foot intervals
Elevation	Mean slope along the seg., based on 500-foot intervals
Elevation	Minimum slope along the seg., based on 500-foot intervals
Lanes	Number of lanes
Parking	Density of Parking Garages and Lots per sq. mile w/in 1/10 mile of the seg.
Parking	Density of Parking Garages and Lots per sq. mile w/in 1/2 mile of the seg.
Parking	Density of Parking Garages and Lots per sq. mile w/in 1/4 mile of the seg.
Parking	Percent of area w/in 100 ft of seg. comprised of parking lots
Parking	Percent of area w/in 500 ft of seg. comprised of parking lots
Segment	Length of seg., in feet
Speed	Posted speed limit
Street Class	The roadway classifcation per the Centerlines file
Transit	Density of MARC Train Stations per sq. mile w/in 1/10 mile of the seg.

Category	Description
Transportation	
Transit	Density of MARC Train Stations per sq. mile w/in 1/2 mile of the seg.
Transit	Density of MARC Train Stations per sq. mile w/in 1/4 mile of the seg.
Transit	Density of Metro Stations per sq. mile w/in 1/10 mile of the seg.
Transit	Density of Metro Stations per sq. mile w/in 1/2 mile of the seg.
Transit	Density of Metro Stations per sq. mile w/in 1/4 mile of the seg.
Transit	Density of Park and Ride Lots per sq. mile w/in 1/10 mile of the seg.
Transit	Density of Park and Ride Lots per sq. mile w/in 1/2 mile of the seg.
Transit	Density of Park and Ride Lots per sq. mile w/in 1/4 mile of the seg.
Transit	Number of bus stops along the seg.
Transit	Number of commuter rail stops along the seg.
Transit	Number of metro stations along the seg.
Transit	Number of routes at all stops along the seg.
Land Use	
Aircraft	Density of Aircraft Facilities per sq. mile w/in 1/10 mile of the seg.
Aircraft	Density of Aircraft Facilities per sq. mile w/in 1/2 mile of the seg.
Aircraft	Density of Aircraft Facilities per sq. mile w/in 1/4 mile of the seg.
Alcohol	Density of Liquor Stores per sq. mile w/in 1/10 mile of the seg.
Alcohol	Density of Liquor Stores per sq. mile w/in 1/2 mile of the seg.
Alcohol	Density of Liquor Stores per sq. mile w/in 1/4 mile of the seg.
Alcohol	Density of off-premise alcoholic beverage locs per sq. mile w/in 1/10 mile of the seg.
Alcohol	Density of off-premise alcoholic beverage locs per sq. mile w/in 1/2 mile of the seg.
Alcohol	Density of off-premise alcoholic beverage locs per sq. mile w/in 1/4 mile of the seg.
Alcohol	Density of on/off-premise alcoholic beverage locs per sq. mile w/in 1/10 mile of the seg.
Alcohol	Density of on/off-premise alcoholic beverage locs per sq. mile w/in 1/2 mile of the seg.
Alcohol	Density of on/off-premise alcoholic beverage locs per sq. mile w/in 1/4 mile of the seg.
Alcohol	Density of on-premise alcoholic beverage locs per sq. mile w/in 1/10 mile of the seg.
Alcohol	Density of on-premise alcoholic beverage locs per sq. mile w/in 1/2 mile of the seg.
Alcohol	Density of on-premise alcoholic beverage locs per sq. mile w/in 1/4 mile of the seg.
Alcohol	Density of unknown alcoholic beverage locs per sq. mile w/in 1/10 mile of the seg.
Alcohol	Density of unknown alcoholic beverage locs per sq. mile w/in 1/2 mile of the seg.
Alcohol	Density of unknown alcoholic beverage locs per sq. mile w/in 1/4 mile of the seg.
Apartments	Density of Apartments per sq. mile w/in 1/10 mile of the seg.
Apartments	Density of Apartments per sq. mile w/in 1/2 mile of the seg.
Apartments	Density of Apartments per sq. mile w/in 1/4 mile of the seg.
Area Type	Activity center in which all or the majority of the seg. falls
Area Type	Complete Streets area type in which all or the majority of the seg. falls
Area Type	Municipality in which all or the majority of the seg. falls
Area Type	Policy area category (G, O, R, Y) in which all or the majority of the seg. fa
Area Type	Policy area in which all or the majority of the seg. falls

Category	Description
Land Use	
Business Parks	Density of Business Parks per sq. mile w/in 1/10 mile of the seg.
Business Parks	Density of Business Parks per sq. mile w/in 1/2 mile of the seg.
Business Parks	Density of Business Parks per sq. mile w/in 1/4 mile of the seg.
Cemeteries	Density of Cemeteries per sq. mile w/in 1/10 mile of the seg.
Cemeteries	Density of Cemeteries per sq. mile w/in 1/2 mile of the seg.
Cemeteries	Density of Cemeteries per sq. mile w/in 1/4 mile of the seg.
Cultural Facilities	Density of Cultural Facilities per sq. mile w/in 1/10 mile of the seg.
Cultural Facilities	Density of Cultural Facilities per sq. mile w/in 1/2 mile of the seg.
Cultural Facilities	Density of Cultural Facilities per sq. mile w/in 1/4 mile of the seg.
Federal Facilities	Density of Federal Facilities per sq. mile w/in 1/10 mile of the seg.
Federal Facilities	Density of Federal Facilities per sq. mile w/in 1/2 mile of the seg.
Federal Facilities	Density of Federal Facilities per sq. mile w/in 1/4 mile of the seg.
Fire Stations	Density of Federal Fire Stations per sq. mile w/in 1/10 mile of the seg.
Fire Stations	Density of Federal Fire Stations per sq. mile w/in 1/2 mile of the seg.
Fire Stations	Density of Federal Fire Stations per sq. mile w/in 1/4 mile of the seg.
Fire Stations	Density of Fire Stations per sq. mile w/in 1/10 mile of the seg.
Fire Stations	Density of Fire Stations per sq. mile w/in 1/2 mile of the seg.
Fire Stations	Density of Fire Stations per sq. mile w/in 1/4 mile of the seg.
Gas Stations	Density of Gas Stations per sq. mile w/in 1/10 mile of the seg.
Gas Stations	Density of Gas Stations per sq. mile w/in 1/2 mile of the seg.
Gas Stations	Density of Gas Stations per sq. mile w/in 1/4 mile of the seg.
Gov't Facilities	Density of MC Government per sq. mile w/in 1/10 mile of the seg.
Gov't Facilities	Density of MC Government per sq. mile w/in 1/2 mile of the seg.
Gov't Facilities	Density of MC Government per sq. mile w/in 1/4 mile of the seg.
Gov't Facilities	Density of Regional Services Centers per sq. mile w/in 1/10 mile of the seg.
Gov't Facilities	Density of Regional Services Centers per sq. mile w/in 1/2 mile of the seg.
Gov't Facilities	Density of Regional Services Centers per sq. mile w/in 1/4 mile of the seg.
Gov't Facilities	Density of State and Muni per sq. mile w/in 1/10 mile of the seg.
Gov't Facilities	Density of State and Muni per sq. mile w/in 1/2 mile of the seg.
Gov't Facilities	Density of State and Muni per sq. mile w/in 1/4 mile of the seg.
HHS Facilities	Density of HHS Facilities per sq. mile w/in 1/10 mile of the seg.
HHS Facilities	Density of HHS Facilities per sq. mile w/in 1/2 mile of the seg.
HHS Facilities	Density of HHS Facilities per sq. mile w/in 1/4 mile of the seg.
Hospitals	Density of Hospitals per sq. mile w/in 1/10 mile of the seg.
Hospitals	Density of Hospitals per sq. mile w/in 1/2 mile of the seg.
Hospitals	Density of Hospitals per sq. mile w/in 1/4 mile of the seg.
Libraries	Density of Libraries per sq. mile w/in 1/10 mile of the seg.
Libraries	Density of Libraries per sq. mile w/in 1/2 mile of the seg.
Libraries	Density of Libraries per sq. mile w/in 1/4 mile of the seg.

Category	Description
Land Use	
Lodging	Density of Lodging per sq. mile w/in 1/10 mile of the seg.
Lodging	Density of Lodging per sq. mile w/in 1/2 mile of the seg.
Lodging	Density of Lodging per sq. mile w/in 1/4 mile of the seg.
Places	Density of Places per sq. mile w/in 1/10 mile of the seg.
Places	Density of Places per sq. mile w/in 1/2 mile of the seg.
Places	Density of Places per sq. mile w/in 1/4 mile of the seg.
Police	Density of Police Facilities per sq. mile w/in 1/10 mile of the seg.
Police	Density of Police Facilities per sq. mile w/in 1/2 mile of the seg.
Police	Density of Police Facilities per sq. mile w/in 1/4 mile of the seg.
Police	Density of Police Stations per sq. mile w/in 1/10 mile of the seg.
Police	Density of Police Stations per sq. mile w/in 1/2 mile of the seg.
Police	Density of Police Stations per sq. mile w/in 1/4 mile of the seg.
Polling	Density of Polling Places per sq. mile w/in 1/10 mile of the seg.
Polling	Density of Polling Places per sq. mile w/in 1/2 mile of the seg.
Polling	Density of Polling Places per sq. mile w/in 1/4 mile of the seg.
Post Offices	Density of Post Offices per sq. mile w/in 1/10 mile of the seg.
Post Offices	Density of Post Offices per sq. mile w/in 1/2 mile of the seg.
Post Offices	Density of Post Offices per sq. mile w/in 1/4 mile of the seg.
Recreation	Density of Golf Courses per sq. mile w/in 1/10 mile of the seg.
Recreation	Density of Golf Courses per sq. mile w/in 1/2 mile of the seg.
Recreation	Density of Golf Courses per sq. mile w/in 1/4 mile of the seg.
Recreation	Density of Park Facilities per sq. mile w/in 1/10 mile of the seg.
Recreation	Density of Park Facilities per sq. mile w/in 1/2 mile of the seg.
Recreation	Density of Park Facilities per sq. mile w/in 1/4 mile of the seg.
Recreation	Density of Recreation Centers per sq. mile w/in 1/10 mile of the seg.
Recreation	Density of Recreation Centers per sq. mile w/in 1/2 mile of the seg.
Recreation	Density of Recreation Centers per sq. mile w/in 1/4 mile of the seg.
Recreation	Density of Swimming Pools per sq. mile w/in 1/10 mile of the seg.
Recreation	Density of Swimming Pools per sq. mile w/in 1/2 mile of the seg.
Recreation	Density of Swimming Pools per sq. mile w/in 1/4 mile of the seg.
Recreation	Density of YMCAs per sq. mile w/in 1/10 mile of the seg.
Recreation	Density of YMCAs per sq. mile w/in 1/2 mile of the seg.
Recreation	Density of YMCAs per sq. mile w/in 1/4 mile of the seg.
Recreation	Percent of area w/in 100 ft of seg. comprised of park land
Recreation	Percent of area w/in 500 ft of seg. comprised of park land
Religious	Density of Places of Worship per sq. mile w/in 1/10 mile of the seg.
Religious	Density of Places of Worship per sq. mile w/in 1/2 mile of the seg.
Religious	Density of Places of Worship per sq. mile w/in 1/4 mile of the seg.
Schools	Density of Colleges or Universities per sq. mile w/in 1/10 mile of the seg.

Category	Description
Land Use	
Schools	Density of Colleges or Universities per sq. mile w/in 1/2 mile of the seg.
Schools	Density of Colleges or Universities per sq. mile w/in 1/4 mile of the seg.
Schools	Density of Elementary Schools per sq. mile w/in 1/10 mile of the seg.
Schools	Density of Elementary Schools per sq. mile w/in 1/2 mile of the seg.
Schools	Density of Elementary Schools per sq. mile w/in 1/4 mile of the seg.
Schools	Density of High Schools per sq. mile w/in 1/10 mile of the seg.
Schools	Density of High Schools per sq. mile w/in 1/2 mile of the seg.
Schools	Density of High Schools per sq. mile w/in 1/4 mile of the seg.
Schools	Density of K-12 schools per sq. mile w/in 1/10 mile of the seg.
Schools	Density of K-12 schools per sq. mile w/in 1/2 mile of the seg.
Schools	Density of K-12 schools per sq. mile w/in 1/4 mile of the seg.
Schools	Density of Middle Schools per sq. mile w/in 1/10 mile of the seg.
Schools	Density of Middle Schools per sq. mile w/in 1/2 mile of the seg.
Schools	Density of Middle Schools per sq. mile w/in 1/4 mile of the seg.
Schools	Density of Private Schools per sq. mile w/in 1/10 mile of the seg.
Schools	Density of Private Schools per sq. mile w/in 1/2 mile of the seg.
Schools	Density of Private Schools per sq. mile w/in 1/4 mile of the seg.
Schools	Density of Special Schools per sq. mile w/in 1/10 mile of the seg.
Schools	Density of Special Schools per sq. mile w/in 1/2 mile of the seg.
Schools	Density of Special Schools per sq. mile w/in 1/4 mile of the seg.
Schools	Density of universities and colleges per sq. mile w/in 1/10 mile of the seg.
Schools	Density of universities and colleges per sq. mile w/in 1/2 mile of the seg.
Schools	Density of universities and colleges per sq. mile w/in 1/4 mile of the seg.
Senior Centers	Density of Senior Centers per sq. mile w/in 1/10 mile of the seg.
Senior Centers	Density of Senior Centers per sq. mile w/in 1/2 mile of the seg.
Senior Centers	Density of Senior Centers per sq. mile w/in 1/4 mile of the seg.
Shopping Centers	Density of Shopping Centers per sq. mile w/in 1/10 mile of the seg.
Shopping Centers	Density of Shopping Centers per sq. mile w/in 1/2 mile of the seg.
Shopping Centers	Density of Shopping Centers per sq. mile w/in 1/4 mile of the seg.
Demographics	
Age	Older Adult Concentration Relative to Regional Average
Age	Older Adult Population
Age	Percent Older Adult
Age	Percent of the population 65 years of age and up w/in 1/10 mile of the seg.
Age	Percent of the population 65 years of age and up w/in 1/2 mile of the seg.
Age	Percent of the population 65 years of age and up w/in 1/4 mile of the seg.
Age	Percent of the population under 18 years of age w/in 1/10 mile of the seg.
Age	Percent of the population under 18 years of age w/in 1/2 mile of the seg.
Age	Percent of the population under 18 years of age w/in 1/4 mile of the seg.

Category	Description
Demographics	
Disabilities	Percent Persons with Disabilities
Disabilities	Persons with Disabilities
Disabilities	Persons with Disabilities Concentration Relative to the Regional Average
EEAs	Located w/in an Equity Emphasis Area
Employment	Employment density (people per sq. mile) w/in 1/10 mile of the seg.
Employment	Employment density (people per sq. mile) w/in 1/2 mile of the seg.
Employment	Employment density (people per sq. mile) w/in 1/4 mile of the seg.
Income	Low Income Concentration Relative to Regional Average
Income	Low Income Population
Income	Median household income w/in 1/10 mile of the seg.
Income	Median household income w/in 1/2 mile of the seg.
Income	Median household income w/in 1/4 mile of the seg.
Income	Percent Low Income
Income	Percent of households with income of $100,000 or more w/in 1/10 mile of the seg.
Income	Percent of households with income of $100,000 or more w/in 1/2 mile of the seg.
Income	Percent of households with income of $100,000 or more w/in 1/4 mile of the seg.
Income	Percent of households with income of $150,000 or more w/in 1/10 mile of the seg.
Income	Percent of households with income of $150,000 or more w/in 1/2 mile of the seg.
Income	Percent of households with income of $150,000 or more w/in 1/4 mile of the seg.
Income	Percent of households with income of $200,000 or more w/in 1/10 mile of the seg.
Income	Percent of households with income of $200,000 or more w/in 1/2 mile of the seg.
Income	Percent of households with income of $200,000 or more w/in 1/4 mile of the seg.
Income	Percent of the pop with income less than 1.5x the poverty level w/in 1/10 mile the seg.
Income	Percent of the pop with income less than 1.5x the poverty level w/in 1/2 mile of the seg.
Income	Percent of the pop with income less than 1.5x the poverty level w/in 1/4 mile of the seg.
Language	Limited English Proficiency Concentration Relative to Regional Average
Language	Limited-English Proficiency Population
Language	Percent Limited English Proficiency
Population	Population density (people per sq. mile) w/in 1/10 mile of the seg.
Population	Population density (people per sq. mile) w/in 1/2 mile of the seg.
Population	Population density (people per sq. mile) w/in 1/4 mile of the seg.
Race/Ethnicity	African American Concentration Relative to Regional Average
Race/Ethnicity	African American Population
Race/Ethnicity	Asian Concentration Relative to Regional Average
Race/Ethnicity	Asian Population
Race/Ethnicity	Latino Concentration Relative to Regional Average
Race/Ethnicity	Latino Population
Race/Ethnicity	Percent African American
Race/Ethnicity	Percent Asian
Race/Ethnicity	Percent Latino

Appendix B. Count Data Collection Plan

TOOLE DESIGN

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MEMORANDUM

July 6, 2022

To: Jesse Cohn, AICP; David Anspacher
Organization: Maryland-National Capital Parks and Planning Commission
From: Frank Proulx, PhD; Thomas Hillman, AICP
Project: Pedestrian Master Plan Support – Task 5: Data Consolidation

Re: Count Data Collection Plan

Introduction

This memorandum summarizes an effort to identify additional multimodal traffic count locations throughout Montgomery County, which will be used as inputs for Montgomery County's Predictive Safety Analysis to identify high risk locations for bicycle, pedestrian, and motor vehicle crashes. The Predictive Safety Analysis approach requires developing an understanding of activity patterns for all modes based primarily on existing counts or estimates of transportation network activity in a given location, which are generally not widely available for all modes. Montgomery County already has an extensive count program, combining counts collected by Montgomery County Department of Transportation (MCDOT), Montgomery Planning, and the Maryland State Highway Authority (SHA). The majority of these are turning movement counts collected at intersections, but MCDOT also collected vehicle and bicycle counts at a small set of midblock segment locations. Many of the existing intersection counts do include pedestrians, bicyclists, and motor vehicles, although the vast majority of them were conducted on arterial roads, which therefore may not be representative of volumes on other road types found throughout the county. Generally, demographic variables, such as income and population density are well-represented in existing counts, as are the Montgomery Planning Policy Area land use contexts, except very-low-density land uses and low population and employment densities. More detail on representativeness of existing counts is provided in the Assess Existing Counts section of this memo.

To build a more representative sample of count locations countywide, short-duration count (SDC) locations should reflect the variety of motor vehicle, bicycle and pedestrian activity patterns across the entire county. Including both high- and low-level activity count locations creates a more accurate portrait of driving, bicycling, and pedestrian levels across Montgomery County. If Montgomery Planning were to only collect SDCs at areas with high counts, such as near Metrorail stations, the pedestrian plaza on Ellsworth Drive in downtown Silver Spring, or on popular shared use paths, counts (and, as a downstream consequence, estimated crashes) at lower volume locations would be overpredicted. More accurate volume and crash prediction estimates can be achieved by collecting

counts from locations with a greater variety of activity levels and location contexts. The goal of the location selection procedure detailed and implemented in this memorandum is to improve representativeness of the count dataset in preparation for a traffic volume modeling and crash prediction project.

While Montgomery County's count dataset is not perfectly representative, and it is sufficiently large and varied that exposure models could be successfully estimated. Expanding the available count dataset to fill gaps in locations types such as unsignalized intersections on local roads in low density areas outside of Bicycle/Pedestrian Priority Areas will help to improve modeling efforts, but the lack of this data should not preclude Montgomery Planning from proceeding with their crash analysis, particularly in light of current disruptions to normal travel patterns. If data is to be collected, it would be preferable to collect counts from the top 20-30 ranked locations, as these would fill major gaps in the current data scheme as location types with many similar intersections and a small number of counts collected.

The process detailed in this memorandum involved the following key steps:

1. Develop Intersection Layer
2. Consolidate Contextual Data
3. Consolidate Count Data
4. Assess Existing Count Data
5. Develop Intersection Typology
6. Identify New Count Locations
7. Prioritize New Count Locations

Each of these steps is discussed in greater detail throughout this memorandum, including key assumptions made and intermediate results of each step.

Develop Intersection Layer

The first major step in this process involved developing a master intersection file, as one was not available for the county. We first identified all apparent intersections using OpenStreetMap road data combined with Montgomery County trail data. This approach, while comprehensive, led to multiple false positives. To make the intersection layer more reflective of existing roadway conditions, we performed the following clean-up steps:

- Combined intersections within 30 feet of one another, which is intended to remove false intersections on "dual carriageway" roads, or those that have been encoded using two separate lines for the different traffic directions,
- Removed any 1 or 2 legged "intersections," which can happen when a street changes name, and
- Removed any "intersections" with access-controlled highways, which are in many cases overpasses or underpasses, not intersections.

This process was not expected to yield a perfectly accurate intersection dataset but was expected to be sufficient for the purposes of planning additional count data collection.

Consolidate Contextual Data

With the "master" intersection layer constructed, we joined contextual details from other datasets that may help explain expected differences motor vehicle, bicycle, or pedestrian volumes, as detailed in Table 1. Additional information about some variables, specifically roadway type and bikeway type are included after the table.

Table 1. Intersection contextual variables definition.

Variable	Description	Source	Notes
Population Density	Average population density within ½ mi of the intersection	American Community Survey (2013-2017)	Aggregated from Census Block Groups using proportional weighted average.
Employment Density	Average employment density within ½ mi of the intersection	Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics (2002-2017)	Does not account for “headquartering” (employees report to a different location). Proportional weighted average of Census Blocks containing each employment location.
Average Median Household Income	Average value within ½ mi of the intersection	American Community Survey (2013-2017)	Proportional weighted average of Census Block Groups.
Distance to Nearest Bus Stop	Euclidian distance, in miles, from intersection to nearest bus stop	Washington Metropolitan Area Transit Authority, Montgomery County Department of Transportation	
Distance to Nearest Major Transit Stop (MetroRail, MARC)	Euclidian distance, in miles, from intersection to nearest major transit stop	Washington Metropolitan Area Transit Authority (MetroRail) and Maryland Transportation Administration Maryland Area Regional Commuter (MARC)	
Roadway Type	“Highest” functional classification or road type most expected to affect pedestrian, bicyclist, and motor vehicle volumes.	Montgomery County Master Plan of Highways and Transitways, Montgomery County Street Centerlines	See detailed roadway type definitions below.
Bikeway Type	Highest level of protection for bicyclists at intersection approaches	Montgomery Planning	See detailed bikeway type definitions below.

Signalization	Binary indicator for whether the intersection is signalized	Montgomery County Department of Transportation	
Policy Area	Categorical indicator for whether an intersection is within a Montgomery Planning Policy Areas	Montgomery Planning	Values have been coded as R=High Density, O= Medium Density, Y = Low Density, and G = Very Low Density
Bicycle and Pedestrian Priority Area	Binary indicator for whether intersection is within a Bicycle and Pedestrian Priority area	Montgomery County Department of Transportation	

Roadway Type

The roadway type field is defined based on a combination of the Master Plan of Highways and Transitways (MPOHT) dataset and the Montgomery County street centerlines file. MPOHT contains descriptive fields for a number of specific types of streets, but it is not comprehensive of all streets in the county. The street centerlines file, on the other hand, covers all streets, but does not contain as nuanced of a description of the road classification. To combine and simplify these two datasets, we grouped similar roadway types together, ranked the groups based on their expected importance in predicting multimodal traffic volumes, and assigned the highest ranked category to the intersection. The groupings, in rank order, are shown in Table 2.

Table 2. Roadway classification assignment scheme.

Rank	Roadway Type	Montgomery County MPOHT Road Classifications	Montgomery County Street Centerlines Codes
1	Freeway	Freeway with HOV Lanes Freeway with planned HOV Lanes Freeway with planned BRT Freeway Controlled Major Highway Controlled Major Highway with planned BRT	A10
2	Highway Ramps	—	A00
3	Arterial	Major Highway Major Highway with planned BRT Major Highway with planned BRT and light rail Arterial Arterial with planned BRT Arterial with planned light rail	A20, A30
4	Business	Business Business with planned BRT Business with planned light rail	
5	Minor Arterial	Minor Arterial with planned BRT Minor Arterial Minor Arterial with planned light rail Country Arterial Parkway	
6	Industrial	Industrial	
7	Country Road	Rustic Road Exceptional Rustic Road Country Road	
8	Primary Residential	Primary Residential	
9	Local	Local Neighborhood	A40, A50
10	Trail	Trail	

With intersections classified in this way, we finally removed any intersections that were classified as trail, as these are simply intersections of multiple trails where crash data is generally not collected.

Bikeway Type

The bikeway type field is defined based on the Montgomery County Bicycle Master Plan bicycle network, with all shared use path types consolidated. Table 3 summarizes the order that was used to assess the bikeway at a given intersection – that is, each intersection was associated with the highest ranked proximate bikeway.

Table 3. Bikeway priority for intersection assignment.

Rank	Roadway Type	Montgomery County Bicycle Network Values
1	Shared Use Path	Trail Park Trail Sidepath Neighborhood Connector School Connector
2	Separated Bike Lane	Separated Bike Lanes
3	Bike Lane	Conventional Bike Lanes
4	Bikeable Shoulder	Bikeable Shoulders
5	No Bikeway	No Bicycle Facility

Consolidate Count Data

The final element of data consolidation involved the historically available count data. Multimodal intersection count data was provided from three distinct databases:

- M-NCPPC's internal count database
- MCDOT's count database
- SHA's count database

These count datasets generally follow standard turning-movement count formats, with 15-minute or hourly count observations for each multimodal turning movement at each observation location. However, two specific cleaning steps were taken when evaluating this data:

- The SHA database contains bicycle movements coded as pedestrian maneuvers, rather than as vehicular turning movements. The primary anticipated use of this data in the Predictive Safety Analysis project is to develop segment-level bicycle volume models. However, these counts cannot be reconciled onto road segments, and therefore are not included in the evaluated data. In these instances, only the bicycle counts were excluded from evaluation; pedestrian and motor vehicle counts remained in the consolidated dataset to be evaluated.
- For some count files, count values were recorded as 0 when in fact data was not collected. For instance, count data may have only been taken during the AM and PM peak periods, but an entire 24-hour count dataset was stored. To evaluate this, for every observation period (i.e., 15-minute interval), we summed the preceding and subsequent 2-hour period, including the observation period, for motor vehicle traffic volumes. If either of these values is 0, all observations for all modes for that time period and location were not included in the dataset, as they are not expected to be true counts.

After cleaning the count data as described above, we calculated the total number of hours counted in a single day by mode and location for each original count database. The largest total number of hours among the three databases for a given location and mode was then selected. For purposes of planning the collection of additional count data, we recommend that any location with less than a 4-hour count not be included in the analysis of this

data, as the errors in extrapolating this data to annualized estimates are expected to have cascading effects on the accuracy of the predictive volume model.

To get a better sense of the distribution of locations with count data for at least 4 hours in a single day for both vehicle, pedestrian, and bicycle counts (Table 4), we compared their totals when categorized by data source. The source datasets shown here reflect the dataset with the longest (up to 24 hours) single day and most recent complete count observation for a given mode, as some intersections have been counted by different agencies. For instance, an intersection with a 24 hour vehicle count on 2/14/2016 in the MCDOT dataset and a 4 hour vehicle count on 5/28/2018 in the M-NCPPC dataset would be categorized as an MCDOT observation. As can be seen, approximately 10% of locations that have sufficient vehicle and pedestrian count data do not have sufficient bicycle count data for analysis purposes, as shown in the 600 available bicycle count locations compared with 666 vehicle/pedestrian count locations.

Table 4. Number of intersections with counts per source dataset and count type.

Data Source	Vehicle/Pedestrian Counts			Bicycle Counts		
	Shorter than 4 hours	4 hours or longer	Total Intersections	Shorter than 4 hours	4 hours or longer	Total Intersections
M-NCPPC	2	317	319	2	329	331
MCDOT	55	177	232	0	99	99
SHA	1	172	173	1	172	173
No Count	0	0	15,278	0	0	15,399
Total	**58**	**666**	**16,002**	**3**	**600**	**16,002**

In addition to the intersection turning movement count datasets described above, MCDOT also has collected vehicle count data at 206 midblock locations and bicycle count data at 117 midblock locations. This data was not considered in the location prioritization process because it does not include pedestrian counts and does not provide as much detail on movements as the turning movement count data. However, this data will likely be useful for exposure model development purposes. This data is not extensively described here, but the roadway types where it was collected are briefly discussed below.

Assess Existing Count Data

With the master intersection table completed, we turned our attention to evaluating coverage of current count data across various dimensions. We evaluated the univariate distributions of count data availability for some of the potential volume predictor variables.

Roadway Type

First, the roadway type variable is presented in

Table 5. Arterials have extensive coverage due to the fact that MCDOT and SHA collected the majority of the count data represented in the consolidated dataset. However, most other roadway types do not have a substantial number of counts collected. Local and Primary Residential roadways, in particular, are dramatically under-represented relative to the total number of intersections.

Table 5. Intersection count availability by roadway type.

Roadway Type	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
Local	63	38	10,137	0.4%
Arterial	534	505	4,079	12.4%
Primary Residential	22	12	1,363	0.9%
Business	16	14	196	7.1%
Freeway	26	26	68	38.2%
Country Road	0	0	67	0.0%
Minor Arterial	1	1	56	1.8%
Industrial	1	1	27	3.7%
Highway Ramps	3	3	9	33.3%
Total	**666**	**600**	**16,002**	**3.7%**

The MCDOT segment data provides additional coverage for vehicle and bicycle counts in some of these contexts, as shown in Table 6. The segment count data may help to fill gaps for both local and primary residential locations.

Table 6. Segment counts by roadway type.

Roadway Type	Vehicle Counts	Bicycle Counts
Local	95	50
Arterial	81	47
Primary Residential	25	15
Business	2	2
Country Road	2	2
Minor Arterial	1	1
Total	**206**	**117**

Both the vehicle/pedestrian counts and bicycle counts are roughly evenly distributed between signalized and unsignalized locations, per Table 7, although signalized intersections are dramatically over-represented relative to the number of intersections, given how many more intersections throughout the county do not have signals present.

Table 7. Count availability by intersection signalization.

Signalization	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
Unsignalized	296	236	15,333	1.5%
Signalized	370	364	669	54.4%
Total	**666**	**600**	**16,002**	**3.7%**

Census Data

For Census-related datasets, we generally see higher representation of counts in higher population density and higher employment density locations, as well as in lower income areas, although the distribution across income levels is more even. The quintiles of these variables for ½ mile buffers around the intersections are shown in Table 8 – Table 10.

Table 8. Count availability by population density.

½ Mile Population Density Quintile (People/Square Mile)	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
0 – 2,250	69	60	3,201	1.9%
2,251 – 3,862	117	106	3,201	3.3%
3,863 – 5,352	136	122	3,200	3.8%
5,353 – 7,268	123	110	3,200	3.4%
> 7,269	221	202	3,200	6.3%
Total	**666**	**600**	**16,002**	**3.7%**

Table 9. Count availability by employment density.

½ Mile Employment Density Quintile (Jobs/Square Mile)	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
0 – 314	35	29	3,201	0.9%
315 – 749	76	68	3,201	2.1%
750 – 1,455	95	80	3,200	2.5%
1,456 – 3,501	157	143	3,200	4.5%
> 3,502	303	280	3,200	8.8%
Total	**666**	**600**	**16,002**	**3.7%**

Table 10. Count availability by surrounding median household income.

½ Mile Average Median Household Income Quintile (USD)	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
$0 - $93,575	190	174	3,201	5.4%
$93,576 - $11,5567	138	129	3,201	4.0%
$115,568 - $13,8749	130	122	3,200	3.8%
$138,750 - $17,3064	118	102	3,200	3.2%
> $173,065	90	73	3,200	2.3%
Total	**666**	**600**	**16,002**	**3.7%**

Land Use Data

When considering land use context based on the policy area type (Table 11), we see that there are relatively few counts at locations in policy area type “Green” (very low density locations), consistent with the findings surrounding population and employment density.

Table 11. Count availability by policy area.

Policy Area	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
Very Low Density (Green)	23	22	1,330	1.7%
Low Density (Yellow)	163	145	6,221	2.3%
Medium Density (Orange)	355	311	7,835	4.0%
High Density (Red)	125	122	616	19.8%
Total	**666**	**600**	**16,002**	**3.7%**

Counts are also relatively evenly distributed between locations in Bicycle and Pedestrian Priority Areas (BiPPAs), per Table 12. More counts are conducted outside of BiPPAs, but locations inside BiPPAs are proportionally more heavily represented.

Table 12. Count availability within Bicycle and Pedestrian Priority Areas.

Bicycle and Pedestrian Priority Area	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
Outside BiPPA	416	363	14,550	2.5%
Within BiPPA	250	237	1,452	16.3%
Total	**666**	**600**	**16,002**	**3.7%**

Bikeway Type

In consideration of bicycle counts specifically, the bicycle facilities present are expected to be an important predictor of volumes (**Table 13**). As can be seen, bikeable shoulder locations may be under-represented, but otherwise there is good coverage by bikeway type. Shared use paths can be used by pedestrians or bicyclists and include trails, sidepaths, and other shared use connectors not for use by motor vehicles. It should be noted that while the county's intersections currently have bicycle infrastructure, this analysis did not evaluate the presence of bicycle infrastructure at the time the bicycle counts were conducted.

Table 13. Bicycle count availability by bikeway type.

Bikeway Type	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
Shared Use Path	111	1,150	9.7%
Separated Bike Lane	18	30	60.0%
Bike Lane	49	322	15.2%
Bikeable Shoulder	3	32	9.4%
No Bikeway	419	14,468	2.9%
Total	**600**	**16,002**	**3.7%**

Proximity to Transit

Transit is also known to be an important predictor of multimodal traffic volumes, particularly for pedestrian volumes. For this, we evaluated both proximity to rail stations (Table 14) and to the nearest bus stop (Table 15). There is good coverage across a range of distances to bus stops. There are a small absolute number of counted intersections within ¼ mile of rail stations, but compared with the number of such intersections, there appears to be good coverage for this type of location.

Table 14. Count availability by distance to nearest rail station.

Distance to nearest rail station	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
< 0.25 mi.	18	16	206	7.8%
0.25 - 0.5 mi.	37	32	508	6.3%
0.5 - 1 mi.	67	55	1,628	3.4%
1+ mi.	544	497	13,660	3.6%
Total	**666**	**600**	**16,002**	**3.7%**

Table 15. Count availability by distance to nearest bus stop.

Distance to nearest bus stop	Vehicle/Pedestrian Counts	Bicycle Counts	Total Intersections	Percent with Bicycle Counts
< 0.1 mi.	264	255	2,013	12.7%
0.1 - 0.25 mi.	78	70	2,520	2.8%
0.25 - 0.5 mi.	69	52	2,796	1.9%
0.5 - 1 mi.	62	51	2,378	2.1%
> 1 mi.	193	172	6,295	2.7%
Total	**666**	**600**	**16,002**	**3.7%**

In summary, Montgomery County's count data is generally well distributed on a number of potentially important explanatory variables. Non-arterial roads (especially local and primary residential roads) are underrepresented compared to their total mileage in the County. Very low-density policy areas are also underrepresented, captured through population and employment density and the policy area variable. Aside from these variables, other context and roadway characteristics associated with pedestrian, bicycle, and activity volume have a reasonably representative distribution of counts.

Develop Intersection Typology

After exploring the availability of count data in recent years, the following variables were selected as likely predictors of differences in multimodal traffic volumes, because they succinctly summarize both the transportation and land use context of each intersection:

1. Roadway type
2. Bikeway type
3. Signalization
4. Policy area type
5. Located within a BiPPA

Roadway type was selected as the first variable to be considered, as it is a large number of categories that should be reflected in the final distribution of count locations. Bikeway type was added next, as the focus on under-representation of bicycle volumes underscores the importance of achieving good coverage on this variable in particular. Next, signalization was considered, as while signalized and unsignalized locations had approximately even numbers of count locations in aggregate, unsignalized intersections on particular roadway types may be relatively under-represented. These three variables were considered to reflect the transportation network characteristics.

Surrounding land use context can also be an important determinant of multimodal traffic volumes. While population density and employment density are frequently used, Montgomery County's policy area variable has been identified to serve as a proxy for these variables. Finally, BiPPAs were added as a means of differentiating potential bicycle and pedestrian activity in otherwise similar density land use contexts. Bus stops are well-distributed in existing count data, and major transit stops represent just a few locations that are also well-represented in the existing data, so they were not included in the intersection typology.

We used these variables to algorithmically define an intersection typology to inform the sampling plan. Sampling within a defined intersection type is intended to account for the overlapping effects of different variables. For instance, an unsignalized residential intersection in a low-density part of the county is likely to see different

volume levels than an unsignalized residential intersection in a high-density part of the county. If these variables were considered independently for intersection identification, the lack of counts in the two different contexts would likely be missed.

The intersection typology was defined according to the following process:

1. Split the intersections according to the first variable (roadway type)
2. Attempt to split intersections using the second variable. If a given category does not have more than 50 locations throughout the county, do not split those values into their own category, and instead pool any such categories. For instance, for a given roadway type, we may have 120 intersections with no bikeway, 24 with a bike lane, and 2 with a separated bike lane. These would be classified as 120 with no bikeway and 26 with “any bikeway”.
3. Repeat Step 2 for remaining variables.

When applied to the intersections generated for Montgomery County with the five variables shown above, this resulted in 64 distinct types of intersections, which are summarized in Appendix A in terms of how many total such intersections exist, and how many have valid count data of each type.

Identify New Count Locations

With all intersections assigned a type, the intersection types were then used as a sampling frame for a stratified random sample of new count locations. To inform this, targets for the number of count locations per intersection type were set according to Table 16. For example, for an intersection type with 83 intersections and 3 bicycle counts, 2 additional intersections were randomly selected (because the target for intersection types with 50 to 100 locations is 5 counts). These values were selected to avoid over-emphasizing non-representative locations, while understanding that some of these locations may have specific characteristics worth observing in the count data.

Table 16. Target number of count locations.

Number of Intersections	Target Number of Count Locations
0-5	0
6-50	2
51-100	5
> 100	10

The sampling was performed relative to the number of bicycle counts, specifically, because these are the most limited in the count database. An initial sampling with these targets yielded 152 potential locations. However, upon inspection, some of the identified locations were found to be duplicative. A manual screen was performed to remove these cases, such as:

- Multiple locations of the same intersection type in close proximity along a single street
- Multiple locations of the same intersection type clustered together, such as unsignalized local streets with no bikeway in high density activity centers
- Locations along streets that were flagged as intersections due to inconsistencies in data coding (i.e. flagged as road in OpenStreetMap and as trail in the countywide trails dataset), such as Hoyles Mill Road
- Any intersection flagged by Montgomery Planning staff as not ideal
- Intersections within incorporated jurisdictions (with the exception of Takoma Park)

After this manual removal of select locations, 93 potential locations remained.

Prioritize New Count Locations

Finally, we prioritized the identified locations based on how much of an existing gap in data they filled. This followed an iterative prioritization scheme, where locations were ranked one at a time. After a given location was ranked, scoring of the remaining potential locations was carried out assuming that the first location was a location where data was collected. In other words, this assumes that Montgomery Planning would follow the ranked list in order. Potential count locations were scored based on the difference between the current number of locations, including identified higher priority locations, with counts in the category and the target number of count sites for categories with similar numbers of matching locations, as detailed in Table 16. For instance, if a given identified new sample location came from a group with 350 similar locations and 3 count sites in the current data, it would receive a priority score of 7 (10 target sites – 3 current count sites).

One randomly selected site from the highest scoring group was selected at a time and added to the priority list. Following this same example, if the same sample location was selected through this process, in the next iteration locations similar to that site would receive a score of 6. This process was repeated until all new sample locations had been ranked.

The results of the sampling and prioritization process are detailed in Table 17.

Table 17. Prioritized Intersection Locations for Count Data Collection

Rank	Intersection Name	Location	Category
1	Peggy Lane and Spencer Road	Silver Spring	Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA
2	Eugene Street and Kimberly Street	Wheaton	Local, No Bikeway, Unsignalized, High Density, Outside BiPPA
3	Madison Street and Nimitz Road	North Kensington	Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA
4	Garrett Park Road and Rock Creek Trail	Wheaton	Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA
5	Golf Estates Drive and Sand Trap Drive	Montgomery County	Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
6	Coronada Place and Faulkner Place	Wheaton	Local, No Bikeway, Unsignalized, High Density, Outside BiPPA
7	Brookmead Drive and Finegan Drive	Darnestown	Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
8	Friendlywood Road and Perrywood Drive	Fairland	Primary Residential, No Bikeway, Unsignalized, Low Density, Outside BiPPA
9	Chase Crossing Circle and Hubbard Drive	North Bethesda	Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA
10	Greenwich NP and Moorland Lane and Northfield Road	Bethesda	Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA
11	College View Drive and Estona Drive	North Kensington	Local, No Bikeway, Unsignalized, High Density, Outside BiPPA
12	Bloom Drive and Nickelby Drive	Damascus	Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
13	Barkwood Drive and Nadine Drive	Aspen Hill	Primary Residential, No Bikeway, Unsignalized, Low Density, Outside BiPPA
14	Bristol Manor Court and Stonehenge Place	North Bethesda	Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA
15	Rock Creek Trail and Wexford Drive	North Kensington	Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA
16	Brushwood Terrace and Brushwood Way	Travilah	Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
17	Cartwright Way and Lake Winds Way	North Potomac	Primary Residential, No Bikeway, Unsignalized, Low Density, Outside BiPPA
18	Burling Road and Burling Terrace and Cornish Road	Bethesda	Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA
19	Clarks Crossing Drive and Sugarloaf Chapel Drive	Clarksburg	Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA
20	Cavanaugh Drive and Daphney House Way	North Potomac	Primary Residential, No Bikeway, Unsignalized, Low Density, Outside BiPPA
21	Cold Meadow Way and Park Vista Drive	Aspen Hill	Local, Shared Use Path, Unsignalized, Low Density, Outside BiPPA
22	Crystal Rock Drive and Rhinestone Drive	Germantown	Minor Arterial, Any Bikeway, Unsignalized, Any Policy Area Type, Any BiPPA
23	Copperfield Lane and Kelley Farm Drive	Darnestown	Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
24	Horizon Terrace and Muncaster Road	Redland	Arterial, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
25	Farnell Drive and Holdridge Road	Glenmont	Local, No Bikeway, Unsignalized, High Density, Within BiPPA

Rank	Intersection Name	Location	Category
26	Bayfield Street and Glenville Road	Silver Spring	Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA
27	Douglas Avenue and McComas Avenue and Saint Margarets Way	Wheaton	Primary Residential, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA
28	Greentree Road and Grubby Thicket Way	North Bethesda	Primary Residential, Shared Use Path, Unsignalized, Any Policy Area Type, Outside BiPPA
29	Edgevale Road and Watson Road	Silver Spring	Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA
30	Lamberton Drive and North Belgrade Road	Kemp Mill	Primary Residential, No Bikeway, Unsignalized, Medium Density, Outside BiPPA
31	Burdette Lane and Roger Drive	Montgomery County	Country Road, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
32	July Drive and Stewart Lane	White Oak	Minor Arterial, Any Bikeway, Unsignalized, Any Policy Area Type, Any BiPPA
33	Jackson Road and Paint Branch Trail and Willow Wood Drive	White Oak	Primary Residential, Shared Use Path, Unsignalized, Any Policy Area Type, Outside BiPPA
34	Jingle Lane and Weller Road	Glenmont	Local, No Bikeway, Unsignalized, High Density, Within BiPPA
35	Flower Avenue and Normandy Drive	Silver Spring	Primary Residential, No Bikeway, Unsignalized, Medium Density, Outside BiPPA
36	Coppelia Drive and Heartwood Drive	Montgomery County	Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
37	Bou Avenue and California Circle	North Bethesda	Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA
38	April Lane and November Circle and White Oak Vista Drive	White Oak	Primary Residential, No Bikeway, Unsignalized, Medium Density, Within BiPPA
39	Orchard Brook Drive and Orchard Brook Terrace	Potomac	Local, No Bikeway, Unsignalized, Low Density, Outside BiPPA
40	Parker Avenue and Wheaton Regional Trail	Wheaton	Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA
41	Sugarland Road and Whites Ferry Road	Montgomery County	Arterial, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
42	Bauer Drive and Emory Lane	Aspen Hill	Primary Residential, No Bikeway, Unsignalized, Low Density, Outside BiPPA
43	Howard Chapel Drive and Sharon Street	Damascus	Country Road, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
44	Cherry Branch Drive and Marc Cocozzella Trail and Persimmon Ridge Road	Clarksburg	Local, Shared Use Path, Unsignalized, Low Density, Outside BiPPA
45	Harling Lane and Tilbury Street	Bethesda	Primary Residential, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA
46	Charles Road and Edgebrook Road	Wheaton	Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA
47	Broadleaf Road and Kings Crossing Boulevard	Germantown	Local, Shared Use Path, Unsignalized, Low Density, Outside BiPPA

Rank	Intersection Name	Location	Category
48	Carrisa Way and Headwaters Drive	Olney	Primary Residential, Shared Use Path, Unsignalized, Any Policy Area Type, Outside BiPPA
49	Lanark Way and Markham Street	Four Corners	Primary Residential, No Bikeway, Unsignalized, Medium Density, Outside BiPPA
50	Derwood Street and Yellowstone Way	Derwood	Local, No Bikeway, Unsignalized, High Density, Within BiPPA
51	Marketree Circle and Marketree Court	Montgomery Village	Local, No Bikeway, Unsignalized, Low Density, Outside BiPPA
52	Antares Drive and Fontana Lane	Montgomery County	Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
53	Grosvenor Lane and Hatherleigh Drive and Hurst Street	North Bethesda	Minor Arterial, Any Bikeway, Unsignalized, Any Policy Area Type, Any BiPPA
54	Bonifant Road and Sandy Ridge Road	Cloverly	Arterial, Bike Lane, Unsignalized, Low Density, Outside BiPPA
55	Manchester Road and Schuyler Road	Silver Spring	Primary Residential, No Bikeway, Unsignalized, Medium Density, Within BiPPA
56	Chestnut Street and Tilbury Street	Chevy Chase	Primary Residential, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA
57	Bonny Brook Lane and Hawkins Creamery Road	Damascus	Arterial, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
58	Somerset Terrace and The Hills Plaza	Montgomery County	Business, No Bikeway, Unsignalized, High Density, Within BiPPA
59	Galway Bay Circle and Kildare Hills Terrace	Germantown	Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA
60	Kentsdale Drive and Newbridge Drive	Potomac	Primary Residential, No Bikeway, Unsignalized, Low Density, Outside BiPPA
61	Citadel Avenue and Old Georgetown Road	North Bethesda	Business, No Bikeway, Unsignalized, High Density, Within BiPPA
62	Decatur Avenue and Saint Paul Street	North Kensington	Primary Residential, No Bikeway, Unsignalized, Medium Density, Within BiPPA
63	Epping Road and Epping Terrace	Glenmont	Local, No Bikeway, Unsignalized, High Density, Within BiPPA
64	Blackthorn Court and Sunflower Drive	Aspen Hill	Primary Residential, No Bikeway, Unsignalized, Low Density, Outside BiPPA
65	Lindell Street and Newton Street	Wheaton	Primary Residential, No Bikeway, Unsignalized, Medium Density, Outside BiPPA
66	Broadway Avenue and Lapwing Way	Clarksburg	Business, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA
67	Blair Road and Blair Road Northwest and Eastern Avenue Northwest	Silver Spring	Business, No Bikeway, Unsignalized, Medium Density, Outside BiPPA
68	Calverton Boulevard and Shanandale Drive	Calverton	Minor Arterial, Any Bikeway, Unsignalized, Any Policy Area Type, Any BiPPA
69	Seneca Road and Spring Meadows Drive	Darnestown	Arterial, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
70	Comus Road and Frederick Road	Montgomery County	Arterial, No Bikeway, Unsignalized, Very Low Density, Within BiPPA

Rank	Intersection Name	Location	Category
71	Richter Farm Road and Smokewood Drive	Germantown	Arterial, Bike Lane, Unsignalized, Low Density, Outside BiPPA
72	China Aster Court and Stardrift Drive	Germantown	Local, Shared Use Path, Unsignalized, Low Density, Outside BiPPA
73	Harmony Hall Road and King James Way and Muddy Branch Road	Montgomery County	Local, Bike Lane, Any Signalization, Any Policy Area Type, Any BiPPA
74	Parkwood Drive and Wildwood Road	South Kensington	Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA
75	Skylark Road and Walnut Haven Drive	Clarksburg	Primary Residential, Shared Use Path, Unsignalized, Any Policy Area Type, Outside BiPPA
76	Central Park Circle and South Germantown Connector and South Germantown Soccerplex Loop, Perimeter Trail	Montgomery County	Local, Shared Use Path, Unsignalized, Other Policy Area Type, Any BiPPA
77	Catoctin Terrace and Tree House Terrace	Layhill	Local, No Bikeway, Unsignalized, Low Density, Outside BiPPA
78	Lisa Drive and Sweetwater Drive	Redland	Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
79	Boswell Lane and Piney Knoll Lane	Travilah	Country Road, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA
80	Hume Drive and Linden Lane and Sitter Avenue	Silver Spring	Industrial, Any Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA
81	Mountain Lake Terrace and Rosebay Drive	Germantown	Local, No Bikeway, Unsignalized, Low Density, Within BiPPA
82	Clearspring Road and Woodfield Road	Damascus	Arterial, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA
83	Hayes Manor Lane and Mount Olney Lane	Olney	Local, Shared Use Path, Unsignalized, Low Density, Outside BiPPA
84	Dawson Farm Road and Mateny Hill Road and Mediterranean Drive	Germantown	Arterial, Bike Lane, Unsignalized, Low Density, Outside BiPPA
85	Climbing Ivy Drive and Dawson Farm Road and Great Seneca Highway	Germantown	Local, Shared Use Path, Signalized, Any Policy Area Type, Any BiPPA
86	New Church Street and Woodfield Road	Damascus	Arterial, No Bikeway, Unsignalized, Very Low Density, Within BiPPA
87	Chandler Road and Falls Road	Potomac	Arterial, Shared Use Path, Unsignalized, Low Density, Outside BiPPA
88	Adrian Street and Parkland Drive	Aspen Hill	Primary Residential, No Bikeway, Unsignalized, Low Density, Within BiPPA
89	Hillwood Drive and Venetia Mill Circle	White Oak	Business, No Bikeway, Unsignalized, Medium Density, Outside BiPPA
90	Bingham Court and Hathaway Drive	Glenmont	Primary Residential, No Bikeway, Unsignalized, Medium Density, Outside BiPPA
91	Cabin Branch Avenue and Dovekie Avenue	Clarksburg	Business, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA
92	Englishman Drive and Englishman Place	North Bethesda	Local, No Bikeway, Unsignalized, High Density, Within BiPPA
93	Killarney Lane and Muddy Branch Road	Montgomery County	Local, Bike Lane, Any Signalization, Any Policy Area Type, Any BiPPA

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Conclusion

This memorandum has discussed and implemented an analytical approach to identify and prioritize additional multimodal count locations in Montgomery County, Maryland. These locations have been selected to yield a representative selection of traffic conditions throughout the county. By randomly selecting additional locations to be reflective of the range of conditions throughout the county, this sampling plan will equip M-NCPPC to develop statistical models of traffic volumes throughout the county.

When collecting this count data, we recommend performing counts for at least 15 hours (from 7AM to 10PM) at each location and including both a weekday and a weekend day. These durations are recommended because of the expected variation in traffic patterns across locations, especially for pedestrian and bicycle traffic. Multimodal traffic counts can vary substantially between locations in terms of the proportion of traffic that occurs during the "peak" periods, and in terms of the relative weekday and weekend traffic volumes. Acquiring counts for longer than 4 hours is expected to lead to a higher accuracy traffic volume model. Additionally, all bicycle counts should be collected using standard turning movement count configuration, as opposed to pedestrian-oriented crosswalk movement counts, to allow for developing a segment-level bicycle volume model. Montgomery Planning may also consider these parameters (15 hours per location, weekday and weekend day, standard turning movement count configuration for bicycle counts) as a requirement for developers to further improve the accuracy of volume models in the future.

With these added count locations, Montgomery Planning will be able to develop a robust multimodal traffic volume model. With high-quality exposure estimates available networkwide, Safety Performance Functions can be developed and applied to screen the network for locations with high expected numbers of crashes of various types, which will allow for timely and cost-effective deployment of safety treatments in pursuit of Montgomery County's Vision Zero goal.

Sincerely,

Frank Proulx, PhD | Data Science Practice Lead

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Appendix A: Intersection Classification

Classification [Road Type, Bikeway Type, Signalization, Policy Area Type, BiPPA]	Number of Intersections	4 Hour Vehicle/Ped Counts	4 Hour Bike Counts	Target Counts	# of Recommended Counts
Local, No Bikeway, Unsignalized, Medium Density, Outside BiPPA	4759	35	18	10	0
Local, No Bikeway, Unsignalized, Low Density, Outside BiPPA	3899	10	6	10	3
Arterial, No Bikeway, Unsignalized, Medium Density, Outside BiPPA	1006	49	43	10	0
Arterial, No Bikeway, Unsignalized, Low Density, Outside BiPPA	744	25	21	10	0
Primary Residential, No Bikeway, Unsignalized, Low Density, Outside BiPPA	671	4	2	10	7
Local, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA	562	1	1	10	8
Arterial, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA	558	6	5	10	5
Primary Residential, No Bikeway, Unsignalized, Medium Density, Outside BiPPA	463	9	5	10	5
Local, No Bikeway, Unsignalized, Medium Density, Within BiPPA	287	1	0	10	8
Arterial, Shared Use Path, Unsignalized, Low Density, Outside BiPPA	232	14	9	10	1
Arterial, No Bikeway, Unsignalized, Medium Density, Within BiPPA	228	29	26	10	0
Arterial, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA	209	16	15	10	0
Local, Shared Use Path, Unsignalized, Medium Density, Outside BiPPA	201	1	1	10	8
Arterial, Bike Lane, Unsignalized, Low Density, Outside BiPPA	146	9	7	10	3
Local, No Bikeway, Unsignalized, High Density, Outside BiPPA	121	0	0	10	3
Arterial, No Bikeway, Signalized, Medium Density, Outside BiPPA	119	64	62	10	0
Arterial, No Bikeway, Unsignalized, High Density, Within BiPPA	115	17	16	10	0
Local, Shared Use Path, Unsignalized, Low Density, Outside BiPPA	91	0	0	5	5
Arterial, No Bikeway, Signalized, Low Density, Outside BiPPA	83	43	43	5	0
Arterial, No Bikeway, Signalized, Medium Density, Within BiPPA	78	48	47	5	0
Primary Residential, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA	74	0	0	5	3
Arterial, No Bikeway, Signalized, High Density, Within BiPPA	73	51	51	5	0
Freeway, Any Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA	68	26	26	5	0
Business, No Bikeway, Unsignalized, High Density, Within BiPPA	68	3	2	5	2
Primary Residential, Shared Use Path, Unsignalized, Any Policy Area Type, Outside BiPPA	66	1	0	5	4

Classification [Road Type, Bikeway Type, Signalization, Policy Area Type, BiPPA]	Number of Intersections	4 Hour Vehicle/Ped Counts	4 Hour Bike Counts	Target Counts	# of Recommended Counts
Local, No Bikeway, Unsignalized, High Density, Within BiPPA	65	0	0	5	5
Primary Residential, No Bikeway, Unsignalized, Medium Density, Within BiPPA	63	3	1	5	3
Arterial, Other Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA	63	19	18	5	0
Arterial, Shared Use Path, Signalized, Medium Density, Any BiPPA	57	31	31	5	0
Country Road, No Bikeway, Unsignalized, Very Low Density, Outside BiPPA	56	0	0	5	2
Minor Arterial, Any Bikeway, Unsignalized, Any Policy Area Type, Any BiPPA	54	0	0	5	4
Local, Bike Lane, Any Signalization, Any Policy Area Type, Any BiPPA	52	6	3	5	2
Arterial, Bike Lane, Signalized, Any Policy Area Type, Outside BiPPA	51	17	17	5	0
Business, No Bikeway, Unsignalized, Medium Density, Within BiPPA	50	4	3	2	0
Arterial, Bike Lane, Unsignalized, Other Policy Area Type, Outside BiPPA	50	4	4	2	0
Arterial, Shared Use Path, Signalized, Other Policy Area Type, Any BiPPA	44	21	20	2	0
Arterial, Shared Use Path, Unsignalized, Medium Density, Within BiPPA	39	7	6	2	0
Business, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA	35	0	0	2	2
Arterial, Shared Use Path, Unsignalized, Other Policy Area Type, Any BiPPA	31	2	2	2	0
Local, No Bikeway, Unsignalized, Low Density, Within BiPPA	31	1	1	2	1
Industrial, Any Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA	27	1	1	2	1
Arterial, No Bikeway, Unsignalized, Low Density, Within BiPPA	24	2	2	2	0
Arterial, Bike Lane, Unsignalized, Other Policy Area Type, Within BiPPA	23	8	8	2	0
Local, Shared Use Path, Unsignalized, Other Policy Area Type, Any BiPPA	22	0	0	2	1
Business, Other Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA	22	5	5	2	0
Arterial, Bike Lane, Signalized, Any Policy Area Type, Within BiPPA	21	12	12	2	0
Arterial, No Bikeway, Signalized, Other Policy Area Type, Any BiPPA	20	15	15	2	0
Arterial, No Bikeway, Unsignalized, High Density, Outside BiPPA	20	5	5	2	0
Local, Shared Use Path, Unsignalized, Medium Density, Within BiPPA	17	0	0	2	0
Local, No Bikeway, Signalized, Any Policy Area Type, Any BiPPA	16	7	7	2	0
Arterial, No Bikeway, Signalized, High Density, Outside BiPPA	11	9	9	2	0
Business, No Bikeway, Signalized, Any Policy Area Type, Any BiPPA	10	4	4	2	0

Classification [Road Type, Bikeway Type, Signalization, Policy Area Type, BiPPA]	Number of Intersections	4 Hour Vehicle/Ped Counts	4 Hour Bike Counts	Target Counts	# of Recommended Counts
Arterial, No Bikeway, Signalized, Low Density, Within BiPPA	10	6	6	2	0
Arterial, No Bikeway, Unsignalized, Very Low Density, Within BiPPA	10	0	0	2	2
Highway Ramps, Any Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA	9	3	3	2	0
Primary Residential, No Bikeway, Unsignalized, Low Density, Within BiPPA	8	1	1	2	1
Arterial, Shared Use Path, Unsignalized, Low Density, Within BiPPA	8	2	2	2	0
Local, Shared Use Path, Signalized, Any Policy Area Type, Any BiPPA	7	1	1	2	1
Business, No Bikeway, Unsignalized, Medium Density, Outside BiPPA	7	0	0	2	2
Country Road, No Bikeway, Unsignalized, Other Policy Area Type, Any BiPPA	6	0	0	2	1
Primary Residential, Other Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA	6	2	2	2	0
Arterial, Bike Lane, Unsignalized, Low Density, Within BiPPA	6	3	3	2	0
Primary Residential, No Bikeway, Signalized, Any Policy Area Type, Any BiPPA	5	1	0	0	0
Country Road, Other Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA	5	0	0	0	0
Local, Shared Use Path, Unsignalized, Low Density, Within BiPPA	4	0	0	0	0
Business, No Bikeway, Unsignalized, High Density, Outside BiPPA	4	0	0	0	0
Primary Residential, Shared Use Path, Unsignalized, Any Policy Area Type, Within BiPPA	4	0	0	0	0
Primary Residential, Shared Use Path, Signalized, Any Policy Area Type, Any BiPPA	3	1	1	0	0
Minor Arterial, Any Bikeway, Signalized, Any Policy Area Type, Any BiPPA	2	1	1	0	0
Local, No Bikeway, Unsignalized, Very Low Density, Within BiPPA	2	0	0	0	0
Local, Other Bikeway, Any Signalization, Any Policy Area Type, Any BiPPA	1	0	0	0	0

APPENDIX C. VOLUME ESTIMATION MODELS

PEDESTRIAN VOLUME MODEL

Statistically Significant Variables		Relationship to Crashes
Roadway/ Infrastructure	Speed Limit	+
	Presence of a median	+
	Presence of a bikeway	-
	Presence of a sidewalk	+
	Dead end	-
	Driveway density	-
	Roadway slope	-
Land Use	Density (based on Policy Area colors and CSDG)	+
	Located in a municipality	+
	Proximity to multifamily housing	+
	Proximity to schools	-
	Proximity to parks	+
	Proximity to emergency facilities	+
	Proximity to off-site alcohol establishments	+
	Proximity to parking lots	+
Transit	Bus routes	+
Demographics	Within an Equity Emphasis Areas	+
	Population over 65	+
	Population under 18	+

NON-SEPARATED BIKEWAY MODEL

Statistically Significant Variables		Relationship to Crashes
Roadway/ Infrastructure	Traffic signal at adjacent intersection	+
	Dead end	-
	Presence of a trail crossing	+
	Presence of a sidewalk	+
Land Use	Density (based on Policy Area colors and CSDG)	+
	Census tract population	-
	Employment density	+
	Proximity to schools	+
	Proximity to universities and colleges	+
	Proximity to recreational points	+
	Proximity to emergency facilities	+
	Proximity to bikeshare	+
Demographics	Within an Equity Emphasis Area	+
	Median household income	+
	Population under 18	-

SEPARATED BIKEWAY MODEL

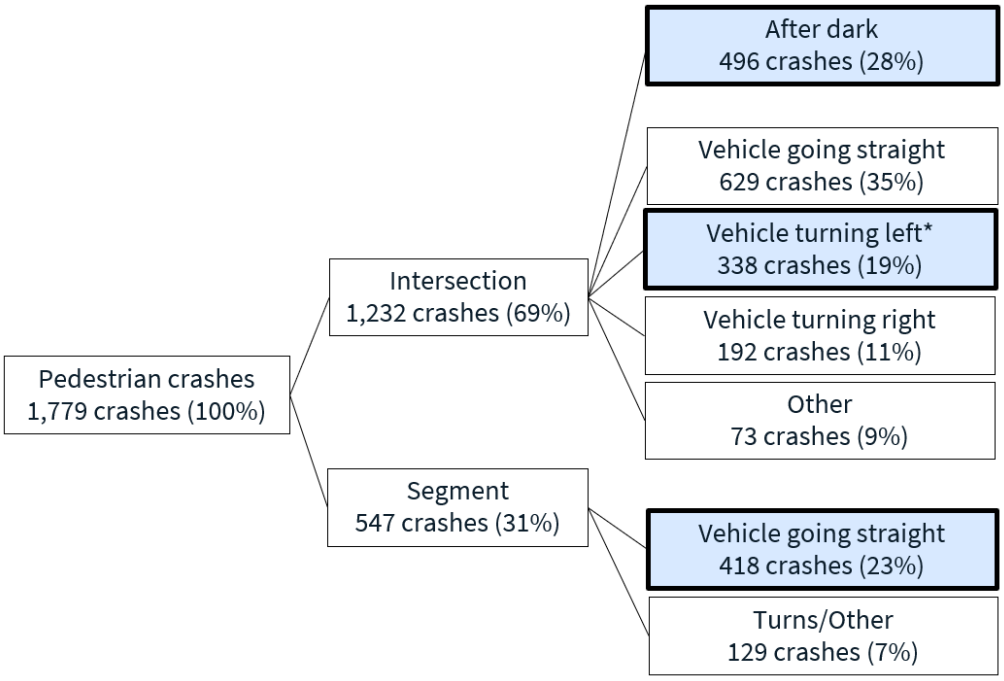
Statistically Significant Variables		Relationship to Crashes
Roadway/ Infrastructure	Traffic signal at adjacent intersection	-
	Dead end	-
	Speed Limit	-
	Presence of a sidewalk	+
Land Use	Density (based on Policy Area colors and CSDG)	+
	Employment density	+
	Proximity to schools	-
	Proximity to alcohol-serving facilities	+
	Proximity to emergency facilities	+
Transit	Proximity to Metro	-
Demographics	Population within an Equity Emphasis Area	+
	Median Household Income	-

MOTOR VEHICLE VOLUME MODEL

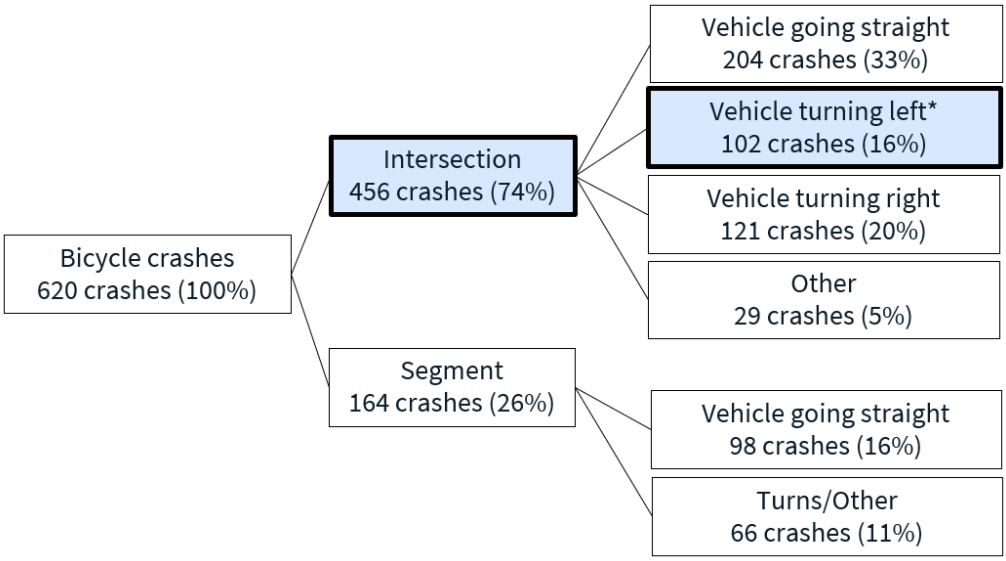
Statistically Significant Variables		Relationship to Crashes
Roadway/ Infrastructure	Speed Limit	+
	Presence of a median	+
	Presence of a bikeway	-
	Presence of a sidewalk	+
	Dead end	-
	Driveway density	-
	Roadway slope	-
Land Use	Density (based on Policy Area colors and CSDG)	+
	Located in a municipality	+
	Proximity to multifamily housing	+
	Proximity to schools	-
	Proximity to parks	+
	Proximity to emergency facilities	+
	Proximity to off-site alcohol establishments	+
	Proximity to parking lots	+
Transit	Bus routes	+
Demographics	Population over 65	+
	Population under 18	+

Appendix D. Crash Types

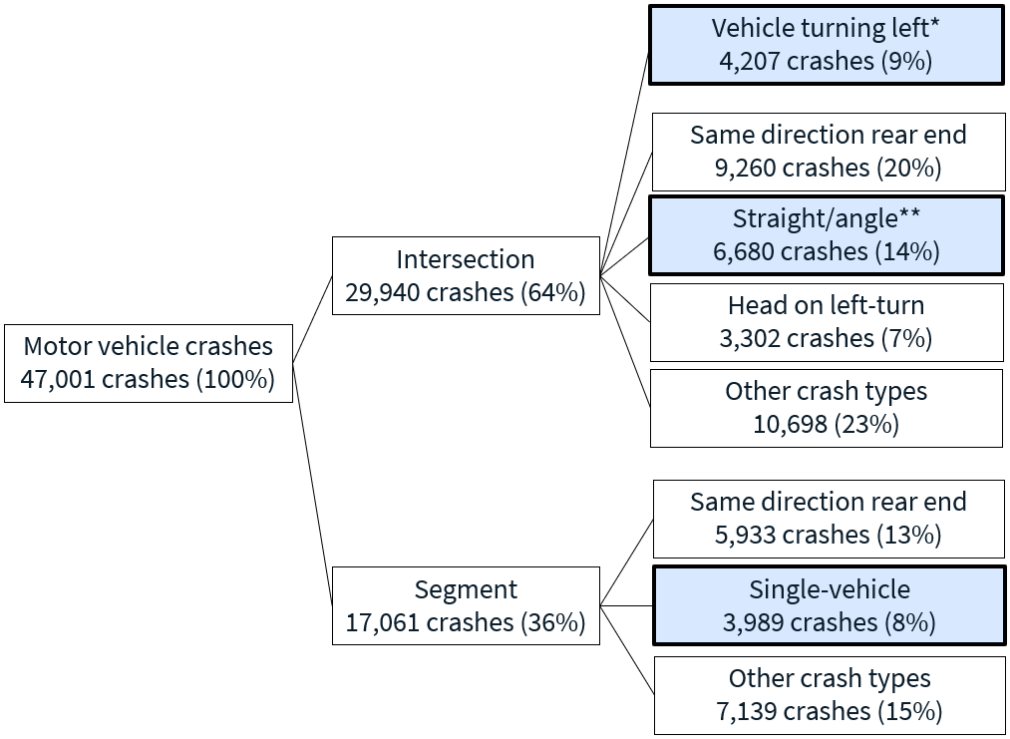
Pedestrian Crashes



Bicycle Crashes



Motor Vehicle Crashes



* Crash type includes motor vehicle, pedestrian, and bicycle crashes with left-turning vehicles.

** Crash type modified during SPF modeling process to only include 4-legged intersections.

APPENDIX E. SPF EQUATIONS

The SPFs are exponential functions, rather than linear functions. The number of predicted crashes is based on the context variables, but captured in the exponent of "e", which is a mathematical constant with a value of 2.718. This means that for each equation follows the following general format:

Predicted crashes = 2.718 ^ (sum of context variables multiplied by their coefficients)

The sections below include a table that summarizes the SPF equation for each crash type.

PEDESTRIAN CRASHES AFTER DARK AT INTERSECTIONS

Statistically Significant Variables		Category	Coefficient
Exposure	Pedestrian traffic	N/A	-0.0003
	Log of Pedestrian traffic	N/A	0.4843
	Motor vehicle traffic	< 5,000 (base)	0
		5,000-9,999	1.5139
		>= 10,000	1.5455
Transportation	Number of intersection legs	N/A	0.4448
	Maximum number of through lanes	N/A	0.1578
	Speed limit	N/A	0.0305
	Number of marked crosswalks	N/A	0.2069
	Presence of a traffic signal	No (base)	0
		Yes	1.0537
	Transportation points of interest (e.g., transit, bikeshare)	N/A	0.0185
	Bus routes (1/10 mile)	N/A	0.0185
	Metro stations (1/4 mile)	N/A	0.2415
Demographics	Population density (1/4 mile)	N/A	0.2329
	Household income (% > $100k in 1/4 mile)	N/A	-0.0216
Intercept	N/A	N/A	-11.4039

PEDESTRIAN CRASHES ON ROADWAY SEGMENTS WITH VEHICLES GOING STRAIGHT

Statistically Significant Variables		Category	Coefficient
Exposure	Pedestrian traffic	N/A	0.0002
	Motor vehicle traffic	< 5,000 (base)	0
		5,000-9,999	0.6876
		>= 10,000	1.1101
Transportation	Block length	N/A	0.7773
	Dead end	No (base)	0
		Yes	-1.3952
	Street classification	Alley, dead-end, parking-lot access, slip lane (base)	0
		Major Arterial	0.9682
		Minor Arterial	0.9206
		Local	0.0359
	Parking lots (500 feet)	N/A	0.0257
	Number of marked crosswalks	N/A	0.2533
	Bus routes (1/10 mile)	N/A	0.0309
Land Use	Alcohol establishments (1/10 mile)	N/A	0.0108
	Recreational points of interest (1/2 mile)	N/A	-0.0023
	Business points of interest (1/2 mile)	N/A	-0.0065
Demographics	Household Income (% > $100k in 1/4 mile)	N/A	-0.0312
Intercept	N/A	N/A	-5.2822

BICYCLE CRASHES AT INTERSECTIONS

Statistically Significant Variables		Category	Coefficient
Exposure	Bicycle traffic (log)	N/A	0.2772
	Motor vehicle traffic	< 2,000 (base)	0
		2,000-3,999	0.4039
		4,000-9,999	2.0541
		10,000-19,999	2.4089
		>= 20,000	2.5530
Transportation	Number of legs	N/A	0.4039
	Number of legs with a median	0 (base)	0
		1	-0.0247
		2	0.4286
		3	0.7380
		4	0.3906
	Number of marked crosswalks	N/A	0.1577
	Presence of a stop sign	No (base)	0
		Yes	0.4725
	Presence of a traffic signal	No (base)	0
		Yes	1.0944
	Proximity to a sidepath	N/A	0.4118
	Proximity to a bike lane (500 feet)	None (base)	0
		Conventional	-0.0388
		Sidepath	0.2752
	Bus Stops	No (base)	0
		Yes	0.4118
Land Use	Proximity to parks (100 feet)	N/A	0.0163
Demographics	Concentration of Latino residents	N/A	0.1352
Intercept	N/A	N/A	-10.3216

LEFT-TURN CRASHES AT INTERSECTIONS (ALL MODES)

Statistically Significant Variables		Category	Coefficients
Exposure	Motor vehicle traffic	< 2,000 (base)	0
		2,000-3,999	0.6991
		4,000-9,999	2.1431
		10,000-19,999	2.6884
		>= 20,000	2.9262
	Pedestrian traffic	< 60 (base)	0
		60-99	-0.3498
		>= 100	-0.2381
Transportation	Number of legs	N/A	0.5260
	Number of lanes	Max <=2 (base)	0
		Max 3-4, Min <=2	0.3294
		Max > 4, Min <=2	0.5386
		Max 3-4, Min 3-4	0.9055
		Max > 4, Min 3-4	0.5034
		Max > 4, Min > 4	0.5135
	Speed limit	N/A	0.0173
	Street classification	Alley, dead-end, parking-lot access, slip lane (base)	0
		Other Street Types	0.7174
	Presence of a traffic signal	No (base)	0
		Yes	1.6466
	Number of high-visibility crosswalks	N/A	0.1360
	Presence of a bikeway (500 feet)	None (base)	0
		Conventional	0.3905
		Sidepath	0.1805
	Parking lots (500 feet)	N/A	0.0208
	Bus stops	No (base)	0
		Yes	0.3944
Land Use	CSDG Area Type	Country (base)	0
		Downtown	-0.7091
		Town Center	-0.6460
		Suburban	-0.6248
		Other	-0.4462
Demographics	Household income (% > $150k in 1/2 mile)	N/A	-0.0131
Intercept	N/A	N/A	-8.2099

MOTOR VEHICLE STRAIGHT/ANGLE CRASHES AT FOUR-LEGGED INTERSECTIONS

Statistically Significant Variables		Category	Coefficient
Exposure	Motor vehicle traffic (log)	N/A	0.5446
Transportation	State roads	No (base)	0
		Yes	1.1799
	Speed limit	N/A	0.0277
	Number of marked crosswalks	N/A	0.1942
	Bus routes (1/10 mile)	N/A	0.1080
	Metro stations (1/2 mile)	N/A	0.0709
Land Use	Located within a municipality	No (base)	0
		Yes	-0.2306
	Recreational points of interest (1/4 mile)	N/A	-0.0118
Demographics	Located within an Equity Emphasis Area	No (base)	0
		Yes	0.2736
	Household income (% > $200k in 1/2 mile)	N/A	-0.0144
Intercept	N/A	N/A	-8.4531

SINGLE VEHICLE CRASHES ALONG ROADWAY SEGMENTS

Statistically Significant Variables		Category	Coefficient
Exposure	Motor vehicle traffic	< 2,000 (base)	0
		2,000-3,999	0.2253
		4,000-9,999	0.9511
		10,000-19,999	0.9530
		>= 20,000	0.7688
	Motor vehicle traffic (log)	N/A	0.2503
	Pedestrian traffic (log)	N/A	-0.1065
Transportation	Roadway segment length (log)	N/A	0.8574
	Street classification	Alley, dead-end, parking-lot access, slip lane (base)	0
		Major Arterial	1.1739
		Minor Arterial	0.8807
		Local	0.0526
	Number of a traffic signals at adjacent intersections	N/A	0.2359
	Maximum street slope	N/A	0.0396
	Dead end	No (base)	0
		Yes	-0.3998
	Street light density	N/A	16.003
	Driveway density (75 feet)	N/A	-0.0435
	Bus stops	N/A	63.6722
Land Use	Population density (1/2 mile)	N/A	-0.0001
	Proximity to parks (500 feet)	N/A	0.0059
	Business points of interest (1/2 mile)	N/A	-0.0061
Demographics	Concentration of African American residents	N/A	0.2631
	Household income (% > $150k in 1/4 mile)	N/A	-0.0078
	Concentration of youth (< 18 years, 1/2 mile)	N/A	-0.0189
	Concentration of seniors (> 65 years, 1/2 mile)	N/A	-0.0137
Intercept	N/A	N/A	-3.7647

Appendix F. Top 50 Locations by Crash Type

PEDESTRIAN CRASHES AFTER DARK AT INTERSECTIONS

Location	Jurisdiction	Location ID
2ND AVE & CAMERON ST	County Jurisdiction	X20993
2ND AVE & FENWICK LN	County Jurisdiction	X20956
COLESVILLE RD & FENTON ST	County Jurisdiction	X21234
COLESVILLE RD & UNIVERSITY BLVD	County Jurisdiction	X22171
COLESVILLE RD & WAYNE AVE & 2ND AVE	County Jurisdiction	X21066
CONNECTICUT AVE & ASPEN HILL RD	County Jurisdiction	X16764
EAST WEST HWY & 16TH ST	County Jurisdiction	X20795
EAST WEST HWY & COLESVILLE RD	County Jurisdiction	X20972
EAST WEST HWY & WISCONSIN AVE & OLD GEORGETOWN RD	County Jurisdiction	X15532
FREDERICK RD & KING FARM BLVD & SHADY GROVE METRO W RD	Rockville	X09707
FREDERICK RD & REDLAND RD & REDLAND BLVD	Rockville	X09984
GEORGIA AVE & BONIFANT ST	County Jurisdiction	X21253
GEORGIA AVE & CAMERON ST	County Jurisdiction	X21090
GEORGIA AVE & COLESVILLE RD	County Jurisdiction	X21161
GEORGIA AVE & CONNECTICUT AVE	County Jurisdiction	X16983
GEORGIA AVE & ELLSWORTH DR	County Jurisdiction	X21224
GEORGIA AVE & GLENALLAN AVE	County Jurisdiction	X19275
GEORGIA AVE & PRICE AVE	County Jurisdiction	X19599
GEORGIA AVE & RANDOLPH RD	County Jurisdiction	X19744
GEORGIA AVE & REEDIE DR	County Jurisdiction	X19641
GEORGIA AVE & SILVER SPRING AVE	County Jurisdiction	X21267
GEORGIA AVE & THAYER AVE	County Jurisdiction	X21258
GEORGIA AVE & UNIVERSITY BLVD	County Jurisdiction	X19555
GEORGIA AVE & WAYNE AVE	County Jurisdiction	X21244
GERMANTOWN RD & CRYSTAL ROCK DR	County Jurisdiction	X02358
GREAT SENECA HWY & CLOPPER RD	County Jurisdiction	X01550
LAYHILL RD & GLENALLAN AVE	County Jurisdiction	X19716
MARYLAND AVE & MIDDLE LN	Rockville	X11246
MIDCOUNTY HWY & MONTGOMERY VILLAGE AVE	County Jurisdiction	X06778
MIDDLEBROOK RD & CRYSTAL ROCK DR	County Jurisdiction	X02232
MONROE ST & JEFFERSON ST	Rockville	X11338
NEW HAMPSHIRE AVE & LOCKWOOD DR	County Jurisdiction	X23608
NEW HAMPSHIRE AVE & OAKVIEW DR	County Jurisdiction	X24208
PINEY BRANCH RD & FLOWER AVE	County Jurisdiction	X22767
RANDOLPH RD & VEIRS MILL RD	County Jurisdiction	X16598
ROCKVILLE PIKE & CHAPMAN AVE & HALPINE RD	Rockville	X13005
ROCKVILLE PIKE & MARINELLI RD	County Jurisdiction	X13981
ROCKVILLE PIKE & MIDDLE LN & PARK RD	Rockville	X11402
ROCKVILLE PIKE & OLD GEORGETOWN RD	County Jurisdiction	X13869
ROCKVILLE PIKE & TWINBROOK PKWY & ROLLINS AVE	Rockville	X13230
SOMERVILLE DR & REDLAND RD	County Jurisdiction	X10120
TWINBROOK PKWY & CHAPMAN AVE	Rockville	X13419
UNIVERSITY BLVD & AMHERST AVE	County Jurisdiction	X19932
UNIVERSITY BLVD & PINEY BRANCH RD	County Jurisdiction	X23339
UNIVERSITY BLVD & VEIRS MILL RD	County Jurisdiction	X19201
WAYNE AVE & RAMSEY AVE	County Jurisdiction	X21114
WISCONSIN AVE & MONTGOMERY LN & MONTGOMERY AVE	County Jurisdiction	X15570
WISCONSIN AVE & WOODMONT AVE & LELAND ST	County Jurisdiction	X15718
WOODMONT AVE & BATTERY LN	County Jurisdiction	X15264
WOODMONT AVE & HAMPDEN LN	County Jurisdiction	X15337

PEDESTRIAN CRASHES ON ROADWAY SEGMENTS WITH VEHICLES GOING STRAIGHT

Location	Jurisdiction	Location ID
CHAPMAN AVE BETWEEN BOU AVE & RANDOLPH RD/MONTROSE PKWY	County Jurisdiction	S27327
COLESVILLE RD BETWEEN FENTON ST & GEORGIA AVE	County Jurisdiction	S30980
COLESVILLE RD BETWEEN RAMSEY AVE & WAYNE AVE/2ND AVE	County Jurisdiction	S28565
COLESVILLE RD BETWEEN SPRING ST & FENTON ST	County Jurisdiction	S30926
COLESVILLE RD BETWEEN WAYNE AVE/2ND AVE & EAST WEST HWY	County Jurisdiction	S31466
CRYSTAL ROCK DR BETWEEN CENTURY BLVD & GERMANTOWN RD	County Jurisdiction	S28625
EAST WEST HWY BETWEEN COLESVILLE RD & BLAIR MILL RD	County Jurisdiction	S00072
FENTON ST BETWEEN PARKING LOT CUT THRU & WAYNE AVE	County Jurisdiction	S30286
FLOWER AVE BETWEEN PINEY BRANCH RD & DOMER AVE	Takoma Park	S30377
FREDERICK AVE BETWEEN MARYLAND AVE & CHESTNUT ST	Gaithersburg	S32002
FREDERICK AVE BETWEEN MONTGOMERY VILLAGE AVE & PERRY PKWY	Gaithersburg	S26404
FREDERICK AVE BETWEEN PERRY PKWY & ODENDHAL AVE	Gaithersburg	S26746
FREDERICK AVE BETWEEN WHETSTONE DR & DALAMAR ST	Gaithersburg	S31011
FREDERICK RD BETWEEN BLUNT RD & GUNNERS BRANCH RD	County Jurisdiction	S27402
FREDERICK RD BETWEEN INDIANOLA DR & GUDE DR	Rockville	S27276
GEORGIA AVE BETWEEN COLESVILLE RD & ELLSWORTH DR	County Jurisdiction	S28651
GEORGIA AVE BETWEEN JUDSON RD/LAYHILL RD & SHERATON ST	County Jurisdiction	S28790
GEORGIA AVE BETWEEN HEATHFIELD RD & CONNECTICUT AVE	County Jurisdiction	S29685
GEORGIA AVE BETWEEN PRICE AVE & REEDIE DR	County Jurisdiction	S29841
GEORGIA AVE BETWEEN REEDIE DR & PRICHARD RD	County Jurisdiction	S27515
GEORGIA AVE BETWEEN SHERATON ST & RANDOLPH RD	County Jurisdiction	S28905
GEORGIA AVE BETWEEN UNIVERSITY BLVD & ENNALLS AVE	County Jurisdiction	S29016
GEORGIA AVE BETWEEN WAYNE AVE & BONIFANT ST	County Jurisdiction	S28652
GERMANTOWN RD BETWEEN MIDCENTER CT & MIDDLEBROOK RD	County Jurisdiction	S28873
GERMANTOWN RD BETWEEN MIDDLEBROOK RD & WISTERIA DR	County Jurisdiction	S27745
HUNGERFORD DR BETWEEN WASHINGTON ST/A ST & STATION3 DR	Rockville	S26698
JEFFERSON ST BETWEEN ROLLINS AVE & CALIFORNIA CIR	Rockville	S30165
LAYHILL RD BETWEEN GREENERY LN & JUDSON RD/GEORGIA AVE	County Jurisdiction	S27709
LOCKWOOD DR BETWEEN HEATHER HOLLOW CIR & NEW HAMPSHIRE AVE	County Jurisdiction	S22128
LOCKWOOD DR BETWEEN NEW HAMPSHIRE AVE & OAK LEAF DR	County Jurisdiction	S29964
LOST KNIFE RD BETWEEN CONTOUR RD & ASBURY DR/ODEND HAL AVE	Gaithersburg	S27397
LOST KNIFE RD BETWEEN LOST KNIFE CIR & CONTOUR RD	County Jurisdiction	S27395
ODEND HAL AVE BETWEEN ASBURY DR/LOST KNIFE RD & RUSSELL AVE	Gaithersburg	S27996
ODEND HAL AVE BETWEEN RUSSELL AVE & FREDERICK AVE	Gaithersburg	S29002
PERRY PKWY BETWEEN FREDERICK AVE & DIAMOND AVE	Gaithersburg	S26599
PINEY BRANCH RD BETWEEN ARLISS ST & GREENWOOD AVE	County Jurisdiction	S30278
PINEY BRANCH RD BETWEEN FLOWER AVE & MANCHESTER RD	County Jurisdiction	S27903
PINEY BRANCH RD BETWEEN GARLAND AVE & ARLISS ST	County Jurisdiction	S28057
PINEY BRANCH RD BETWEEN KODIAK DR & UNIVERSITY BLVD	County Jurisdiction	S28359
REEDIE DR BETWEEN GRANDVIEW AVE & VEIRS MILL RD	County Jurisdiction	S11769
RUSSELL AVE BETWEEN ODEND HAL AVE & LAKEFOREST BLVD	Gaithersburg	S26293
SEMINARY RD BETWEEN GEORGIA AVE & COLUMBIA BLVD	County Jurisdiction	S31408
UNIVERSITY BLVD BETWEEN GRANDVIEW AVE & VEIRS MILL RD	County Jurisdiction	S29839
VEIRS MILL RD BETWEEN ENNALLS AVE & UNIVERSITY BLVD	County Jurisdiction	S29840
VEIRS MILL RD BETWEEN UNIVERSITY BLVD & KENSINGTON BLVD	County Jurisdiction	S29047
VEIRS MILL RD BETWEEN REEDIE DR & ENNALLS AVE	County Jurisdiction	S28789
VEIRS MILL RD BETWEEN REEDIE DR & GEORGIA AVE	County Jurisdiction	S28708
WAYNE AVE BETWEEN DIXON AVE/DISCOVERY PL & RAMSEY AVE	County Jurisdiction	S28598
WAYNE AVE BETWEEN FENTON ST & GEORGIA AVE	County Jurisdiction	S28978
WAYNE AVE BETWEEN GEORGIA AVE & DIXON AVE/DISCOVERY PL	County Jurisdiction	S28655

BICYCLE CRASHES AT INTERSECTIONS

Location	Jurisdiction	Location ID
AIRPARK RD & STRATOS LN & ANTARES DR	County Jurisdiction	X11610
AIRPARK RD & WOODFIELD RD	County Jurisdiction	X11026
BEACH DR & CEDAR LN	County Jurisdiction	X15851
BEACH DR & KNOWLES AVE	County Jurisdiction	X16303
CLARA BARTON PKWY & MAC ARTHUR BLVD	County Jurisdiction	X06334
CLOPPER RD & FIRSTFIELD RD	Gaithersburg	X05167
COLESVILLE RD & ST ANDREWS WAY & SLIGO CREEK PKWY	County Jurisdiction	X21676
COLESVILLE RD & UNIVERSITY BLVD	County Jurisdiction	X22131
COLESVILLE RD & WAYNE AVE & 2ND AVE	County Jurisdiction	X21066
CONNECTICUT AVE & ASPEN HILL RD	County Jurisdiction	X16764
CONNECTICUT AVE & BEACH DR	County Jurisdiction	X16780
DARNESTOWN RD & MUDDY BRANCH RD	County Jurisdiction	X05354
DARNESTOWN RD & QUINCE ORCHARD RD	Gaithersburg	X02931
EAST WEST HWY & BEACH DR	County Jurisdiction	X18438
EAST WEST HWY & COLESVILLE RD	County Jurisdiction	X20972
EAST WEST HWY & GRUBB RD	County Jurisdiction	X19520
FREDERICK AVE & WESTLAND DR	Gaithersburg	X08409
FREDERICK RD & GERMANTOWN RD	County Jurisdiction	X03692
FREDERICK RD & MIDDLEBROOK RD	County Jurisdiction	X04073
FREDERICK RD & PLUMMER DR	County Jurisdiction	X04294
GEORGIA AVE & BONIFANT ST	County Jurisdiction	X21253
GEORGIA AVE & COLESVILLE RD	County Jurisdiction	X21161
GEORGIA AVE & FOREST GLEN RD	County Jurisdiction	X20383
GEORGIA AVE & RANDOLPH RD	County Jurisdiction	X19744
GEORGIA AVE & SPRING ST	County Jurisdiction	X20999
GEORGIA AVE & WAYNE AVE	County Jurisdiction	X21244
GREAT SENECA HWY & CLOPPER RD	County Jurisdiction	X01550
GREAT SENECA HWY & KEY WEST AVE	County Jurisdiction	X06402
GREAT SENECA HWY & MATENY RD	County Jurisdiction	X01587
GREAT SENECA HWY & MUDDY BRANCH RD	Gaithersburg	X05564
GREAT SENECA HWY & QUINCE ORCHARD RD	Gaithersburg	X04135
GREAT SENECA HWY & RICHTER FARM RD	County Jurisdiction	X01469
GUDE DR & SOUTHLAWN LN	Rockville	X12148
NEW HAMPSHIRE AVE & ADELPHI RD & DILSTON RD	County Jurisdiction	X24164
OBSERVATION DR & RIDGE RD	County Jurisdiction	X02916
OLD GEORGETOWN RD & ST ELMO AVE & ARLINGTON RD & WILSON LN	County Jurisdiction	X15097
OLNEY SANDY SPRING RD & OLD VIC BLVD	County Jurisdiction	X20025
OLNEY SANDY SPRING RD & PRINCE PHILIP DR	County Jurisdiction	X18976
RANDOLPH RD & DEWEY RD	County Jurisdiction	X15983
ROCKVILLE PIKE & JONES BRIDGE RD	County Jurisdiction	X15290
SHADY GROVE RD & MUNCASTER MILL RD & AIRPARK RD	County Jurisdiction	X11479
SLIGO CREEK PKWY & FOREST GLEN RD	County Jurisdiction	X20996
SLIGO CREEK PKWY & WAYNE AVE	County Jurisdiction	X22310
UNIVERSITY BLVD & GRANDVIEW AVE	County Jurisdiction	X19428
UNIVERSITY BLVD & NEWPORT MILL RD & DECATUR AVE	County Jurisdiction	X17608
UNIVERSITY BLVD & PINEY BRANCH RD	County Jurisdiction	X23339
WISCONSIN AVE & BRADLEY LN & BRADLEY BLVD	County Jurisdiction	X15866
WISCONSIN AVE & WAVERLY ST & ELM ST	County Jurisdiction	X15604
WOOTTON PKWY & FALLS RD	Rockville	X09602
WOOTTON PKWY & TOWER OAKS BLVD	Rockville	X11038

LEFT-TURN CRASHES AT INTERSECTIONS (ALL MODES)

Location	Jurisdiction	Location ID
ASBURY DR & LOST KNIFE RD & ODENDHAL AVE	Gaithersburg	X07089
BRIGGS CHANEY RD & OLD COLUMBIA PIKE	County Jurisdiction	X24828
BROADBIRCH DR & CALVERTON BLVD & CHERRY HILL RD	County Jurisdiction	X24753
BUREAU DR & DIAMOND AVE	Gaithersburg	X05543
CHESTNUT ST & DIAMOND AVE & MUDDY BRANCH RD	Gaithersburg	X06515
CLOPPER RD & FIRSTFIELD RD	Gaithersburg	X05167
CLOPPER RD & QUINCE ORCHARD RD & DIAMOND AVE	Gaithersburg	X05349
COLESVILLE RD & FENTON ST	County Jurisdiction	X21234
COLUMBIA PIKE & GREENCASTLE RD	County Jurisdiction	X25129
COLUMBIA PIKE & STEWART LN & MILESTONE DR	County Jurisdiction	X23787
CONNECTICUT AVE & BEL PRE RD	County Jurisdiction	X17855
DEMOCRACY BLVD & SEVEN LOCKS RD	County Jurisdiction	X10303
EAST WEST HWY & 16TH ST	County Jurisdiction	X20795
EAST WEST HWY & GRUBB RD	County Jurisdiction	X19520
FALLS RD & RIVER RD	County Jurisdiction	X06164
FATHER HURLEY BLVD & WATERS LANDING DR	County Jurisdiction	X01767
FREDERICK AVE & MONTGOMERY VILLAGE AVE	Gaithersburg	X05936
FREDERICK RD & GUNNERS BRANCH RD	County Jurisdiction	X04054
FREDERICK RD & KING FARM BLVD & SHADY GROVE METRO W RD	Rockville	X09707
FREDERICK RD & REDLAND RD & REDLAND BLVD	Rockville	X09984
FREDERICK RD & SHAKESPEARE BLVD	County Jurisdiction	X03475
GEORGIA AVE & FOREST GLEN RD	County Jurisdiction	X20383
GEORGIA AVE & HATHAWAY DR	County Jurisdiction	X18658
GEORGIA AVE & REEDIE DR	County Jurisdiction	X19641
GEORGIA AVE & SHOREFIELD RD	County Jurisdiction	X19631
GERMANTOWN RD & CRYSTAL ROCK DR	County Jurisdiction	X02358
GERMANTOWN RD & SENECA MEADOWS PKWY & GOLDENROD LN	County Jurisdiction	X03009
GOSHEN RD & WIGHTMAN RD & SNOUFFER SCHOOL RD	County Jurisdiction	X08116
HUNGERFORD DR & WASHINGTON ST & A ST	Rockville	X11086
LAYHILL RD & BONIFANT RD & BEL PRE RD	County Jurisdiction	X20233
MIDDLEBROOK RD & WARING STATION RD	County Jurisdiction	X02887
MONTGOMERY VILLAGE AVE & QUINCE ORCHARD RD & RT124 PARK RIDE	Gaithersburg	X05517
MONTGOMERY VILLAGE AVE & RUSSELL AVE & STATION8 DR	Gaithersburg	X06161
MONTROSE PKWY & EXECUTIVE BLVD & JEFFERSON ST	County Jurisdiction	X12858
NORBECK RD & LAYHILL RD	County Jurisdiction	X20910
REDLAND RD & CRABBS BRANCH WAY	County Jurisdiction	X10683
ROCKVILLE PIKE & CALIFORNIA CIR & BOU AVE	County Jurisdiction	X13404
ROCKVILLE PIKE & TWINBROOK PKWY & ROLLINS AVE	Rockville	X13230
RUSSELL AVE & CHRISTOPHER AVE	Gaithersburg	X05851
RUSSELL AVE & LAKEFOREST BLVD	Gaithersburg	X06322
RUSSELL AVE & ODENDHAL AVE	Gaithersburg	X06611
SHADY GROVE RD & CHOKE CHERRY RD	County Jurisdiction	X08173
SHADY GROVE RD & CRABBS BRANCH WAY	County Jurisdiction	X09857
SHADY GROVE RD & DARNESTOWN RD	County Jurisdiction	X07202
SHADY GROVE RD & OAKMONT AVE	County Jurisdiction	X09302
UNIVERSITY BLVD & INWOOD AVE	County Jurisdiction	X20791
VEIRS MILL RD & ATLANTIC AVE	Rockville	X13765
VEIRS MILL RD & CONNECTICUT AVE	County Jurisdiction	X17318
WOODFIELD RD & SNOUFFER SCHOOL RD & MUNCASTER MILL RD	County Jurisdiction	X10522
WOOTTON PKWY & TOWER OAKS BLVD	Rockville	X11038

MOTOR VEHICLE STRAIGHT/ANGLE CRASHES AT FOUR-LEGGED INTERSECTIONS

Location	Jurisdiction	Location ID
BROADBIRCH DR & CALVERTON BLVD & CHERRY HILL RD	County Jurisdiction	X24753
COLESVILLE RD & FENTON ST	County Jurisdiction	X21234
COLESVILLE RD & UNIVERSITY BLVD	County Jurisdiction	X22171
COLUMBIA PIKE & STEWART LN & MILESTONE DR	County Jurisdiction	X23787
CONNECTICUT AVE & ASPEN HILL RD	County Jurisdiction	X16764
CONNECTICUT AVE & RANDOLPH RD	County Jurisdiction	X17475
DEMOCRACY BLVD & SEVEN LOCKS RD	County Jurisdiction	X10303
EAST WEST HWY & GLENDALE RD	County Jurisdiction	X17267
FIRSTFIELD RD & QUINCE ORCHARD RD	Gaithersburg	X05406
FREDERICK AVE & PERRY PKWY & LAKEFOREST BLVD	Gaithersburg	X06192
FREDERICK RD & GERMANTOWN RD	County Jurisdiction	X03692
FREDERICK RD & REDLAND RD & REDLAND BLVD	Rockville	X09984
FREDERICK RD & SHAKESPEARE BLVD	County Jurisdiction	X03475
GEORGIA AVE & ARCOLA AVE	County Jurisdiction	X19517
GEORGIA AVE & COLESVILLE RD	County Jurisdiction	X21161
GEORGIA AVE & CONNECTICUT AVE	County Jurisdiction	X16983
GEORGIA AVE & DOUGLAS AVE & WINDHAM LN	County Jurisdiction	X19923
GEORGIA AVE & FOREST GLEN RD	County Jurisdiction	X20383
GEORGIA AVE & HATHAWAY DR	County Jurisdiction	X18658
GEORGIA AVE & REEDIE DR	County Jurisdiction	X19641
GEORGIA AVE & WELLER RD	County Jurisdiction	X18817
GERMANTOWN RD & AIRCRAFT DR	County Jurisdiction	X02477
GERMANTOWN RD & CRYSTAL ROCK DR	County Jurisdiction	X02358
GERMANTOWN RD & WISTERIA DR	County Jurisdiction	X01883
HUNGERFORD DR & WASHINGTON ST & A ST	Rockville	X11086
LAYHILL RD & BONIFANT RD & BEL PRE RD	County Jurisdiction	X20233
MIDCOUNTY HWY & SAYBROOKE OAKS BLVD & WOODFIELD RD	Gaithersburg	X09207
MONTGOMERY VILLAGE AVE & CLUB HOUSE RD	County Jurisdiction	X06647
MONTGOMERY VILLAGE AVE & LOST KNIFE RD & CHRISTOPHER AVE	County Jurisdiction	X06574
NEW HAMPSHIRE AVE & ADELPHI RD & DILSTON RD	County Jurisdiction	X24164
NEW HAMPSHIRE AVE & OAKVIEW DR	County Jurisdiction	X24208
NEW HAMPSHIRE AVE & RANDOLPH RD	County Jurisdiction	X22906
OLD COLUMBIA PIKE & FAIRLAND RD	County Jurisdiction	X24695
OLD GEORGETOWN RD & CORDELL AVE	County Jurisdiction	X15025
OLD GEORGETOWN RD & EXECUTIVE BLVD	County Jurisdiction	X13408
RANDOLPH RD & LINDELL ST & DENLEY RD	County Jurisdiction	X18574
RANDOLPH RD & OLD COLUMBIA PIKE	County Jurisdiction	X24547
RANDOLPH RD & SELFRIDGE RD	County Jurisdiction	X16506
ROCKVILLE PIKE & EDMONSTON DR	Rockville	X12204
ROCKVILLE PIKE &GROSVENOR LN	County Jurisdiction	X14731
SEVEN LOCKS RD & TUCKERMAN LN	County Jurisdiction	X10619
SHADY GROVE RD & CAVANAUGH DR & PINEY MEETINGHOUSE RD	County Jurisdiction	X05581
SHADY GROVE RD & GAITHER RD &	County Jurisdiction	X08332
SHADY GROVE RD & MILL RUN DR	County Jurisdiction	X11301
SHADY GROVE RD & MUNCASTER MILL RD & AIRPARK RD	County Jurisdiction	X11479
SHADY GROVE RD & RESEARCH BLVD	County Jurisdiction	X07797
UNIVERSITY BLVD & ELKIN ST	County Jurisdiction	X19713
UNIVERSITY BLVD & MERRIMAC DR	Takoma Park	X23559
UNIVERSITY BLVD & VEIRS MILL RD	County Jurisdiction	X19201
WOODFIELD RD & SNOUFFER SCHOOL RD & MUNCASTER MILL RD	County Jurisdiction	X10522

SINGLE VEHICLE CRASHES ALONG ROADWAY SEGMENTS

Location	Jurisdiction	Location ID
AIRPARK RD BETWEEN STRATOS LN/ANTARES DR & SHADY GROVE RD/MUNCASTER MILL RD	County Jurisdiction	S28902
AIRPARK RD BETWEEN WOODFIELD RD & STRATOS LN/ANTARES DR	County Jurisdiction	S28599
ASHTON RD BETWEEN TUCKER LN & ASHLAND DR	County Jurisdiction	S29819
AVERY RD BETWEEN SOUTHLAWN LN & NORBECK RD	Rockville	S30027
BEACH DR BETWEEN KNOWLES AVE & GROSVENOR LN	County Jurisdiction	S04906
BEACH DR BETWEEN WEXFORD DR & KNOWLES AVE	County Jurisdiction	S06170
BEALLSVILLE RD BETWEEN DARNESTOWN RD & LYNDENWOOD AVE	County Jurisdiction	S30054
BRIGGS CHANEY RD BETWEEN ASTON MANOR DR & GENTRY RIDGE CT	County Jurisdiction	S28329
CLARKSBURG RD BETWEEN LEWISDALE RD & HYATTSTOWN MILL RD	County Jurisdiction	S29187
CLOPPER RD BETWEEN GAME PRESERVE RD & WARING STATION RD	County Jurisdiction	S29117
COLUMBIA PIKE BETWEEN BLACKBURN RD & GREENCASTLE RD	County Jurisdiction	S26732
COLUMBIA PIKE BETWEEN BRIGGS CHANEY RD & FAIRLAND RD	County Jurisdiction	S31960
COLUMBIA PIKE BETWEEN FAIRLAND RD & MUSGROVE RD	County Jurisdiction	S26733
COLUMBIA PIKE BETWEEN GREENCASTLE RD & BRIGGS CHANEY RD	County Jurisdiction	S26439
COLUMBIA PIKE BETWEEN SANDY SPRING RD & BLACKBURN RD	County Jurisdiction	S28217
CONNECTICUT AVE BETWEEN BEACH DR & WOODLAWN RD	County Jurisdiction	S28021
DAMASCUS RD BETWEEN LONG CORNER RD & JARL DR	County Jurisdiction	S30379
DARNESTOWN RD BETWEEN BELLINGHAM DR & WHITES FERRY RD	County Jurisdiction	S29517
DARNESTOWN RD BETWEEN BUCKLODGE RD & CATTAIL RD	County Jurisdiction	S30441
DARNESTOWN RD BETWEEN BUCKLODGE RD & WHITE GROUND RD	County Jurisdiction	S28811
DARNESTOWN RD BETWEEN DICKERSON RD & HUNTER RD	County Jurisdiction	S29457
FALLS RD BETWEEN GREAT MARYLAND AVE & FALLSMEAD WAY	Rockville	S29928
FREDERICK RD BETWEEN LITTLE BENNETT DR & COMUS RD	County Jurisdiction	S29297
FREDERICK RD BETWEEN WHEATFIELD DR & GAME PRESERVE RD	County Jurisdiction	S28983
GAME PRESERVE RD BETWEEN FREDERICK AVE & CHURCH CUT THRU	Gaithersburg	S30744
GEORGIA AVE BETWEEN NEW HAMPSHIRE AVE & GREGG RD	County Jurisdiction	S32094
GERMANTOWN RD AT AIRCRAFT DR	County Jurisdiction	S28301
GOOD HOPE RD BETWEEN CAPE MAY RD & NEW HAMPSHIRE AVE	County Jurisdiction	S31268
GREAT SENECA HWY BETWEEN HORN POINT DR & MATENY RD	County Jurisdiction	S00014
GREAT SENECA HWY BETWEEN LAKELANDS DR & HIGH GABLES DR	Gaithersburg	S00028
LAYTONSVILLE RD BETWEEN HAWKINS CREAMERY RD & ROCKY RD	County Jurisdiction	S32014
MIDDLEBROOK RD AT OBSERVATION DR	County Jurisdiction	S29974
MONTGOMERY AVE BETWEEN NELSON ST & HURLEY AVE	Rockville	S28719
MONTROSE PKWY BETWEEN JEFFERSON ST & MONTROSE RD	County Jurisdiction	S27472
MONTROSE RD BETWEEN MONTROSE PKWY & TILDENWOOD DR	County Jurisdiction	S26703
MUNCASTER MILL RD BETWEEN BOWIE MILL RD & OLDE MILL RUN	County Jurisdiction	S29826
NEW HAMPSHIRE AVE BETWEEN BRIGHTON DAM & BRIGHTON KNOLLS DR	County Jurisdiction	S29613
NEW HAMPSHIRE AVE BETWEEN GOOD HOPE & COLESVILLE MANOR DR	County Jurisdiction	S29844
NORBECK RD BETWEEN BALTIMORE RD & AVERY RD	Rockville	S27568
OLNEY LAYTONSVILLE RD BETWEEN VOLUNTEER DR & WICKHAM RD	County Jurisdiction	S32368
PERRY PKWY BETWEEN FREDERICK AVE & DIAMOND AVE	Gaithersburg	S26599
RANDOLPH RD BETWEEN TOURMALINE CT/WITHAN DR & LAURIE DR	County Jurisdiction	S30793
RIDGE RD BETWEEN KEMPTOWN RD & HOLSEY RD	County Jurisdiction	S30053
SENECA MEADOWS PKWY BETWEEN OBSERVATION & GERMANTOWN RD	County Jurisdiction	S25795
SPENCERVILLE RD BETWEEN SANTINI RD & BURTONSVILLE DR	County Jurisdiction	S29752
WATKINS MILL RD BETWEEN GREENRIVER TER & WAYFARER RD	County Jurisdiction	S28423
WHITES FERRY RD BETWEEN ELMER SCHOOL RD & RIVER RD	County Jurisdiction	S29236
WHITES FERRY RD BETWEEN MORROW RD & PARTNERSHIP RD	County Jurisdiction	S31883
WHITES FERRY RD BETWEEN PARTNERSHIP RD & HERSPERGER LN/FISHER AVE	Poolesville	S29764
WOODFIELD RD BETWEEN ESSEX VIEW DR & CHURCHILL DOWNS RD	County Jurisdiction	S31450

TOTAL CRASH RISK BY CONTEXT CHARACTERISTICS

Context			# Ints.	Intersection Crash Types				# Segs.	Segment Crash Types	
Land Use	Max Lanes	Signalized*		Ped Dark	Bike	Left Turn	Angle		Ped	Single Veh
Urban	1-2	Yes	269	32	15	177	140	502	6	27
		No	3,006	17	11	58	80	5,019	8	45
	3-4	Yes	106	17	8	121	118	465	11	69
		No	49	1	0	4	3	215	2	11
	5+	Yes	14	2	1	9	20	289	12	44
		No	16	0	0	1	0	85	2	6
Suburban	1-2	Yes	315	16	17	179	180	686	3	66
		No	11,705	17	27	105	247	20,819	22	207
	3-4	Yes	43	2	3	35	33	285	4	54
		No	41	0	0	3	1	276	2	25
	5+	Yes	13	1	1	8	6	239	4	57
		No	33	0	0	2	1	233	3	17
Country	1-2	Yes	16	0	0	7	5	47	0	14
		No	1,008	0	1	14	14	1,842	3	139
	3-4	Yes	0	-	-	-	-	1	0	0
		No	0	-	-	-	-	3	0	0
	5+	Yes	1	0	0	0	-	1	0	0
		No	2	0	0	0	1	4	0	2

Highlighted cells have the highest value for any column.

* For roadway segments, signalized indicates whether one or both of the intersections at the end of the roadway segment is signalized

HOT SPOT ANALYSIS (TOP 200 INTERSECTIONS AND SEGMENTS) BY CONTEXT CHARACTERISTICS

Context			# Ints.	Intersection Crash Types				# Segs.	Segment Crash Types	
Land Use	Lanes	Signalized		Ped Dark	Bike	Left Turn	Angle		Ped	Single Veh
Urban	1-2	Yes	269	93	62	61	40	502	21	7
		No	3,006	19	-	-	11	5,019	4	3
	3-4	Yes	106	41	42	48	40	465	50	14
		No	49	-	-	-	1	215	3	-
	5+	Yes	14	6	9	3	7	289	73	14
		No	16	-	-	-	-	85	14	-
Suburban	1-2	Yes	315	32	65	66	53	686	1	25
		No	11,705	1	1	1	27	20,819	4	23
	3-4	Yes	43	5	15	14	12	285	13	16
		No	41	-	1	-	-	276	4	5
	5+	Yes	13	2	1	4	2	239	8	21
		No	33	-	-	-	-	233	4	4
Country	1-2	Yes	16	-	-	1	2	47	-	9
		No	1,008	-	-	-	1	1,842	1	57
	3-4	Yes	0	-	-	-	-	1	-	-
		No	0	-	-	-	-	3	-	-
	5+	Yes	1	-	-	-	-	1	-	-
		No	2	-	-	-	1	4	-	1

Highlighted cells have the highest value for any column.

* For roadway segments, signalized indicates whether one or both of the intersections at the end of the roadway segment is signalized

AVERAGE CRASH RISK BY CONTEXT CHARACTERISTICS

Context			# Ints.	Intersection Crash Types				# Segs.	Segment Crash Types	
Land Use	Lanes	Signalized		Ped Dark	Bike	Left Turn	Angle		Ped	Single Veh
Urban	1-2	Yes	269	0.12	0.06	0.66	0.81	502	0.01	0.06
		No	3,006	0.01	0.00	0.02	0.14	5,019	0.00	0.01
	3-4	Yes	106	0.16	0.08	1.15	1.59	465	0.02	0.15
		No	49	0.01	0.01	0.09	0.66	215	0.01	0.05
	5+	Yes	14	0.15	0.07	0.67	2.44	289	0.04	0.15
		No	16	0.02	0.01	0.09	0.12	85	0.03	0.07
Suburban	1-2	Yes	315	0.05	0.06	0.58	0.90	686	0.00	0.10
		No	11,705	0.00	0.00	0.01	0.10	20,819	0.00	0.01
	3-4	Yes	43	0.05	0.06	0.82	1.36	285	0.01	0.19
		No	41	0.00	0.01	0.07	0.18	276	0.01	0.09
	5+	Yes	13	0.06	0.04	0.64	1.38	239	0.02	0.24
		No	33	0.01	0.01	0.07	0.15	233	0.01	0.08
Country	1-2	Yes	16	0.00	0.02	0.45	0.52	47	0.00	0.31
		No	1,008	0.00	0.00	0.01	0.12	1,842	0.00	0.08
	3-4	Yes	0	-	-	-	-	1	0.00	0.06
		No	0	-	-	-	-	3	0.00	0.15
	5+	Yes	1	0.01	0.01	0.15	-	1	0.01	0.05
		No	2	0.01	0.01	0.19	0.72	4	0.01	0.41

Highlighted cells have the highest value for any column.

* For roadway segments, signalized indicates whether one or both of the intersections at the end of the roadway segment is signalized

Appendix H. Severe and Fatal Crashes Context Analysis

Location Type	# Locs.	Total Crashes			Average Crashes		
		Fatalities	Severe Injuries	Total KSI	Fatalities	Severe Injuries	Total KSI
Complete Streets Design Guide Area Type							
Downtown	1,236	7	107	114	0.006	0.092	0.098
Town Center	2,674	17	162	179	0.007	0.064	0.071
Suburban*	35,277	67	572	639	0.002	0.016	0.018
Country	3,101	20	110	130	0.007	0.038	0.044
Other**	6,450	19	136	155	0.003	0.021	0.024
Complete Streets Design Guide Street Type							
Major Highway	38	1	21	22	0.033	0.700	0.733
Boulevard	2,628	59	432	491	0.025	0.185	0.210
Downtown Blvd	325	8	69	77	0.027	0.234	0.261
Town Center Blvd	565	7	89	96	0.014	0.179	0.193
Downtown Street	573	0	25	25	0.000	0.046	0.046
Town Center Street	336	1	13	14	0.003	0.040	0.043
Neighborhood Conn	5,875	9	122	131	0.002	0.021	0.023
Country Conn	557	6	48	54	0.012	0.097	0.110
Country Road	156	0	6	6	0.000	0.040	0.040
Industrial Street	110	0	3	3	0.000	0.028	0.028
Neighborhood Street	30,756	19	139	158	0.001	0.005	0.005
Rustic Road***	530	4	19	23	0.008	0.038	0.046
Equity Area Type							
EEA	8,365	45	309	354	0.006	0.038	0.044
Non-EEA	40,383	85	779	864	0.002	0.020	0.022

Highlighted cells have the highest value for any column.

* Suburban includes Industrial areas.

** Other includes municipalities with independent planning authority.

*** Includes Exceptionally Rustic Roads.

The analysis above solely includes severe injuries and fatalities that occurred at intersections and segments included in the Predictive Safety Analysis. About 15% of severe injuries and fatalities between 2015 and 2019 are excluded as they occurred at locations not included in the analysis.

Appendix I. Where Countermeasures are Applied

Countermeasure Name/Context	Where Countermeasures are Applied
Automated Speed Enforcement	Streets with more than four lanes in Urban and Suburban areas
Centerline Rumble Strip	Roads in Country areas with two lanes
Convert All-Way Stop Control to Mini-Roundabout	All-way-stop-controlled intersections, with speed limits less than 35 mph, daily vehicle volumes < 10,000, and no more than 2 lanes on any approach
Convert Side-Street Stop Control to All-Way Stop	Side-street stop-controlled intersections, with speed limits less than 35 mph, daily vehicle volumes < 10,000, and no more than 2 lanes on any approach
High Visibility Crosswalks - Signalized Intersections where some Crosswalks are Conventional or Not Marked	Signalized intersections with fewer than 2 high-visibility crosswalks
High Visibility Crosswalks - Signalized Intersections with No Crosswalks	Signalized intersections with no marked crosswalks. Intersections with no nearby sidewalks are excluded unless there is a nearby bus stop
High Visibility Crosswalks - Signalized Intersections with Standard Crosswalks	Signalized intersections with standard marked crosswalks, but not high-visibility crosswalks
High Visibility Crosswalks - Unsignalized Intersections with Standard Crosswalks	Unsignalized intersections with standard marked crosswalks, but not high-visibility crosswalks. Intersections without marked crosswalks across the major street are excluded unless there is a nearby bus stop
Increase All Red Clearance Time - Other Street Types	Signalized intersections on street types not listed above
Increase All Red Clearance Time- Boulevards, Downtown Boulevards, Town Center Boulevards, Major Highways	Signalized intersections on Boulevards, Downtown Boulevards, Town Center Boulevards, and Major Highways
Install a Traffic Signal	Stop controlled intersections with more than 20,000 daily vehicles, more than 4 lanes on the major street approach, and located in an urban area or along a transit corridor
Introduce Fully Protected Left Turns	Signalized intersections in urban and suburban areas with a left-turn lane on the major approach and a current protected/permissive phase
Introduce Protected/Permitted Signal Phase	Signalized intersections in urban areas with 4 legs and a left-turn lane on the major street approach
Lighting at Signalized Intersections	Signalized intersections with less than 2 lights within 75 feet of the center of the intersection

Countermeasure Name/Context	Where Countermeasures are Applied
Lighting at Unsignalized Intersections	Unsignalized intersections with less than 2 lights within 75 feet of the center of the intersection
LPI on Downtown Boulevards	Signalized intersections on Downtown Boulevards where a crosswalk is present across the Downtown Boulevard
LPI on Town Center Boulevards, Boulevards, and Major Highways	Signalized intersections on Town Center Boulevards, Boulevards, and Major Highways
Mid-Block High-Visibility Crosswalks	Segments with no marked crosswalk with 2 lanes, speed limits of 25 mph or less, and longer than 400 feet. Segments without sidewalks are excluded unless there is a nearby bus stop
Mid-Block Pedestrian Hybrid Beacon	Segments with existing mid-block marked crosswalks that have 4 of fewer lanes, speed limits of 35 mph or less, and vehicle volumes greater than 3,000 per day
Mid-Block Raised Crossing	Segments with no marked crosswalk with 2 lanes and speed limits of 30 mph
Reduce Speeds by 5 mph	Roads in Country areas with speed limits over 25 mph
Restricted to Left-In Access	Stop controlled intersections with more than 20,000 daily vehicles, more than 4 lanes on the major street approach, and located in a suburban area
Speed Humps	Segments in urban and suburban areas with no marked crosswalk, 2 lanes, speeds of 30 mph or less, and fewer than 10,000 daily vehicles

Appendix J. Candidate Locations for Systemic Countermeasure Implementation

The following pages include the top 50 ranked candidate locations for each countermeasure and its associated contexts. Based on the SPF analysis and the data available, these locations have been identified as candidates for systemic implementation of the selected countermeasures. However, given the countywide nature of this analysis, individual site reviews are needed to confirm that the identified locations are context-appropriate for the selected countermeasures.

HIGH VISIBILITY CROSSWALK: SIGNALIZED INTERSECTIONS WITH SOME HIGH-VISIBILITY CROSSWALKS

Location	Jurisdiction	Location ID
16TH ST & ELKHART ST & 2ND AVE	County Jurisdiction	X20577
16TH ST & SPRING ST	County Jurisdiction	X20784
BALTIMORE RD & 1ST ST & NORBECK RD	Rockville	X12167
BRADLEY BLVD & ARLINGTON RD	County Jurisdiction	X15099
BROADBIRCH DR & CALVERTON BLVD & CHERRY HILL RD	County Jurisdiction	X24753
COLESVILLE RD & FENTON ST	County Jurisdiction	X21234
COLESVILLE RD & SPRING ST	County Jurisdiction	X21285
COLESVILLE RD & ST ANDREWS WAY & SLIGO CREEK PKWY	County Jurisdiction	X21676
COLUMBIA PIKE & BLACKBURN RD	County Jurisdiction	X25226
DEMOCRACY BLVD & FERNWOOD RD	County Jurisdiction	X12248
EAST WEST HWY & CONNECTICUT AVE	County Jurisdiction	X17057
EAST WEST HWY & SUNDALE DR & WASHINGTON AVE	County Jurisdiction	X20148
FREDERICK AVE & HUNGERFORD DR	Rockville	X11084
GEORGIA AVE & ARCOLA AVE	County Jurisdiction	X19517
GEORGIA AVE & HEWITT AVE	County Jurisdiction	X17811
GEORGIA AVE & ROSSMOOR BLVD	County Jurisdiction	X17091
GEORGIA AVE & SEMINARY PL	County Jurisdiction	X20537
GERMANTOWN RD & AIRCRAFT DR	County Jurisdiction	X02477
GERMANTOWN RD & CRYSTAL ROCK DR	County Jurisdiction	X02358
HUNGERFORD DR & MANNAKEE ST	Rockville	X11092
INDIANOLA DR & CRABBS BRANCH WAY	County Jurisdiction	X10811
MARINELLI RD & EXECUTIVE BLVD	County Jurisdiction	X13631
MARYLAND AVE & JEFFERSON ST	Rockville	X11243
MARYLAND AVE & MIDDLE LN	Rockville	X11246
MIDDLEBROOK RD & GERMANTOWN RD	County Jurisdiction	X02052
MIDDLEBROOK RD & WARING STATION RD	County Jurisdiction	X02887
MONTGOMERY VILLAGE AVE & CLUB HOUSE RD	County Jurisdiction	X06647
MONTGOMERY VILLAGE AVE & LAKE SHORE DR & WALKERS CHOICE RD	County Jurisdiction	X06797
MONTGOMERY VILLAGE AVE & PLEASANT RIDGE DR & WIGHTMAN RD	County Jurisdiction	X07662
NEW HAMPSHIRE AVE & LOCKWOOD DR	County Jurisdiction	X23608
NEW HAMPSHIRE AVE & OAKVIEW DR	County Jurisdiction	X24208
OLD COLUMBIA PIKE & SANDY SPRING RD	County Jurisdiction	X25257
OLD GEORGETOWN RD & AUBURN AVE	County Jurisdiction	X14889
PARK RD & STONESTREET AVE	Rockville	X11490
PINEY BRANCH RD & CARROLL AVE	County Jurisdiction	X23600
RANDOLPH RD & GLENMONT CIR	County Jurisdiction	X19977
ROCKVILLE PIKE	County Jurisdiction	X15275
ROCKVILLE PIKE & CALIFORNIA CIR & BOU AVE	County Jurisdiction	X13404
ROCKVILLE PIKE & RICHARD MONTGOMERY DR & DODGE ST	Rockville	X11662
ROCKVILLE PIKE & SECURITY LN	County Jurisdiction	X14197
ROCKVILLE PIKE & WOOTTON PKWY & 1ST ST	Rockville	X11989
SLIGO CREEK PKWY & PINEY BRANCH RD	County Jurisdiction	X22592
UNIVERSITY BLVD & DENNIS AVE	County Jurisdiction	X21668
UNIVERSITY BLVD & SLIGO CREEK PKWY	County Jurisdiction	X21057
VEIRS MILL RD & CLARIDGE RD	County Jurisdiction	X17976
VEIRS MILL RD & FERRARA AVE	County Jurisdiction	X17084
VEIRS MILL RD & ROBINDALE DR	County Jurisdiction	X15482
WAYNE AVE & CEDAR ST	County Jurisdiction	X21545
WISCONSIN AVE & WAVERLY ST & ELM ST	County Jurisdiction	X15604
WOODMONT AVE & BETHESDA AVE	County Jurisdiction	X15437

HIGH VISIBILITY CROSSWALK: SIGNALIZED INTERSECTIONS WITH ONLY STANDARD CROSSWALKS

Location	Jurisdiction	Location ID
CENTURY BLVD & CRYSTAL ROCK DR	County Jurisdiction	X02280
CHESTNUT ST & DIAMOND AVE & MUDDY BRANCH RD	Gaithersburg	X06515
CLOPPER RD & FIRSTFIELD RD	Gaithersburg	X05167
CONNECTICUT AVE & PLYERS MILL RD	County Jurisdiction	X17175
EAST WEST HWY & WAVERLY ST	County Jurisdiction	X15669
ELLSWORTH DR & FENTON ST	County Jurisdiction	X21323
FATHER HURLEY BLVD & WISTERIA DR	County Jurisdiction	X01498
FREDERICK AVE & PERRY PKWY & LAKEFOREST BLVD	Gaithersburg	X06192
FREDERICK AVE & WESTLAND DR	Gaithersburg	X08409
FREDERICK RD & GERMANTOWN RD	County Jurisdiction	X03692
FREDERICK RD & KING FARM BLVD & SHADY GROVE METRO W RD	Rockville	X09707
FREDERICK RD & MIDDLEBROOK RD	County Jurisdiction	X04073
FREDERICK RD & REDLAND RD & REDLAND BLVD	Rockville	X09984
GEORGIA AVE & ASPEN HILL RD	County Jurisdiction	X17262
GEORGIA AVE & BEL PRE RD	County Jurisdiction	X16842
GEORGIA AVE & CONNECTICUT AVE	County Jurisdiction	X16983
GEORGIA AVE & GLENALLAN AVE	County Jurisdiction	X19275
GEORGIA AVE & JUDSON RD & LAYHILL RD	County Jurisdiction	X19619
GEORGIA AVE & POSTGATE TER & HEATHFIELD RD	County Jurisdiction	X16841
GEORGIA AVE & RANDOLPH RD	County Jurisdiction	X19744
HUNGERFORD DR & BEALL AVE	Rockville	X11290
HUNGERFORD DR & WASHINGTON ST & A ST	Rockville	X11086
LAYHILL RD & GLENALLAN AVE	County Jurisdiction	X19716
MIDCOUNTY HWY & MONTGOMERY VILLAGE AVE	County Jurisdiction	X06778
MIDDLE LN & WASHINGTON ST	Rockville	X11118
MONROE ST & JEFFERSON ST	Rockville	X11338
MONTGOMERY VILLAGE AVE & RUSSELL AVE & STATION8 DR	Gaithersburg	X06161
MONTROSE PARK RIDE & TOWNE RD & MONTROSE RD	County Jurisdiction	X13484
NEW HAMPSHIRE AVE & NORTHAMPTON DR	County Jurisdiction	X24112
NEW HAMPSHIRE AVE & POWDER MILL RD	County Jurisdiction	X24224
PINEY BRANCH RD & ARLISS ST	County Jurisdiction	X22971
PINEY BRANCH RD & BARRON ST	County Jurisdiction	X23226
PINEY BRANCH RD & FLOWER AVE	County Jurisdiction	X22767
PINEY BRANCH RD & GREENWOOD AVE	County Jurisdiction	X22882
RANDOLPH RD & VEIRS MILL RD	County Jurisdiction	X16598
REEDIE DR & FERN ST	County Jurisdiction	X19803
ROCKVILLE PIKE & JONES BRIDGE RD	County Jurisdiction	X15290
ROCKVILLE PIKE & TUCKERMAN LN	County Jurisdiction	X14550
ROLLINS AVE & JEFFERSON ST	Rockville	X12839
SHADY GROVE RD & FALLSGROVE BLVD & MEDICAL CENTER WAY	County Jurisdiction	X07356
SOMERVILLE DR & REDLAND RD	County Jurisdiction	X10120
TWINBROOK PKWY & CHAPMAN AVE	Rockville	X13419
TWINBROOK PKWY & FISHERS LN	County Jurisdiction	X13672
TWINBROOK PKWY & PARKLAWN DR & WICOMICO AVE	County Jurisdiction	X13670
VEIRS MILL RD & GAYNOR RD & PARKLAND DR	County Jurisdiction	X15745
VEIRS MILL RD & GRIDLEY RD & SHOP CTR CUT THRU	County Jurisdiction	X16448
VEIRS MILL RD & TWINBROOK PKWY	County Jurisdiction	X14065
WASHINGTON ST & BEALL AVE	Rockville	X11113
WAVERLY ST & MONTGOMERY AVE	County Jurisdiction	X15690
WOODMONT AVE & BATTERY LN	County Jurisdiction	X15264

HIGH VISIBILITY CROSSWALK: UNSIGNALIZED INTERSECTIONS WITH ONLY STANDARD CROSSWALKS

Location	Jurisdiction	Location ID
ADRIAN ST & PARKLAND DR	County Jurisdiction	X15812
BLUERIDGE AVE & GRANDVIEW AVE	County Jurisdiction	X19422
COLESVILLE RD & RAMSEY AVE	County Jurisdiction	X21115
CONNECTICUT AVE & BALTIMORE ST	County Jurisdiction	X17155
CONNECTICUT AVE & EVERTON ST	County Jurisdiction	X17510
CORDELL AVE & WILSON LN	County Jurisdiction	X14991
ELKIN ST & HICKERSON DR	County Jurisdiction	X19740
ELMCROFT BLVD & KING FARM BLVD	Rockville	X09619
FERN ST & PRICE AVE	County Jurisdiction	X19801
FIDLER LN & RAMSEY AVE	County Jurisdiction	X21082
FREDERICK AVE & DE SELLUM AVE	Gaithersburg	X07318
FREDERICK AVE & FULKS CORNER AVE & CEDAR AVE	Gaithersburg	X07217
FREDERICK AVE & WALKER AVE	Gaithersburg	X06841
FREDERICK AVE & WESTLAND DR	Gaithersburg	X08223
FREDERICK RD & APPLEDOWRE WAY	County Jurisdiction	X03943
FREDERICK RD & COLLINS DR & NEELSVILLE CHURCH RD	County Jurisdiction	X03598
FREDERICK RD & OXBRIDGE DR	County Jurisdiction	X03775
GEORGIA AVE & DENLEY RD	County Jurisdiction	X19122
GEORGIA AVE & HICKERSON DR	County Jurisdiction	X19534
GEORGIA AVE & SHERATON ST	County Jurisdiction	X19701
GEORGIA AVE & WEISMAN RD	County Jurisdiction	X19623
GILBERT PL & BARRON ST	County Jurisdiction	X23229
GIST AVE & FENTON ST	County Jurisdiction	X21417
GREAT SENECA HWY & GREY EAGLE CT	County Jurisdiction	X02240
GREAT SENECA HWY & GROTTO LN	County Jurisdiction	X02041
HALPINE RD & ARDENNES AVE	Rockville	X13506
MARINELLI RD & LANDSDOWN ST	County Jurisdiction	X14042
MONROE ST & MONROE PL	Rockville	X11357
NORMANDY CROSSING DR & HOMECREST RD & LONGMEAD CROSSING DR	County Jurisdiction	X19335
OLD GEORGETOWN RD & DEL RAY AVE	County Jurisdiction	X14955
OLD GEORGETOWN RD & FAIRMONT AVE	County Jurisdiction	X15165
OLD GEORGETOWN RD & MOORLAND LN	County Jurisdiction	X15257
PARK AVE & BROOKES AVE	Gaithersburg	X07333
PINEY BRANCH RD & MANCHESTER RD	County Jurisdiction	X22649
RANDOLPH RD & ATHERTON DR	County Jurisdiction	X17099
RANDOLPH RD & BUSHEY DR	County Jurisdiction	X16972
ROCKVILLE PIKE & MT VERNON PL	Rockville	X11820
ROEDER RD & FENTON ST	County Jurisdiction	X21286
RUSSELL AVE & BROOKES AVE	Gaithersburg	X07189
RUSSELL AVE & WALKER AVE	Gaithersburg	X07108
SLIGO CREEK PKWY & HILLTOP RD & MAPLE AVE	Takoma Park	X22759
TRAVIS AVE & WATKINS MILL RD	Gaithersburg	X05793
UNIVERSITY BLVD & DEARBORN AVE & MOSS AVE	County Jurisdiction	X22944
UNIVERSITY BLVD & GILBERT ST	County Jurisdiction	X23374
UNIVERSITY BLVD & SEEK LN	County Jurisdiction	X23435
VALLEYWOOD DR & ANDREW ST	County Jurisdiction	X18088
VEIRS MILL RD & GRIDLEY RD	County Jurisdiction	X16422
WILLOW LN & 46TH ST	County Jurisdiction	X15845
WISCONSIN AVE & MAPLE AVE	County Jurisdiction	X15361
WISCONSIN AVE & MILLER AVE	County Jurisdiction	X15691

HIGH VISIBILITY CROSSWALK: SIGNALIZED INTERSECTIONS WITH NO CROSSWALKS

Location	Jurisdiction	Location ID
ATTLEBORO RD & EUBIE BLAKE WAY & NORWOOD RD	County Jurisdiction	X21880
BONIFANT RD & NOTLEY RD	County Jurisdiction	X22030
BRADLEY BLVD & BRADMOOR DR & HUNTINGTON PKWY	County Jurisdiction	X13454
BRADLEY BLVD & BURDETTE RD	County Jurisdiction	X11930
BRADLEY BLVD & FERNWOOD RD	County Jurisdiction	X12239
COLUMBIA PIKE & STEWART LN & MILESTONE DR	County Jurisdiction	X23787
DEER PARK DR & RAILROAD ST	Washington Grove	X08801
DEMOCRACY BLVD & FALLS RD & GLEN RD	County Jurisdiction	X06584
EDNOR RD & NORWOOD RD & LAYHILL RD	County Jurisdiction	X21207
EMORY GROVE RD & GOSHEN RD	County Jurisdiction	X07638
FALLS RD & BELLS MILL RD	County Jurisdiction	X07369
FALLS RD & GLEN RD	County Jurisdiction	X07677
FREDERICK RD & CLARKSBURG RD	County Jurisdiction	X01195
GEORGIA AVE & GOLD MINE RD	County Jurisdiction	X18859
GERMANTOWN RD & SPRING MEADOWS DR & DARNESTOWN RD	County Jurisdiction	X00498
GOSHEN RD & VILLAGE AVE	County Jurisdiction	X08229
KINGS VALLEY RD & RIDGE RD	County Jurisdiction	X04801
MARWOOD HILL DR & RIVER RD & PINEY MEETINGHOUSE RD	County Jurisdiction	X04516
NEW HAMPSHIRE AVE & ASHTON RD & OLNEY SANDY SPRING RD	County Jurisdiction	X22199
NEWBRIDGE DR & DEMOCRACY BLVD	County Jurisdiction	X08366
OLD COLUMBIA PIKE & COLUMBIA PIKE	County Jurisdiction	X23851
OLNEY SANDY SPRING RD & NORWOOD RD	County Jurisdiction	X21117
RANDOLPH RD & LINDELL ST & DENLEY RD	County Jurisdiction	X18574
SERVICE RD & NORBECK RD & MUNCASTER MILL RD	County Jurisdiction	X16799
SEVEN LOCKS RD & ORACLE PL & BELLS MILL RD	County Jurisdiction	X10433
STATION10 DR & RIVER RD	County Jurisdiction	X10117
STATION26 DR & DEMOCRACY BLVD	County Jurisdiction	X12053
SWEEPSTAKES RD & WOODFIELD RD	County Jurisdiction	X06750
UNIVERSITY BLVD & WHITESTONE RD	County Jurisdiction	X22585
VEIRS MILL RD & MONTERREY DR & NORRIS DR	County Jurisdiction	X18489
WARFIELD RD & WOODFIELD RD	County Jurisdiction	X11124
WOODFIELD RD & BRINK RD	County Jurisdiction	X09696
WOODFIELD RD & HAWKINS CREAMERY RD	County Jurisdiction	X06600

LIGHTING: SIGNALIZED INTERSECTIONS

Location	Jurisdiction	Location ID
2ND AVE & FENWICK LN	County Jurisdiction	X20956
ASBURY DR & LOST KNIFE RD & ODENDHAL AVE	Gaithersburg	X07089
BALTIMORE RD & 1ST ST & NORBECK RD	Rockville	X12167
BOU AVE & CHAPMAN AVE	County Jurisdiction	X13561
CENTURY BLVD & CRYSTAL ROCK DR	County Jurisdiction	X02280
CHESTNUT ST & DIAMOND AVE & MUDDY BRANCH RD	Gaithersburg	X06515
CLOPPER RD & METROPOLITAN GROVE RD & TWELVE OAKS DR	Gaithersburg	X04889
CONNECTICUT AVE & BEL PRE RD	County Jurisdiction	X17855
CONTOUR RD & ODEND HAL AVE	Gaithersburg	X07251
EAST WEST HWY & SUNDALE DR & WASHINGTON AVE	County Jurisdiction	X20148
FATHER HURLEY BLVD & WATERS LANDING DR	County Jurisdiction	X01767
FATHER HURLEY BLVD & WISTERIA DR	County Jurisdiction	X01498
FENTON ST & PHILADELPHIA AVE & BURLINGTON AVE	County Jurisdiction	X21446
FLOWER AVE & CARROLL AVE	Takoma Park	X23132
FREDERICK RD & SHAKESPEARE BLVD	County Jurisdiction	X03475
GEORGIA AVE & OLNEY LAYTONSVILLE RD & OLNEY SANDY SPRING RD	County Jurisdiction	X18182
GRANT AVE & CARROLL AVE & ETHAN ALLEN AVE	Takoma Park	X22575
GREAT SENECA HWY & QUINCE ORCHARD RD	Gaithersburg	X04135
GREAT SENECA HWY & WISTERIA DR	County Jurisdiction	X02330
JEFFERSON ST & HALPINE RD	Rockville	X12786
LAYHILL RD & BONIFANT RD & BEL PRE RD	County Jurisdiction	X20233
MIDCOUNTY HWY & SAYBROOKE OAKS BLVD & WOODFIELD RD	Gaithersburg	X09207
MIDCOUNTY HWY & WASHINGTON GROVE LN	County Jurisdiction	X09691
MIDDLEBROOK RD & SWEETGUM CIR & FATHER HURLEY BLVD	County Jurisdiction	X01667
MONROE ST & FLEET ST	Rockville	X11298
MONTGOMERY VILLAGE AVE & CENTERWAY RD	County Jurisdiction	X06641
MONTGOMERY VILLAGE AVE & CLUB HOUSE RD	County Jurisdiction	X06647
MONTGOMERY VILLAGE AVE & PLEASANT RIDGE DR & WIGHTMAN RD	County Jurisdiction	X07662
MONTROSE PARK RIDE & TOWNE RD & MONTROSE RD	County Jurisdiction	X13484
MONTROSE PKWY & TOWNE RD	County Jurisdiction	X13457
MONTROSE RD & JEFFERSON ST	County Jurisdiction	X12862
ODENDHAL AVE & GOSHEN RD	Gaithersburg	X07602
PARK RD & STONESTREET AVE	Rockville	X11490
PARKLAWN DR & PARKLAWN DR ACCESS DR	County Jurisdiction	X14502
PHILADELPHIA AVE & MAPLE AVE	Takoma Park	X22331
RANDOLPH RD & LAUDERDALE DR & PARKLAWN DR	County Jurisdiction	X14644
RANDOLPH RD & PARKLAWN DR	County Jurisdiction	X14435
RICHARD MONTGOMERY DR & FLEET ST	Rockville	X11616
ROCK SPRING DR & MARRIOTT DR & FERNWOOD RD	County Jurisdiction	X12123
ROCK SPRING DR & ROCKLEDGE DR	County Jurisdiction	X12439
ROLLINS AVE & JEFFERSON ST	Rockville	X12839
RUSSELL AVE & ODENDHAL AVE	Gaithersburg	X06611
SLIGO CREEK PKWY & WAYNE AVE	County Jurisdiction	X22310
STATION2 DR & CARROLL AVE & PHILADELPHIA AVE	Takoma Park	X22504
TWINBROOK PKWY & CHAPMAN AVE	Rockville	X13419
VEIRS MILL RD & 1ST ST	Rockville	X12059
VEIRS MILL RD & ROBINDALE DR	County Jurisdiction	X15482
VEIRS MILL RD & TWINBROOK PKWY	County Jurisdiction	X14065
W DIAMOND AVE ACCESS RD & PERRY PKWY & DIAMOND AVE	Gaithersburg	X06149
WOODFIELD RD & SNOUFFER SCHOOL RD & MUNCASTER MILL RD	County Jurisdiction	X10522

LIGHTING: UNSIGNALIZED INTERSECTIONS

Location	Jurisdiction	Location ID
1ST ST & GRANDIN AVE	Rockville	X12083
1ST ST & VEIRS MILL SERV RD RD & GRANDIN AVE	Rockville	X12074
ADRIAN ST & PARKLAND DR	County Jurisdiction	X15812
BLAIR MILL RD & EASTERN DR	County Jurisdiction	X21019
BRIGGS CHANEY RD & ROBEY RD	County Jurisdiction	X24969
CALIFORNIA CIR & JEFFERSON ST	County Jurisdiction	X12861
CAMERON HILL CT	County Jurisdiction	X21060
CAMERON HILL CT	County Jurisdiction	X21034
CONTOUR RD & LOST KNIFE RD	County Jurisdiction	X06869
CORDELL AVE & WILSON LN	County Jurisdiction	X14991
DOMER AVE & GREENWOOD AVE	County Jurisdiction	X22909
EAST WEST HWY & CAREY LN	County Jurisdiction	X20746
EAST WEST HWY & FALKLAND LN	County Jurisdiction	X20873
ELKIN ST & BLUERIDGE AVE	County Jurisdiction	X19750
ELMCROFT BLVD & REDLAND BLVD	Rockville	X09886
FLOWER AVE & KENNEBEC AVE	Takoma Park	X22942
FOREST PRESERVE DR & TOWN CENTER BLVD & WATKINS MILL RD	Gaithersburg	X04692
FREDERICK RD & APPLEDOWRE WAY	County Jurisdiction	X03943
FREDERICK RD & COLLINS DR & NEELSVILLE CHURCH RD	County Jurisdiction	X03598
FREDERICK RD & OXBRIDGE DR	County Jurisdiction	X03775
FRIENDSHIP BLVD & PARK AVE	County Jurisdiction	X16012
GARLAND AVE & DOMER AVE	County Jurisdiction	X23123
HAMPDEN LN & ARLINGTON RD	County Jurisdiction	X15128
HUNGERFORD DR & CHOICE HOTELS CIR	Rockville	X11366
KING JAMES WAY & HARMONY HALL RD & MUDDY BRANCH RD	County Jurisdiction	X06456
LIVINGSTON ST & FLACK ST	County Jurisdiction	X19350
MAIN ST & KENTLANDS BLVD	Gaithersburg	X04031
MARKET ST & KENTLANDS BLVD	Gaithersburg	X04365
MAYOR LN & SILVER SPRING AVE	County Jurisdiction	X21299
MINERAL SPRINGS DR & WASHINGTON GROVE LN & FLOWER HILL WAY	County Jurisdiction	X10220
MONROE ST & MONROE PL	Rockville	X11357
NORMANDY CROSSING DR & HOMECREST RD & LONGMEAD CROSSING DR	County Jurisdiction	X19335
PEAR TREE LN & BEL PRE RD	County Jurisdiction	X18003
PINEY BRANCH RD & GARLAND AVE	County Jurisdiction	X23116
PINEY BRANCH RD & MANCHESTER RD	County Jurisdiction	X22649
RANDOLPH RD & PUTNAM RD	County Jurisdiction	X14723
REXMORE DR & CRYSTAL ROCK DR	County Jurisdiction	X02247
RUSSELL AVE & WALKER AVE	Gaithersburg	X07108
SPRING ST & ROEDER RD	County Jurisdiction	X21332
STEWART LN & APRIL LN	County Jurisdiction	X24037
THE HILLS PLZ & PARK AVE	County Jurisdiction	X16099
TRAVIS AVE & WATKINS MILL RD	Gaithersburg	X05793
TSCHIFFELY SQUARE RD & KENT OAKS WAY	Gaithersburg	X03413
VALLEYWOOD DR & ANDREW ST	County Jurisdiction	X18088
VEIRS MILL RD & DODGE ST	Rockville	X11699
WALTER JOHNSON RD & WISTERIA DR	County Jurisdiction	X01969
WAYNE AVE & MANCHESTER RD	County Jurisdiction	X22353
WHITE OAK VISTA DR & STEWART LN	County Jurisdiction	X23960
WILLOW LN & 46TH ST	County Jurisdiction	X15845
WYETH ST & LAYHILL RD	County Jurisdiction	X19861

MID-BLOCK HIGH-VISIBILITY CROSSWALK

Location	Jurisdiction	Location ID
1ST AVE BETWEEN SPRING ST & FENWICK LN	County Jurisdiction	S08915
APPLE RIDGE RD BETWEEN MONTGOMERY VILLAGE AVE & SWALLOW POINT RD	County Jurisdiction	S31736
BOILING BROOK PKWY BETWEEN ROCKING HORSE RD & BOILING BROOK PL	County Jurisdiction	S24786
BONIFANT ST BETWEEN FENTON ACCESS ST & GEORGIA AVE	County Jurisdiction	S10289
CAMERON ST BETWEEN FENTON ST & GEORGIA AVE	County Jurisdiction	S12448
CAMERON ST BETWEEN GEORGIA AVE & RAMSEY AVE	County Jurisdiction	S08851
CARROLL AVE BETWEEN OSAGE ST & UNIVERSITY BLVD	County Jurisdiction	S12352
CARROLL AVE BETWEEN STATION2 DR/PHILADELPHIA AVE & PARK AVE	Takoma Park	S29317
CENTURY BLVD BETWEEN TOWN COMMONS DR & MIDDLEBROOK RD	County Jurisdiction	S20281
CONTOUR RD BETWEEN LOST KNIFE CIR & LOST KNIFE RD	County Jurisdiction	S14437
CONTOUR RD BETWEEN TUNSTALL DR & COPPS HILL DR	County Jurisdiction	S16805
CRYSTAL ROCK DR AT GERMANTOWN RD	County Jurisdiction	S24183
DETRICK AVE BETWEEN HOWARD AVE & KNOWLES AVE	County Jurisdiction	S08081
DIXON AVE BETWEEN DISCOVERY PL/WAYNE AVE & BONIFANT ST	County Jurisdiction	S00933
EDMONSTON DR BETWEEN LEWIS AVE & ROCKVILLE PIKE	Rockville	S02080
ELLSWORTH DR BETWEEN FENTON ST & GEORGIA AVE	County Jurisdiction	S00439
ETHAN ALLEN AVE BETWEEN EAST WEST HWY/NEW HAMPSHIRE AVE & ELM AVE	Takoma Park	S28520
FENTON ST BETWEEN COLESVILLE RD & CAMERON ST	County Jurisdiction	S13360
FENTON ST BETWEEN SILVER SPRING AVE & SLIGO AVE	County Jurisdiction	S29157
FENTON ST BETWEEN THAYER AVE & SILVER SPRING AVE	County Jurisdiction	S31133
FERRARA DR AT FERRARA AVE	County Jurisdiction	S05371
FLOWER AVE BETWEEN PINEY BRANCH RD & DOMER AVE	Takoma Park	S30377
GILBERT PL BETWEEN GILBERT ST & BARRON ST	County Jurisdiction	S07311
GREENWOOD AVE BETWEEN PINEY BRANCH RD & DOMER AVE	County Jurisdiction	S10848
IVY LEAGUE LN AT HUNGERFORD DR	Rockville	S19144
JEFFERSON ST BETWEEN HALPINE RD & ROLLINS AVE	Rockville	S03214
LOST KNIFE CIR	County Jurisdiction	S13888
LYTTONSVILLE RD BETWEEN LYTTONSVILLE PL & ROSS RD	County Jurisdiction	S30169
MAPLE AVE BETWEEN HILLTOP RD/SLIGO CREEK PKWY & LINCOLN AVE	Takoma Park	S30984
MAPLEWOOD AVE BETWEEN FLOWER AVE & EDINBURGH LN/MAPLE AVE	Takoma Park	S32254
MEEM AVE BETWEEN WATER ST/DIAMOND AVE & CHESTNUT ST	Gaithersburg	S18577
METROPOLITAN AVE BETWEEN ST PAUL ST & CONCORD ST/PLYERS MILL RD	County Jurisdiction	S30422
PARAMOUNT PARK DR BETWEEN FREDERICK AVE & SPECTRUM BLVD	Gaithersburg	S22775
PEAR TREE CT	County Jurisdiction	S01264
PHILADELPHIA AVE BETWEEN MAPLE AVE & CEDAR AVE	Takoma Park	S32419
RAMSEY AVE BETWEEN WAYNE AVE & BONIFANT ST	County Jurisdiction	S09876
ROEDER RD BETWEEN SPRING ST & FENTON ST	County Jurisdiction	S10935
ROLLINS AVE BETWEEN ROCKVILLE PIKE/TWINBROOK PKWY & STATION23 DR	Rockville	S31059
ROLLINS AVE BETWEEN STATION23 DR & JEFFERSON ST	Rockville	S31058
RUSSELL AVE AT ODEND HAL AVE	Gaithersburg	S00099
SEMINARY RD BETWEEN STATION19 DR & LINDEN LN/2ND AVE	County Jurisdiction	S30362
SERVICE ROAD A RD BETWEEN FREDERICK AVE & DIAMOND AVE	Gaithersburg	S29367
SHOP CTR CUT THRU BETWEEN COLIE DR & GRIDLEY RD/VEIRS MILL RD	County Jurisdiction	S26942
SLIGO CREEK PKWY BETWEEN SCHUYLER RD & WAYNE AVE/WAYNE AVE	County Jurisdiction	S28890
TEAGARDEN CIR	County Jurisdiction	S00774
THAYER AVE BETWEEN FENTON ST & MAYOR LN	County Jurisdiction	S29798
VEIRS MILL RD AT SAMPSON RD	County Jurisdiction	S02867
WALKER AVE BETWEEN RUSSELL AVE & FREDERICK AVE	Gaithersburg	S23798
WAYNE AVE BETWEEN MANCHESTER PL & MANCHESTER RD	County Jurisdiction	S28428
WILLARD AVE BETWEEN SHOEMAKER FARM LN & PARK AVE	County Jurisdiction	S30740

MID-BLOCK RAISED CROSSING

Location	Jurisdiction	Location ID
ARCOLA AVE BETWEEN HOYT ST/APARTMENT CUT THRU & UNIVERSITY BLVD	County Jurisdiction	S31415
ARCOLA AVE BETWEEN KENBROOK DR & HOYT ST/APARTMENT CUT THRU	County Jurisdiction	S30632
ARCOLA AVE BETWEEN KERSEY RD & LAMBERTON DR	County Jurisdiction	S27899
ARCOLA AVE BETWEEN LAMBERTON DR & WATERMILL LN	County Jurisdiction	S31026
ARLISS ST BETWEEN WALDEN RD/GARLAND AVE & FLOWER AVE	County Jurisdiction	S11503
ASPEN HILL RD BETWEEN MARGOT DR/BALTIC AVE & ADRIAN ST	County Jurisdiction	S30007
AUTOMOBILE BLVD	County Jurisdiction	S00113
BROOKVILLE RD AT GARFIELD AVE	County Jurisdiction	S30182
BROOKVILLE RD BETWEEN TALBOT AVE & STEWART AVE	County Jurisdiction	S31030
BURLINGTON AVE BETWEEN SELIM RD & 13TH ST/GEORGIA AVE	County Jurisdiction	S28051
CARROLL AVE BETWEEN LONG BRANCH PKWY & GARLAND AVE	Takoma Park	S31191
CARROLL AVE BETWEEN MERRIMAC DR & CHESTER ST/WILDWOOD DR	Takoma Park	S31076
CHESTNUT ST BETWEEN DIAMOND AVE & MEEM AVE	Gaithersburg	S21648
DIAMOND AVE BETWEEN FREDERICK AVE & CHESTNUT ST	Gaithersburg	S28052
DIAMOND AVE BETWEEN GIRARD ST & MELVIN ST	Gaithersburg	S29709
DIAMOND AVE BETWEEN MELVIN ST & SUMMIT AVE/SUMMIT AVE	Gaithersburg	S30282
DIAMOND AVE BETWEEN PARK AVE & RUSSELL AVE	Gaithersburg	S31935
DIAMOND AVE BETWEEN RAILROAD ST/WASHINGTON GROVE LN & GIRARD ST	Gaithersburg	S29573
DIAMOND AVE BETWEEN RUSSELL AVE & FREDERICK AVE	Gaithersburg	S31787
GLENALLAN AVE BETWEEN RANDOLPH RD & LAYHILL RD	County Jurisdiction	S28602
GRAND PRE RD BETWEEN BEL PRE RD & CONNECTICUT AVE	County Jurisdiction	S01679
GREENCASTLE RD BETWEEN TURBRIDGE DR & SWAN HOUSE CT	County Jurisdiction	S31594
INDUSTRIAL PKWY BETWEEN OLD COLUMBIA PIKE & TECH RD	County Jurisdiction	S21572
KNOWLES AVE BETWEEN DETRICK AVE & SUMMIT AVE	County Jurisdiction	S30420
LOCKWOOD DR AT COLUMBIA PIKE	County Jurisdiction	S30322
LOCKWOOD DR BETWEEN BURNT MILLS AVE & BURNT MILLS CT	County Jurisdiction	S30481
LOFSTRAND LN BETWEEN TAFT ST & SOUTHLAWN LN	Rockville	S00476
LONGMEAD CROSSING DR BETWEEN HOMECREST RD & LADYMEADE DR	County Jurisdiction	S31168
LONGMEAD CROSSING DR BETWEEN SNOWBIRD TER & TELLURIDE PL	County Jurisdiction	S30978
LONGMEAD CROSSING DR BETWEEN TELLURIDE PL & HOMECREST RD	County Jurisdiction	S32229
LONGMEAD CROSSING DR BETWEEN WIMBLEDON DR/LADYMEADE DR & NORMANDY CROSSING DR/LADYMEADE DR	County Jurisdiction	S30811
OAKMONT AVE BETWEEN RAILROAD ST & CITATION DR	County Jurisdiction	S30041
OLDE TOWNE AVE BETWEEN SUMMIT AVE & FULKS CORNER AVE	Gaithersburg	S23716
PHILADELPHIA AVE BETWEEN CHICAGO AVE & FENTON ST/BURLINGTON AVE	Takoma Park	S31190
PINEY BRANCH RD BETWEEN SILVER SPRING AVE & SLIGO AVE/WESSEX RD	County Jurisdiction	S29465
PINEY BRANCH RD BETWEEN SLIGO CREEK PKWY & PARK CREST DR	County Jurisdiction	S30018
ROBEY RD BETWEEN PALMER HOUSE WAY & ROBEY TER	County Jurisdiction	S31983
SLIGO AVE BETWEEN FENTON ST & MAYOR LN	County Jurisdiction	S09947
SOUTHLAWN LN AT LOFSTRAND LN	Rockville	S19059
STEWART LN BETWEEN APRIL LN & WHITE OAK VISTA DR	County Jurisdiction	S18280
STEWART LN BETWEEN NOVEMBER CIR & LOCKWOOD DR	County Jurisdiction	S19301
STEWART LN BETWEEN WHITE OAK VISTA DR & OLD COLUMBIA PIKE	County Jurisdiction	S19092
WARING STATION RD BETWEEN MIDDLEBROOK RD & STONEY BOTTOM RD	County Jurisdiction	S29598
WESTLAKE TER BETWEEN AUTO PARK AVE & WESTLAKE DR	County Jurisdiction	S28879
WISTERIA DR BETWEEN CIRCLE GATE DR & GREAT SENECA HWY	County Jurisdiction	S32366
WISTERIA DR BETWEEN CRYSTAL ROCK DR & CIRCLE GATE DR	County Jurisdiction	S32033
WISTERIA DR BETWEEN CRYSTAL ROCK DR & DOCTORS DR	County Jurisdiction	S29672
WISTERIA DR BETWEEN GREAT SENECA HWY & MISTY MEADOW TER	County Jurisdiction	S32365
WISTERIA DR BETWEEN WILLOW SPRING DR & PARTRIDGE WOOD DR	County Jurisdiction	S29497
WOOTTON PKWY BETWEEN FLEET ST & EDMONSTON DR	Rockville	S30558

PEDESTRIAN HYBRID BEACON

Location	Jurisdiction	Location ID
AIRCRAFT DR BETWEEN CENTURY BLVD & GERMANTOWN RD	County Jurisdiction	S25729
ARLISS ST BETWEEN WALDEN RD/GARLAND AVE & PINEY BRANCH RD	County Jurisdiction	S06814
ASBURY DR AT FELLOWSHIP CIR	Gaithersburg	S25563
BATTERY LN BETWEEN WOODMONT AVE & KEYSTONE AVE	County Jurisdiction	S29349
BEL PRE RD BETWEEN BEL PRE DR & RIPPLING BROOK DR	County Jurisdiction	S30608
BETHESDA AVE AT WISCONSIN AVE	County Jurisdiction	S24625
BRADLEY BLVD BETWEEN STRATHMORE ST & OFFUTT LN	County Jurisdiction	S29036
BUREAU DR BETWEEN FIRSTFIELD RD & DIAMOND AVE	Gaithersburg	S23188
CAMPUS DR AT MANNAKEE ST	Rockville	S16016
CARROLL AVE BETWEEN TULIP AVE & WESTMORELAND AVE	Takoma Park	S29420
CENTERWAY RD BETWEEN KINGLET PL/BLUE HERON LN & HARKNESS LN	County Jurisdiction	S32367
CENTURY BLVD BETWEEN DORNIER PL & AIRCRAFT DR	County Jurisdiction	S25794
CHAPMAN AVE BETWEEN BOUIC AVE & HALPINE RD/ROCKVILLE PIKE	Rockville	S27166
CHRISTOPHER AVE BETWEEN GALLOP HILL RD & RUSSELL AVE	Gaithersburg	S28832
CONTOUR RD BETWEEN HORIZON RUN RD & LOST KNIFE CIR	County Jurisdiction	S20781
CRABBS BRANCH WAY BETWEEN REDLAND RD & MOCCASIN LN	County Jurisdiction	S30736
CRYSTAL ROCK DR BETWEEN MIDDLEBROOK RD & WISTERIA DR	County Jurisdiction	S21705
DARNESTOWN RD BETWEEN QUINCE ORCHARD RD & BRIAR ROCK DR	Gaithersburg	S29843
EAST WEST HWY BETWEEN COLESVILLE RD & BLAIR MILL RD	County Jurisdiction	S00072
EDGEMOOR LN BETWEEN OLD GEORGETOWN RD & WOODMONT AVE	County Jurisdiction	S28424
EDMONSTON DR BETWEEN ROCKVILLE PIKE & WOOTTON PKWY	Rockville	S02033
FLEET ST BETWEEN PARK AVE & MONROE ST	Rockville	S00817
FLOWER AVE BETWEEN ARLISS ST & PINEY BRANCH RD	County Jurisdiction	S28894
FLOWER AVE BETWEEN DIVISION ST & CARROLL AVE	Takoma Park	S30695
FLOWER HILL WAY BETWEEN WOODFIELD RD & MINERAL SPRINGS DR	County Jurisdiction	S32184
HEWITT AVE BETWEEN BLUE SPRUCE LN & GEORGIA AVE	County Jurisdiction	S26510
JONES MILL RD BETWEEN FORSYTHE AVE/STONEYBROOK DR & LE VELLE DR	County Jurisdiction	S31988
KNOWLES AVE BETWEEN SUMMIT AVE & EWELL AVE	County Jurisdiction	S28076
LOST KNIFE RD BETWEEN CONTOUR RD & ASBURY DR/ODEND HAL AVE	Gaithersburg	S27397
LOST KNIFE RD BETWEEN LOST KNIFE CIR & CONTOUR RD	County Jurisdiction	S27395
MANNAKEE ST BETWEEN HUNGERFORD DR & CAMPUS DR	Rockville	S16865
MARINELLI RD BETWEEN ROCKVILLE PIKE & EXECUTIVE BLVD	County Jurisdiction	S03075
MATENY RD BETWEEN BARLEYCORN WAY & GREAT SENECA HWY	County Jurisdiction	S18303
RESEARCH BLVD BETWEEN RESEARCH PL & GUDE DR	Rockville	S32205
ROBEY RD BETWEEN ROBEY TER & BRIGGS CHANEY RD	County Jurisdiction	S31877
ROCK SPRING DR AT OLD GEORGETOWN RD	County Jurisdiction	S25550
ROCK SPRING DR BETWEEN ROCKLEDGE DR & JACOBSEN ST	County Jurisdiction	S05009
ROCKLEDGE DR BETWEEN ROCK FOREST DR/ROCKLEDGE BLVD & BREUER ST	County Jurisdiction	S24929
ROCKLEDGE DR BETWEEN ROCK SPRING DR & DEMOCRACY BLVD	County Jurisdiction	S05047
SANGAMORE RD BETWEEN SENTINEL DR & BROOKES LN	County Jurisdiction	S32437
SHAKESPEARE BLVD BETWEEN AMBER RIDGE CIR & SENECA MEADOWS PKWY	County Jurisdiction	S25068
SPARTAN RD BETWEEN BUEHLER RD/PARKING LOT CUT THRU & MORNINGWOOD DR/GEORGIA AVE	County Jurisdiction	S14915
STEDWICK RD BETWEEN MONTGOMERY VILLAGE AVE & MILLS CHOICE RD	County Jurisdiction	S31737
WASHINGTONIAN BLVD BETWEEN SHADY ELM ST & WATERFRONT PL	Gaithersburg	S16945
WATKINS MILL RD BETWEEN CLUB HOUSE RD & STEDWICK RD	County Jurisdiction	S31611
WATKINS MILL RD BETWEEN COLTFIELD CT & WATKINS MILL DR	County Jurisdiction	S31956
WATKINS MILL RD BETWEEN TOWN CENTER BLVD & CLOPPER RD	Gaithersburg	S20300
WAYNE AVE BETWEEN FENTON ST & GEORGIA AVE	County Jurisdiction	S28978
WESTBARD AVE AT WESTBARD CIR	County Jurisdiction	S30800
WISCONSIN CIR BETWEEN WESTERN AVE & WILLARD AVE/WISCONSIN AVE	County Jurisdiction	S12842

SPEED HUMPS

Location	Jurisdiction	Location ID
BATTERY LN BETWEEN WOODMONT AVE & KEYSTONE AVE	County Jurisdiction	S29349
BONIFANT ST BETWEEN FENTON ACCESS ST & GEORGIA AVE	County Jurisdiction	S10289
CAMERON ST BETWEEN GEORGIA AVE & RAMSEY AVE	County Jurisdiction	S08851
CAMPUS DR AT FREDERICK RD/HUNGERFORD DR	Rockville	S19647
CARROLL AVE BETWEEN MERRIMAC DR & CHESTER ST/WILDWOOD DR	Takoma Park	S31076
CARROLL AVE BETWEEN UNIVERSITY BLVD & MERRIMAC DR	Takoma Park	S29348
CHAPMAN AVE BETWEEN BOU AVE & RANDOLPH RD/MONTROSE PKWY	County Jurisdiction	S27327
CHAPMAN AVE BETWEEN BOUIC AVE & HALPINE RD/ROCKVILLE PIKE	Rockville	S27166
CLUB HOUSE RD BETWEEN MONTGOMERY VILLAGE AVE & RIDGELINE DR	County Jurisdiction	S29112
COLUMBIA BLVD BETWEEN ALLEY CUT THRU & GEORGIA AVE/SEMINARY RD	County Jurisdiction	S28567
COMMERCE LN	County Jurisdiction	S28706
CONNECTICUT AVE BETWEEN STATION25 DR & BEL PRE RD	County Jurisdiction	S31163
ELLSWORTH DR BETWEEN FENTON ST & GEORGIA AVE	County Jurisdiction	S00439
EXECUTIVE PARK CIR AT EXECUTIVE PARK TER	County Jurisdiction	S21161
FELLOWSHIP CIR BETWEEN ASBURY DR & RUSSELL AVE	Gaithersburg	S00259
FENTON ST BETWEEN COLESVILLE RD & CAMERON ST	County Jurisdiction	S13360
FENTON ST BETWEEN EASLEY ST & THAYER AVE	County Jurisdiction	S30915
FENTON ST BETWEEN SILVER SPRING AVE & SLIGO AVE	County Jurisdiction	S29157
FENTON ST BETWEEN THAYER AVE & SILVER SPRING AVE	County Jurisdiction	S31133
FLOWER AVE BETWEEN ARLISS ST & PINEY BRANCH RD	County Jurisdiction	S28894
FLOWER AVE BETWEEN DIVISION ST & CARROLL AVE	Takoma Park	S30695
FLOWER AVE BETWEEN PINEY BRANCH RD & DOMER AVE	Takoma Park	S30377
GILBERT PL BETWEEN GILBERT ST & BARRON ST	County Jurisdiction	S07311
GRANDVIEW AVE BETWEEN ENNALLS AVE & REEDIE DR	County Jurisdiction	S05621
GRANDVIEW AVE BETWEEN KENSINGTON BLVD & UNIVERSITY BLVD	County Jurisdiction	S32222
HEWITT AVE BETWEEN BLUE SPRUCE LN & GEORGIA AVE	County Jurisdiction	S26510
LOST KNIFE CIR	County Jurisdiction	S13888
MANNAKEE ST BETWEEN HUNGERFORD DR & CAMPUS DR	Rockville	S16865
MAPLE AVE BETWEEN HILLTOP RD/SLIGO CREEK PKWY & LINCOLN AVE	Takoma Park	S30984
MAPLE AVE BETWEEN LINCOLN AVE & RITCHIE AVE	Takoma Park	S31202
METROPOLITAN AVE BETWEEN ST PAUL ST & CONCORD ST/PLYERS MILL RD	County Jurisdiction	S30422
MILESTONE CENTER CT AT MILESTONE CENTER DR	County Jurisdiction	S25287
RAMSEY AVE BETWEEN FIDLER LN & COLESVILLE RD	County Jurisdiction	S10280
RAMSEY AVE BETWEEN WAYNE AVE & BONIFANT ST	County Jurisdiction	S09876
REEDIE DR BETWEEN GEORGIA AVE & TRIANGLE LN	County Jurisdiction	S08752
REEDIE DR BETWEEN TRIANGLE LN & GRANDVIEW AVE	County Jurisdiction	S05858
ROBEY RD BETWEEN ROBEY TER & BRIGGS CHANEY RD	County Jurisdiction	S31877
ROEDER RD BETWEEN SPRING ST & FENTON ST	County Jurisdiction	S10935
ROLLINS AVE BETWEEN STATION23 DR & JEFFERSON ST	Rockville	S31058
SELFRIDGE RD BETWEEN RANDOLPH RD & SIGSBEE RD	County Jurisdiction	S05987
SEMINARY RD BETWEEN SELWAY LN & SUTTON PL	County Jurisdiction	S28094
SEMINARY RD BETWEEN SUTTON PL & STATION19 DR	County Jurisdiction	S28311
STEDWICK RD BETWEEN MONTGOMERY VILLAGE AVE & MILLS CHOICE RD	County Jurisdiction	S31737
SUMMIT AVE BETWEEN DIAMOND AVE & WELLS AVE	Gaithersburg	S31936
SUNDOWN RD BETWEEN ZION RD & 2ND ST/MOBLEY FARM DR	Laytonsville	S29166
TRIANGLE LN AT REEDIE DR	County Jurisdiction	S08685
VEIRS MILL RD AT SAMPSON RD	County Jurisdiction	S02867
WISCONSIN CIR BETWEEN WESTERN AVE & WILLARD AVE/WISCONSIN AVE	County Jurisdiction	S12842
WISTERIA DR BETWEEN CRYSTAL ROCK DR & CIRCLE GATE DR	County Jurisdiction	S32033
WISTERIA DR BETWEEN GREAT SENECA HWY & MISTY MEADOW TER	County Jurisdiction	S32365

LEADING PEDESTRIAN INTERVAL: DOWNTOWN BOULEVARDS

Location	Jurisdiction	Location ID
BRADLEY BLVD & ARLINGTON RD	County Jurisdiction	X15099
BRADLEY BLVD & LELAND ST & HILLANDALE RD	County Jurisdiction	X15277
COLESVILLE RD & FENTON ST	County Jurisdiction	X21234
COLESVILLE RD & SPRING ST	County Jurisdiction	X21285
COLESVILLE RD & WAYNE AVE & 2ND AVE	County Jurisdiction	X21066
DEMOCRACY BLVD & FERNWOOD RD	County Jurisdiction	X12248
EAST WEST HWY & 16TH ST	County Jurisdiction	X20795
EAST WEST HWY & COLESVILLE RD	County Jurisdiction	X20972
EAST WEST HWY & PEARL ST	County Jurisdiction	X15839
EAST WEST HWY & WISCONSIN AVE & OLD GEORGETOWN RD	County Jurisdiction	X15532
GEORGIA AVE & BLUERIDGE AVE	County Jurisdiction	X19515
GEORGIA AVE & BONIFANT ST	County Jurisdiction	X21253
GEORGIA AVE & CAMERON ST	County Jurisdiction	X21090
GEORGIA AVE & COLESVILLE RD	County Jurisdiction	X21161
GEORGIA AVE & ELLSWORTH DR	County Jurisdiction	X21224
GEORGIA AVE & REEDIE DR	County Jurisdiction	X19641
GEORGIA AVE & SILVER SPRING AVE	County Jurisdiction	X21267
GEORGIA AVE & SLIGO AVE	County Jurisdiction	X21260
GEORGIA AVE & THAYER AVE	County Jurisdiction	X21258
GEORGIA AVE & UNIVERSITY BLVD	County Jurisdiction	X19555
GEORGIA AVE & VEIRS MILL RD	County Jurisdiction	X19772
GEORGIA AVE & WAYNE AVE	County Jurisdiction	X21244
OLD GEORGETOWN RD & BATTERY LN	County Jurisdiction	X14674
OLD GEORGETOWN RD & DEMOCRACY BLVD	County Jurisdiction	X12918
OLD GEORGETOWN RD & EDGEMOOR LN & COMMERCE LN	County Jurisdiction	X15377
OLD GEORGETOWN RD & GRAND PARK AVE	County Jurisdiction	X13614
OLD GEORGETOWN RD & ST ELMO AVE & ARLINGTON RD & WILSON LN	County Jurisdiction	X15097
OLD GEORGETOWN RD & WOODMONT AVE	County Jurisdiction	X15283
ROCKVILLE PIKE & CALIFORNIA CIR & BOU AVE	County Jurisdiction	X13404
ROCKVILLE PIKE & HUBBARD DR	County Jurisdiction	X13501
ROCKVILLE PIKE & MARINELLI RD	County Jurisdiction	X13981
ROCKVILLE PIKE & NICHOLSON LN	County Jurisdiction	X14092
ROCKVILLE PIKE & OLD GEORGETOWN RD	County Jurisdiction	X13869
ROCKVILLE PIKE & SECURITY LN	County Jurisdiction	X14197
SHADY GROVE RD & FALLSGROVE BLVD & MEDICAL CENTER WAY	County Jurisdiction	X07356
SHADY GROVE RD & RESEARCH BLVD	County Jurisdiction	X07797
UNIVERSITY BLVD & AMHERST AVE	County Jurisdiction	X19932
UNIVERSITY BLVD & GRANDVIEW AVE	County Jurisdiction	X19428
UNIVERSITY BLVD & VALLEY VIEW AVE	County Jurisdiction	X18776
UNIVERSITY BLVD & VEIRS MILL RD	County Jurisdiction	X19201
WISCONSIN AVE & 47TH ST	County Jurisdiction	X15628
WISCONSIN AVE & BRADLEY LN & BRADLEY BLVD	County Jurisdiction	X15866
WISCONSIN AVE & CHELTENHAM DR & NORFOLK AVE	County Jurisdiction	X15441
WISCONSIN AVE & MONTGOMERY LN & MONTGOMERY AVE	County Jurisdiction	X15570
WISCONSIN AVE & MONTGOMERY ST & PARK AVE	County Jurisdiction	X16199
WISCONSIN AVE & SOMERSET TER	County Jurisdiction	X16116
WISCONSIN AVE & STANFORD ST	County Jurisdiction	X15815
WISCONSIN AVE & WAVERLY ST & ELM ST	County Jurisdiction	X15604
WISCONSIN AVE & WISCONSIN CIR & WILLARD AVE	County Jurisdiction	X16287
WISCONSIN AVE & WOODMONT AVE & LELAND ST	County Jurisdiction	X15718

LEADING PEDESTRIAN INTERVAL: TOWN CENTER BOULEVARDS, BOULEVARDS, AND MAJOR HIGHWAYS

Location	Jurisdiction	Location ID
AIRPARK RD & STRATOS LN & ANTARES DR	County Jurisdiction	X11610
AIRPARK RD & WOODFIELD RD	County Jurisdiction	X11026
BRADLEY BLVD & GLENBROOK RD	County Jurisdiction	X14545
BUREAU DR & DIAMOND AVE	Gaithersburg	X05543
COLESVILLE RD & ST ANDREWS WAY & SLIGO CREEK PKWY	County Jurisdiction	X21676
COLESVILLE RD & UNIVERSITY BLVD	County Jurisdiction	X22131
CONNECTICUT AVE & ASPEN HILL RD	County Jurisdiction	X16764
CONNECTICUT AVE & BEACH DR	County Jurisdiction	X16780
CONNECTICUT AVE & KENSINGTON PKWY & JONES BRIDGE RD	County Jurisdiction	X17078
DARNESTOWN RD & MUDDY BRANCH RD	County Jurisdiction	X05354
DARNESTOWN RD & QUINCE ORCHARD RD	Gaithersburg	X02931
EAST WEST HWY & BEACH DR	County Jurisdiction	X18438
EAST WEST HWY & GRUBB RD	County Jurisdiction	X19520
EAST WEST HWY & MEADOWBROOK LN	County Jurisdiction	X18695
EAST WEST HWY & SUNDALE DR & WASHINGTON AVE	County Jurisdiction	X20148
FREDERICK RD & GERMANTOWN RD	County Jurisdiction	X03692
FREDERICK RD & MIDDLEBROOK RD	County Jurisdiction	X04073
FREDERICK RD & PLUMMER DR	County Jurisdiction	X04294
GEORGIA AVE & FOREST GLEN RD	County Jurisdiction	X20383
GEORGIA AVE & JUDSON RD & LAYHILL RD	County Jurisdiction	X19619
GEORGIA AVE & OLNEY LAYTONSVILLE RD & OLNEY SANDY SPRING RD	County Jurisdiction	X18182
GEORGIA AVE & RANDOLPH RD	County Jurisdiction	X19744
GEORGIA AVE & SPRING ST	County Jurisdiction	X20999
GREAT SENECA HWY & CLIMBING IVY DR	County Jurisdiction	X01847
GREAT SENECA HWY & CLOPPER RD	County Jurisdiction	X01550
GREAT SENECA HWY & KEY WEST AVE	County Jurisdiction	X06402
GREAT SENECA HWY & MATENY RD	County Jurisdiction	X01587
GREAT SENECA HWY & MUDDY BRANCH RD	Gaithersburg	X05564
GREAT SENECA HWY & QUEENSTOWN LN	County Jurisdiction	X01341
GREAT SENECA HWY & QUINCE ORCHARD RD	Gaithersburg	X04135
GUDE DR & SOUTHLAWN LN	Rockville	X12148
KEY WEST AVE & BROSCHART RD & DIAMONDBACK DR	County Jurisdiction	X06836
MC DONALD CHAPEL DR & QUINCE ORCHARD RD & HILLSTONE RD	County Jurisdiction	X03037
MIDCOUNTY HWY & SAYBROOKE OAKS BLVD & WOODFIELD RD	Gaithersburg	X09207
MONTROSE PKWY & EXECUTIVE BLVD & JEFFERSON ST	County Jurisdiction	X12858
NEW HAMPSHIRE AVE & ADELPHI RD & DILSTON RD	County Jurisdiction	X24164
NEW HAMPSHIRE AVE & SPENCERVILLE RD & NORBECK RD	County Jurisdiction	X23676
OBSERVATION DR & RIDGE RD	County Jurisdiction	X02916
OLNEY SANDY SPRING RD & OLD VIC BLVD	County Jurisdiction	X20025
OLNEY SANDY SPRING RD & PRINCE PHILIP DR	County Jurisdiction	X18976
RANDOLPH RD & DEWEY RD	County Jurisdiction	X15983
RANDOLPH RD & VEIRS MILL RD	County Jurisdiction	X16598
ROCKVILLE PIKE & JONES BRIDGE RD	County Jurisdiction	X15290
SENECA MEADOWS PKWY & OBSERVATION DR & SHAKESPEARE BLVD	County Jurisdiction	X02853
SHADY GROVE RD & DARNESTOWN RD	County Jurisdiction	X07202
SHADY GROVE RD & MUNCASTER MILL RD & AIRPARK RD	County Jurisdiction	X11479
UNIVERSITY BLVD & CARROLL AVE	County Jurisdiction	X23491
UNIVERSITY BLVD & NEWPORT MILL RD & DECATUR AVE	County Jurisdiction	X17608
UNIVERSITY BLVD & PINEY BRANCH RD	County Jurisdiction	X23339
UNIVERSITY BLVD & SLIGO CREEK PKWY	County Jurisdiction	X21057

TRAFFIC SIGNAL (LEFT-TURN CRASHES)

Location	Jurisdiction	Location ID
COLESVILLE RD & HASTINGS DR & GRANVILLE DR	County Jurisdiction	X21898
COLESVILLE RD & LEIGHTON AVE	County Jurisdiction	X21850
COLESVILLE RD & LORAIN AVE	County Jurisdiction	X22274
CONNECTICUT AVE & HOWARD AVE	County Jurisdiction	X17147
CONNECTICUT AVE & WARNER ST	County Jurisdiction	X17102
FREDERICK RD & GAME PRESERVE RD & FREDERICK AVE	County Jurisdiction	X04946
FREDERICK RD & SCENERY DR & GUNNERS BRANCH RD	County Jurisdiction	X04103
GEORGIA AVE & BALLARD ST	County Jurisdiction	X20928
GEORGIA AVE & BATCHELLORS FOREST RD & HILLCROFT DR	County Jurisdiction	X17529
GEORGIA AVE & BONNYWOOD LN & TILTON DR	County Jurisdiction	X20310
GEORGIA AVE & DAWSON AVE & LEESBOROUGH DR	County Jurisdiction	X19502
GEORGIA AVE & DAYTON ST & PREDELLA DR	County Jurisdiction	X20023
GEORGIA AVE & HENDERSON AVE	County Jurisdiction	X19562
GEORGIA AVE & HIGHLAND DR	County Jurisdiction	X20760
GEORGIA AVE & KING ST	County Jurisdiction	X21261
GEORGIA AVE & LINDELL ST & GEORGIAN WAY	County Jurisdiction	X19686
GEORGIA AVE & MASON ST	County Jurisdiction	X19728
GEORGIA AVE & NOYES DR	County Jurisdiction	X20856
GEORGIA AVE & PARKER AVE	County Jurisdiction	X19539
GEORGIA AVE & WELLER RD	County Jurisdiction	X18817
GEORGIA AVE & WENDY LN	County Jurisdiction	X17452
RANDOLPH RD & GOODHILL RD	County Jurisdiction	X17777
ROCKVILLE PIKE & LOCUST HILL RD & CEDAR CROFT DR	County Jurisdiction	X15223
ROCKVILLE PIKE & MEETING ST	County Jurisdiction	X13823
SIESTA KEY WAY & KEY WEST AVE	County Jurisdiction	X07363
UNIVERSITY BLVD & BAYFIELD ST	County Jurisdiction	X23463
UNIVERSITY BLVD & DEARBORN AVE & MOSS AVE	County Jurisdiction	X22944
UNIVERSITY BLVD & DRUMM AVE & HILLSDALE DR	County Jurisdiction	X18616
UNIVERSITY BLVD & ELKIN ST	County Jurisdiction	X19713
UNIVERSITY BLVD & FORSTON ST	County Jurisdiction	X23481
UNIVERSITY BLVD & LANGLEY DR	County Jurisdiction	X23323
UNIVERSITY BLVD & MELBOURNE AVE	County Jurisdiction	X23051
UNIVERSITY BLVD & PERRY AVE	County Jurisdiction	X17470
UNIVERSITY BLVD & ST LAWRENCE DR	County Jurisdiction	X22471
VEIRS MILL RD & MONTERREY DR & SCHOOLHOUSE CIR	County Jurisdiction	X18720
VEIRS MILL RD & PENDLETON DR	County Jurisdiction	X18132
WISCONSIN AVE & AVONDALE ST & COMMERCE LN	County Jurisdiction	X15498
WISCONSIN AVE & CHASE AVE	County Jurisdiction	X15413
WISCONSIN AVE & CHEVY CHASE BLVD	County Jurisdiction	X15944
WISCONSIN AVE & CUMBERLAND AVE	County Jurisdiction	X16028
WISCONSIN AVE & DAVIDSON DR	County Jurisdiction	X15930
WISCONSIN AVE & DE RUSSEY PKWY	County Jurisdiction	X15969
WISCONSIN AVE & DRUMMOND AVE	County Jurisdiction	X16008
WISCONSIN AVE & FAIRMONT AVE	County Jurisdiction	X15426
WISCONSIN AVE & HUNT AVE	County Jurisdiction	X15997
WISCONSIN AVE & LANGDRUM LN	County Jurisdiction	X15981
WISCONSIN AVE & MIDDLETON LN	County Jurisdiction	X15470
WISCONSIN AVE & MORGAN DR	County Jurisdiction	X15953
WISCONSIN AVE & NORWOOD DR	County Jurisdiction	X15913
WISCONSIN AVE & NOTTINGHAM DR	County Jurisdiction	X15899

PROTECTED/PERMITTED SIGNAL PHASE

Location	Jurisdiction	Location ID
CLOPPER RD & LONGDRAFT RD	Gaithersburg	X04115
CLOPPER RD & METROPOLITAN GROVE RD & TWELVE OAKS DR	Gaithersburg	X04889
CLOPPER RD & WATKINS MILL RD & PHEASANT RUN DR	Gaithersburg	X04539
ELM ST & ARLINGTON RD	County Jurisdiction	X15130
FRIENDSHIP BLVD & WILLARD AVE	County Jurisdiction	X16020
GEORGIA AVE & BONIFANT ST	County Jurisdiction	X21253
GEORGIA AVE & SILVER SPRING AVE	County Jurisdiction	X21267
MONROE ST & FLEET ST	Rockville	X11298
NEW HAMPSHIRE AVE & GLENSIDE DR & ERSKINE ST	Takoma Park	X23677
QUINCE ORCHARD RD & SIOUX LN & ORCHARD RIDGE DR	Gaithersburg	X04493
RUSSELL AVE & CHRISTOPHER AVE	Gaithersburg	X05851
SLIGO AVE & FENTON ST	County Jurisdiction	X21415
SOMERVILLE DR & REDLAND RD	County Jurisdiction	X10120
WISCONSIN AVE & CHELTENHAM DR & NORFOLK AVE	County Jurisdiction	X15441
WOODMONT AVE & ELM ST	County Jurisdiction	X15344
WOODMONT AVE & HAMPDEN LN	County Jurisdiction	X15337

FULLY PROTECTED LEFT TURN

Location	Jurisdiction	Location ID
16TH ST & ELKHART ST & 2ND AVE	County Jurisdiction	X20577
ASBURY DR & LOST KNIFE RD & ODENDHAL AVE	Gaithersburg	X07089
BUREAU DR & DIAMOND AVE	Gaithersburg	X05543
CLOPPER RD & FIRSTFIELD RD	Gaithersburg	X05167
CONNECTICUT AVE & RANDOLPH RD	County Jurisdiction	X17475
EAST WEST HWY & BEACH DR	County Jurisdiction	X18438
EAST WEST HWY & GRUBB RD	County Jurisdiction	X19520
FREDERICK AVE & WESTLAND DR	Gaithersburg	X08409
GEORGIA AVE & COLESVILLE RD	County Jurisdiction	X21161
GEORGIA AVE & JUDSON RD & LAYHILL RD	County Jurisdiction	X19619
GEORGIA AVE & WAYNE AVE	County Jurisdiction	X21244
GERMANTOWN RD & CRYSTAL ROCK DR	County Jurisdiction	X02358
GERMANTOWN RD & SENECA MEADOWS PKWY & GOLDENROD LN	County Jurisdiction	X03009
GREAT SENECA HWY & CLIMBING IVY DR	County Jurisdiction	X01847
GREAT SENECA HWY & CLOPPER RD	County Jurisdiction	X01550
GREAT SENECA HWY & MATENY RD	County Jurisdiction	X01587
GREAT SENECA HWY & RICHTER FARM RD	County Jurisdiction	X01469
GREAT SENECA HWY & WISTERIA DR	County Jurisdiction	X02330
MADAKET RD & SANGAMORE RD & MAC ARTHUR BLVD	County Jurisdiction	X13596
MIDCOUNTY HWY & SAYBROOKE OAKS BLVD & WOODFIELD RD	Gaithersburg	X09207
MONTGOMERY VILLAGE AVE & RUSSELL AVE & STATION8 DR	Gaithersburg	X06161
NEW HAMPSHIRE AVE & SPENCERVILLE RD & NORBECK RD	County Jurisdiction	X23676
OBSERVATION DR & RIDGE RD	County Jurisdiction	X02916
OLD GEORGETOWN RD & EXECUTIVE BLVD	County Jurisdiction	X13408
OLD GEORGETOWN RD & ST ELMO AVE & ARLINGTON RD & WILSON LN	County Jurisdiction	X15097
OLNEY SANDY SPRING RD & PRINCE PHILIP DR	County Jurisdiction	X18976
OLNEY SANDY SPRING RD & SPARTAN RD	County Jurisdiction	X18576
PINEY BRANCH RD & CARROLL AVE	County Jurisdiction	X23600
RANDOLPH RD & DALEWOOD DR	County Jurisdiction	X18004
RANDOLPH RD & DEWEY RD	County Jurisdiction	X15983
ROCKVILLE PIKE	County Jurisdiction	X15275
ROCKVILLE PIKE & EDMONSTON DR	Rockville	X12204
ROCKVILLE PIKE & JONES BRIDGE RD	County Jurisdiction	X15290
ROCKVILLE PIKE & MARINELLI RD	County Jurisdiction	X13981
ROCKVILLE PIKE & OLD GEORGETOWN RD	County Jurisdiction	X13869
RUSSELL AVE & ODENDHAL AVE	Gaithersburg	X06611
SEVEN LOCKS RD & WOOTTON PKWY	Rockville	X10386
SHADY GROVE RD & DARNESTOWN RD	County Jurisdiction	X07202
SHADY GROVE RD & FALLSGROVE BLVD & MEDICAL CENTER WAY	County Jurisdiction	X07356
SLIGO CREEK PKWY & WAYNE AVE	County Jurisdiction	X22310
UNIVERSITY BLVD & CARROLL AVE	County Jurisdiction	X23491
UNIVERSITY BLVD & GRANDVIEW AVE	County Jurisdiction	X19428
UNIVERSITY BLVD & NEWPORT MILL RD & DECATUR AVE	County Jurisdiction	X17608
UNIVERSITY BLVD & PINEY BRANCH RD	County Jurisdiction	X23339
UNIVERSITY BLVD & SLIGO CREEK PKWY	County Jurisdiction	X21057
VEIRS MILL RD & 1ST ST	Rockville	X12059
WISCONSIN AVE & BRADLEY LN & BRADLEY BLVD	County Jurisdiction	X15866
WISCONSIN AVE & MONTGOMERY LN & MONTGOMERY AVE	County Jurisdiction	X15570
WISCONSIN AVE & WOODMONT AVE & LELAND ST	County Jurisdiction	X15718
WOOTTON PKWY & TOWER OAKS BLVD	Rockville	X11038

INCREASE ALL-RED CLEARANCE INTERVAL: BOULEVARDS, DOWNTOWN BOULEVARDS, TOWN CENTER BOULEVARDS, MAJOR HIGHWAYS

Location	Jurisdiction	Location ID
CASTLE BLVD & BRIGGS CHANEY RD & AUTOMOBILE BLVD	County Jurisdiction	X24946
COLESVILLE RD & FENTON ST	County Jurisdiction	X21234
COLESVILLE RD & SPRING ST	County Jurisdiction	X21285
COLESVILLE RD & UNIVERSITY BLVD	County Jurisdiction	X22131
COLESVILLE RD & UNIVERSITY BLVD	County Jurisdiction	X22171
COLESVILLE RD & WAYNE AVE & 2ND AVE	County Jurisdiction	X21066
CONNECTICUT AVE & ASPEN HILL RD	County Jurisdiction	X16764
CONNECTICUT AVE & BEL PRE RD	County Jurisdiction	X17855
CONNECTICUT AVE & RANDOLPH RD	County Jurisdiction	X17475
EAST WEST HWY & GRUBB RD	County Jurisdiction	X19520
EAST WEST HWY & SUNDALE DR & WASHINGTON AVE	County Jurisdiction	X20148
FREDERICK RD & MIDDLEBROOK RD	County Jurisdiction	X04073
GEORGIA AVE & BEL PRE RD	County Jurisdiction	X16842
GEORGIA AVE & CONNECTICUT AVE	County Jurisdiction	X16983
GEORGIA AVE & JUDSON RD & LAYHILL RD	County Jurisdiction	X19619
GEORGIA AVE & RANDOLPH RD	County Jurisdiction	X19744
GEORGIA AVE & REEDIE DR	County Jurisdiction	X19641
GEORGIA AVE & UNIVERSITY BLVD	County Jurisdiction	X19555
GEORGIA AVE & WAYNE AVE	County Jurisdiction	X21244
GERMANTOWN RD & CRYSTAL ROCK DR	County Jurisdiction	X02358
GERMANTOWN RD & WISTERIA DR	County Jurisdiction	X01883
GREAT SENECA HWY & MUDDY BRANCH RD	Gaithersburg	X05564
GREAT SENECA HWY & WISTERIA DR	County Jurisdiction	X02330
INDIANOLA DR & CRABBS BRANCH WAY	County Jurisdiction	X10811
LAYHILL RD & BONIFANT RD & BEL PRE RD	County Jurisdiction	X20233
MIDDLEBROOK RD & CRYSTAL ROCK DR	County Jurisdiction	X02232
MONTGOMERY VILLAGE AVE & LOST KNIFE RD & CHRISTOPHER AVE	County Jurisdiction	X06574
NEW HAMPSHIRE AVE & ADELPHI RD & DILSTON RD	County Jurisdiction	X24164
NEW HAMPSHIRE AVE & LOCKWOOD DR	County Jurisdiction	X23608
NEW HAMPSHIRE AVE & OAKVIEW DR	County Jurisdiction	X24208
NEW HAMPSHIRE AVE & RANDOLPH RD	County Jurisdiction	X22906
OLD COLUMBIA PIKE & FAIRLAND RD	County Jurisdiction	X24695
RANDOLPH RD & DALEWOOD DR	County Jurisdiction	X18004
RANDOLPH RD & GLENALLAN AVE	County Jurisdiction	X20211
RANDOLPH RD & OLD COLUMBIA PIKE	County Jurisdiction	X24547
RANDOLPH RD & VEIRS MILL RD	County Jurisdiction	X16598
ROCKVILLE PIKE & CALIFORNIA CIR & BOU AVE	County Jurisdiction	X13404
ROCKVILLE PIKE & MARINELLI RD	County Jurisdiction	X13981
ROCKVILLE PIKE & TUCKERMAN LN	County Jurisdiction	X14550
SHADY GROVE RD & MUNCASTER MILL RD & AIRPARK RD	County Jurisdiction	X11479
TWINBROOK PKWY & FISHERS LN	County Jurisdiction	X13672
TWINBROOK PKWY & PARKLAWN DR & WICOMICO AVE	County Jurisdiction	X13670
UNIVERSITY BLVD & PINEY BRANCH RD	County Jurisdiction	X23339
UNIVERSITY BLVD & VEIRS MILL RD	County Jurisdiction	X19201
VEIRS MILL RD & CONNECTICUT AVE	County Jurisdiction	X17318
VEIRS MILL RD & FERRARA AVE	County Jurisdiction	X17084
VEIRS MILL RD & GAYNOR RD & PARKLAND DR	County Jurisdiction	X15745
VEIRS MILL RD & GRIDLEY RD & SHOP CTR CUT THRU	County Jurisdiction	X16448
VEIRS MILL RD & TWINBROOK PKWY	County Jurisdiction	X14065
WOODFIELD RD & SNOUFFER SCHOOL RD & MUNCASTER MILL RD	County Jurisdiction	X10522

INCREASE ALL-RED CLEARANCE INTERVAL: ALL OTHER STREET TYPES

Location	Jurisdiction	Location ID
2ND AVE & FENWICK LN	County Jurisdiction	X20956
ASBURY DR & LOST KNIFE RD & ODENDHAL AVE	Gaithersburg	X07089
BALTIMORE RD & 1ST ST & NORBECK RD	Rockville	X12167
BONIFANT ST & FENTON ST	County Jurisdiction	X21402
CHERRY LAUREL LN & MOONEY DR & SNOUFFER SCHOOL RD	County Jurisdiction	X10038
CLOPPER RD & FIRSTFIELD RD	Gaithersburg	X05167
CLOPPER RD & METROPOLITAN GROVE RD & TWELVE OAKS DR	Gaithersburg	X04889
CLOPPER RD & WATKINS MILL RD & PHEASANT RUN DR	Gaithersburg	X04539
CROFTON HILL LN & MONTGOMERY AVE & RESEARCH BLVD	Rockville	X08749
ELLSWORTH DR & FENTON ST	County Jurisdiction	X21323
FENTON ST & PHILADELPHIA AVE & BURLINGTON AVE	County Jurisdiction	X21446
FIRSTFIELD RD & QUINCE ORCHARD RD	Gaithersburg	X05406
FOREST GLEN RD & SEMINARY RD & CAPITOL VIEW AVE	County Jurisdiction	X19250
FREDERICK AVE & DEER PARK DR & DEER PARK RD	Gaithersburg	X07947
FREDERICK AVE & MONTGOMERY VILLAGE AVE	Gaithersburg	X05936
FREDERICK AVE & PERRY PKWY & LAKEFOREST BLVD	Gaithersburg	X06192
FREDERICK AVE & SUMMIT AVE	Gaithersburg	X07425
FREDERICK AVE & TRAVIS AVE & SPECTRUM AVE	Gaithersburg	X05227
FREDERICK AVE & WATKINS MILL RD	Gaithersburg	X05461
FREDERICK AVE & WESTLAND DR	Gaithersburg	X08409
GREAT SENECA HWY & ORCHARD RIDGE DR & KENTLANDS BLVD	Gaithersburg	X04638
HUNGERFORD DR & WASHINGTON ST & A ST	Rockville	X11086
MONTROSE PKWY & CHAPMAN AVE & RANDOLPH RD	County Jurisdiction	X13932
MONTROSE RD & JEFFERSON ST	County Jurisdiction	X12862
ODENDHAL AVE & GOSHEN RD	Gaithersburg	X07602
OLD GEORGETOWN RD & EXECUTIVE BLVD	County Jurisdiction	X13408
PARKLAND DR & ASPEN HILL RD	County Jurisdiction	X16216
PINEY BRANCH RD & DEVON RD & PINEY BRANCH RD	County Jurisdiction	X22404
RANDOLPH RD & NEBEL ST	County Jurisdiction	X14147
ROCK SPRING DR & MARRIOTT DR & FERNWOOD RD	County Jurisdiction	X12123
ROCKVILLE PIKE & CHAPMAN AVE & HALPINE RD	Rockville	X13005
ROCKVILLE PIKE & EDMONSTON DR	Rockville	X12204
ROCKVILLE PIKE & MIDDLE LN & PARK RD	Rockville	X11402
ROCKVILLE PIKE & RICHARD MONTGOMERY DR & DODGE ST	Rockville	X11662
ROCKVILLE PIKE & TWINBROOK PKWY & ROLLINS AVE	Rockville	X13230
ROCKVILLE PIKE & WOOTTON PKWY & 1ST ST	Rockville	X11989
ROLLINS AVE & JEFFERSON ST	Rockville	X12839
RUSSELL AVE & CHRISTOPHER AVE	Gaithersburg	X05851
RUSSELL AVE & ODENDHAL AVE	Gaithersburg	X06611
SLIGO AVE & FENTON ST	County Jurisdiction	X21415
SLIGO CREEK PKWY & WAYNE AVE	County Jurisdiction	X22310
THAYER AVE & FENTON ST	County Jurisdiction	X21408
TWINBROOK PKWY & CHAPMAN AVE	Rockville	X13419
VEIRS MILL RD & 1ST ST	Rockville	X12059
VEIRS MILL RD & BROADWOOD DR	Rockville	X13028
WAYNE AVE & DIXON AVE & DISCOVERY PL	County Jurisdiction	X21175
WAYNE AVE & FENTON ST	County Jurisdiction	X21388
WAYNE AVE & RAMSEY AVE	County Jurisdiction	X21114
WESTLAKE TER & WESTLAKE DR	County Jurisdiction	X11427
WOODFIELD RD & MAIN ST	County Jurisdiction	X06840

MINI-ROUNDABOUT

Location	Jurisdiction	Location ID
2ND AVE & BALLARD ST	County Jurisdiction	X20817
2ND AVE & HANOVER ST	County Jurisdiction	X20457
2ND AVE & LUZERNE AVE	County Jurisdiction	X20348
2ND AVE & ROOKWOOD RD	County Jurisdiction	X20329
AMHERST AVE & ELKIN ST	County Jurisdiction	X19950
ARDENNES AVE & CRAWFORD DR	Rockville	X13344
BAUER DR & ARCTIC AVE	County Jurisdiction	X15538
BLUERIDGE AVE & GRANDVIEW AVE	County Jurisdiction	X19422
BRUNETT AVE & FOREST GLEN RD	County Jurisdiction	X21569
DAIRYMAID DR & METZ DR	County Jurisdiction	X01825
DEBORAH DR & BELLS MILL RD	County Jurisdiction	X09874
DUVALL LN & DEER PARK RD	Gaithersburg	X06868
EDINBURGH LN & MAPLE AVE & MAPLEWOOD AVE	Takoma Park	X22773
ELGIN RD & FISHER AVE	Poolesville	X00097
EXECUTIVE BLVD & WOODGLEN DR	County Jurisdiction	X13942
FERRARA DR & CHARLES RD	County Jurisdiction	X16468
FLOWER AVE & DOMER AVE	Takoma Park	X22819
FLOWER AVE & HOUSTON AVE	Takoma Park	X22912
FLOWER AVE & KENNEBEC AVE	Takoma Park	X22942
FLOWER AVE & WABASH AVE	Takoma Park	X22892
GAINSBOROUGH RD & BELLS MILL RD	County Jurisdiction	X09352
GATESHEAD MANOR WAY & ASTON MANOR DR	County Jurisdiction	X25138
GRANDVIEW AVE & ENNALLS AVE	County Jurisdiction	X19456
GRIDLEY LN & INWOOD AVE	County Jurisdiction	X20842
GROVE ST & THAYER AVE	County Jurisdiction	X21537
HALPINE RD & ARDENNES AVE	Rockville	X13506
HERITAGE HILLS DR & QUEEN ELIZABETH DR	County Jurisdiction	X17758
HILDEGARD LN & THOMPSON RD & PEACH ORCHARD RD	County Jurisdiction	X24598
HOLLY AVE & PHILADELPHIA AVE	Takoma Park	X22109
JAMES ST & CEDAR AVE	Gaithersburg	X07032
LANARK WAY & LORAIN AVE	County Jurisdiction	X21861
MEADOW HALL DR & MC AULIFFE DR	Rockville	X13977
NORMANDY CROSSING DR & HOMECREST RD & LONGMEAD CROSSING DR	County Jurisdiction	X19335
PARK AVE & BROOKES AVE	Gaithersburg	X07333
PINNACLE DR & CENTURY BLVD	County Jurisdiction	X02176
QUINTON RD & SUNDALE DR	County Jurisdiction	X20082
RAINBOW DR & GOOD HOPE RD	County Jurisdiction	X24157
ROCKING HORSE RD & BOILING BROOK PKWY	County Jurisdiction	X15151
RUSSELL AVE & BROOKES AVE	Gaithersburg	X07189
SHAKESPEARE BLVD & NEELSVILLE CHURCH RD	County Jurisdiction	X04098
SPENCER RD & RICHLAND ST & SUNDALE DR	County Jurisdiction	X20130
ST PAUL ST & PLYERS MILL RD	County Jurisdiction	X17828
SUMMIT HALL RD & DEER PARK RD	Gaithersburg	X07169
TAYLOR ST & BROOKVILLE RD	County Jurisdiction	X17734
TSCHIFFELY SQUARE RD & KENT OAKS WAY	Gaithersburg	X03413
TULIP AVE & MAPLE AVE	Takoma Park	X22123
WEISMAN RD & GRANDVIEW AVE	County Jurisdiction	X19500
WELLER RD & HATHAWAY DR	County Jurisdiction	X18499
WINDHAM LN & INWOOD AVE	County Jurisdiction	X20820
WINDMILL LN & GOOD HOPE RD	County Jurisdiction	X23911

ALL-WAY STOP CONTROL

Location	Jurisdiction	Location ID
2ND AVE & GLEN ROSS RD	County Jurisdiction	X20366
AMBASSADOR DR & DEERWATER DR & WATERS LANDING DR	County Jurisdiction	X01156
ANNDYKE WAY & WATERS LANDING DR	County Jurisdiction	X01030
ARCOLA AVE & GRANDVIEW AVE	County Jurisdiction	X19421
ARGYLE CLUB LN & VILLAGE GATE DR & LONGMEAD CROSSING DR	County Jurisdiction	X20107
BENT WILLOW CT & PARTRIDGE WOOD DR & WISTERIA DR	County Jurisdiction	X02519
BRADFORD RD & MANCHESTER RD	County Jurisdiction	X22527
BRADMOOR DR & GREENTREE RD	County Jurisdiction	X13237
BRIGHTON DR & DEER PARK RD	Gaithersburg	X07305
BRUNSWICK AVE & PLYERS MILL RD	County Jurisdiction	X19233
CAROLINE AVE & FRANKLIN AVE	County Jurisdiction	X22173
CHESTER ST & WILDWOOD DR & CARROLL AVE	County Jurisdiction	X23447
COLLEGE VIEW DR & NEWPORT MILL RD	County Jurisdiction	X18236
COLSTON DR & GRUBB RD	County Jurisdiction	X19622
DALLAS AVE & FOREST GLEN RD	County Jurisdiction	X21439
DRUMM AVE & PLYERS MILL RD	County Jurisdiction	X18180
EADES ST & ASPEN HILL RD	County Jurisdiction	X15434
ELM AVE & ETHAN ALLEN AVE	Takoma Park	X23253
EPPING RD & SHERATON ST & DENLEY PL & DENLEY RD	County Jurisdiction	X18730
EVANS PKWY & MEDICAL PARK DR & DENNIS AVE	County Jurisdiction	X20517
FLOWER AVE & HUDSON AVE	Takoma Park	X22891
FLOWER AVE & MELBOURNE AVE	County Jurisdiction	X22487
FLOWER AVE & SCHUYLER RD	County Jurisdiction	X22560
FOREST BROOK RD & WARING STATION RD	County Jurisdiction	X03139
FOREST BROOK RD & WINDING CREEK WAY & WARING STATION RD	County Jurisdiction	X03136
GIST AVE & FENTON ST	County Jurisdiction	X21417
GRANT AVE & MAPLE AVE	Takoma Park	X22373
GRUBB RD & WASHINGTON AVE	County Jurisdiction	X19880
HOTTINGER CIR & STONEY BOTTOM RD & WARING STATION RD	County Jurisdiction	X02895
IRIS PL & ASPEN HILL RD	County Jurisdiction	X15664
IRIS ST & ASPEN HILL RD	County Jurisdiction	X15586
JULEP AVE & DENNIS AVE	County Jurisdiction	X20869
LAWRENCE AVE & NEWPORT MILL RD	County Jurisdiction	X17599
LEATHERBARK DR & FOREST BROOK RD & WARING STATION RD	County Jurisdiction	X03266
LITTLE SENECA PKWY & SPICEBUSH DR	County Jurisdiction	X03419
LUND PL & MADISON ST & NEWPORT MILL RD	County Jurisdiction	X17730
MARTINS LANDING DR & SILVERGATE WAY & WISTERIA DR	County Jurisdiction	X02846
MONROE ST & SEMINARY RD	County Jurisdiction	X20018
MORNINGSIDE DR & TAMARACK RD	County Jurisdiction	X23858
NORMANDY CROSSING DR & LADYMEADE DR & LONGMEAD CROSSING DR	County Jurisdiction	X19556
OCALA ST & FRANKLIN AVE	County Jurisdiction	X22249
ORIENTAL ST & ASPEN HILL RD	County Jurisdiction	X15527
SAYBROOK AVE & FRANKLIN AVE	County Jurisdiction	X22376
SPENCER RD & GRUBB RD	County Jurisdiction	X19420
STONEY BOTTOM RD & ESMOND TER & WARING STATION RD	County Jurisdiction	X03003
TWINBROOK PKWY & MEADOW HALL DR	Rockville	X14115
WAYNE AVE & BRADFORD RD	County Jurisdiction	X22565
WELLER RD & FLACK ST	County Jurisdiction	X18672
WIMBLEDON DR & LADYMEADE DR & LONGMEAD CROSSING DR	County Jurisdiction	X19963
WIRE AVE & FRANKLIN AVE	County Jurisdiction	X22318

TRAFFIC SIGNAL (ANGLE CRASHES)

Location	Jurisdiction	Location ID
BELLS MILL RD & DEMOCRACY BLVD	County Jurisdiction	X12551
COLESVILLE RD & HASTINGS DR & GRANVILLE DR	County Jurisdiction	X21898
COLESVILLE RD & LORAIN AVE	County Jurisdiction	X22274
COLESVILLE RD & TIMBERWOOD AVE	County Jurisdiction	X22222
COLUMBIA PIKE & NORTHWEST DR	County Jurisdiction	X23093
COLUMBIA PIKE & OAK LEAF DR	County Jurisdiction	X23308
CONNECTICUT AVE & DECATUR AVE	County Jurisdiction	X17296
CONNECTICUT AVE & DUPONT AVE	County Jurisdiction	X17234
CONNECTICUT AVE & HOWARD AVE	County Jurisdiction	X17147
FREDERICK RD & GAME PRESERVE RD & FREDERICK AVE	County Jurisdiction	X04946
FREDERICK RD & SCENERY DR & GUNNERS BRANCH RD	County Jurisdiction	X04103
GEORGIA AVE & BALLARD ST	County Jurisdiction	X20928
GEORGIA AVE & BATCHELLORS FOREST RD & HILLCROFT DR	County Jurisdiction	X17529
GEORGIA AVE & BONNYWOOD LN & TILTON DR	County Jurisdiction	X20310
GEORGIA AVE & DAWSON AVE & LEESBOROUGH DR	County Jurisdiction	X19502
GEORGIA AVE & DAYTON ST & PREDELLA DR	County Jurisdiction	X20023
GEORGIA AVE & EVANS PKWY & EVANS DR	County Jurisdiction	X20067
GEORGIA AVE & HENDERSON AVE	County Jurisdiction	X19562
GEORGIA AVE & HIGHLAND DR	County Jurisdiction	X20760
GEORGIA AVE & KAYSON ST	County Jurisdiction	X18464
GEORGIA AVE & KING ST	County Jurisdiction	X21261
GEORGIA AVE & LINDELL ST & GEORGIAN WAY	County Jurisdiction	X19686
GEORGIA AVE & NOYES DR	County Jurisdiction	X20856
GEORGIA AVE & PARKER AVE	County Jurisdiction	X19539
GEORGIA AVE & WELLER RD	County Jurisdiction	X18817
NEW HAMPSHIRE AVE & ELDRID DR	County Jurisdiction	X23012
NEW HAMPSHIRE AVE & OAKLAWN CT & OAKLAWN DR	County Jurisdiction	X24087
NEW HAMPSHIRE AVE & PARKMAN RD & OVERLOOK DR	County Jurisdiction	X24146
NEW HAMPSHIRE AVE & SHAW AVE	County Jurisdiction	X22831
NEW HAMPSHIRE AVE & TANLEY RD	County Jurisdiction	X23434
RANDOLPH RD & ATHERTON DR	County Jurisdiction	X17099
RANDOLPH RD & BREGMAN RD	County Jurisdiction	X22652
RANDOLPH RD & BUSHEY DR	County Jurisdiction	X16972
RANDOLPH RD & CHARLES RD	County Jurisdiction	X16301
RANDOLPH RD & ENGLISH ORCHARD CT & HEURICH RD	County Jurisdiction	X20445
RANDOLPH RD & GOODHILL RD	County Jurisdiction	X17777
ROCKVILLE PIKE & BROAD BROOK DR & ELSMERE AVE	County Jurisdiction	X15158
ROCKVILLE PIKE & WICKSHIRE WAY & FLANDERS AVE	County Jurisdiction	X14310
UNIVERSITY BLVD & DEARBORN AVE & MOSS AVE	County Jurisdiction	X22944
UNIVERSITY BLVD & DRUMM AVE & HILLSDALE DR	County Jurisdiction	X18616
UNIVERSITY BLVD & ELKIN ST	County Jurisdiction	X19713
UNIVERSITY BLVD & INDIAN SPRING DR	County Jurisdiction	X22761
UNIVERSITY BLVD & KERWIN RD	County Jurisdiction	X21655
UNIVERSITY BLVD & LANGLEY DR	County Jurisdiction	X23323
UNIVERSITY BLVD & LORAIN AVE	County Jurisdiction	X22001
UNIVERSITY BLVD & MELBOURNE AVE	County Jurisdiction	X23051
UNIVERSITY BLVD & PERRY AVE	County Jurisdiction	X17470
VEIRS MILL RD & MONTERREY DR & SCHOOLHOUSE CIR	County Jurisdiction	X18720
VEIRS MILL RD & PENDLETON DR	County Jurisdiction	X18132
WISCONSIN AVE & AVONDALE ST & COMMERCE LN	County Jurisdiction	X15498

RESTRICT TO LEFT-IN ACCESS

Location	Jurisdiction	Location ID
16TH ST & GRACE CHURCH RD	County Jurisdiction	X20580
CLIFF PINE DR & BRENISH DR & WOODFIELD RD	County Jurisdiction	X11280
CLOPPER RD & LIBERTY MILL RD	County Jurisdiction	X01153
CONNECTICUT AVE & BALTIMORE ST	County Jurisdiction	X17155
CONNECTICUT AVE & BLACKTHORN ST	County Jurisdiction	X17055
CONNECTICUT AVE & BRIGHTVIEW ST	County Jurisdiction	X17376
CONNECTICUT AVE & DUNNEL LN	County Jurisdiction	X16783
CONNECTICUT AVE & FRANKLIN ST	County Jurisdiction	X16955
CONNECTICUT AVE & GREENLY ST	County Jurisdiction	X17524
CONNECTICUT AVE & IRVING ST	County Jurisdiction	X17037
CONNECTICUT AVE & KIRKE ST	County Jurisdiction	X17033
CONNECTICUT AVE & LELAND ST	County Jurisdiction	X17051
CONNECTICUT AVE & LENOX ST	County Jurisdiction	X17034
CONNECTICUT AVE & MELROSE ST	County Jurisdiction	X17038
CONNECTICUT AVE & NEWLANDS ST	County Jurisdiction	X17027
CONNECTICUT AVE & NEWLANDS ST	County Jurisdiction	X17031
CONNECTICUT AVE & OXFORD ST	County Jurisdiction	X17039
CONNECTICUT AVE & THORNAPPLE ST	County Jurisdiction	X17047
CONNECTICUT AVE & UNDERWOOD ST	County Jurisdiction	X17042
CONNECTICUT AVE & VIRGILIA ST & WILLIAMS LN	County Jurisdiction	X17048
CONNECTICUT AVE & WOODBINE ST	County Jurisdiction	X17046
DARNESTOWN RD & ARGOSY DR & DUFIEF MILL RD	County Jurisdiction	X05148
GERMANTOWN RD & MILLENIUM CT & CIDER BARREL DR	County Jurisdiction	X03457
OLD GEORGETOWN RD & ALTA VISTA RD	County Jurisdiction	X14066

CENTERLINE RUMBLE STRIP

Location	Jurisdiction	Location ID
ASHTON RD BETWEEN TUCKER LN & ASHLAND DR	County Jurisdiction	S29819
BARNESVILLE RD BETWEEN SUGAR RIDGE TER & PEACH TREE RD	County Jurisdiction	S31695
BEALLSVILLE RD BETWEEN ALMANNA FRM CUT THRU & BIG WOODS RD	County Jurisdiction	S32029
BUCKLODGE RD BETWEEN MOORE RD & DARNESTOWN RD	County Jurisdiction	S31874
BUCKLODGE RD BETWEEN OLD BUCKLODGE LN & WHITES STORE RD	County Jurisdiction	S29528
BUCKLODGE RD BETWEEN WHITES STORE RD & MOORE RD	County Jurisdiction	S31827
BURNT HILL RD BETWEEN KINGSTEAD RD & KINGSLEY RD	County Jurisdiction	S29142
BURNT HILL RD BETWEEN PRICES DISTILLERY RD & KINGSTEAD RD	County Jurisdiction	S29063
CLARKSBURG RD BETWEEN HYATTSTOWN MILL RD & SNOWDEN FARM PKWY	County Jurisdiction	S29618
CLARKSBURG RD BETWEEN LEWISDALE RD & HYATTSTOWN MILL RD	County Jurisdiction	S29187
CLARKSBURG RD BETWEEN OLD BALTIMORE RD & CHRISMAN HILL DR	County Jurisdiction	S31253
DAMASCUS RD BETWEEN FARM ACCESS RD & WINDCREST LN	County Jurisdiction	S31698
DARNESTOWN RD BETWEEN BELLINGHAM DR & WHITES FERRY RD	County Jurisdiction	S29517
DARNESTOWN RD BETWEEN BUCKLODGE RD & CATTAIL RD	County Jurisdiction	S30441
DARNESTOWN RD BETWEEN BUCKLODGE RD & WHITE GROUND RD	County Jurisdiction	S28811
DARNESTOWN RD BETWEEN DICKERSON RD/MARTINSBURG RD & HUNTER RD	County Jurisdiction	S29457
DARNESTOWN RD BETWEEN EDEN ROCK CT & GERMANTOWN RD	County Jurisdiction	S31007
DARNESTOWN RD BETWEEN JERUSALEM RD & BEALLSVILLE RD	County Jurisdiction	S29600
DARNESTOWN RD BETWEEN GERMANTOWN RD & BERRYVILLE RD	County Jurisdiction	S31300
DICKERSON RD BETWEEN DICKERSON CHURCH RD & DARNESTOWN RD	County Jurisdiction	S31471
EDWARDS FERRY RD BETWEEN WHITES FERRY RD & CLUB HOLLOW RD	County Jurisdiction	S29690
EDWARDS FERRY RD BETWEEN WESTERLY RD & OFFUTT RD	County Jurisdiction	S29790
ELMER SCHOOL RD AT WHITES FERRY RD	County Jurisdiction	S29754
GEORGIA AVE BETWEEN NEW HAMPSHIRE AVE/DAMASCUS RD & GREGG RD	County Jurisdiction	S32094
GERMANTOWN RD BETWEEN BLACK ROCK RD & CITIZENS LN	County Jurisdiction	S31559
GREGG RD BETWEEN GEORGIA AVE & GREGG CT	County Jurisdiction	S29139
HUNTER RD BETWEEN DARNESTOWN RD & WASCHE RD	County Jurisdiction	S32170
LAYTONSVILLE RD BETWEEN HAWKINS CREAMERY RD & ROCKY RD	County Jurisdiction	S32014
MARTINSBURG RD BETWEEN DICKERSON CP ENT & WHITES FERRY RD	County Jurisdiction	S30242
PARTNERSHIP RD BETWEEN SUGARLAND RD & RIVER RD	County Jurisdiction	S31524
PARTNERSHIP RD BETWEEN WHITES FERRY RD & SUGARLAND RD	County Jurisdiction	S31788
PEACH TREE RD BETWEEN BARNESVILLE RD & SELLMAN RD	County Jurisdiction	S31669
PEACH TREE RD BETWEEN MOORE RD & DARNESTOWN RD	County Jurisdiction	S29530
PEACH TREE RD BETWEEN COMUS RD & OLD BALTIMORE RD	County Jurisdiction	S31636
RIDGE RD BETWEEN BROWN CHURCH RD & KEMPTOWN RD	County Jurisdiction	S29635
RIVER RD BETWEEN HUNTING QUARTER RD & HUGHES RD	County Jurisdiction	S28058
RIVER RD BETWEEN LONGACRES PRESERVE CT & PETTIT WAY	County Jurisdiction	S27884
RIVER RD BETWEEN PARTNERSHIP RD & HUNTING QUARTER RD	County Jurisdiction	S31635
SLIDELL RD BETWEEN COMUS RD & OLD BALTIMORE RD	County Jurisdiction	S31513
SLIDELL RD BETWEEN OLD BALTIMORE RD & BARNESVILLE RD	County Jurisdiction	S31748
SUGARLAND RD BETWEEN MONTEVIDEO RD & PARTNERSHIP RD	County Jurisdiction	S31820
SUGARLAND RD BETWEEN SUGARLAND LN & HUGHES RD	County Jurisdiction	S29104
WASCHE RD AT HUNTER RD	County Jurisdiction	S29665
WHITES FERRY RD BETWEEN ELMER SCHOOL RD & RIVER RD	County Jurisdiction	S29236
WHITES FERRY RD BETWEEN MORROW RD & PARTNERSHIP RD	County Jurisdiction	S31883
WHITES FERRY RD BETWEEN SUGARLAND RD & MORROW RD	County Jurisdiction	S32015
WHITES STORE RD BETWEEN BUCKLODGE RD & PEACH TREE RD	County Jurisdiction	S31889
WILLARD RD BETWEEN OFFUTT RD & IZAAK WALTON WAY	County Jurisdiction	S30294
WOODFIELD RD BETWEEN WATKINS RD & DEANNA DR	County Jurisdiction	S32057
ZION RD BETWEEN RIGGS RD & BROOKEVILLE RD	County Jurisdiction	S29439

REDUCE SPEEDS BY 5 MPH

Location	Jurisdiction	Location ID
ASHTON RD BETWEEN TUCKER LN & ASHLAND DR	County Jurisdiction	S29819
BARNESVILLE RD BETWEEN CLARKSBURG RD & GANLEY RD	County Jurisdiction	S31109
BARNESVILLE RD BETWEEN SUGAR RIDGE TER & PEACH TREE RD	County Jurisdiction	S31695
BEALLSVILLE RD BETWEEN ALMANNA FRM CUT THRU & BIG WOODS RD	County Jurisdiction	S32029
BROOKEVILLE RD BETWEEN GRAYHEAVEN MANOR RD & ZION RD	County Jurisdiction	S32422
BUCKLODGE RD BETWEEN MOORE RD & DARNESTOWN RD	County Jurisdiction	S31874
BUCKLODGE RD BETWEEN OLD BUCKLODGE LN & WHITES STORE RD	County Jurisdiction	S29528
BUCKLODGE RD BETWEEN WHITES STORE RD & MOORE RD	County Jurisdiction	S31827
BURNT HILL RD BETWEEN KINGSTEAD RD & KINGSLEY RD	County Jurisdiction	S29142
BURNT HILL RD BETWEEN PRICES DISTILLERY RD & KINGSTEAD RD	County Jurisdiction	S29063
CLARKSBURG RD BETWEEN BARNES RD & PRICES DISTILLERY RD	County Jurisdiction	S29593
CLARKSBURG RD BETWEEN HYATTSTOWN MILL RD & SNOWDEN FARM PKWY	County Jurisdiction	S29618
CLARKSBURG RD BETWEEN LEWISDALE RD & HYATTSTOWN MILL RD	County Jurisdiction	S29187
CLARKSBURG RD BETWEEN OLD BALTIMORE RD & CHRISMAN HILL DR	County Jurisdiction	S31253
CLARKSBURG RD BETWEEN WOODVIEW DR & MOXLEY RD	County Jurisdiction	S29550
DAMASCUS RD BETWEEN FARM ACCESS RD & WINDCREST LN	County Jurisdiction	S31698
DAMASCUS RD BETWEEN NEW HAMPSHIRE AVE/GEORGIA AVE & SUNDOWN RD	County Jurisdiction	S31487
DARNESTOWN RD BETWEEN EDEN ROCK CT & GERMANTOWN RD	County Jurisdiction	S31007
DARNESTOWN RD BETWEEN JERUSALEM RD & BEALLSVILLE RD	County Jurisdiction	S29600
DICKERSON RD BETWEEN DICKERSON CHURCH RD & DARNESTOWN RD	County Jurisdiction	S31471
EDWARDS FERRY RD BETWEEN WHITES FERRY RD & CLUB HOLLOW RD	County Jurisdiction	S29690
EDWARDS FERRY RD BETWEEN WESTERLY RD & OFFUTT RD	County Jurisdiction	S29790
ELMER SCHOOL RD AT WHITES FERRY RD	County Jurisdiction	S29754
GEORGIA AVE BETWEEN NEW HAMPSHIRE AVE/DAMASCUS RD & GREGG RD	County Jurisdiction	S32094
GERMANTOWN RD BETWEEN BLACK ROCK RD & CITIZENS LN	County Jurisdiction	S31559
GREGG RD BETWEEN GEORGIA AVE & GREGG CT	County Jurisdiction	S29139
HAWKINS CREAMERY RD BETWEEN HAWKINS CREAMERY CT & HAWKINS LANDING DR	County Jurisdiction	S31606
HUNTER RD BETWEEN DARNESTOWN RD & WASCHE RD	County Jurisdiction	S32170
LAYTONSVILLE RD BETWEEN ROCKY RD & GRIFFITH RD	County Jurisdiction	S31750
MARTINSBURG RD BETWEEN DICKERSON CP ENT & WHITES FERRY RD	County Jurisdiction	S30242
MONTEVIDEO RD BETWEEN THOROBRED DR & OLD RIVER RD	County Jurisdiction	S31725
PARTNERSHIP RD BETWEEN SUGARLAND RD & RIVER RD	County Jurisdiction	S31524
PARTNERSHIP RD BETWEEN WHITES FERRY RD & SUGARLAND RD	County Jurisdiction	S31788
PEACH TREE RD BETWEEN BARNESVILLE RD & SELLMAN RD	County Jurisdiction	S31669
PEACH TREE RD BETWEEN MOORE RD & DARNESTOWN RD	County Jurisdiction	S29530
PEACH TREE RD BETWEEN COMUS RD & OLD BALTIMORE RD	County Jurisdiction	S31636
RIDGE RD BETWEEN KEMPTOWN RD & HOLSEY RD	County Jurisdiction	S30053
SLIDELL RD BETWEEN COMUS RD & OLD BALTIMORE RD	County Jurisdiction	S31513
SLIDELL RD BETWEEN OLD BALTIMORE RD & BARNESVILLE RD	County Jurisdiction	S31748
SPENCERVILLE RD BETWEEN OURSLER RD & PEACH ORCHARD RD	County Jurisdiction	S29445
SUGARLAND RD BETWEEN MONTEVIDEO RD & PARTNERSHIP RD	County Jurisdiction	S31820
SUGARLAND RD BETWEEN SUGARLAND LN & HUGHES RD	County Jurisdiction	S29104
WASCHE RD AT HUNTER RD	County Jurisdiction	S29665
WASCHE RD BETWEEN HUNTER RD & EDWARDS FERRY RD/WHITES FERRY RD	County Jurisdiction	S29164
WHITES FERRY RD BETWEEN MORROW RD & PARTNERSHIP RD	County Jurisdiction	S31883
WHITES FERRY RD BETWEEN SUGARLAND RD & MORROW RD	County Jurisdiction	S32015
WHITES STORE RD BETWEEN BUCKLODGE RD & PEACH TREE RD	County Jurisdiction	S31889
WILLARD RD BETWEEN OFFUTT RD & IZAAK WALTON WAY	County Jurisdiction	S30294
WOODFIELD RD BETWEEN EXODUS DR & BRINK RD	County Jurisdiction	S32189
ZION RD BETWEEN RIGGS RD & BROOKEVILLE RD	County Jurisdiction	S29439

AUTOMATED SPEED ENFORCEMENT

Location	Jurisdiction	Location ID
COLESVILLE RD BETWEEN LANARK WAY & HASTINGS DR/GRANVILLE DR	County Jurisdiction	S26501
COLESVILLE RD BETWEEN TOMS DR/COLUMBIA PIKE & CRESTMOOR DR	County Jurisdiction	S28613
COLUMBIA PIKE BETWEEN BLACKBURN RD & GREENCASTLE RD	County Jurisdiction	S26732
COLUMBIA PIKE BETWEEN BRIGGS CHANEY RD & FAIRLAND RD	County Jurisdiction	S31960
COLUMBIA PIKE BETWEEN FAIRLAND RD & MUSGROVE RD	County Jurisdiction	S26733
COLUMBIA PIKE BETWEEN GREENCASTLE RD & BRIGGS CHANEY RD	County Jurisdiction	S26439
COLUMBIA PIKE BETWEEN INDUSTRIAL PKWY & OLD COLUMBIA CUTOVER PIKE	County Jurisdiction	S27077
COLUMBIA PIKE BETWEEN MUSGROVE RD & RANDOLPH RD/CHERRY HILL RD	County Jurisdiction	S27557
COLUMBIA PIKE BETWEEN RANDOLPH RD/CHERRY HILL RD & TECH RD	County Jurisdiction	S26235
COLUMBIA PIKE BETWEEN SANDY SPRING RD & BLACKBURN RD	County Jurisdiction	S28217
COLUMBIA PIKE BETWEEN STEWART LN & NEW HAMPSHIRE AVE	County Jurisdiction	S27214
CONNECTICUT AVE AT DENFELD AVE	County Jurisdiction	S28662
CONNECTICUT AVE BETWEEN BEACH DR & WOODLAWN RD	County Jurisdiction	S28021
CONNECTICUT AVE BETWEEN DENFELD AVE & LAWRENCE AVE	County Jurisdiction	S27067
CONNECTICUT AVE BETWEEN INDEPENDENCE ST & DEAN RD	County Jurisdiction	S27902
FREDERICK AVE BETWEEN CHRISTOPHER AVE & MONTGOMERY VILLAGE AVE	Gaithersburg	S26333
FREDERICK AVE BETWEEN MONTGOMERY VILLAGE AVE & PERRY PKWY	Gaithersburg	S26404
FREDERICK AVE BETWEEN TRAVIS AVE/SPECTRUM AVE & PARAMOUNT PARK DR	Gaithersburg	S27204
FREDERICK AVE BETWEEN WATKINS MILL RD & CHRISTOPHER AVE	Gaithersburg	S26291
FREDERICK RD BETWEEN INDIANOLA DR/WATKINS POND BLVD & GUDE DR	Rockville	S27276
FREDERICK RD BETWEEN RIDGEMONT AVE & SHADY GROVE RD	Rockville	S29045
FREDERICK RD BETWEEN WHEATFIELD DR & GAME PRESERVE RD	County Jurisdiction	S28983
GEORGIA AVE BETWEEN BATCHELLORS FOREST RD & THISTLEBRIDGE DR	County Jurisdiction	S26140
GEORGIA AVE BETWEEN ROSSMOOR BLVD & BEL PRE RD	County Jurisdiction	S28211
GEORGIA AVE BETWEEN SLIGO AVE & BLAIR MILL RD	County Jurisdiction	S32125
GERMANTOWN RD BETWEEN BOWMAN MILL DR & DAWSON FARM RD	County Jurisdiction	S28022
GERMANTOWN RD BETWEEN OBSERVATION DR & SENECA MEADOWS PKWY	County Jurisdiction	S28731
HUNGERFORD DR BETWEEN WASHINGTON ST/A ST & STATION3 DR	Rockville	S26698
MIDDLEBROOK RD AT OBSERVATION DR	County Jurisdiction	S29974
MONTGOMERY VILLAGE AVE BETWEEN FREDERICK AVE & QUINCE ORCHARD RD	Gaithersburg	S26299
MONTGOMERY VILLAGE AVE BETWEEN LOST KNIFE RD & RUSSELL AVE	Gaithersburg	S26461
MONTROSE RD BETWEEN TILDENWOOD DR & FARM HAVEN DR	County Jurisdiction	S28566
NEW HAMPSHIRE AVE BETWEEN ELTON RD & OAKVIEW DR	County Jurisdiction	S31745
NEW HAMPSHIRE AVE BETWEEN BONIFANT RD & COLESVILLE MANOR DR	County Jurisdiction	S29844
NEW HAMPSHIRE AVE BETWEEN RODNEY RD & OAKLAWN CT/OAKLAWN DR	County Jurisdiction	S27964
RANDOLPH RD BETWEEN DEWEY RD & GAYNOR RD/ROCKING HORSE RD	County Jurisdiction	S26730
RIDGE RD AT FATHER HURLEY BLVD	County Jurisdiction	S28778
RIDGE RD AT OBSERVATION DR	County Jurisdiction	S28874
RIDGE RD BETWEEN BRINK RD & HENDERSON CORNER RD	County Jurisdiction	S28570
RIDGE RD BETWEEN FREDERICK RD & OBSERVATION DR	County Jurisdiction	S28999
ROCKVILLE PIKE BETWEEN TALBOTT ST & TEMPLETON PL	Rockville	S28727
SHADY GROVE RD BETWEEN CHOKE CHERRY RD & CORPORATE BLVD	Gaithersburg	S30304
SHADY GROVE RD BETWEEN CRABBS BRANCH WAY & OAKMONT AVE	County Jurisdiction	S29029
SHADY GROVE RD BETWEEN TUPELO DR/EPSILON DR & BRIARDALE RD	County Jurisdiction	S29250
VEIRS MILL RD BETWEEN HAVARD ST & TURKEY BRANCH PKWY	County Jurisdiction	S26711
VEIRS MILL RD BETWEEN TURKEY BRANCH PKWY & GAYNOR RD/PARKLAND DR	County Jurisdiction	S28486
VEIRS MILL RD BETWEEN REEDIE DR & GEORGIA AVE	County Jurisdiction	S28708
WISCONSIN AVE BETWEEN EAST WEST HWY/OLD GEORGETOWN RD & MONTGOMERY LN/MONTGOMERY AVE	County Jurisdiction	S29681
WOODFIELD RD BETWEEN CYPRESS HILL DR/RICKENBACKER DR & AIRPARK RD	County Jurisdiction	S28514
WOODFIELD RD BETWEEN ROSEWOOD MANOR LN & HADLEY FARMS DR	County Jurisdiction	S26575

Appendix K. Countermeasure Costs

Countermeasure	Cost	Unit	Source*
All-Way Stop Control	$5,000	per location	MCDOT
Automated Speed Enforcement	$0	per location	MCDOT (Costs are offset by revenue)
Centerline Rumble Strip	$1.50	per foot	MCDOT
Fully Protected Left Turn	$50,000	per location	MCDOT
High-Visibility Crosswalks	$3,070	per location	PedBikeSafe
Increase All Red Clearance Interval	$3,000	per location	PedBikeSafe (comparable to LPI)
Leading Pedestrian Interval	$3,000	per location	PedBikeSafe
"Left-In-Only" Median	$50,000	per location	PedBikeSafe
Lighting	$5,000	per location	PedBikeSafe
Lower Speed Limit by 5 mph	$1,500	per location	MCDOT
Mini-Roundabout	$200,000	Per location	MCDOT
Pedestrian Hybrid Beacon	$175,000	per location	MCDOT
Protected/Permitted Left Turn	$50,000	per location	MCDOT
Raised Pedestrian Crosswalk	$15,000	per location	PedBikeSafe
Speed Humps	$5,000	per location	Speed Humps
Traffic Signal	$350,000	per location	MCDOT

* PedBikeSafe countermeasures can be found at http://www.pedbikesafe.org/pedsafe/countermeasures.cfm.

Appendix L. Areas of Future Study

While the Predictive Safety Analysis provides an in-depth look at systemic safety issues in Montgomery County, additional research and analysis could further serve the county's safety goals. A few potential next steps could address the following:

- **Assess Additional Countermeasures and Countermeasure Scenarios:** Continue to work with agency partners to identify systemic safety solutions to reduce crashes throughout the roadway network. Identify additional countermeasures for review and systemic contexts in which they may be applied.
- **Evaluate Additional Crash Types:** This analysis focused on six common crash types in Montgomery County, covering almost 50% of the county's severe injuries and fatalities between 2015 and 2019. Future analysis could evaluate additional crash types, increasing the overall percentage of crashes and severe injuries and fatalities included in the study. A specific focus of additional analysis could be motor vehicle crash types, as only about 40% of motor vehicle severe injuries and fatalities are included in the studied crash types.
- **Collect Additional Transportation Attributes:** The transportation attributes included in this analysis were limited to those available countywide. Some transportation attributes potentially associated with safety were unable to be included in the project, such as information about signal timing (e.g., protected left-turns, all-red time, etc.) and intersection configuration (e.g., presence and number of turn lanes, and if right-turns are channelized). Incorporating new variables into a future analysis could identify new safety issues not currently addressed in the Predictive Safety Analysis.
- **Conduct Before-and-After Studies:** Only countermeasures with existing research about crash reduction are included in the countermeasure evaluation tool. The county could complete before-and-after studies at locations with systemic treatments to identify the observed crash reduction associated with these safety improvements. This data would not only support a more local understanding of crash mitigation, but also could also serve as a communications tool to demonstrate the value of implementing these treatments.
- **Refine Existing Transportation Attributes:** The Predictive Safety Analysis estimated crashes at the intersection and segment levels. Many of the bicycle and pedestrian variables used in the analysis were derived from the Bicycle Level of Traffic Stress (LTS) and the Pedestrian Level of Comfort (PLOC), which summarize these attributes where they exist – along the sides of the road or as individual crossings. Unfortunately, there is not currently a "crosswalk" or an ID that links these crossings, pathways, and bike lanes to their respective intersections and segments. In order to use the LTS and PLOC data for the Predictive Safety Analysis, proximity analyses were conducted, which generalize the bicycle and pedestrian features. In the future, an ID linking these datasets could be created to allow for more precise inclusion of bicycle and pedestrian variables.
- **Modify Volume Estimates:** A key step of the Predictive Safety Analysis was developing volume estimation models based on annualized existing counts. In this analysis, all short-duration counts were included in the model development, and these counts ranged from two-hour to multi-day

counts. While the developed models provide insight into pedestrian, bicyclist, and motorist behavior, limiting the short-duration counts to those at least eight hours or more could potentially provide a better fitting model, which in turn, could result in updated and/or better fitting SPFs. Many of the variables included in the SPFs were related to exposure, and more precise volume models could potentially result in new significant variables. This effort may just require conducting additional counts, rather than just reanalyzing a subset of the existing counts.