Submitting HSIP Applications for

Roadway Safety Signing Upgrades and Audits

A Placer County Example and Guide

Background

This document is intended to be a guide for California local agencies looking to fund roadway signing upgrades by way of a Signing Upgrade project and Roadway Safety Signing Audit (RSSAs) thru the Highway Safety Improvement Program (HSIP). It encourages agencies to go beyond sign panel and other basic sign upgrades and instead complete a comprehensive review of the roadway safety signing and to make all necessary sign improvements at one time using what this document refers to as a Signing Upgrade project and Roadway Safety Signing Audit (RSSAs).

"Our primary modifications to roadway segments and intersections, which have been identified for safety review under our local Traffic Safety Program, have been related to roadway sign modifications", says an official from Placer County. "We have implemented an annual roadway collision analysis, a more encompassing version of RSSAs, within Placer County and have found that roadside safety sign locations, sheeting, size, etc. have a dramatic effect on overall roadway safety, represented in collision history."

This conclusion from traffic safety personal at Placer County spurred conversations with Caltrans Local Assistance staff related to the use of HSIP funds for RSSAs and Sign Upgrades. As a result of this cross-agency collaboration, this document was created as an example to aid all statewide local agencies interested in applying for federal funding for signing upgrade projects.

The goal of this document is to encourage local agencies to apply for HSIP funds for both signing upgrades and RSSAs by outlining the steps necessary to obtain collision history data and translate it into an HSIP application thru a benefit cost assessment. The time and expense of completing the formal RSSAs would be completed in the PE Phase of an awarded project, allowing all the expenses, aside from a local match requirement, of such an audit to be federally reimbursable to the agency. The expectation being that this will encourage more agencies to incorporate RSSAs into their signing upgrade projects as well as other types of low-cost systematic improvements.

"Spot sign upgrades are important, but an understanding of the roadway network as a whole through a RSSA is an invaluable process resulting in a proactive approach to traffic safety which is expected to prevent fatalities and injury collisions from occurring in the future. A reactionary approach to collision history at a particular location may alleviate a spot problem, but miss this same situation in other instances along a roadway or entire local network. This same situation somewhere else may have an equal potential for collisions which may not have occurred yet. A multi-corridor or network-wide Roadway Safety Sign Audit would identify these similar locations and recommend similar solutions, thus reducing collision potential."

It is important to note that there are many other types of systematic corridor or network wide improvements which could be applicable to a similar type application and project development process (i.e. striping, rumble strips, pavement markings, guardrail, High Friction Surface Treatment (HFST), etc.)

Preparing HSIP Applications for RSSAs & Signing Upgrade Projects

The following steps represent one-option for completing signing upgrade HSIP applications and ultimately RSSAs. It should be noted again that there are many other viable options for completing these projects that are not included in this document. Safety practitioners are encouraged to consider these general steps as they prepare applications for sign upgrade projects or other types of systematic corridor or network wide improvements (i.e. striping, rumble strips, pavement markings, guardrail, High Friction Surface Treatment (HFST), etc.)

A. Determine Initial Project Limits:

1. Plot fatal and severe injury collisions using the local agency's preferred Collision Database/Program. Agencies are recommended to start with only fatality and serious injury collisions to significantly reduce the analysis required to complete the "Benefit" calculation of the HSIP Benefit-to-Cost (B/C) ratio calculation. Fatal and severe injury collisions often represent the largest "benefit" due to the severity of the crash. Other injury and non-injury collisions can ultimately be included in the Benefit calculation, if desired by the agency.

   Note: The SafeTREC TIMS tool is available to all California agencies and safety practitioners as an available tool if the local agency does not have a preferred collision database program. http://www.tims.berkeley.edu/

2. Select corridor(s) or networks to make up the initial scope of the HSIP project. With initial collision data, safety practitioners should consider similar roadway characteristics in choosing the corridors/network project limits. This may include volumes, geometric similarities, functional classifications, or proximity to the initial chosen roadway. Documenting the selection of the roadways subject to improvements is critical and should be based on some kind of "same kind" data where collision data is not present.

B. Determine Project Benefits:

1. Review Crash History and Existing Signing: Once the corridor(s) have been identified for the project application, identify the existing roadway safety-related signs (i.e. warning, object markers, delineators, etc.) along the corridor/roadway(s). *The Caltrans Local Roadway Safety Manual has identified countermeasures (CM) for sign upgrade improvements for HSIP Applications (See Section 4 and Appendix B). "Roadway Countermeasures", R26-R31, are typical countermeasures that agencies may use, but others can also be used in these types of low-cost corridor/systematic projects.*

   http://www.dot.ca.gov/hq/LocalPrograms/HSIP/safetymanual-2012-04-22.pdf

2. For each of the fatal and severe injury collisions (from the TIMS or other database information), identify all existing safety-related signs with reasonable influence areas that encompass the location of the collisions.

3. For each of the fatal and severe injury collisions, identify all locations where the installation of new safety related signs (per MUTCD standards) would be appropriate and provide additional safety/warning guidance to the roadway users.

4. Identify the CMs in the Caltrans Local Roadway Safety Manual that represent one or more of the new and existing safety-related signing improvements indentified in the previous two steps.

5. Summarize the number fatal and severe injury collisions that have occurred within influence area of each of the individual CMs indentified in the previous step.

6. Identify the 3 CMs that will likely result in the greatest overall B/C ratio for the project (Up to three CMs can be used in the B/C calculation

process for any one application). If additional types of safety improvements are part of the proposed project, they will be included in the projects "Cost" calculation, but not in the project's "Benefit" calculation.

Understanding the key factors that go into the overall "Benefit" calculation for each CM is an important part of this step – See Appendix D of the Caltrans Local Roadway Safety Manual.

- The Crash Reduction Factor (CRF),
- The expected life of the CM, and
- Association between Collision Cost and the Degree of Injury for each crash (i.e. fatal, Severe, etc.)

Remember: Only the collisions from 3 CMs can be taken forward into the HSIP B/C calculation process. As part of the application requirements, a collision diagram must be prepared for each of these 3 CMs showing all collisions tied to each CM.

7. All information is now complete for the "Benefit" aspects of the Local-HSIP application process. This information will be inserted into the TIMS B/C calculation tool.

C. Calculate Project Costs:

The process of determining the Project's "Benefits" only focused on the safety-related sign improvements directly connected to past collisions. For most "Roadway Safety Signing Audits and Upgrade Projects", these improvements only represent a small portion of the total signing improvements in the project's overall scope of work. The calculation of the project's "Cost" to be included in the B/C ratio calculations must include the agency's best estimate of all signing improvements as well as all project delivery costs. For this example/document, the improvements will be broken down into three general types:

Upgrade existing signs
i.e. new sheeting, larger signs. Countermeasure #R26, NS5

Install new signs
i.e. chevrons, delineators, object markers, advance warning signs. Countermeasure #R27, R28, R29, R30, R31, NS5, NS7, NS8

Relocated signs
i.e. advance warning sign compliance with MUTCD Countermeasure # R28.

1. Start with all the existing roadway safety-related signs within the overall project limits (identified earlier). Estimate the percentage,

number, and costs of these existing signs that will be upgraded as part of the project. *This estimate will require engineering judgment. Often, not all existing signs need to be upgraded or relocated. Some signs will need to be upgraded and relocated. In addition, the costs per sign will vary greatly depending on economics of scale and site conditions.*

- **Upgrade existing signs**
  Example: 1000 total existing signs along the corridor. 80% need to be upgraded (R26) at $100/sign = $80,000
- **Relocate existing signs**
  Example: 1000 total existing signs along the corridor. 60% need to be re-installed in the correct locations per MUTCD standards for curve warning distanced (R28) at $50/sign = $30,000

2. Estimate the percentage, number, and cost of additional safety-related signs that will be identified in the RSSA and added as part of the project. *This estimate will require engineering judgment.*

   - **Install New signs**
     Example: 1000 total existing signs along the corridor. 30% new signs needed (R27, R28, R31) at $200/sign = $60,000

3. Estimate Total Signing Cost (Upgrades, Relocations, and New):

   Total for above example →$80,000 + $30,000 + $60,000 = $170,000 for signs in the corridor.

4. Estimate Total Project Costs:

   The total project cost needs to include the Total Signing Construction Costs, all other incidental Constructions Costs (mobilization, etc.), Preliminary Engineering Costs (the detailed Roadway Safety Signing Audit will be performed here), ROW Costs, and Construction Inspection/Engineering Costs required to complete the project.

   Note: Given the relatively low construction cost of signing improvements and the resource-intensive PE nature of completing RSSAs (see appropriate section/steps below), Caltrans Local-HSIP Program Coordinators will consider and anticipate granting exceptions to allow the PE Phase costs to be greater than 25% of the Engineer's Construction Cost Estimate. If needed, an exception should be requesting for individual projects during the application preparation process.

5. Important Consideration:

   As part of this approach for corridor/network roadway safety signing audit (RSSA) and upgrade projects, it should be understood that the

process outlined in this document will result in a preliminary scope and estimate for a HSIP RSSA and signing Upgrade project application. The actual number of sign improvements and overall costs can only be established after the comprehensive analysis of the corridor safety signing needs, which under this approach is completed as part of the preliminary engineering portion of the project after federal funding is secured. It is also to be understood that if those numbers and costs are underestimated in the application, the agency cannot expect to receive additional federal funds to fully fund all elements of the project.

D. Calculate Benefit/Cost (B/C) Ratio:

1. The B/C ratio can be calculated by simply inserting the collision and cost information calculation in earlier steps into the SafeTREC TIMS B/C calculation tool. Note: This is a required part of submitting HSIP Applications.

   For the detailed calculations supporting the TIMS B/C tool, see Appendix D of the Caltrans Local Roadway Safety Manual

   http://www.dot.ca.gov/hq/LocalPrograms/HSIP/safetymanual-2012-04-22.pdf

E. Reconsider Project Limits and Project Scope based on the initial B/C ratio:

In general, these types of RSSA and signing upgrade projects are expected to result in project applications with very high B/C ratios (10+ to 100+). Projects which result high initial B/C ratios (i.e. 30+) represent perfect opportunities for local agencies to make additional safety-related signing improvements on their lowest volume corridors, which often have lower numbers of crashes. The following represent three possible scenarios where the local agency may want to reconsider their project limits and proposed scope to include these low volume roadways into the project scope (calculated in steps A thru C above):

1. For projects with **HIGH** initial B/C's::
   Local agencies may want to simply include extra low volume corridors into their project scope and project costs, without even bringing in the additional crash data on these corridors. This may result in a significantly lower B/C for the project, but if the resulting B/C is still greater than 15 or 20, the agency may feel highly competitive with this B/C ratio.

2. For projects with **MEDIUM** initial B/C's:
   Local agencies may also want to factor in the additional crashes from the new low-crash corridors to increase both the project

"Benefits" and the project "Costs" as a result of the new scope. By adding in extra benefits and costs, the new B/C may go down, but not as much as only adding in costs. If the resulting B/C drops significantly the agency may have to rethink adding in the new scope.

3. <u>For projects with **LOW** initial B/C's:</u>
   If the initial B/C is lower than the agency feels comfortable with, they should also consider factoring in all injury and Property Damage Only (PDO) collisions into their project "Benefit" or reducing some of the higher "cost" scope that does not correspond to a high benefit. The agency may not want to modify the scope to add roadways with lower crash data. Be advised that these changes to the scope could also lower the B/C further and increases the chances that the project will not get funded.

   NOTE: As Agencies reconsider the ideal scope for their projects, they must remember that the minimum B/C ratio to receive funding will change for every call for projects. If/when the funding-size of the Call goes down, it would be reasonable to expect the minimum B/C to receive funding will go up. As more agencies focus on lower-cost, systematic improvements to higher crash locations, this will tend to push the minimum B/C higher.

F. Prepare the HSIP Application

1. Refer to Caltrans Local Assistance website for the HSIP guidelines, application form, application instructions, engineer's estimate template, and other information necessary to prepare a successful and complete application. http://www.dot.ca.gov/hq/LocalPrograms/hsip.htm

2. Download HSIP application and fill in fields

3. Prepare Application Attachments:

   - Vicinity/Location map, including limits of all corridors/roadways
   - Project Map – existing and proposed conditions (include photos if available)
   - Collisions diagram(s)
   - Collision summary report
   - TIMS B/C calculation output sheet
   - Detailed Engineer's Estimate

G. **The application is funded!!!**

(This is a key assumption before the remaining steps can be completed using federal HSIP funding. If an RSSA and Signing Upgrade application is submitted and NOT funded, then the above steps need to be redone during a future call-for-projects and the agency needs to ensure the new B/C is significantly higher.)

Delivering HSIP RSSAs & Signing Upgrade Projects

The following steps/elements of completing RSSAs are key steps for local agencies to understand their roadway signing status and needs. It should be understood that there may be many other viable steps/elements not included in this document. Safety practitioners are encouraged to consider these general steps as they estimate the costs to prepare RSSAs and as they complete the actual RSSAs for sign upgrade projects. As mentioned earlier, similar steps/elements could be used to complete Roadway Safety Audits as part of the PE Phase of other types of systematic corridor or network wide improvements (i.e. striping, rumble strips, pavement markings, guardrail projects, etc.)

A. Completing the detailed Roadway Safety Signing Audit (RSSA)

1. Outline the Objective:
   - "Increase roadway safety thru review and upgrade of roadway warning and intersection signs to comply with MUTCD standards as well as provide a clear message to traveling public of roadway features that may not be readily apparent."

2. Review Corridor(s)/Network Collisions included in HSIP Grant
   - Agency needs to map and review all past collisions (not just the fatal and severe injury crashes that were looked at during the application phase) within the project limits.

3. Identify Existing Assets and Resources:
   - Sign Log – electronic database, file or manual
     - → Catalog existing signs along identified corridor(s)
     - → Is there a desire to have GPS coordinates for integration into GIS?
     - → Size, height, retro reflectivity, speeds
     - → Current Ball Bank, Speed Surveys,
     - → Posted or Prima Facia Speed Limits in effect
   - ROW limitations (if any)

4. Collect Data
   - Perform Ball Bank and/or Speed Surveys in locations needed
     - → Current Ball Bank Standard (CA MUTCD Figure 2C-101 (CA))

- Determine horizontal and vertical alignment distances to objects associated with warning signs or obstructions (i.e. W1-1 is 500' from curve).

- Catalog other features of the roadway which may require additional notification to the driver: (i.e. railroad crossing, bridge locations, pedestrian and bicycle facilities, controlled intersections, etc.)

- Perform night review of the corridor

- Reference CA MUTCD Table 2C-1 for additional Warning Sign and Plaque reference

5. Determine existing sign compliance: (CA MUTCD 2012 Table Reference)

    - CA MUTCD Chapter 2C – Warning Signs and Object Markers

      http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/camutcd2012/Part2CF.pdf

    - CA MUTCD Chapter 2A – General

      http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/camutcd2012/Part2AB.pdf

    - "*Warning Signs should not be placed too far in advance of the conditions, such that drivers might tend to forget the warning because of other driving distractions, especially in urban areas*"
        - → Retro reflectivity - (Section 2A.07-.08, Table 2A-3)
        - → Size for speeds – (Table 2C-2 and 2C-2(CA)), (Table 2C-3)
        - → Horizontal Alignment Sign Selection – (Table 2C-5)
        - → Advance Placement Locations for Warning Signs – (Table 2C-4)
        - → Lateral Departure Location (Figure 2A-2)
        - → Curve warning compliance – (2C-1)
        - → Chevron Alignment Spacing – (Table 2C-6)

6. Input from Road Department

    - Date of Last night inspection
    - Routine Maintenance Schedules
    - Material and Labor Costs

- Staff time estimate for sign replacement and new sign install
- USA – location determination and marking

7. Project Costs:

- Identify the signs to be upgraded and new signs to be installed. Assign a cost to each action (i.e. new install, new sheeting, etc.)
- Prepare Detailed Engineer's Estimate
  - → Right of Way – Is this needed for sign install/relocation?
  - → Environmental – Are there sensitive roadside areas which may require additional study not covered by Categorical Exemption?
  - → Preliminary Engineering – Cost associated with administering grant delivery requirements
  - → Construction Costs – Materials and Labor (w/ hours for USA identifications)
  - → Construction Inspect./Engineering – if necessary

I. Environmentally clear, prepare final design and construct the comprehensive roadway safety signing package identified in the Roadway Safety Signing Audit (RSSA)

J. The agency has now completed comprehensive corridor/network-wide Signing Upgrades!!