TABLE OF CONTENTS

INTRODUCTION .......................................................................................................................... 1
PROJECT HISTORY, PROCESS, AND GOALS ........................................................................... 3

ABOUT INVEST 1.0 .................................................................................................................... 5
INVEST TOOL 1.0 TOOL MODULES AND SCORECARDS: SELECTING CRITERIA TO MEASURE AND APPLY TO PMLR ................................................................. 5
ENVISION: THE VALUE OF ADDITIONAL SUSTAINABILITY EVALUATION TOOLS .......... 6
SUMMARY OF RESULTS ........................................................................................................... 7

MEASURING AND INTERPRETING: THE VALUE OF INVEST 1.0 FOR PMLR AND TRIMET AND A NON-HIGHWAY PROJECT ................................................................. 9
PROJECT DEVELOPMENT SCORING BREAKDOWN ............................................................... 10
OPERATIONS & MAINTENANCE SCORING BREAKDOWN ...................................................... 10

MEANINGFUL INTERPRETATIONS: FEEDBACK FOR FHWA ............................................. 11
RECOMMENDATIONS AND LESSONS LEARNED ................................................................ 12

CONCLUSION AND FUTURE ACTIONS .................................................................................. 15

APPENDIX A ................................................................................................................................... A-1
APPENDIX B ................................................................................................................................... B-1
APPENDIX C ................................................................................................................................... C-1
This report evaluates the effectiveness of TriMet’s innovative efforts to measure the success of key sustainability strategies integrated into the planning, design, construction, maintenance, and operation phases of its 7.3-mile Portland Milwaukie Light Rail (PMLR) Transit Project. The project connects Portland State University in downtown Portland, inner Southeast Portland, Milwaukie and north Clackamas County, thereby providing improved transportation access for residents of Portland and Clackamas County.

TriMet believes that good transit service is crucial to protecting quality of life. To that end, the agency works toward sustainability. TriMet’s commitment to sustainability states, “We strive to build and operate our systems in the most sustainable way possible, from construction projects to daily operations.” This commitment to sustainability is reflected not only in providing a new transit option for the Portland metropolitan area’s urban travelers, but also in incorporating green principles in the conception, planning, design, construction, operation, and maintenance of the PMLR system.

PMLR employs an industry-leading approach to sustainable design practices as diverse as the reuse of materials, habitat enhancement, installation of public art, and on-site alternative energy generation.

In furtherance of their industry leadership in sustainability, TriMet initiated a systematic and systemic capture of its efforts in a pioneering step to collect, assess, and record the entire package of PMLR’s sustainability practices. This report evaluates the effectiveness of key practices and highlights benefits and lessons learned from both the sustainability implementation experience as well as the use of innovative tools for measuring success. These processes help tell PMLR’s sustainability story to a broad spectrum of audiences, particularly the transit industry at large.

“There’s been significant focus on the sustainability of the built environment, but not in infrastructure, which covers larger areas and has wider, more variable impacts.

The lack of indicators and assessment methods to comprehensively measure the progress toward sustainable infrastructure has been a barrier to its development.”

current and potential organizational sustainability standards and practices through the lens of the Federal Highway Administration’s (FHWA) Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) 1.0, a highway transportation sustainability tool to:

- Find more integrated and efficient ways to address TriMet’s sustainability goals above and beyond regulatory requirements.
- Develop methods to more easily track progress toward meeting TriMet performance standards.
- Create better linkages between planning, environmental, design and construction phases of infrastructure development.
- Integrate new sustainability practices and standards into TriMet planning, design and operational practices.

By documenting its use of INVEST 1.0 in a case study, TriMet is providing a unique example of how to most effectively utilize the tool in evaluating transit projects as part of larger transportation planning efforts and specifically during project development and through operations and maintenance. While INVEST 1.0 was developed to evaluate sustainability of highway projects, TriMet has broken new ground in applying the tool to a transit-only project.

The benefits of the process are three-fold: **INVEST 1.0 provides a new lens to evaluate, document, and enhance TriMet sustainability practices**; enriches the efficacy and value of the tool by providing feedback to FHWA as it continues to refine and expand the tool; and the process and its documentation ultimately offers lessons learned for a wider audience of transportation planners and designers nationwide.
A growing body of literature for evaluating buildings is devoted to environmentally and energy-efficient material selection and design. Rating systems such as the Leadership in Energy and Environmental Design (LEED) program promote sustainable building development by specifying suites of criteria for judging how “green” a building is and provide guidance on selecting and using indicators in this assessment. Less has been done to develop tools to evaluate the sustainability of transportation infrastructure systems and specifically transit.

One of the key questions asked in this process is why more transportation agencies are not making strides to engage sustainability tools in their planning and implementation? Broadly, we observed that a number of factors come into play, including cost, transparency, and accountability:

- It is difficult to evaluate greening and green infrastructure approaches for public infrastructure projects.
- Agencies are increasingly defining sustainability by the extent to which a project exceeds existing regulatory requirements, but what does this mean?
- Absent transparency, there is always risk.
- Without measures of sustainable return on investment, how do you explain to stakeholders the significance of investments in sustainability?

In light of TriMet’s values and goals as an agency, it viewed PMLR as an ideal opportunity to elevate and integrate the sustainable development of a new capital project and in so doing, re-examine methods of designing and building a light rail system to integrate:

- Energy conservation and alternative energy innovation
- Stormwater management
- Judicious material selection
- Urban ecology
- Other sustainable practices and technologies

Sustainability visioning for the PMLR project began in February 2010 during a two-day workshop with key members of TriMet’s planning, design, community affairs, and administrative teams. The workshop resulted in the identification of 27 sustainability strategies.

In November 2012, TriMet funded the effort to track and document PMLR’s sustainability strategies, practices, and stories. Due to the fact that construction of the west side of the project and the bridge was nearing completion and that the eastside work was well underway, the consultant team worked with TriMet staff to create a transparent, repeatable, and efficient data collection and management plan in order to most successfully measure the effectiveness of the sustainability strategies.

Given the noticeable absence of a singular, exhaustive set of metrics or indicators for the transit industry, the consultant team developed a pragmatic approach to developing and evaluating PLMR-specific metrics for sustainability. For each selected practice, relevant industry- or agency-approved methodologies were used to quantify the benefits that are being delivered. Through this process, TriMet also identified a number of potential evaluative tools currently used, such as LEED, as well as new tools with the potential for further enhancing its sustainability work, such as ENVISION and FHWA’s INVEST 1.0.

Projects such as TriMet’s PMLR provide a compelling example for other transportation agencies seeking to incorporate transit as part of their comprehensive transportation planning and sustainable infrastructure efforts. TriMet’s story emphasizes the benefits that such a tool can have not only on sustainability’s triple bottom line but also on how commitments to sustainability can

“We strive to build and operate our systems in the most sustainable way possible, from construction projects to daily operations.”

TriMet Vision Statement
increase access to funding and improve stakeholder perceptions of the transit system itself.

Although each transportation project is context sensitive to the community in which it is constructed, TriMet engaged INVEST 1.0 to educate the larger transportation community about valuable lessons learned, as well as to convey where and how INVEST 1.0 has expanded the PMLR project’s sustainability strategies. This report is also intended to provide FHWA feedback for improving INVEST 1.0 specifically for transit agencies or for highway transportation planners incorporating transit as part of their sustainability strategies.

This report contains observations and analysis of the PMLR project, application of the INVEST 1.0 scoring metric, and recommendations and lessons learned. A map of the project area, a detailed narrative of the scoring modules, and a brief case study are attached as appendices. We have shaped these materials to provide guidance and inspiration to other agencies who aim to set the sustainability bar to a higher standard, to include transit as larger transportation planning, and to use INVEST in achieving those goals.

LED lights and platform signs at the South Waterfront/SW Moody Avenue station
FHWA defines INVEST 1.0 as a “self-evaluation tool” to highlight and measure sustainability throughout the life cycle of highways and other transportation investments. It includes three modules for evaluation: INVEST for Systems Planning, INVEST for Project Development, and INVEST for Operations and Maintenance. The focus of INVEST 1.0 stresses the importance of incorporating sustainable practices into highway projects for both mobility and access; however, the tool also provides a useful framework for evaluating non-highway infrastructure projects by providing a comprehensive list of best practices or criteria that can be incorporated into various phases of planning, project development, operations, and maintenance.

While these criteria are less specific than those of comparable evaluation frameworks (such as the Envision tool also utilized by TriMet), they encourage project teams to set clear goals and remain accountable to sustainable objectives, awarding extra points for monitoring performance over time under the aegis of the Operations and Maintenance module. INVEST 1.0 does not incentivize sustainability practices that are already required for projects such as NEPA and SEPA processes. Because it is voluntary and self-evaluative, it requires users to evaluate current standards and practices and take the next step in integrating innovative methods into future project phases or organizational planning.

INVEST 1.0 TOOL MODULES AND SCORECARDS: SELECTING CRITERIA TO MEASURE AND APPLY TO PMLR

TriMet tested two of the three assessment modules to evaluate PMLR: the Project Development (PD) and Operations and Maintenance (OM). TriMet coordinated with agency project staff and contractors to request relevant data to meet the requirements for documentation of criteria. Where documentation and data specific to PMLR project elements were unavailable, the project team applied INVEST scoring criteria to relevant, agency-wide policies in order to produce a more holistic evaluation of TriMet’s sustainability practices, and the relative effectiveness thereof.

For PD, INVEST 1.0 offers six different scorecards for evaluating projects, which are geared toward specific highway project types and locations. They include:

- **Paving** – for projects that are devoted exclusively to pavement preservation or restoration projects that extend the service life of existing facilities and enhance safety, as well as pavement restoration projects that restore pavement structure, ride quality, and spot safety.
- **Basic Rural** – for small rural reconstruction or rural bridge replacement projects that do not expand roadway capacity.
- **Basic Urban** – for small urban reconstruction or urban bridge replacement projects that do not expand roadway capacity.
- **Extended Rural** – for rural construction projects including a new roadway facility or structure where nothing of its type currently exists and major reconstruction projects that add travel lanes to an existing roadway or bridge.
- **Extended Urban** – for urban construction projects including a new roadway facility or structure where nothing of its type currently exists and major reconstruction projects that add travel lanes to an existing roadway or bridge.
- **Custom** – for projects that do not fit any of the predefined scorecard options, the Custom Scorecard allows the user to develop a unique set of criteria that is most appropriate for the project being evaluated. The Custom Scorecard starts with a set of 19 non-negotiable, core criteria that must be included as part of the score. There are no achievement levels associated with the custom scorecard.

The Custom Scorecard was selected for the PD module evaluation as it was the best fit for the PMLR project. Under the PD module, 26 criteria were selected to assess the PMLR project, including FHWA’s 19 non-negotiable core criteria. In addition to the core criteria, 7 additional criteria were added to assess key elements of the PMLR project: PD-9 Ecological Connectivity, PD-10 Pedestrian Access, PD-11 Bicycle Access, PD-12 Transit and HOV Access, PD-14

1. [https://www.sustainablehighways.org/](https://www.sustainablehighways.org/)

Unlike the other two modules (Planning and Operations and Maintenance), PD criteria are weighted by INVEST 1.0 to better assess the overall impact of projects in meeting sustainability goals. Different criteria have more or fewer points available. Because the project is currently under construction, in some respects evaluating PD data was both more rigorous and at the same time, less complete, because data collection of construction practices was not implemented in advance.

Goals for utilizing the PD module were to:

- Use scoring criteria and best practices identified in the Project Development module.
- Identify sustainability areas where further analysis is needed in order to understand social, economic, and environmental impacts, benefits or tradeoffs of alternative practices.
- Assess and apply the best practices related to PMLR project construction currently underway and for future projects.

For the OM module there is one scorecard with 15 points possible for all criteria. Seven applicable criteria of the 14 available were selected for evaluation. The range of criteria was limited, as some of the criteria were not relevant to PMLR, (e.g., OM-07 Pavement Management System or OM-10 Highway Infrastructure Preservation and Maintenance), and for others (such as OM-08 Bridge Management System or OM-11 Traffic Control Infrastructure), data were not yet available. As the FHWA INVEST website offers, “It is not expected that an agency will achieve many of the OM criteria in INVEST right now.” Extensive general data exist to document important agency sustainability practices in operations and maintenance; however, specific data with respect to the PMLR project, still under construction, were not yet available. In this respect, the value of this exercise was more in selecting criteria, which points to several steps TriMet will be able to take terms of project performance over time.

Goals for utilizing the OM module were to:

- Improve safety for the project.
- Enhance project and organizational performance.
- Identify and apply the best practices identified by INVEST 1.0 to the operations and maintenance for current and future projects.

**ENVISION: THE VALUE OF ADDITIONAL SUSTAINABILITY EVALUATION TOOLS**

In addition to INVEST 1.0, TriMet also utilized the Envision Sustainable Infrastructure Rating System as the basis for creating an initial PMLR sustainability matrix. 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. The system has 60 sustainability criteria, called credits, which are used to evaluate, grade, and give recognition to infrastructure projects that use transformational, collaborative approaches to assess the sustainability indicators over the course of a project’s life cycle.

Envision was used only as a categorical system for PMLR’s sustainability matrix rather than a formal rating tool. The matrix uses Envision’s 60 criteria divided into five categories to organize the information being collected. PMLR is not registered with Envision, but the application of these two frameworks in tandem allowed the consultant team to see overlap in certain areas of strength, as well as reinforce lessons learned through the process of applying these frameworks.

Envision is set up to provide guidance for sustainable infrastructure design at the beginning of project development...
and to be applied as a project assessment tool. Envision was applied retroactively in the PMLR project which makes these scores a tribute to TriMet’s commitment to sustainability in the development of transit projects. Attaining 41 percent of the total applicable Envision points is no simple feat, and, as such, qualified PMLR for the second highest level of achievement within the Envision system. As these scores exhibit, the project team was meticulous in incorporating the most fundamental values of sustainability into the earliest phases of planning and design. Not only did this commitment set standards early on in the process for later phases of planning, but perhaps more importantly, it provided the construction teams with a precedent of conscientious accountability and consistency.

The power of using these two sustainability evaluation tools 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 1.0, these metrics helped to clarify project accomplishments, serve as a baseline for the INVEST 1.0 analysis, and to highlight gaps in either systems or practices in place for PMLR as a project and more broadly for TriMet as an agency.

**SUMMARY OF RESULTS**

INVEST 1.0 offers four achievement levels—bronze, silver, gold and platinum—for the three modules. Points required to attain these achievement levels are assigned as part of the scoring process and differ in the required number depending on which scorecard is used (for PD module), whether weighting is applied, and how many criteria are selected for evaluation. Because the TriMet PMLR project did not fall within the description of a standard highway project, a Custom Scorecard was selected for the PD module, and while the required points for achievement levels are not identified in the formal tables, through the evaluation process, points were assigned for Custom Scorecards and an approximate level of achievement was assigned.

Initial scoring for the PMLR project yielded a bronze achievement level in both the PD and OM modules. The subsequent addition of selected and relevant criteria and further project analysis using the PD module elicited a silver and
finally a gold achievement level, with a score of 67. Project scoring in the OM module yielded a score of 77, or bronze achievement level. PMLR managed to score well in the criteria measured; however, the overall achievement level was lower because not all criteria were assessed as part of the preliminary review.

In many respects, these achievement levels are less important than the overall analysis and evaluation process, they helped TriMet understand the relative benchmarks for its sustainability accomplishments, as well as reinforced where there were areas for improvement. As alluded above, in most categories, PMLR scored well in terms of the application of INVEST 1.0 philosophy and/or criteria. However, the lack of sufficient supporting documentation, contractual language, and/or systems in place to capture such data proved challenging in terms of efficiently and holistically collecting and interpreting these data in the context of specific metrics.

PMLR demonstrated consistently high marks for education and outreach, bicycle and pedestrian facility improvements, and overall sustainability planning and agency vision. The application of energy reduction and innovative energy sources used for PMLR and systemically also attest to the agency’s leadership in transit planning, implementation and operations.

Notwithstanding the fact that TriMet, as an agency, supports substantive organizational tools, benchmarks and regular reviews to educate, encourage and implement sustainability goals, specific data collection for PMLR with respect to operations were more difficult to garner.
MEASURING AND INTERPRETING:
THE VALUE OF INVEST 1.0 FOR PMLR AND TRIMET AND A NON-HIGHWAY PROJECT

Despite the fact that INVEST 1.0 was developed primarily as a tool for evaluation of highway infrastructure projects, it provides a valuable tool for evaluating non-highway projects, providing a manageable and useful set of criteria for evaluating a range of sustainable practices above and beyond standard regulatory requirements. The tool reinforces the need to include performance standards and measures in the very early stages of the project’s planning and contractual conception.

Important considerations when drafting initial contracts include:

• **Identifying** sustainability practices and uses that should be measured, with justification as to why each practice has been selected.
• **Delegating** measurement and data collection responsibilities including clear timelines for reporting.
• **Developing** technical guidelines for analysis, interpretation, and application of these principles.

Including provisions for the application of these metrics in the early stages of the project’s life requires more planning effort, it is essential to create a system of accountability for data tracking and compilation at multiple levels and organize documentation for INVEST 1.0. Ultimately, these efforts make final scoring more meaningful, especially when each criterion is assigned to an expert within the criteria framework and established as a contractual requirement in the planning stage.
## PROJECT DEVELOPMENT SCORING BREAKDOWN

<table>
<thead>
<tr>
<th>No.</th>
<th>Criterion</th>
<th>Possible Score</th>
<th>PMLR Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD-02</td>
<td>Lifecycle Cost Analyses</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>PD-03</td>
<td>Context Sensitive Project Development</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>PD-04</td>
<td>Highway and Traffic Safety</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>PD-05</td>
<td>Educational Outreach</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PD-06</td>
<td>Tracking Environmental Commitments</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>PD-07</td>
<td>Habitat Restoration</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PD-08</td>
<td>Stormwater</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>PD-09</td>
<td>Ecological Connectivity</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PD-10</td>
<td>Pedestrian Access</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PD-11</td>
<td>Bicycle Access</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PD-12</td>
<td>Transit and HOV Access</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>PD-14</td>
<td>ITS for System Operations</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>PD-15</td>
<td>Historical, Archaeological, and Cultural Preservation</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PD-17</td>
<td>Energy Efficiency</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>PD-18</td>
<td>Site Vegetation</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PD-19</td>
<td>Reduce and Reuse Materials</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>PD-20</td>
<td>Recycle Materials</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>PD-21</td>
<td>Earthwork Balance</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>PD-22</td>
<td>Long-Life Pavement Design</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>PD-23</td>
<td>Reduced Energy and Emissions in Pavement Materials</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>PD-24</td>
<td>Contractor Warranty</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>PD-25</td>
<td>Construction Environmental Training</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>PD-26</td>
<td>Construction Equipment Emission Reduction</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>PD-27</td>
<td>Construction Noise Mitigation</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>PD-28</td>
<td>Construction Quality Control Plan</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>PD-29</td>
<td>Construction Waste Management</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

## OPERATIONS & MAINTENANCE SCORING BREAKDOWN

<table>
<thead>
<tr>
<th>No.</th>
<th>Criterion</th>
<th>Possible Score</th>
<th>PMLR Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>OM-01</td>
<td>Internal Sustainability Plan</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>OM-02</td>
<td>Electrical Energy Efficiency and Use</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>OM-03</td>
<td>Vehicle Fuel Efficiency and Use</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>OM-04</td>
<td>Recycle and Reuse</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>OM-05</td>
<td>Safety Management</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>OM-06</td>
<td>Environmental Commitments Tracking System</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>OM-13</td>
<td>Transportation Management and Operations</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>
As observed in the guidelines provided by FHWA, while the achievement levels that quantify or qualify success in sustainable transportation practices are not finely tuned, the assignment of points, or a bronze or gold level, have nevertheless provided TriMet with guidance in terms of understanding the effectiveness of its sustainable strategies and areas where there are gaps in practices and/or documentation.

Additional observations regarding the use of INVEST 1.0 for a transit project include:

- More guidance is needed in terms of scoring and documentation where there are inevitable overlaps of project elements and scoring criteria/requirements. This presents a challenge in terms of what project element to score under which criterion. For example, PD-04 Highway and Traffic Safety issues with respect to vehicle, pedestrian, and bicycle safety overlap with PD-10 and PD-11 Improving safety and convenience of pedestrian/bicycle networks for people of all ages and abilities by providing or enhancing facilities within the project footprint.

- Expand the definition of PD-04 Highway and Traffic Safety to capture the full range of health and safety planning and implementation, including non-vehicle/crash considerations and data such as air quality, access to recreational/nonmotorized facilities, Crime Prevention Through Environmental Design implementation, and crime reduction.

- Include more criteria and standards and greater weighting in PD-17 Energy Efficiency to include alternative energy sources to incentivize use of solar, wind, and other sources such as PMLR’s eco-track and Wayside Energy Reclamation pilot projects.

- The sustainability standards are well-conceived, but given that this is a transit project versus a highway project, there is difficulty in understanding achievements of the project relative to those of other highway projects, given that they are essentially measuring, in many cases, apples to oranges. As such, ensure that weighting in the PD module will accurately assess and reflect the character, scale and/or extent of a project.

- Provide more weighting for PD-05 Education Outreach, PD-10 Pedestrian Access, PD-11 Bicycle Access, and PD-12 Transit and HOV Access. Two points for these criteria are not sufficient when much of the emphasis of such a project is agency, contractor, and public education, as well as nonmotorized and transit improvements.

- Clarify evaluating project practices versus agency practices and provide guidance regarding potential gaps between the two, or award credit or partial credit for these practices.

- It is important to identify the expected timeframe, budget, and staffing that will be required to complete an accurate, comparable analysis. These estimates will vary based on the size and type of project and the respective agency. This will help other agencies understand the framework and level of effort for these analyses and concomitant achievement levels.

- The tool offers significant flexibility in evaluating projects in terms of the diversity of supporting documentation that may be applied, but the range of metrics that evaluate goals such as energy use is more limited and sometimes difficult to achieve. Broadly, the highway orientation of INVEST 1.0 places a significant emphasis on pavement (PD-19, PD-20, PD-22, PD-23, OM-07, OM-10)—use, reuse, reduction—making it somewhat difficult to apply a one-to-one evaluation of a rail (transit) project. Obviously, the use of materials such as concrete, asphalt, and steel are an integral part of the light rail system—reduction of concrete in the Willamette crossing bridge structure footings demonstrates a significant carbon footprint reduction. However, innovative practices in other arenas, such as TriMet’s deconstruction materials reuse, is not overtly supported or identified.

- Further, INVEST 1.0 energy efficiency scoring criteria (PD-17) seem to be based primarily upon utilization of efficient luminaires. While efficient lighting, in terms of reduced light pollution and lowered energy costs with high efficiency fixtures such as LEDs, is an important component of PMLR and TriMet policy and practices, the tool is less overt in awarding credit where energy savings are realized through the creation or expansion of mass transit, improved/expanded bicycle and pedestrian facilities, and energy savings through solar and wind power, as well as other innovative technologies such as track regenerative braking technologies.
RECOMMENDATIONS AND LESSONS LEARNED

TriMet has demonstrated an industry-leading vision in PMLR’s sustainability initiatives. Early workshops, including the sustainability visioning workshop held in February 2010 and the sustainability workshop for the Ruby Junction expansion held in May 2011, set the stage for a project with sustainability at its core.

Some of the strategies identified in these early sessions did not come to fruition. Changes and setbacks can be expected in any project of this size. A major drawback to the sustainability work done during the planning and design phases, however, was that a framework was not fully developed for how sustainability practices would be collected, measured, and integrated into the construction phase of the project. This made evaluation under the auspices of the PD and OM modules challenging. The suggestions for improvement in this report focus on more successfully incorporating and implementing early sustainability visioning efforts into the entire life of the project.

The February 2010 sustainability visioning workshop ultimately resulted in a PMLR East Segment Sustainability Report that was created by VIA Architects. That report describes 27 strategies that were identified in the workshop and has been the basis for the implementation of sustainability practices during the construction phase of this project and, or more importantly, in future capital projects.

The East Segment Sustainability Report successfully set the stage for sustainability strategies and ensured that elements of the work were captured through the planning and design stages of the project, but implementation plans were not successfully applied through the construction phase. The responsibility table and strategy audits provided a platform on which to build sustainability practices through construction, but the work was not further developed. Construction contracts did not include tools or metrics that would outline criteria, methods, and means for capturing sustainability data. Nor did the contracts require procedures that would 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.

One of the key realizations is the importance of incorporating the use of INVEST 1.0 (or any other metric for that matter) from the beginning of the project, through project development to construction and post-construction to ensure agency, contractor, and community awareness and understanding, as well as to allow for the feasible implementation of data collection, collation, analysis, and response. Early education and training about data collection requirements and the reporting framework will help ingrain sustainability reporting in staff and contractors. This should be a topic of discussion at partnering and kick-off meetings. It should also be incorporated into construction meetings, as construction staff (both agency and contractors) are often unaware of and/or lack the incentive to document all the good sustainability work they are doing until they make time to pause, consider the practices being implemented, and relay or report that information.

The following section provides ideas and guidance for closing this gap between design, construction, and operations and maintenance in future TriMet projects.

- Prioritize institutional goals for sustainability in terms of measurable and achievable standards with metrics such as INVEST 1.0 or Envision, Sustainable Sites, LEED, or Green Highways. Moving sustainability reporting to the forefront of all project development will also help inform staff and contractors about the importance of collecting quantifiable information and following beneficial and innovative practices. Monthly or quarterly reports can help formalize the tracking process and provide a framework which contractors can
use to collect information with relative ease. 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.

- Periodically evaluate the utility and effectiveness of sustainability metrics such as INVEST 1.0 and Envision to ensure meaningful data and measures and avoid redundancy and/or gaps in evaluation efforts.

- The ability or inability to provide documentation for several of the scoring criteria indicates areas in post-construction/operations and maintenance where the project can continue to improve meaningful sustainability practices by having the mechanisms in place to collect data in a meaningful way such as:
  - Ensure systematic, consistent, and timely collection and collation of safety management data in response to scoring on PD-04, PD-05, PD-10, PD-11, PD-12, PD-14. Developing a pre- and post-construction study of impacts and effects is an important element of measuring and insuring project safety, particularly since no future safety calculations were generated as part of the environmental impact statement (EIS). The only data collection from agencies and local governments is of existing crash data at intersections.
  - Lifecycle Cost Analyses (PD-03)—post-construction quantifiable analysis of materials selection and performance is a vital component of data collection and analysis and should utilize the FHWA Technical Bulletin for Life-Cycle Cost Analysis (only for pavement assessments) and/or use of RealCost software.
  - Emphasis on Long-Life Pavement Design requires adjustments to include other durable materials and relates to Lifecycle Cost Analyses.
  - Energy Efficiency (PD-17) and Electric Energy Efficiency and Use (OM-02) require coordination of agency practices and project innovations and a coherent mechanism post-construction of identifying key practices and measures and tracking those over time.
  - Establish mechanisms to accurately and quantitatively measure and report cut and fill quantities in order to provide sufficient documentation of efforts to meet or exceed thresholds in PD-21 Earthwork Balance. While the project team addressed balancing cut and fill at a number of sites as part of mitigation efforts, including floodplain cut and fill balancing at Crystal Springs Creek Johnson Creek, and Kellogg Lake, the gaps in documentation made it impossible to verify the INVEST 1.0 module-specified 10 percent threshold. This demonstrates the need to incorporate a requirement of sustainability documentation into initial project contracts in order to ensure the availability of hard data that is necessary for thorough evaluation using INVEST 1.0 and other rating tools.

- Enlist capital projects as an opportunity for pilot projects that can be measured, evaluated and improved/expanded to systemwide implementation. For example, during this project, TriMet gained a better understanding of the need to provide storage areas for reusable materials salvaged from deconstruction activities. This allows construction to proceed on the cleared site and makes those reclaimed materials available for use later in the project. Forming partnerships with nonprofits that receive reusable material will also help provide contractors with information about recycling options. Often, nonprofit groups will travel to the project site and deconstruct or pick up certain materials at their own cost which can be a cost savings for contractors. Details, such as materials, pick-up times, and locations may require more time and coordination than traditional practices, but the practice can be beneficial for contractors and the agency in the long run.

- Embed the RFQ and RFP process with sustainability language/expectations and scoring mechanisms at the project outset. Difficult negotiations with contractors surrounding material reuse reporting made it clear to TriMet that on future projects specific sustainability metrics and practices need to be stated up front in advertised projects.

- Include sustainability priorities and practices in all contractual language to ensure contractor compliance with sustainability practices, data collection, and monitoring, such as developing a construction waste management plan and contractor engagement of an independent environmental monitor. This will help to avoid resistance from contracting firms
caused by additional work and cost. New contract requirements will increase accountability, as well as consistency and uniformity of reporting procedures across the local industry.

• **Establish contract language up front to ensure prime and subcontractor compliance** with goals, measurements, standards and analysis, including the use of an independent environmental tracking manager.

• **Provide mechanisms for pre- and post-evaluation of energy use** (vehicle miles traveled reduction measures/fuel consumption, utilities/light fixtures and wattage, LR braking) and safety (crashes, other user conflicts, crime, health).

• **Utilize breadth and depth of agency and contractor knowledge to have ownership** of and provide accurate and timely evaluation of project priorities and results.

• **Provide clear agency guidelines for sustainability practices, goals, measurement standards, and reporting**

• **Push institutional policy changes with the owner (TriMet) in monitoring, collection and analysis of sustainable practices data, both as an agency and with contractors during planning phases prior to the project development stage that guarantee systemic changes in practice in response to prioritized criteria from INVEST 1.0.**
CONCLUSION AND FUTURE ACTIONS

Employing INVEST 1.0 in conjunction with other sustainability evaluation tools provided TriMet with valuable feedback to understand and communicate its accomplishments in sustainable practices, identify areas where improvements could be made, and finally share valuable lessons learned as part of this intensive evaluation process. Through the use of INVEST 1.0 to evaluate the PMLR project, TriMet has been able to:

- Evaluate the effectiveness of its sustainability strategies.
- Use an infrastructure- and transportation-specific evaluation tool.
- Engage comprehensive indicators that include all life stages and reflect planning, implementation, and operations.
- Identify additional opportunities for sustainable construction and operations.
- Underscore the importance of implementing and communicating agency and project efficiencies and cost savings.
- Use an objective framework which allows clear measures of whether sustainability objectives are met.
- Continue to build transparency and accountability and reduce risk.
- Share data and critical feedback on INVEST 1.0 and comparisons to other systems such as LEED and Envision.
- Communicate the effectiveness of sustainability initiatives to internal and external stakeholders and provide greater visibility for agencies and FHWA.

- Advance and disseminate the science and discipline of sustainable development throughout the transit industry as a whole.
- Position itself as an agency to secure additional public support.

As part of future actions, the INVEST 1.0 study will help TriMet in ongoing transit planning, implementation, and operations and maintenance by:

- Incorporating lessons learned about building contractor education and data collection requirements into RFPs and contract language.
- Establishing clear, repeatable, meaningful, and recordable data measures.
- Continuing to push boundaries of sustainability innovations with pilot projects such as Wayside Energy Regeneration regardless of whether metrics exist to measure success.
- Building better mechanisms for working between agency departments and between agency and contractors on both operational and capital sustainability project planning, implementation, and monitoring.

FHWA designed INVEST 1.0 to be introduced during the very early planning and design stages of a project, as guidance for sustainable infrastructure design; however, in this case, because INVEST 1.0 had not been publically released until the PMLR project was well into construction, it was applied retroactively. Unfortunately, this retroactive application meant that certain INVEST 1.0 standards which require early planning and design efforts were not incorporated into the project. It is recommended that if TriMet wants to continue to effectively apply the INVEST 1.0 scoring system, that it apply the framework early in the planning and design phases of the project. Earlier application of the rating system in planning and design in future projects will help bring sustainability improvements to fruition. For example, the incorporation of sustainability reporting requirements into demolition and other construction contracts on future projects will raise the bar of accountability and result in higher levels of reportage and material reuse.

TriMet has demonstrated that comprehensive and detailed environmental assessments and record keeping for the PMLR project are a critical component of successful and measurable sustainable practices. The agency incorporates an extensive and rigorous QC/QA program incorporated broadly across the project from planning, design and engineering, construction and operations, and is a leader in implementing an agency-wide Safety Certification program to ensure accountability and effectiveness. As TriMet moves forward with project and agency efforts to enhance and expand sustainability practices, integrating the lessons and recommendations collected from these efforts, as well as using INVEST again to improve project performance will be a priority.
APPENDIX A
This page intentionally left blank.
SCORING NARRATIVE

For each module (PD and OM), a narrative explanation of the criterion objectives, PMLR project achievement, observations and feedback on the INVEST tool and opportunities for future actions are provided.

PD-02 LIFE-CYCLE COST ANALYSES – 0/3 POINTS

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.

No points were awarded for Life-Cycle Cost Analysis (LCCA) because it was not included in TriMet planning or contracting. While an alternatives analysis was conducted as part of the Environmental Impact Statement (EIS) documentation and Continuous Value Enhancement Process (CVEP) standards for cost comparison, the project did not utilize the guidelines from the FHWA technical bulletin *Life-Cycle Cost Analysis in Pavement Design – In Search of Better Investment Decisions* (September 1998), *Life-Cycle Cost Analysis Primer* (2002), and/or RealCost software (or equivalent).

Much of the focus for LCCA relies on analysis of best practices for pavement design, that is pavement mix/type for bus lanes, which is not necessarily applicable for light rail but could be adapted. The *Life-Cycle Cost Analysis Primer* introduces the benefit-cost analysis (BCA), which not only considers cost, but other benefits such as reduction in travel time or distance, reduced vehicle operating costs, improved safety, etc., and may be more appropriate for non-highway-type projects.

For future projects, TriMet could build in mechanisms to engage FHWA tools, such as LCCA or BCA, or other metrics examining agency expenditures (planning, engineering, design, construction, maintenance, operations, and administration costs) and user costs (time, safety, fuel, other vehicle operating costs associated with normal operations, and work zone delays) throughout the life of an alternative, not only on initial investments.

PD-03 CONTEXT SENSITIVE PROJECT DEVELOPMENT—5/5 POINTS

Deliver projects that harmonize transportation requirements and community values through effective decision-making and thoughtful design.

Context Sensitive Design principles and benefits are integrated as part of the PMLR project through the EIS process and TriMet public outreach mechanisms in place and/or developed specifically for the project. Visual Quality Analysis, part of the EIS, outlines quantitative and qualitative strategies for assessing project impacts in project right-of-way and adjacencies. Agency-wide conformation to Context Sensitive Solutions (CSS) principles for PMLR and other projects is evidenced by the general manager’s correspondence to regional partners, which details agency approaches to design and references guiding policies for CSSs in urban areas. In addition, the project public involvement strategies and structures meet or exceed INVEST criteria for public involvement that entail “two-way communications that ultimately influence the vision and design of the project.” In addition, INVEST prescribes a six-step framework:

1. Develop a decision-making process and management structure.
2. Define the problem.
3. Develop the project and the evaluation framework for the project.
4. Determine alternatives.
5. Screen the alternatives.
6. Evaluate and select an alternative.

Even though many of the criteria and approaches were met and documented through the EIS, public outreach materials and structures, as well as reference to documents such as *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities* (Institute of Transportation Engineers, 2006), specific documentation of the application of the formal mechanisms of CSS is not as
apparent. Regardless, it was deemed that TriMet met or exceeded objectives for the Context Sensitive Project Development and will continue to engage formal and informal tools in future projects.

**PD-04 HIGHWAY AND TRAFFIC SAFETY—6/10 POINTS**

*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.*

INVEST defines project safety as the analysis, prevention, and education of crash data and subsequent modeling to prevent future vehicle crashes. It uses the following to assess project safety: “Nominal safety refers to the extent to which a site (corridor, intersection, segment, or area) meets currently applicable design standards and guidelines. Substantive safety refers to actual or anticipated safety performance as defined by crash frequency and crash severity. Substantive safety reflects the science of safety: objective knowledge built on science-based discoveries of data-driven assessments of the safety impacts of road design, road user actions or behaviors, and vehicle attributes.”

TriMet collects annual collision data to report to Oregon Department of Transportation (ODOT), but it is not broken down by type or location. While project safety was a factor considered in the analysis of project alternatives configuration in the EIS, specific safety performance modeling and assessment for post-construction has not been established. Both pre- and post-data collection and analysis should be included, such as the Empirical Bayes (EB) before-after study.

The project also utilizes ITS for track signalization, emergency vehicle prioritization, and passenger guidance and information. In addition, there are applications of crime prevention through environmental design (CPTED) principles in station design, as well as conforming to and improving upon standards for pedestrian and bicycle safety (e.g., buffers, sidewalk and bicycle lane widths, signage, sight distances, lighting, and other design components).

In general, TriMet has a policy for preventative rail maintenance in operational modes as part of ongoing safety measures, and presumably this is built into every capital project it undertakes.

It is unclear whether TriMet has or is utilizing specific FHWA standards for Road Safety Audits (RSA), or assessments, which require an independent and multidisciplinary team, consider all users and their capabilities and limitations, and generation of a formal RSA report and formal response; American Association of State Highway and Transportation Officials (AASHTO) Safety Analyst, Interactive Highway Safety Model, or other spreadsheet or analytical tools developed to apply to predictive methods in the Highway Safety Manual could also be used. INVEST also recommends utilizing the National Cooperative Highway Research Program (NCHRP) Human Factors Guidelines for Road Systems, which looks at the relationship between devices and systems and the people who are meant to use them.

Nominal safety standards for project development are not according points. Points for INVEST scoring are awarded based upon:

- Building awareness among the public regarding contributing factors to crashes
- Giving explicit consideration of safety using quantitative, scientifically proven methods

INVEST safety does not consider individual/personal health and/or crime statistics at transit and station facilities and/or bicycle/pedestrian facilities as part of highway and traffic safety. Although safety and health were considered as part of the EIS, no Health Impact Assessment was conducted (see OPHI Lake Oswego to Portland HIA). This may or may not be considered/scored under PD-10 and PD-11 for bicycle and pedestrian health, safety, and welfare.

**PD-05 EDUCATION OUTREACH—2/2 POINTS**

*Increase public, agency, and stakeholder awareness of the integration of the principles of sustainability into roadway planning, design, and construction.*

There is extensive documentation of outreach strategies and efforts in place by TriMet for the PMLR project under the auspices of the EIS requirements, as well as standardized and project-specific TriMet communications approaches to stakeholder outreach and involvement.

See PD-14 for ITS operations.

TriMet and PMLR utilize an extensive social media program, allowing users to download 52 transit-specific applications that are
based on TriMet’s open data, with schedule, points-of-interest files, bike-to-transit maps, trip planning and real-time arrival information for most phones and platforms, including information for people who are visually impaired.

More weight (points) should be given to educational outreach as it impacts agency, contractor, and public understanding, appreciation, and ownership of sustainability practices.

PD-06 TRACKING ENVIRONMENTAL COMMITMENTS—3/5 POINTS

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

Through the EIS and Record of Decision (ROD), TriMet documented and tracked environmental commitments, both regulatory/agency and non-regulatory/community-based. The ROD Environmental Commitment Mitigation is appended as documentation to the INVEST scoring module.

An early East Segment Sustainability report included a tracking matrix, however, this system was never implemented for construction. As a result, a comprehensive environmental compliance tracking system was not employed for the project. In addition, INVEST criteria require that the contractor assign an independent environmental compliance monitor to provide quality assurance services and report directly to regulatory and lead agencies. As a result, only 3 out of 5 points were given.

In future, this should be part of the contracting, including description of an environmental tracking system, “including instructions on what is to be included and how the chain of documentation flows throughout the phases of the project.”

PD-07 HABITAT RESTORATION—3/3 POINTS

Avoid, minimize, 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.

There is extensive documentation of environmental evaluations, including habitat assessments, both of existing conditions as well as alternatives analysis of potential project impacts on habitat integrity. Supporting documentation includes EIS ecosystem analyses, mitigation enhancement strategies, and specific enhancement and restoration projects, such as Johnson Creek. Johnson Creek restoration included floodplain, wetland, and riparian restoration with the placement of 20 large woody debris features, which were repurposed in conjunction with tree removal for the Trolley Rail Project.

The project also utilized light fixtures in keeping with dark sky principles, an important component of habitat protection, as well as habitat creation through the placement of osprey nesting platforms on the Willamette River. This was not specified as part of habitat restoration, however TriMet felt this was an important project element with a substantial impact in an urban environment.

PD-08 STORMWATER—5/9 POINTS

Improve stormwater quality from the impacts of the project and control flow to minimize its erosive effects on receiving water bodies and related water resources using management methods and practices that reduce the impacts associated with development and redevelopment.

The PMLR project meets requirements for pollution reduction outlined in the City of Portland Stormwater Management Manual, which requires 70 percent removal of total suspended solids (TSS) from 90 percent of the average annual runoff. Those include suspended solids, heavy metals, nutrients, bacteria and viruses, organics (oil, grease, hydrocarbons, etc.), and floatable trash and debris.

PMLR utilizes an extensive system of stormwater planters and water quality features to maximize on-site infiltration. The project is treating all stormwater generated from the new bridge on the Willamette River, as well as providing green roof treatments for the Park Avenue Park and Ride garage. The project is also piloting the use of eco-track, which employs a planted trackway instead of paving. The planted trackway provides runoff capture, as well as aesthetic benefits and insect habitat.

Certainly stormwater planters provide water quality benefits by suspending sediments and other pollutants, but it is not clear where specific data for sediment, metals, and other pollutant targets are being measured and whether stormwater facilities listed in project documentation and landscape plans are meeting the INVEST
minimal threshold. The minimum requirement of treating pollutants from at least 80 percent of the total annual runoff volume is not being met, nor are INVEST target standards for managing the flow of at least 80 percent of the total runoff volume based on controlling peak flows or durations from the project site. As a result, 5 of 9 points were assigned.

**PD-09 ECOLOGICAL CONNECTIVITY—3/3 POINTS**

Avoid, minimize, or enhance wildlife, amphibian, and aquatic species passage access and mobility, and reduce vehicle-wildlife collisions and related accidents.

See PD-07 above.

Extensive environmental analysis of existing conditions in the project area including wetland, vegetation, wildlife, fisheries species and Threatened and endangered species that may be affected by PMLR under the auspices of the EIS and the evaluation of alternatives and alignment options. The preferred alternative was selected as a result of eliminating alternatives that would have had the most deleterious impacts on ecosystem resources.

The result of this analysis was a baseline for establishing mitigation measures to first avoid and then minimize impacts in compliance with permit requirements. In addition, the project completed a biological assessment and followed the terms and conditions stipulated in the Biological Opinion issued by National Oceanic and Atmospheric Administration (NOAA) Fisheries on June 23, 2010.

In particular, fish passage and habitat in riparian and wetland systems was assessed for area creeks, streams, and the Willamette River for avoidance, minimization, and, in cases where mitigation was required, enhancement or restoration including Johnson Creek. 20,000 square feet of derelict pile removal from three sites on the western shore and 33,000 square feet of revegetation were proposed for the Willamette River, as well as riverbank modifications to create 25,500 square feet of shallow water beach habitat for juvenile salmonids by utilizing a stepped concrete planter wall, bank stabilization with river rock and repurposed concrete rubble, and vegetation enhancement. TriMet achieved full points in this category and continues to enhance local and regional ecological connectivity through project and operational efforts.

**PD-10 PEDESTRIAN ACCESS—2/2 POINTS**

Improve the safety and convenience of pedestrian networks for people of all ages and abilities by providing or enhancing facilities within the project footprint.

Existing pedestrian facilities were upgraded, such as the rebuilt pedestrian/bicycle crossings over Powell Boulevard and Union Pacific Railroad (UPRR) at SE Rhine Street; and new pedestrian access and safety features were added including 14-foot-wide shared use paths on the new Tilikum Crossing and the new Kellogg Creek Bridge, as well as new station access with a pedestrian crossing over Park Avenue connecting to a park and ride.

PMLR will include more than $40 million in bicycle and pedestrian facilities on nearby streets. More weight (points) should be given to pedestrian access as it comprises a critical element of non-highway/transit sustainability investments and improvements.

**PD-11 BICYCLE ACCESS—2/2 POINTS**

Promote bicycling in communities by providing or enhancing safe and convenient bicycling facilities within the project footprint.

Bicycle facilities include 5.75 miles of new bicycle paths and 440 bike parking spots throughout the PMLR corridor with security measures and long-term storage capacity. Bicycle parking goes beyond minimum code requirements. The new bicycle lanes include dedicated lanes, improved track crossings, and station access. Specific modifications of existing and new infrastructure are being made in the project area to improve safety and access for bicycles including realignments along McLoughlin Boulevard to allow for future multiuse paths, as well as modified and new rail crossings for planned bicycle facilities.

See PD-05 Education Outreach.

More weight (points) should be given to bicycle access as it comprises a critical element of non-highway/transit sustainability investments and improvements.

**PD-12 TRANSIT AND HOV ACCESS—4/5 POINTS**

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.

PMLR is adding 7.5 miles of new double-tracks for light rail with 8 light rail trains for a predicted 22,000–27,000 trips per day, as well as 11 new stations and 2 park-and-rides with 1,400 additional spaces. Pedestrians and bicyclists are accommodated by improving accessibility and connectivity to transit stations by inventorying existing facilities including sidewalks, crosswalks, signalization, and bicycle parking spaces. In addition, there is improved bus access with the construction of the transit/bicycle/pedestrian-only Tilikum Crossing.

More weight (points) should be given to transit and HOV access as it comprises a critical element of highway sustainability investments and improvements.

PD-14 ITS FOR SYSTEM OPERATIONS—4/5 POINTS

Improve the efficiency of transportation systems without adding infrastructure capacity in order to reduce emissions and energy use, and improve economic and social needs.

TriMet has integrated Intelligent Transportation Systems (ITS) throughout its bus and rail systems, including PMLR. Features include Transit Tracker (real-time customer information displays) at rail stations and bus stops, Transit Signal Priority extended green-time for buses, and Automated Stop Announcements. PMLR utilizes Closed Circuit Television (CCTV) for monitoring and managing entry and access at station areas. Several agencies and area governments, including Clackamas County, utilize Opticon Systems which clear the way for emergency vehicles at traffic signals, and TriMet has specifications in place to ensure that gate crossings allow emergency vehicles to safely cross light rail tracks with preemption strategies at SW Naito Parkway, SW Lincoln Street, and SE 12th Avenue. In addition, PMLR is utilizing protected displays of time and route information to assist passengers with decision making.

See PD-05 regarding public outreach.

PD-15 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL PRESERVATION—3/3 POINTS

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.

Section 106 review processes included public participation. Several property locations and districts within the project area are listed or eligible for the National Register of Historic Places (NRHP), including the Royal Foods Warehouse and Office, Westmoreland Park, and the R. Derwey House (Milwaukie). No archaeological resources that are eligible for listing in the NRHP were identified in the Project Area of Potential Effects (APE). Mitigation for impacts on the Duck Pond at Westmoreland Park include interpretive displays at Bybee Station describing the historic attributes of the park, the pond, and its relationship to Works Progress Administration (WPA) era projects, as well as preparation of NRHP nomination materials.

During the preparation of the FEIS, tribal representatives were contacted before major decision milestones to seek their comments and advice and to ensure the preservation and respect of existing cultural, environmental, and historic resources. In addition, historic cobblestones and brick discovered during project excavation are being used to construct segments of the Trolley Trail, a historic streetcar line right-of-way that Metro and the North Clackamas Parks and Recreation District (NCPDR) purchased in 2001 and are currently developing into a regional multi-use trail. Through the McLaughlin case study, the team discovered a 19th-century wooden rail car that was set to be demolished in a building. They partnered with the Oregon Rail Foundation who was able to analyze the car and take it away for restoration.

PD-17 ENERGY EFFICIENCY—6/8 POINTS

Reduce energy consumption of lighting systems through the installation of efficient fixtures and the creation and use of renewable energy.

The Type 5 light rail vehicles will operate at a maximum speed of 55 miles per hour and will include a low floor design providing easy access for passengers of all abilities. Siemens is expected to deliver the vehicles by starting in September 2014 and completing delivery by August 2015. The vehicles also feature energy efficient lighting, heating, ventilation, and air conditioning (HVAC), and ergonomic cabs.
TriMet has information about the use of wayside regenerative braking systems on the MAX since 1997. However, the new Type 5 LRVs will not incorporate the energy storage units on individual trains. Instead, the PMLR project includes locating an energy storage device at the Tacoma Substation. LTK Engineering Service’s analysis determined that the added capital cost of the energy storage system was approximately $320,000; however, use of this system would result in an annual energy cost savings of $232,188, or a payback of only 1.4 years (VIA Architecture report, page 5). The wayside regenerative energy storage from braking light rail vehicles will be captured in a pilot project at the SE Tacoma Street/Johnson Creek MAX Station. Normally, this energy can be captured and passed to a nearby vehicle through overhead wires if another vehicle is present, but otherwise is lost. All lighting along the project alignment will be LED instead of contract-specified metal halide—bulbs last 3.5 times as long and use 1/6 the electricity, an almost 75 percent reduction in energy usage. PMLR lighting fixtures are being specified by LTK under direct contract with TriMet.

Several studies are being conducted to evaluate new agency-standard station fixtures in order to meet both energy conservation goals and support dark sky principles. The Moving Together Project reduced net energy consumption by TriMet offices by 22 to 38 percent. The Moving Together Project is the employee consolidation initiative TriMet has taken as part of the PMLR project. TriMet partnered with Pivot Architecture to perform extensive and critical analyses of all potential building sites as part of the Moving Together Project’s employee consolidation process. They did this to ensure maximized efficiency and long-term adaptability of their final design, and the Center Street building has been constructed on a previously developed greyfield (a greyfield is a formerly developed area which has suffered from under-use and/or insufficient investment, but is otherwise a valuable real estate asset). Estimates for future fuel use by the regional transportation system are lower when PMLR is included in the estimate. Fewer vehicles on the road will result in reduced consumption of fossil fuels and reduced greenhouse gas emissions. Solar photovoltaic panels are being used for the Park Avenue Park and Ride garage to achieve net-zero. PD-18 SITE VEGETATION—3/3 POINTS

Promote sustainable site vegetation within the project footprint that does not require long-term irrigation, consistent mowing, or invasive/noxious weed species removal.

Landscape approach includes extensive use of both native and drought-tolerant species, limited use of irrigation, and no mowing. Extensive landscape plans and schedules to support site vegetation approaches and materials were also developed. PMLR does not utilize graywater for irrigation because of the minimal roof areas of shelters and buildings—the yield is insufficient to warrant the infrastructure cost to build it. In addition, throughout the alignment, there were over 30 percent more trees planted by the project than those that were removed, and the project team only revegetated using native species.

See PD-08 Stormwater above.

PD-19 REDUCE AND REUSE MATERIALS—6/8 POINTS

Reduce life-cycle impacts from extraction and production of virgin materials by recycling materials.

Reducing the material quantity and the size of bridge foundation reduced footing concrete needs by nearly half. The construction prime converted a conveyor that was on site to a bicycle/pedestrian bridge to provide temporary pedestrian access during construction. The other construction prime, Stacy & Witbeck, purchased back crushed concrete after building demolition and used the materials for fill in applications where there were no specific standards of compaction (slopes, banks, etc.). Quantities were measured from truck tickets from Ironhouse, which processes and sells back asphalt and concrete from Stacy & Witbeck. It is 2-mile roundtrip from the APE to Stacy & Witbeck’s processing area. Although the repurchased crushed concrete was the same cost as virgin rock fill, there was a shorter transportation distance. Specific items suitable for salvage are identified on the civil engineering drawings. TriMet’s real estate group will address building demolition and salvage outside of the general PMLR construction contract. Several dozen buildings will be demolished, and TriMet’s real estate group has completed a comprehensive list of the elements in these buildings that show the greatest promise for salvage and reuse. At the time of final design, none of these elements
was directly incorporated into the design of the new transit facilities in order to maintain consistency of system identity and construction standards. Finding appropriate destinations for the salvaged building elements will be an ongoing effort between TriMet and the future demolition contractors. TriMet worked with Ramos, Inc., a local demolition contractor, and Jardín Foundation to deconstruct and beneficially reuse materials from commercial and residential projects within the right-of-way, as well as to develop resources and a methodology for quantifying reductions in embodied GHG emissions associated with reuse of materials. TriMet received approval from FTA to donate materials to qualified nonprofit agencies; in this case, materials were donated to Habitat for Humanity and the Rebuilding Center. In addition, TriMet, as an agency, applied waste reduction, reuse, and recycling strategies when relocating project administrative offices.

**PD-20 RECYCLE MATERIALS—2/8 POINTS**

*Reduce life-cycle impacts from extraction, production, and transportation of virgin materials by recycling materials.*

30,211 tons of recycled material were imported for use during construction. 1,745 tons of uncontaminated material have been exported to local recycle and salvage yards, rather than being sent to landfills.

Additionally, on the West Side, as of December 2012, just under 5 percent of exported material was salvaged/recycled, and 23 percent of imported construction material had previously been recycled. As of March 2014, almost 29 percent of exported material was salvaged/recycled, and 25 percent of imported construction material had previously been recycled.

**PD-21 EARTHWORK BALANCE—0/3 POINTS**

*Reduce the need for transport of earthen materials by balancing cut and fill quantities.*

Even though the project team addressed balancing cut and fill at a number of sites as part of mitigation efforts, including floodplain cut and fill balancing at Crystal Springs Creek Johnson Creek, and Kellogg Lake, the gaps in documentation made it impossible to meet the INVEST module-specified 10 percent threshold.

**PD-22 LONG-LIFE PAVEMENT DESIGN—1/3 POINTS**

*Minimize life-cycle costs by designing long-lasting pavement structures.*

Unpainted stainless steel handrails and guardrails were used on platforms and the bridge, as well as galvanized and steel cables; the bridge itself was unpainted, natural concrete bridge. Durable materials and finishes were used on furnishings such as benches, trash bins, and sign poles. Finish on the porcelain tiles on the bridge abutments allows for easy removal of tagging. Only 1 out of 3 points was assigned due to the emphasis on pavement structures.

**PD-23 REDUCED ENERGY AND EMISSIONS IN PAVEMENT MATERIALS—0/3 POINTS**

*Reduce energy use in the production of pavement materials.*

Reduction of material quantity and the size of bridge foundation reduced footing concrete by nearly half.

**PD-24 CONTRACTOR WARRANTY—1/3 POINTS**

*Improve quality and minimize life-cycle costs by promoting the use of extended contractor warranties for pavement.*

The PMLR project includes warranties for many elements, including items such as green roofs (attachment in INVEST PD module). Verification is still needed for contractor warranties. The warranties cover the constructed portion of pavement structures (or other relevant non-highway, non-concrete) for 3 years or 5 years and include definitions of what products are warranted, the length of warranty period, the responsibilities of the owner and contractor, maintenance, conflict resolution process, contractor quality control plan, measurement methods, performance-based requirements, requirements for remedial correction action, basis of payment, and final warranty acceptance.

**PD-25 CONSTRUCTION ENVIRONMENTAL TRAINING—0/1 POINTS**

*Provide construction personnel with the knowledge to identify environmental issues and best practice methods to minimize impacts to the human and natural environment.*

TriMet does have a very comprehensive and detailed environmental assessment and compliance component for the whole project. These policies were born out of the Final Environmental Impact Statement (FEIS) and have been applied across project
mitigation and construction activities, as well as engineering, field offices, and contractors involved in project planning, construction, and operations. While TriMet does not have a single, named, sustainability tracking person on the contractor’s team, there has been extensive record keeping and data collection to ensure the project meets the environmental criteria and goals.

PD-26 CONSTRUCTION EQUIPMENT EMISSION REDUCTION—1/2 POINTS
Reduce air emissions from non-road construction equipment.

Stacy and Witbeck, TriMet’s contractor, has implemented an emission reduction program and the construction vehicles are complying with the State of California’s emission requirements, which are the most stringent air quality requirements in the country.

Contract requirements need to be verified for a no-idling policy during construction and for using non-road construction equipment with engines that meet US EPA Tier emission standards for 50 or 75 percent of fleet operating hours or have diesel retrofit devices for after-treatment pollution control for at least 50 or 75 percent of fleet operating hours.

PD-27 CONSTRUCTION NOISE MITIGATION—1/2 POINTS
Reduce or eliminate annoyance or disturbance to surrounding neighborhoods and environments from road construction noise, and improve human health.

The contractor has developed strategies to address both noise and vibration issues associated with construction and operations. There is no question that vibration levels for light rail operation are much lower than for freight trains, nonetheless, testing was performed to determine how vibration travels through local soils. Noise reduction strategies employed by the project team include sound barriers, track lubrication at curves, building sound insulation, adjustable crossing bells, directional bells, and bell shrouds. Vibration mitigation strategies employed by the project team include ballast mats, resilient fasteners, tire-derived aggregate ballast track in place of paved tracks, special track work at crossovers and turnouts, and rail grinding/wheel truing.

PD-28 CONSTRUCTION QUALITY CONTROL PLAN—3/5 POINTS
Improve quality by requiring the contractor to have a formal quality control plan.

TriMet has employed an extensive and rigorous QA/QC plan and program incorporated across the whole project, which is one of the greatest efforts the agency has made over the years to develop, train, and implement. This policy extends across the whole of planning, design, engineering, construction, and project operations.

PD-29 CONSTRUCTION WASTE MANAGEMENT—1/3 POINTS
Utilize a management plan for road construction waste materials to minimize the amount of construction-related waste destined for landfill.

TriMet has measured 31,967 metric tons of salvaged/reused materials. “Deconstruction” or selective demolition of houses/structure with donations to local salvagers and housing authorities. TriMet/Ramos, Inc., conducted research early in the demolition process in order to minimize landfill waste coming from the old buildings and attempted to follow the lead of the City of Boulder, Colorado, where city regulations explicitly require contractors to submit comprehensive reports prior to and following the demolition, encouraging transparency and accountability in the use of materials. The team engaged a local salvaging outlet to develop site logistics, salvaging, and scheduling needs. They disassembled, sorted, stacked, and delivered salvaged materials, and successfully deconstructed and salvaged dimensional lumber and metal siding panels. City of Roses Recycling - a disadvantaged business enterprise (DBE), minority business enterprise (MBE), and emerging small business (ESB) company - provided drop box services to aid with recycling efforts. All wood, metal, and cardboard materials were separated at the site and less than one ton of material actually went to the landfill. As of April 2013 there were just over 20,000 tons of excavated materials as opposed to the expected 40,000 tons. Aside from the concrete slab on grade, 99.9 percent of the structures’ materials were repurposed.

OM-01 INTERNAL SUSTAINABILITY PLAN—11/15 POINTS
Focus on sustainability improvements within the agency’s internal operations that affect all three principles of the triple bottom line.
TriMet employs an administrative, construction, and operations approach to sustainability planning, including green construction practices, solar powered bus shelter lighting, and recycling at TriMet facilities.

**OM-02 ELECTRICAL ENERGY EFFICIENCY AND USE—11/15 POINTS**

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.

The agency employs a number of energy reduction goals and strategies including the use of regenerative braking systems on light rail, as well as wind and solar power for its South Terminus substation and communications building. It is one of the largest solar projects in downtown Portland and the first for TriMet’s MAX light rail. It provides real-time energy tracking.¹

**OM-03 VEHICLE FUEL EFFICIENCY AND USE—11/15 POINTS**

Reduce fossil fuel use and emissions in vehicles used for operations and maintenance.

TriMet is one of the first transit agencies to test and operate buses cooled by a NASCAR-inspired system. The system is an efficient engine configuration that runs fans using less engine power, cuts maintenance time and costs, and is easier to maintain. TriMet is using a biodiesel fuel blend which meets federal standards for ultra-low-sulfur diesel for buses. The agency also voluntarily measures exhaust opacity which complies with California standards. The light rail system uses only electricity and uses regenerative braking systems on 101 of its 127 light-rail vehicles to provide additional power to the traction electrification system.

**OM-04 RECYCLE AND REUSE—13/15 POINTS**

Create and pursue a formal recycling and reuse plan for agency operated facilities and maintenance activities.

TriMet staff practice reduce, reuse, and recycle strategies at agency facilities to reduce the amount of waste and the cost of disposal and purchase of new materials. In 2007, Sustainability Coordinators was created, a network of employee environmental advocates at each of TriMet’s facilities. Coordinators serve as the key contacts at their facilities for sustainability and environmental efforts. This network has helped TriMet step up an already successful recycling program. In addition to the used bottles and cans, printer paper and cartridges, computers, monitors and other electronics generated from our offices, the efforts of the Sustainability Coordinators are also enabling TriMet to successfully recycle or reuse a wide range of materials from our maintenance facilities, including:

- Motor oil—re-refined off-site for reuse
- Oil filters—burned for energy recovery and the metal recycled into rebar
- Antifreeze—recycled for reuse
- Paint and other chemicals— inventoried materials recycled or disposed of off-site
- Paint thinner—recycled on-site for reuse in our body and paint shop
- Non-hazardous parts cleaning solvent—re-refined with used oil
- Bus and train washwater—reused and then treated to remove oil and grime
- Shop towels—laundered off-site and reused
- Scrap metal—recycled into other metal products
- Aerosol cans—punctured and recycled as scrap metal
- Small device batteries—recharged on-site or recycled
- Large bus and train batteries—sent back to the manufacturer and recycled
- Light bulbs, tubes and ballasts—metals are separated from glass and both are recycled
- Tires—recycled into other rubber products
- Wooden pallets—refurbished and reused or recycled, depending on condition
- Corrugated cardboard—recycled into new cardboard
- Shrinkwrap and bubblewrap—reused on-site

**OM-05 SAFETY MANAGEMENT—9/15 POINTS**

Maximize the safety of the existing roadway network through a systematic and comprehensive review of safety data and the allocation of resources in planning and programming to support safety in operations and maintenance.

TriMet’s Safety Certification program is an agency wide policy that has been diligently planned, implemented, and rigorously followed - with back-checks to ensure accountability and effectiveness. Project and operational safety are analyzed through the EIS process and analysis of alternatives. Safety is defined primarily through the lens

¹ [http://live.deckmonitoring.com/?id=tri_met_south_terminus](http://live.deckmonitoring.com/?id=tri_met_south_terminus)
of crime and accident prevention through design, whether in terms of passenger safety, track safety, or health issues related to the project. TriMet collects annual collision data to report to ODOT, but it is not broken down by line. Information appears to be unavailable at the time of evaluation. The agency also works with other municipalities to collect data and identify intersections with high collision numbers. The agency has regular safety reviews and receives recommendations from outside consultants concerning passenger safety, driver/operator education, and operations and maintenance. Anecdotally, it is suggested that an increase of transit use reduces accidents among young and elderly by removing potential elderly and young drivers from the road, as well as providing alternative mobility, but TriMet has not measured this with respect to project modeling. Extensive public outreach as well as analysis of methods to ensure and improve track crossing safety and driver and bicycle/pedestrian are also part of project and operational planning and implementation. In addition, TriMet has worked to address the need for operational safety guidelines of trains while also being sensitive to health and welfare through noise mitigation and establishment of quiet zones. This information has been presented in public forums and made available on the Internet. This has entailed implementing supplementary safety measures to provide effective substitutes for locomotive horns in areas where there are quiet zones. These include: wayside horns, temporary and permanent closure, one-way streets with gates, gates with medians or channelization devices, and four-quadrant gates.

**OM-06 ENVIRONMENTAL COMMITMENTS TRACKING SYSTEM—9/15 POINTS**

Ensure that environmental commitments made during project development related to operations and maintenance are documented, tracked, and fulfilled.

TriMet received an EPA grant in 2000 to implement an environmental management system and employs the Natural Step Framework. It also employs environmental standard operating procedures at all maintenance facilities, including regular environmental audits. Environmental commitments are met through project-based regulatory environmental commitments and operational-based audits and reviews.

Although a preliminary East Segment Sustainability report included a tracking matrix, this was never implemented for construction. As a result, a comprehensive environmental compliance tracking system was not employed specifically for the PMLR project. As mentioned previously, TriMet does have a very comprehensive and detailed environmental assessment and compliance component for the whole project. These policies were born out of the Final Environmental Impact Statement (FEIS) and have been applied across project mitigation and construction activities, as well as engineering, field offices, and contractors involved in project planning, construction, and operations. While TriMet does not have a single, named, sustainability tracking person on the contractor’s team, there has been extensive record keeping and data collection to ensure the project meets the environmental criteria and goals.

**OM-13 TRANSPORTATION MANAGEMENT AND OPERATIONS—13/15 POINTS**

Maximize the utility of the existing roadway network through use of technology and management of operations.

TriMet has integrated ITS throughout its bus and rail systems, including PMLR. Features include: Transit Tracker (real time customer information displays) at rail stations and bus stops, Transit Signal Priority extended green-time for buses, and Automated Stop Announcements. PMLR utilizes CCTV for monitoring and managing entry and access at station areas. Several agencies and area governments, including Clackamas County, utilize Opticon Systems, which clears the way for emergency vehicles at traffic signals. TriMet has specifications in place to ensure that gate crossings allow emergency vehicles to safely cross light rail tracks with preemption strategies at SW Naito Parkway, SW Lincoln Street, and SE 12th Avenue. In addition, PMLR is utilizing protected displays of time and route information to assist passengers with decision-making. TriMet employs extensive outreach strategies to promote community building and transit oriented design and whole systems transportation. The organization has also developed transit investment priorities with emphasis on financial stability and improving operations and enhancing service.
This page intentionally left blank.
CASE STUDY

An Innovative Application: Engaging INVEST for a Non-Highway Project—TriMet’s Portland Milwaukie Light Rail (PMLR)

OREGON

Lead Agency: **TriMet**

INVEST Modules: Project Development and Operations and Maintenance

**Links:**
- [http://www.trimet.org/index.htm](http://www.trimet.org/index.htm)
- [http://trimet.org/pm/index.htm](http://trimet.org/pm/index.htm)
- [http://www.trimet.org/sustainable/index.htm](http://www.trimet.org/sustainable/index.htm)

The Tri-County Metropolitan Transportation District of Oregon (TriMet) engaged the INVEST 1.0, a sustainable highway tool, to evaluate the Portland Milwaukie Light Rail (PMLR) transit project. Given the absence of a singular, exhaustive set of metrics or indicators for the transit industry, the INVEST 1.0 tool for evaluating highway projects offered a worthwhile opportunity to use a federally-tested set of metrics to understand, improve on, and communicate about transportation infrastructure.

PMLR is a 7.3-mile light rail corridor providing access for residents of Portland and Clackamas County. TriMet believes that good transit service is crucial to protecting quality of life. To that end, the agency strives to build and operate a transit system in the most sustainable way possible, from construction projects to daily operations. Through innovative policies and technologies, TriMet emphasizes using “green” construction practices, fuel conservation, emissions reduction, and alternative energy sources like solar, wind, and regenerative braking technologies. At the same time, sustainable practices focus on protecting and enhancing the environment, providing safe, comfortable, and direct multimodal options for all users, and communicating those efforts to the public it serves. The INVEST 1.0 tool provides a comprehensive framework for TriMet to assess the effectiveness of its sustainability strategies and their integration into the PMLR project.

**PROJECT DEVELOPMENT MODULE: PMLR**

TriMet utilized the INVEST 1.0 Project Development (PD) module custom scorecard to evaluate and score the PMLR project. They built upon the required 19 core criteria and added 7 more criteria to provide a more rigorous and well-rounded analysis of the PMLR project and to better reflect the goals, achievements and gaps in a transit project. These additional criteria included:

- PD-9 Ecological Connectivity
- PD-10 Pedestrian Access
- PD-11 Bicycle Access
- PD-12 Transit and HOV Access
- PD-14 ITS for System Operations
- PD-21 Earthwork Balance
- PD-27 Construction Noise Mitigation

Because TriMet used the custom scorecard, no formal achievement level was assigned. However, based upon scoring for paving, basic rural, extended rural, basic urban, and extended urban scorecards, **PMLR achieved a 67, or Gold, achievement level in the PD module.**

The INVEST 1.0 PD custom scorecard provided enough flexibility to allow TriMet to adapt parallel sustainability metrics with similar criteria in cases where the scoring criteria within the custom scorecard were not directly applicable to the PMLR project.
OPERATIONS AND MAINTENANCE MODULE: PMLR

TriMet used the Operations and Maintenance (OM) module to conduct a preliminary evaluation of its internal sustainability policies and practices in operation, selecting 7 of the 14 criteria for specifically assessing future operations and maintenance practices for PMLR. Unlike the PD module, the criteria are not weighted. In this instance, only 7 criteria were selected because several were not relevant, or the data were not yet available as the project is still under construction.

PMLR scored 77, or Bronze, achievement level in the OM module. The value of this exercise was both in selecting the criteria and in assessing the available data, all of which point to prospective future steps TriMet will be able to take to assess project performance over time.

KEY OUTCOMES OF USING INVEST 1.0

Using INVEST’s prioritized criteria has reinforced TriMet’s efforts to guarantee institutional goals for sustainability through measurable, achievable metrics. As a result of using the INVEST 1.0 tool in its analysis of the PMLR project, TriMet has identified several key factors for application to future projects:

• **Utilize INVEST in synergy with other sustainability evaluation tools.** INVEST works well with other tools that TriMet has used in its ongoing efforts to push sustainability practices beyond standard requirements, meeting the challenges of climate change, livability, and economic vitality.

• **Apply the INVEST tool early in the process.** Early application of the tool, together with continual evaluation throughout the project, helps ensure accuracy, and lays the groundwork for implementation of sustainable practices throughout the lifecycle of future projects.

• **Coordinate efforts to use and document criteria for different sustainability metrics** (such as Envision, Sustainable Sites, LEED, etc.). Careful coordination will help to avoid redundancy and/or gaps and ensure consistency of policy and implementation.

• **Identify other, future opportunities for pilot projects** that can be measured, evaluated and improved/expanded to system-wide implementation within the agency, as well as serving as regional and national examples.

• **Embed RFQ and RFP process with sustainability language/expectations** and scoring mechanisms, and establish related contract language. This will help to ensure contractor (prime and sub) compliance with goals, measurements, standards, and analysis by stating requirements up front, including the use of an independent environmental tracking manager.

• **Engage a broad spectrum of agency and contractor participation.** Through contractual language, agency policies, and training at project inception, work to build collaboration that will help guarantee that data are collected, distributed, and interpreted in a way that is consistent, meaningful, achievable, and duplicable.

• **Ensure that INVEST scoring is sufficiently flexible** to include or allow for additional criteria and documentation of project goals or elements that are appropriate or specific to non-highway projects in order to garner more meaningful evaluations. For example, alternative energy savings aside from the use of LED light fixtures, or the reduction, reuse and recycling of materials that may not be pavement and/or road focused.

These outcomes will help guide the agency in its ongoing sustainability efforts, provide valuable lessons learned for other transportation planners, and offer productive feedback to FHWA—helping to improve the ease and dissemination of the INVEST tool for non-highway projects, ensuring more accurate scoring and meaningful results.