



FINAL REPORT

Massachusetts Department of Transportation INVEST Project Report Summary of INVEST Use, Key Findings, and Next Steps



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Executive Summary

The Infrastructure Voluntary Evaluation Sustainability Tool (INVEST), developed by the Federal Highway Administration (FHWA), aims to assist transportation agencies nationwide in evaluating and advancing the sustainability of their planning, project development, and operations and maintenance processes. In addition to being a voluntary, web-based self-evaluation tool, INVEST also serves as a resource for communication and collaboration as transportation agencies internally coordinate the integration of sustainability into their core business practices.

INVEST evaluates the sustainability of the full lifecycle of highway and transportation projects and programs, using four modules: System Planning for States (SPS), System Planning for Regions (SPR), Project Development (PD), and Operations and Maintenance (OM). Each module is independent and can be evaluated separately.

MassDOT INVEST Program Overview

In 2014, the Massachusetts Department of Transportation (MassDOT) received funding from FHWA, as part of their second round of INVEST Implementation Projects, to use INVEST and assess the organization's sustainability practices. MassDOT selected to base their evaluation on INVEST criteria associated with the Operations and Maintenance (OM) and Project Development (PD) modules. MassDOT established the following goals to measure the effectiveness and success of engaging departments and divisions across the state in the evaluation process:

- › Introducing INVEST as a sustainability resource and evaluation tool.
- › Highlighting existing sustainability best practices.
- › Using INVEST evaluation to identify gaps and opportunities to incorporate new sustainability best practices.
- › Developing new initiatives to help MassDOT achieve greater sustainability.

INVEST Outcomes and Next Steps

MassDOT held a total of five workshops, including four using criteria from the OM module to assess operations and maintenance policies/procedure, and one using the PD module to evaluate the Casey Arborway Project – a highway overpass replacement project. The outcomes of the OM criteria evaluation provided MassDOT with a better understanding of gaps and opportunities for achieving greater sustainability in its policies and practices. For the PD criteria evaluation of the Casey Arborway Project, the Project earned the Gold level of achievement under the INVEST rating system underscoring MassDOT's commitment to sustainability and success in addressing the links between transportation projects and a community's economic vitality and improvements to natural and built environments. Overall, MassDOT's participation in the INVEST Program has benefited the organization and the citizens of the Commonwealth in many ways, including enhancing awareness of

sustainability as a critical element in all aspects of the way MassDOT plans, designs, and operates.

MassDOT is using the information gained from the INVEST evaluation workshops to assess and prioritize opportunities that will help enhance MassDOT's sustainability program and initiatives. In each of the INVEST workshops, participants worked in small groups to develop sustainability initiatives for MassDOT to evaluate and potentially pursue. Workshop participants reconvened as one large group to discuss and vote on each initiative's costs, return on investment, implementation feasibility, and associated benefits. The top initiatives were then prioritized by GreenDOT and Environmental Services staff using a weighted criteria evaluation and scoring prioritization tool. Some initiatives are already slated for implementation; however MassDOT will advance additional priority initiatives as part of the INVEST project.



Chapter 1: Introduction

Federal Highway Administration’s Sustainable Highways Initiative

The Federal Highway Administration’s (FHWA) Sustainable Transport and Climate Change Team leads the Sustainable Highways Initiative whose mission is to support, “Programs and activities conducted across FHWA to facilitate balanced decision-making among environmental, economic, and social values – the triple bottom line of sustainability.”¹ As a part of this initiative, FHWA developed INVEST (Infrastructure Voluntary Evaluation Sustainability Tool) to assist transportation agencies with the evaluation and integration of sustainability practices in planning, project development, and operations and maintenance policies and processes. FHWA conducted nationwide pilot programs that collected feedback from state and local transportation planning agencies to develop INVEST as a tool to improve sustainability of the transportation industry.

INVEST is a web-based, self-evaluation tool comprised of sustainability best practices for highway and other roadway projects. INVEST is comprised of seventy-nine criteria that are categorized under four modules (see Table 1). Each INVEST module is independent to allow for separate evaluations. Each criteria includes a goal, background description, explanation of relationship to sustainability, criteria scoring requirements, and additional resources. An online scoring system is provided to enable users to centrally track and document evaluations, upload documentation, and provide notes that can be shared with designated INVEST users. This platform and framework encourages collaboration and communication across transportation agencies and other constituents to identify opportunities to improve sustainability performance.

¹ Federal Highway Administration (FHWA). *Sustainable Highways Initiative*. <https://www.sustainablehighways.dot.gov/default.aspx>

Table 1: INVEST Module Descriptions

INVEST MODULE	DESCRIPTION
System Planning for States (SPS)	Includes 16 criteria for evaluating system-level planning and programming policies, processes, procedures, and practices geared towards States, Tollways, and local agencies that own infrastructure and perform landscape-scale and corridor-wide planning.
System Planning for Regions (SPR)	Includes 16 criteria for evaluating system-level planning and programming policies, processes, procedures, and practices geared towards Metropolitan Planning Organizations, Council of Governments, or other planning organizations that perform landscape-scale planning for a metropolitan area and may not own infrastructure.
Project Development (PD)	Includes 33 criteria that are organized from planning to design and construction.
Operations and Maintenance (OM)	Includes 14 criteria including 4 aimed at internal operations and 10 focused on maintenance and operations of the highway system.

Source: FHWA. *Sustainable Highways. INVEST Version 1.2 Modules and Criteria.*

<https://www.sustainablehighways.org/664/criteria.html>

Sustainability at MassDOT

The Massachusetts Department of Transportation (MassDOT) is committed to preserving environmental integrity, supporting economic development, and enhancing public health across the Commonwealth. This commitment is demonstrated through MassDOT's aim to integrate sustainability principles into all aspects of the way the organization plans, designs, builds, and operates the state transportation system.

In 2006 MassHighway, which is now the Highway Division of MassDOT, published the Project Development and Design Guide (PDDG), which provides guidance for designers, project proponents, and agency staff on designing and implementing federal or state-funded roadway projects. The PDDG embraces the Complete Streets design principles, and outlines general guidance on flexible, context-based approaches to ensuring safe and convenient accommodation of all roadway users. The PDDG also provides direction on environmental stewardship standards for project design, including drainage and hydrology; landscaping; and wildlife protection.

In 2010 MassDOT adopted the GreenDOT Policy Directive, which is a comprehensive sustainability initiative that aims to position MassDOT as a national leader in greening the state transportation system. Through a wide range of initiatives, from strategic planning to construction and system operations, MassDOT is committed to using resources efficiently to serve its existing customers while persevering resources for future generations.

In alignment with corresponding state laws and policies, such as the Global Warming Solutions Act (2008) and the Healthy Transportation Compact (2009), the GreenDOT Policy establishes the following three goals:

- › **Reduce greenhouse gas emissions;**
- › **Promote healthy transportation modes and smart growth development; and**
- › **Support environmental stewardship.**

In 2012 MassDOT coordinated with staff across departments and offices to identify initiatives and actions for embedding the sustainability vision into the core business practices through the GreenDOT Implementation Plan (the Plan). As a part of this plan, MassDOT developed a stewardship goal to, “Operate the transportation system in a manner that embraces our stewardship of the Commonwealth’s natural, cultural, and historic resources.” The Plan includes sixteen goals and approximately four hundred implementation targets, as well as outlines MassDOT’s sustainability initiatives for all MassDOT divisions under the themes of air quality, energy consumption, material procurement, land management, transportation planning and design, waste management, and water resources.

MassDOT Goals for INVEST

In 2014 MassDOT received funding from FHWA, as part of their second round of INVEST Implementation Projects, to evaluate the agencies’ sustainability performance and achievements using the INVEST rating system. MassDOT initiated the project by comparing INVEST criteria goals with the agencies’ existing goals and policies. MassDOT’s Environmental Services Division selected five INVEST Operations and Maintenance (OM) criteria for evaluation, including:

- › OM-1: Internal Sustainability Plan
- › OM-2: Electrical Energy Efficiency and Use
- › OM-3: Vehicle Fuel Efficiency and Use
- › OM-4: Reuse and Recycle
- › OM-12: Road Weather Management

The Casey Arborway Project was selected for the INVEST Project Development (PD) evaluation, which was a highway overpass removal project with a focus on enhancing multimodal connectivity in a neighborhood of Boston. MassDOT identified twenty-five PD criteria to be a part of the sustainability evaluation process (See [Table 3](#)).

Given that the PDDG, GreenDOT Policy, and Implementation Plan are MassDOT’s primary resources and guidance documents for sustainability performance, MassDOT compared the agencies’ existing goals to the selected INVEST criteria. MassDOT staff reviewed the INVEST OM and PD criteria in comparison to MassDOT goals and concurred that INVEST is a relevant sustainability tool to evaluate the agency under the recommended criteria. To view the evaluation spreadsheet, see Appendix A.

To support MassDOT’s efforts to integrate sustainability as a core value across the agency, MassDOT conducted five statewide INVEST workshops with participants including MassDOT employees and additional members of the Casey Arborway design team. These workshops used the INVEST framework as a platform for discussing sustainability principles, assessing the agency’s performance, and identifying new initiatives to help MassDOT achieve goals. Workshop goals included:

- › **Introducing INVEST as a sustainability resource and evaluation tool.**
- › **Highlighting existing sustainability best practices.**
- › **Using INVEST evaluation to identify gaps and opportunities to incorporate new sustainability best practices.**
- › **Developing new initiatives to help MassDOT achieve greater sustainability.**

From 2014 to 2015, MassDOT held a total of five statewide workshops with an estimated total of 156 attendees including representation from MassDOT’s six Highway Districts. Three workshops focused on MassDOT’s OM policies and procedures; one workshop was dedicated to road weather management (RWM); and one PD workshop evaluated MassDOT’s Casey Arborway Project in Boston. MassDOT scored well under the INVEST evaluation, however the outcome of the scoring was not as significant in the process as the opportunity for a diverse set of staff to come together collectively and reflect on their practices, compare them to best practices in the industry within the INVEST framework, and identify strategies for improving sustainability.

MassDOT was able to achieve the aforementioned goals by integrating the INVEST framework into the format of the statewide workshops. The following chapters describe MassDOT’s approach to workshop design, summarize recommendations, and highlight the road forward for improving MassDOT’s sustainability performance.

Chapter 2: Operations and Maintenance

Four workshops using the INVEST OM criteria were held. Three workshops focused on MassDOT’s OM policies and procedures; one workshop was dedicated to road weather management (RWM). This chapter describes the INVEST OM module and MassDOT’s workshop design and format to achieve workshop goals.

INVEST Operations and Maintenance (OM) Module

The INVEST OM module includes a total of fourteen criteria, with criteria dedicated to the agencies’ internal practices as well as operations and maintenance of highway systems. MassDOT focused on five INVEST OM criteria, including evaluating their own sustainability plan, energy use, fuel efficiency, recycling programs and road weather management (RWM).² Table 2 lists and describes the INVEST OM criteria selected by MassDOT.

Table 2: MassDOT’s Selected INVEST OM Criteria

INVEST OM CRITERIA	DESCRIPTION
OM-1: Internal Sustainability Plan	Focus on sustainability improvements within the agency’s internal operations that affect all three principles of the triple bottom line.
OM-2: Electrical Energy Efficiency and Use	Reduce the consumption of fossil fuels during operation and maintenance of agency owned and/or operated facilities through improvements in efficiency and the use and/or generation of renewable energy sources.
OM-3: Vehicle Fuel Efficiency and Use	Reduce fossil fuel use and emissions in vehicles used for operations and maintenance.
OM-4: Reuse and Recycle	Create and pursue a formal recycling and reuse plan for agency operated facilities and maintenance activities.
OM-12: Road Weather Management	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.

² MassDOT used INVEST Criteria Version 1.1 for the evaluation of OM-1 through 4, and Version 1.2 for OM-12.

MassDOT Operations & Maintenance

MassDOT oversees and maintains more than 15,975 lane miles of roadway, as well as more than 4,950 bridges and associated infrastructure.² MassDOT is committed to the safe and consistent operation of these critical statewide resources. The agency is taking a proactive approach by engaging sustainability rating systems to improve efficiency of operations and maintenance processes.

Operations and Maintenance Workshops Overview

To improve sustainability in operations, MassDOT organized a series of three OM workshops with all of MassDOT's Highway Districts that addressed OM-1, OM-2, OM-3, and OM-4. A separate statewide workshop was held for OM-12: Road Weather Management; however the format of the workshops remained consistent across the workshops. The five-hour long workshops incorporated interactive presentations on sustainability practices, an overview of INVEST resources, small-group breakout sessions on INVEST OM criteria, and a large-group initiative evaluation exercise.

A total of ninety MassDOT employees attended OM workshops including highway, traffic, and bridge engineers; facility, materials, and equipment managers; as well as representatives from FHWA, environmental services, environmental management systems specialists, and members of the GreenDOT program. The goal of these workshops was to highlight MassDOT's sustainability initiatives, introduce INVEST as a sustainability resource, evaluate the agency's performance, and identify new sustainability initiatives to help the agency achieve goals. The following discusses the OM: 1-4 workshops with the RWM workshop later described on page 24.

Operations and Maintenance Participant Engagement & Education

The OM workshops utilizing OM: 1-4 commenced with interactive, educational presentations that highlighted statistics related to waste generation, electricity use, and transportation-related greenhouse gas emissions. Each informational slide was followed by a polling question for participants to anonymously report on sustainability-related habits or topics (see example in Figure 1). These engagement activities encouraged participants to contemplate the pillars of sustainability, share questions or ideas, and reach consensus about the definition of sustainability. It also provided the foundation for discussing MassDOT's sustainability policies and initiatives, as well as introducing INVEST's sustainability framework and best practices.

² MassDOT. Highway Division Webpage. Retrieved on January 21, 2016, from: <https://www.massdot.state.ma.us/highway/Departments/SnowIce.aspx>

Operations and Maintenance INVEST Assessments and Recommended Initiatives

After a presentation on the INVEST program, attendees volunteered to participate in two separate small-group breakout sessions to discuss the INVEST OM criteria and evaluate MassDOT's highway operation practices. Based on the INVEST online scoring modules, MassDOT developed hard-copy questionnaires to facilitate small-group evaluations, document gaps, and identify initiatives that would help MassDOT's performance. Each small-group reported back to the larger group on the evaluation process, the INVEST score, and provided two recommended sustainability initiatives generated by group assessments and discussions.

All of the small-groups' top-two recommended sustainability initiatives were compiled into a polling presentation for large-group discussion and evaluation. MassDOT led large-group discussions to deliberate on a total of eight initiatives' including benefits, associated costs, and implementation challenges. During this discussion, the group was polled using real-time charts that displayed if there was general agreement, disagreement, or uncertainty about the initiatives' return on investment, cost effectiveness, and overall feasibility. Participants also discussed the associated co-benefits of implementing certain initiatives and addressed questions. The OM INVEST Scoring Results are provided in Appendix B.

Key Outcomes

As a result of the INVEST OM workshops, MassDOT employees statewide have a better understanding of how MassDOT and FHWA are defining sustainability and measuring the effectiveness of operations. The small-group format provided opportunities for employees to collaborate and learn how MassDOT is supporting sustainability agency-wide. Participants gained insight to how their positions impact sustainability, identify gaps in current processes, and evaluate opportunities to improve MassDOT protocols or the INVEST rating system.

Holding three separate OM workshops enabled MassDOT to compare responses and protocols across all six highway districts. While the majority of participant responses to the OM criteria's scoring questions were analogous, several responses underscored that the agency could benefit from improved communication networks across districts. In some cases, employees were unaware that MassDOT has completed a comprehensive sustainability plan in the form of the GreenDOT Implementation Plan. In other cases, GreenDOT employees were unaware that some districts had previously organized their own sustainability committees.

While group assessments and INVEST scores for MassDOT's OM policies were insightful, the most valuable aspect of the workshop was the collaboration between employees to conceive new sustainability solutions. Post workshop surveys highlighted that on average workshop participants agree on the following:

- › **83% of workshop participants felt that they can personally make an impact on improving sustainability practices in their current roles.**
- › **87% of workshop participants felt that the recommended priority initiatives are practical for their department.**
- › **88% of workshop participants felt that is somewhat likely or very likely that they will use INVEST as a sustainability resources in their current roles.**

Next Steps

MassDOT is using workshop feedback and documentation to compare best practices across districts and identifying strategies to improve performance across districts. Under OM-02 Electrical Energy Efficiency, workshop activities highlighted that District 2 uses solar energy, which is tied to an online portal that displays the amount of energy saved and greenhouse gas emissions avoided. Under OM-04 Recycle and Reuse, District 1 shared how they were able to reduce greenhouse gas emissions from fuel used to haul waste by reducing the frequency of pickups, which also saved the district on contractor hauling fees.

Some of the lessons-learned and best practices from the MassDOT OM workshop may be applicable across all six highway districts. However, the OM workshops also underscored that MassDOT's highway districts have different characteristics that cannot always be solved by blanket solutions. District feedback emphasized that the most effective way to move forward with the GreenDOT Implementation Plan will be to collaborate with District champions and support a grassroots approach to

embracing the sustainability goals and tasks. See Appendix B for the MassDOT OM Case Study.

Key outcomes and next steps for MassDOT based on the evaluation of its policies and procedures using the INVEST OM module include:

- › **MassDOT was able to compare the sustainability of its operations statewide using a common framework.**
- › **MassDOT staff contributed ideas for new sustainability initiatives.**
- › **MassDOT staff gained greater understanding of sustainability best practices and support for new sustainability initiatives.**
- › **MassDOT is establishing sustainability teams to continue their focus on sustainability.**

Chapter 3: Project Development

In 2014 MassDOT held an INVEST PD workshop to evaluate MassDOT's Casey Arborway Project in Boston. MassDOT invited thirty-five internal and external project team members to participate in the sustainability evaluation. This chapter describes the INVEST PD module and MassDOT's workshop design and format to achieve workshop goals.

INVEST Project Development Module

The INVEST Project Development (PD) module includes thirty-three criteria that are organized from planning to design to construction.³ The INVEST PD Criteria are categorized into seven different scorecards that are based on project types (paving, basic, extended, scenic/recreational or custom core) and physical locations (rural or urban).

MassDOT selected the Casey Arborway Project for PD evaluation, which is a highway overpass removal project to enhance multimodal connectivity in Boston. The Casey Arborway Project characteristics aligned with INVEST's basic urban scorecard for, "small urban reconstruction or urban bridge replacement projects that do not expand capacity of the roadway."⁴ In addition to the criteria included in basic urban scorecard, MassDOT opted to use the custom core scorecard in order to include *PD-16: Scenic, Natural, or Recreational Qualities* in the assessment of the Casey Arborway Project's parkways. MassDOT selected a total of twenty-five criteria to be a part of the evaluation process in the PD Workshop. Table 3 outlines the selected PD criteria and provides a goal description for each.

Casey Arborway Project Overview

The Monsignor William J. Casey Overpass was a 1,650-foot long elevated section of highway that passes through the Jamaica Plain neighborhood in the City of Boston. The overpass was found structurally deficient in 2010 and beyond the point of effective repair. This project called for the removal of the overpass and the construction of an at-grade roadway network, as a means of eliminating the physical and visual barriers that had divided the neighborhood. Overall project goals included enhancing circulation for all modes and users; promoting transportation choices; increasing neighborhood connectivity; establishing a sense of place to celebrate the area's architectural, transportation, and open space history; and integrating sustainability into design concepts.

³ MassDOT used Version 1.1 of the INVEST PD criteria for the Casey Arborway Project evaluation.

⁴ INVEST Sustainable Highways Self-Evaluation Tool. (2012). *INVEST 1.1 Compendium*. Retrieved on January 20, 2016, from: <https://www.sustainablehighways.org/files/869.pdf>

Table 3: MassDOT Selected INVEST PD Criteria – Custom Core Scorecard

INVEST PD CRITERIA	GOAL DESCRIPTION
PD-2: Lifecycle Cost Analysis	Reduce life-cycle costs and resource consumption through the informed use of life-cycle cost analyses of key project features during the decision-making process for the project.
PD-3: Context Sensitive Project Development	Deliver projects that harmonize transportation requirements and community values through effective decision-making and thoughtful design.
PD-4: Highway and Traffic Safety	Safeguard human health by incorporating science-based quantitative safety analysis processes within project development that will reduce serious injuries and fatalities within the project footprint.
PD-5: Educational Outreach	Increase public, agency, and stakeholder awareness of the integration of the principles of sustainability into roadway planning, design, and construction.
PD-6: Tracking Environmental Commitments	Ensure that environmental commitments made by the project are completed and documented in accordance with all applicable laws, regulations, and issued permits.
PD-7: Habitat Restoration	Avoid, minimize, rectify, reduce, and compensate the loss and alteration of natural (stream and terrestrial) habitat caused by project construction and/or restore, preserve, and protect natural habitat beyond regulatory requirements.
PD-8: Stormwater Quality and Flow Control	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.
PD-10: Pedestrian Facilities	Provide safe, comfortable, convenient, and connected pedestrian facilities for people of all ages and abilities within the project footprint.
PD-11: Bicycle Facilities	Provide safe, comfortable, convenient, and connected bicycling facilities within the project footprint.
PD-12: Transit and HOV Facilities	Promote use of public transit and carpools in communities by providing new transit and high occupancy vehicle (HOV) facilities, or by upgrading existing facilities within the project footprint.
PD-14: ITS for System Operations	Improve the efficiency of transportation systems through deployment of technology and without adding infrastructure capacity in order to reduce emissions and energy use, and improve economic and social needs.

INVEST PD CRITERIA	GOAL DESCRIPTION
PD-15: Historic, Archaeological, and Cultural Preservation	Preserve, protect, or enhance cultural and historic assets, and/or feature National Scenic Byways Program (NSBP) historic, archaeological, or cultural intrinsic qualities in a roadway.
PD-16: Scenic, Natural, and Recreational Qualities	Preserve, protect, and/or enhance routes designated with significant scenic, natural, and/or recreational qualities in order to enhance the public enjoyment of facilities.
PD-17: Energy Efficiency	Reduce energy consumption of lighting systems through the installation of efficient fixtures and the creation and use of renewable energy.
PD-18: Site Vegetation, Maintenance, and Irrigation	Promote sustainable site vegetation within the project footprint by selecting plants and maintenance methods that benefit the ecosystem.
PD-19: Reduce, Reuse, and Repurpose Materials	Reduce lifecycle impacts from extraction and production of virgin materials by recycling materials.
PD-20: Recycle Materials	Reduce lifecycle impacts from extraction, production, and transportation of virgin materials by recycling materials.
PD-22: Long-Life Pavement	Minimize life-cycle costs by designing long-lasting pavement structures.
PD-23: Reduce Energy and Emissions in Pavement Materials	Reduce energy use in the production of pavement materials.
PD-24: Contractor Warranty	Improve quality and minimize lifecycle costs by promoting the use of extended contractor warranties for pavement.
PD-25: Construction Environmental Training	Provide construction personnel with the knowledge to identify environmental issues and best practice methods to minimize impacts to the human and natural environment.
PD-26: Construction Equipment Emission Reduction	Reduce air emissions from non-road construction equipment.

Casey Arborway Project Workshop Overview

MassDOT held a one-day workshop to evaluate the Casey Arborway Project with thirty-five attendees, which included the project management team, landscape architects, traffic engineers, transportation planners, highway designers, pavement specialists, public outreach specialists, architectural historians, members of the MassDOT GreenDOT program, as well as other partner agencies such as FHWA and the Department of Conservation and Recreation. MassDOT also invited highway designers, environmental engineers, and others that were not involved in the project to solicit external feedback on the project, as well as introduce INVEST as a resource for project development staff.

Similar to the OM workshops, MassDOT's goals were to highlight one of MassDOT's completed exemplary projects, introduce INVEST as a sustainability resource, evaluate the project methods and characteristics, and identify new sustainability initiatives to help achieve MassDOT sustainability goals. The workshop included an overview of the Casey Arborway Project, the INVEST rating system, three rounds of breakout sessions, and a large-group initiative evaluation exercise.

Casey Arborway Project INVEST Assessment





The MassDOT PD workshop held three small-group breakout sessions. MassDOT organized the twenty-five PD criteria into four PD criteria groups including Resource Management, Community, Construction, and Energy and Environment. In advance of the workshop, attendees were assigned to primary and secondary PD criteria groups based on their role on the Casey Arborway Project or at MassDOT. In two separate sessions, each group evaluated and scored the Casey Arborway Project using two different sets of INVEST PD criteria groups. In the third breakout session, the corresponding groups shared their scoring results and methodologies to reconcile INVEST points and recommend new sustainability initiatives. See Appendix D for more details of this workshop and for a case study on this project.

According to the workshop participants, the Casey Arborway Project achieved the Gold level under the INVEST rating system scoring 58 of 108 possible points, or 54 percent (see Figure 2). While the scores and level of achievement were significant for the project in highlighting exemplary sustainability performance, it is equally important that the workshop exercises also generated important project insight for MassDOT and feedback for FHWA on the INVEST rating system and guidance materials. See [Chapter 4: Sustainability Initiatives and Next Steps](#) for more details.

Casey Arborway Project Recommended Sustainability Initiatives

During the breakout sessions, workshop participants proposed new sustainability initiatives and identified eight priority initiatives for large group evaluation. The group discussed the associated costs and implementation challenges for each initiative. Real-time polling software was used to enable attendees to anonymously participate in polling questions to gauge general agreement, disagreement, or

Figure 1: INVEST Level of Achievements

Project Development Achievement Levels		Fraction of Total Points Possible	Points Required					
Achievement level	No. of Available Points		Paving	Urban Basic	Urban Extended	Rural Basic	Rural Extended	Scenic and Recreational
	Platinum	60%	38	82	103	71	92	82
	Gold	50%	32	68	86	60	77	68
	Silver	40%	25	54	69	48	61	54
	Bronze	30%	19	41	52	36	46	41

uncertainty of each initiatives' return on investment, cost effectiveness, and overall feasibility. This was followed by a group discussion of co-benefits of initiative implementation and additional comments or questions. See Appendix D case study of the MassDOT Casey Arborway Project workshop.

Key Outcomes

Under the INVEST PD module, the workshop participants awarded the Casey Arborway Project the Gold level of achievement based on the criteria provided in the basic urban scorecard with the addition of PD-16: Scenic, Natural, or Recreational Qualities. Through a collaborative workshop assessment and deliberation across groups of participants, the Casey Arborway Project achieved 58 total points out of 108 points possible. At 54 percent, in the INVEST rating system grants Gold status to the Casey Arborway Project.

While group assessments and INVEST scores for MassDOT's Casey Arborway Project were constructive, the most valuable aspect of the workshop was the collaboration between MassDOT employees and consultant team designers and engineers was to determine additional initiatives to improve sustainability of project development. Post workshop surveys highlighted the attitudes of workshop participants.

- › **88% of workshop participants felt MassDOT makes an effort to incorporate sustainability practices into project development.**
- › **71% of workshop participants felt that they can personally make an impact on improving sustainability practices in their current roles.**
- › **87% of workshop participants felt that the recommended priority initiatives are practical for MassDOT.**

The benefits of the INVEST evaluation extend beyond the Casey Arborway Project's Gold level of achievement. MassDOT's PD workshop provided a unique opportunity for internal and external analysis of MassDOT's approach to project development in relation to FHWA's best practices for sustainable highways. This interdisciplinary format engaged a wide range of project team roles allowing for a diverse set of

perspectives to be shared in small and large group formats. It revealed existing project activities and approaches that improved sustainable aspects of the project, which were in some cases believed to be above and beyond those which received credit through INVEST.

One example was related to INVEST Version 1.0's PD-24: Contractor Warranty for pavement preservation. The criteria was not applicable to MassDOT because the agency has an internal pavement preservation program that extends pavement service life up to forty years, which was far beyond the five year warranty required by PD-24 in INVEST Version 1.0. The MassDOT PD workshops highlighted additional sustainability practices across the agency, while providing useful feedback to FHWA so that criteria limitations could be addressed in INVEST Version 2.0.

Based on participant feedback from the PD workshop, MassDOT recommended that the FHWA provide additional guidance on whether INVEST should take a literal or intent-based approach toward scoring project development for a more comprehensive and effective evaluation process. If the INVEST PD criteria questions had been interpreted based on intent, the Casey Arborway Project would have earned even higher level of achievement (Platinum), whereas with the literal approach the project scored at the Gold level. However, workshop participants remained rigorous in their analysis to align with the literal requirements provided in the INVEST rating system to gather feedback and help FHWA to further improve the applicability of sustainability best practices.

Next Steps

Key outcomes of MassDOT's Casey Arborway Project evaluation using the INVEST PD module included:

- › MassDOT reaffirmed the sustainability of the Casey Arborway through the INVEST scoring system.
- › MassDOT had more tangible and measurable sustainability performance data to share with future project designers, stakeholders, and the community.
- › MassDOT gained insight into the challenges and opportunities of planning for sustainability in future projects through a discussion of the project based around INVEST.
- › MassDOT achieved each of the four original goals described above, including introducing the INVEST framework to MassDOT staff, highlighting current best practices, identifying ways to align projects with INVEST, and developing new initiatives.
- › The strong efforts toward sustainability in the Casey Arborway Project provided many lessons for future projects.

Chapter 4: Sustainability Initiatives and Next Steps

Across the State, MassDOT facilitated INVEST Workshops with presentations on sustainability best practices related to highway and transportation projects and programs. Workshop participants joined small group breakout sessions to review INVEST’s sustainability best practices, brainstorm about potential initiatives to improve the agency’s performance, and recommend top priority initiatives for larger group assessment.

Figure 2: GreenDOT Focus Areas



These workshop exercises resulted in the compilation of twenty-four priority sustainability initiatives (see Table 4). Workshop participants collectively vetted each of these initiatives in a large group polling exercise, which assessed return on investment, cost effectiveness, and overall feasibility. GreenDOT’s focus areas provided a basis for the discussion to highlight the associated co-benefits of initiative implementation (see Figure 4). These exercises encouraged participants to think about what it means to improve sustainability practices and how these efforts could benefit their role and community.

Table 4: List of Priority Sustainability Initiatives Identified by INVEST Workshop Participants

Workshop	Priority Sustainability Initiative
OM	Establish an agency-wide recycling program, with associated training (dependent on waste hauler availability).
OM	Contract with waste haulers to identify revenue-generating opportunities for recyclable materials (ex: e-waste, cardboard, metals).
OM	Educate inmate litter crews on proper recycling separation procedures and implement inmate recycling program.
OM	Track savings from waste diversion/recycling and disseminate to MassDOT staff to encourage behavior modifications.
OM	Define sustainability metrics and establish a formal tracking system to monitor performance improvements.
OM	Develop and initiate a streamlined system for providing implementation steps to and requesting performance data from staff and contractors.
OM	Increase options for teleconferencing or web meetings and associated trainings.
OM	Establish policy and implement flexible work hours and telecommute options.
OM	Track energy use for districts and depots.
OM	Develop and leverage data management system to support energy use tracking, monitoring, and reporting.

Workshop	Priority Sustainability Initiative
OM	Appoint a sustainability manager for each district to monitor and communicate progress on BMPs and be a liaison with GreenDOT.
OM-RWM	Increase staff capacity: Hire additional staff and ensure they are well trained.
OM-RWM	Improve public outreach/education and increase communication between state and agencies
OM-RWM	Provide the right amount of technical resources: material (salt), equipment, etc.
OM-RWM	Provide more material storage capacity
OM-RWM	Construct more salt brine producing facilities
OM-RWM	Provide more media/public education on expectations for road conditions and environmental factors
OM-RWM	Improve RWIS by increasing stations and data points
OM-RWM	Improve the type of data collected and reporting methods that allow for contractors and/or vehicles to report remotely
OM-RWM	Develop and distribute more strategic contractor training to work smarter (not harder)
PD	Utilize state of the art media and visualization techniques to promote and describe project.
PD	Develop and implement policy to incorporate cost-benefit analyses into project reviews.
PD	Require contractors to report C&D waste recycling.
PD	Create a database management system to improve environmental commitment tracking and compliance reporting.
PD	Formalize a training program for environmental compliance commitments so compliance, project outcomes, tracking and reporting are easier for staff and contractors.
PD	Incorporate sustainability design criteria into the scope of contract documents.

"OM" represents the Operations & Maintenance Workshops for INVEST OM 1-5 Criteria.

"OM-RWM" represents the Operations & Maintenance Workshop for INVEST OM-12: Road Weather Management.

"PD" represents the Project Development Workshop for the Casey Arborway Project.

MassDOT recorded all participant polling data and organized an internal review team to further assess and prioritize opportunities that will help enhance MassDOT's sustainability program. GreenDOT and Environmental Services staff used an initiative prioritization tool, which provides a quantitative, scoring approach to structure the decision making processes and escalate initiatives that will help MassDOT achieve their goals based on anticipated impacts of implementation (i.e., reduces greenhouse gas emissions, increases community resiliency, results in long-term cost savings, etc.). GreenDOT and Environmental Services staff conducted two separate evaluations of the initiatives using the tool, and then reconvened to compare and discuss scores. MassDOT's internal evaluation process identified eight priority initiatives, two of which are already in the implementation phase as described below. The sustainability initiative summary is provided in Appendix E.

Priority Initiative 1: Establish a policy and implement flexible work hours and telecommute options.

At three of the INVEST Workshops, participants recommended initiatives that pertained to establishing flexible work hours and telecommuting options. MassDOT previously piloted a similar program in 2011 and re-launched a new and improved alternative work options program in January 2016. As the new program matures, MassDOT will collect information on participation rates and agency performance. Based on the overall effectiveness of the alternative work options program, MassDOT will refine existing policies and potentially establish a permanent program.

Priority Initiative 2: Create a database management system to improve environmental commitment tracking and compliance reporting.

During the INVEST Workshops, MassDOT employees reported that a high level of effort and time is expended to ensure that projects comply with federal, state, local regulations, and permit conditions. To improve compliance efforts, MassDOT is seeking a comprehensive system for tracking commitments and ensuring accuracy and completion of all environmental commitments. MassDOT is also developing an internal survey to determine the agency's range of environmental tracking activities and methodologies to identify needs and gaps in existing systems. MassDOT is researching comprehensive database systems used by other state DOTs to determine the best option for supporting MassDOT staff in managing environmental compliance.

MassDOT Road Weather Management Program

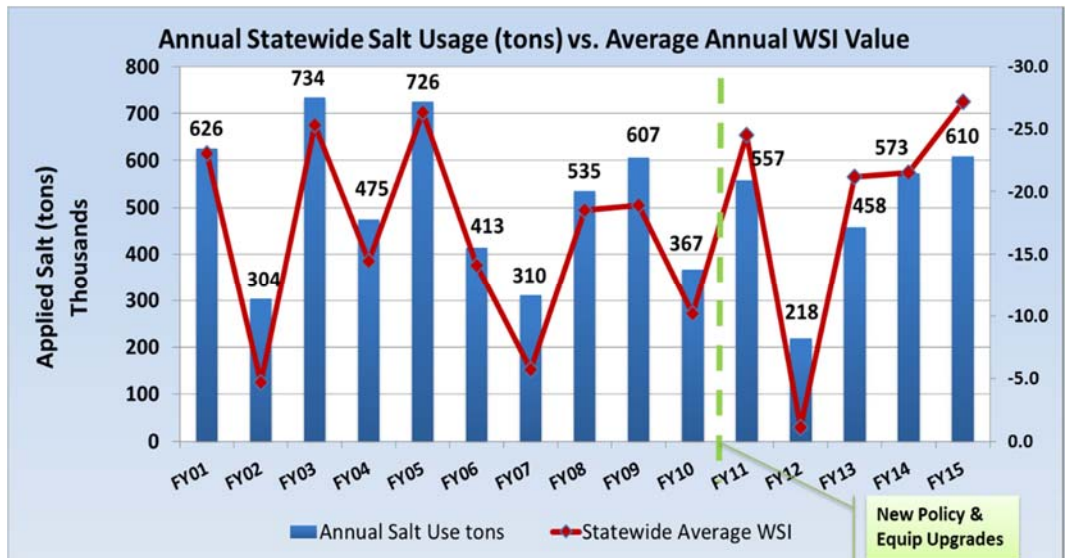
MassDOT is committed to taking a proactive approach to maintaining safe and accessible roadways and highways in an environmentally conscientious manner. Over the past five years, MassDOT achieved significant measureable improvements

83%
Percent of workshop participants who feel that in their current roles they can improve sustainability at MassDOT

in snow and ice removal operations, through implementing new policies and equipment upgrades. To further sustainability as a core value, MassDOT held a full day workshop dedicated to INVEST OM-12 Road Weather Management (RWM). Group discussions focused on best practices and available MassDOT resources, such as the Materials Management Plan for tracking material application; the statewide Road Weather Information System for collecting weather condition data; and the Maintenance Decision Support System for managing response operations.

Based on participant feedback collected during the INVEST workshop, MassDOT is assessing the different sets of needs and opportunities for each of the six districts. Recognizing that some solutions for one district may not be applicable to others, MassDOT is working with each district to identify custom sustainability measures and performance metrics that consider local characteristics. MassDOT will use this information to update and consolidate RWM guidance documents, and ensure that these documents are accessible to agency employees and hired contractors. MassDOT’s proactive approach to improving RWM planning is positioning the agency to respond to inclement weather, urgent water quality issues, and external pressure to reduce environmental impacts and greenhouse gas emissions. The

Figure 3: Trend of Statewide Average Use of Road Salt (FY2001 - FY2015)



MassDOT Initiative Summary is provided in Appendix E.

MassDOT Sustainability Initiatives

Over 150 workshop participants were engaged in sustainability discussions and recognized for their ability to perpetuate changes in operations and project development to achieve sustainable outcomes. Statewide workshops highlighted existing achievements and best practices across the districts. MassDOT is exploring ways to create model programs to mimic best practices across all districts.

For example, Districts 1 & 2 reported in the past they had formed internal sustainability teams. MassDOT recognizes that this may be an ideal model for continued engagement on sustainability, which is also related to the agency's *Priority Initiative 5: Appoint a sustainability manager for each district to monitor and communicate progress on best management practices and be a liaison with GreenDOT*. The workshops also highlighted discrepancies across districts demonstrating that not all facilities accommodate recycling. As a result, MassDOT is formalizing reform efforts under *Priority Initiative 5a: Establish an agency-wide recycling program with associated training* (See Appendix E).

MassDOT Innovation and Tech Transfer Exchange



In March 2016, MassDOT held its 4th annual *Innovation and Tech Transfer Exchange*, inviting transportation professionals from MassDOT, municipalities, consultants, contractors, vendors, and manufacturers. This two-day conference focuses on how transportation technologies and/or innovative methodologies can help to create sustainable solutions. MassDOT staff hosted an informational booth about INVEST sustainability resources, statewide workshops, and MassDOT's priority sustainability initiatives to improve agency performance. Informational fact sheets, website links, and project contact information were distributed to attendees. Many people who stopped by the booth were completely unfamiliar with INVEST and the MassDOT Project, so it was a worthy awareness-raising activity.

Evaluation of Route 79 Interchange Reconstruction Project in Fall River

In spring 2016, MassDOT additionally used the INVEST Project Development module to evaluate the Route 79/I-195 Interchange Reconstruction Project in Fall River, MA. Through the INVEST evaluation, MassDOT gained insight into the sustainability best practices incorporated throughout the planning, design, and construction phases of the project, as well as challenges and opportunities to consider for future roadway projects. The project achieved the INVEST Platinum-rating.

Conclusive Remarks

MassDOT is committed to preserving environmental integrity, supporting economic development, and enhancing public health across the Commonwealth. The FHWA's INVEST resources were essential to establishing the sustainability framework of MassDOT's statewide workshops and creating a platform for collaboration on operational and project development improvements.

MassDOT's statewide INVEST workshops have cultivated a shared understanding of sustainability principles and best practices, and demonstrated the agency's commitment to improving sustainability performance at all levels. With over 150 participants engaged in sustainability discussions, MassDOT is well positioned to continue to develop sustainable projects and implement priority sustainability

initiatives. The MassDOT Project Design and Development Guide requires a number of sustainability and context sensitive design components for all projects. The GreenDOT Policy and Implementation Plan target specific sustainability goals. Additionally, MassDOT currently has a number of plans in place to improve the early phases of project development and the INVEST criteria will serve as a good reference for aligning processes with more positive sustainability outcomes. MassDOT will continue to use INVEST to evaluate and integrate sustainability principles into the way the agency plans, designs, builds, and operates the state transportation system.