

# SPR-16: Infrastructure Resiliency

For Regions

1-15 points

**Goal:** Anticipate, assess, and plan to respond to vulnerabilities and risks associated with current and future hazards (including those associated with climate change) to ensure multi-modal transportation system reliability and resiliency. Identify a range of vulnerability and risks to both existing and planned transportation infrastructure.



Affected Triple Bottom Line Principles

## Sustainability Linkage

Planning for infrastructure resiliency in the face of potential hazards supports all of the triple bottom line principles by reducing spending on infrastructure replacement, improving the safety and security of multimodal transportation system users, and providing energy savings from long-lasting investments, among others.

## Background and Scoring Requirements

### Background

Helpful online references and tools for this criterion include FHWA's [Climate Adaptation Website](#)<sup>1</sup> and FHWA's [Vulnerability Assessment Framework Website](#)<sup>2</sup>.

For the purposes of this credit, key terms are defined as follows:

- **“Climate variability and change”** refers to long-term variations in climate, such as changes in sea level, temperature, precipitation intensity, and coastal storms, among others. While sea level rise primarily affects coastal regions, changes in the frequency and intensity of warm/cold weather days, precipitation events (flooding/droughts), and storms can affect infrastructure throughout the United States.
- **“Extreme weather events”** refers to flooding, hurricanes, fires, droughts, and winter storms, for example.
- **“Hazards”** are conditions or circumstances that may result in undesirable outcomes. Natural hazards may include seismic and extreme weather events, and/or the effects of climate variability and change. Man-made hazards may include security threats or structural failures from terrorism.
- **“Risk”** is the potential for an unwanted outcome resulting from an event—in this case, a climate stressor or other hazard. It is determined by the product of (a) the likelihood of the impact, and (b) the consequence of the impact.
- **“Risk Assessment”** is an assessment of the likelihood and potential consequences of exposure to a hazard.
- **“Vulnerability”** in this context refers to the degree to which transportation infrastructure can be adversely affected by various hazards.
- **“Vulnerability Assessment”** is an assessment of the potential consequences of hazards on the durability and performance of specific transportation infrastructure (e.g., inundation of roads and enhanced scour of structures).

## **Climate Change and Resiliency Vulnerability and Risk Assessments**

The following steps are part of a process of identifying potential climate change and natural hazards, evaluating the vulnerabilities of infrastructure posed by those hazards and performing a risk assessment to estimate the likelihood of such an event happening.

### ***Hazard Identification***

An important first step in evaluating and addressing infrastructure resiliency is the identification of potential hazards to the infrastructure system, such as seismic events, relative sea level rise, storm activity/intensity, temperature and heat waves, precipitation events, lake levels, stream flow, volcanism, etc. Subsequent to the identification of potential hazards, agencies typically perform an assessment of locations (and transportation infrastructure) and their respective severity of risk relative to the hazards identified. Severity is typically stated in terms of not vulnerable/at-risk, potentially vulnerable/at-risk, or vulnerable/at-risk assets, with potentially vulnerable and at-risk being the generally preferred terms.

### ***Vulnerability Assessment***

A vulnerability assessment focuses on how existing or planned transportation facilities may fare given current and future hazards. A vulnerability assessment should cover transportation assets in the planning area or a substantial subset of that area, as appropriate. Asset data on key existing and planned assets should be used. This could include elevations of the assets (not just the land), drainage capabilities, types of pavements and their ability to withstand excessive heat, more intense freeze-thaw cycles, and a variety of stress factors through time.

Investigating past events and resulting impacts can inform the assessment of vulnerabilities to seismic and storm events, and the impacts of long-term climate change effects. By comparing historical events with historical maintenance and repair needs, agencies can estimate how well specific assets might withstand certain stressors. For example, agencies could consider effects of past weather events on emergency response and evacuations required or on the services provided by an asset (e.g., changes in VMT and/or the value of goods transported).

The vulnerability assessment should include an assessment of all relevant natural hazards, not just climate related events. That said, FHWA's [Climate Adaptation website](#)<sup>1</sup> has a section dedicated to [Climate Change Vulnerability Assessment Framework website](#)<sup>2</sup> that has valuable tools and resources for performing this work.

### ***Risk Assessment***

A risk assessment is a method for estimating the likelihood of a particular impact resulting from a defined set of stressors, including climate change related impacts, and also assesses the consequences of the impact in terms of how they affect the surrounding community, metropolitan area, or state.

## **Scoring Requirements**

### **Requirement SPR-16.1**

#### **2 points. Develop and Adopt Goals and Objectives**

The agency has developed goals and objectives consistent with partner agencies (DOTs and other) for infrastructure resiliency in transportation planning documents, such as the LRTP, TIP, and others. Examples of goals and objectives include: engagement/coordination with state and local agencies, prioritization of projects that mitigate infrastructure risks, development of event-based transportation plans, etc.

### **Requirement SPR-16.2**

#### **2 points. Coordinate with Partner Agencies**

The agency regularly coordinates with partner agencies within its jurisdiction throughout the transportation planning process, to reduce barriers and further the prospects for implementation of strategies to address infrastructure resiliency. This coordination utilizes institutional mechanisms such as ad hoc or standing committees.

### **Requirement SPR-16.3**

#### **2 points. Integrate Vulnerability and Risk Assessment Information into Planning Documents**

Coordinate with partner agencies to collect infrastructure vulnerability and risk assessments into LRTP, TIP and other relevant planning documents and identify and inventory necessary event-based transportation plans that need to be developed as a result (see SPR-16.4).

### **Requirement SPR-16.4**

#### **2-5 points. Develop and Implement Adaptation and Resilience Strategies**

Coordinate with partner agencies to develop appropriate strategies to address transportation events related to hazard events such as seismic events, storms, heat waves, precipitation events, flooding, volcanism, etc. These strategies may include, but are not limited to the following:

- Planning for Redundancy
- Relocating Assets
- Changing Operations and Maintenance
- Leverage and Adjust Existing Systems and Procedures to Integrate Climate Change Risk

See MTC's *Climate Change and Extreme Weather Adaptation Options for Transportation Assets in the Bay Area Pilot Project*<sup>3</sup> for examples of 124 strategies identified and screened for integration into the agency.

One of the following scores applies:

- **0 points.** The agency has not developed adaptation strategies.
- **2 points.** The agency has developed, but not yet implemented, adaptation strategies to manage some the impacts the agency can reasonably expect to occur.
- **3 points.** The agency has developed, but not yet implemented, adaptation strategies to manage most the impacts the agency can reasonably expect to occur.
- **4 points.** The agency has developed and is implementing adaptation strategies to manage some of the impacts the agency can reasonably expect to occur based on its completed vulnerability and risk assessments.
- **5 points.** The agency has developed and is implementing adaptation strategies to manage most of the impacts the agency can reasonably expect to occur based on its completed vulnerability and risk assessments.

### **Requirement SPR-16.5**

#### **2 points. Develop Performance Measures**

The agency has infrastructure resiliency performance measures incorporated into its transportation planning documents (including LRTP, TIP, and other planning documents). Examples of performance measures can be found in NCHRP *Report 708: A Guidebook for Sustainability Performance Measurement for Transportation Agencies*<sup>4</sup>.

## **Requirement SPR-16.6**

### **2 points. Demonstrate Sustainable Outcomes**

Monitor progress towards goals for at least one year after goal establishment using the performance measures established in SPR-16.5 and show measurable advancement towards stated goals.

## **Resources**

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

1. FHWA, Climate Adaptation website, [http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/](http://www.fhwa.dot.gov/environment/climate_change/adaptation/)
2. FHWA, Vulnerability Assessment Framework website, [http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/adaptation\\_framework/](http://www.fhwa.dot.gov/environment/climate_change/adaptation/adaptation_framework/)
3. Metropolitan Transportation Commission (MTC), *Climate Change and Extreme Weather Adaptation Options for Transportation Assets in the Bay Area Pilot Project* (December 2014), [http://files.mtc.ca.gov/pdf/MTC\\_ClimateChng\\_ExtmWthr\\_Adtpn\\_Report\\_Final.pdf](http://files.mtc.ca.gov/pdf/MTC_ClimateChng_ExtmWthr_Adtpn_Report_Final.pdf)
4. NCHRP, Report 708: A Guidebook for Sustainability Performance Measurement for Transportation Agencies, [http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_708.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_708.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 of the following documentation sources (or equal where not available):

1. Transportation planning document(s) (LRTP, TIP/STIP, and/or UPWP) that contain evidence of the consideration of hazard identification, vulnerability assessment, risk assessment, and/or adaptation strategies.
2. Hazard Mitigation Plan(s).
3. Documentation of a vulnerability assessment of critical transportation infrastructure. This could include studies on the vulnerability of specific areas.
4. Documentation of a risk assessment of critical infrastructure. This should address the process used, an assessment of likelihood, and the resulting assessment of risk.