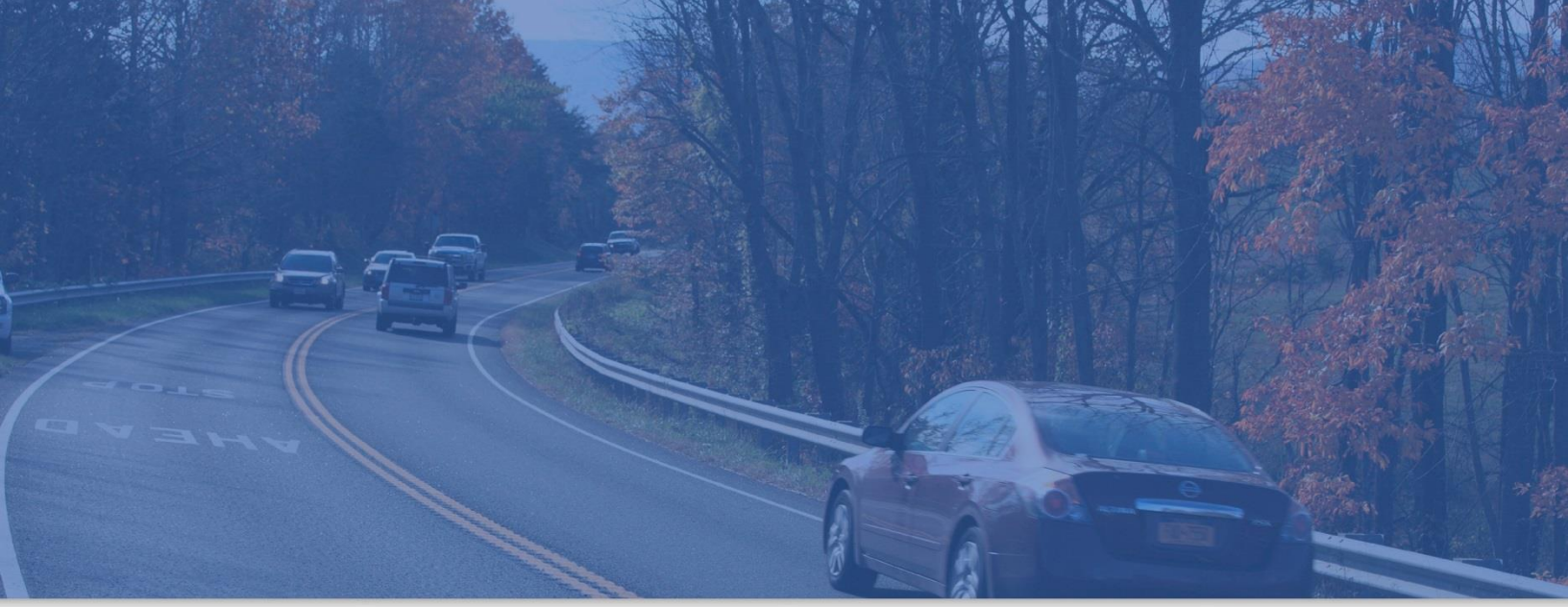
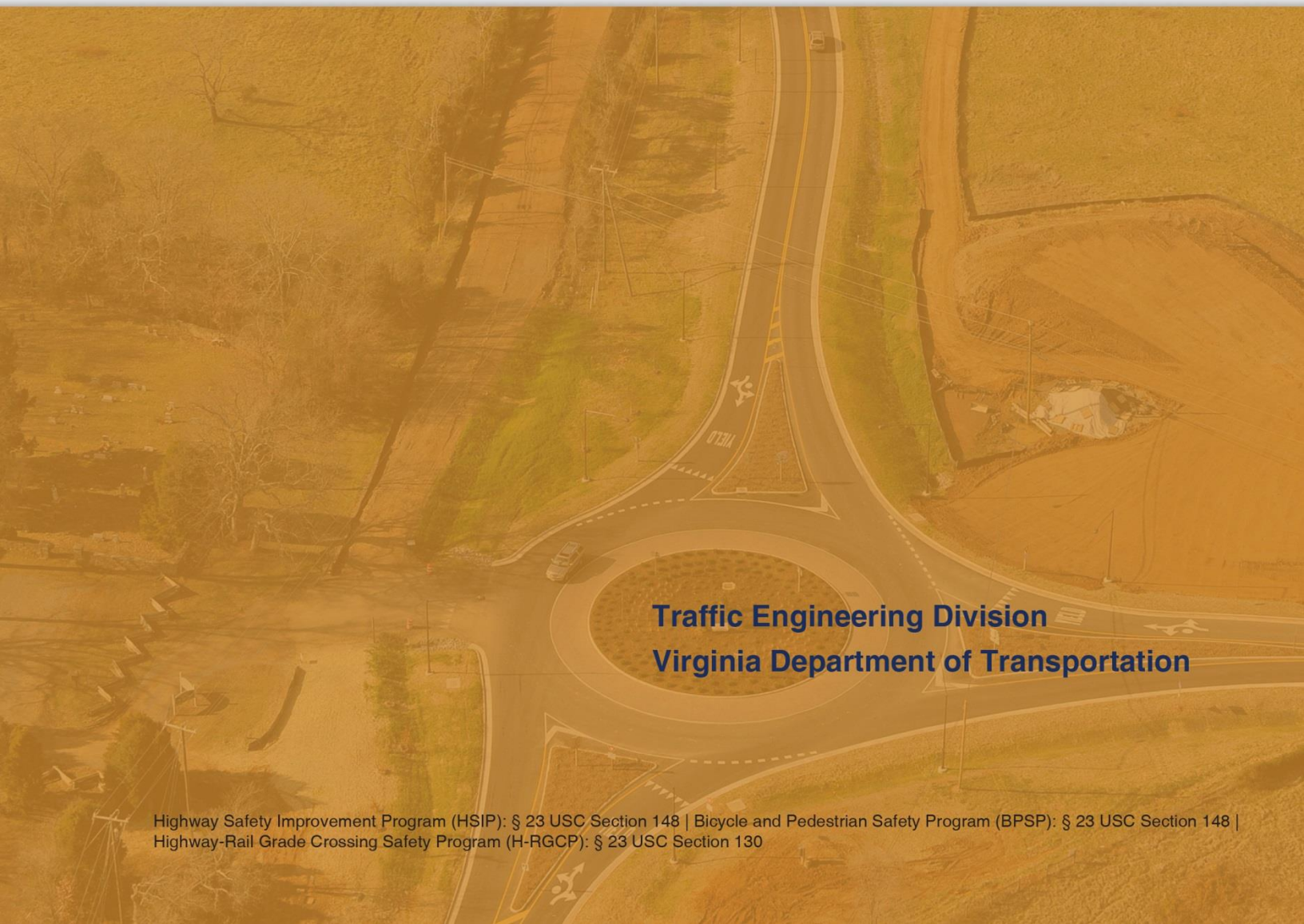


VDOT
Virginia Department of Transportation

Highway Safety Improvement Program

Implementation Guidelines



Traffic Engineering Division
Virginia Department of Transportation

Highway Safety Improvement Program (HSIP): § 23 USC Section 148 | Bicycle and Pedestrian Safety Program (BPSP): § 23 USC Section 148 | Highway-Rail Grade Crossing Safety Program (H-RGCP): § 23 USC Section 130

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1 Highway Safety Improvement Program (HSIP)

1.1 Program Overview

Federal legislation, Fixing America's Surface Transportation (FAST) Act, authorizes the Federal surface transportation programs for highways, highway safety, and transit. The Highway Safety Improvement Program (HSIP) is a core program administered at the federal level by the U.S. Department of Transportation's (USDOT) Federal Highway Administration (FHWA) Office of Safety. HSIP's purpose is to make significant progress in reducing highway fatalities and serious injuries on all public roadways. A Public road is "any road under the jurisdiction of and maintained by a public authority and open to public travel." An increase in funding occurred from previous legislation to the FAST Act. Funding levels rose from approximately $37M in 2012 to $64M in 2013 and now $65M in 2017.

The Virginia Department of Transportation (VDOT) is required to develop and implement an effective, integrated and coordinated Strategic Highway Safety Plan (SHSP) that involves a comprehensive, data driven approach to implement the HSIP. The Commonwealth updated their SHSP for the 2017-2021 period to provide a comprehensive framework (4E's: Engineering, Enforcement, Education, and Emergency Response) for reducing highway fatalities and serious injuries and establishes statewide goals, objectives, and key emphasis areas. Section 1113 of the FAST Act describes the program and policy for implementing the HSIP (23USC148). The 23USC130 contains the Highway-Rail Grade Crossing Safety Program (H-RGCP), with dedicated funding, as part of the HSIP.

To obligate HSIP funds, Virginia must advance the safety data capabilities for collection, analysis, and integration in a manner that—

- complements the Department of Motor Vehicles (DMV) annual Highway Safety Program (HSP) and the Commercial Vehicle Safety Plan (CVSP) through the SHSP;
- includes all public roads, including public non-State-owned roads;
- identifies hazardous locations, sections, and elements that constitute a hazard to motorists, motorcyclists, bicyclists, pedestrians, and persons with disabilities;
- includes identifying the relative severity of hazardous locations in terms of crashes (including crash rate), serious injuries, fatalities, and traffic volume levels; and
- improves the ability to identify the number of fatalities and serious injuries on all public roads with a breakdown by functional classification and ownership.

Virginia's HSIP must also:

- determine priorities for the correction of hazardous road locations, sections, railway-highway crossing, and as identified through safety data analysis;
- identify opportunities to prevent future hazardous conditions;
- establish and implement a schedule of highway safety improvement projects for hazard correction and prevention; and

- submit an annual HSIP Report where an evaluation process analyzes the results achieved by the HSIP projects and the SHSP vision, mission, and goals established to save lives and prevent serious injuries.

The FHWA HSIP website includes information about various aspects of the program. FHWA has also published its own HSIP Manual to help state DOTs to develop their own comprehensive HSIP processes.

VDOT has developed a HSIP Implementation process that involves the identification of high crash locations, an analysis of problems and countermeasures, and the prioritization and scheduling of improvement projects. VDOT's HSIP program consists of the following programs:

- Chapters 2 and 3: Highway Safety Program (HSP);
- Chapter 4: Systemic Safety Improvement (SSI);
- Chapter 5: Bicycle and Pedestrian Safety Program (BPSP);
- Chapter 6: Highway-Rail Grade Crossing Safety Program (H-RGCP);
- Chapter 7: Local Agency Safety Program (LASP).

The High Risk Rural Roads Program (HRRRP) was a set-aside of the HSIP funds for rural major collectors and lower functional class roadways maintained by VDOT. The FAST Act requires HRRR set-aside if the targeted functional class roadways fatality rate has increased over the last two years. Under ACTION: 23 U.S.C. 148(g) (1) Fiscal Year 2018 High Risk Rural Roads (HRRR) Special Rules. Virginia was identified as experiencing an increase in its fatality rate on rural roads over the most recent two-year period.

Therefore, the state must obligate 4.4M of safety funds toward HRRR safety projects in the next fiscal year.

The BPSP dedicates resources to the most vulnerable highway users and is funded out of Section 148 allocations (See Chapter 5). The H-RGCP remains a set-aside of HSIP funds (See Chapter 6).

1.2 Program Administration

The VDOT Traffic Engineering Division (TED) administers the Federal and State highway safety programs within the Commonwealth of Virginia. VDOT's State Highway Safety Engineer oversees the HSIP activities with staff dedicated to transportation safety planning for project identification and staff for project development and delivery monitoring.

VDOT continues to implement an annual review of safety improvements proposals for selection. Local governments, railroad companies, and VDOT staff submit engineering studies of potential safety projects. These safety proposals are evaluated on a district basis to focus limited resources on areas of greatest need. HSIP funds are available for two types of projects: 1) locations or corridors where a known, 'substantive safety' problem exists as indicated by location-specific data on severe crashes; or 2) where a risk based analysis has demonstrated the need for low-cost, widely implemented systemic countermeasures that target high-risk roadway features. For additional information on systemic analysis and countermeasures, refer to FHWA Systemic Safety website. All HSIP expenditures require that a specific project action can produce a measurable and significant reduction in the number or risk of severe crashes. To achieve the maximum benefit, the focus of the program is on cost effective use of the funds allocated for safety

improvements. VDOT's HSIP project selection methods prioritize safety proposals that align with the SHSP, address roadways with actual or potential for higher deaths and serious injuries, and target the underlying safety issue.

1.3 Program Funding

HSIP is now a core program and the new FAST Act HSIP apportionment formula is based on a percentage after other transportation programs are apportioned. In 2018, Virginia is expecting to receive approximately $62M for highway and non-motorized safety improvements and $4.7M for highway-rail grade crossing improvements. Up to of ten percent of the HSIP allocation will be targeted for BPSP improvements.

Federal-aid projects are reimbursable for costs incurred after FHWA authorization. Reimbursement requests must be submitted to VDOT after FHWA authorization for each project development phase.

1.4 Program Contacts

For additional information regarding the Highway Safety Improvement Program, please visit VDOT TED website, email (HSIProgram@VirginiaDOT.org) or phone the contacts below:

HSIP Contact Information:

Mr. Mark A. Cole, P.E.
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Michael.Wray@VDOT.Virginia.gov

2 HSIP Project Life Cycle

2.1 Safety Proposals

2.1.1 Proposal Selection and Schedule

Proposed safety improvements on VDOT-maintained roadways for the upcoming Six-Year Improvement Program (SYIP) will be accepted for approval through November 1st. Safety proposals submitted by local agencies on VDOT or locally maintained roadways must follow the schedule outlined in Chapter 7. The HSIP annual proposal process follows both the federal and Virginia's fiscal years as shown in Table 2-1.

Table 2-1: HSIP Implementation Schedule

Deadline	Phase	Description
August 1st – November 1st	Intake Period	• Smart portal open. • Submitters can create applications and submit the applications in their organizations. • Submitters can update/submit applications • Submitters can unsubmit applications in their organization. • Submitters can prioritize application in their organization. • District can put comments, create alerts and answer alerts on Locality applications.
November 1st – December 1st	Local Liaison Validation (Locality Application only)	• Local Liaison review the completeness of the applications before submitting the application for district TED validation. • Local Liaison review either the Project is consistent with Locality Comprehensive Transportation Plan and followed the policy and procedure outlined on Locally Administered Projects (LAP) Manual. • Local Liaison co-ordinate with Locality to edit the major changes on the application.
November 1st – January 1st	District Validation	• District can perform validations on Locality applications • District can comment, create alert and answer alerts on applications. • District Validator can update all application for assigned programs
November 1st – February 1st	Central Office Validation	• CO validators can perform validations on all applications • CO can comment, create alert and answer alerts on applications
February 1st – March 1st	Detail Review/Scoring	• Detail review of the scored applications. • Conference call with each district to review the draft funding plan and invite feedback/comments. • Application goes to Public Visibility.
March 1st – May 1st	Fund Programmed	• Proposed project will be set up in pool – Temporary UPC • Coordination with the PIM office is required prior to the creation of any TUPC for HSIP Projects. • Genmod will be open and Funding will be allocated. • Final Permanent UPC will be set up in pool • Draft SYIP will be presented to CTB
May 1st – June	CTB Approval	• Prepare the final draft of the highway safety SYIP for CTB approval. • Final approved CTB approval list will be shared to locality and district.

The Commonwealth Transportation Board approves all new safety projects so deadlines are important. HSIP allocations for each fiscal year are approved by FHWA as a line item in the Statewide Transportation Improvement Program (STIP). FHWA funds are available in the next federal fiscal year that begins October 1st. After approval of the STIP, project managers should request authorization preliminary engineering phase for work on HSIP projects to begin. *Reimbursement cannot be requested for any work done prior to authorization by FHWA and the Federal Program Management Division.*

The HSIP staff and Infrastructure Investment Division will coordinate with District Administrators, District Planning and Investment Managers (PIMs) and PE Managers so that each project manager or local assistance coordinator liaison is aware of new HSIP projects.

2.1.2 Eligibility and Submittal Requirements

All project applications are required to be submitted through the Smart Portal Application Tool. The Smart Portal is the central website for submitting project applications for various funding programs at the Virginia Department of Transportation and Department of Rail and Public Transportation. This site is where eligible entities enter, manage, and submit project applications for funding as well as identify project priorities when multiple projects are submitted. Eligible entities can use the Smart Portal for submitting project applications for the Highway Safety (HSIP), Bike/Ped Safety (BSPS), Systemic Safety Improvements (SSI) and Highway- Rail Grade Crossing Safety Program (H-RGCP) applications. Eligible entities desiring to submit project applications must identify one person as the Administrator for the entity (organization, agency).

Figure 2-1 shows the work flow HSIP validation.
Note: District Local Liaison Step is not required for VDOT Maintained Roads Applications.

Figure 2-1: Work Flow HSIP Validation

The eligibility criteria and procedures vary for the safety programs. The HSP targets vehicle only crashes and requires a Benefit / Cost analysis at high crash locations or corridor segments; however, the SSI approach utilizes a risk assessment methodology to address risk throughout a region or network of roadways. The BPSP and H-RGCP applications also require a risk analysis due to the unpredictability of these crash types. Refer to Chapters 4 and 5, respectively, for information on eligibility, funding expectations, requirements, project proposal procedures for each program.

When submitting multiple proposals, they must be ranked and prioritized for each safety program (HSP, BPSP and H-RGCP) within their jurisdiction.

2.1.3 Project Scoring Process

Project Scoring Process Applications submitted to the Smart Portal are scored using the following an objective 100 point-based scoring system. See Chapters 3-6 for HSP, BPS, H-RGCP or SSI specific chapter for scoring criteria.

2.2 Safety Proposal Planning

The HSIP is a partnership between the FHWA, VDOT and local agencies. HSIP staff will assist VDOT districts by identifying high crash locations on VDOT maintained highways and provide consultation in the interpretation of data for the development of targeted action plans and proposing treatments consistent with Virginia's SHSP. VDOT districts should form a HSIP Safety

Team that includes a traffic engineer, a design engineer and other partners to study candidate safety proposals on the State-maintained network using HSIP Districtwide PE Funding. Additional partners may include district operations, materials, utilities and maintenance personnel to review safety proposal scope, cost and schedules.

Local agencies submitting safety proposals on VDOT maintained roads shall follow the requirements in Chapter 7 and must contact district local liaison and preliminary engineering staff to review the scope, cost and schedule. When the required safety proposal documentation is completed, concurrence should be obtained from the District PE Manager and Planning and Investment Manager. The appropriate manager (ATE or PE Manager) must sign the HSIP proposal form as the project sponsor for VDOT maintained and locally maintained roadways. Only the VDOT District Traffic Engineers have authority to submit the HSIP application for locally administered projects.

2.3 Safety Project Phases

The implementation of projects involves phases of preliminary engineering and construction. Some projects have the potential right-of-way acquisition and utility work. Once a safety proposal is selected, the sponsor must work with the project managers to ensure that the scope and cost of the project do not increase beyond that which was initially submitted. If additional improvements are appropriate for different target crashes at the same location, then another safety proposal should be submitted or other funding resources to cover the related project should be explored. The related project may be coordinated and/or advertised with the selected safety project.

Most HSIP projects should follow Tier I oversight as explained in IIM-LD-249.3. Furthermore, project schedules are important to Virginia's transportation users since a safety issue has been identified. The intent of the HSIP is to expend federal funds on safety improvements that can be designed and constructed within three years. Projects should not require acquisition of significant rights of way, nor should they require extensive environmental review and mitigation. Federal funds must be authorized for PE within two months of the STIP approval. Safety partners failing to get funds authorized within two months must request a time extension from HSIP staff and are subject to removal if the extension is not granted. The goal is to have PE phase completed as quickly as possible and within 12 months of project authorization.

2.3.1 Preliminary Engineering Phase

Based on new FHWA guidance and VDOT guidance, outlined in IIM-IID-3.0, projects must be fully funded, through construction before any safety funding can be authorized for release. Once the project funding has been authorized, the project can be designed and constructed within 3 years.

It is FHWA's policy that safety improvements that are part of a broader Federal-aid project should be funded from the same source as the broader project. Therefore, it is not recommended to budget safety funding with any other funding unless it is absolutely required.

For surplus/deficit fund transfer, CTB and CO-TED concurrence is required before the transfer form goes to CO-IID for final approval.

Prior to beginning reimbursable work, the project and each project phase (Preliminary Engineering, Right of Way Acquisition, Advertisement, and Award) must be formally authorized (approved) by the FHWA to be eligible for reimbursement. This authorization MUST be received

prior to beginning any work to be reimbursed with federal aid. Refer to the Locally Administered Projects (LAP) Manual Section 9.3 for additional information on the project development process. In general, there are three key steps required for PE authorization:

1. The allocations must be programmed.
2. The project phases must be in the STIP/TIP.
3. All the required agreements must be executed.

Upon receipt of federal authorization for preliminary engineering, work can begin on the design of the selected HSIP project. The preliminary engineering phase includes project scoping and environmental documentation. Consultants used for preliminary engineering must follow the required federal and state procedures for procuring professional services.

Within two months of authorizing preliminary engineering, the assigned project manager will conduct a scoping meeting to identify the design elements and to set the schedule. The scoping report should use the HSIP proposal forms and associated engineering safety study reports as the basis for the safety project. Ancillary design elements that do not have targeted crashes and reductions identified from the engineering study should not be added to the scope.

The HSIP project should be scoped to identify features that need to be constructed or upgraded based on the engineering study. The project manager is responsible for identifying substandard design features. Design Waivers are required when deviations from VDOT's design criteria occur on VDOT owned and maintained roadways only. When design criteria meet or exceed AASHTO and Americans with Disabilities Act Accessibility Guidelines (ADAAG) minimum design standards, but fall short of VDOT's minimum design standards, a Design Waiver shall be required. Design Waivers will be applicable to all projects regardless of functional classification and funding and shall be documented and approved in accordance with the Design Waiver Request Form LD-448. Items requiring a Design Waiver include, but are not limited to, the following:

- Clear Zone
- Paved Shoulder Width
- Curb and Gutter
- Minimum Radius
- Pedestrian Accessibility Compliance

(See IIM-LD-55)

- Ditch Width
- Lane Tapers
- Buffer Strip Width
- Super-elevation
- Intersection Sight Distance
- Total Shoulder Width

A Design Exception/Design Waiver is not required for safety and operational projects such as HSIP and ITS projects on NHS roadways in accordance with the Memorandum dated August 28, 2013. A Design Exception is not required for Spot Safety and Operational Improvement Projects if existing geometric features do not degrade on non-NHS roadways with a scope limited to one or more of these elements:

- Intersection improvement that does not add capacity, such as turn lane extension, and changing turning radius
  Note: Adding a right or left turn lane increases capacity
- Vertical curve adjustment (HSIP only)

- Horizontal curve adjustment (HSIP only)
- Signal Optimization/Retiming
- Adaptive Signals operation
- ITS devices and systems to improve safety & operational efficiency
- Sign upgrade to comply with latest MUTCD requirements
- Flashing Beacons/Warnings
- Acceleration Lanes on non-interstate system
- Pedestrian and Bicycle accommodation such as bicycle lanes, shared use path, pedestrian refuge, sidewalk and crosswalk projects
- Roadway Lighting, Signs, Signals, Raised Pavement Markers, Pavement Markings
- Installation or adjustment of Guardrail Systems to meet VDOT's current policy and/or standards
- Shoulder Widening up to 4 feet
- Paving existing graded shoulder
- High friction surfacing
- Safety edge
- Rumble strip installation

For example, if the engineering and crash analysis identifies the need for improving shoulder width and the vertical alignment, but only the shoulder width is being improved, then a design exception / waiver is needed for the substandard vertical curve. For additional information, refer to IIM-LD-227.

During the scoping phase, the project manager should determine if the target advertisement date and estimated costs are reasonable. After the targeted advertisement date or estimated costs are set, HSIP staff must be notified and concurrence obtained on the schedule and funding. The schedule and cost estimate from this time forward will be monitored as HSIP project delivery performance metrics.

Jurisdictions that have locally-maintained roadways can administer the design, advertisement and construction of their HSIP projects or allow VDOT to administer these projects following the Chapter 7 and LAP Manual requirements. If the jurisdiction administers a project, then the locality must ensure that all VDOT and FHWA design, advertisement, contracting and construction requirements are satisfied. The jurisdiction must notify VDOT staff of the proposed schedule and cost changes for monitoring in accordance with LAP Manual procedures. VDOT uses this information to coordinate funding with Virginia's Federal Strategy and to provide the required state and federal authorizations.

HSIP projects typically involve minimal environmental documentation since most projects qualify for "Programmatic Categorical Exclusion" or project specific "Categorical Exclusion". Projects with greater environmental impact, such as needed drainage improvements or projects in historic districts may require additional analysis and documentation.

2.3.2 Right-of-Way Acquisition and Utilities

Safety projects should not require significant acquisition of right-of-way. Right-of-way acquisition may be authorized during the preliminary engineering phase. For no-plan and

minimum plan projects, acquisition should adhere to VDOT R/W policy and procedures. Larger projects with R/W acquisition and relocation must be accomplished following the Uniform Relocation Assistance and Real Property Acquisition Act with required approved right-of-way plans and FHWA authorization before property acquisition can begin.

Project designers and managers are responsible for identifying and relocating utilities that conflict with the safety project in conformance with Federal requirements. Refer to Volume 2 of VDOT's Right of Way and Utilities Manual for complete requirements.

2.3.3 Construction Phase

When preliminary engineering and right-of-way acquisition phases are completed on VDOT administered projects, the Scheduling and Contract Division prepares the construction bid and contract documents. Federal Program Management Division secures authorization to advertise the project. The recommendation for the award of a project is made and is submitted to VDOT's commissioner for approval. Should additional HSIP funds be needed upon review of the bid submissions, please contact HSIP staff for review and concurrence.

Federal regulations require all HSIP projects to be competitively bid. The only exception is when a Public Interest Finding, commonly called a "Cost Effectiveness Finding", is submitted to and approved by FHWA. The basis of this finding must be that VDOT state forces or local forces can construct the HSIP project at a considerably lower cost than advertising the project and receiving competitive bids. The finding must show both cost and time savings. HSIP projects are not eligible for the Special Advertising and Award Process (SAAP).

Projects are also eligible for construction under an existing district-wide or locality-wide contract, provided the contract follows prescribed federal guidelines and have approval from the Commonwealth Transportation Board (CTB). Projects completed using regional contracts have generally included the installation of traffic control devices, such as traffic signals or other systemic countermeasure installation.

2.4 HSIP Project Delivery – Performance Measurement

Once projects have been programmed and funds have been allocated, the HSIP Staff monitors the HSIP projects from scoping through construction to the final voucher. The project monitoring process consists of tracking changes that occur to the following project functions: project advertisement dates, funding authorization dates, engineer's estimates and expenditures per the HSIP Project Delivery Performance Measurement guidelines.

Two activities are monitored and measured to ensure that the HSIP projects are being delivered on time and on budget. HSIP Project schedules and cost both directly affect the Federal Strategy and VDOT's ability to meet their Obligation Authority for the HSIP Program.

- Schedule: When an HSIP project phase slips into the next FFY then it adversely affects the HSIP obligation and spending rates. Schedule at the phase level of an HSIP project is monitored. Increased scope and utilities and right-of-way issues are the most common reasons for a shift in a phase start date. A delay in project scoping can also cause delays from the beginning. The Project Task and Scheduling Guide must be followed if any updates or need to initiate the task/activity or selecting the right template in Project Web Application (PWA).

- Cost: When a project cost estimate is too high or too low, the HSIP obligation rate is also adversely affected. Cost estimates at the phase level of an HSIP project is the also monitored. Surveying, Construction, Engineering and Inspection (CEI) costs as well as storm water management cost are the most commons reasons for increased cost. When an HSIP project experiences a cost increase, the viability of the project, through its benefit-cost ratio, decreases. Initially good HSIP proposals may quickly inhibit the outcome from the program with little safety benefit due to scope creep. (Detailed and accurate cost estimates should utilize VDOT's Project Cost Estimation System (PCES) worksheets. Project sponsors who do not have access to the PCES worksheets shall submit detailed costs with a descriptive reason for not using PCES. VDOT district local assistance staff will work with local jurisdictions to ensure project cost estimates are consistent with PCES).

HSIP Staff will work with the safety partners to recalculate the benefit to cost ratio (B/C) if project costs increase, to determine if the HSIP project is eligible for any available HSIP funding. Attending field reviews, scoping meetings, reviewing and approving scoping reports may also be part of the HSIP monitoring process. HSIP Staff will also monitor the effectiveness of the safety proposals selected and how these projects contribute to achieving the SHSP goals.

Virginia adopted an AASHTO goal "Towards Zero Deaths" vision statement in the SHSP with a goal to reduce deaths and serious injuries by half by 2030. This goal equates to a 3 percent reduction per year.

The HSIP Program Manager will monitor the HSIP program's contribution to the established SHSP goals by reporting on the anticipated effectiveness of the District selected HSIP projects which target death and severe injury (K+A injury) crashes. For each HSIP project selected, the HSIP Program Manager will determine an estimated crash modification factor and life cycle cost. This estimated K+A crash savings will be compared to the SHSP's targeted K+A goals. The HSIP Program Manager will report, by project, district, and at the statewide level, the portion of the reduction by emphasis area that the engineering countermeasures produced. Table 2-2 outlines the HSIP program's performance metrics and goals.

Table 2-2: HSIP Performance Metrics and Goals

Performance Measurement Goal	
Schedule	To have 85% of the HSIP projects have their phase obligations delivered within the FFY estimated at the scoping meeting.
Cost	To have 85% of the HSIP projects have the final cost within 110% of the cost estimate at the scoping meeting.
Targeted KA Crashes	To annually program safety projects with two times the district three percent annual reduction (target) for roadway departure and intersection related death (K) and severe injuries (A) from crashes.

2.5 Project and Program Evaluation

VDOT submits an annual HSIP report to FHWA documenting the progress in implementing the HSIP, the effectiveness of the overall program, and the effectiveness of individual projects. For individual projects, the annual report identifies the safety proposals selected, those obligated and completed, and the effectiveness of completed projects. To evaluate the effectiveness of each completed project, HSIP Staff completes before-and-after crash studies. Documentation is critical to both project and program evaluation. First, it is necessary to track the implementation timeframe (beginning and end of construction) to define the before and after periods for analysis. Second, it is necessary to track the types and location of improvements, so that program evaluations can be conducted for groups of similar treatments. Crash statistics and traffic volume data (where available) are collected for three years before and after the construction period. Jurisdictions who maintain their own roadways must agree to provide information necessary for a post-construction evaluation. The data collected will also be used to assess and document crash modification factors for selected HSIP improvements. The following sections provide additional discussion of program and project evaluation.

2.5.1 Project Evaluation

Observational before-after studies are often employed to estimate the safety effectiveness of a specific treatment or project. Crash modification factors derived from before-after data are based on the change in safety performance due to the implementation of some treatment. The observed change in crash experience at treated sites between the periods before and after treatment may be due not only to the treatment, but to other factors as well. Other factors include:

1. Changes in traffic volume.
2. Changes in crash reporting.
3. Regression-to-the-mean.

Simple before-after comparisons that are reported to FHWA annually, also known as naïve before-after studies, do not account for these changes. As a result, CMFs derived from such studies are usually considered unreliable and rated as being of poor quality. More rigorous methods for estimating the safety effectiveness of individual projects include: before-after with comparison group method and the Empirical Bayes (EB) before-after method. FHWA's A Guide to Developing Quality Crash Modification Factors[1] discusses these two methods in detail.

In some cases, the same treatment is implemented at multiple locations. In addition to estimating the safety effectiveness of individual projects, it may be of interest to estimate a crash modification factor for the overall treatment. If the safety effectiveness is already estimated for each of the individual projects, then the estimation of a treatment-specific crash modification

[1] Gross, F., B. Persaud, and C. Lyon. *A Guide to* Developing *Quality Crash Modification Factors*. Federal Highway Administration, Report FHWA-SA-10-032, Washington, DC, 2010.

factor is relatively straightforward using the procedures outlined in Hauer, 1997[2]. The benefit of a treatment-specific estimate is the increase in sample size, which tends to reduce the uncertainty of the estimate.

2.5.2 Program Evaluation

Program evaluations are more high-level than project evaluations. At the highest level, the overall effectiveness of the HSIP is evaluated by tracking the progress in implementing projects, obligating HSIP funds, and reducing crash-related fatalities and injuries. Sub-programs of the HSIP include groups of projects that target specific crash types, such as SHSP Emphasis Areas (e.g., run-off-road crashes, intersection crashes, and young driver crashes). The effectiveness of sub-programs is evaluated, similar to the overall HSIP, by tracking the progress in implementing projects, obligating funds, and reducing fatalities and injuries related to the specific sub-program. For example, the effectiveness of a run-off-road program may be evaluated in the future by comparing the number of miles of rumble strips installed statewide to the number of run-off-road fatalities and injuries statewide.

[2] Hauer, E., Observational Before-After Studies in Road Safety: Estimating the Effect of *Highway and Traffic Engineering Measures on Road Safety*. Pergamon Press, Elseviser Science Ltd., Oxford, U.K., 1997.

3 Highway Safety Program (HSP)

3.1 Program Overview

The primary objective of the HSP is to identify and improve locations where there is a high concentration, or risk, of vehicle crashes that result in deaths or injuries and to implement strategies to attain Virginia's Towards Zero Deaths vision.

Each year, HSIP staff fulfills transportation safety planning requirements by producing listings of the high severe crash intersections and highway sections on VDOT maintained roadways and distributes them to VDOT traffic engineering staff. Jurisdictions that maintain their own roadway network and want to participate must identify their high crash locations. Safety proposals are not limited to the locations that are identified by HSIP staff.

VDOT's network is in a geospatial web-based Roadway Network System (RNS). RNS and the associated data mart do not currently incorporate the method and tools to produce high crash locations listings by district or jurisdiction.

HSIP staff conducts network screening for the engineering emphasis areas in Virginia's Strategic Highway Safety Plan (SHSP). Priority SHSP emphasis area maps are generated to rank intersection-related crash locations and routes with the most severe roadway departure crashes in each jurisdiction. The related data tables and maps are available to on the Traffic Engineering Division OutsideVDOT website. Requests for access may be requested by contacting HSIP staff. HSIP Staff also produce maps showing route ranking, non-motorized (bicycle and pedestrian) and the behavioral emphasis areas related crashes for VDOT maintained roadways for each jurisdiction.

Further, VDOT is now employing more advanced network screening of roadway intersections and segments using the Highway Safety Manual Safety Performance Function and Empirical Bayes (EB) assessment of expected and predicted crashes compared to the past crash experience. Listings and maps of intersections and segments in each District where expected are greater than predicted crashes have been identified as locations with Potential for Safety Improvement (PSI). Recently completed network screening analysis and related data tables/maps and Crash Data Analysis Manual are available to on the Traffic Engineering Division OutsideVDOT website.

VDOT districts should use the safety data mapping information with local knowledge to initiate further engineering study of the locations identified with the most severe crashes. Detailed crash analysis and site evaluation is typically conducted through a documented engineering study. The engineering study should document the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD). The engineering study should include relevant steps outlined in a traditional RSA. The steps for conducting an RSA or to complete an engineering study are documented on the FHWA RSA website and VDOT RSA Guidelines, however applicants are not required to submit a full RSA. Please contact HSIP staff if there is a question about the level of study required. The submitted engineering study, and proposal will form the basis for the initial scoping document for the project.

Engineering studies to scope safety projects review recent crash data and existing roadway / intersection characteristics (i.e., geometry, control, sight distance, travel speeds, lane widths, etc.) to characterize crash data and risks specific to the location of interest. The studies are designed to accomplish four essential steps: 1) examine the safety data to determine contributing crash factors or geometric features; 2) conduct a field review; 3) identify countermeasures; and 4) assess the effectiveness of suggested countermeasures for a safety proposal.

For other planned construction projects, FHWA's HSIP Manual provides a list of safety-related tasks recommended for the Preliminary Design Process. Safety benefits should be quantified for each alternative during the alternatives selection process. Although right-of-way costs or other constraining factors may play a significant role in the project alternatives selection process, the safety benefits associated with each alternative should be considered in the overall evaluation. Texas Transportation Institute developed the Interim Road Safety Design Workbook to assist engineers with evaluating potential safety tradeoffs associated with various design alternatives.[3]

VDOT districts and jurisdictions are encouraged to assess the most recent data that is available in RNS or VDOT Tableau Crash Tool. VDOT Crash Data Analysis Manual has been developed which provide the documentation and guidance on the use of VDOT supplied crash data and its attributes. Analyzing crashes for a three or five-year period should reveal a crash severity type pattern or common geometric features occurring at an intersection or highway section. The longer five-year period may be used for locations with more random crash occurrences. If a crash pattern or roadway feature is determined, countermeasures may be identified to address specific crash types or roadway features.

Liability associated with data collection and data analysis is limited through 23 U.S.C. 409, which states, "Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or rail-way-highway crossings, pursuant to sections 130, 144, and 148 [152] of 23 U.S.C. or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or state court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data."

3.2 Proposal Eligibility

HSIP projects implement countermeasure(s) to address severe crashes on any public road. For safety proposals to be eligible for HSP funding there must be a documented crash history or risk assessed and tied to an emphasis area in the SHSP. There may be some treatments that address a serious crash type / patterns or geometric feature, but that are not eligible for HSIP funding. Some of the types of work ineligible for HSIP funding are:

- Bridge replacement

[3] TE Memo 362.1 identifies the need for signed and sealed engineering studies that involve detailed crash analysis and countermeasure development – see section 3.5.2. A RSA without detailed crash analysis, such as a review of design drawings, presently do not need to be sealed.

- Automated enforcement
- General maintenance (maintenance of roadways, signs, signals, pavement markings, markers, etc.).

The keys to success in HSIP project selection include are 1) employing a data driven process that focuses on reducing deaths and serious injuries; 2) studying the common geometric features and crash records for problem identification and contributing factors; 3) applying a full range of countermeasures proven effective in reducing severe crashes or tailored to specific infrastructure types or conditions, and 4) focusing on lower cost solutions. Eligible safety proposals have been categorized by VDOT as follows:

- General: (safety data [collection, analysis, and improvement]; safety planning; RSAs; retro-reflectivity; signage and pavement markings improvements; older drivers and pedestrian enhancements)
- Intersection (intersection safety, systemic improvement, traffic control, high friction surface, emergency preemption)
- Roadway Departure (systemic improvements, geometric improvements, rumble strips or another warning device, roadside hazard elimination, pavement and shoulder widening, guardrails, barriers and crash attenuators installation, high friction surfaces.)
- Non-Motorized (traffic calming, pedestrian or bicycle improvements, school zone improvements, truck parking facilities)
- Rail Crossing (traffic enforcement, railway-highway grade crossing installation)
- Work Zone (emergency communications equipment, operational activities, traffic enforcement activities)

Some of the improvement categories above are broadly defined to incorporate the 28 improvement types listed in FAST Act HSIP (23 USC Section 148). A detailed resource of safety improvements for different targeted crash types is available in NCHRP Report 500 series. The FHWA safety website also has numerous resources on countermeasures. A comprehensive list of CMFs (modification and reduction factors) is available at the CMF Clearinghouse website. Guidance on the use of the CMF Clearinghouse is provided in Section 3.2.1. Consult with the HSIP staff for clarification or questions regarding project categories and/or eligibility.

Projects completed under regional contracts are eligible provided the contract contains the appropriate federal language. Railroads and private roads are not eligible for HSP funding. Special Advertised and Awarded Projects (SAAP) are not eligible as well.

3.3 Project Funding

Highway safety projects are federally financed at 90 percent with the state or locality providing 10 percent local match. VDOT has allocated State funds to provide the required local match so safety projects have been completely funded. Low-cost safety proposals will be considered; however, a significant increase in project cost will also affect the economic assessment used to determine eligibility and prioritize selection for funding. HSIP will also consider the consistency with the SHSP and number of severe crashes targeted. Any project exceeding the original scope cost estimate for any phase will be monitored and count against the overall performance

measurement. All modifications to scope, cost estimates, and schedule will require HSIP staff concurrence and in some cases District Engineer approval on the revised benefit-cost assessment. All decisions are subject to limiting HSIP allocations. For jurisdictions with locally maintained roadways, any increase over the authorized project scope will be funded by the locality per the resolution agreement.

Based on new FHWA guidance and VDOT guidance, outlined in IIM-IID-3.0, projects must be fully funded, through construction before any safety funding can be authorized for release. Once the project funding has been authorized, the project can be designed and constructed within 3 years.

In general, it is FHWA's policy that safety improvements that are part of a broader Federal-aid project should be funded from the same source as the broader project. Therefore, it is not recommended to budget safety funding with any other funding unless it is absolutely required. For surplus/deficit fund transfer, CTB and CO-TED concurrence is required before the transfer form goes to CO-IID for final approval. The SYIP amendments and fund transfer process is outlined on the VDOT website IIM-IID-2.1.

3.4 Proposal Requirements

Eligible HSIP proposals must encompass the following four factors:

1. They must be relevant to the program purpose of reducing severe crashes, or risks to transportation users.
2. They must address hazardous situations through good safety planning and identified by safety data driven network screening.
3. They must demonstrate compliance with the appropriate VDOT design guidelines and standards. For example, traffic signal installations shall provide a traffic signal warrant analysis[4] and the latest design standards must be used.
4. Safety proposals must upgrade non-standard safety features to existing standards, when those features are related to the targeted crashes identified within the work area of the engineering study[5] (or Roadway Safety Assessment). Requests for exceptions or waivers to this requirement will follow the appropriate design procedures. Further, all projects must meet the requirements of the Americans with Disabilities Act (ADA).

3.5 Safety Improvement Proposal Procedure

3.5.1 Proposal Planning

The HSIP is a partnership between the FHWA, VDOT and local agencies. HSIP staff will assist VDOT districts by identifying high crash locations on VDOT maintained highways and provide consultation in the interpretation of data for the development of targeted action plans and proposing treatments consistent with Virginia's SHSP. VDOT districts should form a HSIP Safety

[4] Safety Partners submitting projects to install traffic signals at new locations **must** submit a copy of the warrant analysis showing that the signal meets the criteria outlined in the most recently adopted MUTCD.

[5] TE Memo 362.1 identifies the need for signed and sealed engineering studies that involve detailed crash analysis and countermeasure development – see section 3.5.2. A RSA without detailed crash analysis, such as a review of design drawings or a windshield review of a roadway, presently do not need to be sealed.

Team that includes a traffic engineer, a design engineer and other partners to study candidate safety proposals on the State-maintained network using HSIP Districtwide PE Funding. Additional partners may include district operations, materials, utilities and maintenance personnel to review safety proposal scope, cost and schedules.

3.5.2 Eligible Sponsors

Local jurisdictions who can certify their ability to deliver federal-aid projects and VDOT offices are eligible for HSP funding on all public roadways. All local agencies must provide their safety proposals to VDOT district staff to obtain concurrence following Chapter 7 requirements. Only VDOT District Traffic Engineers have authority to submit the HSIP application for locally administered projects. Sufficient VDOT district review and submittal time should be provided to allow for programming safety projects. Any proposals sent directly to HSIP staff will be forwarded to the appropriate VDOT district contact for review.

3.5.3 Project Proposal Requirements

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in credentials. If a HSP application was submitted in the past, users can re-use/clone the past application as new application for this fiscal year, and a new APPID will be assigned automatically.

Applications must include an engineering study documenting the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD). The engineering study should include relevant steps outlined in a traditional RSA. The steps for conducting an RSA or to complete an engineering study are documented on the FHWA RSA website and VDOT RSA Guidelines, however applicants are not required to submit a full RSA. Please contact HSIP staff if there is a question about the level of study required. The submitted engineering study, and proposal will form the basis for the initial scoping document for the project.

Each submission *must* also include the following information:

Section 1: General

- Agency: The name of the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project.
- Project Sponsor: The name of the person representing the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project.
- Contact Information: The contact information for the person representing the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project. Contact information includes the Address, City, State, Zip, Email, and Phone Number.
- General Location: This section defines the general location of the proposed work. Select from the dropdown menus to identify the VDOT District and Region.
- General Project Description: This section defines the general type of proposed work. Select from the dropdown menus to identify the Program Type and Project Type. The Program

Type is defined as a "Regular" Highway Safety Improvement Program (HSIP), High Risk Rural Roads (HRRR), Strategically Targeted Affordable Roadway Solutions (STARS), or Corridors of Statewide Significance (COSS) project. The Project Type is defined as a Segment, Intersection, or Corridor project.

- **Roadway Description:** This section defines the type of roadway on which the proposed work is to be performed. Select from the dropdown menus to identify the Functional Class Code, Area Location Code, Federal System Code, System, and Traffic Control.
- **Study Period:** This section defines the study period of the analysis. Identify the begin date of the study period under Study Period Begins. Identify the end date of the study period under Study Period Ends.
- **Specific Location:** This section defines the specific location and limits of the proposed work. Identify the County, Safety Proposal Location/Route, From / Major Road, and To / Cross Street.

Section 2: Crash History

Crash data and analysis tools are available to obtain crash categories and crash history here:

- VDOT Tableau Crash Tool
- VDOT Annual Crash Summary Books
- 2012-2016 Potential For Safety Improvement (PSI) Information
- Crash Data Analysis Manual

- **Primary Crash Categories:** For each crash category, indicate the number of crashes by severity. The total number of crashes by severity will be displayed automatically on the subsection below.
- **Secondary Crash Categories:** For each secondary crash type, indicate the number of crashes by severity. Note that the sum of secondary crash categories MAY NOT equal the total number of crashes because there is overlap among the secondary crash categories. The breakdown of crashes by secondary crash type is necessary because some crash modification factors (CMFs) apply to these crash types.
- **Number of Years in Crash History:** Enter the number of years represented by the crash history provided in the table. This is used in the calculation of the benefit-cost ratio.
- **Discount Rate %:** Use the Discount rate of 3%. This discount rate is used to adjust for inflation.

Section 3: Improvements

Use the drop-down menu to select a proposed systemic improvement to address each of the risk factors. If there is more than one countermeasure, refer to "Single or Multiple Improvements" in Section 3.5.5.

Cost: Compute the economic cost of each proposed improvement. The safety proposal must show the estimated project costs broken down by project phase (PE, R/W and Utilities, and Construction). Detailed and accurate cost estimates should be provided. If possible, applicants

should use VDOT's Project Cost Estimation System (PCES) worksheets. However, project sponsors who do not have access to the PCES worksheets shall submit detailed costs with a descriptive reason for not using PCES. VDOT district local assistance staff will work with local jurisdictions to ensure project cost estimates are consistent with PCES.

- **Proposed Improvement:** Enter the name of the proposed improvement (e.g., install traffic signal or increase sight distance).
- **Service Life:** Enter the service life for each proposed improvement. Refer to the tab titled, Service Life (YRS), in the Excel version of the HSP application form to identify the appropriate service life for a proposed improvement.
- **PE Cost + $5000:** Enter the estimated PE cost for each proposed improvement. All HSIP projects need at least $10,000 in PE for HSIP Staff processing and review. Do not add oversight costs to each treatment; rather, add to the first treatment that will be annualized with any others in the economic assessment.
    - Note that VDOT District and Central Office personnel charge review and administration time to projects managed by localities. Safety Projects not managed by VDOT shall include a minimum of $5,000 for VDOT PE costs.
- **Right-of-Way and Utility Cost:** Enter the estimated right-of-way and utility cost for each proposed improvement. Note that these are up front, one-time costs to acquire right-of-way and move or install utilities as part of the construction of the proposed improvement.
- **Construction Cost:** Enter the estimated construction cost for each proposed improvement.
- **Total Construction Cost (PV):** The present value of the total construction cost is automatically computed for each proposed improvement.
- **Contingency (10%):** A 10% contingency is automatically computed for each proposed improvement based on the construction cost.
- **Annual Maintenance:** Enter the annual maintenance costs for each proposed improvement. Refer to the tab titled, Maintenance & Utility Costs, in the Excel version of the HSP application form to identify annual maintenance and utility costs for select improvements.
- **Maintenance Cost (PV):** The present value of the maintenance cost is automatically computed for each proposed improvement based on the annual maintenance cost, discount rate, and service life.
- **Total Cost (PV):** The present value of the total cost is automatically computed for each proposed improvement based on the present value of the total construction cost, contingency, and present value of the maintenance cost.

Benefits: Compute the economic benefit of each improvement.

- **CMF Value:** Enter the associated CMF value(s) for each proposed improvement. Note that up to three benefits or CMFs may be entered for a given improvement to consider the net benefit (i.e., differential effect of improvement on different crash types and severities). It is appropriate to consider the net benefit when the proposed improvement could increase some crash types and/or severities while reducing others.

- **Applicable Crash Type:** Select from the dropdown menu to identify the crash type associated with the CMF(s).
- **Applicable Crash Severity:** Select from the dropdown menu to identify the crash severity associated with the CMF(s). May select more than one if necessary.
- **Include CMF in Final Analysis (yes/no):** Select from the dropdown menu to indicate whether or not to include each CMF in the final analysis. Note that all CMFs should be included in the analysis if they apply to different crash types and/or severities (e.g., one is for fatal plus injury crashes and the other is for property damage only crashes). If there is any overlap among the CMFs (e.g., one CMF is for total crashes and the other is for injury crashes), then the user will need to select the most appropriate CMF(s).
- **Reference Link to CMF ID from CMF Clearinghouse:** Copy and paste the hyperlink from the CMF Clearinghouse for each specific CMF. Each CMF should have a unique hyperlink that corresponds to the CMF ID.
- **Other Notes:** Enter any further notes to help support or justify the use of the specific CMF(s) selected from the CMF Clearinghouse.

B/C Ratio: Compute the B/C ratio for specific combinations of CMFs.

- **Proposed Improvement:** The name of the proposed improvement is automatically carried over from the improvements section.
- **Included in Analysis (yes/no):** Select from the dropdown menu to indicate whether or not to include each proposed improvement in the final B/C analysis.
- **Present Value of Benefit:** The present value of the benefit is computed automatically for each proposed improvement.
- **Present Value of Cost:** The present value of the cost is computed automatically for each proposed improvement.
- **B/C by CMF:** The individual B/C ratio is computed automatically for each proposed improvement.
- **B/C Ratio:** The overall B/C ratio is computed automatically for the selected combination of proposed improvements.

Project Schedule: The Begin PE date should be set no earlier than October 1st of the first year to allow for FHWA STIP approval and project authorization to begin. With this start, the advertisement date should be with 12 months but shall not be any later than January of the second year for projects added to the current fiscal year. The completion date of a project should not be any later than January of the fourth year. In other words, a project will be advertised in two years and completed in three years from STIP approval at the latest. The project sponsor and project manager are responsible for coordinating the proposal schedule.

Section 4: Location

Using the provided interactive map, locate the study area where the proposed improvements will be implemented. Use the appropriate functions to place a polygon around the study area.

Applicants may use more than one polygon to locate multiple study areas and can edit study areas if necessary. VDOT LRS system is available on portal for users to select. Also, a user can pre-populate the line/point events on the portal by importing the files in the form of spreadsheet/CVS/text. Applicants are also asked to describe the location in the following section.

Section 5: Additional Questions

- Location: Describe the location of the safety proposal. Attach either a map, picture or sketch map and include information on traffic volumes, regulatory and warning signs, markings, other key traffic control devices.
- Problem ID: Description of the identified safety issues.
    a. Does the location appear on the District SHSP Priority List of Intersections or Corridors? If so, what priority level (1, 2, or 3) and how many Fatal + Injury crashes involve speeding, young drivers, occupant protection, or impaired driving?
    b. Does the location appear as on the District Priority List of Intersections, Segments, or Corridors based on frequency or for Potential for Safety Improvements (PSI)?
- Diagnosis: Please describe the alternatives analyzed, including engineering measures reviewed or previously implemented to attempt to address the safety issue.
- Countermeasure Section: Please describe the location of the safety proposal. Attach either a map, picture or sketch map and include information on traffic volumes, regulatory and warning signs, markings, other key traffic control devices.
    a. Target intersection, interchange, driveway or roadway departure related crash types.
    b. Address certain crash types at multiple locations (systemic measures) possessing the same roadway features based upon crash risk and crash thresholds. Document any engineering improvements that do not have known crash modification factors but are expected to reduce crash risk.
- Coordination: Please describe any enforcement or education activities or grants being pursued concurrently through Virginia DMV or other sources.
- Cost and Schedule: Please describe how the proposal cost was calculated and how can you ensure the proposal can be completed within the proposed budget / schedule.

Section 6: Supporting Documents

Supporting documentation, that will strengthen or validate the HSP application, should be uploaded to the Smart Portal. Traditional HSP Safety proposals must include an engineering study documenting the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD). Additional documentation may include photos, large maps, study reports or resolution letters.

Applicants are also required to submit a VDOT's Project Cost Estimation System (PCES) estimate. If applicant does not have access to a PCES estimate, the applicant is required to submit an alternate detailed project cost estimate. The PCES or alternative cost estimate must be attached to the project application submission.

Each of the six areas listed in the Smart Portal must be completed. Well-documented proposals are more likely to receive higher scores and ranking for funding priorities. A separate proposal form must be completed for each candidate location, and there is no limit to the number of proposals submitted.

Proposals on VDOT maintained systems must be reviewed by Regional Traffic Engineering and Preliminary Engineering staff to assess traffic control and design costs. Time should be allowed for review from other disciplines, particularly design engineers, to concur with constructability and right-of-way impact issues. Proposals for locally maintained roadways must be coordinated and have concurrence of the District Local Assistance Liaison who will be assigned as the project sponsor following Chapter 7 procedures.

3.5.4 Electronic Submission

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in All submissions must be received in VDOT's Traffic Engineering office by November 1st to be considered for qualification of HSIP funds. Locally Administered Projects must be validated by District Traffic Engineers (DTE), DTE is responsible for coordinating with VDOT Local Liaison and submit the applications. Locally Administered Projects must submit their initial application to the VDOT Local Liaison by August 1st and final application by September 1st following the project submittal work flow.

Applicants assign an Administrator who will serve as the POC for the application. The Administrator will work with district staff to submit the HSIP application. The Administrator POC will oversee the creation, submission, and prioritization of candidate projects for all the application programs. The Administrator is also used as the default point of contact for each project application submitted.

3.6 Project Selection

Project selection follows a two-step process. The first step is to determine the eligibility of the safety proposal for HSIP funding. The second step is to prioritize eligible proposals based on factors including the B/C ratio or risk reduction, link to SHSP emphasis areas, total targeted severe crashes, project cost range, engineering review, public support, and available HSIP funding.

After HSP proposals are deemed eligible, HSIP staff consider several factors to determine which HSP proposals to fund. These factors can be grouped into two general categories.

- Proposal Utility: What is the proposal's ability to address the safety issue presented?
- Proposal Feasibility: What is the readiness and schedule of the proposal to be constructed based upon public support, right-of-way issues, utility issues, and environmental issues?

With the adoption of FAST Act and wider use of systemic treatments that consider both severe crash densities and relative risk, HSIP staff will evaluate elements related to both proposal utility and feasibility. Examples of these elements are shown in Table 3-1.

Table 3-1: Selection Process

Proposal Elements	
Proposal Utility	B/C Ratio or Risk Reduction
	Link to SHSP Emphasis Area
	Link to Identified Safety Issue
	Targeted Severe Crashes
	Support from Engineering Review/Road Safety Audit
Proposal Feasibility	Project Cost
	Public Support
	Right-of-way / Utility Issues
	Schedule
	Environmental Issues

For HSP proposals, B/C ratios would still be used to determine eligibility; however, Districts will be encouraged to consider project utility and feasibility within the following broad safety project categories:

- Systemic Approach
- Traditional Spot or Corridor Segment Approach

With the adoption of FAST Act, the systemic approach institutionalizes a new methodology for Virginia traffic engineers to deploy. VDOT Districts and local agencies must determine a balanced approach between the two safety approaches. HSIP has initially set a target of allocating one third of the funds to systemic projects and two-thirds to traditional projects. This split will vary by district and local agency based upon the predominant environment and crash types.

3.6.1 Project Prescreening Criteria

States are required to develop and maintain a method to prioritize safety improvements that is data-driven (e.g., crash and/or risk assessment). VDOT has developed a scoring criteria to prioritize HSP proposals.

The project selection method involves three phases: an initial review, a risk narrative review/ preliminary scoring, and an engineering review. The initial review addresses how each proposed safety project meets the minimum eligible criteria, including:

- Project eligibility
- Project requirements
- Required authorization signature

The risk narrative review phase scores the following six factors shown in Table 3-2.

Table 3-2: HSP Scoring Rubric

Factor	Description	Weight
B/C Ratio	A benefit cost ratio is greater than or equal to 1.	40%
Problem ID	a. If the location appears on the District Priority List of Intersections or Corridors due to frequency or Potential for safety improvements (PSI), (25%). b. The intersection does not appear on the District Priority List of Intersections or Corridors, (0%).	25%
High Risk Number of Crashes	a. If the number of fatal crashes (K) + incapacitating injuries (B) is greater than or equal to 1, (10%). b. If the number of fatal crashes (K) + incapacitating injuries (B) is less than 1 or equal to 1 and non-incapacitating injuries (B) + not visible but complains of pain injuries (B) is greater than or equal to 1, (8%) c. If the number of fatal crashes (K) + incapacitating injuries (B) is less than 1 or equal to 1 and non-incapacitating injuries (B) + not visible but complains of pain injuries (B) is less than or equal to 1 and property damage only crashes are greater than 1, (5%).	10%
Cost Estimate	The cost estimate is uploaded to the Smart Portal and accurately uses PCES or VDOT approved line item costs to estimate the Preliminary Engineering, ROW and Utilities/ Environmental Clearance and Construction costs.	5%
Project Schedule	The project schedule is uploaded to the Smart Portal and indicates start and end dates for the Preliminary Engineering, ROW and Utilities/ Environmental Clearance and Construction phases.	5%
Multiple Funding Sources	The application indicates whether the project requires multiple funding sources.	5%
Supporting Documents	The necessary supporting documents to are uploaded to the Smart Portal.	5%
Location	Use GIS Mapping tool in application to locate proposed improvements	5%

The final engineering review uses the preliminary scoring as a tool to prioritize and determine if applications have all the necessary information. A detailed review is then conducted to confirm that the existing problem matches the description of the proposal. This review also looks at the proposed solution and assesses the practicality and constructability of the project.

Projects are funded based on the final ranked scores, until fiscal year funds are exhausted. VDOT project sponsors will be notified of approved projects that may be entered into the Six Year Improvement Program (SYIP) – Project Pool. The final project list is submitted by the VDOT Programming Division to the Commonwealth's Transportation Board for final approval. The approved HSP projects may be found on the SYIP website. Listings of new HSP projects are also available from HSIP staff contacts.

4 Systemic Safety Improvement (SSI)

4.1 Program Overview

Crashes are inherently random and as such, in many instances, crash locations vary from year to year. Figure 4-1 shows the location of crashes in the Fredericksburg District over three years, from 2012- 2014. Addressing safety concerns at the locations identified for one year may not have affected the crashes the following year. **Applying the systemic approach may help address crash types that are not identified through crash frequency by identifying locations where risk is greatest, regardless of crashes.** As shown with data from the Fredericksburg District, fatal and severe crashes may vary in location from year to year however, the crash trends (such as crash type or facility type) may remain consistent. Systemic analysis addresses the risk factors associated with those consistent trends.

Figure 4-1: Fredericksburg, VA Crash Data

The Systemic process provides a consistent framework for addressing risk using the HSIP process by focusing on identifying system-wide roadway safety concerns and strategies to address these concerns. Based on the safety data provided, this process allows analysts to determine which common risk factors are influencing driver behavior and how these crashes occur. Different risk factors may include various system, crash, or facility types.

Applying a systemic approach to addressing safety is beneficial to proactively address widespread safety issues and cost-effectively minimize crash potential. Rather than focus on specific crash locations, a systemic approach targets consistent crash trends and common risk factors in crashes throughout the roadway network. A systemic improvement is one that is widely implemented based on high-risk roadway features that are correlated with specific crash types rather than crash frequency. The systemic problem identification entails a system-wide crash analysis targeting specific crash characteristics at the system level.

For proposals without known CRF/CMFs, the expected risk reduction for those elements should be documented (e.g., reduction in conflicts or exposure, improved separation, enhanced guidance, or reduced severity). For example, curb extensions (also called bulb-outs or bump-outs) do not have an associated CMF, but help to reduce risk to pedestrians by reducing the crossing distance and minimizing exposure to traffic.

There are two resources to aid in implementation of the systemic process, FHWA has created the Systemic Safety Project Selection Tool and the AASHTO Highway Safety Manual (HSM). VDOTs Systemic Process, shown in Figure 4-2, is a combination of these two processes and is comprised of nine steps. Essentially the process concentrates on identifying focus crash types and risk factors; screening and prioritizing candidate locations; selecting low-cost, highly effective countermeasures; prioritizing the resulting projects; and finally identifying the number of fatal and serious injury crashes impacted.

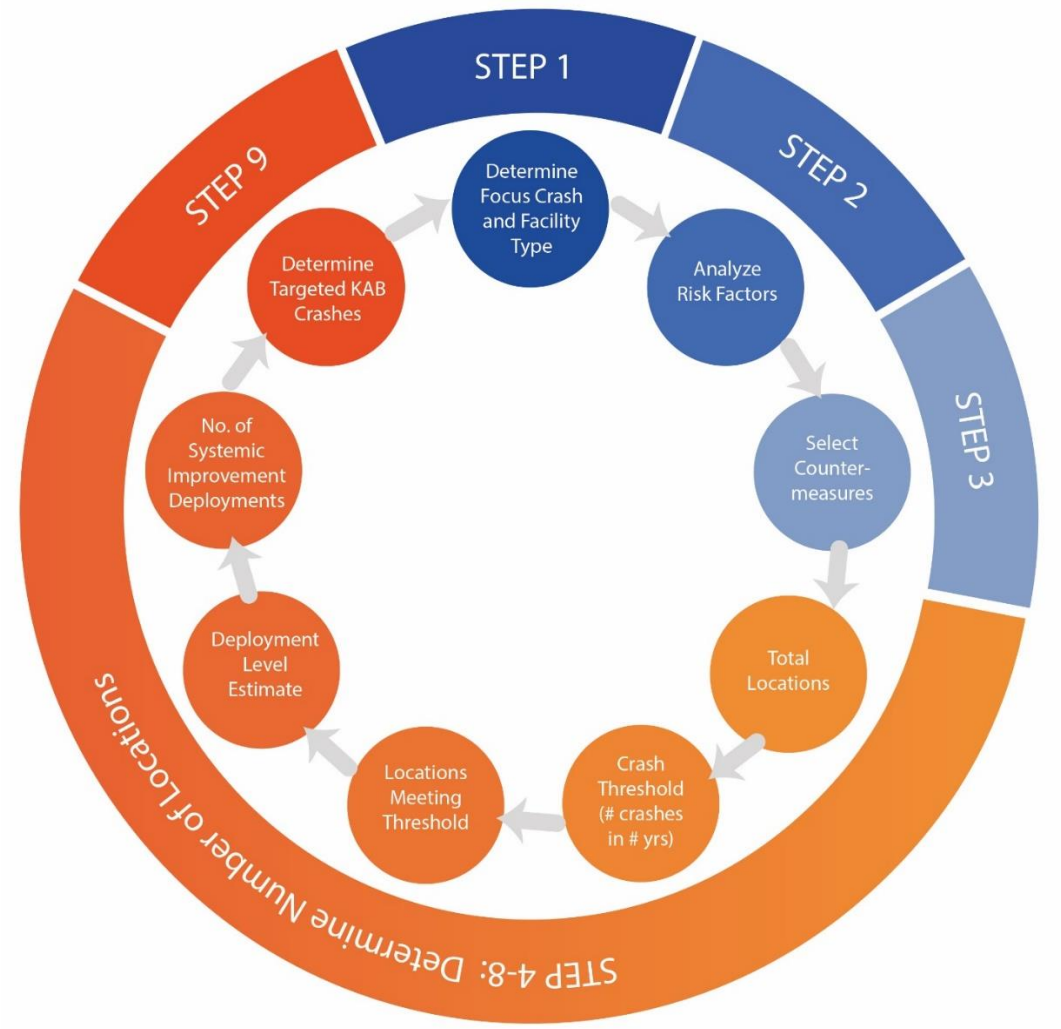


Figure 4-2: VDOT Systemic Safety Process

4.2 Proposal Eligibility

Proposals are evaluated for eligibility based on the benefits from the expected crash reductions versus the improvement cost over a proposal's life cycle. To determine the benefits, the latest three or five years of available crash reports related to the improvement are compiled by crash severity. Identify those crashes that are targeted for reduction, and associated with the proposed improvement.

A B/C ratio greater than 1.0 is used to assess the eligibility of a proposal for funding; but, a high B/C ratio does not guarantee funding. The improvement must address risk and mitigation of fatal and severe injury crashes in relationship to the SHSP. Other factors such as the total targeted severe crashes, validity of improvement countermeasure, project cost, and the time frame to complete the project are also considered to select eligible safety proposals. In general, safety projects delivered in minimal time with no right-of-way acquisition that target high severe crash locations will receive more favorable consideration. To be eligible for HSIP funding, proposals must have a B/C ratio greater than one for a location or a known risk for systemic improvements to address a SHSP emphasis areas.

In some cases, it may not be possible to develop a B/C ratio. For example, there may not be a crash history at the specific location of interest even though a clear safety issue has been identified based on exposure to certain risk factors. In other cases, there may not be sufficient supporting information (e.g., reliable CRFs). In these situations, it is critical to document the risk factors and identify how the proposed treatment will address or mitigate the risk factors. The following guidance is offered to help document risk when a B/C analysis is not possible.

4.2.1. Identify Contributing Risk Factors

The first step in documenting risk is to identify the risk factors associated with the location of interest. Specific risk factors differ by facility type, but are generally related to the level of exposure, potential for severity, and roadway characteristics with a documented effect on safety. Error! Reference source not found. provides a brief sample of risk factors for various facility types.

Table 4-1: Risk Factors

LOCATION	RISK FACTORS		
	Exposure	Severity Potential	Roadway Characteristics
Segments	Segment length and traffic volume are the two factors related to exposure. As exposure increases, the potential for crashes increases.	Vehicle speed, crash type, and type of object struck are factors related to the severity of a crash. As speed increases, there is greater potential for a severe crash. Crash types such as head-on and run-off-road crashes are typically more severe than rear-end and sideswipe crashes. The AASHTO Roadside Design Guide provides additional details on mitigating the severity of crashes with roadside objects.	There are numerous segment characteristics (e.g., cross-section, alignment, signing, striping, and roadside design) that influence safety. The AASHTO Highway Safety Manual and the FHWA CMF Clearinghouse are resources to help document the safety impacts of segment characteristics.
Intersections	Traffic volume is the primary factor related to exposure. As exposure increases, the potential for crashes increases.	Vehicle speed and crash type are two factors related to the severity of a crash. As speed increases, there is greater potential for a severe crash. Crash types such as right-angle and turning-related crashes are typically more severe than rear-end and merging-related crashes.	There are numerous intersection characteristics (e.g., number of approaches, lane configuration, traffic control, skew, signing, striping, and lighting) that influence safety. The AASHTO Highway Safety Manual and the FHWA CMF Clearinghouse are resources to help document the safety impacts of intersection characteristics.
Non-motorized	Traffic volume, pedestrian volume, and bicycle volume are factors related to exposure. As exposure increases, the potential for crashes increases.	Vehicle speed is the primary factor related to the severity of a crash. As speed increases, there is greater potential for a severe crash.	There are numerous roadway characteristics (e.g., number of driveways along a sidewalk, length of crossing at intersections, signing, striping, and lighting) that influence safety. The AASHTO Highway Safety Manual and the FHWA CMF Clearinghouse are resources to help document the safety impacts of roadway characteristics.

Further discussion of risk factors is provided in the VDOT "HSIP General Crash Pattern and Countermeasures" document as well as the NCHRP Report 500 series guides, the Highway Safety Manual, and on FHWAs Systemic Safety website.

4.2.2. Identify Potential Frequency and Severity

Crash data and analysis tools are available to obtain crash categories and crash history here:

- VDOT Tableau Crash Tool
- VDOT Annual Crash Summary Books
- 2012-2016 Potential For Safety Improvement (PSI) Information
- Crash Data Analysis Manual

If data is not available, the FHWA RSA Guide[6] provides a framework for conducting a qualitative assessment of the relative crash risk. This crash risk assessment is based on the potential crash frequency and severity. The potential crash frequency is qualitatively estimated based on expected exposure (i.e., how many road users will likely be exposed to the identified safety issue) and probability (i.e., how likely is it that a collision will result from the identified issue). The potential crash severity is qualitatively estimated since factors such as anticipated speeds, expected collision types, and the likelihood that vulnerable road users will be exposed. These two risk elements (frequency and severity) are then combined to obtain a qualitative risk assessment using the matrix shown in

Table *4-2*.

Table 4-2: Crash Risk Assessment Matrix

FREQUENCY RATING	SEVERITY RATING			
	Minor	Moderate	Serious	Fatal
Frequent	Moderate-High	High	Highest	Highest
Occasional	Moderate	Moderate-High	High	Highest
Infrequent	Low	Moderate	Moderate-High	High
Rare	Lowest	Low	Moderate	Moderate-High

4.2.3. Identify Link between Proposal and Risk Reduction

Proposals should identify the fundamental link between the proposed improvement(s) and the underlying risk factor(s). For example, risk to non-motorized users increases with exposure to vehicles in time and space. Sidewalks or paths help to separate vehicles and non-motorized users in space while traffic signals help to separate vehicles and non-motorized users in time.

Refer to the "HSIP General Crash Pattern and Countermeasures" document as well as the NCHRP Report 500 series guides for further details on the relationship between the proposed treatments and risk reduction. NCHRP Report 600 (Human Factors Guide) is another potential resource as it is designed to help the non-expert in human factors to consider human capabilities and limitations.

4.2.4. Identify Link between Proposal and SHSP

The SHSP identifies goals and emphasis areas for safety. All proposals submitted for funding under the HSIP should directly relate to one or more of the SHSP emphasis areas. The proposer should review the most recent SHSP and identify the link between the proposed improvement

[6] Federal Highway Administration, *Road Safety Audit Guidelines*, Report No. FHWA-SA-06-06, Washington, DC, 2006.

and the SHSP. Specifically, the proposal should identify the emphasis area and strategy that would be supported by the improvement.

4.3 Project Funding

Highway safety projects are federally financed at 90 percent with the state or locality providing 10 percent local match. VDOT has allocated State funds to provide the required local match so safety projects have been completely funded. High-cost safety proposals will be considered; however, remember that significant increase in project cost will also affect the economic assessment used to determine eligibility and prioritize selection for funding. HSIP will also consider the consistency with the SHSP and number of severe crashes targeted. Any project exceeding the original scope cost estimate for any phase will be monitored and count against the overall performance measurement. All modifications to scope, cost estimates, and schedule will require HSIP staff concurrence and in some cases District Engineer approval on the revised benefit-cost assessment. All decisions are subject to limiting HSIP allocations. For jurisdictions with locally maintained roadways, any increase over the authorized project scope will be funded by the locality per the resolution agreement.

Based on new FHWA guidance and VDOT guidance, outlined in IIM-IID-3.0, projects must be fully funded, through construction before any safety funding can be authorized for release. Once the project funding has been authorized, the project can be designed and constructed within 3 years.

In general, it is FHWA's policy that safety improvements that are part of a broader Federal-aid project should be funded from the same source as the broader project. Therefore, it is not recommended to budget safety funding with any other funding unless it is absolutely required. For surplus/deficit fund transfer, CTB and CO-TED concurrence is required before the transfer form goes to CO-IID for final approval. The SYIP amendments and fund transfer process is outlined on the VDOT website IIM-IID-2.1.

4.4 Proposal Requirements

Eligible HSIP proposals must encompass the following four factors:

1. They must be relevant to the program purpose of reducing severe crashes, or risks to transportation users.
2. They must address hazardous situations through good safety planning and identified by safety data driven network screening.
3. They must demonstrate compliance with the appropriate VDOT design guidelines and standards.
4. Safety proposals must upgrade non-standard safety features to existing standards, when those features are related to the targeted crashes identified within the work area of the engineering study[7] (or Roadway Safety Assessment). Requests for exceptions or waivers

[7] TE Memo 362.1 identifies the need for signed and sealed engineering studies that involve detailed crash analysis and countermeasure development – see section 3.5.2. A RSA without detailed crash analysis, such as a review of design drawings or a windshield review of a roadway, presently do not need to be sealed.

to this requirement will follow the appropriate design procedures. Further, all projects must meet the requirements of the Americans with Disabilities Act (ADA).

4.5 Safety Improvement Proposal Procedure

4.5.1. Proposal Planning

The following is an overview of the systemic process. Following this overview is a more detailed description each of the steps in the application process.

Step 1: Determine Focus
(crash and facility type)

- Select Focus Crash Type (angle, rear-end, roadway departure, sideswipe, bicycle, pedestrian)
- Focus Facility Type (unsignalized intersections, undivided corridors, etc.)

Focus Crash Types		Focus Facility Types	
Angle	Head-On	Undivided Corridor	Signalized Intersections
Roadway Departure	Pedestrian	Divided Corridor	Mid-Block
Sideswipe	Bicycle	**Curves**	
Rear End		Unsignalized Intersections	

Step 2: Analyze Risk Factors

- Determine what roadway elements are associated with those focus crash or facility types
- Example risk factors can be found in the HSM

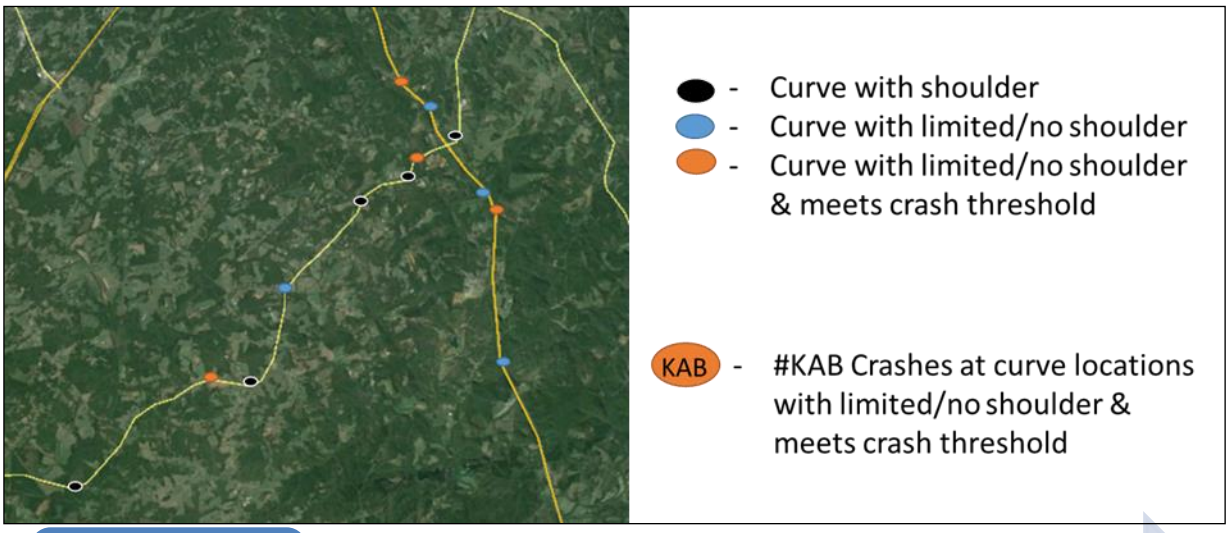
Focus Crash Type: *Roadway Departure* Focus Facility Type: *Curves*	Risk Factors			
	Inadequate roadway geometry	**Inadequate shoulder width**	Inadequate guardrail	Fixed objects in clear zone
	Inadequate lane width	Excessive speed	Poor nighttime visibility or lighting	Inadequate sight distance
	Inadequate median width	Pavement design/quality	Inadequate delineation (signs, pavement markings, delineators)	Slippery pavement
	Roadside design			

Step 3: Select Countermeasures

- Select countermeasures to address the focus crash/facility type and corresponding risk factors.

Steps 4 - 8: Determine number of Locations

- Select the total number of locations that have the selected risk factors present.
- Select a crash threshold.
- Determine the number of locations that meet that threshold.
- Based on the available budget or other constraints, determine the deployment level estimate.



Step 9: Determine Targeted KAB Crashes

- Determine the number of KAB crashes that will be addressed at the Systemic Improvement Deployment Locations.

4.5.2. Eligible Sponsors

Both state and local agencies are eligible for SSI funding. All proposal sponsors must be able to identify and allocate funding for expenses above the initial cost estimate. Only VDOT District Traffic Engineers have authority to submit the HSIP application for locally administered projects.

Local jurisdictions who can certify their ability to deliver federal-aid projects and VDOT offices are eligible for SSI funding on all public roadways. All local agencies must provide their safety proposals to VDOT district staff to obtain concurrence following Chapter 7 requirements. Only VDOT District Traffic Engineers have authority to submit the HSIP application for locally administered projects. Sufficient VDOT district review and submittal time should be provided to allow for programming safety projects. Any proposals sent directly to HSIP staff will be forwarded to the appropriate VDOT district contact for review.

4.5.3. Safety Improvement Proposal Procedure

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in credentials. If a HSP application was submitted in the past, users can re-use the past application as new application for this fiscal year, and a new APPID will be assigned automatically.

Applications must include an engineering study documenting the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD) by providing new devices, features or elements. The engineering study should include relevant steps outlined in a traditional RSA. The steps for conducting an RSA or to complete an engineering study are documented on the FHWA RSA website and VDOT RSA Guidelines, however applicants are not required to submit a full RSA. Please contact HSIP staff if there is a question about the level of study required. The submitted engineering study, and proposal will form the basis for the initial scoping document for the project.

Each submission *must* also include the following information:

Section 1: General

- Project Description: Provide a short project description.
- Agency: The name of the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project.
- Project Point of Contact: The name of the person representing the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project.
- Additional Funding Resources: Indicate from a drop-down if the applicant is applying for multiple funding sources.
- Contact Information: The contact information for the person representing the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project. Contact information includes the Address, City, State, Zip, Email, and Phone Number.
- Location: This section defines the location of the proposed work. Select from the dropdown menus to identify the VDOT District, Region, Area Location Code, and Federal System Code and Functional Class Code. Also includes limits of the proposed work. Identify the County, Safety Proposal Location/Route, From / Major Road, and To / Cross Street.
- General Project Description: This section defines the general type of proposed work. Select from the dropdown menus to identify the Program Type and Project Type. The Program Type is defined as a "Regular" Highway Safety Improvement Program (HSIP), High Risk Rural Roads (HRRR), Strategically Targeted Affordable Roadway Solutions (STARS), or Corridors of Statewide Significance (COSS) project. The Project Type is defined as a Segment, Intersection, or Corridor project.

- **Study Period:** This section defines the study period of the analysis. Identify the begin date of the study period under Study Period Begins. Identify the end date of the study period under Study Period Ends.

Section 2: Improvements

- **Focus Crash and Facility Type:** To determine either the focus crash type or the facility type analyze the crash data to determine which crash types or facility types are the most predominant throughout the District. A District may find that they have a high proportion of roadway departure crashes and that those crashes occur on curves and tangents but that the more severe crashes occur on curves. Therefore, the focus crash type is roadway departure and the focus facility type is curve. Another District may find that most crashes occur at intersections and that the crashes are primarily angle and rear end crash types; however, the angle crashes resulted in more severe injuries. The District may choose the intersection focus facility type and angle crashes as the focus crash type due to the crash severity.

  Indicate the focus crash type and facility type through the drop-down menus. The focus crash types include the following options: Angle, Roadway Departure, Rear-End, Sideswipe, Head-On, Bicycle, or Pedestrian. The focus facility types include the following options: Signalized Intersection, Unsignalized intersection, Segment, Curve, or Mid-block.

- **Number of Years in Crash History:** Enter the number of years represented by the crash history provided in the table. This is used in the calculation of the benefit-cost ratio.

- **Discount Rate %:** Use the Discount rate of 3%. This discount rate is used to adjust for inflation.

Risk Factor: Use the drop-down menus to select the top risk factor(s) associated with the focus crash types and facilities. For example, with a Roadway Departure Focus Crash Type and Focus Facility Type of Curves, risk factors could include curve radius, speed, and lighting.

- **Proposed Systemic Improvements**: Use the drop-down menus to select a proposed systemic improvement to address each of the risk factor. If there are more than one countermeasure to address a risk factor, repeat the risk factor.

- **Crash Threshold:** Number of crashes in specific number of years

- **Locations Meeting Threshold:** Indicate the number of locations that meet the crash threshold.

- **Total Locations Deployment Level Estimate:** There are two considerations when identifying the total locations and deployment level estimate. It is possible treat all of the locations where the focus facility type and risk factor(s) are present and where the crash threshold is met. However, due to budget considerations, it may be necessary to limit countermeasure deployment. The number of locations treated is controlled through the Deployment Level Estimate.

- **Targeted KAB Crashes**: This section identifies the number of KAB crashes that will be addressed at the Systemic Improvement Deployment Locations.

Cost: Compute the economic cost of each proposed improvement. The safety proposal must show the estimated project costs broken down by project phase (PE, R/W and Utilities, and

Construction). Detailed and accurate cost estimates should be provided. If possible, applicants should use VDOT's Project Cost Estimation System (PCES) worksheets. However, project sponsors who do not have access to the PCES worksheets shall submit detailed costs with a descriptive reason for not using PCES. VDOT district local assistance staff will work with local jurisdictions to ensure project cost estimates are consistent with PCES.

- **Proposed Improvement:** Enter the name of the proposed improvement (e.g., install traffic signal or increase sight distance).
- **Service Life:** Enter the service life for each proposed improvement. Refer to the tab titled, Service Life (YRS), in the Excel version of the HSP application form to identify the appropriate service life for a proposed improvement.
- **PE Cost + $5000:** Enter the estimated PE cost for each proposed improvement. All HSIP projects need at least $10,000 in PE for HSIP Staff processing and review. Do not add oversight costs to each treatment; rather, add to the first treatment that will be annualized with any others in the economic assessment.
    - Note that VDOT District and Central Office personnel charge review and administration time to projects managed by localities. Safety Projects not managed by VDOT shall include a minimum of $5,000 for VDOT PE costs.
- **Right-of-Way and Utility Cost:** Enter the estimated right-of-way and utility cost for each proposed improvement. Note that these are up front, one-time costs to acquire right-of-way and move or install utilities as part of the construction of the proposed improvement.
- **Construction Cost:** Enter the estimated construction cost for each proposed improvement.
- **Total Construction Cost (PV):** The present value of the total construction cost is automatically computed for each proposed improvement.
- **Contingency (10%):** A 10% contingency is automatically computed for each proposed improvement based on the construction cost.
- **Annual Maintenance:** Enter the annual maintenance costs for each proposed improvement. Refer to the tab titled, Maintenance & Utility Costs, in the Excel version of the HSP application form to identify annual maintenance and utility costs for select improvements.
- **Maintenance Cost (PV):** The present value of the maintenance cost is automatically computed for each proposed improvement based on the annual maintenance cost, discount rate, and service life.
- **Total Cost (PV):** The present value of the total cost is automatically computed for each proposed improvement based on the present value of the total construction cost, contingency, and present value of the maintenance cost.

Benefits: Compute the economic benefit of each improvement.

- **CMF Value:** Enter the associated CMF value(s) for each proposed improvement. Note that up to three benefits or CMFs may be entered for a given improvement to consider the net benefit (i.e., differential effect of improvement on different crash types and severities). It

is appropriate to consider the net benefit when the proposed improvement could increase some crash types and/or severities while reducing others.

- Applicable Crash Type: Select from the dropdown menu to identify the crash type associated with the CMF(s).
- Applicable Crash Severity: Select from the dropdown menu to identify the crash severity associated with the CMF(s). May select more than one if necessary.
- Include CMF in Final Analysis (yes/no): Select from the dropdown menu to indicate whether or not to include each CMF in the final analysis. Note that all CMFs should be included in the analysis if they apply to different crash types and/or severities (e.g., one is for fatal plus injury crashes and the other is for property damage only crashes). If there is any overlap among the CMFs (e.g., one CMF is for total crashes and the other is for injury crashes), then the user will need to select the most appropriate CMF(s).
- Reference Link to CMF ID from CMF Clearinghouse: Copy and paste the hyperlink from the CMF Clearinghouse for each specific CMF. Each CMF should have a unique hyperlink that corresponds to the CMF ID.
- Other Notes: Enter any further notes to help support or justify the use of the specific CMF(s) selected from the CMF Clearinghouse.

B/C Ratio: Compute the B/C ratio for specific combinations of CMFs.

- Proposed Improvement: The name of the proposed improvement is automatically carried over from the improvements section.
- Included in Analysis (yes/no): Select from the dropdown menu to indicate whether or not to include each proposed improvement in the final B/C analysis.
- Present Value of Benefit: The present value of the benefit is computed automatically for each proposed improvement.
- Present Value of Cost: The present value of the cost is computed automatically for each proposed improvement.
- B/C by CMF: *The individual B/C ratio is computed automatically for each proposed improvement.*
- B/C Ratio: The overall B/C ratio is computed automatically for the selected combination of proposed improvements.

Project Schedule: The Begin PE date should be set no earlier than October 1st of the first year to allow for FHWA STIP approval and project authorization to begin. With this start, the advertisement date should be with 12 months but shall not be any later than January of the second year for projects added to the current fiscal year. The completion date of a project should not be any later than January of the fourth year. In other words, a project will be advertised in two years and completed in three years from STIP approval at the latest. The project sponsor and project manager are responsible for coordinating the proposal schedule.

SYIP Allocations: Provide Existing Project VDOT UPCs or DRPT Project numbers in applicable.

Other Committed Funds: Provide information on other committed funds if applicable.

Section 3: Location

Using the provided interactive map, locate the study area where the proposed improvements will be implemented. Use the appropriate functions to place a polygon around the study area. Applicants may use more than one polygon to locate multiple study areas and can edit study areas if necessary. VDOT LRS system is available on portal for users to select. A user can pre-populate the line/point events on the portal by importing the files in the form of spreadsheet/CVS/text. Applicants are also asked to describe the location in the following section.

Section 4: Supporting Documents

Supporting documentation, that will strengthen or validate the SSI application, should be uploaded to the Smart Portal. Traditional HSP Safety proposals must include an engineering study documenting the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD). Additional documentation may include photos, large maps, study reports or resolution letters.

Applicants are also required to submit a VDOT's Project Cost Estimation System (PCES) estimate. If applicant does not have access to a PCES estimate, the applicant is required to submit an alternate detailed project cost estimate. The PCES or alternative cost estimate must be attached to the project application submission.

Each of the six areas listed in the Smart Portal must be completed. Well-documented proposals are more likely to receive higher scores and ranking for funding priorities. A separate proposal form must be completed for each candidate location, and there is no limit to the number of proposals submitted.

Proposals on VDOT maintained systems must be reviewed by Regional Traffic Engineering and Preliminary Engineering staff to assess traffic control and design costs. Time should be allowed for review from other disciplines, particularly design engineers, to concur with constructability and right-of-way impact issues. Proposals for locally maintained roadways must be coordinated and have concurrence of the District Local Assistance Liaison who will be assigned as the project sponsor following Chapter 7 procedures.

4.5.4. Systemic Application Example

Section 4.5.4 outlines an example of how to conduct the initial steps of a systemic analysis including selection of focus crash and facility types, determination of systemic risk factors, selection of systemic improvements, and how to determine the number of locations where those improvements will be implemented. Figure 4-3 shows the systemic analysis methodology.

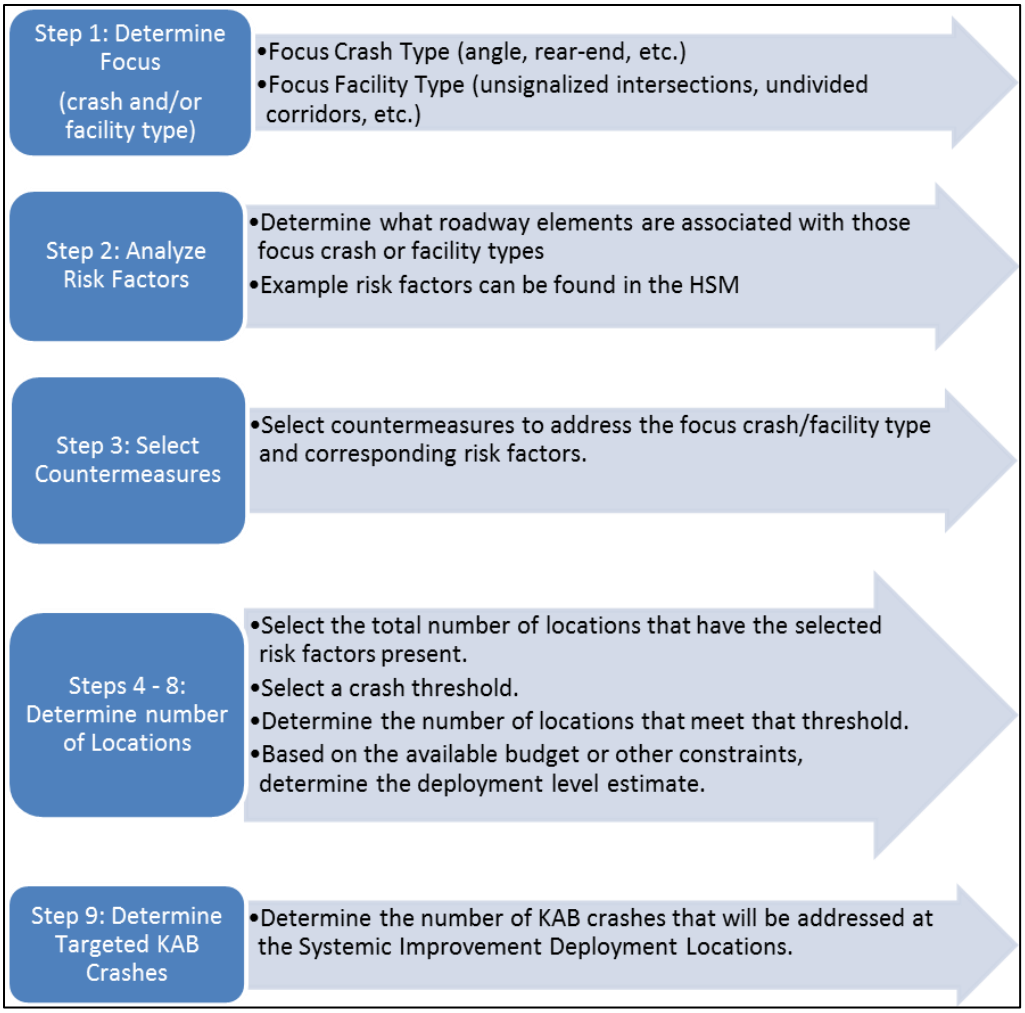


Figure 4-3: Systemic Analysis Methodology

Step 1: Select Focus Crash Type and/or Focus Facility Type

To begin the systemic analysis, the crash data must be analyzed to determine trends throughout the study area. An analysis of the crash types indicates that there are 30 percent angle crashes, 15 percent roadway departure, no head-on collisions, 8 percent sideswipe crashes, 46 percent rear-end crashes, and 3 percent were pedestrian crashes. Similarly, the roadway facilities were also analyzed and 55 percent of the crashes occurred at signalized intersections, 24 percent at unsignalized intersections, 17 percent on undivided corridor segments, and 6 percent on divided corridor segments. Based on this analysis, the focus crash type is selected as rear-end and the focus facility type of signalized intersections is selected. These focus areas are related and have overlapping risk factors so they can be entered into the same application.

Step 2: Identify Risk Factors

Once the focus crash and facility types are selected, identify the associated risk factors. The HSM provides a list of risk factors, however these are elements identified through the crash data and roadway geometry that contribute to the crashes. The risk factors associated with rear-end crashes at signalized intersections include the following:

- Poor visibility of signal
- Inadequate signal timing
- Excessive speed
- Slippery pavement
- Inadequate sight distance
- Unexpected lane changes on approach
- Narrow lanes
- Unexpected stops on approach
- Inadequate lighting

Through data analysis it is determined that those risk factors present at the majority of crashes includes poor visibility of signal, excessive speed, and inadequate signal timing. In the application form it is possible to include up to three risk factors. It is not necessary to include three, however, at least one risk factor needs to be identified.

Step 3: Identify Proposed Systemic Improvement

Based on the focus crash type, focus facility type, and associated risk factors, appropriate countermeasures can be selected. Cost and effectiveness are both considerations when implementing systemic countermeasures as these measures need to be installed on a broad scale to address those conditions throughout the study area. It may not be feasible to comprehensively install high cost countermeasures. The countermeasures selected in this example are to replace the 8" signal head with a 12" signal head, installation of dynamic warning signs for high-speed approaches, and to re-time traffic signals for better coordination and for proper red and amber clearance intervals.

Similar to the selection of risk factors, up to three systemic improvements can be selected. More than one countermeasures can be selected for each risk factor. If one risk factor was identified then three countermeasures could be identified for that risk factor.

Step 4: Total Locations

Based on the facilities and risk factors where these crashes are present, the entire study area must be screened to identify all potential locations. In this example, all signalized intersections are candidates. For the first risk factor of "poor visibility of signal", all signals with limited sight distance due to horizontal/vertical curvature, or other obstructions, should be identified. In the example, it was determined that 50 locations met these criteria; this number is then entered into the "total locations" column of the application form.

Similarly, speed data obtained from speed limits, crash data, or speed studies, should be used to identify which signals have high speed approaches. The number of locations for both of these risk factors/systemic improvements is entered into the total locations field of the application form. In this example, there are 20 locations with high speed signal approaches and 200 locations with traffic signals that could possibly benefit from signal timing review.

Step 5: Crash Threshold

Crash thresholds are automatically entered based on the focus crash type, focus facility type, and countermeasures selected. As shown in this example, "transverse rumble strips" have a crash threshold of "5 red-light running crashes in 5 years".

Step 6: Locations Meeting Threshold

Using the total number of locations and applying the crash threshold, it is possible to determine the number of locations meeting the threshold. In this example, out of the 50 locations with

sight distance concerns and poor visibility of signal, 35 locations have had 1 crash in 5 years. Similarly, out of the 20 signals with high speed approaches 10 have had at least 10 crashes in 5 years. No crash threshold was required for signal retiming so all 200 locations met the threshold.

Step 7: Deployment Level Estimate

Ideally, the proposed systemic improvements would be implemented at each of the locations meeting the crash threshold. However, based on the available budget or other constraints, it may be necessary to adjust the number of locations where the countermeasure is installed. For example, based on a review of mast arms, it is determined that only 50 percent of those can accommodate the additional load associated with upgrading the signal heads from 8" to 12". Using this information, the deployment level estimate of 0.5 is entered into the application form. Similarly, it is determined that 25 percent of the signals have been retimed recently and do not need to be retimed so the deployment level estimate is 0.75. There are no initial constraints identified for the installation of dynamic warning signs so the deployment level is 100 percent or "1" as entered into the application. Based upon available funds it may be necessary to revise this initial deployment level estimate. In this example, it was determined that installing dynamic warning signs was not feasible based on available funding so the estimate was reduced to 80% or 0.8 as entered into the HSIP application.

Step 8: No. of Systemic Improvement Deployments

The final number of systemic improvement deployments is automatically calculated based on the locations meeting threshold (Step 6) and the deployment level estimate (Step 7).

Step 9: Targeted KAB Crashes

Enter the number of KAB crashes that will be targeted based on the systemic improvement. So in this example, there were 90 crashes that could have been prevented by replacing the 8" signal head with a 12" signal head.

Step 10: Compute the Economic Cost of Each Improvement and the Benefit/Cost Analysis

Enter in information regarding the proposed systemic improvement cost and the applicable CMFs to calculate the benefit/cost ratio. Refer to the benefit/cost analysis description in section 3.5.5 of the HSIP manual for further description.

4.5.5. Electronic Submission

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in credential. All submissions must be received in VDOT's Traffic Engineering office by November 1st to be considered for qualification of HSIP funds Locally Administered Projects must be validated by District Traffic Engineers (DTE), DTE is responsible for coordinating with VDOT Local Liaison and submit the applications. Locally Administered Projects must submit their initial application to the VDOT Local Liaison by August 1st and final application by September 1st following the project submittal work flow.

Applicants assign an Administrator who will serve as the POC for the application. The Administrator will work with district staff to submit the SSI application. The Administrator POC will oversee the creation, submission, and prioritization of candidate projects for all the

application programs. The Administrator is also used as the default point of contact for each project application submitted.

4.6 Project Selection

States are required to develop and maintain a method to prioritize safety improvements that is data-driven (e.g., crash and/or risk assessment). VDOT has developed a scoring criteria to prioritize HSP proposals.

4.6.1. Project Prescreening Criteria

The project selection method involves three phases: an initial review, a risk narrative review/ preliminary scoring, and an engineering review. The initial review addresses how each proposed safety project meets the minimum eligible criteria, including:

- Project eligibility
- Project requirements
- Required authorization signature

The risk narrative review phase scores the following six factors in Table 4-3.

Table 4-3: SSI Scoring Rubric

Factor	Description	Weight
B/C Radio	A benefit cost ratio is greater than or equal to 1.	40%
Location	Specify location on GIS mapping tool and include route name, district, MPO PDC and jurisdiction served.	30%
High Number of Targeted Crashes	If fatal(K) + incapacitating (A) + non-incapacitating (B) injury crashes is greater 1 (10%).	10%
Cost Estimate	The cost estimate is uploaded to the Smart Portal and accurately uses PCES or VDOT approved line item costs to estimate the Preliminary Engineering, ROW and Utilities/ Environmental Clearance and Construction costs.	5%
Project Schedule	The project schedule is uploaded to the Smart Portal and indicates start and end dates for the Preliminary Engineering, ROW and Utilities/ Environmental Clearance and Construction phases.	5%
Multiple Funding Sources	The application indicates whether the project requires multiple funding sources.	5%
Supporting Documents	The application indicates whether the project requires multiple funding sources.	5%

The final engineering review uses the preliminary scoring as a tool to prioritize and determine if applications have all the necessary information. A detailed review is then conducted to confirm that the existing problem matches the description of the proposal. This review also looks at the proposed solution and assesses the practicality and constructability of the project. Projects that are on the jurisdiction's master plan and/or high crash corridors, or that have documented low bicycle Level of Service or Compatibility Index will be given priority.

Projects are funded based on the final ranked scores, until fiscal year funds are exhausted. VDOT project sponsors will be notified of approved projects that may be entered into the Six Year Improvement Program (SYIP) – Project Pool. The final project list is submitted by the VDOT Programming Division to the Commonwealth's Transportation Board for final approval. The approved SSI projects may be found on the SYIP website. Listings of new SSI projects are also available from HSIP staff contacts.

5 Bicycle and Pedestrian Safety Program (BPSP)

5.1. Program Overview

Non-motorized safety concerns differ from motor vehicle-related concerns as these users are the most vulnerable to injury or death from a crash. While bicycle and pedestrian involved crashes can cluster on a corridor or at a high-risk intersection, they are typically more dispersed and random than motor vehicle crashes. Further, there is less information available on non-motorized treatments, including fewer CMFs. As such, benefit-to-cost (B/C) ratio analysis and ranking procedures used for HSP proposals do not fully integrate factors addressing non-motorized safety and risk. Given the limitation of assessing and prioritizing non-motorized improvements, VDOT developed the BPSP to specifically address these safety issues.

The purpose of the BPSP is to evaluate proposals addressing non-motorized crashes and risks in Virginia. Proposals target the reduction in the number and severity, or the risk of and exposure to crashes. The intent of the BPSP is to promote proposals that address a known safety or accommodation issue, are smaller in scale, and can be completed quickly. Hence, proposals should not involve many utilities, significant right-of-way, nor extensive environmental mitigation.

Furthermore, the program is intended to address non-motorized safety concerns in locations with crash risks that typically do not have sufficient crash numbers needed to rank well for project selection under the HSP project selection methods. Proposals are selected based on risk factors from documented purpose and need that are compared to other like projects.

The Safe Routes to School (SRTS) program and the BPSP will coordinate improvements in eligible neighborhoods as necessary. SRTS is intended to improve and encourage biking and walking within two miles of K-8th grade schools. Projects programmed under SRTS will be funded 100 percent by FHWA. For more information on the SRTS program is available on the VDOT SRTS website.

5.2. Proposal Eligibility

Eligible proposals must address documented non-motorized safety concerns on any public road, public surface transportation facility, or publicly owned bicycle or pedestrian pathway or trail.

BPSP eligible improvements include, but are not limited to, on-street facilities; shared-use paths; treatments for intersections, mid-block crossings, crosswalks; signs and pavement markings; accessibility features; and traffic calming measures. Proposals that are not eligible for the program are bicycle parking, directional signing, landscaping, maintenance, traffic calming only for motor vehicles (i.e., no improvement for non-motorized traffic), and traffic management measures.

The VDOT Pedestrian Safety Action Plan (PSAP) provides guidance on specific locations already noted for safety improvements. The PSAP priority corridor map and analysis outcomes should be referenced to develop HSIP-Bike & Ped applications.

5.3. Project Funding

BPSP projects are federally financed at 90 percent with the state or locality providing 10 percent match.

Based on new FHWA guidance and VDOT guidance, outlined in IIM-IID-3.0, projects must be fully funded, through construction before any safety funding can be authorized for release. Once the project funding has been authorized, the project can be designed and constructed within 3 years.

In general, it is FHWA's policy that safety improvements that are part of a broader Federal-aid project should be funded from the same source as the broader project. Therefore, it is not recommended to budget safety funding with any other funding unless it is absolutely required. For surplus/deficit fund transfer, CTB and CO-TED concurrence is required before the transfer form goes to CO-IID for final approval. The SYIP amendments and fund transfer process is outlined on the VDOT website.

5.4. Proposal Requirements

Eligible proposals must encompass the following five factors:

1. Proposals need to document the expected reduction in crashes or risk for bicyclists and pedestrians. Submittal of non-motorized crash analysis can support a proposal that is a priority for the jurisdiction. Regardless of the availability of crash data, proposals should identify the fundamental link between the proposed improvement(s) and the underlying risk factor(s). For example, risk to non-motorized users increases with exposure to vehicles in time and space. Sidewalks or paths help to separate vehicles and non-motorized users in space while traffic signals help to separate vehicles and non-motorized users in time. Refer to the "HSIP General Crash Pattern and Countermeasures" document, the NCHRP Report 500 series guides, the FHWA Bicycle and Pedestrian Safety website, BIKESAFE, PEDSAFE, and FHWA Bicycle and Pedestrian Road Safety Audit Guidelines for further details on the relationship between the proposed treatments and risk reduction. NCHRP Report 600 (Human Factors Guide) is another potential resource as it is designed to help the non-expert in human factors to consider human capabilities and limitations.
2. Proposals must address existing hazardous conditions. Include master plans or roadway safety assessments that address non-motorized travel in the proposal area.
3. Proposal costs should be less than $1 M but higher costs and phased projects over multiple years will be considered.
4. Sponsors must demonstrate that the proposal will meet all the necessary VDOT design guidelines for construction to ensure that approved projects will be completed in a reasonable time period (e.g. proposed installation of a traffic signal should provide a traffic signal warrant analysis).
5. Proposals must upgrade non-standard safety features to existing standards, when those features are within the proposal area. Requests for exceptions to this requirement will follow the appropriate procedures. Further, all projects must meet the requirements of the Americans with Disabilities Act (ADA).

5.5. Safety Improvement Proposal Procedure

5.5.1. Proposal Planning

BPS proposals should be consistent with VDOT's Bicycle and Pedestrian Policy as well as local non-motorized comprehensive plans. References to related documents shall be provided. To aid non-motorized proposals on VDOT maintained systems, the latest three years of related crashes and injuries have been summarized for each route or segment within each jurisdiction. Contact HSIP staff for the summary tables and maps.

Priority BPS projects should target the top 85th percentile routes in each jurisdiction. Urban localities should consider mapping at least three years of bicycle and pedestrian crashes to identify corridors and spot locations to target proposals. Documentation of the planning process should be provided with the BPS proposal.

5.5.2. Eligible Sponsors

Both state and local agencies are eligible for BPSP funding. All proposal sponsors must be able to identify and allocate funding for expenses above the initial cost estimate. Only VDOT District Traffic Engineers have authority to submit the HSIP application for locally administered projects.

Local jurisdictions who can certify their ability to deliver federal-aid projects and VDOT offices are eligible for BPSP funding on all public roadways. All local agencies must provide their safety proposals to VDOT district staff to obtain concurrence following Chapter 7 requirements. Only VDOT District Traffic Engineers have authority to submit the HSIP application for locally administered projects. Sufficient VDOT district review and submittal time should be provided to allow for programming safety projects. Any proposals sent directly to HSIP staff will be forwarded to the appropriate VDOT district contact for review.

5.5.3. Project Proposal Requirements

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in credentials. If a BPSP application was submitted in the past, users can re-use the past application as new application for this fiscal year, and a new APPID will be assigned automatically.

Applications must include an engineering study documenting the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD). The engineering study should include relevant steps outlined in a traditional RSA. The steps for conducting an RSA or to complete an engineering study are documented on the FHWA RSA website and VDOT RSA Guidelines, however applicants are not required to submit a full RSA. Please contact HSIP staff if there is a question about the level of study required. The submitted engineering study, and proposal will form the basis for the initial scoping document for the project.

Each submission *must* also include the following information:

Section 1: General

- Agency: The name of the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project.

- **Project Sponsor:** The name of the person representing the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project.
- **Contact Information:** The contact information for the person representing the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project. Contact information includes the Address, City, State, Zip, Email, and Phone Number.
- **General Location:** This section defines the general location of the proposed work. Select from the dropdown menus to identify the VDOT District and Region.
- **Roadway Description:** This section defines the type of roadway on which the proposed work is to be performed. Select from the dropdown menus to identify the Functional Class Code, Area Location Code and Federal System Code.
- **Study Period:** This section defines the study period of the analysis. Identify the begin date of the study period under Study Period Begins. Identify the end date of the study period under Study Period Ends.
- **Specific Location:** This section defines the specific location and limits of the proposed work. Identify the County, Safety Proposal Location/Route, From / Major Road, and To / Cross Street.
- **Type of Plans-** Indicate if the plan is No Plan, Minimum Plan or Complete.
- **Supplemental Short Answer Questions**
  - Fully Describe Project
  - Identify the Issues
  - Identify Potential Measures to Address the Issues
  - Proposed Project Schedule and Cost
  - Describe Local Support

Section 2: Location

Use the GIS Location application to identify the specific PSAP project location. PSAP crash clusters and the priority corridor map can be found on Treds Mapping website.

Section 3: Problem Identification

- Identify the safety issues and document the risk exposure for non-motorized travel and report any non-motorized crashes
- Determine the total potential conflicts and include engineering study as supplemental documentation

Section 4: Proposed Improvement Project

- Describe how the proposal addresses non-motorized safety and mobility issues
- Describe alternatives that were considered and why they were not selected as the preferred alternative

- Describe the existing land uses and expected changes that would influence the amount of non-motorized travel.

Section 5: Proposal Schedule and Cost

- Provide detailed schedule and cost estimate information using VDOT's Project Cost Estimating System (PCES) or with itemized locality costs including VDOT's preliminary engineering costs. If not PCES, provide detailed cost estimate with rationale why PCES could not be used.
- Describe how this proposal is cost effective and leverages other transportation funding.
- Indicate if this proposal is ready for construction and indicate any issues that may affect an expedited delivery.

Section 6: Local Support

- Indicate if there are any other programmed transportation projects and their constructions schedules that would be impacted by this proposal.
- Describe any local support such as letters, petitions and or resolutions from boards, councils or agencies

Section 7: Supporting Documents

Supporting documentation, that will strengthen or validate the HSP application, should be uploaded to the Smart Portal. Traditional HSP Safety proposals must include an engineering study documenting the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD). Additional documentation may include photos, large maps, study reports or resolution letters.

Applicants are also required to submit a VDOT's Project Cost Estimation System (PCES) estimate. If applicant does not have access to a PCES estimate, the applicant is required to submit an alternate detailed project cost estimate. The PCES or alternative cost estimate must be attached to the project application submission.

Each of the seven areas listed in the Smart Portal must be completed. Well-documented proposals are more likely to receive higher scores and ranking for funding priorities. A separate proposal form must be completed for each candidate location, and there is no limit to the number of proposals submitted.

Proposals on VDOT maintained systems must be reviewed by Regional Traffic Engineering and Preliminary Engineering staff to assess traffic control and design costs. Time should be allowed for review from other disciplines, particularly design engineers, to concur with constructability and right-of-way impact issues. Proposals for locally maintained roadways must be coordinated and have concurrence of the District Local Assistance Liaison who will be assigned as the project sponsor following Chapter 7 procedures.

5.5.4. Electronic Submission

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact

SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in credential. All submissions must be received in VDOT's Traffic Engineering office by November 1st to be considered for qualification of HSIP funds Locally Administered Projects must be validated by District Traffic Engineers (DTE), DTE is responsible for coordinating with VDOT Local Liaison and submit the applications. Locally Administered Projects must submit their initial application to the VDOT Local Liaison by August 1st and final application by September 1st following the project submittal work flow.

Applicants assign an Administrator who will serve as the POC for the application. The Administrator will work with district staff to submit the HSIP application. The Administrator POC will oversee the creation, submission, and prioritization of candidate projects for all the application programs. The Administrator is also used as the default point of contact for each project application submitted.

5.6. Project Selection

States are required to develop and maintain a method to prioritize safety improvements that is data-driven (e.g., crash and/or risk assessment). VDOT has developed scoring criteria to prioritize BPSP proposals.

To effectively and equitably identify potential bicycle and/or pedestrian safety projects, an objective 100 point-based scoring system is used to account for the following characteristics associated with these types of projects that may have:

- Minimal crash history that does not support a benefit/cost analysis;
- The potential for severe fatal and injury crashes; and
- Well-documented safety hazards associated with each location.

5.6.1. Project Prescreening Criteria

The project selection method involves three phases: an initial review, a risk narrative review/ preliminary scoring, and an engineering review. The initial review addresses how each proposed safety project meets the minimum eligible criteria, including:

- Project eligibility
- Project requirements
- Required authorization signature

The risk narrative review phase scores the following six factors in Table 5-1.

Table 5-1: BPSP Scoring Rubric

Factor	Description	Weight
Project Identification	Identify the Issues	30%
Proposed Improvement Projects	Identify potential measures to address the issues	45%
Cost Estimate	The cost estimate is uploaded to the Smart Portal and accurately uses PCES or VDOT approved line item costs to estimate the Preliminary Engineering, ROW and Utilities/ Environmental Clearance and Construction costs.	5%
Project Schedule	The project schedule is uploaded to the Smart Portal and indicates start and end dates for the Preliminary Engineering, ROW and Utilities/ Environmental Clearance and Construction phases.	5%
Multiple Funding Sources	The application indicates whether the project requires multiple funding sources.	5%
Supporting Documents	The necessary supporting documents to are uploaded to the Smart Portal.	10%

The final engineering review uses the preliminary scoring as a tool to prioritize and determine if applications have all the necessary information. A detailed review is then conducted to confirm that the existing problem matches the description of the proposal. This review also looks at the proposed solution and assesses the practicality and constructability of the project. Projects that are on the jurisdiction's master plan and/or high crash corridors, or that have documented low bicycle Level of Service or Compatibility Index will be given priority.

Projects are funded based on the final ranked scores, until fiscal year funds are exhausted. VDOT project sponsors will be notified of approved projects that may be entered into the Six Year Improvement Program (SYIP) – Project Pool. The final project list is submitted by the VDOT Programming Division to the Commonwealth's Transportation Board for final approval. The approved BPSP projects may be found on the SYIP website. Listings of new BPSP projects are also available from HSIP staff contacts.

6 Highway-Rail Grade Crossing Safety Program (H-RGCP)

6.1 Program Overview

The purpose of the Highway-Rail Grade Crossing Safety Program (H-RGCP) is to reduce the risk and number of crashes involving trains at highway-rail grade crossings. Section 130 of Title 23, US Code continues to provide funds to improve safety at any public highway-rail-grade crossing. A public road is defined as "any road under the jurisdiction of and maintained by a public roadway authority and open to public travel." Private crossings are located "on a private roadway … not maintained by a public roadway authority." and are not eligible to be funded within this program.

Over $140 million has been spent on upgrading more than 1,340 rail grade crossing locations throughout the Commonwealth of Virginia, since inception of the Federal Highway Safety Act of 1973. This program has continued with subsequent acts and has provided funds to enhance safety at grade crossing locations. Virginia's grade crossing inventory presently consists of about 1,861 public at-grade crossings.

6.2 Proposal Eligibility

Proposals are developed through safety partners and are reviewed and ranked on a statewide competitive basis.

The federal legislation requires at least fifty percent of appropriated funds to be available for installation of warning devices, which include the following:

- Active warning devices (flashing lights and/or gates);
- Circuitry improvements (motion detectors and constant warning time predictors);
- Traffic and railroad signal upgrades to provide interconnection;

Up to fifty percent is also available for elimination of hazards, including the following:

- Grade Separation;
- Crossing closure;
- Surface improvements (upgrade to hi-type crossing surface consisting of rubber or concrete, etc.);
- Standard signs and pavement markings;
- General site improvements (improve sight distance restrictions, alignment, grade, etc.);

These funds can also be used to cooperatively fund a project. However, H-RGCP safety improvements are intended to be quickly completed to minimize the identified risks. As such, projects that require right-of-way and/or have utility impacts will be scrutinized whether completion will occur within 36 months of approval.

6.3 Project Funding

Annually, the H-RGCP federal apportionment is approximately $5 million. Highway-Rail safety projects are federally financed at 90 percent with the state providing the 10 percent match. Please be sure to provide current cost estimates. If there is an increase in the estimate once PE has been completed, the safety partners will be responsible for any additional funding over and above what was originally provided. Note that work performed prior to the Commonwealth Transportation Board (CTB) approval or Federal project authorization will not be eligible for Federal reimbursement from Section 130 funds. Selected projects must be included in the Statewide Transportation Improvement Program (STIP) and approved by the Federal Highway Administration (FHWA).

Based on new FHWA guidance and VDOT guidance, outlined in IIM-IID-3.0, projects must be fully funded, through construction before any safety funding can be authorized for release. Once the project funding has been authorized, the project can be designed and constructed within 3 years.

In general, it is FHWA's policy that safety improvements that are part of a broader Federal-aid project should be funded from the same source as the broader project. Therefore, it is not recommended to budget safety funding with any other funding unless it is absolutely required. For surplus/deficit fund transfer, CTB and CO-TED concurrence is required before the transfer form goes to CO-IID for final approval. The SYIP amendments and fund transfer process is outlined on the VDOT website IID-IID-2.0.

6.4 Proposal Requirements

Virginia is required to develop and maintain information and develop safety planning methods to prioritize crossings for improvements on a statewide basis. VDOT utilizes the Federal Railroad Administration's (FRA) "Accident Prediction Model"[8] (APM) as its methodology for establishing a statewide crossing improvement priority listing. The procedure is a mathematical formula, and incorporates a factor for vehicle traffic, and number of trains that produce an "exposure index value." Additional factors utilized to compute the "accident prediction value" include:

- Through trains per day
- Maximum timetable speed
- Number of main tracks
- Highway surface
- Number of highway travel lanes
- Highway-Rail crashes

These "accident prediction values" are used as a tool to develop an annual preliminary ranking of crossings in need of further review for safety improvements. Since exposure is the primary component of this procedure, the greater the "accident prediction value", the more likely it is to qualify for funding.

[8] FRA uses the term accident rather than crash; references to the FRA methodology will use accident in Quotations

6.5 Safety Improvement Proposal Procedure

6.5.1. Proposal Planning

Each year, HSIP Staff will transmit highway-rail grade crossing inventory listings to the localities, railroads, and VDOT Regional Traffic Engineers and Residency Engineers for review of potential safety improvements at grade crossing locations within their jurisdictions. The Local Assistance Division and Regional Traffic Engineers are requested to work with, or forward these listings to, the appropriate persons in cities, towns and counties who may submit locations for candidate improvements. Utilizing the grade crossing list, the sponsors are requested to conduct engineering safety assessments including field reviews of the locations prior to submitting proposed safety improvements.

Submittals within Cities and Towns must be coordinated with the District Local Assistance Liaisons to ensure proposal cost estimates are consistent and following Chapter 7 process. Signature of the authorized person responsible for expending the additional funds is required to be considered for H-RGCP funding. There may be instances where crossing warning devices are scheduled as part of a roadway construction project and the proposed type of warning is an upgrade of the existing warning devices. When this occurs and diagnostic reviews determine a short term need for the installation of warning devices, the crossing improvement may be advanced in the implementation schedule.

6.5.2. Eligible Sponsors

Both state and local agencies are eligible for H-RGCP funding. All proposal sponsors must be able to identify and allocate funding for expenses above the initial cost estimate. Only VDOT District Traffic Engineers have authority to submit the HSIP application for locally administered projects.

Local jurisdictions who can certify their ability to deliver federal-aid projects and VDOT offices are eligible for H-RGCP funding on all public roadways. All local agencies must provide their safety proposals to VDOT district staff to obtain concurrence following Chapter 7 requirements. Only VDOT District Traffic Engineers have authority to submit the HSIP application for locally administered projects. Sufficient VDOT district review and submittal time should be provided to allow for programming safety projects. Any proposals sent directly to HSIP staff will be forwarded to the appropriate VDOT district contact for review.

6.5.3. Project Proposal Requirements

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in credentials. If a H-RGCP application was submitted in the past, users can re-use the past application as new application for this fiscal year, and a new APPID will be assigned automatically.

Applications must include an engineering study documenting the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD) by providing new devices, features or elements. The engineering study should include relevant steps outlined in a traditional RSA. The steps for conducting an RSA or to complete an engineering study are documented on the FHWA RSA website and VDOT RSA Guidelines, however applicants are not required to submit a full RSA. Please contact HSIP staff if there is a question about the

level of study required. The submitted engineering study, and proposal will form the basis for the initial scoping document for the project.

Each submission *must* also include the following information:

Section 1: General

- Agency: The name of the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project.
- Project Sponsor: The name of the person representing the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project.
- Contact Information: The contact information for the person representing the governmental agency, municipality, organization, citizen's group or private individual who is proposing a safety improvement project. Contact information includes the Address, City, State, Zip, Email, and Phone Number.
- General Location: This section defines the general location of the proposed work. Select from the dropdown menus to identify the VDOT District and Region.
- Project Type: Indicate if the project is a surface improvement or warning device
- Roadway Description: This section defines the type of roadway on which the proposed work is to be performed. Select from the dropdown menus to identify the Functional Class Code, Area Location Code and Federal System Code.
- Study Period: This section defines the study period of the analysis. Identify the begin date of the study period under Study Period Begins. Identify the end date of the study period under Study Period Ends.
- Type of Traffic Control: Indicate the type of traffic control
- System Type: Indicate system type: Primary, Secondary or Urban system
- Specific Location: This section defines the specific location and limits of the proposed work. Identify the County, Safety Proposal Location/Route, From / Major Road, and To / Cross Street.
- DOT AAR: Indicate the American Association of Railroads number
- Type of Plan- Indicate if the plan is No Plan, Minimum Plan or Complete.
- Supplemental Short Answer Questions
  - Fully Describe Project
  - Identify the Issues
  - Identify Potential Measures to Address the Issues
  - Proposed Project Schedule and Cost
- SYIP Allocations- Provide Existing Project VDOT UPC(s) or DRPT Project Number(s), if applicable
- Other Committed Funds- Provide information on other committed funds if applicable

- Cost Estimate- provide project phase schedule and cost estimate information

Section 2: Location

Use the GIS Location application to identify the specific project location and identify the beginning and ending termini.

Section 3: Supporting Documents

Supporting documentation, that will strengthen or validate the HSP application, should be uploaded to the Smart Portal. Traditional HSP Safety proposals must include an engineering study documenting the purpose and need of any improvements that impact the roadway, traffic operations, and traffic control devices (TCD). Additional documentation may include photos, large maps, study reports or resolution letters increased ADT counts, school bus traffic, hazardous material vehicle crossing, and land use development.

Except for grade crossing improvements within railroad right of way, all improvements on VDOT or locality right of way, Applicants are required to submit a VDOT's Project Cost Estimation System (PCES) estimate. If applicant does not have access to a PCES estimate, the applicant is required to submit an alternate detailed project cost estimate. The PCES or alternative cost estimate must be attached to the project application submission. Typical proposal costs for rail improvements are provided in Appendix B.

Each of the areas listed in the Smart Portal must be completed. Well-documented proposals are more likely to receive higher scores and ranking for funding priorities. A separate proposal form must be completed for each candidate location, and there is no limit to the number of proposals submitted.

6.5.4. Electronic Submission

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in credential. All submissions must be received in VDOT's Traffic Engineering office by November 1st to be considered for qualification of HSIP funds Locally Administered Projects must be validated by District Traffic Engineers (DTE), DTE is responsible for coordinating with VDOT Local Liaison and submit the applications. Locally Administered Projects must submit their initial application to the VDOT Local Liaison by August 1st and final application by September 1st following the project submittal work flow.

Applicants assign an Administrator who will serve as the POC for the application. The Administrator will work with district staff to submit the HSIP application. The Administrator POC will oversee the creation, submission, and prioritization of candidate projects for all of the application programs. The Administrator is also used as the default point of contact for each project application submitted.

6.6 Project Selection

States are required to develop and maintain a method to prioritize safety improvements that is data-driven (e.g., crash and/or risk assessment). VDOT has developed a scoring criteria to prioritize H- RGCP proposals.

6.6.1 Project Prescreening Criteria

The project selection method involves three phases: an initial review, a risk narrative review/ preliminary scoring, and an engineering review. The initial review addresses how each proposed safety project meets the minimum eligible criteria, including:

- Project eligibility
- Project requirements
- Required authorization signature

The risk narrative review phase scores the following six factors in Table 6-1.

Table 6-1: H-RGCP Scoring Rubric

Factor	Description	Weight
Project Identification	Identify the Issues	
Proposed Improvement Projects	Identify potential measures to address the issues	45%
Cost Estimate	The cost estimate is uploaded to the Smart Portal and accurately uses PCES or VDOT approved line item costs to estimate the Preliminary Engineering, ROW and Utilities/ Environmental Clearance and Construction costs.	5%
Project Schedule	The project schedule is uploaded to the Smart Portal and indicates start and end dates for the Preliminary Engineering, ROW and Utilities/ Environmental Clearance and Construction phases.	5%
Multiple Funding Sources	The application indicates whether the project requires multiple funding sources.	5%
Supporting Documents	The necessary supporting documents to are uploaded to the Smart Portal.	10%

Proposals will be evaluated on a statewide basis. The grade crossing APM inputs are adjusted to incorporate additional data identified in the engineering study and proposal form, such as, vehicle type volumes, and physical characteristics. Candidate locations are ranked statewide using the FRA APM formula. Field reviews are conducted by HSIP staff to evaluate the crossing to confirm or adjust the proposal as needed. This review considers the following components:

- Sight distance – sufficient sight distance for approaching motorists to make a safe stop. Sight distance also applies to vehicles stopped at rail crossings.

- Roadway geometry – hazards and limitations to approaching motorists resulting from roadway geometry such as a steep grade, narrow pavement, horizontal curves, angle of crossing, adjacent roadway improvements.
- Adjacent land use development – adverse safety effects, caused by congestion, conflicts, or other problems created by adjacent land use.

6.7 Project Development

Projects are developed in accordance with project implementation procedures outlined in this section. Several VDOT divisions are involved in the project development by phase. The Rail Project Management Section (RPMS) of Right of Way Division (ROW) typically authorizes the project with concurrence from HSIP staff. VDOT's *Federal Program Management Division* processes federal project authorization requests for funding obligation with the FHWA.

6.7.1 Design

Facilities and equipment that are the responsibility of the railroad for maintenance and operation shall conform to the standards established in the VDOT's Roadway Design Manual, AASHTO's Policy on Geometric Design of Highways and Streets "Green Book" and FHWA's Manual on Uniform Traffic Control Devices (MUTCD). When design guidelines cannot be met, the current design exception or design waiver process established in the Roadway Design Manual shall be followed.

Restrictions apply when a highway/railroad grade crossing is located within the limits of a Federal-aid project for construction of a highway or improvement of an existing highway. For such a location, the crossing shall not be opened for unrestricted use by traffic, or the project accepted by VDOT until the appropriate protective devices, advance warning signs, and pavement markings are installed and functioning properly. Traffic control devices and pavement markings shall comply with the latest edition of the MUTCD and VDOT supplements to the extent applicable to federal and state guidelines. Example: the MUTCD guidelines state advance warning signs (W10-1) SHALL BE installed for each public roadway approach at all public crossings.

6.7.2 Environmental Review

VDOT's Environmental Division is also responsible for conducting and documenting the necessary environmental reviews to ascertain any adverse environmental impacts. Typically, these types of projects are exempt from the State Environmental Review Process (SERP). However, the Environmental Division makes this determination on a project by project basis. Environmental documents are required for all actions before federal funds can be spent on the construction phase. Based on past experience, Grade Crossing Improvements Program projects, typically do not involve significant environmental impacts, and qualify as "Programmatic Categorical Exclusions (PCEs)" when such projects do not:

- Induce impacts to planned growth or land use for the area;
- Require any relocation;
- Require substantial land acquisition except when acquired for preservation purpose as permitted by categories in PCE Agreement;

- Require a U.S. Coast Guard permit;
- Require an individual U.S. Army Corps of Engineers Section 404 permit;
- Have an adverse effect on historic properties;
- Use land (i.e. convert it) protected by Section 4(f);
- Involve significant air, noise, or water quality impacts;
- Have significant impacts on travel patterns;
- Require any changes in Interstate access control;
- Otherwise; either individually or cumulatively, have any significant environmental impacts;

6.7.3 Agency and Railroad Agreements

Where construction of a Federal-aid project requires the use of railroad properties or the adjustment to railroad facilities there shall be an agreement in writing. This agreement shall be compiled by VDOT's Rail Project Management Section (RPMS) and submitted to the appropriate railroad company for a detail engineering estimate, design and signature. The agreement is returned in a timely manner to VDOT for signature and processing with FHWA. Note: a third party agreement signature is required where VDOT does not maintain the roadway over the crossing such as within incorporated cities. The written agreement shall include the following information where applicable:

- A detailed statement of the work to be performed by each party;
- A method of payment;
- The extent to which the railroad is obligated to move or adjust the facilities at its own expense;
- The railroad's share of the cost;
- An itemized cost estimate of the work to be performed by the railroad;
- The method to be used for performing the work, either by railroad forces or by contract;
- Identification of the party or parties responsible for maintenance;
- The form, duration, and amounts of any needed insurance;
- References to plans and specifications;

The railroad company shall provide a plan sheet consisting of:

- Crossing Layout;
- Existing warning system;
- Width of pavement/proposed width
- Track layout;
- Significant topography;
- Limits of right of way;
- A profile of highway approaches

- Other details sufficient to allow proper location of protective devices;

6.8 Project Implementation

Improvement projects will follow the following procedures in the project implementation phase.

1. Upon federal authorization, the Rail Project Management Section shall notify the railroad company in writing to proceed with phase of work as described in the agreement.
2. The railroad company shall take the appropriate action to order equipment and begin work as scheduling permits and complete the project within a timely manner. Project implementation will take approximately twelve months.
3. The railroad performs the Force Account work, or, if non-railroad (highway) work is involved, the work is performed by VDOT forces or VDOT contract forces. VDOT audits all bills for compliance with applicable Federal regulations to determine the eligibility of the items.
4. When project is completed, the appropriate party will be responsible for installing and maintaining the warning signs and pavement markings outside of railroad right-of-way.
5. The railroad companies shall issue an "in-service" notice to the appropriate sections within VDOT when work is complete. VDOT Districts where work is performed shall prepare a C-5 and copy the HSIP staff after final inspection has been performed.
6. VDOT Rail Project Management Section shall process final bills with the Fiscal Division as received from the railroad companies.
7. VDOT performs a project audit, responds to any audit exceptions and prepares a Final Voucher for submittal to FHWA for approval.
8. The railroad, VDOT's HSIP Section and the Rail Project Management Section shall record and maintain project documentation upon completion and final audit.
9. Evaluation is conducted on a statewide basis.

6.9 Program Administration

The H-RGCP is administered by HSIP staff. The objective of the program is to reduce the number of injuries and fatalities at grade crossings include the following:

10. Establishing a multi-year program that is updated annually, on a schedule that meets the needs of the VDOT District Offices, Cities and MPOs and other localities in building their Regional and Federal Statewide Transportation Improvement Programs.
11. Ensuring that the most cost-effective projects are being selected and that Federal law and requirements are met.

Implementing a structured process to approve or disapprove cost and schedule changes to encourage appropriate use of fund.

7 Local Agency Safety Program (LASP)

7.1. Program Overview

This chapter is only for Locally Administered Highway Safety Improvement Program (HSIP) projects. Localities that request VDOT to administer HSIP projects within their jurisdiction should coordinate the request with their VDOT Local Liaison.

Highway Safety Improvement Program (HSIP) projects on locally owned/maintained roadways are an important part of Virginia's highway safety initiatives. Locally administered HSIP funded projects contribute to the Commonwealth's target of reducing deaths and severe injuries on all public roads by three percent per year as set forth in Virginia's 2017-2021 Strategic Highway Safety Plan. Approximately 20 percent of Virginia's most severe injuries from crashes occur on locally maintained roadways. To realize the benefits from reducing crashes and the resulting injuries, infrastructure improvements must be implemented as quickly as possible. To that end, VDOT and FHWA are committed to partnering with localities to deliver safety projects that will help Virginia meet its safety performance targets.

With locally maintained roadways accounting for approximately 20 percent of Virginia's serious injury and fatal crashes, VDOT is allocating 20 percent of its annual HSIP appropriation for Locally Administered HSIP projects. This allocation is expected to be in the order of $10 million for Federal Fiscal Year 2017.

7.2. Proposal Eligibility

Locally Administered Projects must meet the following criteria to be eligible for funding.

1. If the locality has not administered a federal aid highway improvement project (including HSIP) within the previous 5 years, they will be limited to a maximum of one (1) new HSIP project that must progress into the construction phase before consideration is given to fund additional HSIP projects. (Note: In accordance with Chapter 10 of VDOT's Locally Administered Projects (LAP) Manual, a locality may still be denied to administer the project based on the locality's Request to Administer and their self-evaluation to administer Federal Aid projects.)

2. A locality will be permitted to request HSIP project funds if the aggregate amount currently allocated to the locality is either less than $5 million or the locality has 5 or less HSIP projects. If a locality exceeds this threshold, the locality will be permitted to apply for additional funds only if 70 percent of the HSIP project allocations have been authorized for construction at the time of application.

3. For HSIP projects that do not have a right-of-way (RW) phase, the locality will be required to complete the preliminary engineering (PE) phase and have the project authorized for construction within 18 months of the PE phase funds being authorized. For projects having a RW phase, the locality will be required to complete the PE and RW phases and have the project authorized for construction within 30 months of the PE phase funds being authorized. Should the project not progress to the construction (CN) phase within the time

frame identified above, VDOT reserves the right to remove the CN phase funds. VDOT will re-evaluate the project's schedule and will fund the CN phase when funding becomes available.

VDOT reserves the right to restrict localities from applying for additional HSIP projects if a locality has one (1) or more projects not meeting the above schedule requirements and not progressing to the next phase.

4. HSIP projects administered by a locality shall show regular expenditure of funds indicating progression of the project. At no time should more than one year pass without expenditure of funds on an HSIP project. Should this occur, project proposals will not be considered until expenditures on projects resume.

5. VDOT expects HSIP projects to be closed out within six (6) months of project completion. VDOT will consider certain mitigating circumstances that may prevent project closeouts to occur within this timeframe as they arise (i.e. outstanding claims, court cases, etc.).

Figure 7-1 contains a flow chart with the criteria used to determine the eligibility of a locality to request and to administer new safety improvement projects with Federal HSIP funding. Adherence to the criteria will help to ensure the locality's ability to deliver their HSIP projects in a timely manner:

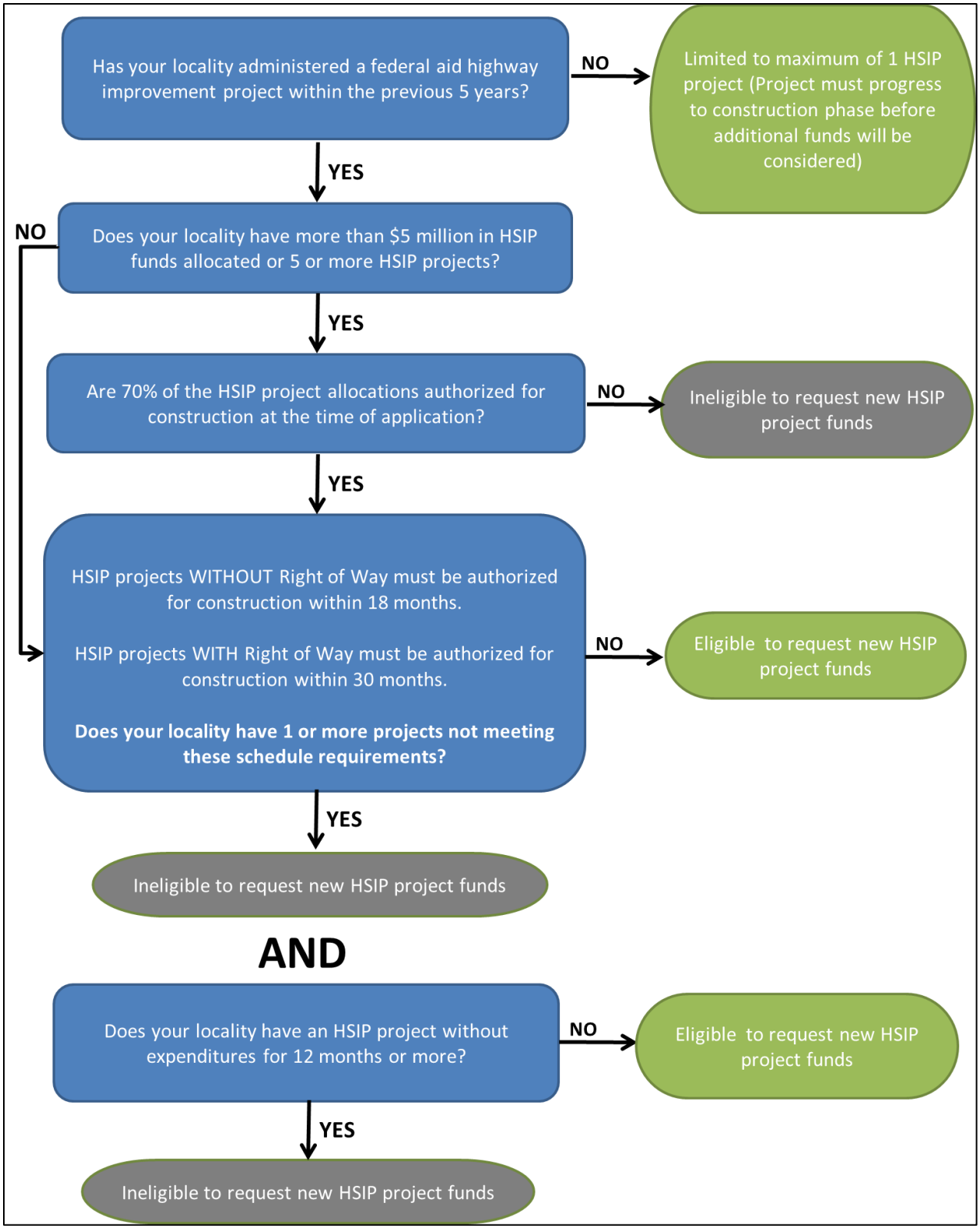


Figure 7-1: LAP Eligibility Criteria

7.3. Project Funding

Recognizing that safety needs surpass available funds, only Tier 1, as defined in the VDOT Locally Administered Projects (LAP) Manual, local HSIP projects will be considered and programmed. However, federal aid projects that are less than $500,000 require significant administration from all parties that is often disproportionate to the scope. As such, VDOT encourages localities to identify safety projects having costs greater than $500,000 for consideration. In addition, when localities have multiple project locations or systemic improvements, VDOT recommends that the locality bundle the projects to combine the design and construction administration.

The requirements and stipulations contained herein for Locally Administered HSIP projects are provided to ensure the timely delivery of safety projects, that proper oversight is being conducted, and that project performance criteria are being met.

7.4. Proposal Requirements

HSIP considers three eligible project scopes:

1. Roadway spots or intersections
2. Roadway corridors
3. Systemic treatments at multiple locations

Should localities apply for HSP, BPS, H-RGCP or SSI funding refer to each application's specific chapter, chapters 3-6 respectively for specific requirements need to complete the proposal.

7.5. Safety Improvement Proposal Procedure

7.5.1. Proposal Planning

The locality is required to coordinate the development and submission of the proposal with their respective VDOT Local Liaison staff to ensure the project is adequately scoped, cost estimates are realistic and include CEI and contingencies, and the proposed phase dates and schedules are appropriate and can be met with a high degree of certainty. The following provides the critical dates that the locality must adhere to in order to be considered for new HSIP projects in the next fiscal year's Six Year Improvement Program (SYIP).

August 1st – Locality must submit their INITIAL proposals and all supporting documentation as outlined in the next section to the VDOT Local Liaison no later than August 1. Locality should meet with VDOT Local Liaison prior to this submission to discuss their proposals, scope, estimates, and schedule. The locality is encouraged to take into consideration the time required to execute a City/State agreement and any necessary TIP/STIP amendments when developing their project schedules.

September 1st – Locality must submit their FINAL proposals and all supporting documentation to the VDOT Local Liaison no later than September 1. The final proposals should incorporate the necessary changes to the initial proposals as recommended by the VDOT Local Liaison in the step above. Along with the proposal, the locality is required to submit a letter, at the time of application, from the City/County/Town Engineer or the Director of Public Works indicating support of the project and committing the locality to meeting the schedule as proposed.

September 15th - VDOT Local Liaison will review the proposal and supporting documentation and forward this information by September 15th to the VDOT Regional Traffic Engineer (RTE) along with an endorsement of the project or comments recommending modifications to the proposal.

October 31st - VDOT RTE will review the proposal package and request any additional documentation or refinements by the locality by October 31. The RTE will develop a prioritized list of locally administered projects by construction district and submit the list(s) to the VDOT HSIP staff in the Central Office by November 1.

November – January - VDOT HSIP staff will review statewide HSIP final submittals and develop a prioritization of projects between November 1 and February 1.

February - Notifications to localities and VDOT Districts of projects tentatively identified for funding will be made in February.

i. District PIM and Local Liaisons will be notified of the selected HSIP projects and will be required to enter the supporting documentation into the Project Pool.
ii. District Local Liaison shall notify the locality of the tentative project selection and inclusion in the SYIP.
iii. District PIM shall notify the VDOT HSIP staff of the creation of the project in the Project Pool.
iv. VDOT HSIP staff will transfer the appropriate funds to the new project(s) (temporary or permanent UPC) with annual allocations matching the phase costs and scheduled dates.

June - Final CTB approved SYIP will be shared with localities in June. The SYIP will include the final list of funded HSIP projects.

7.5.2. Project Proposal Requirements

All safety proposals submitted for considerations must use the SmartPortal and follow the Highway Safety Improvement Program Implementation Guidelines. Contact SmartPortal@CTB.Virginia.gov or CO-TED Highway Safety Improvement program team to obtain log in credentials. If an application was submitted in the past, users can re-use the past application as new application for this fiscal year, and a new APPID will be assigned automatically. Locally Administered Projects must submit their initial application to the VDOT Local Liaison by August 1st and final application by September 1st.

Should localities want to apply for HSP, BPS, H-RGCP or SSI funding refer to each application's specific chapter, chapters 3-6 respectively.

Applicants assign an Administrator who will serve as the POC for the application. The Administrator will work with district staff to submit the HSIP application. The Administrator POC will oversee the creation, submission, and prioritization of candidate projects for all of the application programs. The Administrator is also used as the default point of contact for each project application submitted.

7.6. Project Selection

States are required to develop and maintain a method to prioritize safety improvements that is data-driven (e.g., crash and/or risk assessment). VDOT has developed a scoring criteria to prioritize Highway Safety, Bike and Pedestrian, Rail Safety and Systemic Safety Improvements.

7.6.1. Project Selection Criteria

The project selection method involves three phases: an initial review, a risk narrative review/ preliminary scoring, and an engineering review. To effectively and equitably identify potential safety projects, an objective 100 point-based scoring system is used prescreen projects and determine if applications have all the necessary information. Chapters 3-6 outline the specific scoring criteria for each safety program.

The final engineering review uses the preliminary scoring as a tool to prioritize and determine if applications have all the necessary information. A detailed review is then conducted to confirm that the existing problem matches the description of the proposal. This review also looks at the proposed solution and assesses the practicality and constructability of the project.

Projects are funded based on the final ranked scores, until fiscal year funds are exhausted. VDOT project sponsors will be notified of approved projects that may be entered into the Six Year Improvement Program (SYIP) – Project Pool. The final project list is submitted by the VDOT Programming Division to the Commonwealth's Transportation Board for final approval.

Appendix A - CMF Clearinghouse Guidance

CMF Clearinghouse Guidance

A crash modification factor (CMF) is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. The main difference between a crash reduction factor (CRF) and a CMF is that CRFs provide an estimate of the percentage reduction in crashes, while CMFs are multiplicative factors used to compute the expected number of crashes after implementing a given improvement.

Mathematically stated, CMF = 1 - (CRF/100). For example, if a countermeasure is expected to reduce the number of injury crashes by 23 percent (i.e., the CRF is 23), the CMF will be 1 - (23/100) = 0.77. On the other hand, if the treatment is expected to increase the number of property damage crashes by 23 percent (i.e., the CRF is -23), the CMF will be = 1 - (-23/100) = 1.23.

The Crash Modification Factors (CMF) Clearinghouse is a web-based repository of more than 4,000 CMFs covering hundreds of treatments. The purpose of the CMF Clearinghouse is to compile all documented CMFs in a central location for use in highway safety analysis.

The CMF Clearinghouse provides a searchable database that can be easily queried to identify CMFs to meet user's needs. Use the “Quick Search” function on the homepage to search by keyword in the countermeasure name, abstract, citation, or CMF ID. The search results can be filtered by star quality rating, crash type, crash severity, and other roadway characteristics. The results can also be filtered to identify CMFs included in the Highway Safety Manual. In using the search function, users should start with a general search by keyword (e.g., rumble strip) and narrow the search from there as applicable. If too many stipulations are imposed, then the search may return few or no CMFs. In other cases, there may be too many CMFs returned for a general search.

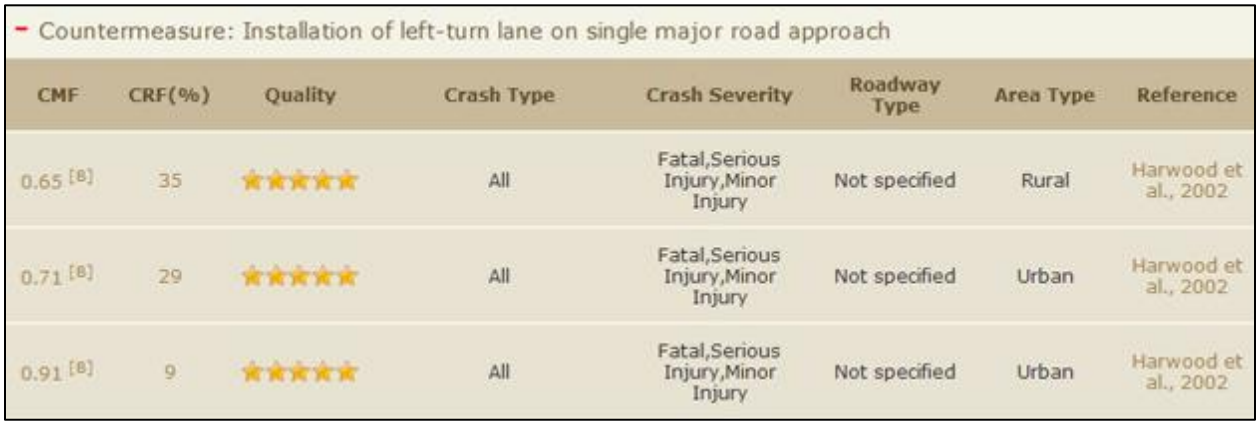
Note that the inclusion of a CMF in the CMF Clearinghouse does not constitute an endorsement of the CMF or support for its use. It is the user’s responsibility to determine the most appropriate CMF for their analysis need. To help users select an appropriate CMF for their needs, the following guidance is provided.

- Quality: A star quality rating is assigned to CMFs when possible. The star quality rating is based on the statistical rigor of the underlying study, and considers factors such as the study design, standard error of the CMF value, potential biases, data source, and sample size. In general, users should select from those CMFs rated three stars and above. In certain cases, the only CMFs available, or the most applicable CMF, may be rated less than two stars. Consult with the HSIP staff for clarification or questions regarding CMF eligibility.
- Applicability: CMFs should be selected based on applicability, where the characteristics associated with the CMF closely match the characteristics of the scenario at hand. For example, CMFs often vary by crash type and crash severity. While it is useful to determine the change in crashes by type and severity, this

should only be done when applicable CMFs are available for the specific crash type and severity of interest. As another example, CMFs may be specific to urban or rural areas, and a CMF for a rural area should be applied to situations that match. The applicability of a CMF is based on the underlying study and the CMF Clearinghouse reports the details for each CMF. Consult with the HSIP staff for clarification or questions regarding CMF applicability.

- Documentation: The selection process should be documented, including the link to the CMF in the Clearinghouse and assumptions used in selecting the CMF. Each CMF has a unique ID number (i.e., 3127), located on the CMF details page. The details page for each CMF also has a unique URL that can be reported for quick reference. For example, see CMF #3127.

As an example, consider the search results for "Installation of left-turn lane on single major road approach" shown in Figure A-1. The location of interest is an urban signalized intersection, and a new left-turn lane was suggested by a road safety assessment team to help mitigate crashes at this intersection. There are multiple CMFs for this countermeasure based on the initial search, and the first step is to review the star quality rating. All CMFs from the search have the same star rating, so none of the CMFs are eliminated at this point. Next, the applicability is examined to further assess the CMFs. Based on a cursory review of the data shown in the figure (i.e., crash type, crash severity, roadway type, and area type); it becomes clear that all three CMFs are related to all crash types that result in fatality or injury. It is also clear that two of the CMFs are applicable to urban areas while the third applies to rural areas. The location of interest is an urban signalized intersection, so the rural CMF can be eliminated. Based on the figure it is not clear which of the two urban CMFs should be selected. Upon further examination of the details page (accessed by clicking on each CMF from the Clearinghouse website), it is noted that the CMF of 0.71 is applicable to stop-controlled intersections, while the CMF of 0.91 is applicable to signalized intersections. In this case, the CMF of 0.91 is selected since it has more than three stars, and applied to urban signalized intersections. Note that the CMF is only applicable to fatal and injury crashes. As such, it should be applied to that subset of crashes during the analysis (not to total crashes).



− Countermeasure: Installation of left-turn lane on single major road approach

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Roadway Type	Area Type	Reference
0.65 [B]	35	★★★★★	All	Fatal,Serious Injury,Minor Injury	Not specified	Rural	Harwood et al., 2002
0.71 [B]	29	★★★★★	All	Fatal,Serious Injury,Minor Injury	Not specified	Urban	Harwood et al., 2002
0.91 [B]	9	★★★★★	All	Fatal,Serious Injury,Minor Injury	Not specified	Urban	Harwood et al., 2002

Figure A-1 Left Turn Lane CMF Information:

The situation may arise where two CMFs are exactly the same with respect to crash and roadway applicability. In these cases, it is necessary to examine the following factors.

- Transferability of CMF. The CMF Clearinghouse identifies the "Municipality", "State", and "Country" from which data were used in developing the CMF. If all else is equal, it may be preferable to select the CMF that is based on data from a region that is most similar to the jurisdiction of interest. For example, if there are two similar CMFs and one is based on data from California, while the other is based on data from North Carolina, then it may be preferable to use the CMF from North Carolina for jurisdictions in Virginia.
- Traffic volume range. The CMF Clearinghouse identifies the "Major Road Traffic Volume" and "Minor Road Traffic Volume" for sites that were used to develop the CMF. These fields may help to identify the CMF that is most applicable to the location of interest.
- Age of data. The CMF Clearinghouse identifies the "Date Range of Data Used". In general, more recent data would be preferred (all other factors being equal). Studies conducted more recently typically use more advanced techniques, higher precision data, and have other advantages related to the progression of knowledge, data quality, and study methods that develop over time in the field of highway safety research. More recent data will also better reflect changes in vehicle fleet characteristics and technology.
- Score details. The star quality rating is based on five categories: study design, sample size, standard error, potential bias, and data source. Many CMFs in the Clearinghouse are accompanied by details of the scores behind the star rating as shown in Figure A-2.

Figure A-2: CMF Quality Data

- Clicking on the score details link will display a window showing the scores that the CMF received in each category. Given that two CMFs have the same overall star rating; it may be preferable to select the CMF with the better study design score. If the study design is equal, then the CMF with the smaller standard error would be preferred.
- Original study report. The CMF Clearinghouse provides a link, where possible, to the original study document. Users may find it useful to refer to the original study report to understand the background of the CMF development process, including the underlying data and the application of the treatment.

Users can visit the CMF Clearinghouse to do the following activities:

- Learn more about CMFs.
- Identify potential countermeasures.
- Obtain the expected effectiveness of countermeasures.

- Compare alternative treatments.
- Get information on trainings related to CMFs.
- Find resources on cost-benefit analysis.

Appendix B- Highway-Rail Grade Crossing Improvement Costs

Highway-Rail Grade Crossing Improvement Projects and Costs 2015

Typical Warning Device Upgrades / Improvements

Upgrade to 12" Lens - $50,000
Flashing Lights only - $195,000
Flashing Lights and Gates - $230,000
Cantilever Flashing Lights - $300,000
Cantilever Flashing Lights and Gates - $330,000

If sidewalk present at Highway/Rail Grade Crossing:
Pedestrian Gate – separate pedestal - $55,000
Pedestrian Gate – add to gate - $35,000

If a Unidirectional will be required, add $90,000
Interconnection of Railroad Signals and Highway Traffic Signals – $40,000-$60,000
Source – VDOT's Rail Project Agreement Section and the Norfolk Southern Railroad

**Cantilever Flashing Lights and Gates are typically used where there are 2 or more travel lanes in one direction or sight distance is limited on either approach to a rail crossing

**Unidirectional devices may be required when warning devices are installed at some crossing locations.

NOTE: The additional costs associated with traffic control, detours or lane closures, if needed, is not included in the installation estimates for rail upgrades/improvements