PD-04: Highway and Traffic Safety

1-10 points

Goal: Safeguard human health and reduce social and economic impacts from crashes by incorporating science-based quantitative safety analysis processes within project development that will reduce serious injuries and fatalities within the project footprint.

Affected Triple Bottom Line Principles

Sustainability Linkage

Reducing fatal and serious injuries contributes to the social and economic principles by reducing the impacts associated with personal and public property damage, injury, and loss of life.

Background and Scoring Requirements

Background

For the purpose of this criterion, the key terms are defined as follows:

- **"Nominal safety"** – Refers to the extent to which a site (corridor, intersection, segment, or area) meets currently applicable design standards and guidelines. *Substantive* safety refers to actual or anticipated safety performance as defined by crash frequency and crash severity. Substantive safety reflects the science of safety: objective knowledge built on science-based discoveries of data-driven assessments of the safety impacts of road design, road user actions or behaviors, and vehicle attributes.
- **"Road Safety Audits" or "Road Safety Assessments"** – The formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. RSAs *qualitatively* report on potential road safety issues and identify opportunities for improvements in safety for all road users based on input from designers, traffic engineers, maintenance experts, law enforcement, and human factors experts. RSAs are particularly beneficial at the planning and design stages of project development. Guidance on RSAs can be found on the FHWA website[1].

Scoring Requirements

__**Requirement PD-04.1**__

2 points. Incorporate Human Factors Considerations into RSA

One of the following scores applies:

- **0 points.** Rely solely on published design and operational performance standards during the project development process.
- **2 points.** Evaluate, document, and incorporate interactions between road users and the roadway using fundamentals captured in Chapter 2 of the Highway Safety Manual[2] and the Human Factors Guideline for Road Systems3. Road Safety Audits (RSA)/Assessments are completed in accordance with FHWA's Road Safety Audit Guidelines and include human factors principles (from Chapter 2 of the Highway Safety Manual[2]and the Human Factors Guideline for Road Systems3).

Requirement PD-04.2

1 point. Build Awareness among the Public Regarding Contributing Factors to Crashes

Use media, for example the agency website or flyers, to raise awareness among the public about contributing factors to crashes on the existing facility or similar facilities on the network in a manner that is easy to understand. The purpose of these awareness efforts would be to support an improved understanding of road users about their personal responsibility in preventing crashes and to improve overall safety culture.

Requirement PD-04.3

1-6 points. Explicit Consideration of Safety using Quantitative, Scientifically Proven Methods

Best practices for using quantitative safety methods and measures to identify and evaluate, for example, safety improvements or actions, are presented in the advanced approaches in the HSM that account for regression to the mean (RTM), the impact of countermeasures presented in Part D of the HSM, and highly rated CMFs in the FHWA CMF Clearinghouse. Predictive methods for evaluation of quantitative safety refers to analytical approaches that result in a calculation of the predicted and/or expected frequency and/or severity of crashes for a given site or set of conditions. Such methods are described in the *AASHTO* Highway Safety Manual[2]. They incorporate the use of safety performance functions, crash modification factors that meet the HSM inclusion rules, and local or state-specific calibration.

Tools that can be used in this process include AASHTO SafetyAnalyst[4], the Interactive Highway Safety Design Model (IHSDM), spreadsheet tools developed to apply the predictive methods in the HSM, and analytical tools that use substantive safety as the basis of the analysis. While crash rates have been in use for many years, these (and other methods that do not account for the characteristics of crash data and the impact of, for example, RTM) do not represent state of the practice.

The Integrating the HSM into the Highway Project Development Process[5] guide describes examples of the application of the HSM in the project development process.

Incorporate substantive safety performance into project development decision-making through the use of scientifically proven and statistically reliable predictive methods for evaluation of quantitative safety. Significant project decisions include establishment of project type and design criteria, selection of project design alternatives, and development of preliminary and final design details, including the use of design exceptions as necessary.

No credit is given for using design and operational performance standards and guidelines to assess nominal safety of the project throughout the project development process; or using less reliable quantitative safety methods such as crash rates to forecast future anticipated safety performance; or conducting RSAs that only assess nominal safety performance to describe safety (for example, assessing and documenting whether design standards and guidelines are met).

Scoring for this requirement is based on the following, cumulative requirements:

- **Requirement PD-04.3a**

  1 point. Establish the Project Type as Defined in the HSM

  Establish the project type, as defined in the HSM, during scoping of project alternatives through a quantitative and statistically reliable process. This process includes consideration of historic safety performance of the existing facility or similar facilities.

- **Requirement PD-04.3b**

  2 points. Develop and Evaluate the Project Design and/or Operational Alternatives

  Develop and evaluate project design and/or operational alternatives using explicit consideration of substantive safety through quantitative, statistically reliable methods.

- **Requirement PD-04.3c**

  3 points. Use Quantitative and Statistically Reliable Methods and Knowledge

  Use quantitative and statistically reliable methods and knowledge to assess substantive safety performance in the development of preliminary and final design details. Where a project includes design exceptions, evaluate the safety impact of the design exception(s) with these methods, and identify potential mitigating actions to improve safety performance. Note: if the project has no design exceptions, the agency can earn 3 points by documenting that their policies and processes for evaluation and documentation of design exceptions incorporate substantive safety principles described above.

Requirement PD-04.4

1 point. Evaluate Safety Performance of the Project after Implementation

Given the relative rarity of crashes, a statistically reliable post-evaluation period may take several years. As agencies may wish to complete a sustainability assessment sooner than that, earning one credit for this step is possible by documenting that agencies (a) have formal safety project evaluation policy and process in place that are statistically reliable, and (b) indicating that the agency intends to apply such process to this project.

A statistically reliable evaluation process includes at least the following elements:

- Collection and recording of the traffic volumes, roadway, and crash data for the three years prior to implementation for use after implementation.
- Keeping record of the implementation date (i.e., actual start of construction work and completion date of construction (last day before official opening) is recorded for use after implementation).
- The agency is able to retrieve the abovementioned information for a post-implementation safety performance review.
- The method used in the evaluation process is advanced enough to account for regression to the mean (RTM).

The Empirical Bayes (EB) before-after study (with or without comparison sites) method is considered the most appropriate means assessing the safety effectiveness of a treatment. The EB method accounts for regression to the mean (RTM) effects which are common to highway and traffic safety studies and applications. The HSM provides details on how to conduct post-implementation evaluations to demonstrate statistically valid safety effects. The evaluation shall assess three to five years of before and after data in determining the effect of the project on crashes and crash severity. The EB methods rely on predictive methods, for example, the use of safety performance functions, crash modification factors that meet the HSM inclusion rules, and local or state-specific calibration. If such models do not exist or calibrations of the HSM models have not been completed, the naive before-after study approach is acceptable.

One of the following scores applies:

- **0 points**. Perform no post-evaluation of the project, or use only less reliable methods such as crash rates to evaluate the safety performance of the project after implementation.
- **1 point**. Use a statistically reliable, science-based method to evaluate the safety effectiveness of the implemented project.

Resources

Above-Referenced Resources

The following resources are referenced in this criterion and consolidated here:

1. FHWA, Safety website, http://safety.fhwa.dot.gov/rsa
2. AASHTO, Highway Safety Manual, http://www.highwaysafetymanual.org and https://bookstore.transportation.org/collection_detail.aspx?ID=135
3. NCHRP, Human Factors Guideline for Road Systems (NCHRP Report 600 series), http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_600Second.pdf
4. AASHTO, SafetyAnalyst, http://safetyanalyst.org/
5. FHWA, Integrating the HSM into the Highway Project Development Process (2012), https://safety.fhwa.dot.gov/hsm/hsm_integration/hsm_integration.pdf

Additional Resources

The following resources provide information on this criterion topic in addition to the sources directly referenced:

6. FHWA, *Road Safety Audit Guidelines,* 2006, http://safety.fhwa.dot.gov/rsa/guidelines/documents/FHWA_SA_06_06.pdf

Scoring Sources

The project is considered to have met this criterion if the requirements above can be reasonably substantiated through the existence of one or more following documentation sources (or equal where not available):

1. Documentation of examples where human factors were considered in the project development process; or, if an RSA took place, documentation of the RSA, which may include resumes or biographies of RSA team members demonstrating their experience and qualifications to conduct RSAs. The documentation needs to include evidence that the fundamentals of human factors were applied (reflect knowledge and application of Chapter 2 of the HSM and the *Human Factors Guideline for Road Systems* (NCHRP 600 series).
2. Documentation of public awareness or information presented to the public to support a change in safety culture. These will include information (quantitative) on contributing factors, for example, speeding, drinking and driving, and distracted driving based on historic crash performance.
3. Documentation of the project scoping process, including data and analysis describing how the existing facility's safety performance was used to make decisions on scope of project improvements.
4. Project reports, technical memos, or other supporting documentation that demonstrate application of HSM-quality evaluations of the project and alternatives considered. These include documentation of the existing safety performance (frequency, crash type, severity) and comparison with an appropriate benchmark. Include analysis of the expected safety performance of alternatives considered (with specific reference to SPFs and CMFs used), as well as how quantitative safety was considered as part of overall project decision-making.
5. Design exception review and evaluation reports approved by the appropriate agency authority that include quantitative estimates of the expected safety performance of the design exception, specific mitigation measures, and estimates of the quantitative safety performance of the proposed mitigation measures. Where no design exceptions were required, documentation of the agency's processes and procedures for design exceptions that cite reference to and use of substantive, science-based crash analyses and methods.
6. Documentation of the post-implementation effectiveness evaluation of the project, including a collection of crash data before and after implementation, and shall follow the Empirical Bayes process or advanced methods that account for RTM. Where post-evaluation requires a lengthy period beyond project implementation, documentation of the agency's formal process for evaluation with a statement of intent or policy regarding post-evaluation can be submitted.