



INVEST
ECONOMIC • SOCIAL • ENVIRONMENTAL

INVEST

User Guide

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U.S. Department of Transportation
Federal Highway Administration

Introduction

Defining Sustainability

The goal of sustainability can be described with the “triple bottom line”, which includes giving consideration to three principles: Social (also known as equity or people), Environmental (also known as ecology or planet), and Economic (also known as money or profit). The goal of sustainability is the satisfaction of basic social and economic needs, both present and future, and the responsible use of natural resources, all while maintaining or improving the well-being of the environment on which life depends.

The concept of sustainable development was described in a 1981 White House Council on Environmental Quality report, “If economic development is to be successful over the long term, it must proceed in a way that protects the natural resource base...” The Brundtland Commission of the United Nations (1987) further defined sustainable development as “development which meets the needs of current generations without compromising the ability of future generations to meet their own needs.”

In the transportation industry, projects and systems serve many different and sometimes competing objectives, including safety, mobility, environmental protection, livability, and asset management. A sustainable approach seeks to meet all of these needs while hitting economic targets for cost-effectiveness throughout a highway’s life cycle. For the Federal Highway Administration (FHWA), a sustainable approach to highways means helping decision makers make balanced choices among environmental, economic, and social values—the triple bottom line of sustainability—that will benefit current and future road users. A sustainable approach looks at access (not just mobility), movement of people and goods (not just vehicles), and provision of transportation choices, such as safe and comfortable routes for walking, bicycling, and transit. Sustainability encapsulates a diversity of concepts as well, including efficient use of funding, incentives for construction quality, regional air quality, climate change considerations, livability, and environmental management systems.

About INVEST

INVEST is a voluntary, self-directed and free web tool created to help state departments of transportation (DOTs), metropolitan planning organizations (MPOs), local transportation agencies, and others assess and improve the sustainability of transportation projects and programs. INVEST also serves as a practical collection of sustainability best practices. The name INVEST came from “Infrastructure Voluntary Evaluation Sustainability Tool.”

FHWA built INVEST using input and advice from transportation professionals, with their specific needs in mind. As a result, the information in INVEST is practical and tangible, and relates to the things transportation organizations do every day. It translates broad sustainability principles into specific actions, and gives transportation professionals a way to measure sustainability. INVEST helps transportation agencies go above and beyond minimum requirements to promote responsible stewardship.

Although FHWA encourages transportation professionals to use INVEST, it is completely voluntary. Users can take advantage of its capabilities wherever and however they think it will do the most good for their own planning. The use of INVEST is not intended to encourage comparisons across transportation agencies.

The data transportation organizations use to make their evaluations using INVEST belongs to them. However, INVEST users may choose to share results within their organizations or collaborate with others to ensure a more accurate assessment.

The INVEST Tool is web-based and completely free. No license is required.

How INVEST Works

INVEST provides four scoring modules for transportation professionals to use – system planning for States, system planning for regions, project development, and operations and maintenance. By using the criteria provided in each of these modules, decision-makers can evaluate their plans, projects, and programs. Scoring enables transportation agencies to gauge their performance in adopting sustainability practices. More importantly, however, INVEST helps agencies identify workable solutions that allow them to further incorporate sustainability into pending planning or project decisions, and to identify potential changes to business processes. In addition, when FHWA received input back from users, they heard that the collaboration that takes place between team members during the evaluation is a highly valuable aspect of the tool.

Each INVEST criterion has a write-up that describes the goal of the criterion, linkage to the sustainability triple bottom line principles, the scoring requirements for receiving points, sources of supporting documentation, and links to resources where users can find additional information about sustainability practices they may wish to implement. The web-based format makes it easy for users to score their projects by answering scoring questions on the right hand side of the page to determine the score while having access to more detailed information on the left hand side. Space is provided for users to record scoring assumptions and notes, upload supporting documents, and record follow-up actions that would improve the project score.

Scoring modules on INVEST website

Overview of Modules

System Planning

The System Planning for States (SPS) and System Planning for Regions (SPR) modules provide criteria to self-evaluate an agency's system-level planning and programming policies, processes, procedures, and practices.

The System Planning for States (SPS) module is geared towards States, Tollways, and local agencies that perform landscape-scale and corridor-wide planning and that typically own infrastructure. The System Planning for Regions (SPR) module is geared towards Metropolitan Planning Organizations, Council of Governments, or other planning organizations that perform landscape-scale planning for a metropolitan area (and that typically do not own the infrastructure.)

The System Planning modules focus on performing system-level analyses in a manner that contributes to the overall sustainability of the network and the individual projects programmed in this phase of the lifecycle. The SP criteria are primarily written for the scoring of an agency's fiscally constrained long range transportation plan (LRTP), which is considered to include the agency's transportation planning process, project selection criteria, the TIP/STIP, and project programming. However, other transportation planning documents, such as a unified planning work program (UPWP), corridor plans, and/or related plans (e.g. modal plans, visioning plans, etc) may also be scored, as appropriate.

Scoring

The SPS and SPR modules each contain 17 criteria, listed below, combined into a single scorecard. There is one bonus criterion unique to System Planning, SPS-4: Integrated Planning: Bonus (for States)/ SPR-4: Integrated Planning: Bonus (for Regions). To be eligible for this bonus criterion, the agency must score the maximum of 45 points on criteria SPS-1, SPS-2 and SPS-3 or SPR-1, SPR-2 and SPR-3. The purpose of this bonus is to reward agencies that are truly performing integrated planning across their program.

- SPS-01/SPR-01: Integrated Planning: Economic Development and Land Use
- SPS-02/SPR-02: Integrated Planning: Natural Environment
- SPS-03/SPR-03: Integrated Planning: Social
- SPS-04/SPR-04: Integrated Planning: Bonus
- SPS-05/SPR-05: Access & Affordability
- SPS-06/SPR-06: Safety Planning
- SPS-07/SPR-07: Multimodal Transportation and Public Health
- SPS-08/SPR-08: Freight and Goods Movement
- SPS-09/SPR-09: Travel Demand Management
- SPS-10/SPR-10: Air Quality
- SPS-11/SPR-11: Energy and Fuels
- SPS-12/SPR-12: Financial Sustainability
- SPS-13/SPR-13: Analysis Methods
- SPS-14/SPR-14: Transportation Systems Management & Operations
- SPS-15/SPR-15: Linking Asset Management and Planning
- SPS-16/SPR-16: Infrastructure Resiliency
- SPS-17/SPR-17: Linking Planning and NEPA

Project Development

The Project Development module spans the entire project development process. It includes early project planning, alternatives analysis, environmental documentation, preliminary and final design, and construction. Although the criteria span all phases of project development, including construction activities, the project owner typically has control over the decisions and actions necessary to meet all of the criteria.

Scoring

The Project Development Module of INVEST has 7 project scorecards available for the evaluation of projects. This approach allows for flexibility, since not all of the criteria will apply to every project. Six of the scorecards are based on both the type of project (paving, basic, extended, or scenic/recreational) and the location (rural or urban) and include a defined subset of the 33 total criteria relevant to the type and location of the project.

There is also a custom scorecard that includes 11 core criteria plus user-selected criteria to make a custom self-evaluation for projects that don't fit well into the five defined scorecards.

The Project Development module contains the 33 criteria listed below, used in various combinations to create the 7 different scorecards.

Project Development by Criteria Scorecard							
	Paving	Urban Basic	Urban Extended	Rural Basic	Rural Extended	Scenic and Recreational	Custom Core Criteria ¹
PD-1 Economic Analyses			●		●		
PD-2 Life-Cycle Cost Analyses	●	●	●	●	●		●
PD-3 Context Sensitive Project Development		●	●	●	●	●	
PD-4 Highway and Traffic Safety	●	●	●	●	●	●	●
PD-5 Educational Outreach		●	●	●	●	●	
PD-6 Tracking Environmental Commitments	●	●	●	●	●	●	●
PD-7 Habitat Restoration		●	●	●	●	●	
PD-8 Stormwater Quality and Flow Control		●	●	●	●	●	
PD-9 Ecological Connectivity			●	●	●	●	
PD-10 Pedestrian Facilities		●	●			●	
PD-11 Bicycle Facilities		●	●			●	
PD-12 Transit & HOV Facilities		●	●			●	
PD-13 Freight Mobility			●		●		
PD-14 ITS for System Operations		●	●		●		
PD-15 Historical, Archaeological, and Cultural Preservation		●	●	●	●	●	
PD-16 Scenic, Natural, or Recreational Qualities			●	●	●	●	
PD-17 Energy Efficiency		●	●	●	●		
PD-18 Site Vegetation, Maintenance, and Irrigation		●	●	●	●	●	
PD-19 Reduce, Reuse, and Repurpose Materials	●	●	●	●	●	●	●
PD-20 Recycle Materials	●	●	●	●	●	●	●
PD-21 Earthwork Balance			●		●	●	
PD-22 Long-Life Pavement	●	●	●	●	●	●	●
PD-23 Reduced Energy and Emissions in Pavement Materials	●	●	●	●	●	●	●
PD-24 Permeable Pavement	●	●	●	●	●	●	●
PD-25 Construction Environmental Training		●	●	●	●	●	
PD-26 Construction Equipment Emission Reduction	●	●	●	●	●	●	●
PD-27 Construction Noise Mitigation		●	●			●	
PD-28 Construction Quality Control Plan	●	●	●	●	●	●	●
PD-29 Construction Waste Management	●	●	●	●	●	●	●
PD-30 Low Impact Development		●	●	●	●	●	
PD-31 Infrastructure Resiliency Planning and Design			●		●	●	
PD-32 Light Pollution		●	●	●	●		
PD-33 Noise Abatement		●	●				
Total Number of Criteria in Scorecard	11	27	34	23	29	27	11

(¹) Indicates the core criteria that must be included in the custom scorecard.
The user may choose as many additional criteria as desired.

Operations & Maintenance

Operations and Maintenance (OM) evaluates the system-level operations and maintenance activities to determine how they contribute to the overall sustainability of the transportation infrastructure. The OM criteria score an agency's internal and system operations as well as any asset management and maintenance activities performed on the agency's infrastructure.

Scoring

The OM module contains 14 criteria listed below combined into a single scorecard.

- OM-1: Internal Sustainability Plan
- OM-2: Electrical Energy Efficiency and Use
- OM-3: Vehicle Fuel Efficiency and Use
- OM-4: Reduce, Reuse, and Recycle
- OM-5: Safety Management
- OM-6: Environmental Commitments Tracking System
- OM-7: Pavement Management System
- OM-8: Bridge Management System
- OM-9: Maintenance Management System
- OM-10: Highway Infrastructure Preservation and Maintenance
- OM-11: Traffic Control Infrastructure Maintenance
- OM-12: Road Weather Management Program
- OM-13: Transportation Management and Operations
- OM-14: Work Zone Traffic Controls



Useful Functions

Collaborate

Using the collaboration function, multiple team members can use INVEST to work together on a single project. After creating the project on INVEST, the lead can invite others to collaborate on the same project.

To add team members, click on “My Workspace” on the top bar of the website or click on “Continue an Existing Project or Program” on the Score tab page. If you are the lead user, either link will bring you to a page with links to each of the programs or projects on the INVEST website you have access to as a registered user or collaborator. To the right of each program or project is a function called “Actions”. Clicking “Actions” provides several options, one of which is collaboration. To set up another team member as a collaborator, click on Collaborate icon and then enter the name, e-mail address, desired permissions (edit or view), and then select “Add team member.”

Next Actions

Through the Next Actions function, users can list the future tasks needed to either achieve a criterion or appropriately document when that criterion is achieved. An agency that is revising its program could keep track of the next actions needed to achieve a criterion.

Upload Supporting Documents

A user can use this function to upload any supporting documents that would justify a score selected for a criterion.

It is provided both for the convenience of the user and for future reference as needed.

View Full Scorecard and Snapshot Function

The View Full Scorecard function gives a user the ability to view, save, and print a scorecard at a specific moment in the scoring process. The Snapshot function allows a user to save the scorecard for future reference and can be viewed or printed if needed. Both of these outputs display all of the criteria, the score, scoring notes, the next actions for each criterion, and a list of the uploaded support documents.

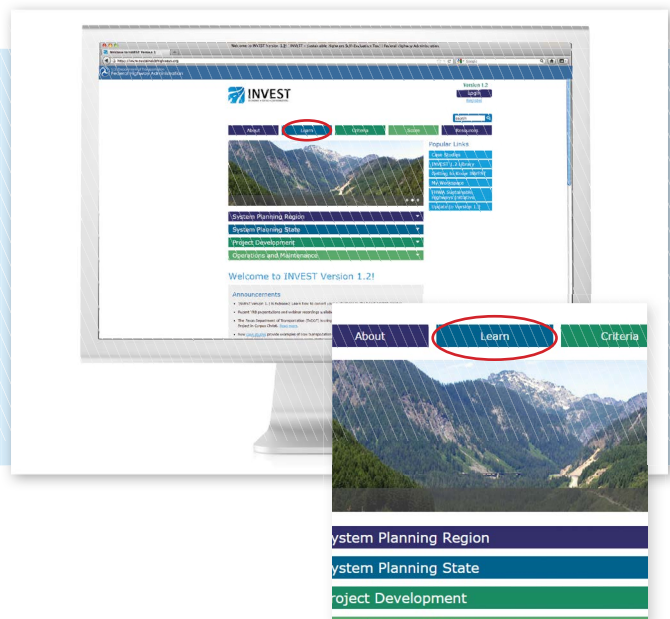


Usage Tips

- **Select a lead staff member** to conduct and lead the INVEST self-evaluation process.
- **Give the lead time to learn about INVEST**, navigate through the INVEST website, and learn about the content and tool prior to beginning the evaluation.
- **Create a test program** in order to navigate the score tab and practice scoring by entering sample data in the program registration fields.
- **Browse INVEST criteria.** Use the Criteria tab to learn about the criteria. Each criterion contains a title, goal, point ranges, linkage to the sustainability triple bottom line principles, background, scoring requirements, resources, and scoring sources.
- **Assemble a cross-discipline scoring team** of individuals who are knowledgeable about the project or program to be evaluated and/or about the subject matter areas in the criteria.
- **Gather information in preparation for a scoring workshop.** To prepare for the scoring workshop, every member of the scoring team should review the INVEST website. Once they have become familiar with the criteria required by their specific discipline, they should collect the appropriate information for each criterion. This information can usually be found in the Scoring Sources section of the criteria write-ups. By developing a draft list of information needed for each criterion, scoring team members can be assigned to collect the relevant documentation materials for specific criteria. In this way, everything needed for scoring will be available during the workshop.
- **Conduct a scoring workshop.** Convening a workshop has several advantages. Team knowledge surpasses those of individuals, the process starts the conversation regarding incorporating sustainability into agency actions, and the workshop fosters discussion and reflection through a sustainability lens. The agenda can be focused on stepping through the scoring for each of the criteria and discussing areas where the agency has the greatest opportunities to improve.

TO LEARN MORE

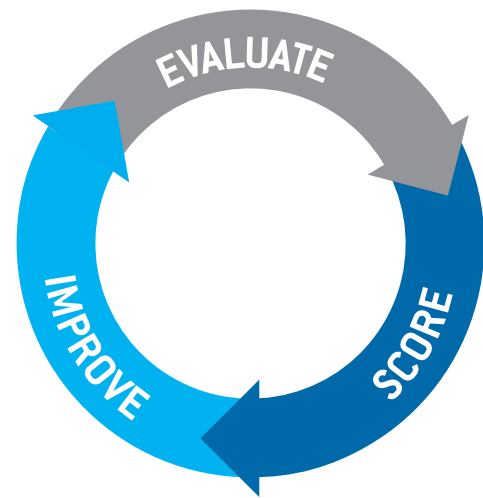
FHWA's INVEST has an extensive series of tutorials under the Learn tab on the INVEST home page. To go there directly, visit www.sustainablehighways.org/120/learn.html



Criteria in Action

EVALUATE – SCORE – IMPROVE

In this section of the user guide, you will find specific examples of how transportation agencies used INVEST criteria to evaluate, score, and improve their level of sustainability. Each example shows first how an agency used a particular INVEST criterion to **evaluate** their level of sustainability in that area, second how the agency **scored** on the criteria, including justification and sources of documentation, and last but far from least, how the agency **improved** sustainability practices by learning from the INVEST evaluation and identifying cost effective changes in practice to implement. For more information on agencies use of INVEST criteria, see the Criterion Examples section of the website located under the Resources tab.



The following criteria are covered:

- **System Planning**
 - SPS-01/SPR-01 Integrated Planning: Economic Development and Land Use
 - SPS-15/SPR-15 Linking Asset Management and Planning
- **Project Development**
 - PD-08 Stormwater Quality and Flow Control
 - PD-20 Recycle Materials
 - PD-29 Construction Waste Management
- **Operations and Maintenance**
 - OM-07 Pavement Management System
 - OM-12 Road Weather Management Program

SPS-01/SPR-01 Integrated Planning: Economic Development and Land Use

The goal of INVEST criteria SPS-01 and SPR-01 Integrated Planning: Economic Development and Land Use is to proactively encourage and facilitate sustainability through the coordination of transportation, land use, and economic development planning.

The North Central Texas Council of Governments (NCTCOG), one of the agencies that pilot tested INVEST, scored well on this criterion (formerly known as SP-01 as the pilot version only had one system planning module). However NCTCOG found through the INVEST self-evaluation that there was room for enhancing their work in this area in such a way that would both improve sustainability outcomes, and help the agency take more credit for the good work it was already doing. Leveraging internal staff expertise, NCTCOG assembled staff responsible for developing the long range transportation plan (LRTP) as well as subject matter experts on particular areas such as bicycle and pedestrian improvements and transit oriented development. Staff then reviewed the criteria, gathered data and documentation, and conducted a scoring workshop to develop scores. A total of up to 15 points are available under this criterion.

EVALUATE – SCORE

Develop and Adopt Goals and Objectives (2 points)

NCTCOG gained both points available. NCTCOG's policy board adopted policies on how to prioritize sustainable development projects, as outlined in the LRTP. This includes policies for utilizing existing system capacity, improving rail mobility, promoting mixed use development, and improving access management.

Engage Partner Agencies (3 points)

NCTCOG scored all three points in this area as it works closely with the full range of partners in the area, including local governments, counties, the Texas Department of Transportation, and area transit agencies. It also utilizes institutional mechanisms such as the Bicycle and Pedestrian Advisory Committee to facilitate engagement, as specified in the criteria.

Use Best Practice Quantitative Methods (2 points)

NCTCOG gained partial points for using best practice quantitative methods. NCTCOG uses a best-practice transportation model (Dallas-Fort Worth Regional Travel Model) to analyze and evaluate the performance of alternative land use/transportation policies and scenarios. They also use an integrated land use model called G-LUM (Gravity Land Use Model), though it is not considered a best-practice model.

Provide Leadership (2 points)

To support scoring two points, NCTCOG cited its robust Sustainable Development Funding Program, through which it has allocated over \$120 million in funding through three calls for projects in 2001, 2006, and 2011.

Demonstrate Sustainable Outcomes (6 points)

NCTCOG did not score points on this criterion. For future improvement, NCTCOG plans to focus on this final sub-criterion, which offers six points for developing sustainability performance metrics, tracking these metrics, and demonstrating achievement.

IMPROVE

NCTCOG realized that they were doing a lot of things in this area, but that it would be to their advantage to better document and measure outcomes. As NCTCOG begins work on their next LRTP, they plan to focus on developing sustainability performance measures. As the agency has allocated millions of dollars through sustainability-related programs, NCTCOG aims to quantify the benefit of these programs at meeting sustainability and mobility goals such as air quality and reduced congestion.

NCTCOG plans to conduct work in four phases:

- **Phase 1. Performance Measure Assessment** – Identify possible performance measures using resources recommended by INVEST and examining measures used by other transportation agencies. Additionally, NCTCOG will evaluate data availability and assess efforts outside of the metropolitan transportation planning process that could support performance measure development.
- **Phase 2. Performance Measure /Objective Development** – Develop SMART (Specific, Measurable, Achievable, Realistic, Timely) objectives and performance metrics for desired System Planning Criteria.
- **Phase 3. Integration into the Metropolitan Transportation Planning Process** – Collect and analyze appropriate data. Identify and involve stakeholders and appropriate committees for technical and public input.



Plano Transit-oriented Development – Funded through Sustainable Development Funding Program.
Source: NCTCOG

- **Phase 4. Document results of performance measures in the Metropolitan Transportation Plan**– Incorporate SMART objectives and performance measures into the metropolitan transportation planning phases.

SPS-15/SPR-15 Linking Asset Management and Planning

The goal of the System Planning criteria SPS-15/SPR-15 Linking Asset Management and Planning is to leverage transportation asset management data and methods within the transportation planning process to make informed, cost-effective program decisions and better use existing transportation assets.

NCTCOG received partial credit on this INVEST criterion (formerly known as SP-15), but found through the INVEST self-evaluation that there was room for improvement. While the criterion changed between the pilot test version and Version 1.0, NCTCOG's experience still illustrates how an agency might go about scoring and then improving performance. A total of up to 15 points are available under this criterion.

EVALUATE – SCORE

Incorporate Asset Management Based Performance Measures (3 points)

NCTCOG received partial credit for this area. The agency has goals and objectives in its current metropolitan transportation plan, Mobility 2035: The Metropolitan Transportation Plan for North Central Texas and NCTCOG's Congestion Management Process that support this area. However, it recognizes that it needs to develop planning level performance measures and targets. NCTCOG also notes that the metropolitan transportation plan currently frames this area within operations and maintenance rather than asset management.

Incorporate Asset Management Data and Economic Analysis to Prioritize Investments (8 points)

NCTCOG received partial credit here because the agency incorporates asset management data to prioritize investments, but lacks a process at the technical or policy level and does not provide documentation. INVEST recommends that agencies leverage life-cycle cost analyses and benefit cost analysis to evaluate project alternatives and prioritize investments.

Prioritize Maintenance and Preservation (4 points)

Four points are available for agencies that prioritize transportation decisions that support the maintenance and good repair of existing transportation assets. NCTCOG received partial credit in this area as it has goals and objectives that support this area. However, NCTCOG does not yet demonstrate attainment of the agency's maintenance and preservation goals over at least a one-year period, as called for in the INVEST criterion, because the agency does not identify or call for a performance target in this area.

IMPROVE

Based on the initial INVEST evaluation, NCTCOG decided to target linking asset management and planning as an area for improvement in the next iteration of its metropolitan transportation plan. NCTCOG plans to develop and track asset management related performance metrics, improve tools, and compile useful data for selecting projects and developing programs (such as bridge ratings).

NCTCOG has divided this work into three phases:

- **Phase 1.** Develop and document a strategy for an asset management initiative.
- **Phase 2.** Integrate asset management into NCTCOG's next metropolitan transportation plan development process.
- **Phase 3.** Document results and incorporate outcomes of NCTCOG's asset management initiative in the next metropolitan transportation plan.

The INVEST evaluation helped NCTCOG identify specific areas for improvement, including developing sustainability performance metrics and linking asset management and planning.

In sum, NCTCOG found that the INVEST evaluation provided a good baseline of where they were doing well, and helped identify where they could make improvements. NCTCOG then chose specific areas for improvement, including developing sustainability performance metrics and linking asset management and planning. NCTCOG is now moving forward on these areas.

PD-8 Stormwater Quality and Flow Control

The Cleveland Innerbelt Bridge project provides an example of scoring and documenting the INVEST stormwater management criterion. The goal of the criterion is to improve stormwater quality from the impacts of the project and control flow to minimize their erosive effects on receiving water bodies and related water resources, using management methods and practices that reduce the impacts associated with development and redevelopment. Previously under the pilot test version, Version 1.0, and Version 1.1 projects received up to three points in each of three categories (water quality, flow control, and low-impact development) for a total possible score of nine points. In Version 1.2 a new criterion, PD-30 Low Impact Development, was created to address the third category, so PD-08 now has a total of six possible points.

EVALUATE – SCORE

Water Quality (1-3 points)

The score for water quality requires treating pollutants from at least 80 percent of the total annual runoff volume. The table below is then used to calculate the number of points achieved. The Cleveland Innerbelt Bridge project received the maximum of three points for this sub-criterion (see the last line of the table) as it treats greater than 90 percent of the annual runoff volume of sediments, metals, and other pollutants, and the target impervious surface area treated is greater than 125% of the impervious surface area added.

Table 1: Water Quality – Redeveloped Roadways

Amount of Runoff Treated (% of Annual Volume)	Target Pollutant	Target Imp. Surface Area (% of Added) ¹	Points
80% – 89%	Sediment	101% – 125%	0
		>125%	1
	Sediment, and Metals or Other ²	101% – 125%	1
		>125%	2
90% +	Sediment	101% – 125%	1
		>125%	2
	Sediment, and Metals or Other ²	101% – 125%	2
		>125%	3

Column 3 – For retrofit projects, see Table 2 for equivalent percentages to use.

(¹) – % of Added = Treated Impervious Surface Area / Added Impervious Surface Area

(²) – Other basin-specific pollutant of concern is targeted

These outcomes are particularly important as the Innerbelt project is located in a combined stormwater - sewer area. The project was designed to separate stormwater from combined sewers at feasible locations and treat the separated runoff by an Ohio DOT approved best management practice. Using project documents, staff documented exactly how many acres of drainage area would be treated using different methods.

The total pre-project area that drained to the combined sewer was 58 acres. The Innerbelt Bridge project separated 20 acres of area that previously drained to the combined sewer system and rerouted these areas to manufactured systems and extended detention basins designed to best management practices from the Ohio DOT Location & Design Manual Volume 2. The remaining 38 acres will stay connected to the combined sewer and will receive treatment at a wastewater treatment plant.

Flow Control (3 points)

Flow Control requires managing the flow from at least 80 percent of the total runoff volume, and is based on controlling durations and attenuating peak flow magnitudes from the project site. The table below is used to calculate the number of points achieved for flow control based on the amount of runoff treated, what was treated, and the target impervious surface area treated.

Ohio DOT designed the stormwater system to control 100 percent of peak flows for the 5, 10, and 25 year flows. Controlling peak flows from storm events reduced the probability of overflowing the system and discharging sewer directly to the Cuyahoga River. Peak flows were managed through detention and water quality treatment for all separated areas that discharge directly to the Cuyahoga River. Data from the tables from the E. 9th Street, Gateway, E. 22nd, and Tremont Roadway Reports for the Cleveland Innerbelt Bridge Project show pre/post flows to area tributaries and combined and separated sewers. According to this data, over 125% of the target impervious surface area is treated for flow durations. This places the project's performance on the final line of the table below, earning the project all three points for this sub-criterion.

Table 3: Flow Control

Amount of Runoff Managed (% of Annual Volume)	Flow Control Standard Used	Target Imp. Surface Area (% of Added) ¹	Points
80% – 89%	Peak Rate	101% – 125%	0
		>125%	1
	Flow Durations	101% – 125%	1
		>125%	2
90% +	Peak Rate	101% – 125%	1
		>125%	2
	Flow Durations	101% – 125%	2
		>125%	3

— ODOT scored 3 points.

Low Impact Development / Effective Best Management Practices (3 points)

Best management practices for stormwater management mimic natural hydrology to treat pollutants and include detention ponds, wet ponds, wetlands, biofilters, and media filters. The Innerbelt project received the maximum of three points for this area as 100 percent of impervious surface area is treated using best management practices. All 20 acres separated from the combined sewer and 6.3 acres from East Bank & W. 3rd Street are being treated per Ohio DOT's Location and Design Manual Volume 2. The remaining 38 acres will stay connected to the combined sewer for treatment.

Documentation

The scoring team attached tables from the E. 9th Street, Gateway, E. 22nd, and Tremont Roadway Reports for the Cleveland Innerbelt Bridge Project in order to show pre/post flows to area tributaries and combined and separated sewers.

IMPROVE

Through the INVEST evaluation process, Ohio DOT learned that this project demonstrated a strong commitment to stormwater management. They also learned as the project progressed that ground-truthing is required, because even with the extensive analysis conducted ahead of time to improve stormwater management, on the ground realities can reveal additional challenges that need to be addressed.



Cleveland Innerbelt Bridge Project

PD-20 Recycle Materials

The goal of PD-20 Recycle Materials is to reduce lifecycle impacts from extraction, production, and transportation of virgin materials by recycling materials. Projects receive up to five points for recycle asphalt pavement or recycled concrete aggregate, up to six points for in-place pavement recycling, up to two points for reuse of sub-base granular material, up to one point for recycling minor structural elements, and up to two points for salvaging or relocating buildings, for a total maximum of ten points.

EVALUATE – SCORE

Recycled Asphalt Pavement or Recycled Concrete Aggregate (5 points)

Using the calculations shown below, the project team calculated that 25% of the pavement used in the project is from recycled asphalt pavement.

Mix Type	% Recycled Asphalt Mix	Estimated cubic yards of asphalt	Estimated cubic yards of recycled asphalt mix (column 2 multiplied by column 3)
446-1H Asphalt Warm Mix	15%	4247.21	637.08
446-2 Intermediate Asphalt	35%	6143	2150.05
448.1 Intermediate Asphalt	35%	770	269.5
12.55MM Asphalt Warm Mix	15%	9386.25	1407.94
19.0MM Asphalt Warm Mix	30%	10744	3233.2
Total		31290.46	7687.77
Total % Recycled Material			25% (7687.77/31,290.46)

Using the INVEST on the next page, the project received two points.

Table 1: Points for Average Recycled Content (% by weight or volume of materials)

Recycling Method Used	Points Earned				
	1	2	3	4	5
Percent average recycled material (ARC) required for recycling in pavements	10%	20%	30%	40%	50% or more
Percent average recycled material (ARC) required for granular base course or	20%	30%	40%	50%	60% or more

The pilot test version of INVEST that Ohio DOT used to score the project did not include the other sub-criteria (in-place pavement recycling, reuse of sub-base granular material, recycle minor structural elements, and salvage or relocate buildings). In-place pavement recycling sub-criterion provides points for recycling pavement materials in place using cold-in-place recycling, hot-in-place recycling, and full depth reclamation methods. The reuse of sub-base granular materials sub-criterion provides points for Reuse the subbase granular material of existing pavement elements as subgrade embankment or as part of the new subbase during construction of the proposed new pavement structure. The recycle minor structural elements sub-criterion provides points for relocating and reusing at least 90 percent of the minor structural elements, including existing luminaires, signal poles, and sign structures that are required to be removed and/or relocated onsite. Finally, the salvage or relocate buildings sub-criterion provides points for salvaging or moving a building instead of demolishing it.

IMPROVE

Ohio DOT found the INVEST self-evaluation process valuable and is now looking at using INVEST on additional projects. The agency is investigating the potential of requiring construction contractors to score their projects using INVEST and implement sustainability practices to achieve at least a minimum score.

PD-29 Construction Waste Management

Western Federal Lands Highway Division (WFLHD) has used the INVEST Project Development module to score 19 different projects. Through this process, WFLHD has identified eleven criteria for which their projects typically score well and nine criteria for which they tend to not score well on, with the remainder falling in the middle or varying by project. Looking across a set of projects to make adjustments to overall processes is a great way to use INVEST and maximize sustainability improvements. PD-29 – Construction Waste Management is one of the criteria for which WFLHD found they earned points, but could improve, and are now actively working to do so.

EVALUATE – SCORE

The goal of INVEST's construction waste management criterion is to utilize a management plan for road construction waste materials to minimize the amount of construction-related waste destined for landfill. In the pilot version of INVEST, the Going to the Sun Road in Glacier National Park, Montana scored one out of one points because WFLHD required the contractor to maintain a formal Construction and Demolition Waste Management Plan (CWMP). INVEST lays out in detail what an effective CWMP contains.

As a result of pilot testing and feedback from early users, INVEST Version 1.0 and Version 1.2 added

additional elements to this criterion, allowing more ways for agencies to get credit for waste management activities on a project. Now an agency receives an additional point if it can document that they have diverted at least 50 percent of the construction waste from landfills or two points if they can show they have diverted at least 75 percent. An agency can also get one additional point for hauling excess materials directly to other projects for recycling. WFLHD found that while they do require the CWMP, they do not require the contractor to document the flow of waste nor do they transport materials directly to specific project sites for reuse. INVEST recommends documentation such as trucking tickets with weights, destinations, materials, and calculations of percentages diverted from landfills.

Looking across a set of projects to make adjustments programmatically to overall processes is a great way to use INVEST and maximize sustainability improvements.



A worker rebuilds a wall at Glacier National Park by re-using salvaged masonry stone. *Source: FHWA*

IMPROVE

WFLHD is now looking at coming up with special contract requirements for the contractor to report on waste destinations. This will enable them to document those practices already in use that reduce construction waste, such as a current practice of reusing old paving material as base for road reconstruction. It will also enable WFLHD to track progress and make further improvements in reducing waste.

OM-7 Pavement Management System

The Utah Department of Transportation (UDOT) scored well on this criterion, as it has a mature pavement management system in place, but also found through the INVEST self-evaluation process that UDOT could further improve its pavement management system by integrating Lidar data into the system to enhance the quality of the data.

The goal of OM-7 is to leverage a pavement management system to balance activities that extend the life and function of pavements while considering the impacts to the human and natural environment. Projects receive points in five different areas for a total maximum of fifteen points.

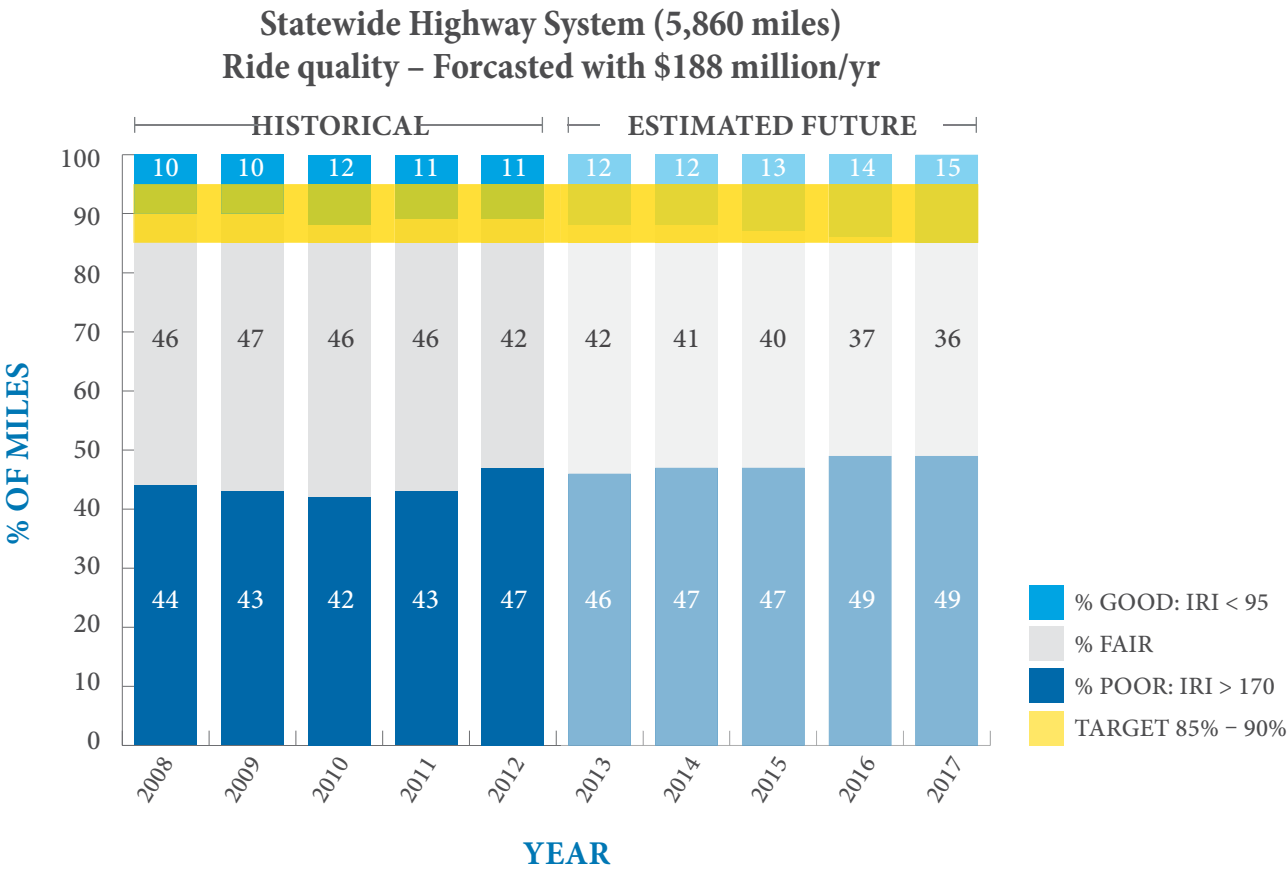
EVALUATE – SCORE

Develop a Pavement Management System and Collect Data (1 point)

UDOT received one point in this area as it has a pavement management system that includes an inventory, a condition assessment, a determination of needs, a prioritization of projects needing maintenance and rehabilitation, a method to determine the impact of funding decisions, and a feedback process.

Track Pavement Network Performance (3 points)

UDOT received three points in this area because it tracks performance using metrics for roughness, cracking, rutting, and faulting and has measures related to project timeliness. The graph below for instance shows past performance and projected future performance on pavement roughness, using the International Roughness Index (IRI).



Set Goals and Monitor Progress (2 points)

UDOT received two points in this area as it sets quantifiable goals relating to both condition and project timeliness and monitors progress towards goals. For instance, UDOT set a target of 85 to 95 percent of the state highway system meeting an IRI of “good” or “fair” (IRI below 170). As shown in the graph above, UDOT is overachieving on the goal. Based on this information, UDOT decided to reallocate \$3 million originally slated for pavement repair to culvert rehabilitation and signage improvements.

Leverage Data to Demonstrate Sustainable Outcomes (7 points)

Scoring for this requirement is based on the following, cumulative elements.

- **2 points.** Prioritize projects based on system modeling, scenario analyses, trade-off analyses, and system optimization rather than a “worst-first” approach.
- **2 points.** Leverage life-cycle cost analysis (LCCA) techniques to predict costs and to perform short- and long-term budget forecasting.
- **1 point.** Include routine pavement preservation needs in the annual UPWP or STIP/TIP that are based on the condition and timeliness goals set above.
- **2 points.** Leverage pavement management system to link pavement repair, preservation, and maintenance projects to adjacent capital projects.

UDOT received all of the points under these elements. UDOT prioritizes projects through its pavement management system using life-cycle cost analysis techniques. During the latest revision of the unified work plan, UDOT managers made a conscious decision to include pavement. Pavement projects in the STIP come directly from the pavement management system. Finally, UDOT leverages the pavement management system to harmonize projects that are located near one another in order to minimize traffic disruptions and improve efficiencies.

Sustainable Specifications (2 points)

An agency earns two points for having standard specifications and/or special provisions specific to at least one sustainable pavement solution (such as warm mix asphalt, long life pavement, and recycle asphalt pavement) and requires the consideration of sustainable pavements as a first solution. UDOT did not receive points under this criterion because they use a standard specification for all of their asphalt mixes. The specification does not mandate warm mix asphalt, but allows contractors to use warm mix asphalt. Because of cost savings, contractors are choosing to use warm mix rather than hot mix. For documentation, UDOT provided its specifications for asphalt mixes (Section 02741 in its standard specifications).

In sum, UDOT learned that its pavement management processes are rational and performance driven. Seemingly disparate pieces – planning, specification, maintenance – are all working together to yield the desired conditions.

IMPROVE

As with many of the agencies that pilot-tested INVEST, after scoring their program, UDOT developed a set of recommendations for improved sustainability. UDOT went one step further by prioritizing recommendations for action. UDOT also documented the benefit that would accrue to the agency, the division responsible for implementation, the relationship of the action to sustainability, the effort and cost that would be required, and the ease of implementation.

The recommendation that UDOT listed as its top priority was to incorporate collected Lidar data into the pavement management system. Even though undertaking this activity will not improve their INVEST score, the Lidar data will give UDOT a more accurate inventory of the network. This will allow UDOT to more accurately measure distances and calculate quantities for the pavement management system and the bridge management system. The excerpt below summarizes the recommendation:

Recommended Action: Implement collected Lidar data into the pavement management system.

Benefit(s): The consistency of the pavement condition data will lead to better results from the pavement management system.

Responsible Division: Asset Management

Relation to Sustainability: UDOT already has a highly sophisticated pavement management system. The consistency of the data collected will improve the accuracy and reduce the subjectivity in the current data set.

Effort/Cost: Due to the amount of data, the effort will be extensive. The Asset Management Division is in the process of doing this.

Ease of Implementation: Once data is processed and loaded, the process will be the same as the current process.

OM-12 Road Weather Management Program

The goal of INVEST criterion OM-12 is to plan, implement, and monitor a road weather management program (including snow and ice control) to reduce environmental impacts with continued or better level of service. Agencies receive points in six areas for a maximum total of fifteen points. This criterion was modified as part of INVEST Version 1.2, so the requirements and allocation of points per section differ slightly from previous versions of INVEST, including the version that UDOT used for their evaluation.

EVALUATE – SCORE

Develop a Road Weather Management Program (2 points)

A Road Weather Management Program (RWMP) includes strategies that can be used to mitigate the impacts of rain, snow, ice, fog, high winds, flooding, tornadoes, hurricanes, avalanches, and other inclement weather on traffic.

UDOT gained two points for this area. UDOT's RWMP has been a major component enabling the agency to maintain a uniform level of expenditures even with expanding facilities. Whereas one truck used to plow one lane, a single truck can now plow three lanes, using wing plows that widen the right and left sides and a tow plow that removes additional snow. UDOT also increased the capacity of their trucks so that trucks can be out for 2 ½ hours rather than 90 minutes. UDOT's RWMP is extremely iterative and the agency is continuously refining as it is learning. The RWMP emphasizes weather forecasting and preparation. Best management practices are tailored for the different climatological regions of the state.

Set Goals and Monitor Progress (3 points)

UDOT received points for having established quantifiable performance metrics based on level of service, amount of materials used and other relevant parameters. UDOT also received an additional point for monitoring progress towards goals for at least one year and showing measurable advancement towards stated goals. UDOT sets performance goals for each road section and monitors conditions hourly during storms, providing regular updates to the public.

Implement a Road Weather Information System (3 points)

Roadway Weather Information Systems (RWIS) are a way to monitor pavement and weather conditions in real-time using sensors to measure atmospheric, pavement, and/or water level conditions. This data allows the operator to make the best decisions about how to respond, for example, when to apply chemicals, how much to apply, and what type of chemical to apply, thereby reducing the amount of salt and chemical applied and increasing its effectiveness. UDOT scored all points available in this area. UDOT plow trucks are equipped with road pavement sensors. This allows truck operators to make adjustments to chemical application while they are on the road. UDOT's road condition cameras, fixed RWIS stations, and mobile RWIS all feed information into traffic management and operations decisions. This has enabled the agency to reduce operating costs and speed response times.

Implement the Standards of Practice or Standard Operating Procedure (SOP) for Snow and Ice Control (2 points)

An agency receives one point for having an RWMP that includes, at a minimum, the following elements specific to snow and ice control:

- Reducing salt use in environmentally sensitive areas
- Existence of an anti-icing program
- Conducting periodical training program for proper use of salt and chemicals
- Best Management Practice (BMP) for chemical storage facilities

- Proper storage of chemical and chemical-abrasive stockpiles
- Proper calibration of equipment
- Reducing cost and improving fuel efficiency by planning and optimizing routes

An agency receives an additional point if the agency's program includes performance standards that take into account sustainability, and demonstrate a reduction in materials and truck fuel usage.

UDOT received the maximum score. This area highlights all three of the sustainability triple bottom line principles.

UDOT's innovative snow removal practices:

- Save \$124,000 per year compared to standard practice (economic)
- Reduce the amount of salt used by 30 percent (environmental)
- Improve road safety and accessibility (social)

These practices include the implementation of slurry spreaders which reduce the amount of salt required, gravity flow brine tanks that decrease the need to pump, and the installation of snow fences that block snow from drifting across lanes. UDOT also carefully manages chemicals at storage sites and refrains from using salt when temperatures are low enough that plowing alone is sufficient.

UDOT's snow removal practices save \$124,000 per year, reduce the amount of salt used by 30%, and improve road safety and accessibility.

Implement Materials Management Plan (2 points)

An agency receives two points for successful implementation of a Materials Management Plan to monitor quantities of salt applied and level of service during and after an event; includes salt, chemicals, sand, etc. As noted above, UDOT monitors levels of salt applied and levels of service.

Implement a Maintenance Decision Support System (3 points)

An agency receives up to three points for developing a Maintenance Decision Support System (MDSS) to improve the effectiveness and efficiency of roadway weather treatments and implement best practices. An MDSS uses atmospheric weather modeling and generates recommendations for road treatment based on sensor readings from road locations. UDOT was not able to receive points under this criterion because they chose not to implement an MDSS. UDOT made this decision because the large geographic scale and computer based algorithms of an MDSS do not work well for the complex weather patterns and micro climates Utah experiences due to its mountainous and varied topography. UDOT has found that its own system actually outperforms an MDSS and costs less. UDOT's own system takes into account wind, sensitivity to micro climates, three different convergence zones, and lake effects.



Utah's snow removal practices save money and reduce environmental impact by using less salt and fewer trucks to keep the roads clear. *Source: UDOT*

Scoring Sources and Documentation

Documentation included the Road Weather Management Program, the Road Weather Information Systems, and progress reports on performance metrics. The Road Weather Information System data is available to the public at udottraffic.utah.gov.

IMPROVE

As discussed earlier, after scoring their operations and maintenance program, UDOT developed a prioritized set of recommendations for improved sustainability. UDOT listed as medium priority a recommendation to produce a snow removal decision support system, which would essentially formalize the agency's current process. The excerpt below summarizes the recommendation:

Recommended Action: Produce a Snow Removal Decision Support System.

Benefit(s): Best use of resources by using the appropriate amount of material and equipment.

Responsible Division: Maintenance

Relation to Sustainability: Using the proper amount of material (salt, red salt, etc.) is vital to keeping the roads safe during storms. Excess use wastes resources (material and money) as well as introducing more salt to the environment.

Effort/Cost: Although each storm is unique, guidelines regarding best practices (including type and amount of material; use of brine; time between plow passes; etc.) are available and should be implemented. Performance measures should also be established.

Ease of Implementation: Measuring snow removal performance has always been difficult. The shed crews take great pride in their plowing efforts. Extensive, continuing education will be required to follow best practices.

Using INVEST to Accomplish Your Goals

FHWA created INVEST to help state departments of transportation (DOTs), metropolitan planning organizations (MPOs), local transportation agencies, project teams, and others assess and improve the sustainability of transportation projects and programs. FHWA built INVEST using input and advice from transportation professionals, with the specific needs of the aforementioned agencies in mind. As a result, the information in INVEST is practical and tangible, and relates to activities transportation organizations do every day. It translates broad sustainability principles into specific actions, and provides transportation professionals a way to measure sustainability. INVEST helps transportation agencies go above and beyond minimum requirements to promote responsible stewardship.

Since INVEST became available, transportation agencies from around the country have been implementing it to evaluate and improve their projects and programs and to accomplish agency-wide sustainability goals. This section includes specific examples of how transportation agencies are using INVEST to advance and instill better business practices, facilitate sustainability on projects and programs, educate staff and stakeholders to improve understanding of sustainable practices, and promote internal and external communication and outreach. As illustrated in the figure below, INVEST offers multiple approaches and applications to help your agency in achieving specific sustainability goals.

Figure: Approaches to Achieving Sustainability Goals

GOAL	APPROACH
Advance Better Business Practices	Make a Business Case for Sustainability
	Monitor Performance and Benchmark with INVEST
Integrate Sustainability into Projects and Programs	Improve the Sustainability of Specific Transportation Projects
	Keep Projects on Track to Meet Your Sustainability Goals
	Provide Contractors with Incentives for Maximizing Sustainability
	Improve the Planning Process
	Conduct Programmatic Evaluations and Modify Agency Guidelines to Address Sustainability
	Maximize Sustainability of Operations and Maintenance Programs
Improve Education and Understanding of Sustainability	Change the Perception of Sustainability
	Provide a Consistent Reference for Sustainable Practices
	Motivate and Encourage Innovations
	Emphasize Outcomes over Score
	Build Intellectual Capacity
Facilitate Internal and External Communication and Outreach	Encourage Internal Communication
	Facilitate External Communication
	Demonstrate a Commitment to Sustainability and Self-improvement

Advance Better Business Practices

MAKE A BUSINESS CASE FOR SUSTAINABILITY

Agencies who consider sustainability intangible and difficult to measure will likely appreciate the concise and results-driven approaches to sustainable transportation planning, design, and operations and maintenance provided within INVEST. INVEST has proven to provide measureable and quantifiable results and summarizes the primary and secondary environmental, social, and economic benefits of each criterion.

Many INVEST criteria have potential cost savings associated with their implementation, some of which are highlighted in the INVEST Cost Savings Report. Analyses of INVEST criteria that agencies have used have shown quantifiable economic benefits.

More than half of the agencies interviewed for the FHWA Summary Report on State DOT Feedback on INVEST 1.0, (INVEST 1.0 Feedback Report), noted that they like using INVEST because it allows them to quantify sustainability efforts that had been previously difficult to measure. Using INVEST provides an unbiased evaluation of programs and projects in which to measure performance, provides a “ruler” for measuring future progress, and can aid agencies in establishing goals for programs and projects now and in the future.

There are six criteria for which FHWA conducted a formal analysis to determine the potential cost savings of the criterion. These are called [INVEST Cost Saving Narratives](#). The following criteria (based on INVEST Version 1.0/1.1) have a narrative and are summarized in Figure below: SP-06, SP-09, PD-14, PD-20, OM-08, and OM-12. These narratives quantifiably show how implementation of each of the criterion can save money and reduce costs.

Figure: INVEST Cost Saving Narratives

Module	Criterion	Agency Benefit	Road User Benefit
System Planning	Safety Planning (SP-06)	Reduce costs from crashes for emergency response, property damage, administrative, legal, liability	Savings in crash property damage, travel delays, work-place productivity
System Planning	Travel Demand Management (SP-09)	Avoid expensive capacity investments by reducing congestion and parking demand	Cost savings associated with congestion reduction and improved reliability and enhanced overall mobility
Project Development	Systems Operations (PD-14)	Avoid expensive capacity investments	Reduced congestion Improved reliability
Project Development	Recycle Materials (PD-20)	10-50% savings in paving costs	Travel time savings from reduced construction delay
Operations and Maintenance	Bridge Management System (OM-08)	Reduce costs by extending the useful service-life of bridges through more efficient maintenance	Reduced travel time, vehicle operation, and accident-related costs as the result of bridge reconstruction
Operations and Maintenance	Road Weather Management (OM-12)	10-25% reduction in winter maintenance cost	Saves millions \$ in travel delays

The tool also illustrates economic, social, and environmental benefits of sustainability through best practices, helping to make a business case to senior-level management and other stakeholders. This can help agencies identify which criteria are important for their particular agency to pursue, given their agency's goals and context.

Case studies show quantifiable economic benefits in accomplishing criteria requirements and can therefore help agencies make an economic business case for sustainability.

Utah DOT Example

Using INVEST, the Utah Department of Transportation (UDOT) developed specific recommendations for sustainability improvements to its operations and maintenance program. One high priority recommendation resulting from the evaluation of OM-07 Pavement Management System was to implement collected LIDAR data into UDOT's Pavement Management System (PMS). The recommendation also supplemented an effort at the time to switch from manual pavement condition assessment to automated data collection. UDOT calculated substantial cost savings from implementing this recommendation. The identified annual savings from automating the data collection and incorporating the LIDAR data are \$39M. Adding up the total savings and dividing by the costs yields a benefit cost ratio of 3.5, meaning that the monetary benefits to UDOT of implementing the recommendation outweigh the costs by three and a half times.

UDOT also realized annual cost savings from establishing and implementing corridor performance measures for traffic signal operations (OM-13 Transportation Management and Operations). Another recommendation that came out of the INVEST self-assessment was to implement a "World Class" signal timing program with multiple ITS solutions and performance measures for traffic signal operations. The Department committed \$3M annually to accomplish this target. They implemented real time performance measurement of traffic signals, installed dynamic dilemma zone detection on higher speed corridors, improved traffic signal operations support for regional impact events, installed corridor responsive ramp metering, and installed a traffic adaptive signal system. With these signal improvements, goods and service providers are able to move more efficiently to meet their schedules thanks to reduced traffic delays. Individuals spend less time on the road – allowing them more productive time each day. The traffic signal operations enhancements reduce congestion and crashes along with the resulting property damage, injuries, and associated traffic delays. Conservative annual savings for the signal timing program are estimated at over \$5M for a Benefit/Cost ratio = 1.73.

MONITOR PERFORMANCE AND BENCHMARK WITH INVEST

INVEST is a valuable long term tool when used by an agency to monitor performance and quantify sustainability changes made over time. Rather than using INVEST as a one-time static assessment of a project or program, agencies across the U.S. are using INVEST to evaluate past performance, current performance, and identify goals for future performance. Some agencies have adopted INVEST to be used on a regular basis. For example, using INVEST yearly for the System Planning (SP) and Operations and Maintenance (OM) modules can help to benchmark the programs evaluated and document year-over-year achievement (performance monitoring) of sustainability goals. For an agency, the use of the Project Development (PD) module on every project can ensure a high standard of achievement across all projects and identify process improvements and standard specification modifications necessary to facilitate higher achievement on future projects. Using INVEST multiple times throughout the lifetime of a single project helps to identify potential sustainable solutions early in design, and then ensures those solutions are carried forward during design and construction.

Illinois Tollway Example

The Illinois Tollway is an example of an agency that used INVEST to benchmark and track planning programs and operations and maintenance programs, over time. First, the agency used both the SP and OM modules to score Illinois Tollway funding programs in four baseline years, as well as over thirty-five projects constructed between 1998 and 2014, ranging in cost from \$400,000 to \$134 million. Projects were evenly distributed amongst bridge, asphalt, and cement project types. The comprehensive scoring was done to set baselines for future work and identify potential barriers to implementing sustainable practices. The Illinois Tollway then determined in which areas their projects tended to score well and areas for improvement. They found steady sustainability progress on both the planning side and the operations and maintenance side. Now that the Illinois Tollway has established baseline performance, the agency will be evaluating and improving the sustainability of in-progress projects that are part of the \$12 billion capital program. The agency will be using INVEST in a program-wide analysis to develop target scores, score projects during several stages of design, and then again after substantial completion. Each year they will look at the previous year's scores and evaluate areas that need to change to improve overall sustainability. INVEST will allow them to identify institutional and other barriers that may be preventing implementation of sustainable practices. It also will be used to consistently report sustainability performance to stakeholders. The benchmarking done by the Illinois Tollway is one of the benefits of using INVEST over time.

Related to benchmarking and performance monitoring, INVEST can inform ongoing sustainability efforts when future plans, practices, and policies incorporate lessons learned from the agency's self-evaluation. Many agencies across the country are realizing the quantifiable economic benefits of using INVEST over time. Measuring improvements before and after implementing recommendations stemming from INVEST evaluations is a strong business practice for agencies and creates a compelling case for continually improving upon sustainability goals. INVEST can also be used to evaluate and build upon existing sustainability efforts such as a strategic plan, like California Department of Transportation's sustainability plan, or Minnesota DOT's Sustainability Initiative.

Caltrans Example

California DOT's (Caltrans) groundbreaking report, *Smart Mobility 2010: A Call to Action for the New Decade*, laid out a vision for developing a new approach to transportation that is multimodal, sustainable, and integrated with land use. As part of its continuing preparation for implementing the Smart Mobility Framework, Caltrans identified the sustainability tools, research, guidance, and best practices that have been developed or initiated since the publication of *Smart Mobility 2010*. After completing that investigation Caltrans chose to test the use of INVEST statewide to see how the tool could benefit the planning, programming, and maintenance of the California state highway system. This included an INVEST evaluation of their Operations & Maintenance Programs, System Planning, and Project Development for four specific projects. Caltrans found that the sustainability measures from INVEST could help them define their priorities and that the collaborative discussions spurred by the INVEST evaluations were invaluable. They also found the System Planning exercise to be useful during plan and guidance development.

Minnesota DOT Example

[The Minnesota Department of Transportation's \(MnDOT\) use of INVEST highlights the tool's potential to improve an agency's broad and ongoing sustainability efforts.](#) In 2010, MnDOT established their Sustainability Initiative to create a broad focus on both internal and external sustainability for the agency, expanding the concept of sustainability beyond environmental issues to social and economic ones. Initial objectives for the Sustainability Initiative included gaining an understanding of what MnDOT was already doing well and establishing an agency-wide baseline. To aid with moving this initiative forward, MnDOT undertook a "stem-to-stern" self-evaluation, becoming the first state DOT to do so. MnDOT used INVEST to intensively investigate agency practices and policy and shape future improvements. Their project had three objectives: better understand and document the agency's current practices; identify gaps and high-value opportunities; and establish priorities and next steps to further increase sustainability. The main outcome of using INVEST was that MnDOT developed a sustainability plan to provide policy direction, develop and track performance measures, and serve as a catalyst for increasing sustainability awareness and engagement throughout the agency and across all phases of the project life cycle (planning, project development and delivery, and maintenance and operations).

Integrate Sustainability into Projects and Programs

IMPROVE THE SUSTAINABILITY OF SPECIFIC TRANSPORTATION PROJECTS

The INVEST Project Development (PD) module provides guidance in improving the sustainability of individual transportation projects. Users of INVEST can take a prospective approach and evaluate projects that are planned or currently under development or take a retrospective approach and learn from projects already completed. Both types of evaluations can help agencies identify areas for improvement, while at the same time highlight areas in which the project or agency excels.

The Workshop Approach

Many project teams have found cross-discipline workshops to be an effective way to score projects and programs, discover ways of increasing the sustainability of current or future work, and increase awareness and understanding of sustainability. Not only do workshops help teams with identifying specific project improvements, but they also serve as a forum to collect vital feedback on ways to make programmatic adjustments to the processes that take place in planning, design, construction, and operations & maintenance.

Massachusetts Department of Transportation (MassDOT) used the INVEST PD module to prospectively evaluate the Casey Arborway Project, which will replace a structurally deficient 1950s era overpass with an at-grade roadway with enhanced transit, pedestrian, and bicycle connectivity. MassDOT convened an INVEST workshop of the entire project team, including designers, the consultant team, landscape architects, cultural resources, environmental, storm water, pavement, bridge, and community relations, as well as other staff who were not involved in the project but wanted to learn more about the tool.

The workshop allowed for discussion and consensus on different viewpoints and considerations in scoring each criterion. MassDOT discovered numerous areas where they could improve upon their practices in order to achieve more points, and hence greater sustainability, with future projects. These included making their contracting mechanism more inclusive of sustainability goals, leveraging existing project information to better track and report environmental commitments, formalizing a training process for environmental compliance commitments, and considering benefit-cost analyses and life cycle cost assessments for project elements. The agency hopes that the individuals involved in the workshop will provide greater consideration in terms of the INVEST criteria and sustainability moving forward in their daily work. The workshop also helped to open conversations with MassDOT leadership to gain the buy-in necessary to make sustainability practices at the agency routine and proactive.

Arizona DOT Example

[The Arizona Department of Transportation \(ADOT\) used INVEST to score twenty planned or under construction roundabout projects.](#) Roundabouts have seen increased application across the United States and in Arizona due to their safety and congestion reduction benefits. ADOT found the scoring process helpful both in improving the sustainability of the individual roundabout projects and in understanding the sustainability of the state's roundabout program as a whole. As a result, ADOT has committed to assessing up to 30 other 5-year construction projects using INVEST to help identify meaningful process improvements.

KEEP PROJECTS ON TRACK TO MEET YOUR SUSTAINABILITY GOALS

While many transportation agencies use INVEST either proactively or retroactively to assess the sustainability of particular projects, INVEST can also be an effective tool to monitor and evaluate the progress of a project in development. Initial use of INVEST has led some users to establish a “sustainability schedule” or set of milestones at which points the project progress toward sustainability is evaluated. In the examples below, the agencies have institutionalized these practices to ensure ongoing tracking of sustainability goals in projects moving forward.

Illinois Tollway Example

[The Illinois Tollway institutionalized the use of INVEST in its processes by identifying key decision points, responsible parties, actions, timelines, and templates for implementing INVEST.](#) These processes are explained in the [Illinois Tollway’s INVEST Project Development Manual](#). At the project level, the Illinois Tollway’s INVEST-related activities and submittals are organized around six key milestones highlighted in the figure below:

Figure: Six Key Project Milestones for Illinois Tollway

Milestone	Action Required
Pre-Conceptual Planning	<ul style="list-style-type: none">• INVEST evaluation to identify sustainable solutions and establish target INVEST score.
30% Design	<ul style="list-style-type: none">• Implement sustainable solutions.• INVEST evaluation to determine <i>target</i> INVEST score.
60% Design	<ul style="list-style-type: none">• Implement sustainable solutions.
95% Design	<ul style="list-style-type: none">• Implement sustainable solutions.• INVEST Evaluation to determine <i>as-designed</i> INVEST score.
Pre-construction	<ul style="list-style-type: none">• Discuss sustainable solutions.• Design engineer hands off project to construction manager.
Substantially Complete	<ul style="list-style-type: none">• Construct sustainable solutions and use sustainable practices.• INVEST evaluation to determine <i>as-constructed</i> INVEST score.

The planner, design engineer, and construction manager use an INVEST score sheet and INVEST tracking form to keep track of progress towards sustainability goals at each milestone. The Illinois Tollway has found this approach to greatly improve the sustainability of in-progress projects and ensure that the agency keeps on track to deliver its fifteen-year, \$12 billion capital program to improve mobility, relieve congestion, and reduce congestion.

Ohio DOT Example

[INVEST also helped the Ohio Department of Transportation \(Ohio DOT\) improve the sustainability of the largest project in Ohio DOT history, the replacement of the Cleveland Innerbelt Bridge on I-90, now called the George V. Voinovich Bridge.](#) The project has two phases – the first was construction of the westbound bridge, completed in 2013; the second phase, design and construction of the eastbound bridge, began in 2014. Ohio DOT used INVEST to score the first phase to see if the project was meeting its goals. Ohio DOT found the process so valuable that the agency stipulated in its Request For Proposals (RFP) for the second phase of the project that the contractor use INVEST to demonstrate sustainability.

The Ohio DOT design-build team is delivering on the goals and managing the project with sustainability in mind. The team uses an INVEST task force consisting of experts in various aspects of the project (e.g., viaduct, pavement, stormwater, etc.) for the scoring process. The expert task force meets every two weeks to integrate INVEST criteria into day-to-day decisions on design, planning, and construction. As the project progresses, members of the scoring team not on the expert task force will meet every six months to re-score the project and track progress towards sustainability goals. The team uses the INVEST website, as well as an activity report, to track scoring, documentation, issues that must be resolved, and action items needed for the team to move forward in evaluating and resolving each criterion.

Some INVEST criteria require early consideration during design (such as PD-10 Pedestrian Access). By contrast, others require on-going tracking for the duration of construction (such as PD-29 Construction Waste Management Plan). To ensure that each criterion is addressed at the optimal time, the Ohio DOT contractor team developed a sustainability schedule intended to overlie the project schedule. The schedule highlights action items and key dates to ensure that the team makes efficient use of time and that windows of opportunity to fulfill INVEST criteria are not missed. This is particularly important for a large project in which decisions will be spread out over a long period of time.

PROVIDE CONTRACTORS WITH INCENTIVES FOR MAXIMIZING SUSTAINABILITY

To ensure they achieve their sustainability goals, some INVEST users have successfully embedded INVEST into contract documents and design-build processes. An agency clearly expresses a commitment to sustainability to potential bidders from the beginning by including INVEST criteria or requirements to use INVEST to demonstrate sustainability in procurement requests and contract mechanisms. The expectations are set early that the work to be done will be held to a high standard for sustainability. Examples from Ohio, Texas, and Oregon show that incorporating INVEST into project contracts provides contractors with incentives for maximizing sustainability and keeping costs low.

Ohio DOT Example

[The Ohio DOT experience with INVEST started with use of the PD module for the westbound part of the George V. Voinovich Bridge Project.](#) Following the success of this application, Ohio DOT incorporated a requirement to use INVEST to demonstrate sustainability into the RFP for the eastbound bridge's design-build contract. The RFP required the contractor to develop a sustainability plan and use INVEST to demonstrate sustainability achievements. Ohio DOT asked contractors to state in their proposals how many INVEST points they could deliver and to commit to achieving a certain sustainability level. In Ohio DOT's process of selecting the contractor, the contractor's sustainability commitments and plans were scored along with traditional criteria such as project management and design.

By including a requirement on INVEST in the RFP for the design-build contract, Ohio DOT provided a strong incentive for bidders to incorporate sustainability practices in their proposals while keeping costs competitive. The winning bidder committed to achieve a Platinum INVEST rating and bid below the Ohio DOT official engineering estimate. An eco-charrette with the winning contractor, Ohio DOT, and FHWA allowed all parties to further improve the project.

Texas DOT Example

Another example of an agency integrating INVEST as part of the design-build process comes from the Texas Department of Transportation (TxDOT). [TxDOT used INVEST on the \\$750 million Harbor Bridge Replacement Project in Corpus Christi, which will be the longest cable-stayed bridge in the United States.](#) TxDOT applied INVEST to the procurement phase of the project to ensure that sustainability principles are considered during its project development.

In July of 2014, FHWA hosted a workshop for TxDOT, the City of Corpus Christi, and the Corpus Christi MPO. The workshop provided an overview of the tool and a hands-on opportunity to work with the web-based modules. A representative from Ohio DOT attended the workshop and provided lessons learned from the Voinovich Bridge Replacement Project, including details regarding Ohio DOT's RFP process. This workshop was instrumental in illustrating how INVEST could be used to achieve the triple bottom line of sustainability throughout its project development and design phases.

After the workshop, TxDOT moved forward in developing an RFP for the Harbor Bridge Replacement Project. The RFP required bidders to provide a Sustainability Plan that describes their approach and commitment to sustainable design, construction, and operational and maintenance practices to optimize and balance the environmental, social, and financial performance of the project. As part of the Sustainability Plan, bidders were required to demonstrate how they would achieve the Platinum level for the INVEST PD module and the Silver level for the OM module. TxDOT evaluated Sustainability Plans based on the demonstrated ability to achieve the performance targets for the PD and OM modules. Additionally, incorporation of sustainable design and construction practices was also part of the evaluation, with special emphasis on demonstration of sustainable project features and programs, and inclusion of community engagement and outreach practices (including environmental justice commitments and practices). TxDOT ultimately selected a team that committed to achieve the Platinum level for both the PD and OM modules.

TriMet Example

[Tri-County Metropolitan Transportation District of Oregon \(TriMet\) used INVEST to evaluate the Portland Milwaukie Light Rail \(PMLR\) Transit Project.](#) The PMLR scored well in terms of the application of INVEST philosophy and criteria. For instance, the project demonstrated strong sustainability performance with features such as pedestrian / bicycle paths on the new river bridge, planted trackway, wetland restoration, recycling, LED lighting, context sensitive development, regenerative braking, solar power, and ITS. However, the project lacked sufficient supporting documentation, contractual language, and systems in place to efficiently and holistically collect and interpret performance data in the context of specific metrics. Construction contracts did not include requirements to measure performance or ensure sustainability practices would be implemented. For example, contractors were not legally obligated to provide reports documenting recycled material practices, nor were they responsible for implementing alternative or innovative sustainability practices such as donating removed materials or deconstructing buildings.

As a result of using INVEST in its analysis of the PMLR project, TriMet identified several key factors for application to future projects, which included embedding the RFQ and RFP processes with sustainability language/ expectations and scoring mechanisms, and establishing related contract language. Including sustainability priorities and practices in all contractual language will help to ensure contractor compliance with sustainability practices, data collection, and monitoring. New contract requirements will increase accountability, as well as consistency and uniformity of reporting procedures. Additionally, requiring staff and contractors to begin collecting and reporting on key sustainability practices from the beginning of a project will help to build momentum and ownership in capturing TriMet's sustainability story.

IMPROVE THE PLANNING PROCESS

The System Planning (SP) module contains criteria focusing on the scoring of an agency's long range transportation plan (LRTP), which includes the agency's transportation planning process, project selection criteria, the TIP/STIP process, and project programming. The criteria can also be applied to other transportation planning documents, such as a unified planning work program (UPWP), corridor plans, modal plans, and visioning plans. As illustrated below, numerous MPOs have taken advantage of INVEST to improve regional planning processes and inform updates to LRTPs.

Cape Cod MPO Example

[The Cape Cod Commission \(CCC\), which is the MPO for Cape Cod, Massachusetts, used the SP module to evaluate their current Regional Transportation Plan \(RTP\) and inform the development of their next RTP.](#) The current RTP scored well on many aspects of the criteria as INVEST aligned well with the CCC's goals. The CCC found that they scored lower on aspects of INVEST criteria that required defined performance measures. The CCC developed a number of recommendations for their next RTP based on the INVEST evaluation, such as developing quantifiable performance measures in multiple areas (e.g. land use and economic development), considering the use of a standing technical advisory committee of internal and external environmental interests, better addressing public health considerations, and analyzing vulnerabilities to climate change and extreme weather.

Kittery MPO Example

The Kittery Area Comprehensive Transportation System (KACTS) is the MPO for the Maine portion of the Kittery-Portsmouth, Maine and Dover-Rochester, New Hampshire urbanized areas. [KACTS utilized the SP module to score their approved 2010 LRTP and used the results to identify opportunities to better integrate and showcase sustainability principles in their 2014 LRTP.](#) A committee was formed to score the 2010 LRTP with representation from KACTS staff, local municipalities, advocacy groups, Maine DOT, and the FHWA. The committee solely evaluated the content of the plan and did not award points for existing activities or programs that were not specifically mentioned. The scoring results highlighted numerous areas for improvement for future LRTP updates including the need for KACTS to better and more accurately reflect all of the programming that it completes every year.

KACTS used the results of the 2010 LRTP scoring process to guide and influence the development of the 2014 LRTP. KACTS recognized that the new plan should be more informative and useful for the public, and more clearly illustrate their practices, partnerships, policies, and programs that relate to sustainability. As a result, there was a marked increase in the number of points allocated to the 2014 LRTP compared with the 2010 LRTP. The considerable increase in points was mainly due to the addition of sustainability elements from the 2010 to the 2014 LRTP.

North Central Texas COG Example

The North Central Texas Council of Governments (NCTCOG) serves as the COG for a 16-county region centered on Dallas and Fort Worth. [NCTCOG assessed its adopted LRTP, *Mobility 2035*, using INVEST's SP module to evaluate the update of the Dallas-Fort Worth Metropolitan Transportation Plan and assure that all possible sustainability opportunities had been covered.](#) The INVEST results showed that local agencies had done a good job on operations and maintenance efforts that extend the useful life of infrastructure. The INVEST score also validated the COG's effort to manage travel demand by improving the link between transportation and land use. Through use of the tool, NCTCOG found that it needed to improve the connection between asset management and planning, and to address infrastructure resiliency. NCTCOG then used sustainability best practices from INVEST to improve in these areas and incorporate changes in the next iteration of the LRTP.

With partner and stakeholder coordination, the NCTOG staff is currently working on efforts to link transportation asset management and planning on two regional freeway corridors: IH 35E and IH 20/IH 30. Additional pilot studies for several other corridors in the region are expected to begin in FY2015 and conclude later that year with a project prioritization list that will be recommended for incorporation into the upcoming Mobility 2040 plan. A final report will then be compiled to demonstrate the overall accomplishments and effectiveness of linkages between asset management and long range planning.

Cleveland MPO Example

[The Northeast Ohio Areawide Coordinating Agency \(NOACA\), the MPO for Cleveland, Ohio, used the OM module to evaluate the effectiveness of its Regional Safety Program \(RSP\), improve its safety data analysis and reporting, and produce a Transportation Safety Action Plan \(TSAP\).](#) The ultimate goal was to improve the region's sustainability by reducing fatal and serious injuries. The INVEST tool allowed NOACA to assess sustainability of the current RSP and incorporate strategies into the development of the TSAP. The results were used to refine regional safety goals and objectives, evaluate and prioritize projects, and establish safety performance measures and targets.

Southern California MPO Example

[The Southern California Association of Governments \(SCAG\), Southern California's MPO, used INVEST to evaluate its 2012-2035 Regional Transportation Plan/ Sustainable Communities Strategy \(RTP/SCS\) and to make improvements to the next RTP/SCS based on the results.](#) As part of the scoring process for the current RTP/SCS, SCAG found that INVEST was accurate in pointing out the strengths and weaknesses of its current LRTP processes. Moving ahead, SCAG plans to begin translating the assessment of the 2012 RTP/SCS into recommendations and actions for the development of the 2016 RTP/SCS.

CONDUCT PROGRAMMATIC EVALUATIONS AND MODIFY AGENCY GUIDELINES TO ADDRESS SUSTAINABILITY

While agencies can use INVEST to identify improvements for individual projects, the tool is also hugely informative and valuable for agencies looking to take a more holistic, programmatic approach to assessing a set of projects. This approach allows agencies to have a more complete picture of areas where the agency is excelling and where there is room for improvement. As highlighted below, multiple entities have capitalized on INVEST to help them carry out programmatic evaluations of agency construction practices.

Western Federal Lands Example

[FHWA, through its Western Federal Lands Highway Division \(WFL\), has taken advantage of the PD module to evaluate the sustainability of its projects, increase awareness, and identify areas of improvement for current and future projects.](#) Western Federal Lands has scored over 20 projects in the last few years. The experience helped WFL identify where they tend to score well and where they do not tend to score well. WFL has also identified areas for improvement for subsequent projects. These include adding a requirement for contractors to track waste, transitioning from hot to warm mix asphalt, and exploring how to increase reuse of rock material (particularly important in the context of parks since imported rocks must be heated and washed to avoid invasive species). Using INVEST to look across a set of projects to make adjustments programmatically to overall processes helped WFL maximize sustainability improvements.

In addition to programmatic evaluations, INVEST can also be a useful tool in steering the modification of internal policies and guidelines to better incorporate and solidify sustainable practices. This approach allows agencies to move beyond a project-by-project application of sustainability principles and practices to a more systematic way of integrating sustainability into agency processes and procedures.

Washington DOT Example

[WSDOT used the SP module to score three corridor planning studies in the Seattle/Tacoma metropolitan area and then integrated the recommendations that came out of the INVEST evaluation into WSDOT's updated Practical Planning Guidelines.](#) WSDOT planners across the state use these guidelines to develop corridor, sub-area, and modal plans. One of the greatest benefits of integrating INVEST into WSDOT's updated planning guidelines will be to help planners view their work through a sustainability lens built upon a well-developed and nationally vetted framework. This provides a methodology for planners to begin implementing WSDOT's sustainability values into their everyday work.

MAXIMIZE SUSTAINABILITY OF OPERATIONS AND MAINTENANCE PROGRAMS

Beyond its PD and SP modules, INVEST also offers agencies best practices to enhance the sustainability of operations and maintenance programs using the OM module. The OM module focuses on the scoring of an agency's internal system operations, asset management, and maintenance activities performed on the agency's infrastructure. The data collected from operations and maintenance and identification of new project needs can be used to inform the System Planning step to complete the lifecycle of projects.

Delaware DOT Example

[The Delaware Department of Transportation \(DelDOT\) used the OM module to score its Pavement and Rehabilitation Program and other OM activities.](#) Even though DelDOT has actively employed sustainable practices (such as the use of recycled materials) for over 20 years, the agency had never quantified these efforts prior to INVEST. By using INVEST, DelDOT was able to measure the sustainability achievement of its Pavement and Rehabilitation Program and identify areas for improvement across many aspects of project delivery. Examples of opportunities to enhance the agency's sustainability efforts included improving the tracking and monitoring of recycling, increasing the use of alternative fuels in fleet vehicles, and considering the use of performance metrics for traffic control plans.

Utah DOT Example

[Utah DOT \(UDOT\) is another agency that has spearheaded the use of the OM module.](#) UDOT initially used INVEST in the winter of 2011-2012 to develop specific recommendations for sustainability improvements to its OM Program. UDOT then performed a new self-evaluation in the summer of 2014 to measure progress and identify room for improvement. UDOT found that it had made progress in a number of areas. While UDOT's most recent INVEST evaluation revealed that the sustainability of the agency's operations and maintenance program is strong and improving, striving for even further improvement, UDOT developed six additional recommendations for future action.

Montana DOT Example

[Montana DOT \(MDT\) evaluated the agency's OM practices using INVEST criteria OM-2 and OM-3, focusing on sustainability areas that might save money, such as fuel and electrical efficiency.](#) MDT also conducted a benefit-cost analysis related to OM-4 evaluating a potential pilot for incorporating recycling at MDT rest areas in MDT District 1. As part of this analysis MDT reviewed other states rest area recycling practices. MDT determined that while the direct monetary benefits to MDT are small, the costs of instituting a recycling collection system are also small, and such an effort would enhance MDT's green image. Based on the INVEST evaluation and the related cost-benefit analyses, MDT is considering implementing improvements to its processes to better document MDT's progress toward sustainability.

Pennsylvania DOT Example

Pennsylvania DOT (PennDOT) recently used INVEST to evaluate its OM Programs. PennDOT used all fourteen INVEST OM criteria plus SP- 14 (Transportation Systems Management & Operations), to evaluate and improve their sustainability practices. The INVEST team conducted interviews with subject matter experts for each OM criterion. They found that operations were quite decentralized. In order to make sure they did not miss any information, and that the final score was accurate and reflected current practices, the team needed to speak with a wide variety of staff from across the agency. PennDOT subsequently held a scoring workshop and finalized the INVEST results, which included opportunities for improvements going forward. PennDOT concluded that they will improve their INVEST scores and sustainability by addressing the following initiatives: Develop and implement a comprehensive sustainability plan; Formalize coordination or create a partnership with the Department of General Services; and Increase development and implementation of quantifiable performance metrics related to sustainable practices.

Improve Education and Understanding of Sustainability

CHANGE THE PERCEPTION OF SUSTAINABILITY

INVEST is helping agencies and stakeholders define in new ways what sustainability means for the transportation sector. The application of INVEST helps to mature the topic of sustainability by taking it beyond standard environmental considerations. Using the triple-bottom-line concept, INVEST makes sustainability more relevant at DOTs and other transportation agencies in that it highlights social and economic benefits, expanding the perception of what it is to be “sustainable” and how these practices can be incorporated into daily practices. Agencies commonly found that the longer they used INVEST, the more engrained it became in their culture. For instance, through the concepts instilled by INVEST, project managers know which sustainability considerations to look for at the beginning and throughout a project, plan, or program.

“The tool is helpful in that it views sustainability in a comprehensive way. The majority of the time you talk about sustainability, you are dealing with environmental issues or non-motorized solutions. Transportation infrastructure looks at the materials, methodologies, and energy sources that you use. It is nice to have all of these elements in INVEST rather than just a few of the criteria that normally take all of the attention in discussions of sustainability.”

Member of District of Columbia Department of Transportation Project Development and Environmental Office

Federal Lands Example

FLH also found that INVEST helped them to further develop their definition of sustainability. FLH reported that their use of INVEST is intended mainly for training to encourage internal considerations of livability, sustainability, and context-sensitive solutions. FLH’s goals are to make sustainability part of standard procedures, and to emphasize that sustainability is not just environmentally or safety related, but also includes economic and social impacts. The focus of INVEST on the triple bottom line is helping FLH achieve this goal as they use the tool.

Utah DOT Example

At Utah DOT (UDOT), using INVEST helped to broaden the agency’s definition of sustainability and how staff view and understand sustainability as it relates to transportation. A member of the UDOT INVEST team recognized that staff members did not formally consider the agency as “sustainable.” However, the way INVEST presents the three principles of sustainability resonated with the state and illustrated that agency practices are already sustainable in various aspects. Using INVEST helped UDOT take sustainability from a purely environmental concept to a broader, more inclusive concept that addresses social and economic issues. INVEST has also helped the agency to realize the benefits of sustainability, and gain traction on initiatives like active transportation and health in transportation.

Many users of INVEST have found the materials associated with the tool to be valuable and easy-to-use for planning, programming, and project development. Some agencies—including the Illinois Tollway and state DOTs in Utah and Washington—used INVEST to inform updates to their planning guidelines and standard operating procedures, while other agencies used INVEST materials as a day-to-day reference for sustainability considerations. Additionally, many agencies identified the INVEST case studies as helpful in illustrating how

best practices are obtainable by any agency. Ultimately, INVEST could become a one-stop-shop of sustainability references for DOTs and transportation agencies throughout the country.

District of Columbia DOT Example

District of Columbia DOT (DOT) appreciated the ability of INVEST to provide a consistent reference for sustainability practices. The agency recognized that the best aspects of using the self-evaluation tool were the ability to quantify sustainability and the consistency of these quantification methods. Staff members at DDOT noted that sustainability can often harbor philosophical debates; whereas, the INVEST tool allows the agency to illustrate sustainability benefits through quantifiable measures and “bring everyone onto the same page” since the tool leaves little room for interpretation. Going forward, the agency plans to create a baseline of new projects and then score these projects over time as they move through project development process. DDOT staff members are looking forward to seeing the longitudinal results afforded by INVEST being used as a consistent reference.

MOTIVATE AND ENCOURAGE INNOVATIONS

Agencies specifically laud INVEST for motivating project managers to go the extra mile to achieve higher scores for their project, program, or plan. This motivation generates innovation, by inspiring staff to find ways to add sustainable elements and practices to their work while staying within budget. INVEST can also encourage staff by recognizing and acknowledging existing sustainability efforts that push the envelope and go above and beyond typical requirements.

Arizona DOT Example

[In addition to using the INVEST modules to support sustainability planning, design, and operations at the agency, ADOT also used the tool to design an internal sustainability project development award that encourages district engineers to go above and beyond standard practices as measured by INVEST criteria.](#) The agency created this avenue to increase exposure to and familiarity with sustainability throughout the agency.

Western Federal Lands Example

[WFL rewards innovation using the PD module to score, rank, and select the recipient of its Annual Sustainability Award.](#) Starting in 2012, WFL instituted the award to better market and showcase WFL sustainability efforts. During the first year, WFL compiled a list of 17 eligible (under-construction or recently constructed) projects including new construction and rehabilitation projects. As part of the scoring process, WFL met with each of the project managers to discuss the scope of the projects and identify sustainability features. In 2013, WFL scored and ranked all of their existing large scale projects to determine the Annual Sustainability Award winner. An added benefit of the award was that project managers were interested to learn what the award winner had done and what they could do better. Now project managers are trying to better incorporate sustainability throughout the entire project development process. Overall the Annual Sustainability Award is contributing to a culture of sustainability at WFL and increasing awareness by providing a quantifiable way to define and measure sustainability.

EMPHASIZE OUTCOMES OVER SCORE

While INVEST is a tool meant to evaluate the sustainability of a particular project or program, its inherent value is not the score it produces, but the outcomes it achieves and the recommendations it generates. A recurring theme in the feedback FHWA received on INVEST is that agencies care more about the benefits of INVEST through generating conversation, enhancing sustainability practices, and establishing benchmarks, and less about their final scores.

“Human nature compels us to want to score well when we measure ourselves. Although the resulting score indicates how we are performing in relationship to sustainability based on the established criteria, the real benefit is how we use the information we attained in answering the questions.”

– Utah DOT

Kittery MPO Example

[The Kittery Area Comprehensive Transportation System \(KACTS\) used INVEST to broadly improve sustainability principles and outcomes in their long range transportation plan \(LRTP\).](#) They used the SP module to score their approved 2010 LRTP and used the results to identify opportunities to better integrate and showcase sustainability principles in their 2014 LRTP. The scoring committee solely evaluated the content of the plan and did not award points for existing activities or programs that were not specifically mentioned. This approach to scoring led to the 2010 LRTP receiving a total score of 17 out of 250 possible points. The scoring results highlighted numerous areas for improvement for future LRTP updates including the need for KACTS to better and more accurately reflect all of the programming that it completes every year. Their use of INVEST was therefore a means by which they could improve their plan, rather than focus solely on their final score.

Washington DOT Example

Similarly, Washington DOT (WSDOT) approached application of the INVEST tool without the desire to obtain a specific score; rather, members at the agency wanted to identify the next incremental steps to becoming more sustainable. Performing the evaluation process served primarily to facilitate conversations and learn about sustainability.

BUILD INTELLECTUAL CAPACITY

Users of INVEST have also applauded its educational benefits and its ability to help build intellectual capacity within transportation agencies. In addition to framing the topic of sustainability and encouraging internal communications across disciplines, INVEST trainings and workshops promote staff understanding of sustainable practices and provide concrete examples of how to better integrate and implement innovative elements into projects, plans, and programs.

Eastern Federal Lands Example

[The Eastern Federal Lands Highway Division \(EFL\) within FLH has provided training on sustainability and livability for a number of years, and more recently incorporated INVEST into that training.](#) EFL decided to embed concepts from INVEST's PD module into their Construction Winter Training Program, the aim of which is to increase awareness and facilitate greater discussion about sustainability while further integrating sustainability considerations into project planning, design, and construction. As part of the training, EFL provides project teams with design alternatives and innovative approaches to better address context-sensitivity issues, apply livability principles, and incorporate sustainable highway practices featured in INVEST. As a result of these trainings and the need to better inform staff of the environmental process and CSS, in 2012, EFL implement-

ed an Environmental Sustainability review. The review is now completed for each project during the initial scoping meeting to identify opportunities for reducing environmental impacts and for improving long-term sustainability. This review reflects INVEST criteria and serves as a checklist to ensure that sustainability is considered by project teams early and often during the project development process.

Central Federal Lands Example

[The Central Federal Lands Highway Division \(CFL\) is using INVEST as a knowledge transfer tool to better inform staff of sustainable highway practices and as a mechanism to share lessons learned to help identify improvements for future projects.](#) In 2013, CFL used the PD module to carry out INVEST evaluations for three separate under-construction or recently constructed projects. Scoring team members gathered for kickoff meetings, were assigned criteria based on their area of expertise, wrote how their project addressed each criterion, and developed scoring summaries. These summaries described how the team carried out the scoring process, identified any issues they encountered, and recommended several criteria to focus on for future projects. CFL has shared the lessons learned from the scoring process with its staff members and will use the knowledge imparted through the scoring summaries to select and prioritize sustainability improvements in the future. By sharing information and lessons learned, CFL is increasing intellectual capacity and exposing more staff to sustainability concepts, approaches, and applications. To further learn and grow from their involvement in using INVEST, project teams made several recommendations on ways to enhance and improve the sustainability of future projects.

Facilitate Internal and External Communication and Outreach

ENCOURAGE INTERNAL COMMUNICATION

In addition to advancing more sustainable practices, INVEST can also be a powerful mechanism to encourage internal communication within agencies. When staff from different departments within an agency collaborate to evaluate a project using INVEST, this opens lines of communication that will likely carry over into other aspects of an agency's work. Many agencies that have used INVEST see it as a tool to initiate conversations between agency divisions and departments as a way to encourage the breakdown of "silos". Many agencies convened individuals from various divisions or levels to complete the INVEST evaluation, because not only did their INVEST teams recognize that various divisions overlap in planning, programming, and project development, but that they also needed subject matter experts from a variety of fields to assist in scoring. Oftentimes cross-collaboration, such as that inspired by using INVEST, can help these individuals learn from one another to make the scoring a cross-discipline learning process, as well as a more effective one.

Washington DOT Example

Numerous agencies have experienced success in facilitating internal communication within their agencies as a product of using INVEST. [Washington DOT \(WSDOT\) involved approximately 30 people in the scoring of their SR 520 Project using the PD module.](#) Scoring of each criterion involved personnel from different internal divisions, including the Urban Planning Office, the Public Transportation Division (multimodal focus), and the Community Transportation Planning Office, as well as coordination with consultants and state employees. Using INVEST for these evaluations allowed WSDOT to collaborate with subject matter experts—in transit operations, climate change, policy, emergency management, and bridge programs. The experts reviewed WSDOT's planning practices, identified best practices from their perspective, and examined the INVEST tool criteria to help score the evaluation. INVEST also helped to spur discussion in individual project disciplines and leader to a larger conversation about what sustainability means to the agency as a whole.

Arizona DOT Example

Arizona DOT (ADOT) also had success in improving internal communication while using INVEST. The agency brought together project managers with designers, planners, and engineers for internal scoring workshops. In general, senior project managers and designers seldom interact and have different vantages in terms of work and scope, even within the same agency. For the ADOT internal scoring workshops, each project manager partnered with a designer, planner, or engineer with an analyst perspective in order to score a project, which was an effective method to facilitate conversation across divisions within the agency. This method also allowed both parties to gather a new perspective of the plan, project, or program being evaluated and consider strategic methods outside of their normal spheres for achieving higher scores in the future.

FACILITATE EXTERNAL COMMUNICATION

While INVEST can be extraordinarily beneficial in encouraging internal communication, it can also be quite helpful in facilitating communications with partner agencies, municipalities, political organizations, and other stakeholders. Through its criteria, INVEST encourages users to work more closely with outside agencies to coordinate and advance sustainability efforts.

Arizona DOT Example

ADOT found the SP module to be an effective tool for facilitating partnerships with local governments. The agency conducted INVEST workshops with local agencies, such as the city of Sedona, to improve sustainability outcomes and communication, especially where state highway actions directly impact local governments and vice versa.

Cape Cod MPO Example

INVEST inherently has the potential to increase public relations opportunities (such as conversations with stakeholder and municipal partners) that help to promote an agency's use of INVEST. For example, in Massachusetts, the Cape Cod Commission (CCC), a regional planning agency, used the PD module, and as a result the Massachusetts Department of Transportation (MassDOT) reached out to the CCC to discuss their use of the tool. MassDOT met with the CCC prior to using INVEST in order to discuss the CCC's experience and identify areas for potential collaboration, which increased the tool's effectiveness at both the regional and state levels.

Springfield MPO Example

[The MPO for Springfield, IL, Springfield Sangamon County Regional Planning Commission \(SSPC\), also used INVEST to improve communication with external stakeholders.](#) The SSPC applied criteria from the PD module to a corridor improvement project along the Peoria Road / Route 66 Corridor. The MPO held a workshop with stakeholder agencies in the region, including city officials and the state DOT. Planners explained how the INVEST tool measures sustainability and how it could be applied to the corridor project. They showed visuals of each of the key criteria analyzed, outlining very clearly the requirements for receiving points, and showing where improvements could be made at specific locations along the corridor. Planners also showed before and after visuals with photographs depicting the corridor's current status, and mock-ups depicting its appearance after installation of the sustainability improvements suggested by the INVEST criteria. One of the key outcomes of using INVEST to score the corridor project was that it raised interest among Springfield stakeholders in implementing sustainability practices.

DEMONSTRATE A COMMITMENT TO SUSTAINABILITY AND SELF-IMPROVEMENT

INVEST can be a vital tool for helping public relations and outreach and soliciting pertinent and necessary feedback from community stakeholders. INVEST can also be helpful in explaining sustainability concepts to the general public and getting community support for a particular project, plan, or program.

Ohio DOT Example

The INVEST application benefited Ohio DOT District 12 from a public relations perspective. The Cleveland Innerbelt Bridge Project website features a "Sustainability Initiatives" page that tracks progress toward sustainability goals and highlights recognitions that the project received. Using INVEST for the bridge project gave Ohio DOT the ability to celebrate their daily environmental and economic business practices and demonstrate the effective use of tax dollars to decision-makers and their constituents.

Kittery MPO Example

The Kittery Area Comprehensive Transportation System (KACTS) MPO in southern Maine used INVEST to help show their commitment to continual self-improvement as they strive to improve the sustainability of their planning efforts over time. [KACTS used INVEST to score their 2010 Long Range Transportation Plan \(LRTP\) and used the results to inform the creation of the 2014 LRTP.](#) The LRTP working group recognized that the updated plan should be more informative and useful for the public to more clearly illustrate their practices, partnerships, policies, and programs that relate to sustainability. The change in content from the 2010 to the 2014 LRTP and this iterative process showed their stakeholders that they were committed to self-improvement and led to a considerable increase in points scored.

INVESTing Time

The amount of time required to use INVEST varies greatly by agency and application. The first time an agency uses INVEST there will be a learning curve to become familiar with the tool. Subsequent evaluations will see a significant decrease in time. A typical process for using INVEST first requires a point person to browse the tool and become familiar with how it works. This typically takes about a day. After that, the person will need to identify subject matter experts and have them gather supporting documents that they will each use to develop an initial score. The agency may then choose to hold a workshop so that all experts and stakeholders can reach consensus on their scores and discuss options for sustainability improvements. Finally, the agency can use this final score and the options for improvements discussed, to develop, analyze, and implement recommendations for improving future sustainability practices at their agency. Since INVEST is very much a learning tool, the time spent discussing sustainability, specific scores on criteria, and practical changes for the future is very valuable.

A more intensive use of INVEST could include detailed analyses of the costs, benefits, and implementation considerations for sustainability practices. Transportation agencies could also choose to spend more in-depth time to rescore and re-analyze a project using INVEST at certain milestones. Tracking performance in this way can provide long-term benefits for an agency and ensure that sustainability practices are continuing to be implemented. The graphics below and on the next page showcase the wide variety of time that INVEST users spend on scoring projects through the PD module and plans through the SP module.

Figure: Time and Labor Spent on PD Module

Agency	Project	INVEST Users	Workshop Time	Individual Time
Cape Cod Commission	Hyannis Access Study	Seven staff on interdisciplinary team	Full day	Three to four staff spending half days for a week
District of Columbia DOT	Retrospective evaluation of a project	Project Development and Environmental Office Team	No workshop	Several days for data collection; collectively scored the project, which took approximately four hours.
Washington State DOT	Retrospective evaluation of SR 520 Project	22-person interdisciplinary scoring team including staff and contractors	No workshop	Each scorer spent approximately one hour for initial responses, with minor additional time for follow-up questions

Figure: Time and Labor Spent on SP Module

Agency	Plan	INVEST Users	Workshop Time	Individual Time
Cape Cod Commission	2012 Regional Transportation Plan	Eight staff on interdisciplinary team	Full day	Three to four staff spending half days for a week
Kittery Area Comprehensive Transportation System	2010 Long Range Transportation Plan (LRTP) and 2014 LRTP	Review Committee with representation from local municipalities, advocacy groups, Maine DOT, and FHWA	6 hour workshop	Plans were scored as a group at the workshop, instead of individually. In advance of workshop committee members allocated a couple of hours each to familiarize themselves with the tool.
Puget Sound Regional Council (PSRC)	Transportation 2040 Update	11 staff within long-range transportation planning team	No workshop	Equivalent of having three full time staff over the course of three to four days
Washington State DOT	Corridor Studies	Nine staff on interdisciplinary scoring team assisted by 28 subject matter experts (internal and external)	Full day	Individuals spent several hours each filling out a pre-workshop score sheet for each criterion and consulting subject matter experts

Relating INVEST to Other Sustainability Tools

While there are other sustainability tools available that address different aspects of the highway profession, INVEST is the only tool that meets all of the following:

- Specific to transportation
- Covers the full transportation life-cycle, from early system planning, through preliminary design, final design and construction, and continuing through operations and maintenance.
- Free
- Based on a self-evaluation
- Does not require third party certification



INVEST can be used on its own, in conjunction with other tools, or tailored to meet a specific agency's needs. FHWA drew upon ideas from other rating systems during the development of INVEST and continues to coordinate with developers of other tools.

In short, INVEST is practical and built for the real world: completely voluntary, private, free, flexible and practical.

The figure below summarizes INVEST's niche among other tools related to sustainability and infrastructure:

Figure: Comparison of Sustainability Evaluation Tools

Sustainability Evaluation Tool	Type of Tool ¹	Transportation System Lifecycle					Organized by		
		System Planning & Programming	Project Development			Operations & Maintenance	Solutions	Phase	Discipline
			Project Planning	Project Design	Project Construction				
Envision™	Voluntary, SA & RS								x
GreenLITES	Mandatory Internal Certification						x		x
GreenLITES Operations	SA						x		x
Greenroads	Voluntary, RS							x	x
I-LAST	Voluntary, SA							x	x
INVEST	Voluntary, SA							x	x
LEED-ND®	Voluntary, RS								
SITES™	Voluntary, RS						x		x
STARS	Voluntary, RS								

LEGEND
RS = 3rd Party Rating System
SA = Self Assessment
 Tool Specifically Targeted at Roadway Projects
 Tool Targeted at General Infrastructure

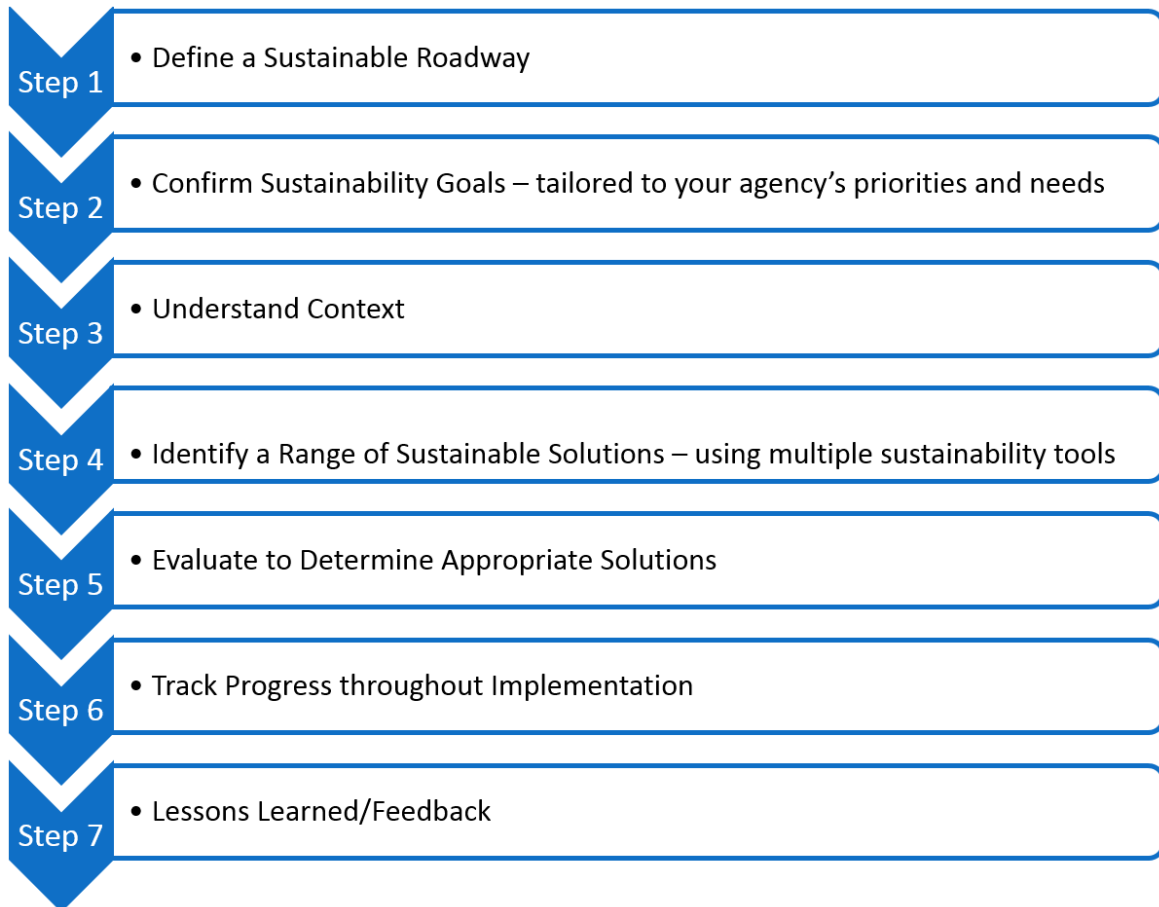
¹ Type of Tool indicates planned ultimate tool type. Some emerging systems are at a lesser point of development.

Credit for graphic: Lisa Reid, Anneke Davis, Tim Bevan, CH2MHill

USE IN CONJUNCTION WITH OTHER TOOLS

While INVEST was created to be used as a separate tool, it can also easily be used in conjunction with other tools. Developed by CH2M Hill, the following seven step approach provides the framework for how any agency would go about using multiple sustainability tools in conjunction with one another:

Figure: Seven Step Approach to Using Multiple Sustainability Tools Together



“The use of one or more evaluation tools will likely provide a greater selection of applicable sustainable solutions. This is advantageous as it can maximize the number of solutions that best fit the context and phase of the project. In addition, focusing on only one evaluation tool can skew the project team to prioritize high point value solutions to achieve credit for actions that may not be sustainable. Using multiple evaluation tools and evaluating their solutions against the goals of an agency or project provides the project team an opportunity to focus on key sustainability goals and accomplish them without losing focus by trying to score highly within any particular tool.”

– An Approach for Integrating Sustainability into Roadway Project Development[1]

[1] Reid, L., A. Davis, and T. Bevan. 2012. TRB Submittal 13-1772: An Approach for Integrating Sustainability into Roadway Project Development.

TriMet Example

An example of an agency that used INVEST along with another sustainability tool is TriMet. In addition to INVEST, TriMet also used the Envision Sustainable Infrastructure Rating System as the basis for creating an initial sustainability matrix for the Portland Milwaukie Light Rail (PMLR) Transit Project. Envision is the product of a joint collaboration between the Zofnass Program for Sustainable Infrastructure, the Harvard University Graduate School of Design, and the Institute for Sustainable Infrastructure. It is intended to provide a holistic framework for evaluating and rating the community, environmental, and economic benefits of projects. Using these two sustainability evaluation tools together was hugely beneficial to TriMet and cannot be overemphasized. Envision is designed to focus more broadly on many different types of infrastructure projects, and it provided an initial matrix from which to develop an exhaustive list of criteria that engendered the collection of available data. Used in conjunction with INVEST, these metrics helped to clarify project accomplishments, serve as a baseline for the INVEST analysis, and highlight gaps in either systems or practices currently in place.

CUSTOMIZE TO MEET AGENCY NEEDS

INVEST is a national tool designed to meet the needs of a broad range of agencies who have the flexibility to use the tool to best serve their needs. As such, some of the criteria, or some aspects of some criteria may not apply well to all agencies. For example, the Project Development module provides a custom scorecard to address this issue and better meet the needs of different types of projects. Also, because INVEST is a self-evaluation tool, users can interpret the criteria through the lens of their particular context rather than following the criterion exactly. As INVEST is intended to measure performance above and beyond current requirements and typical practices, agencies should not expect to score points on every criterion. The value of INVEST lies more in the process of evaluation and working towards improving sustainability outcomes rather than focusing solely on the score itself.

Illinois Tollway Example

[One such agency that adapted the tool to meet their needs is the Illinois Tollway.](#) Illinois Tollway developed supplemental text to add to existing INVEST criteria and developed some of their own criteria based on Tollway-specific needs. The supplements incorporated additional best practices and scoring elements into the INVEST criteria. Some were specific to the Tollway while others come from other sustainability rating systems, including I-LAST and Greenroads.

In addition, the Illinois Tollway added criteria in areas they felt were important, but that were not already covered by INVEST. These included criteria such as regional employment, which were not appropriate at the national level, as well as criteria related to goals that are important to the Illinois Tollway's service area, such as visual aesthetics and light pollution. The Illinois Tollway has also developed a criterion for the incorporation of innovative sustainable roadway design or construction practices to allow for the use of cutting edge technology and encourage the development of new methods.

