Pilot Testing FHWA’s INVEST Sustainable Highways Tool with a Bridge Replacement Project
FHWA Infrastructure Voluntary Evaluation Sustainability Tool (INVEST)

INVEST is a Tool to Measure **Sustainability**

Social - Environmental - Economic Performance
(Triple Bottom Line)

Goals: Balance the Triple Bottom Line
Benefit present and future conditions
Pilot Testing Process

Bridge Replacement Project Selected for Pilot Test

Step 1: Webinar Kickoff
Step 2: Project Manager Preparation
Step 3: Assign Criteria and Data Collection
Step 4: Owner Scoring Workshop
Step 5: Feedback
Step 6: Webinar – Results Discussion
Purpose and Need for Bridge Replacement

Structurally Deficient

Sufficiency Rating – 7 out of 100
Existing Bridge Conditions

Location: North of Raleigh in Wake County
Bridge Built: 1951
Bridge Length: 70 feet
Lane Width: 10 feet
Average Daily Traffic: 4,100 vehicles per day
Proposed Bridge

Bridge Length: 130 feet
Lane Width: 11 feet
4-foot offsets on bridge
Bicycle accommodations and bicycle safe railing
2030 ADT: 9,600 vehicles per day

Currently in Right of Way Acquisition
Construction Cost Estimate: $1,000,000
Proposed Typical Section

30’-6” Clear Roadway Width

Prestressed Concrete Cored Slab
FHWA INVEST PILOT TESTING

Pilot Testing Evaluates:

- Scoring Criteria
- Other aspects of the tool

Focus is to Improve INVEST - not worry about the score
# Project Development Criteria

## Basic Scorecard = 20 Criteria (for Bridge Replacements)

- PD-1 Cost Benefit Analysis
- PD-2 Highway and Traffic Safety
- PD-3 Context Sensitive Project Development (or equivalent)
- PD-4 Lifecycle Cost Analysis
- PD-5 Freight Mobility
- PD-6 Educational Outreach
- PD-7 Tracking Environmental Commitments
- PD-8 Habitat Restoration

## Extended Scorecard = 30 Criteria

- PD-9 Stormwater
- PD-10 Ecological Connectivity
- PD-11 Recycle & Reuse Materials
- PD-12 Create Renewable Energy
- PD-13 Site Vegetation
- PD-14 Pedestrian Access
- PD-15 Bicycle Access
- PD-16 Transit & HOV Access
### Project Development Criteria

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PD-1: Cost Benefit Analysis

Goal

Using the principles of cost benefit analysis, ensure that user benefits, including environmental and social benefits, exceed full life-cycle costs, including estimates of environmental and social costs.

Requirements

3 Points. Conduct a cost benefit analysis for the project that shows the net present value (NPV) of expected user benefits exceeds life-cycle costs including social and environmental (e.g. air emissions or safety costs or benefits); and construction and maintenance costs where they can be quantified. For larger projects that reduce travel time, improve trip reliability, expand access to markets, or improve modal accessibility; the cost benefit analysis could be expanded to include broader jobs, income and Gross Domestic Product (GDP)-related benefits alongside user benefits.
PD-2: Highway and Traffic Safety  
1-10 points

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

Requirements
4 points: Complete a Road Safety Audits/Assessment (RSA) in accordance with FHWA’s Road Safety Audit Guidelines at appropriate times during project development.

5 points: As part of project development decision-making, incorporate scientifically proven and statistically reliable predictive methods for evaluating quantitative safety effects. Significant project decisions include establishing project type and design criteria, selecting project design alternatives, and developing final design details including the use of design exceptions as necessary.
PD-4: Lifecycle Cost Analyses

Goal

Inform the decision-making process for the project through lifecycle cost analyses of key project features.

Requirements

3 points. Complete calculations for Lifecycle Cost Analyses (LCCA) of key project features. Comparing multiple design alternatives is encouraged but not required. Points are awarded cumulatively, up to a maximum of 3 points, for each LCCA as follows:

1 point. Perform an LCCA of all pavement structure alternatives considered in accordance with the method described in the FHWA’s Interim Technical bulletin, Life-Cycle Cost Analysis in Pavement Design (1998). This may be completed manually, or by using the FHWA’s free RealCost software, or any equivalent software.


1 point. Perform an LCCA of the project’s major feature (bridges, tunnels, retaining walls, or other items not listed in the preceding options) in accordance with generally accepted engineering economics practices.
**PD-5: Freight Mobility**

1-7 points

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<th>Extended</th>
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**Goal**

Decrease the impacts from freight movements.

**Requirements**

Facilities installed for this requirement shall be consistent with the need, purpose, and appropriateness for freight mobility within the project footprint.

1 – 7 Points: Implement one or more of the features in Table 1. Points for features are cumulative if roadways have more than one feature, however this criterion shall not exceed seven (7) points.
PD-6: Educational Outreach

Goal

Increase public, agency, and stakeholder awareness of roadway sustainability activities.

Requirements

Incorporate a comprehensive public educational outreach program that promotes and educates the public about sustainability, into the planning, design, construction and operational phases of the roadway project. Leverage public involvement processes where possible.

2 points. Install or perform a minimum of two of the following educational elements:
PD-7: Tracking Environmental Commitments
5 points

Goal
Ensure that environmental commitments made by the project are completed and documented in accordance with all applicable laws, regulations and issued permits.

Requirements
3 points. Beginning in project development, use a comprehensive environmental compliance tracking system for the project to identify how environmental commitments will be identified, tracked, fulfilled and verified throughout design and construction.

2 points. Require that the principal project constructor (interpreted to be the prime contractor, design builder, or construction management firm) has a documented environmental management system (EMS) that meets or exceeds the standards set forth by ISO 14001:2004 (may not be formally certified) and is in use on the project to track environmental commitments.
PD-8: Habitat Restoration

Goal
Offset the loss and alteration of natural (stream and terrestrial) habitat caused by road construction. Restore and protect natural habitat beyond regulatory requirements.

Requirements
3 Points: Either of the requirements below must be met for points. The points can be obtained through project-specific mitigation or through the use of banking.
PD-9: Stormwater

1-9 points

Goal

Improve stormwater quality from the impacts of the project and control flow to minimize their erosive effects on receiving waters using management methods and practices that reduce the impacts associated with development.

Requirements

1. Treat pollutants from at least 80 percent of the total runoff volume.
2. Control peak flows or durations from the project site.
3. Percentage of impervious surface area treated using best management practices.
4. Implement low impact development (environmental site design) technique where feasible.
5. Manage stormwater runoff from the project site if practical. If not practical, manage offsite developed areas from the same watershed providing equivalent or better resource protection.

To calculate the points achieved for this criterion use the following table and add the points accomplished for water quality, flow control and water quality effectiveness/volume reduction up to a maximum of 9 points total.
**PD-10: Ecological Connectivity**

**2-3 points**

- Basic
- Extended

**Goal**

Provide or improve wildlife, amphibian, and aquatic species passage access and mobility across roadway facility boundaries.

**Requirements**

The first requirement and either of the other requirements must be met to achieve points.

**Requirement 1:**
Conduct a site-specific ecological assessment of the roadway project using GIS data or regional expertise. Report the resulting impacts that the roadway has on the major ecosystems, according to the best scientific knowledge available. A project or resource agency biologist should be involved with the assessment. The ecological assessment should be consistent with the State-approved wildlife action plans, if available.

**Requirement 2:**
2 points. Existing Alignments Only. Replace in-kind, retrofit, or upgrade any and all existing culverts and wildlife fencing structures deemed structurally deficient, damaged, obsolete, insufficiently sized, or otherwise inadequate. Actions must be approved by the project ecologist or resource / regulatory biologist, or other appropriate staff.
PD-11: Recycle & Reuse Materials  

1-8 points

Goal

Reduce lifecycle impacts from extraction and production of virgin materials.

Requirements

8 points. Use recycled materials as a substitute for virgin materials or reuse existing materials or structural elements. Points can be earned for this criterion for both recycling and reusing and combined to a maximum of 8 points.

Recycled Materials: “Recycle” is defined as recovering a portion of a used product or material from the waste stream for reprocessing and/or repurposing with substantial transport offsite or within the project limits. A “recycled material” is any material, from any project, that has been:

- Processed at a location outside of the roadway project limits
- Material from any source outside the construction site that has been repurposed for use on the project, even if salvaged and still in its original condition.
PD-14: Pedestrian Access

1-2 points

Basic

Extended

Goal
Promote walkable and wheelable (wheelchairs, strollers, scooters) communities by providing pedestrian facilities within the project footprint.

Requirements
Facilities installed for this requirement should be consistent with the need, purpose, and appropriateness for pedestrians within the project footprint.

1 Point. Implement new (or improve existing) operations or technologies for pedestrian facilities. This includes added signage or minor access improvements for pedestrians, such as signalized intersections or crosswalks, shelters, and wheelchair ramps.

OR

2 Points. Implement physical or constructed changes to the roadway structure, dimensions or form that enhance safe, convenient, and attractive pedestrian access within the right-of-way (ROW), such as a sidewalk, raised crosswalk, bulb-out or pedestrian bridge structure.
PD-15: Bicycle Access

**Goal**

Promote bicycling in communities by providing dedicated cycling facilities within the project footprint.

**Requirements**

Facilities installed for this requirement shall be consistent with the need, purpose, and appropriateness for bicycles within the project footprint.

1 Point. Implement new (or improve existing) operations or technologies for bicycle facilities. This includes (but is not limited to) added signage or minor access improvements for bicycles, such as installing bicycle detectors in driving lanes or granting signal priority, adding bicycle-friendly stormwater drains, code-required dimension upgrades, resurfacing existing bicycle lanes, or adding new streetside bicycle storage facilities (lockers, racks, etc.).

OR

2 Points. Implement physical or constructed changes to the roadway structure, dimensions, or form that provide safety and convenience such as bicycle lanes or other bikeways. Lanes shared with motorized vehicles do not meet this requirement.
PD-17: Historical, Archaeological and Cultural Preservation

2 points

Goal

Respect and preserve cultural and historic assets, and/or feature National Scenic Byways Program (NSBP) historic, archaeological, or cultural intrinsic qualities in a roadway.

Requirements

2 Points. Requirements 1a or 1b and Requirements 2 and 3 must be met to achieve points.
**PD-19: Low-Emitting Materials**  

**Goal**  
Reduce human exposure to hazardous airborne compounds from construction materials.

**Requirements**  
2 points. The Owner should require the Contractor to do the following to receive points:

1. **Requirement 1:** Do not use cutback asphalt.

2. **Requirement 2:** All paints and coatings must comply with GS-11 Green Seal Environmental Standard for Paints and Coatings.

This credit should cover paints, coatings, adhesives, sealants, herbicides, and other materials used on the project.
PD-20: Energy Efficient Lighting 1-5 points

**Goal**
Reduce lifetime energy consumption of lighting systems for roadways.

**Requirements**
Install energy efficient lighting systems that are compliant with all safety requirements applicable to the roadway project.

Points are awarded based on the percentage of reduced energy use. To determine this reduction, compare the energy usage if the roadway project were to be constructed with high-pressure sodium luminaires to the energy usage of an energy efficient lighting design. The two designs must both meet the same lighting standards.

Points are awarded based on the percentage of reduced energy use as follows:

1 point: 10%
2 points: 20%
3 points: 30%
4 points: 40%
5 points: 50% or greater
PD-21: ITS for System Operations 1-5 points

Basic  Extended

Goal
Meet economic and social needs and improve mobility without adding capacity, or improve the efficiency of transportation systems.

Requirements
Include Intelligent Transportation System (ITS) applications listed in the Federal Highway Administration (FHWA) and Research and Innovative Technology Administration’s (RITA) Joint Program Office (JPO) of ITS Applications Overview portion of the ITS website (see: http://www.itsoverview.its.dot.gov) or any equivalent source. FHWA’s operations website is located at http://ops.fhwa.dot.gov/. Table 1 lists the standard ITS applications and FHWA and RITA ITS website categories allowable for this criterion.

5 Points: Points are awarded as follows: 1 point for installing at least one application in any category (listed in Table 1), 2 points for installing at least one application in two separate categories, up to 5 points for installing one application in five separate categories.
PD-22: Long-Life Pavement Design 5 points

Goal
Minimize life cycle costs by promoting design of long-lasting pavement structures.

Requirements
5 points. Both requirements must be met to achieve this criterion.

Requirement 1: Design at least 75 percent of the total new or reconstructed pavement surface area for regularly trafficked lanes of pavement to meet long-life pavement design criteria. Compute the total surface area of all trafficked lanes and show that, at a minimum, 75 percent of that area is designed for long-life. Do not include shoulders, medians, sidewalks and other paved areas in the computation. Long-life pavement is defined as a pavement structure that is designed using a minimum 40-year design life.

AND

Requirement 2: Pavement design is in accordance with a design procedure that is formally recognized, adopted and documented by the project owner. In many instances (but not all) this could be the process described in the 1993 AASHTO Design of Pavement Structures manual or the process described in AASHTO MEPDG-1 Mechanistic- Empirical Pavement Design Guide, Interim Edition: A Manual of Practice.
PD-27: Construction Equipment Emission Reduction

Goal
Reduce air emissions from non-road construction equipment.

Requirements
1 or 2 points. Use non-road construction equipment that meet at least one of the following criteria:

- Have engines that meet the current U.S. Environmental Protection Agency (EPA) Tier emission standards (Tier 3/Interim Tier 4 as of April 2011) in effect for non-road engines of the applicable engine power group.

- Have diesel retrofit devices for after-treatment pollution control verified by EPA or the California Air Resources Board (CARB) for use with non-road engines.
PD-28: Construction Noise Mitigation  1-2 points

Basic  Extended

Goal
Reduce or eliminate annoyance or disturbance to surrounding neighborhoods and environments from road construction noise, and improve human health.

Requirements
Establish, implement, and maintain a formal Noise Mitigation Plan (NMP) during construction for the prime contractor. This criterion is worth 1 point; an additional 1 point is available for urban projects greater than $100 million in construction value.
PD-29: Construction Quality Control Plan

5 points

Goal
The prime contractor will establish, implement, and maintain a formal construction Quality Control Plan (QCP).

Requirements
The Owner shall require the Contractor to establish, implement, and maintain a formal QCP during roadway construction. The Contract Documents should include a requirement for a QCP that includes, at a minimum, the following information:

- Key quality control personnel, their responsibilities and qualifications (resumes, certifications, etc.).
- Procedures used to control quality during construction including (as a minimum):
  - Items to be monitored (including pavement mix designs)
  - Testing to be done (including testing standards and frequency)
  - When corrective action is required (action limits)
  - Procedures to implement corrective action
  - Procedures to modify QCP if ineffective or when modifications are necessary
- The QCP should cover all project construction; not just the pavement.
- Subcontractors need to be included in this plan, which typically means identifying a responsible party and obtaining a quality control procedure from the subcontractor.
- The QCP should be approved by the owner before construction begins.
Scoring the Bridge Replacement Project

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<tr>
<th>Basic Scorecard</th>
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<tr>
<td>Total # Points</td>
<td>85</td>
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<tr>
<td>BRONZE (30%)</td>
<td>26</td>
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<tr>
<td>SILVER (40%)</td>
<td>34</td>
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<tr>
<td>GOLD (50%)</td>
<td>43</td>
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<tr>
<td>PLATINUM (60%)</td>
<td>51</td>
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26 Points Total
Bronze Medal
Summary of Evaluating the INVEST Tool

Staff were interested in the INVEST concept

There are benefits to beginning the INVEST evaluation early

Begs the question: Is this a look into the future?
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