Montgomery
County Council

Committee: Directly to Council
Committee Review: N/A
Staff: Glenn Orlin, Senior Analyst
Purpose: Receive briefing and have discussion – no vote expected
Keywords: #VisionZero

AGENDA ITEM #7
January 28, 2020
Discussion

SUBJECT

Vision Zero Program - Update

EXPECTED ATTENDEES

Presenters include:

Tim Smith, Acting State Highway Administrator

Wade Holland, Acting Vision Zero Coordinator for the County Government

Casey Anderson, Chair, Montgomery County Planning Board; and

Kristy Daphnis, Chair, Pedestrian, Bicycle, and Traffic Safety Advisory Committee

COUNCIL DECISION POINTS & COMMITTEE RECOMMENDATION

Not applicable

DESCRIPTION/ISSUE

The Council has scheduled this update in response to the recent spate of pedestrian fatalities. The Council will receive briefings from the State Highway Administration, County Government, the Park & Planning Commission, and the Pedestrian, Bicycle & Traffic Safety Advisory Committee.

SUMMARY OF KEY DISCUSSION POINTS

To be determined.

This report contains:

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AGENDA ITEM #7
January 28, 2020

MEMORANDUM

January 23, 2020

TO: County Council

FROM: Glenn Orlin, Senior Analyst GO

SUBJECT: Vision Zero Program

PURPOSE: Update

Vision Zero (VZ) is a wide-ranging program of engineering, education, and enforcement initiatives to significantly reduce and even eliminate fatal and severe injury accidents to pedestrians, bicyclists, and motor vehicle users by 2030.[1] This is the third Council update on the VZ program in the last year, the prior two on March 26, 2019 and November 19, 2019. During this update the Council will hear updates from:

Tim Smith, Acting State Highway Administrator, concentrating on what VZ efforts have been undertaken by SHA in Montgomery County since the briefing two months ago, as well as what actions are being taken to specifically address the two fatalities on Georgia Avenue within the last couple of weeks;

Wade Holland, Acting VZ Coordinator for the County Government, describing its 2020 VZ Work Program (he will have a PowerPoint presentation), and reporting what VZ efforts have been undertaken by County DOT, Police, etc. since the November briefing, and the status for hiring a permanent VZ Coordinator;

Casey Anderson, Chair, Montgomery County Planning Board, describing the Planning staff's planned VZ Work Program (see ©1-26); and

Kristy Daphnis, Chair, Pedestrian, Bicycle, and Traffic Safety Advisory Committee, commenting on the Committee's recent activities.

[1] Key search term: #VisionZero

The cumulative time for these updates should take about a half-hour, leaving about an hour for Q&A among Councilmembers and staff. Others anticipated to be on hand as resources for the Q&A session are:

Adriana Hochberg, Assistant Chief Administrative Officer
Chris Conklin, Director, County Department of Transportation (DOT)
Captain Tom Didone, Acting Chief, Field Services Division, Department of Police (MCPD)
Captain David McBain, Acting Traffic Division Director, MCPD
Andre Futrell, District 3 Engineer, SHA
Erica Rigby, P.E., Deputy District 3 Engineer, SHA
Derek Gunn, P.E., Assistant District 3 Engineer – Traffic, SHA
Samantha Biddle, Director, Organizational Excellence, SHA
Leon Langley, Assistant Director of Transportation, Montgomery County Public Schools (MCPS) – may be joined later by Todd Watkins, Director of Transportation, MCPS

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MONTGOMERY COUNTY PLANNING DEPARTMENT
THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION

MCPB
Item No. 2
Date: 01/23/2020

Vision Zero Update and Work Program Discussion

DA David Anspacher, Transportation Supervisor, david.anspacher@montgomeryplanning.org, 301-495-2191
KW Karen Warnick, Management Services Chief, karen.warnick@montgomeryplanning.org, 301-495-4517
JS Jason Sartori, Functional Planning and Policy Chief, jason.sartori@montgomeryplanning.org, 301-495-2172

Completed: 01/16/2020

SUMMARY

Receive briefing and add the Predictive Safety Analysis project to the department's work program for the current fiscal year (FY20).

DESCRIPTION

The purpose of this discussion is to:

1) Provide an update on the Planning Department's Vision Zero work plan.
2) Provide an overview of the Department's Vision Zero accomplishments in 2019.
3) Request approval from the Planning Board to add a Predictive Safety Analysis project to the department's work program for the current fiscal year.

BACKGROUND

Vision Zero is 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 regardless of whether travel is by car, bus, bicycle or foot. Vision Zero recognizes that people will sometimes make mistakes and that our roads should be designed to ensure those inevitable mistakes do not result in severe injuries or fatalities.

Through its 2016 County Council resolution, Montgomery County committed to eliminating traffic fatalities and severe injuries. In 2017, the County Executive released an initial two-year action plan of activities to advance the County toward Vision Zero and substantial progress has been made toward most of these items (see Attachment A). The two items that are in the Planning Department's work program – ENG-2 (Road Design Standards, aka the Complete Streets Design Guide / Roadway Classification Study) and LPA-6 (Pedestrian Master Plan) – are both well underway. A One-Year 2020 Action Plan will be released by the County imminently to bridge activities between the current Two-Year Action Plan and the Ten-Year Action Plan. The County will be developing a Ten-Year Action Plan over the next year.

PLANNING DEPARTMENT'S VISION ZERO WORK PLAN

Vision Zero is a multidisciplinary effort that requires the support of all County agencies to be successful. The Montgomery County Planning Department has an important role to play in Vision Zero and can

support Montgomery County's program with community engagement, data analysis, master planning, development review and capital project review, among other things. The Planning Department has prepared a Vision Zero Work Plan describing the tasks that the department can undertake to support the County's Vision Zero program. This work plan includes a description of each task, the justification for the task, the required resources and the anticipated timeline to completion.

Staff will brief the Planning Board on the Planning Department's Vision Zero Work Plan on January 16. A copy of the work plan is included as Attachment B. (See ©4-19)

RECAP OF THE PLANNING DEPARTMENT'S VISION ZERO ACCOMPLISHMENTS IN 2019

The Planning Department had several Vision Zero accomplishments in 2019. These include hiring the department's first Vision Zero Coordinator, completing the Veirs Mill Corridor Master Plan, MARC Rail Communities Master Plan and Aspen Hill Vision Zero Study, co-leading the development of the Complete Street Design Guide / Roadway Functional Classification Project and the Fire Department Access Performance-Based Design Guide with the Department of Transportation and the Department of Permitting Services, initiating the Pedestrian Master Plan, preparing a Pedestrian Level of Comfort Map and reviewing a number of important regulatory projects.

A summary of the Planning Department's Vision Zero accomplishments in 2019 is included as Attachment C.

PREDICTIVE SAFETY ANALYSIS

One of the changes that many Vision Zero communities undertake is to transition from a safety approach that focuses on locations where high rates of severe injuries or fatalities have already occurred to one that also proactively identifies and treats locations with similar risk characteristics. This approach – what we are calling a Predictive Safety Analysis – seeks to prevent serious injury or fatal crashes from happening throughout the roadway network, including at locations without a recent history of crashes, but where a high risk of future crashes may be suspected based on the roadway characteristics and surrounding context.

Planning Department staff requests approval from the Planning Board to add a Predictive Safety Analysis project to the Department's work program for the current fiscal year (FY20). It is anticipated that this project will take 12 months.

The Planning Department is well-positioned to complete this effort as we have the necessary staffing to manage the project and we have extensive data management and analysis expertise. Staff believes this project is necessary to initiate this fiscal year, as the analysis it provides is critical to guiding the projects and policy changes that will be identified in the County's ten-year action plan, which the County intends to complete by the end of calendar year 2020. The project, which is described in greater detail in Attachment D, will be completed in partnership with the Montgomery County Department of Transportation (MCDOT) and CountyStat, with their staff participating heavily in the development of the project. The Planning Department has recently hired Jesse Cohn as its first Vision Zero Coordinator and one of her primary tasks would be to manage this project. Staff estimates the cost of this project to be approximately $250,000, based on similar work that was completed by the City of Seattle, Washington.

(See © 20-26)

Staff recommends that we use a combination of existing funds to complete this project.

The Functional Planning and Policy Division has identified $75,000 in its current FY20 operating budget that can be used toward this project, including 1) $25,000 for Transportation Modeling for the Pedestrian Master Plan and 2) $50,000 for Data for Vision Zero.

An additional $125,000 has been identified through early estimates of FY20 personnel savings, which the Planning Department is requesting to reallocate for the Predictive Safety Analysis project.

The Department believes that the remaining $50,000 can be identified in additional personnel savings or other budget savings over the remaining six months in FY20.

Another option to fund this project would be to seek a supplemental appropriation for any remaining funding shortfall from the County Council.

Staff has considered asking MCDOT to contribute funding to this project. However, when we have tried this option in the past, we have found the process to be complicated and very time-consuming to transfer funding between departments, relative to the timeline for this project. MCDOT already has committed to be a critical partner in the Predictive Safety Analysis, and that department's capital budget will be a key source of funding to implement recommendations from the study.

MCDOT has provided a letter supporting the addition of the project to the Planning Department's work program, which is included as Attachment E.

SUMMARY OF STAFF RECOMMENDATIONS

Staff recommends:

- Adding the Predictive Safety Analysis to the Planning Department's current work program, with a completion date of January 2021.
- Funding the Predictive Safety Analysis in part by transferring $125,000 to the project from personnel savings in the Planning Department's FY20 operating budget.

ATTACHMENTS

Attachment A – Progress in Implementing the Vision Zero Two-Year Action Plan

Attachment B – Planning Department Vision Zero Work Plan

Attachment C – Overview of Planning Department's Vision Zero Accomplishments in 2019

Attachment D – Predictive Safety Analysis Work Plan

Attachment E – Letter from the Montgomery County Department of Transportation

VISION ZERO BACKGROUND

Montgomery County is one of the first counties and suburban communities to commit to Vision Zero. The County's neighborhoods and subdivision patterns are largely auto-centric, characterized by long blocks, wide travel lanes and low-densities. Coupled with a transportation system built to prioritize motor vehicle travel, these land use patterns encourage motorists to drive at high speeds and create a highly disconnected walking and bicycling network.

These suburban features present greater challenges to achieving the objectives of Vision Zero than the grid of walkable streets that define the development pattern of many North American cities that have adopted Vision Zero. Montgomery County's land use patterns and the design of its transportation network were intentional and represent the fulfillment of a vision to segregate land uses and connect distant activity centers by high-speed automobile travel. Achieving Vision Zero will require re-envisioning its existing development patterns and transportation network.

Vision Zero is a multidisciplinary effort that requires the support of all County agencies to be successful. The Montgomery County Planning Department has an important role to play in Vision Zero and can support Montgomery County's program with community engagement, data analysis, master-planning, development review and capital project review, among other things.

WORK PLAN OVERVIEW

To support the successful implementation of Montgomery County's Vision Zero policy, the Montgomery County Planning Department should focus on the following elements:

- Educate residents, community organizations and elected officials.
- Develop collaborative partnerships with local, regional and state agencies, as well as the community, to advance Vision Zero.
- Base recommendations for the Planning Department's work products on robust data analysis that informs changes to County policies and priorities.
- Utilize the master plan process to re-envision our communities, especially our suburban transit corridors and commercial areas, as multimodal complete streets with appropriate land use densities.
- Review and approve regulatory projects with a Vision Zero focus.
- Review capital projects and identify budget priorities that best support Vision Zero.

This work plan includes a list of actions the Planning Department can initiate to support Montgomery County's Vision Zero program, identifies the resources that are needed to complete these tasks and assigns a timeline to each task. The work plan is divided into four sections:

- Building Knowledge and Collaborative Partnerships
- Problem Verification
- Develop Solutions
- Incorporate Solutions into Work Program

BUILDING KNOWLEDGE AND COLLABORATIVE PARTNERSHIPS

The Planning Department engages with the community, appointed and elected officials, and governmental agencies through master plans, regulatory applications, review of capital projects and review of budget priorities. This comprehensive participation provides an opportunity for the Planning Department to educate stakeholders and develop collaborative partnerships to advance Vision Zero. The following list of actions identifies strategies to educate participants, establish a shared understanding of Vision Zero and provide opportunities for collaboration amongst individuals and groups to advance Vision Zero in their communities and throughout Montgomery County.

Develop a Vision Zero Toolkit for Community Organizations	
Lead: Vision Zero Coordinator	**Support**: Communications Team, Transportation Planners
Action: Collaborate with Montgomery County to develop a toolkit for community organizations and community members to build a systematic understanding of Vision Zero and provide resources for advocating on behalf of Vision Zero through participation in master plan development, regulatory review and capital project review / budgeting. Toolkit can be translated into multiple languages and may include: • Educational letters and flyers. • Presentation talking points. • Video that explains Vision Zero in an approachable way. • Yard signs to build awareness of Vision Zero (with messaging such as "20 is Plenty"). • Residential testimonials. • Walk audit checklists.	
Justification: To ensure that community leaders have the resources they need to develop a Vision Zero constituency and to educate other community members about Vision Zero.	
Resources: Communications support	
Timeline: Short Term	

Engaging Hard-to-Reach Communities	
Lead: Vision Zero Coordinator	**Support**: Communications Team
Action: Collaborate with Montgomery County to convene hard-to-reach groups to advance understanding of Vision Zero in their communities. • Identify opportunities to reach community members in the County's Equity Emphasis Areas and vulnerable populations, such as students. • Identify and engage leaders in traditionally hard-to-reach communities.	
Justification: To ensure that all communities are aware of and have the opportunity to participate in Vision Zero.	
Resources: Communications support	
Timeline: Ongoing	

Educate Community Members, Agency Staff and Appointed/Elected Officials	
Lead: Vision Zero Coordinator	**Support**: Communications Team, Transportation Planners
Action: Collaborate with Montgomery County to educate community organizations, community members, county agencies and appointed and elected officials about Vision Zero and opportunities for engagement. • Organize and implement a Vision Zero summit for established organizations with a stated interest in Vision Zero. • Organize and implement a Citizen's Academy, or program designed to provide community members with a working knowledge of the roles of governmental agencies in Vision Zero and a central resource for community members. • Organize demonstration projects, through placemaking events or tactical urbanism, to exhibit solutions, improvements or strategies consistent with Vision Zero. • Educate county and state employees indirectly through master plans, capital project review and regulatory review. • Educate appointed and elected officials through briefings, master plan development, capital project review and regulatory approvals. • Develop partnerships with other stakeholders, such as the public health community. • Share data and analysis developed through the Problem Verification section of this work plan as well as the best practices identified in the Develop Solutions section to inform educational efforts. • Request Civic Associations and Homeowners Associations to designate a Vision Zero liaison.	
Justification: Build a better understanding of Vision Zero.	
Resources: Communications support	
Timeline: Ongoing	

Vision Zero Electronic Newsletter	
Lead: Vision Zero Coordinator	**Support**: Communications Team
Action: Develop and maintain a Vision Zero electronic newsletter to: • Share information related to new and ongoing plans and projects with a Vision Zero focus. • Provide updates on transportation and planning projects that improve roadway safety. • Share opportunities for interaction and participation to advance Vision Zero strategies. • Offer resources for community members to learn about available or newly developed resources to advance Vision Zero.	
Justification: To inform community organizations and community members of progress toward Vision Zero in Montgomery County and opportunities for involvement.	
Resources: Communications support	
Timeline: Ongoing	

PROBLEM VERIFICATION

A critical first step to successfully implement Vision Zero is to verify the causes of severe injuries and fatalities on the County's transportation network. The Planning Department maintains extensive datasets and is capable of complex data analysis. These resources can be used to systematically identify roadway characteristics that create safety challenges. Data analysis will help Montgomery Planning to prioritize master plan and regulatory recommendations and to provide comments on the capital budget and capital projects and will help community members in advocating for safer streets.

A preliminary analysis of crashes in Montgomery County indicates that roadway safety is a reflection of land use and the County's high-speed, high-volume roads, which often lack safe facilities for pedestrians, bicyclists and transit users. Countywide, between 2015 and 2019 about 30 percent of severe injury crashes and 50 percent of fatalities involve pedestrians and bicyclists. In rural areas motor vehicle occupants represent over 95 percent of these crashes. In the county's major employment and activity centers (Silver Spring, Bethesda, White Flint, Wheaton, Rockville Town Center and Friendship Heights) pedestrians and bicyclists represent approximately 65 percent of these crashes. Proven strategies in cities that have adopted Vision Zero may be appropriate in our major employment and activity centers, but alternative and innovative approaches are needed in the County's rural and suburban areas.

Develop a Severe and Fatal Crash Dataset	
Lead: Vision Zero Coordinator	**Support**: Functional Planning & Policy Division
Action: Create and maintain a dataset to conduct crash analysis based on land use and street characteristics. • Develop systematic procedures for cleaning CountyStat crash data. • Add variables to enrich analysis, including land use context, roadway functional classification, number of travel lanes (total and through), roadway vehicle volumes, posted speed limit and distance between safe crossings. • Incorporate racial, income and health data into the database. • Work with Montgomery County Police Department to clean crash data. • Identify when and where infrastructure conditions have changed during the period of crash data collection.	
Justification: This dataset will enable staff to conduct reactive safety analyses to identify the types of land use and street characteristics that contribute to severe and fatal crashes. It will serve as a building block for a predictive safety analysis.	
Resources: CountyStat crash data and existing GIS resources.	
Timeline: Ongoing	

Develop a Multimodal Volumes Data Collection Plan	
Lead: Vision Zero Coordinator	**Support**: Functional Planning & Policy Division
Action: Develop a data collection plan to identify locations where pedestrian, bicycle and motor vehicle volume data is needed to develop a model that estimates volumes where they do not currently exist.	
Justification: A data collection plan is needed to identify locations where pedestrian, bicycle and motor vehicle volume data is underrepresented in the department's intersection database.	
Resources: Consultant support, existing pedestrian, bicycle and motor vehicle volume data	
Timeline: Short Term	

Collect Multimodal Counts and Traffic Speed Data	
Lead: Vision Zero Coordinator	**Support**: Functional Planning & Policy Division
Action: Collect auto, bicycle and pedestrian volume data at locations identified in the Multimodal Volumes Data Collection Plan.	
Justification: This data will be used to develop a model to estimate pedestrian, bicycle and motor vehicle volumes on every road segment in the County.	
Resources: New pedestrian, bicycle and motor vehicle volume data.	
Timeline: Short Term	

Estimate Pedestrian, Bicycle and Motor Vehicles Volumes Countywide	
Lead: Vision Zero Coordinator	**Support**: Functional Planning & Policy Division
Action: Develop a model to estimate pedestrian, bicycle and motor vehicle volumes where they do not currently exist and to convert these volumes into annual volumes.	
Justification: Measures of exposure such as pedestrian, bicycle and motor vehicle volumes are normalization factors (i.e., the denominator) that equalize for differences in the quantity of potential crash events in different road environments and therefore help to quantify risk.	
Resources: Consultant support, existing pedestrian, bicycle and motor vehicle volume data.	
Timeline: Short Term	

Create a Database to Store Multimodal Counts and Traffic Speed Data	
Lead: Functional Planning and Policy Division	**Support**: Information Technology & Innovation
Action: Modify the existing intersection count application (mcatlas.org/intersections) to include counts at unsignalized and mid-block locations and to include speed data.	
Justification: Successful Vision Zero programs make safety-related data available to the public.	
Resources: Existing GIS resources.	
Timeline: Medium Term	

GIS Layers of Variables that are Hypothesized to be Correlated with Severe and Fatal Crashes	
Lead: Vision Zero Coordinator	**Support**: Functional Planning and Policy Division
Action: Using the Severe and Fatal Crash Dataset, create street segment and crossing GIS layer that identifies variables that are locally hypothesized to be correlated with severe and fatal crashes.	
Justification: This dataset will allow the County to identify variables that are correlated with severe and fatal crashes in Montgomery County.	
Resources: Severe and Fatal Crash Dataset	
Timeline: Short Term	

Develop Safety Performance Factors	
Lead: Vision Zero Coordinator	**Support**: Functional Planning and Policy Division
Action: Develop Safety Performance Factors (SPF) for common crash types involving severe and fatal injuries. SPFs are equations used to predict the average number of crashes per year at a location as a function of exposure and roadway characteristics.	
Justification: Data analysis will help Montgomery Planning prioritize master plan and regulatory recommendations and to provide comments on the capital budget and capital projects.	
Resources: Severe and Fatal Crash Dataset, Estimate of Pedestrian, Bicycle and Motor Vehicles Volumes Countywide and the GIS Layers of Variables Hypothesized to be Correlated with Severe and Fatal Crashes.	
Timeline: Short Term	

Create a Pedestrian Level of Comfort Map	
Lead: Functional Planning and Policy Division	**Support**: N/A
Action: Develop a pedestrian level of comfort methodology and code the pedestrian network countywide.	
Justification: Similar to the Bicycle Level of Stress map, this effort will enable sophisticated analysis of connectivity within geographic areas and to public facilities that will support master plan recommendations and help to prioritize pedestrian improvements.	
Resources: University of Maryland Center for Smart Growth Contract	
Timeline: Short Term	

Develop Procedures for Data Collection and Analysis	
Lead: Vision Zero Coordinator	**Support**: Transportation Planners

Action: Develop procedures for Vision Zero data collection and analysis for master plans and regulatory review, including:
• Data Collection
  ○ Location and time periods of motor vehicle, pedestrian and bicycle counts, including signalized and unsignalized locations and high-volume mid-block crossing locations.
  ○ Location and time periods of speed studies.
• Develop a Vision Zero-standard approach to data analysis
  ○ Crash analysis
  ○ Conflict analysis
  ○ Connectivity analyses	

Justification: Effective data collection and analysis is needed to understand where safety problems are most severe and to help prioritize Vision Zero recommendations. Through Vision Zero, safety can be achieved by reducing travel speeds and conflicts.	
Resources: Consultant Support	
Timeline: Short Term	

DEVELOP SOLUTIONS

Once the safety challenges have been systematically identified through data collection and analysis, staff will identify engineering solutions and policy changes that address the challenges present in Montgomery County's diverse land uses – challenges resulting from the segregation of land uses and prioritization of high-speed vehicular travel over several decades. These solutions will be used to incorporate Vision Zero into the department's work program, including master plan recommendations, regulatory approvals/changes and review of capital projects.

Identify Best Practices in Implementing Vision Zero in the Suburbs	
Lead: Vision Zero Coordinator	**Support**: Transportation Planners, Community Planners and Urban Designers
Action: This investigation will look at best practices in suburban counties that have adopted Vision Zero (Macon, Georgia; Alameda, California; and Contra Costa, California) and cities that have suburban areas (New York; Alexandria, Virginia) and will include: • Best practices to manage suburban arterial speeds. • Best practices to reduce suburban arterial conflicts. • Identify context-sensitive design characteristics to reduce vehicular speeds.	
Justification: To understand how other jurisdictions approach transportation safety on suburban roads.	
Resources: Consultant Support	
Timeline: Medium Term	

Develop Policies for Street Types and Land Use Context	
Lead: Vision Zero Coordinator	**Support**: Transportation Planners
Action: Develop policies for different combinations of street typologies and land use context to address the safety challenges identified in the Problem Verification section. Policies will include these areas: • Access management • Frequency of safe crossings in urban areas, transit corridors, suburban areas and rural areas • Locations where unsignalized trails crossings are acceptable	
Justification: Bring Montgomery County's policies in line with strategies to reduce severe and fatal crashes.	
Resources: Consultant Support	
Timeline: Medium Term	

Develop Complete Streets Design Guide / Roadway Functional Classification Study	
Lead: M-NCPPC and MCDOT	**Support**: DPS
Action: This project has two main elements: • A Complete Streets Design Guide to design and operate roads to provide safe, accessible and healthy streets for all users of our roadway system in support of the County's Vision Zero policy, and • A replacement for Montgomery County's roadway functional classification system that organizes categorizes streets based on how they are used by people and their land use context, rather than the current approach that largely organizes street based on how vehicles use them.	
Justification: Montgomery County's road design standards are out of date.	
Resources: Consultant Support	
Timeline: Ongoing	

INCORPORATE SOLUTIONS INTO WORK PROGRAM

Using the results of the Develop Solutions section of this work plan, staff will work to incorporate solutions to the identified safety challenges into the Planning Department's work program through master plan recommendations, regulatory approvals/changes and review of capital projects.

Educate Staff on Vision Zero	
Lead: Vision Zero Coordinator	**Support**: Transportation Planners

Action: Educate staff about Vision Zero:
• Vision Zero briefing to all staff.
  ○ Provide clear and consistent messaging for staff on the importance of Vision Zero, roles and responsibilities.
• Master Planners:
  ○ Meet with teams of recently initiated master plans to provide guidance on incorporating Vision Zero into their planning effort.
  ○ Convene a meeting with all master plan teams to discuss how to incorporate Vision Zero into master plans.
  ○ Incorporate Vision Zero into the General Plan.
• Regulatory Planners:
  ○ Meet with regulatory supervisors to identify opportunities and challenges to incorporating Vision Zero into regulatory review.
  ○ Convene a meeting with all regulatory reviewers to discuss how to incorporate Vision Zero into development review, our authority in code to request Vision Zero improvements, and how to overcome challenges with incorporating Vision Zero into development review.	

Justification: Master plan and regulatory staff must understand the principles of Vision Zero to build a culture of safety in the Planning Department.	
Resources: Existing Staffing	
Timeline: Short Term	

Continuing Education	
Lead: Vision Zero Coordinator	**Support**: Transportation Planners, Communications Staff
Action: Continue education on Vision Zero through conferences, webinars, etc. for staff to remain current on the latest data and solutions as well as the challenges and opportunities associated with the integration of Vision Zero into master plans, regulatory review and capital projects.	
Justification: Continuing education allows for an evolution of Vision Zero in our work.	
Resources: Conference and webinar fees	
Timeline: Ongoing	

Incorporate Corridor Master Plans into Department Work Program	
Lead: Area Teams	**Support**: Functional Planning and Policy Division

Action: Based on the analysis conducted in the Problem Verification section, recommend additional master plans to the Planning Department's work program:
 	
• Potential Corridors
  o High Injury Network: Randolph Road, Georgia Avenue and University Boulevard.
  o Bus Rapid Transit Facility Planning Studies: New Hampshire Ave (FY22 – 24), Old Georgetown Road (FY 24 – 25)
• Develop procedures with MCDOT on an approach to conducting corridor master plans.	

Justification: Master-planning provides an effective means of re-envisioning development patterns and the transportation network as multimodal, mixed-use communities.	
Resources: Existing Staffing	
Timeline: Long Term	

Changes to State and Local Policies, Regulations and Laws	
Lead: Vision Zero Coordinator	**Support**: Transportation Planners
Action: Collaborate with MCDOT to identify changes to state and local regulations that support Vision Zero, including: local authority to reduce speed limits, strengthen access management regulations for development approvals and provide policies that reduce lane widths, target speeds and curb radii outside of urban road code areas.	
Justification: This is an action in Montgomery County's Two-Year Action Plan.	
Resources: Existing Staffing	
Timeline: Medium Term	

Develop a Pedestrian Master Plan	
Lead: Functional Planning and Policy Division	**Support**: Transportation Planners
Action: Complete a Pedestrian Master Plan for the County to address the unique issues faced by pedestrians and people with disabilities.	
Justification: This is an action in Montgomery County's Two-Year Vision Zero Action Plan.	
Resources: Consultant Support	
Timeline: Ongoing	

Incorporate Vision Zero into Master Plans	
Lead: Vision Zero Coordinator	**Support**: Transportation Planners, Community Planners, Design and Communication Staff

Action: Based on the analysis conducted in the Problem Verification section, incorporate Vision Zero into master plans areas through these items:
 	
• Collect pedestrian, bicycle and motor vehicle volume data at signalized and unsignalized crossings and mid-block crossings and speed data for specific master plans.
• Create a more refined evaluation of the master plan area:
  ○ Roadway characteristics conducted in the problem verification section to identify safety issues.
  ○ High-priority areas such as schools, libraries, major transit stations and other public facilities for the ability to walk and bicycle comfortably.
• Develop a master-planning toolkit to address common transportation safety issues.	

Justification: Master-planning provides an effective means of re-envisioning development patterns and the transportation system to create a safe transportation network.	
Resources: Consultant Support	
Timeline: Medium Term	

Incorporate Vision Zero into Development Review	
Lead: Vision Zero Coorindator	**Support**: Transportation Planners, Community Planners and Design Staff
Action: Incorporate Vision Zero into development review through these items: • Educate the development community on Vision Zero principles. • Develop toolkit for regulatory reviewers to reduce speeds and conflicts by creating a sense of enclosure, consolidating access points, creating a finer-grained network of streets and concentrating greater levels of activity, which can result in more frequent, safe crossings and create more activity. • Establish a Vision Zero finding for regulatory projects.	
Justification: Development projects have the ability to improve safety by reducing conflict points and reducing street design speeds.	
Resources: Existing Staffing	
Timeline: Short Term	

Incorporate Vision Zero into the Subdivision Staging Policy	
Lead: Functional Planning and Policy Division	**Support**: Transportation Planners
Action: Update the Subdivision Staging Policy to reflect an effective transportation safety element: • Incorporate safety evaluation and data collection in traffic studies, including travel speed data. • Incorporate safety into transportation system performance measures and technical analysis.	
Justification: The Subdivision Staging Policy currently analyzes motor vehicle mobility but does not evaluate transportation-system safety.	
Resources: Consultant Support	
Timeline: Ongoing	

Capital Project Review	
Lead: Functional Planning and Policy Division	**Support**: Transportation Planners
Action: Incorporate Vision Zero into recommendations on the capital budget and capital projects: • Identify and prioritize transportation safety projects for inclusion in the capital budget based on crash severity, equity, etc. • Incorporate a Vision Zero review for mandatory referrals and facility planning studies.	
Justification: Designing transportation infrastructure to be safe is the primary way to achieve Vision Zero.	
Resources: Existing Staffing	
Timeline: Ongoing	

RESOURCE SUMMARY

This section of the work plan includes an initial summary of the resources that will be needed to accomplish the actions in the work plan, identifies those items that are existing (FY20), proposed (FY21) and potential future (FY22 and beyond) work program items and the level of effort to implement each action (* = relatively easy, *** = relatively difficult).

Action	Section	Resources	Timeline	Applicable Projects and Initiatives	Level of Effort
Develop a Vision Zero Toolkit for Community Organizations	Building Knowledge	Communications Support	Short Term	No	**
Engaging Hard-to-Reach Communities	Building Knowledge	Communications Support	Ongoing	No	***
Educate Community Members, Agency Staff and Appointed/Elected Officials	Building Knowledge	Communications Support	Ongoing	No	***
Vision Zero Electronic Newsletter	Building Knowledge	Communications Support	Ongoing	No	*
Develop a Severe and Fatal Crash Dataset	Problem Verification	CountyStat crash data and existing GIS resources.	Ongoing	No	**
Develop a Multimodal Volumes Data Collection Plan	Problem Verification	Consultant support, existing pedestrian, bicycle and motor vehicle volume data	Short Term	Transportation Modeling for the Pedestrian Master Plan (FY 20)	**
Collect Multimodal Counts and Traffic Speed Data	Problem Verification	New multimodal counts and traffic speed data	Short Term	Data for Vision Zero (FY 20)	*
Estimate Pedestrian, Bicycle and Motor Vehicles Volumes Countywide	Problem Verification	Consultant Support, Existing Pedestrian and Bicycle Counts	Short Term	Request Year End Funds (FY 20)	***
GIS Layers of Variables that are Hypothesized to be Correlated with Severe and Fatal Crashes	Problem Verification	Severe and Fatal Crash Dataset	Short Term	Request Year End Funds (FY 20)	***

Attachment B: Planning Department Vision Zero Work Plan

Action	Section	Resources	Timeline	Applicable Projects and Initiatives	Level of Effort
Develop Safety Performance Factors	Problem Verification	Severe and Fatal Crash Dataset, Measure of Exposure for Walking and Bicycling, Transportation Network Dataset	Short Term	Request Year End Funds (FY 20)	***
Create a Pedestrian Level of Comfort Map	Problem Verification	Consultant to refine Pedestrian Level of Comfort methodology	Short Term	Pedestrian Connectivity Mapping (FY 20)	***
Develop Procedures for Data Collection and Analysis	Problem Verification	Consultant Support	Short Term	No	*
Develop Complete Streets Design Guide / Roadway Functional Classification Study	Develop Solutions	Consultant Support	Ongoing	Roadway Functional Classification System (FY 19)	***
Educate Staff on Vision Zero	Incorporate Solutions into Work Program	Existing Staffing	Short Term	No	**
Continuing Education	Incorporate Solutions into Work Program	Conference and webinar fees	Ongoing	No	*
Capital Project Review	Incorporate Solutions into Work Program	Existing Staffing	Ongoing	No	*
Incorporate Vision Zero into Development Review	Incorporate Solutions into Work Program	Existing Staffing	Short Term	No	*
Incorporate Vision Zero into the Subdivision Staging Policy	Incorporate Solutions into Work Program	Consultant Support	Ongoing	Policy Area and Local Area Transportation Update (FY 20)	***
Develop a Pedestrian Master Plan	Incorporate Solutions into Work Program	Consultant Support	Ongoing	Pedestrian Master Plan (FY 20)	***
Create a Database to Store Multimodal Counts and Traffic Speed Data	Problem Verification	Existing GIS resources	Medium Term	No	**

Attachment B: Planning Department Vision Zero Work Plan

Action	Section	Resources	Timeline	Applicable Projects and Initiatives	Level of Effort
Identify Best Practices in Implementing Vision Zero in the Suburbs	Develop Solutions	Consultant Support	Medium Term	No	**
Develop Policies for Street Types and Land Use Context	Develop Solutions	Consultant Support	Medium Term	No	**
Changes to State and Local Policies, Regulations and Laws	Incorporate Solutions into Work Program	Existing Staffing	Medium Term	No	***
Incorporate Vision Zero into Master Plans	Incorporate Solutions into Work Program	Consultant Support	Medium Term	No	*
Incorporate Corridor Master Plans into Department Work Program	Incorporate Solutions into Work Program	Existing Staffing	Long Term	No	*

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MEMORANDUM

October 18, 2019

To: David Anspacher
Organization: M-NCPPC, Montgomery County Planning
From: Frank Proulx PhD, Thomas Hillman AICP, Alia Anderson AICP
Project: Montgomery County Safety Performance Function Estimation Methodology

Re: Safety Performance Function Methodology

INTRODUCTION

To advance implementation of its Vision Zero program, Montgomery County is transitioning from a descriptive crash analysis framework to one that integrates predictive analytical methods. With this shift, in addition to focusing safety improvement efforts on locations where high rates of injuries or fatalities have already occurred, the County will also proactively identify and treat locations with similar risk characeristics. This approach seeks to prevent serious injury or fatal crashes from happening throughout the roadway network, including at locations without a recent history of crashes, but where a high risk of future crashes may be suspected based on the characteristics of those locations. This type of analysis can also be used to quantify the expected reduction in crashes from treatments that may be applied to improve safety at these locations.

This document provides specific guidance for Montgomery County staff to implement this approach by estimating and deploying predictive safety performance functions (SPFs). SPFs can be used to predict crash rates for roadway segments or intersections with similar characteristics. SPFs are used to estimate the baseline conditions at a given crash site, to which Crash Modification Factors (CMFs) may be applied to estimate the crash reduction from a given treatment. By modeling and applying SPFs, Montgomery County can understand both sides of the safety coin: where treatments are needed, and the potential effectiveness of treatments that could be applied, as long as a CMF is available.

The SPF analytical method is comprised of the following steps:

1. Data Consolidation and Assembly
2. Exposure Estimation
3. SPF Estimation
4. Application

A detailed methodology of each step of the workflow is provided in the following sections. Required skills for SPF estimation and application in this context include: data management, geoprocessing techniques, generalized linear models, basic machine learning, and knowledge of multi-modal (i.e. including bicycle and pedestrian) safety concepts. During and after each step, examine the data or outputs (as necessary) using maps, graphs, or other descriptive statistics. This will serve as an important check to make sure the results make intuitive sense, and that there are no unresolved underlying data issues.

The methodology and commentary contained herein is based on the project team's understanding of available data at the time of preparation, and requires implementation by professionals trained in inferential transportation safety statistical modeling methods. It is intended to yield a relative prediction of locations where safety

treatments may be beneficial, but is not intended to provide a precise determination of conditions at any location. Further data collection, engineering analysis, and design are necessary prior to implementing safety treatments. Motor vehicle crashes are complex occurrences that often result from multiple contributing factors. Reuse and/or alteration of this instrument of service is at the user's sole risk.

1. DATA CONSOLIDATION AND ASSEMBLY

There are two applicable units of analysis to estimate SPFs: roadway segments and intersections. The following steps are necessary to collect and consolidate the data for SPF estimation. Note that while the predictive safety will be applied to all modes of travel, Step 1 focuses on bicycle and pedestrian data because those data are less available.

Section 1. Consolidate Crash- or Volume-Associated Predictors in GIS

Join all variables applicable to each unit of analysis into a single GIS layer for each (i.e. one layer for intersections, and one layer for segments). Any variable that is available and hypothesized to be locally correlated with pedestrian or bicyclist volumes and crash patterns should be included.

1. Create Segment GIS Layer
    a. Common examples for segment data include:
        - Population density (e.g., the overall population density within a ¼ mile buffer of the segment)
        - Employment density
        - Commercial property
        - University locations (e.g., whether the segment is within 1/10 mile of a university)
        - Federal campuses
        - Transit stations / bus stops
        - AADT
        - Bike lanes
        - Sidewalks
        - Number of lanes
        - Speed limit
        - Roadway width
        - Horizontal and vertical alignment (e.g. sharp hills or tight winding roads)
        - Presence, width, and type of median
        - Frequency of Protected Crossings (*see steps 2 and 3*)
        - Intersection characteristics (*see steps 2 and 3*)
    b. Possible additional examples noted by Montgomery County:
        - Functional class
        - Urban road code area
        - Access control
        - Maintenance responsibility
2. Create Intersection GIS Layer
    a. Join relevant segment data from 1.a above to intersection geometries.
    b. Common examples of intersection data include (note that some of these, such as number of lanes, can be summarized in various ways):
        i. Number of lanes (e.g., total through-lanes, total through-lanes on highest functional classification approach)
        ii. Turning bays
        iii. Turning restrictions
        iv. Signalization
        v. Signs
        vi. Crosswalks (e.g. marked crosswalks present on highest functional classification approach, total number of marked crosswalks)
        vii. Number of legs on intersection (3, 4, or 5+)

viii. Highest speed limit
ix. T or Y intersection (for 3 leg intersections)
x. Presence, width, and type of median
xi. Other pedestrian safety improvements (RRFB, HAWK)

c. Calculate intersection skew in GIS (Optional)
i. This step computes the angles between all lines that intersect at an intersection (azimuth).
ii. It is not essential to estimate an SPF, but may improve the accuracy of estimates.

3. For both segments and intersections, calculate additional statistics that may help predict crash outcomes:
a. E.g. Population density within 1/10, 1/4, 1/2 mile
b. Proximity to "Town Centers"
c. Proximity to train stations (i.e. Metrorail, MARC/Amtrak, and light rail) and bus rapid transit stations.

Section 2. CAVEAT: Install Dates - Possible Approaches

Roadway networks are frequently updated as lane configurations, speed limits, or other characteristics change. Meanwhile, since crashes are statistically rare events, multiple years of data are required in a safety analysis to ensure crash trends reflect real safety issues, rather than unrelated variation alone. To identify the estimated crash rate of a given location typology, it is important to ensure that the underlying data used to define those locations and estimate their SPFs is consistent and reliable. In particular, it is necessary to identify when and where infrastructure conditions have changed during the period of crash data collection, or to otherwise account for this change. Possible approaches to address this issue include:

1. If data are available for infrastructure modifications by year (e.g. segments and intersections), the record can be split into multiple records representing "before" and "after" periods around the change, based on an "effective date".
a. If this method is used, consider eliminating data from the year containing the "effective date" of the change or any construction preceding it, if known. This helps control for safety effects of construction, which is beyond the scope of this methodology.
b. A simplified variation of this is to separately tabulate the crash data and infrastructure condition data for each year, resulting in a dataset with distinct observations for every road unit for each year in the study period. This approach may be vulnerable to "short study window" issues (i.e., too many records with no crashes). It may be worthwhile to eliminate the data from study years in which changes were implemented or construction took place, if known.
c. All variations of this approach require volume and infrastructure data to be reasonably accurate for each year
2. Stamp each intersection with when it last changed (and only use crashes at that location after that point). This is essentially using only the "after" period from method 1 above and dropping the before period.
3. Drop those locations that have substantially changed within the study period. This method may be appropriate where changes have occurred recently but the exact dates are unknown, or if a location has experienced multiple changes over the study period.
4. Pick a short enough study window to ensure homogenous conditions.
a. If the study window is too short, there may not be enough crash data to estimate an accurate model, and even in short study windows, some infrastructure conditions may have changed. The standard study window to balance these concerns is 3-5 years.

Section 3. Clean Crash Data

1. Ensure crashes are geocoded to accurate locations on the roadway network.

   a. Add X and Y information to any crashes where this is not reported based on other location-based fields in the crash dataset (e.g. route, cross-street, distance from intersection, etc.).
      i. Exercise caution when geocoding based on addresses; some crashes with an address only and no route/cross-street information may have occurred in parking lots or otherwise off the roadway network, and these crashes should not be geolocated to the roadway, as this would artificially inflate the safety concern on that portion of the roadway (these are often property damage only crashes in parking lots).
   b. Check existing X and Y coordinates in the dataset for accuracy. Compare tabular location information to the coordinates provided. Adjust or discard crash records as appropriate.
2. Code crashes by subsets to be subsequently modeled, for example:
   a. Crash Types (Crash types specific to motor vehicles are commonly reported by police and stored in crash databases; crash types relevant to bicyclists and pedestrians should also be modeled)
   b. Crash Year
   c. Mode (bicyclist, pedestrian, motorcycle, or motor vehicle; model scooter crashes separately if data is available to distinguish these from pedestrians)
      i. Caution: A single crash may involve parties using more than one mode, yet is usually coded with a single mode. Often the most vulnerable mode is coded, for example:
         1. If a pedestrian is involved, code as a pedestrian crash
         2. If a bicyclist is involved, code as a bicyclist crash
         3. If a motorcycle is involved, code as a motorcycle crash
         4. If none of these are involved, then code as a motor vehicle
      ii. An alternative coding approach is to default to the mode with the worst injury. In most cases this will result in a similar categorization.
3. Join crashes to relevant network attributes (i.e. intersection or segment, as appropriate).
   a. Some crashes have an intersection Boolean field, which could be used for attribution of intersection and non-intersectino crashes.
   b. In the asbsence of this Boolean field, or for data cleaning and valiation of the field, intersection crashes can be calculated using geospatial information using one of two common methods:
      i. Create a defined buffer around an intersection and all crashes within that buffer are intersection crashes (e.g. 50 or 100 feet, or)
      ii. Create a dynamic buffer that is different for each intersection depending on how many lanes each intersection approach is. More lanes means a wider intersection means the buffer should be bigger.
4. Aggregate to units of analysis (e.g., count of crashes based on the variables to be modeled)
   a. Basic approach: Total # of pedestrian, bicycle, motorcycle, motor vehicle crashes per unit of analysis (i.e., intersection or segment).
   b. Advanced approach: Total # of crashes per year, per unit of analysis, by mode and crash type to be modeled.

Section 4. Annualize Existing Pedestrian and Bicycle Volume Estimates (Count Data)

If motor vehicle or motorcycle annualized volumes are not available (i.e., only raw counts are available for these modes), the same procedure can be applied to motor vehicle count data to annualize volume estimates.

1. Summarize observed pedestrian crossings at the intersection level and bicycle volumes at the segment level, as well as the observation period when that data was collected.
   a. E.g. Two hour turning movement counts at each intersection with available count data.
2. Annualize the short-duration volume data to an "average annual daily traffic" format to account for variation in what the observed short-duration count implies about total activity levels due to factors such as time of day, land use, weather, and season. This can be approached as follows:
   a. If local permanent counters are available, evaluate the patterns to identify any distinct hour-of-day patterns.
      i. Group counters with similar hour-of-day peaking patterns for pedestrian and bicycle volumes
      ii. Calculate hour-of-day extrapolation factors

iii. Assign short-duration count locations to the identified groups based on similar land uses contexts and apply factors to short-duration counts to produce a daily volume for the day the count was collected

b. Otherwise, select factors from counters from other locales or from the National Bicycle and Pedestrian Documentation Project

c. Use a day of year calculation (ratio of that date's total volume to the AADT at that location) to extrapolate the short-duration counts, based on the geographically closest permanent count site. This technique adjusts for seasonality and weather effects, which have been shown to dramatically impact bicycle and pedestrian counts.[1]

3. The resulting Annual Average Daily Bicycle Traffic (AADBT) and Annual Average Daily Pedestrian Traffic (AADPT) values will be used to develop exposure models in the following step.

2. EXPOSURE ESTIMATION

Estimate Annual Pedestrian, Bicycle and Motor Vehicle Volumes at Missing Locations

Develop a predictive model to estimate bicycle, pedestrian, motorcycle and motor vehicle volumes at locations where they do not currently exist. Pedestrian volumes are best modeled at the intersection level. Bicycle, motorcycle and motor vehicle volumes are best modeled at the segment level and used to infer intersection volumes.

1. Estimate a Poisson or Negative Binomiall model
    a. Find the best model to predict the annualized counts based on other variables that could predict volumes such as population density, land use, transportation network characteristics, proximity to transit, ACS bicycle and pedestrian commute estimates, or volume estimates from a travel demand model, if available, to predict intersection pedestrian volumes and segment bicycle and motor vehicle volumes.
        i. Choose which variables to use as inputs for the model using some type of standard approach or technique, based on what skills and resources are available. This might be following the example of previous models or studies completed by the County, following examples from existing literature or reports, or applying some type of statistical or machine learning analysis technique, such as bivariate correlation, decision tree models, random forest models, stepwise model building, etc.
        ii. Assess model fit. Cross validation is one common method to assess model fit in this context, which can be accomplished using various free software packages.[2]
        iii. Generally, avoid including variables that are highly correlated with one another. For example, population density and adjacency to high capacity transit could be highly correlated. This is not a hard and fast rule, but if there are too many variables that are highly correlated, the model will be inefficient and the predictions will be less accurate.
2. For motor vehicle volumes, if values are not available from a regional travel demand model, they can either be calculated as above or by using spatial interpolation.
3. Once models have been estimated for pedestrian, bicycle, motorcycle and motor vehicle volumes, they must be applied to the full dataset to predict volumes at each intersection and road segment. Any models that were estimated at the segment level should also be aggregated to the intersections that they spatially intersect with; keep in mind that the sum of all segment volumes should be divided by 2 to account for the incoming and outgoing flow (each vehicle that enters also exits, and is thus observed on two segments).

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[1] NCHRP Report 797 Appendix D contains additional additional details on the day-of-year factoring approach.

[2] For example, see documentation on SciKit Learn for more information on cross-validation: https://scikit-learn.org/stable/modules/cross_validation.html

3. SPF ESTIMATION

SPF Estimation follows a very similar workflow to Step 2, with the following notes:[3]

1. Estimate a model for each identified crash type (see Section 1, "Clean Crash Data", item 2a). Minimally, this might include the following:
    a. Intersection bicyclist, pedestrian, and motor vehicle crashes.
    b. Segment bicyclist and motor vehicle crashes. Pedestrian segment crashes typically are not modeled as it is difficult to parse out whether these crashes are people on the sidewalk, people accessing cars parked on the block (i.e., walking in the street), or people crossing midblock. In each of these cases, exposure would likely need to be estimated separately, which would require more detail than is available in standard count data.
2. Whereas in Step 2 the outcome/dependent variable was traffic volumes, here it is the number of crashes. The critical difference in the modeling approach is that now we must account for "exposure" variables, which are typically transformed using a natural logarithm. Some modeling packages do this implicitly if you indicate that a variable is an exposure variable, and others you must supply the log-transformed variables as a separate input. For intersection models, the relevant traffic volumes are the standard exposure value; for segment models, the length of the segment is also typically taken into account.
3. Test for multicollinearity (i.e., using a variance inflation factor test) and choose the best model accordingly.
4. If conditions have changed substantially during the observation period, it may not be appropriate to include a given observation directly (i.e., as described previously in Step 1, Section 2). Control for observations where conditions may have changed. For example, with bike lanes, you may have a certain infrastructure condition in the first 4 years of the study period and a separated bicycle lane installed for the final year. There are two common options for dealing with this problem:
    a. Do not include observations in the model that have changed substantially over the study period
    b. Split each segment/intersection into multiple observations for the 'before" and "after" period from when they were modified. This approach is more robust, but requires more complicated data management. If this approach is taken, the numer of crashes will need to be separately tabulated for the two time periods, and the number of each years in each will need to be recorded and included in the model as an "offset" variable; i.e., a log-transformed variable whose parameter has been fixed to have a value of 1.
        i. If reliable infrastructure from the "before" period is unavailable, it's acceptable to discard the "before" period and only look at the after case.
        ii. If either the before period or the after period is extremely short (say, 1 year), exclude it.

[3] See FHWA guidance on this topic for more information: https://safety.fhwa.dot.gov/rsdp/downloads/spf_development_guide_final.pdf.

4. APPLICATION

1. Apply the SPF to the full dataset to produce the model-estimated number of crashes for each segment and intersection by mode.
2. Apply the Empirical Bayes (EB) method to adjust the SPF predicted value by accounting for the observed value at a given location. This provides a more reliable estimate of crashes. This procedure uses both the the SPF estimate and the observed number of crashes to produce the most reliable estimate of the "true" (expected) crash rate before safety treatment.[4]
3. Choose how to use the information for prioritization:
    a. EB estimates can be used as the expected number of crashes at a given location.
    b. EB estimates can be used directly to focus on high crash locations, and can be divided by the estimated volumes to identify high risk locations
    c. The Potential for Safety Improvement (PSI), or the difference between EB predicted number and SPF-Predicted number, can also be used for prioritization; this indicates the theoretical improvements in crash totals that could be made for a "poorly performing" location. This is because the corrected EB value is the best estimate available of current safety conditions at that location, while the SPF provides the estimate of crashes that would be predicted based on all of the variables in the SPF. Sites with an EB value that is higher than the SPF estimate are theoretically experiencing more crashes than similar sites. This "excess" of crashes at that particular site would likely benefit most from safety improvements.[5]

[4] For an example application of how to calculate EB estimates, see the "before" estimates from the Highway Safety Improvement Manual, section 6.1 Project Evaluation: https://safety.fhwa.dot.gov/hsip/resources/fhwasa09029/sec6.cfm.

[5] An example application of this method is available on pages 8-9 of the HSM introduction: http://www.highwaysafetymanual.org/Documents/HSMP-1.pdf. See Figure 1 of HSM Case Study 4: Development of SPF for Network Screening in Illinois for a graphical depiction of this phenomenon: https://safety.fhwa.dot.gov/hsm/casestudies/il_cstd.cfm. Further detail is available in AASHTO Highway Safety Manual Chapter 4: Network Screening Excess Expected Average Crash Frequency with Empirical Bayes (EB) Adjustment.