



MEMORANDUM

TO: VDOT District Highway Safety Partners

FROM: Mark A. Cole, P.E.
VDOT Traffic Engineering
Assistant Division Administrator (Highway Safety)

RE: Eight Systemic Safety Countermeasures – Implementation Criteria

Eight Systemic Safety Countermeasures – Implementation Criteria

This document summarizes the expectations and implementation criteria for each of the eight systemic safety countermeasures that are part of VDOT’s Systemic Safety Implementation Plan approved by the CTB in September of 2019. These eight systemic safety countermeasures include the following:

1. High-Visibility Signal Backplates (HVSB)
2. Flashing Yellow Arrow (FYA)
3. Pedestrian Crossings
4. Centerline Rumble Strip*
5. Edgeline Rumble Strip/Stripes*
6. Curve Delineation
7. Unsignalized Intersection
8. Safety Wedge

*Centerline and Edgeline Rumble Strips are included in one category below.

The information herein was assembled with the help of representatives from all nine VDOT districts. Several notes are general and listed under general comments, below, followed by detailed expectations for each of the eight systemic countermeasures.

General Comments

Budgets

- Districts should not spend more than allocated for each systemic project. If a District has more funds than needed to complete the systemic projects, they should advise Tracy Turpin or Deepak Koirala in the Traffic Engineering HSIP Project Delivery team. All surplus safety funds shall be return to the statewide balance entry account for redistributing by the Central Office Safety team to fund other systemic safety initiatives at the discretion of the Commissioner and CTB.

Project Delivery

- Each District should determine the best delivery method to meet the schedule and budget that was approved by CTB to complete all VDOT- maintained locations.
- If state forces are to be used, a finding of public interest must be completed since these are Federal funds
- When initiating these task/activities in the pool and selecting the right template in Project Web Application (PWA), the district shall follow VDOT’s [Project Task and Scheduling Guide](#). The Department will utilize the Dashboard to monitor all tasks/activities as they relate to these initiatives.

- District Traffic Engineering shall provide documentation to the Central Office HSIP Program Delivery team for any locations where there are limitations or issues that prevent the installation of these systemic countermeasures. This documentation should be included in the district's monthly reports on the SharePoint Site.

Project Tracking Criteria

- Central Office will provide a SharePoint Site that will reside on Inside VDOT at the following: <https://insidevdot.cov.virginia.gov/div/te/5UULT/W9HQV/SitePages/Home.aspx> and the District Traffic Engineer's Office will be responsible for entering project data for each of the systemic projects on the SharePoint
- Typical installation location data needed for intersection improvements will include (but may not be limited to) the following: UPC#, District, Jurisdiction (County), RNS Intersection Node ID, Regional Signal ID, GPS Coordinates (Latitude/Longitude), Admin By, and Major or Minor approach information (Route Number).
- Typical installation location data needed for road segment improvements will include (but may not be limited to) the following: UPC#, District, Jurisdiction (County), Start and End State Milepost Installation Locations, RNS Node ID, Admin By, and Route Number.

Public Outreach and General Information

- The following document was created by the Communications and Traffic Engineering Divisions to provide general information to the public on each of the systemic countermeasures that are being deployed as part of this effort: https://drive.google.com/file/d/1UVP-CKFzQ2j82lsA5yDR_oE4HdVl9Sq6/view?usp=sharing

High-Visibility Signal Backplates (HVSBS)



Expectation and Implementation Criteria

- District shall install High Visibility Signal Backplates (HVSBS) on all VDOT- maintained traffic signals. Locations that need pole upgrades are not eligible for this round of HVSBS installations.
 - Pole upgrades include signal structure replacement or major signal structure modifications

Cost and Funding

- An estimate of \$1,000 per HVSBS and 10 HVSBS per intersection was used for the purposes of establishing District budgets. Approximately, \$10,000 per intersection.
- The estimated cost per intersection for a HVSBS survey to determine what type of backplate is needed is approximately \$750 per intersection, based on the experience of Richmond District.
- The budget for HVSBS projects in each District is all inclusive of preliminary engineering, materials, labor, traffic control, CEI, etc to complete the work.

Flashing Yellow Arrow (FYA)



Expectation and Implementation Criteria

- Complete the retrofit and installation of all flashing yellow arrows (FYA) for left turns at VDOT-maintained traffic signals. Locations that need pole upgrades are not eligible for this round of FYA installations.
 - Pole upgrades include signal structure replacement or major signal structure modifications.
 - Eligible FYA installations include retrofits of existing green balls or protected-permissive phasing only. Protected-only phasing conversions to FYA are not eligible for funding as part of this project.

Cost and Funding

- An estimated cost of \$4,000 per signal head and 4 signal heads per intersection was used for the purposes of establishing District budgets.
- The budget for the FYA projects in each District is all inclusive of preliminary engineering, materials, labor, and traffic control to complete the work.

Additional Installation Criteria

- The preferred FYA type is a traditional four-section head
- In retrofit situations with a structural or height restriction, three-section, bimodal FYA are allowable. For specific guidance on bimodal arrows, contact Matthew Bonacci in the Central Office traffic signal team at Matthew.Bonacci@VDOT.Virginia.gov or (804) 786-6176.
- Older controllers and cabinets may need to be upgraded in order to install FYA for that intersection. In that case, Districts shall first install FYA at all locations that do not need controller and cabinet upgrades first, and if there's any funding left over, Districts may upgrade the old controllers, cabinets, and then install FYA with the leftover funding. The top priority is to replace all locations that do not require cabinets or controllers upgrades first.
- This work should also include the installation of FYA signing if the signal structural analysis allows. Installing R10-V1 (Left Turn Yield of Flashing) is a should statement in the Virginia Supplement to the MUTCD. Districts should be adding in signage anyways when implementing FYA. Also, the proposed revision to the VA Supplement to the MUTCD will introduce new design of R10-V1. Districts should use this design to implement FYA as Revision 2 to the VA Supplement to the MUTCD will be out soon.



Pedestrian Crossings



Expectation and Implementation Criteria

- The criteria and countermeasures included for pedestrian crossings are as follows:
 - The [PSAP priority corridor and crash cluster map](#) should be used to identify and review the signalized intersections where pedestrian crossing countermeasures should be installed as part of this effort.
 - The typical improvements that should be considered for installation include: new or retrofit marked crosswalks, pedestrian signal heads with pedestrian countdown signals, Accessible Pedestrian Signals (APS) and Accessible Pedestrian Signal Detector (APD), and ADA-compliant curb ramps (only if none currently exist). This work shall be conducted at VDOT traffic signals located on the pedestrian priority corridors and crash clusters that are identified in VDOT's Pedestrian Safety Action Plan (PSAP). The intent of this project is not to bring existing ramps up to ADA compliance. FHWA has provided concurrence that the systemic improvements will likely not trigger the need to upgrade the curb ramps, but the District should do their due diligence and ensure the information is correct/updated in the curb ramp inventory. Any work generated from this analysis than the District Traffic Engineering shall coordinate with others in the district to get it scheduled.
 - Sidewalk connections, curb and gutter improvements, widening, and etc. are not included in the scope of this HSIP funding. These items can be funded by the District and delivered concurrently with other funding sources.
- Roadway Lighting
 - Street lighting should only be included if it can be accomplished within the budget and if it is needed to address an identifiable safety need.
 - Refer to [IIM-TE-390](#) for lighting guidance.
- Cost and Funding:
 - A cost estimate of \$50,000 per intersection was used for determining District budgets. The estimate is based upon previous-historical similar projects/bid review, consultant review and district recommendations.
 - The budget for pedestrian improvements is all inclusive and includes marked crosswalks, pedestrian signal heads with pedestrian countdown signals, APS and APD, and ADA-compliant curb ramps (only if none currently exist - Check with FHWA - IIM-TE-388)
- Pedestrian Crossing Installation:
 - When installing pedestrian crossings at signals as part of this project, a crossing on all legs of the intersection is the preferred treatment. However, in situations where physical or operational constraints make it difficult to install crossings on all legs of the intersection, at least one crossing

of the mainline is required. Typical constraints that may result in not installing crosswalks across all legs of the intersection include

- Physical constraints (need for roadway reconfiguration)
- High volume turning movements on certain legs of intersection
- Signal operational efficiency

Centerline and Edgeline Rumble Strip



Expectation and Implementation Criteria

- Complete installation of edgeline rumble strips or stripes on primary system roads at all prioritized locations that can be installed without shoulder widening.
- Complete installation of centerline rumble strips on all prioritized two-lane, undivided primary roads in accordance with current rumble strip policy.
- The HSIP team developed a comprehensive inventory that includes completed as well as ongoing and planned rumble strip projects. In addition, a methodology to develop prioritization levels for candidate locations across the Commonwealth has been developed. The inventory is provided as a geodatabase in various formats (i.e. Google Earth, ArcGIS, ArcGIS Online). The ArcGIS Online format can be found at: <http://www.arcgis.com/home/item.html?id=886c47dc07c643cd9b4a690c44f90240>
- For more information and summary by district, refer to the memo on the rumble strip inventory and prioritized candidate implementation locations.
- Edgeline Or Centerline Rumble Strip/Stripes on Primaries ([IIM-LD-212.6](#) and [IIM-TE-368.0](#))
 - Providing consistency across jurisdictional boundaries is expected. When the rumble strip passes across different jurisdiction/district boundaries, the uniformity and consistency of rumble strip design shall be necessary. Adjacent districts should coordinate and agree to a rumble strip installation strategy that provides consistency across District lines.

Curve Delineation



Expectation and Implementation Criteria

- Review and install curve delineation devices at all locations on VDOT-maintained roads in each District that meet MUTCD criteria as outlined in Table 2C-5.
- The budgets for each District were determined using curve quantities that were verified by the Districts. (Originally identified by RdW Countermeasures Implementation Plan and district validated it)

Other Installation Criteria

- MUTCD Requirements for Warning Signs and Chevron Signs based on Traffic Volume and Curvature.
- For freeways, expressways and roadways with more than 1,000 AADT that are functionally classified as arterial or collectors, should be based upon speed difference (Advisory Vs Statutory).
- Curve warning signs and speed placards to be required for speed differential of 10 mph or more.
- Chevrons to be required for speed differential of 15 mph or more.

Cost and Funding

- Per curve cost estimate used for determination of budget for each District: \$32,500 per location (Length of Curve) i.e. curve start point (point of curve – PC) to Curve End Point (point of tangent – PT).

Reference Documents

- [Fredericksburg District Chevron Compliance Procedures](#)
- [Fredericksburg District Task Order 266 Chevron Final Submittal of 2_22_2017](#)
- [Fredericksburg District Bid Order 16_107196](#)

Unsignalized Intersection

The criteria in this section have been revised based on HSIP implementation experience and District feedback and are current as of October 12th, 2021.



Expectation and Implementation Criteria¹

- Complete review and installation of low-cost countermeasure(s) at approximately 1,700 unsignalized intersections identified by VDOT as having a higher crash risk. Improvements should be identified using the following guidance:
 - Districts should strive to improve all intersections from their existing conditions, within the guidelines of the Virginia Supplement to the MUTCD and all applicable IIMs.
 - **Tier 1 standard improvements shall be installed at all identified intersections in accordance with the Virginia Supplement to the MUTCD and all applicable IIMs.**
 - If an intersection currently has the required Tier 1 improvements, Districts should consider installing optional improvements in Tier 1 or the standard Tier 2 improvements. Similarly, for intersections that already have Tier 2 improvements installed, Districts should consider installing optional Tier 2 or Tier 3 improvements.
 - Tier 1 optional improvements, Tier 2 optional improvements, and all Tier 3 improvements are not “package” improvements. Those improvements can be selected individually and as appropriately based on site-specific conditions.
 - While a set of identified safety measures are provided below, District Traffic Engineers, or their designee, can also add improvements that are not included in the tier listing, so long as those improvements:
 - Target/mitigate potential intersection crashes;
 - Are deemed appropriate by the DTE or their designee; and
 - Result in total program cost that are within the budget of the average per intersection cost (i.e., \$15,000 per location multiplied by number of identified unsignalized intersection locations) while implementing at least standard Tier 1 standard improvements at all locations.

¹ Background on this countermeasure can be found in VTRC19-R5:

http://www.virginia.gov/vtrc/main/online_reports/pdf/19-r5.pdf. Note that the current criteria and tier countermeasures shown in this report have changed based on District feedback and HSIP implementation.

Unsignalized intersection treatments include the following:

Tier 1

Estimated cost to implement Tier 1 standard improvement items is **\$6,000 - \$9,000** depending on the intersection configuration (i.e., 3- or 4-leg).

- **Standard (Required):**
 - Standard Stop signs (R1-1)
 - Properly placed Stop Bars (unless the approach is on a gravel road)
 - Advance warning signs and/or guide signs, such as advance Intersection Ahead warning signs (W2-1 through W2-8), Advisory Speed Limit plaques (W13-1P), and/or advanced Route Shield signs (M1-4, M1-V1, or M1-V2) on the mainline approaches
 - Removal of any foliage or parking that limits sight distance where right-of-way is available
- **Optional:**
 - Advance “Stop Ahead” warning signs (W3-1) on stop-controlled approaches
 - Additional “Watch for Turning Vehicles” advance warning sign (W11-V3) stacked with the advance Intersection Ahead warning signs (W2-1 through W2-8)
 - Double-yellow centerlines (up to 50 ft) on stop-controlled approaches
 - For T-intersections, Two-Direction Large Arrow warning sign (W1-7) opposite the T-stem approach
 - Yellow retroreflective strip on advance intersection and “Stop Ahead” warning sign posts
 - Red retroreflective strip on the stop sign posts

Tier 2

- **Standard:**
 - Advance “Stop Ahead” intersection warning signs (W3-1) on stop-controlled approaches
 - Yellow retroreflective strip on advance intersection and “Stop Ahead” warning sign posts
 - Red retroreflective strip on the stop sign posts
- **Optional:**
 - Advance intersection sign (W2-1 through W2-8) with supplemental Street Name plaques (W16-8P or W16-8aP)
 - Advance Street Name sign on the mainline approaches (D3-2 & D3-V2)
 - Installation of a minimum 6-ft-wide raised splitter island on the stop-controlled approaches (if no pavement widening is required)
 - Dual (left and right) intersection warning signs (W2-1 through W2-8) or a single oversized intersection warning sign on the mainline approaches
 - Dual (left and right) advance “Stop Ahead” warning signs (W3-1) or a single oversized advance “Stop Ahead” warning sign on stop-controlled approaches
 - Dual (left and right) Stop signs (R1-1) or a single oversized Stop sign
 - Additional “Watch for Turning Vehicles” standard-sized sign (W11-V3) or oversized advance warning sign stacked with the advance Intersection Ahead warning signs (W2-1 through W2-8)
 - Double-yellow centerlines (up to 50 ft) on stop-controlled approaches
 - For T-intersections, Two-Direction Large Arrow warning sign (W1-7) opposite the T-stem approach

Tier 3

- **Optional:**
 - Dual (left and right) oversized advance “Stop Ahead” intersection warning signs (W3-1) on stop-controlled approaches
 - Dual (left and right) oversized Stop signs (R1-1)

- Dual (left and right) oversized Advance Intersection warning signs (W2-1 through W2-8) on the mainline approaches
- Advance intersection sign (W2-1 through W2-8) with supplemental Street Name plaques (W16-8P or W16-8aP)
- Advance Street Name sign on the mainline approaches (D3-2 & D3-V2)
- “Stop Ahead” pavement marking on the stop-controlled approaches
- Transverse rumble strips across the stop-controlled approach lanes (use only “Stop Ahead” pavement markings if noise is a concern)
- Additional “Watch for Turning Vehicles” standard-sized sign (W11-V3) or oversized advance warning sign stacked with the advance Intersection Ahead warning signs (W2-1 through W2-8)
- Double-yellow centerlines (up to 50 ft) on stop-controlled approaches
- For T-intersections, Two-Direction Large Arrow warning sign (W1-7) opposite the T-stem approach
- Solar or hard-wired flashing beacon systems for regulatory or warning signs

Cost Estimate Used to Establish District Budgets

- \$15,000 per intersection based on the Tier 1 with additional, optional measures.

Locations by District

https://app.powerbigov.us/links/IRQJ8fh25z?ctid=620ae5a9-4ec1-4fa0-8641-5d9f386c7309&pbi_source=linkShare

<http://vdot.maps.arcgis.com/apps/webappviewer/index.html?id=352d3f3929914c4eac40009c2b248027>

Safety Wedge Installation Criteria



Expectation and Implementation Criteria

- Pavement shoulder wedge is required on new construction, mill-and-fill, and straight overlay projects that mill or pave to the edge of pavement. The pavement shoulder wedge shall be installed under following conditions and follow the IIM-TE-391 / IIM-MD-002.01 (https://virginiadot.org/business/resources/IIM/TE-391_Pavement_Shoulder_Wedge.pdf)
 - Open ditch sections no curb and gutter
 - Paved shoulder widths 4 feet wide or less
 - Speed limits greater than 35 MPH
 - Specified final asphalt surface lift thickness at least 1.25 inches
- Pavement shoulder wedge shall be stopped in the following conditions.
 - Driveways, intersections, interchanges or bridges
 - Ditch slope begins within one foot from edge of pavement
 - Less than one foot of unpaved shoulder exists
 - Guardrail exists and the face of guardrail is within 3 feet from existing edge of pavement.

Cost and Funding

- **The standard Special Provision (SP315-000320-01) for pavement shoulder wedge will guide payment for 1) Pavement Shoulder wedge Preparation and 2) Pavement Shoulder wedge construction.**
 - Cost for the required asphalt will be paid with the contract prices for asphalt based on tonnage
 - Shoulder wedge prep work will be paid under bid item 16368 at the contract unit price per linear foot.
 - Generally the safety budget for Safety Wedge installation includes only for pavement shoulder wedge preparation, however for this purpose all the funds for shoulder preparation and additional asphalt will be funded by Maintenance resurfacing funds.