HSIP Analyzer is a PDF form-based software that streamlines the process of cost estimate, safety improvement countermeasure evaluation, crash data input and Benefit Cost Ratio (BCR) calculation. The use of the HSIP Analyzer is required for all applications for Highway Safety Improvement Program (HSIP) Cycle 10 Call for Projects. The completed HSIP Analyzer is one of the required attachments to the HSIP Application Form (Attachment No. 5, last page of the application form).

There are two HSIP application categories: BCR and Funding Set-asides. This manual provides instructions for using the HSIP Analyzer to prepare a BCR application. Please use the other manual for Funding Set-aside Applications.

Please review these instructions thoroughly before you start to prepare a BCR application.

For more information regarding the HSIP program, please review the HSIP Guidelines, Local Roadway Safety Manual for California Local Road Owners and other related information at https://dot.ca.gov/programs/local-assistance/fed-and-state-programs/highway-safety-improvement-program.

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For an application that needs a BCR, the HSIP Analyzer consists of the below sections:

- **General Information**
  Provides Application ID, Project Location, Project Description, type of project locations (signalized intersections, non-signalized intersections or roadways), safety countermeasures to be applied, estimated project schedule and other general information.

- **Section I: Construction Cost Estimate and Cost Breakdown**
  Provides estimate for construction items, determines the project’s maximum Funding Reimbursement Ratio (FRR).

- **Section II: Project Cost Estimate**
  Provides the cost estimate for the entire project, including all phases (PE, ROW, CON and CE). Also determines the requested HSIP funding amount.

- **Section III. Crash Data**
  Provide crash data for the purpose of calculating the project benefit in Section IV.

- **Section IV. Calculation and Results**
  Calculate the project benefit, the BCR and provide calculation result summaries. Errors are displayed in lieu of calculation results if detected.

One BCR application may include one or multiple locations. Please note:

a. **All the locations in the application must be of the same type: Signalized Intersections (S), Non-Signalized Intersections (NS), or Roadways (R).** For example, an application may have 5 Non-Signalized Intersections, but it cannot have 2 Non-Signalized Intersections, 1 Signalized Intersection and 2 roadway sections.

b. **All the locations in the application must receive the same proposed safety improvements, i.e. all the safety countermeasures (CMs) must be applied to all the locations.** Up to three (3) safety countermeasures may be used in calculating the benefit of the project.

*If the above criteria are not met, please break your proposed project into multiple applications.* Applicants may consider combining the applications into one project during implementation if multiple applications of small sizes are selected for funding. The purpose of this requirement is to evaluate the locations of same characteristics with similar safety concerns together and justify the selection of the locations based on their own expected safety benefits.

Example:

A project includes 20 signalized intersections. CMs “Add Intersection Lighting” (S01) and “Install pedestrian countdown signal heads” (S17PB) will be applied to all 20 intersections. If for another set of 12 intersections only CM S17PB will be installed since lighting exists, these 12 intersections should have a separate application.

**Exception 1:** If your project has only very few locations that the applicable CMs are slightly different from the majority, you may include all locations in one application which then needs multiple HSIP Analyzer files. All HSIP Analyzer files pertaining to your application must be attached to the last page of the application form. Please sum the benefits and calculate the application’s BCR manually as (Total benefits/Total Project Cost). Enter the BCR into the application form.

Example:

A project includes 20 signalized intersections. CMs “Add Intersection Lighting” (S01) and “Install pedestrian countdown signal heads” (S17PB) will be applied to all 20 intersections. If you have 2 more intersections that only CM S17PB will be applied, you may include all 22 intersections in one application but use two HSIP Analyzer files.
Exception 2: If your project proposes corridor safety improvements which may include a number of signalized intersections, non-signalized intersections, and roadway sections, you may include all locations in one application which then needs multiple HSIP Analyzer files. All HSIP Analyzer files pertaining to your application must be attached to the last page of the application form. Please sum the benefits and calculate the application’s BCR manually as (Total benefits/Total Project Cost). Enter the BCR into the application form.
General Information

**Application ID:** Enter the exact Application ID from the Application Form, e.g. 03-Sacramento-1.

Save the completed HSIP Analyzer as file name “HA” + Application ID before you attach it to the last page of the Application Form (e.g. "HA03-Sacramento-1.pdf").

*If your application has multiple HSIP Analyzer files (this is rare), please use different file names and attach all to the application form. See the previous page for more explanation.*

**Project Location:** Enter (copy & paste) the exact Project Location from the Application Form.

**Project Description:** Enter (copy & paste) the exact Project Description from the Application Form.

**Application Category, Location Type and Countermeasures:**

- Select “Benefit Cost Ratio (BCR)” from the drop-down list;
- Select the location type (“Signalized Intersections”, “Non-Signalized Intersections” or “Roadway Sections”). Only countermeasures (CMs) pertaining to the selected location type will be displayed in the below drop-down lists for CM selection.
- Number of Intersections and Miles of Roadway: provide number of intersections (if “Signalized Intersections” or “Non-Signalized Intersections” is selected above) or the length of roadways (if “Roadway Sections” is selected above).
- Select number of countermeasures for the project (1, 2 or 3); and
- Select the name for each countermeasure.

The countermeasures selected here will be populated in Section I (Construction Cost Estimate and Cost Breakdown) and Section III (Crash Data).

If an error message is displayed at the bottom of this page, the message must be cleared before proceeding to the next page. An error message will be displayed if one of the following specific CM rules is violated:

1) S08 and S02 should not be selected together.

   S08 (“Convert signal to mast arm (from pedestal-mounted)” ) and S02 (“Improve signal hardware: lenses, back-plates, mounting, size, and number”) should not be selected together as the work of S02 is considered part of CM S08.

2) Any of the below CMs should not be selected in combination with any other CMs:
   - S16 - Convert intersection to roundabout (from signal);
   - NS03 - Install signals;
   - NS04 - Convert intersection to roundabout (from all way stop);
   - NS05 - Convert intersection to roundabout (from stop or yield control on minor road).

**Project information**

Most of the information requested in this session is required for Caltrans to meet its annual safety program reporting requirements to the FHWA. Responses to these questions will NOT be used in the scoring, ranking or selection process. The responses will be incorporated in statewide and national safety program assessments and used to determine the health of the overall program and potential areas of focus for future program improvements.

Some of the questions are self-explanatory so not all questions are explained here.
Functional Classification (FC):
Visit https://dot.ca.gov/programs/research-innovation-system-information/office-of-highway-system-information-performance, click “California Road System (CRS) maps” in the middle of the webpage, and determine the Functional Classification (FC) of the road(s) where most of the work will be constructed. If the amounts of work are equal among multiple FCs, use the highest FC. Select the FC from the drop-down list.

Urban/Rural Area:
Select “Urban” or “Rural” from the drop-down list, when most of the proposed work is in urban or rural area.

What is the approximate total cost percentage that is HR3 eligible?
Work in rural area and associated with roads functionally classified as “Major Collector”, “Minor Collector” and/or “Local”, is High-Risk-Rural-Roads (HR3) eligible. HR3 eligible projects, when selected for funding, will be tracked separately due to the FHWA’s special requirements. Provide an approximate total cost percentage that is HR3 eligible (rounded to the nearest ten percent).

Annual Average Daily Traffic and Year Collected:
Indicate the existing (or most current) Annual Average Daily Traffic (AADT) volume at the project location and the year the data were collected.
- If the proposed improvement is on a road segment, the AADT is the number of vehicles that use that section of roadway, in both directions, on an average day. You may enter the same number for the Major Road and Minor Road.
- If the proposed improvement is at an intersection, separate the AADT volumes approaching the intersection into Major Road and Minor Road.
- If the proposed improvements span a large distance and/or are spread out over several routes/locations, provide the range of AADT volumes with the high-end input in the "Major Road" field and the low-end input in the "Minor Road" field.

Posted Speed Limit (mph):
Input the highest posted speed within the project limits.

SHSP Challenge Area:
The goal of this question is to tie the improvements to California’s Strategy Highway Safety Plan (SHSP). Most projects should fall within one of the Challenge Areas. Select the primary one if multiple Challenge Areas apply. Visit https://dot.ca.gov/programs/traffic-operations/shsp for more details on the California SHSP Challenge Areas.

Is the project focused primarily on “spot location(s)” or “systemic” improvements?
The Local Roadway Safety Manual includes a detailed description of these two approaches. When more than one type of systemic improvements is proposed in one application, applicants need to select a single “primary type”.

Approximate percentage of project cost going to improvements related to motorized travel:
HSIP projects benefit a mix of roadway users and modes of travel. For statewide tracking purposes, Caltrans needs to approximate the percent of the overall project costs going to improvements for motorized vs. non-motorized roadway users. Please make the best approximation of the percentage related to motorized travel based on the estimated project cost and the primary goals and objectives of the project.
Project Schedule:

The local agency is expected to deliver the project per the HSIP Program Delivery requirements. The delivery requirements for HSIP Cycle 10 projects are: (1) Preliminary Engineering (PE) Authorization by 9/30/2021; and (2) Construction (CON) Authorization by 12/31/2023.

The exceptions are:

- The milestone of PE authorization does not apply if the project will not use the HSIP funds for PE;
- For a project that a consultant is used for the PE work, an additional time of 6 months is allowed for meeting the CON Authorization milestone. The additional time is for the agency to advertise and select the consultant for the work of the PE phase.

Please answer the below two questions:
- Will this project use HSIP funds for Preliminary Engineering (PE) Phase?
- Will an external consultant be hired to do the PE work?

Then specific delivery requirements for your proposed project, if selected for funding, will be displayed.

Please provide your best estimated dates for the following implementation milestones (leave blank if not applicable). Please make sure the proposed schedule will meet the above delivery requirements.

- PE Authorization Date;
- Environmental Clearance Date;
- Right of Way Clearance Date;
- Final PS&E Date;
- CON Authorization Date;
- Construction Contract Award Date;
- Construction Completion Date; and
- Project Close-Out Date.
Section I: Construction Cost Estimate and Cost Breakdown

The purpose of this section is to:

- Provide a detailed engineer's estimate for construction items. The costs for other phases i.e. Preliminary Engineering (PE), Right of Way (ROW), and Construction Engineering (CE) will be accounted for in Section II.
- Determine the maximum Funding Reimbursement Ratio (FRR) of the project.

I.1 Countermeasures (CMs) applied to all locations (from Page No. 1)

The CM information comes from Page No. 1.

I.2 Detailed Engineer’s Estimate for Construction Items:

- **Table for Detailed Engineer’s Estimate:**
  
The gray fields are calculated and read-only. Each line is for one construction item. Click + or – buttons to add a new line or delete an existing line.

  In each line, enter the construction item description, quantity, unit, unit cost, and the cost percentages that are directly attributed to each of the countermeasures (CMs) and OS (“other safety-related components”). The remaining percentage is calculated and goes to NS (“non-safety-related components”).

  At the bottom of the table, an overall cost percentage will be calculated for each CM, OS and NS.

- **Contingencies:**
  
  In general, not all project construction costs are well defined at the time the HSIP applications are prepared. For this reason, applicants are allowed to include Construction Item Contingencies as a percentage of the known construction costs. This is the only project contingencies allowed in an HSIP application. When applicants calculate their Preliminary Engineering (PE) and Construction Engineering (CE) costs as a percentage of the Total Construction Cost, contingencies will automatically be built into the PE and CE costs.

- **Total Construction Cost:**
  
  The total construction cost is the sum of the construction item costs and the contingencies, rounded up to the nearest hundreds.

I.3 Funding Reimbursement Ratio

The project’s maximum FRR is calculated as:

- The smallest of the Funding Eligibility (FE) percentages of the selected CMs, when the percentage of the non-safety-related components is no more than 10%:

  *For example, if the FE of the 3 CMs are 100%, 90% and 100%, and the % of the non-safety-related components is 8%, the project’s maximum FRR will be 90%.*

- OR the smallest of the FE percentages of the selected CMs minus the percentage of the non-safety-related-components exceeding 10%, when the percentage of the non-safety related components is more than 10%.

  *For example, if the FE of the 3 CMs are 100%, 90% and 100%, and the % of the non-safety-related components is 18%, the project’s maximum FRR will be 90%-(18%-10%)=82%.*

After the completion of Section I, the following data will be transferred to Section II (Project Cost Estimate) automatically: (1) Total Construction Cost; and (2) Maximum Funding Reimbursement Ratio (FRR). FRR will be used as the maximum "HSIP/Total" percentage allowed in Section II.
Section II: Project Cost Estimate

Section II of the application form is used for the overall project cost estimate including all applicable phases, i.e. Preliminary Engineering (PE), Right of Way (ROW), Construction (CON), and Construction Engineering (CE). All project costs (all phases and funding sources) must be accounted for in this section.

The costs included in the application represent the likely total project cost necessary to fully construct the proposed scope. If the proposed project is a piece of a larger construction project, the entire scope of the larger project must be identified and included in this section even if substantial elements are to be funded by other sources. The Total Project Cost from this section will be used in the later Benefit Cost Ratio (BCR) calculation.

The following data are transferred to this section from Section I:
• Total Construction Cost;
• Maximum Funding Reimbursement Ratio (FRR), i.e. Maximum "HSIP/Total" percentage allowed for this project.

All the grey fields contain formulas and are read-only.

For each line in the table, enter the total cost (rounded up to the nearest hundred dollars) and the desired HSIP/Total Cost ratio. The desired HSIP/Total ratio cannot be more than the project’s maximum FRR. You may click the “Set” button on top of the table to set all "HSIP/Total" percentages to the project's max FRR. The amounts of HSIP Funds and Local/Other Funds will be calculated by the form.

Check Box indicating Agency does NOT request HSIP funds for PE Phase:

If no HSIP funds for the PE Phase are requested, this Check Box will be checked automatically. This information will only be used for project delivery tracking. It will not affect the ranking or selection of applications for funding.

Automatic Data Validation:

Once all costs and ratios are entered, a message will appear if errors are detected, based on the below criteria. Please fix the errors unless justification for exceptions is provided in narrative question no. 3 in the Application Form.

1) The “HSIP Funds” for Construction Items may not be zero.
2) "HSIP Funds" for Preliminary Engineering may not exceed 25% of the HSIP Construction Cost.
   Exception: for low cost systematic projects such as Roadway Safety Signing Audits (RSSA), Caltrans anticipates approving PE costs over 25%. For more information on this type of project, see the example document at the HSIP website.
3) "HSIP Funds" for Right of Way may not exceed 10% of the HSIP Construction Cost.
4) "HSIP Funds" for Construction Engineering may not exceed 15% of the HSIP Construction Cost.
5) "HSIP Funds" may not exceed $10,000,000.
6) To maintain efficiencies in the overall Program and Project Management, the "Total HSIP Funds" must be $100,000 or more. If needed, agencies should consider extending the project limits and/or adding another safety improvement in order to increase both the total project Benefits and Costs.
   Exception: (1) Caltrans recognizes that for some rural agencies with extremely small numbers of crashes, this $100,000 minimum HSIP funding requirement may not be achievable without their applications having low B/C ratios, which may not be fundable. If an agency believes their jurisdiction falls into this category, they may request an exception to this $100,000 minimum funding requirement through their District Local Assistance Engineer; (2) You may combine multiple applications (if selected for funding) in implementation so the combined project has more than $100,000 of HSIP funds.

After the completion of the project cost estimate, “Total Project Cost” will be automatically transferred to Section IV (Calculation and Results).
Section III: Crash Data

The benefit of an HSIP safety project is achieved by reducing potential future crashes due to the application of the safety countermeasures (CMs). In this section, you will need to provide information regarding the historical crash data at the project sites.

Different CMs will reduce crashes of different types during the life of the safety improvements. Depending on the selected CMs for the application, you will be required to fill in one or more crash data tables, for any combination of the five crash types (datasets): "All", "Night", "Ped & Bike", "Emergency Vehicle", and "Animal" (Each of the later four datasets is a sub-dataset of the "All" dataset.)

If a Roundabout CM (S16 or NS04 or NS05) is selected, additional information (such as roundabout configuration and ADT) is required.

Please refer to the Local Roadway Safety Manual for information.

Please answer the below two questions:

- Please indicate the sources of the crash data. Typical sources include Statewide Integrated Traffic Records System (SWITRS), UC Berkeley SafeTREC TIMS, your locally preferred mapping software (such as Crossroads) or any other data sources.

- Please explain how “incremental approach” has been pursued if CM R15, R16, R17 or R18 is proposed. Please skip this question of none of these CMs are being proposed.

  Countermeasure R15 (Widen shoulder), R16 (Curve shoulder widening (outside only)), R17 (Improve horizontal alignment (flatten curves)) and R18 (Flatten crest vertical curve) are not eligible unless they are done as the last step of an "incremental approach". Applicants need to document they have already installed lower cost and lower impact CMs but the crash rate is unacceptably high. What safety improvements have been pursued and installed at the project sites within the last ten years?

  Applicants need to demonstrate lower cost and lower impact CMs have already installed, such as signing/striping upgrades to MUTCD standards/recommendations, rumble strips, improving pavement friction (High Friction Surface Treatment, or HFST), etc. You have already monitored the crash occurrences after these improvements were installed, and the 'after' crash rate is still unacceptably high. In addition, a summary of the 'before' and 'after' crash analysis is preferred and provided as the last attached to the HSIP Application Form.

  If “incremental approach” has not been pursued while CM R15, R16, R17 or R18 is proposed, please explain why a special exception should be made to your application.

III.1: List of project locations

List all locations/sites included in this project. Please note all locations/sites must be of the location type as entered on page 1.

One location is pre-populated for each location group. Click “+” button to add a new line, or click “-” to delete an existing line. Enter a location description for each line.

The locations may be intersections or roadway sections, e.g. “Intersection of A St. and B St.”, “A St. between B St. and C St.”, etc. If your project has a large number of locations, please aggregate some locations into one description, e.g. 10 stop controlled intersections, 5 horizontal curves, etc., as long as they have similar features and the safety improvements to be implemented are the same.

The locations in this list will be pre-populated in the crash data table(s) in Section III.2.

III.2: Countermeasures and crash data

1) Countermeasures to be applied: The CM information is pre-populated from the inputs on page 1. Each CM has a corresponding crash type that the CM targets. The crash types are: “All”, “Night”, “Ped & Bike”, etc.
“Emergency Vehicle” and “Animal”. Each of the later four is a subset of the first. Based on the CMs for the project, only the tables for the required crash data types are displayed.

**Note:** If a “roundabout” CM, i.e. S16, NS04 or NS05 (CM ID), is used, the below information is required as the benefit calculation for roundabouts is different from the other CMs.

- Project location: “Urban” or “Rural” (select from dropdown list)
- Intersection type: “Full Intersection” or “T intersection” (select from dropdown list)
- Roundabout: “1 lane” or “2 lanes” (select from dropdown list)
- Average Daily Traffic (ADT), Major Road: ADT on the major road of the intersection
- Average Daily Traffic (ADT), Minor Road: ADT on the cross road of the intersection

2) Enter the date range of the crash data. The crash data time period must be a minimum of 3 years and a maximum of 5 years. The most recent available crash data must be used.

3) Based on the CMs that are selected, crash data tables of the required categories ("All", "Night", “Ped & Bike", "Emergency Vehicle", and "Animal") are displayed for data entry.

### Important information regarding countermeasures and crash data

Below is more information and explanations regarding countermeasures and crash data. Please read and make sure the data provided are correct. Past HSIP calls for projects indicated that the most flaws found in disqualified applications are related to misapplication of countermeasures and miscounting of crash data.

**Safety Countermeasures vs. Crash Data Tables**

A total of 82 countermeasures are available to be utilized in the HSIP Analyzer. Different countermeasures may target different crash types. For example, installing a new signal at an intersection intends to reduce crashes of all types, while installing pedestrian countdown signal heads only reduces crashes related to pedestrians and bicyclists (Ped & Bike), and adding intersection lighting targets crashes at night only.

For the use of the HSIP Analysis, there are 5 different crash types: “All”, “Night”, “Ped & Bike”, “Emergency Vehicle” and “Animal”. Each of the later four datasets is a sub-dataset of the "All" dataset. Refer to the Appendix for more information. In the 82 countermeasures listed in the Appendix, 59 are for crashes of all types, 18 for Ped&Bike crashes, 3 for night crashes, 1 for crashes with emergency vehicles, and 1 for crashes with animals involved.

Depending on the selected countermeasures, you will be required to fill in one or more crash data tables, for one or a combination of the five crash types. For example, if two countermeasures are utilized in a group – “Install flashing beacons as advance warning” (Countermeasure S10) and “Add intersection lighting” (Countermeasure S01), two crash data tables are required, one for all crashes (for S10) and the other for night crashes (for S01).

**Crash Data Table**

A Crash Data Table is a summary table of crash data for all the locations included in the project, with one row for one location and one column for a severity. Below is the structure of a Crash Data Table for Ped&Bike crashes.

**Example:** **Crash Data Table for Crash Type: Pedestrians and Bicyclists Involved**

<table>
<thead>
<tr>
<th>Location</th>
<th>Fatality</th>
<th>Severe Injury</th>
<th>Injury - Other Visible</th>
<th>Injury - Complaint of Pain</th>
<th>Property Damage Only</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersection of A St. &amp; B St.</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Intersection of A St. &amp; C St.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Intersection of A St. &amp; D St.</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1</strong></td>
<td><strong>4</strong></td>
<td><strong>2</strong></td>
<td><strong>9</strong></td>
<td><strong>18</strong></td>
<td><strong>34</strong></td>
</tr>
</tbody>
</table>
Safety countermeasures available for use in HSIP Analyzer

The available countermeasures are broken down into three groups (Signalized Intersection, Non-signalized Intersection, and Roadway Segment). The Appendix of this document provides a complete list of the countermeasures. Review Section 4.0 and Appendix B of the California Local Roadway Safety Manual before making the final selection of countermeasures to utilize in the BCR calculations. The detailed description of the countermeasures and guidance on how they can be applied will help applicants ensure they are utilizing the most appropriate countermeasures for their projects.

Any single project may use up to three countermeasures. When a countermeasure of a major safety improvement is selected, other incidental elements of the major countermeasure should be not used together with the major one. For example: A project proposing a new signal shall not include countermeasures for lighting, signing, striping, or minor median improvements as they are incidental elements of the new signal and do not represent stand-alone improvements.

Specific rules for some particular countermeasures

Please pay attention to the specific rules and requirements pertaining to CMs NS03, NS14, NS23PB, R08 and R14 (Refer to Appendix B of the California Local Roadway Safety Manual for more details):

1) NS03, Install signals:

   All new signals must meet CA MUTCD "safety" warrants: 4, 5 or 7;
   No other intersection CMs can be applied to the intersection crashes in conjunction with this CM.

2) NS14, Install raised median on approaches (NS.I.)
   R08, Install raised median

   All new raised medians must not include the removal of the existing roadway structural section and must be dowelled into the existing roadway surface.

3) NS23PB, Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK)):

   For HAWK or other pedestrian signals, the justification may be Warrant 4, 5 and/or 7, or passing the test in Figure 4F-1/4F-2 in Chapter 4F of CA MUTCD. Please refer to Chapter 4F of CA MUTCD for more details.

4) R14, Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes):

   "Intersection" crashes can only be applied when they resulted from turning movements that had no designated turn lanes/phases in the existing condition and the Road Diet will provide turn lanes/phases for these movements. This CM does not apply to roadway sections that already included left turn lanes or two way left turn lanes before the lane reductions. New bike lanes are also expected to be part of these projects. Pre-approval from the HSIP program manager is needed for: 1) the use of this CM without removing a travel lane in each direction and/or without adding new bike lanes; and/or 2) if any pavement is planned to be removed for the purpose of adding landscaping, planter-boxes, or other non-roadway user features.

Crash Data

1) Crash data time period:

   The crash data time period must be a minimum of 3 years and a maximum of 5 years and the most recent available crash data must be used.

2) Multiple crash data tables may be needed for a group. Depending on the selected countermeasure(s), different categories of the crash data are required. Each table is for one of the 5 categories (dataset/sub-datasets): All; Night; Ped & Bike; Emergency Vehicle; and Animal.

3) There are three sub-severities of injury crashes: “Severe Injury”, “Injury – Other Visible” and “Injury – Complaint of Paint”. If the injury crashes in your agency’s crash database do not have more detailed sub-severities, all of the injury crashes must be entered as “Injury – Other Visible”.

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4) Every occurrence of crash applied to the countermeasures is be counted as one crash, regardless of the number of vehicles and the number of people involved in the crash. For example, if there is one crash which involved three vehicles and caused two injuries and one fatality, the crash would be tracked in the application as 1 fatal crash.

5) Collision Diagrams and Collision lists:

Applicants are required to provide Collision Diagrams and Collision Lists as supporting documents (attachments) to the application. The Collision Diagrams and the Collision Lists should be organized so application reviewers can easily identify the collision data and their corresponding project locations.

6) **All crashes applied to a given countermeasure must be within the countermeasures influence-area.**

The following are some general criteria to guide the applicants in determining appropriate influence-areas for countermeasures. Before applying these general criteria, it is the applicant’s responsibility to ensure that they are reasonable for their particular application. (More guidance relating to each specific countermeasure is included in Section 4 and Appendix B of the California Local Roadway Safety Manual).

- b) For intersection improvements, collisions that occurred within 250 feet of the intersection in all directions affected by the improvement may be used. If the distance to the nearest intersection is less than 500 feet, only those collisions that occurred from mid-block may be used.
- c) Longitudinal Improvements (guardrail, raised median, turn pockets, etc): All crashes potentially effected by and within the limits of the improvement.
- d) Signage, striping, delineators, or other warning devices: All crashes potentially effected by and/or within the limits of the driver's potential reaction to the improvements.
- e) The influence-area may be extended beyond the physical improvements and/or the limits above if standard traffic engineering principles, as documented in Caltrans, American Association of State Highway and Transportation Officials (AASHTO) or FHWA publications, suggest it would be appropriate to do so. When the influence-area of the project is not obvious and judgment has been used in identifying the influence-area, it is the applicant’s responsibility to provide additional documentation showing the reasonableness of the judgment.

7) Do not include collisions unreported by law enforcement. Collision summary reports that corroborate the collision numbers must be attached to the application. Do not attach the actual collision reports prepared by the law enforcement officer. For applicants using TIMS Query & Map tool to analyze and summarize SWITRS crash data, applicants may find it necessary to add in known crashes that were not included in the TIMS summaries. These crashes may be added manually as long as the agency’s safety managers include supporting documentation and a comment and/or signature attesting to the source of these crashes and the accuracy of the total crash data.

8) The safety countermeasures constructed by the projects will not eliminate 100% of the safety risks and future crashes. This is especially true for lower-cost systemic improvements, such as signing and striping projects. Based on this, it is often reasonable for an agency to construct follow-up improvements along a corridor or at a location that has already had an HSIP project constructed. (Example: an agency has completed a striping upgrade project on a corridor. In a later HSIP cycle, the agency proposes a signing project on the same corridor based on an overlapping set of crashes.) For this reason, Caltrans allows agencies to reuse crashes in a current call for projects that have been used in a prior call for projects. It is the agency’s responsibility to verify this and document it in the application in the Narrative Questions or separate backup documentation.
Section IV: Calculation and Results

Click the button Calculate to perform the calculation of the benefit and the BCR.

If errors are detected, the calculation will stop, and a table will display the errors. The errors must be fixed prior to the next calculation attempt.

The possible errors are:

- No location type (S/NS/R) is provided.
- No CMs are available for the location type.
- CMs S08 and S02 should not be used together.  
  *The work of S02 (“Improve signal hardware”) is considered as part of CM S08 (“Convert signal to mast arm”).*
- CM NS3 should not be used with any other CM.  
  *CM NS3 (“Install signals”) should cover any other intersection improvements.*
- Roundabout, when selected, should be the only CM.  
  *The benefit calculation for a roundabout is unique. It is not allowed to have a roundabout and other safety countermeasures in the same project.*
- Roundabout is the proposed work but roundabout information is not provided.
- Crash data period is not between 3 and 5 years.
- Num of crashes in a sub-dataset > the num in All dataset.  
  *For at least one of the severities, the number of crashes in a subset (“Night”, “Ped & Bike”, “Emergency Vehicle”, or “Animal”) is more than the corresponding severity in “All” crashes.*

After the errors are fixed and the calculation is successfully performed, the results are presented in two tables: “Benefit Summary” and “BCR and other key information”. Please transfer the "Total Project Cost", "HSIP Funds Requested" and the BCR to Page 2 of the HSIP Application Form.
Appendix: List of Countermeasures
(From Local Roadway Safety Manual – Section 4.2)

The list of countermeasures is from Section 4.2 of the Local Roadway Safety Manual. It is provided here for your convenience.

The countermeasures listed in the following three tables have been sorted into 3 categories: Signalized Intersection (S), Non-Signalized Intersection (NS), and Roadway Segment (R). Pedestrian and bicycle related countermeasures have been included in each of these categories, as the consideration of non-motorized travel is important for all roadway classifications and locations. The countermeasures included in these tables are used in the HSIP Analyzer. When selecting countermeasures and CRFs to apply to their specific safety needs, local agency safety practitioners should consider the availability, applicability, and quality of CMFs, as discussed in section 4.1 of the Local Roadway Safety Manual.

Only Crash Types, CRFs, Expected Lives, and Funding Eligibility of the countermeasures for use in Caltrans local HSIP program are provided. Fields in the countermeasure tables are:

- **CRF** - Crash Reduction Factor used for HSIP calls-for-projects.
- **Expected Life** - 10 years or 20 years.
- **Funding Eligibility** – the maximum HSIP funding reimbursement ratio.
  - Forty (45) countermeasures: 100%
  - Thirty-five (36) countermeasures: 90%
  - One (1) countermeasure: 50% (CM No. S03: Improve signal timing, as this CM will improve the signal operation rather than merely the safety.)
### Table 1. Countermeasures for Signalized Intersections

<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>Countermeasure Name</th>
<th>Crash Type</th>
<th>CRF</th>
<th>Expected Life (Years)</th>
<th>HSIP Funding Eligibility</th>
<th>Systemic Approach Opportunity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>S01</td>
<td>Lighting</td>
<td>Add intersection lighting (S.I.)</td>
<td>Night</td>
<td>40%</td>
<td>20</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>S02</td>
<td>Signal Mod.</td>
<td>Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number</td>
<td>All</td>
<td>15%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>S03</td>
<td>Signal Mod.</td>
<td>Improve signal timing (coordination, phases, red, yellow, or operation)</td>
<td>All</td>
<td>15%</td>
<td>10</td>
<td>50%</td>
<td>Very High</td>
</tr>
<tr>
<td>S04</td>
<td>Signal Mod.</td>
<td>Provide Advanced Dilemma Zone Detection for high speed approaches</td>
<td>All</td>
<td>40%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>S05</td>
<td>Signal Mod.</td>
<td>Install emergency vehicle pre-emption systems</td>
<td>Emergency Vehicle</td>
<td>70%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>S06</td>
<td>Signal Mod.</td>
<td>Install left-turn lane and add turn phase (signal has no left-turn lane or phase before)</td>
<td>All</td>
<td>55%</td>
<td>20</td>
<td>90%</td>
<td>Low</td>
</tr>
<tr>
<td>S07</td>
<td>Signal Mod.</td>
<td>Provide protected left turn phase (left turn lane already exists)</td>
<td>All</td>
<td>30%</td>
<td>20</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>S08</td>
<td>Signal Mod.</td>
<td>Convert signal to mast arm (from pedestal-mounted)</td>
<td>All</td>
<td>30%</td>
<td>20</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>S09</td>
<td>Operation/Warning</td>
<td>Install raised pavement markers and striping (Through Intersection)</td>
<td>All</td>
<td>10%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>S10</td>
<td>Operation/Warning</td>
<td>Install flashing beacons as advance warning (S.I.)</td>
<td>All</td>
<td>30%</td>
<td>10</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>S11</td>
<td>Operation/Warning</td>
<td>Improve pavement friction (High Friction Surface Treatments)</td>
<td>All</td>
<td>55%</td>
<td>10</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>S12</td>
<td>Geometric Mod.</td>
<td>Install raised median on approaches (S.I.)</td>
<td>All</td>
<td>25%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>S13PB</td>
<td>Geometric Mod.</td>
<td>Install pedestrian median fencing on approaches</td>
<td>P &amp; B</td>
<td>35%</td>
<td>20</td>
<td>90%</td>
<td>Low</td>
</tr>
<tr>
<td>S14</td>
<td>Geometric Mod.</td>
<td>Create directional median openings to allow (and restrict) left-turns and u-turns (S.I.)</td>
<td>All</td>
<td>50%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>S15</td>
<td>Geometric Mod.</td>
<td>Reduced Left-Turn Conflict Intersections (S.I.)</td>
<td>All</td>
<td>50%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>S16</td>
<td>Geometric Mod.</td>
<td>Convert intersection to roundabout (from signal)</td>
<td>All</td>
<td>Varies</td>
<td>20</td>
<td>100%</td>
<td>Low</td>
</tr>
<tr>
<td>S17PB</td>
<td>Ped and Bike</td>
<td>Install pedestrian countdown signal heads</td>
<td>P &amp; B</td>
<td>25%</td>
<td>20</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>S18PB</td>
<td>Ped and Bike</td>
<td>Install pedestrian crossing (S.I.)</td>
<td>P &amp; B</td>
<td>25%</td>
<td>20</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>S19PB</td>
<td>Ped and Bike</td>
<td>Pedestrian Scramble</td>
<td>P &amp; B</td>
<td>40%</td>
<td>20</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>S20PB</td>
<td>Ped and Bike</td>
<td>Install advance stop bar before crosswalk (Bicycle Box)</td>
<td>P &amp; B</td>
<td>15%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>S21PB</td>
<td>Ped and Bike</td>
<td>Modify signal phasing to implement a Leading Pedestrian Interval (LPI)</td>
<td>P &amp; B</td>
<td>60%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
</tbody>
</table>
### Table 2. Countermeasures for Non-Signalized Intersections

<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>Countermeasure Name</th>
<th>Crash Type</th>
<th>CRF</th>
<th>Expected Life (Years)</th>
<th>HSIP Funding Eligibility</th>
<th>Systemic Approach Opportunity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS01</td>
<td>Lighting</td>
<td>Add intersection lighting (NS.I.)</td>
<td>Night</td>
<td>40%</td>
<td>20</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS02</td>
<td>Control</td>
<td>Convert to all-way STOP control (from 2-way or Yield control)</td>
<td>All</td>
<td>50%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>NS03</td>
<td>Control</td>
<td>Install signals</td>
<td>All</td>
<td>30%</td>
<td>20</td>
<td>100%</td>
<td>Low</td>
</tr>
<tr>
<td>NS04</td>
<td>Control</td>
<td>Convert intersection to roundabout (from all way stop)</td>
<td>All</td>
<td>Varies</td>
<td>20</td>
<td>100%</td>
<td>Low</td>
</tr>
<tr>
<td>NS05</td>
<td>Control</td>
<td>Convert intersection to roundabout (from stop or yield control on minor road)</td>
<td>All</td>
<td>Varies</td>
<td>20</td>
<td>100%</td>
<td>Low</td>
</tr>
<tr>
<td>NS06</td>
<td>Operation/ Warning</td>
<td>Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs</td>
<td>All</td>
<td>15%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>NS07</td>
<td>Operation/ Warning</td>
<td>Upgrade intersection pavement markings (NS.I.)</td>
<td>All</td>
<td>25%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>NS08</td>
<td>Operation/ Warning</td>
<td>Install Flashing Beacons at Stop-Controlled Intersections</td>
<td>All</td>
<td>15%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>NS09</td>
<td>Operation/ Warning</td>
<td>Install flashing beacons as advance warning (NS.I.)</td>
<td>All</td>
<td>30%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>NS10</td>
<td>Operation/ Warning</td>
<td>Install transverse rumble strips on approaches</td>
<td>All</td>
<td>20%</td>
<td>10</td>
<td>90%</td>
<td>High</td>
</tr>
<tr>
<td>NS11</td>
<td>Operation/ Warning</td>
<td>Improve sight distance to intersection (Clear Sight Triangles)</td>
<td>All</td>
<td>20%</td>
<td>10</td>
<td>90%</td>
<td>High</td>
</tr>
<tr>
<td>NS12</td>
<td>Operation/ Warning</td>
<td>Improve pavement friction (High Friction Surface Treatments)</td>
<td>All</td>
<td>55%</td>
<td>10</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS13</td>
<td>Geometric Mod.</td>
<td>Install splitter-islands on the minor road approaches</td>
<td>All</td>
<td>40%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS14</td>
<td>Geometric Mod.</td>
<td>Install raised median on approaches (NS.I.)</td>
<td>All</td>
<td>25%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS15</td>
<td>Geometric Mod.</td>
<td>Create directional median openings to allow (and restrict) left-turns and u-turns (NS.I.)</td>
<td>All</td>
<td>50%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS16</td>
<td>Geometric Mod.</td>
<td>Reduced Left-Turn Conflict Intersections (NS.I.)</td>
<td>All</td>
<td>50%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS17</td>
<td>Geometric Mod.</td>
<td>Install right-turn lane (NS.I.)</td>
<td>All</td>
<td>20%</td>
<td>20</td>
<td>90%</td>
<td>Low</td>
</tr>
<tr>
<td>NS18</td>
<td>Geometric Mod.</td>
<td>Install left-turn lane (where no left-turn lane exists)</td>
<td>All</td>
<td>35%</td>
<td>20</td>
<td>90%</td>
<td>Low</td>
</tr>
<tr>
<td>NS19PB</td>
<td>Ped and Bike</td>
<td>Install raised medians / refuge islands (NS.I.)</td>
<td>Ped and Bike</td>
<td>45%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS20PB</td>
<td>Ped and Bike</td>
<td>Install pedestrian crossing at uncontrolled locations (new signs and markings only)</td>
<td>Ped and Bike</td>
<td>25%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>NS21PB</td>
<td>Ped and Bike</td>
<td>Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)</td>
<td>Ped and Bike</td>
<td>35%</td>
<td>20</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS22PB</td>
<td>Ped and Bike</td>
<td>Install Rectangular Rapid Flashing Beacon (RRFB)</td>
<td>Ped and Bike</td>
<td>35%</td>
<td>20</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>NS23PB</td>
<td>Ped and Bike</td>
<td>Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK))</td>
<td>Ped and Bike</td>
<td>55%</td>
<td>20</td>
<td>100%</td>
<td>Low</td>
</tr>
</tbody>
</table>
### Table 3. Countermeasures for Roadways

<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>Countermeasure Name</th>
<th>Crash Type</th>
<th>CRF</th>
<th>Expected Life (Years)</th>
<th>HSIP Funding Eligibility</th>
<th>Systemic Approach Opportunity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>R01</td>
<td>Lighting</td>
<td>Add segment lighting</td>
<td>Night</td>
<td>35%</td>
<td>20</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>R02</td>
<td>Remove/ Shield Obstacles</td>
<td>Remove or relocate fixed objects outside of Clear Recovery Zone</td>
<td>All</td>
<td>35%</td>
<td>20</td>
<td>90%</td>
<td>High</td>
</tr>
<tr>
<td>R03</td>
<td>Remove/ Shield Obstacles</td>
<td>Install Median Barrier</td>
<td>All</td>
<td>25%</td>
<td>20</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>R04</td>
<td>Remove/ Shield Obstacles</td>
<td>Install Guardrail</td>
<td>All</td>
<td>25%</td>
<td>20</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>R05</td>
<td>Remove/ Shield Obstacles</td>
<td>Install impact attenuators</td>
<td>All</td>
<td>25%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>R06</td>
<td>Remove/ Shield Obstacles</td>
<td>Flatten side slopes</td>
<td>All</td>
<td>30%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R07</td>
<td>Remove/ Shield Obstacles</td>
<td>Flatten side slopes and remove guardrail</td>
<td>All</td>
<td>40%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R08</td>
<td>Geometric Mod.</td>
<td>Install raised median</td>
<td>All</td>
<td>25%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R09</td>
<td>Geometric Mod.</td>
<td>Install median (flush)</td>
<td>All</td>
<td>15%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R10PB</td>
<td>Geometric Mod.</td>
<td>Install pedestrian median fencing on approaches</td>
<td>P &amp; B</td>
<td>35%</td>
<td>20</td>
<td>90%</td>
<td>Low</td>
</tr>
<tr>
<td>R11</td>
<td>Geometric Mod.</td>
<td>Install acceleration/ deceleration lanes</td>
<td>All</td>
<td>25%</td>
<td>20</td>
<td>90%</td>
<td>Low</td>
</tr>
<tr>
<td>R12</td>
<td>Geometric Mod.</td>
<td>Widen lane (initially less than 10 ft)</td>
<td>All</td>
<td>25%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R13</td>
<td>Geometric Mod.</td>
<td>Add two-way left-turn lane (without reducing travel lanes)</td>
<td>All</td>
<td>30%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R14</td>
<td>Geometric Mod.</td>
<td>Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)</td>
<td>All</td>
<td>30%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R15</td>
<td>Geometric Mod.</td>
<td>Widen shoulder</td>
<td>All</td>
<td>30%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R16</td>
<td>Geometric Mod.</td>
<td>Curve Shoulder widening (Outside Only)</td>
<td>All</td>
<td>45%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R17</td>
<td>Geometric Mod.</td>
<td>Improve horizontal alignment (flatten curves)</td>
<td>All</td>
<td>50%</td>
<td>20</td>
<td>90%</td>
<td>Low</td>
</tr>
<tr>
<td>R18</td>
<td>Geometric Mod.</td>
<td>Flatten crest vertical curve</td>
<td>All</td>
<td>25%</td>
<td>20</td>
<td>90%</td>
<td>Low</td>
</tr>
<tr>
<td>R19</td>
<td>Geometric Mod.</td>
<td>Improve curve superelevation</td>
<td>All</td>
<td>45%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R20</td>
<td>Geometric Mod.</td>
<td>Convert from two-way to one-way traffic</td>
<td>All</td>
<td>35%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R21</td>
<td>Geometric Mod.</td>
<td>Improve pavement friction (High Friction Surface Treatments)</td>
<td>All</td>
<td>55%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
</tbody>
</table>
### Table 3. Countermeasures for Roadways (Continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>Countermeasure Name</th>
<th>Crash Type</th>
<th>CRF</th>
<th>Expected Life (Years)</th>
<th>HSIP Funding Eligibility</th>
<th>Systemic Approach Opportunity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>R22</td>
<td>Operation/ Warning</td>
<td>Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)</td>
<td>All</td>
<td>15%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>R23</td>
<td>Operation/ Warning</td>
<td>Install chevron signs on horizontal curves</td>
<td>All</td>
<td>40%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>R24</td>
<td>Operation/ Warning</td>
<td>Install curve advance warning signs</td>
<td>All</td>
<td>25%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>R25</td>
<td>Operation/ Warning</td>
<td>Install curve advance warning signs (flashing beacon)</td>
<td>All</td>
<td>30%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>R26</td>
<td>Operation/ Warning</td>
<td>Install dynamic/variable speed warning signs</td>
<td>All</td>
<td>30%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>R27</td>
<td>Operation/ Warning</td>
<td>Install delineators, reflectors and/or object markers</td>
<td>All</td>
<td>15%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>R28</td>
<td>Operation/ Warning</td>
<td>Install edge-lines and centerlines</td>
<td>All</td>
<td>25%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>R29</td>
<td>Operation/ Warning</td>
<td>Install no-passing line</td>
<td>All</td>
<td>45%</td>
<td>10</td>
<td>100%</td>
<td>Very High</td>
</tr>
<tr>
<td>R30</td>
<td>Operation/ Warning</td>
<td>Install centerline rumble strips/stripes</td>
<td>All</td>
<td>20%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>R31</td>
<td>Operation/ Warning</td>
<td>Install edgeline rumble strips/stripes</td>
<td>All</td>
<td>15%</td>
<td>10</td>
<td>100%</td>
<td>High</td>
</tr>
<tr>
<td>R32PB</td>
<td>Ped and Bike</td>
<td>Install bike lanes</td>
<td>P &amp; B</td>
<td>35%</td>
<td>20</td>
<td>90%</td>
<td>High</td>
</tr>
<tr>
<td>R33PB</td>
<td>Ped and Bike</td>
<td>Install Separated Bike Lanes</td>
<td>P &amp; B</td>
<td>45%</td>
<td>20</td>
<td>90%</td>
<td>High</td>
</tr>
<tr>
<td>R34PB</td>
<td>Ped and Bike</td>
<td>Install sidewalk/pathway (to avoid walking along roadway)</td>
<td>P &amp; B</td>
<td>80%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R35PB</td>
<td>Ped &amp; Bike</td>
<td>Install/upgrade pedestrian crossing (with enhanced safety features)</td>
<td>P &amp; B</td>
<td>35%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R36PB</td>
<td>Ped and Bike</td>
<td>Install raised pedestrian crossing</td>
<td>P &amp; B</td>
<td>35%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
<tr>
<td>R37PB</td>
<td>Ped and Bike</td>
<td>Install Rectangular Rapid Flashing Beacon (RRFB)</td>
<td>P &amp; B</td>
<td>35%</td>
<td>20</td>
<td>100%</td>
<td>Medium</td>
</tr>
<tr>
<td>R38</td>
<td>Animal</td>
<td>Install animal fencing</td>
<td>Animal</td>
<td>80%</td>
<td>20</td>
<td>90%</td>
<td>Medium</td>
</tr>
</tbody>
</table>