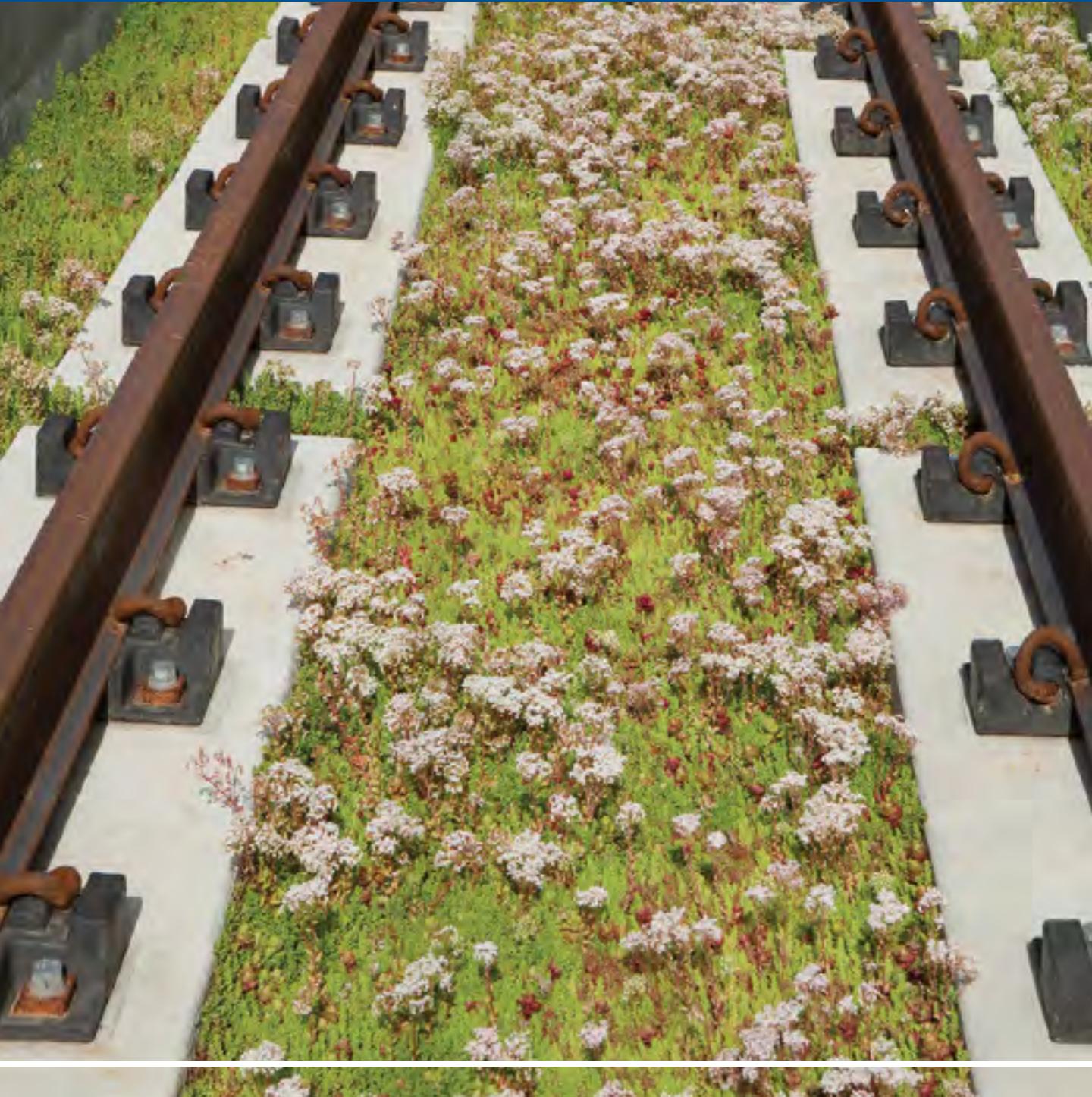


Portland-Milwaukie Light Rail Transit Project Sustainability Report

MAKING THE MAX ORANGE LINE GREEN



TRI MET



This page: Planting new landscaping along the MAX Orange Line.
Cover photo: Eco-track in bloom at the Lincoln St/SW 3rd Ave Station.

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The Portland-Milwaukie Light Rail Transit Project is a partnership of:

Introduction

An Innovative Approach to Sustainability

When the 7.3-mile Portland-Milwaukie Light Rail Transit Project opens September 12, 2015, as the new MAX Orange Line, it will connect downtown Portland, inner southeast Portland, Milwaukie and North Clackamas County. By 2030, Metro projects there will be approximately 22,000 households and 85,000 employees within walking distance of the new MAX stations. By this time, the line is projected to carry up to an average of 22,765 weekday rides.

FOCUS ON SUSTAINABILITY

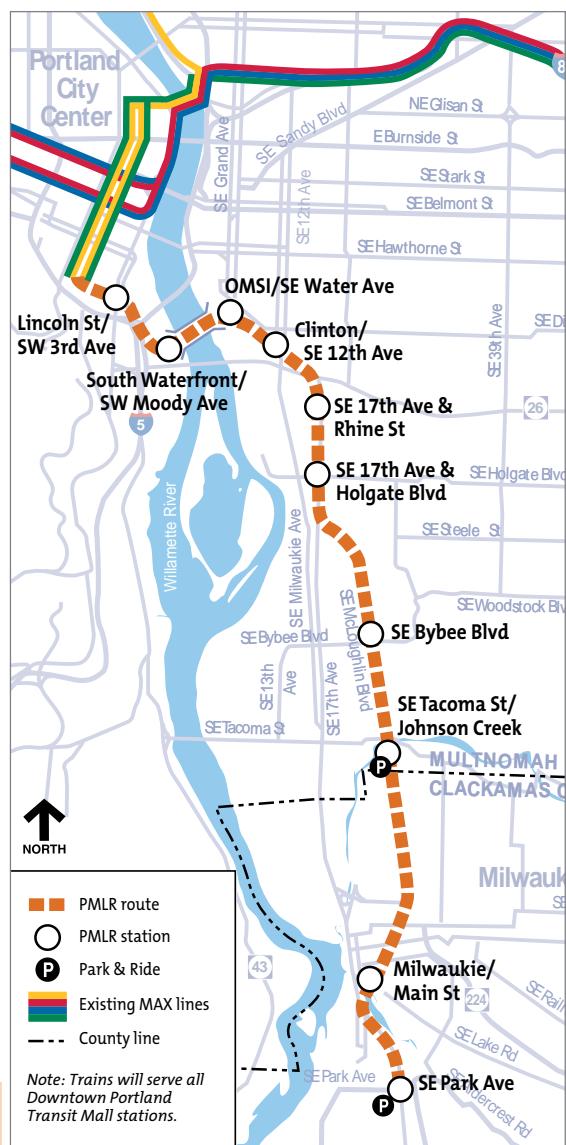
The project employed an industry-leading approach to sustainable design, with early and ongoing commitments made to sustainable practices and a groundbreaking reporting process. The project sets new standards for what can be considered part of a light rail project, with initiatives as diverse as growing infrastructure, active transportation

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

—TriMet's Commitment to Sustainability

MAX Orange Line route and stations map.

amenities and on-site alternative energy generation. The new Orange Line will serve as a best practices standard for bringing principles of sustainability into large infrastructure projects.



Introduction

WORKING TOWARD A SUSTAINABLE INFRASTRUCTURE RATING SYSTEM

Two rating systems were informally applied to the project: the Envision™ Sustainable Infrastructure Rating System and the Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) 1.0. This work is significant given the absence of a singular, exhaustive set of sustainability metrics or indicators for the transit industry. TriMet hopes that the knowledge gained by informally applying these rating systems will begin to develop an industry-wide standard.

SUSTAINABILITY PRACTICES MATRIX AND THIS REPORT

The full scope of the sustainability effort has been captured in the Sustainability Practices Matrix. More than 300 sustainability-focused practices, considerations and materials were identified and cataloged. The matrix is an important reference tool, providing a basis for tracking impacts and effectiveness—serving to inspire those inside and outside TriMet to learn from and advance sustainability efforts on future projects.

This report highlights key sustainability practices captured in the Sustainability Practices Matrix. The practices have been organized under broad categories, though many overlap and intertwine.

Two new pieces of infrastructure—Tilikum Crossing, *Bridge of the People*, and the SE Park Ave Park & Ride—are spotlighted to showcase practices coming together into a synergetic whole. The practices highlighted in this report illustrate the depth and breadth of efforts to incorporate sustainability principles into every aspect of the project.



The MAX Orange Line travels near many parks, recreational area and multi-use paths, including Westmoreland Park and the Eastmoreland Golf Course.

Key Practices

Leadership

TriMet's commitment to sustainability has been reflected throughout the conception, planning, design, construction, and operation of the system. The project's approach to sustainable design included early and continuing commitments, as well as collaborative partnerships.

EARLY COMMITMENTS TO SUSTAINABILITY

It Began with a Strategy

TriMet hosted an early project workshop with VIA Architects to deliberately bring triple-bottom-line principles (which assign equal importance to social, environmental and financial considerations) into the light rail project and resulting MAX line. The result was 28 sustainability strategies that would be supported and tracked throughout project design, construction and operation. In addition to these, hundreds more were added as the project moved forward.

The Possibilities Project

During the project design phase TriMet formed a diverse team of creative design professionals to expand the urban design work, explore opportunities for development, and identify new sustainability practices and renewable energy partnerships. This effort was called the Possibilities Project. It embraced the needs of the community, poised residents to leverage the new line for their own goals and led to many of the actions outlined in this report. Ideas about connections to neighborhoods, planting patterns, solar energy, electric vehicle charging stations, strategic partnerships, and many others, were developed during the process.

"It is exciting to see initiatives that were previously aspirations being turned into reality."

—Neil McFarlane, General Manager

Key Practices

PARTNERING FOR BETTER OUTCOMES

Electric Vehicle Study: Researching Emerging Technologies

The Transportation Research and Education Center (TREC) at Portland State University (PSU) is a research program supporting innovation in transportation. John MacArthur, a research associate at PSU, is taking advantage of the new electric vehicle (EV) parking stations at two Park & Ride facilities to study EV use patterns, such as how travellers complete the first and last mile of their trip, trip-chaining between various destinations during a typical day, and connections to other parts of the transportation system. PSU researchers will collect data from TriMet's charging stations—such as average charge duration—and conduct in-person surveys at Park & Ride facilities. The study will provide a better understanding of how people use the transportation system and their travel behavior.

Energy Trust of Oregon: Saving Energy and Generating Renewable Energy

Energy Trust of Oregon (ETO) is a nonprofit organization dedicated to helping utility customers benefit from saving energy and generating renewable energy. ETO provided technical assistance to the project in its applications for funding incentives to:

- Install solar panels throughout the project
- Reduce energy use by installing LED lighting and smart-lighting controls
- Design and install energy reduction and generation systems into Ruby Junction Light Rail Vehicle Facility improvements

ETO also helped with installation of the systems to ensure they meet rigorous standards for installation, durability and quality.

Zipcar: Car Sharing

TriMet has partnered with Zipcar to provide car sharing programs along its light rail lines. This offers transit riders more options to complete the “last mile” (or first mile) of their trip.

Key Practices

COMMUNITY INVOLVEMENT

Community members are important stakeholders and have been consulted extensively regarding sustainability initiatives. The project's Citizens Advisory Committee and interest groups, including tribal nations and bike-pedestrian advocacy groups, were involved in discussions about amenities and plans. TriMet worked with organizations such as the Oregon Museum of Science and Industry (OMSI) and Oregon Health and Sciences University (OHSU) to leverage the new transit line to best support their community-focused missions.

Stormwater

Integrating stormwater treatment into the project's infrastructure is an important piece of the sustainability effort. TriMet hopes treatments piloted for the MAX Orange Line become the standard for future projects.

STORMWATER TREATMENT

Bio-swales, stormwater planters and rain gardens are being incorporated as much as possible along the rail corridor. These stormwater treatment facilities are planted with hardy plants and shrubs in porous soil that can collect stormwater and runoff from surrounding surfaces and retain it long enough to be safely filtered back into the groundwater. Not only do vegetated stormwater facilities provide passive stormwater benefits—such as slowing the rate of infiltration, attenuating peak stormwater flow, removing contaminants and increasing infiltration—they also provide beautiful landscaping features for the community.



Community members look at route maps during one of the project's many open houses.

Key Practices

The project will capture and filter stormwater at 252 curbside facilities and 34 other swales and basins. These facilities are expected to treat more than 34 acres of stormwater runoff from surrounding areas where rain cannot penetrate the surface. Rain that falls on Tilikum Crossing will be captured and directed to stormwater treatment facilities on the east and west sides of the river. This is a first for Portland; runoff from other bridges currently goes directly into the city's combined sewer overflow facilities.

Pervious pavement has been installed around the Lincoln St/SW 3rd Ave Station platform, which will capture, store and safely release about 2,700 gallons of rain per year.



This large bioswale next to the OMSI/Southeast Water Avenue Station captures and filters stormwater diverted from the deck of Tilikum Crossing.

Key Practices

Functional Habitat

Landscaping and vegetated stormwater facilities can create habitat for pollinators such as bugs and butterflies. This is excellent news for urban gardeners—85% of the world’s flowering plants depend on insects for pollination—and is key to maintaining healthy ecosystems in and around our cities. Many native pollinators have suffered declining populations over recent decades. Reasons are difficult to pinpoint, however, providing new habitat in urbanized areas is one of the best ways to conserve these species. Native species do not require pesticides, which is another benefit to pollinators.

Eco-Roofs

With their top layer of vegetation and soil, green roofs help divert stormwater by absorbing rainwater (reducing runoff by an average of 60 percent in any given area). Eco-roofs also improve building insulation, provide habitat, absorb CO₂, help lower urban air temperatures, and filter dust, particulates and other harmful pollutants out of the air. A 1,000-square-foot eco-roof can remove an estimated 40 pounds of airborne particles per year.



The project includes eight structures with eco-roofs—six on the east side of the river and two on the west side—for a total of 3,500 square feet. Locations include signal and communications buildings, substations and bike facilities. Enviroscapes NW, a Pacific Northwest company, supplied and installed the roofs.

Neighbors of structures with eco-roofs see them as positive improvements for the community. OHSU representatives have said the eco-roofs complement the amenities they are working to provide in their neighborhood.

An eco-roof on a light rail systems building near the South Waterfront/SW Moody Ave Station.

Key Practices

The City of Milwaukie was also supportive, working with the project to ensure eco-roof installation could be accommodated within city guidelines.

Growing Track

The Lincoln St/SW 3rd Ave Station includes 4,204 square feet of eco-track. Although green trackways exist in Europe, this is a first for Portland and the only known treatment in the United States. The vegetated track provides a carpet of flowering, low-growing evergreen plants, some of which change from green to red to orange depending on the season. The sedums were custom-grown by Etera from Mt. Vernon, Wash. This eco-track is part of a larger effort to enrich the urban experience along the light rail route. The goal was to establish a new type of green street to contribute to a neighborhood known for its parks and greenery. Eco-track also helps reduce train noise and vibration. This eco-track serves as a test pilot project case for vegetated trackways in future projects.

Eco-track being installed at the Lincoln St/SW 3rd Ave Station.



Key Practices

Spotlight: Tilikum Crossing

A vital element of the project is a new bridge across the Willamette River. The first new river crossing in Portland in more than 40 years, Tilikum Crossing is exclusively dedicated to transit (light rail trains, buses and streetcars), bicycles and pedestrians.



Tilikum Crossing connects existing routes to create a new, four-mile bike/pedestrian loop across the Willamette River. The 14-foot wide multi-use paths on the bridge are wider than similar paths on existing Portland bridges.

Key Practices

Tilikum Crossing features many thoughtful design elements:

- The cable-stayed design meant only two in-water foundations were needed—other bridge types may have required more in-water foundations
- Bike counters on the bridge display cycling patterns and support future infrastructure investment
- As part of the project's Public Art program, 178 LED lights are programmed to mimic rhythms of the water below—changing color based on the river's speed, height and temperature
- Stormwater runoff on the bridge will be directed to stormwater treatment basins on land
- The two pedestrian/bicycle paths are extra wide—14 feet each—in response to community feedback
- The bridge provides a unique site for research on potential wind-generated energy in urban environments

The river's speed, height and temperature is translated into real-time aesthetic lighting for Tilikum Crossing, using 178 LED light bulbs.



Key Practices

Resource Use

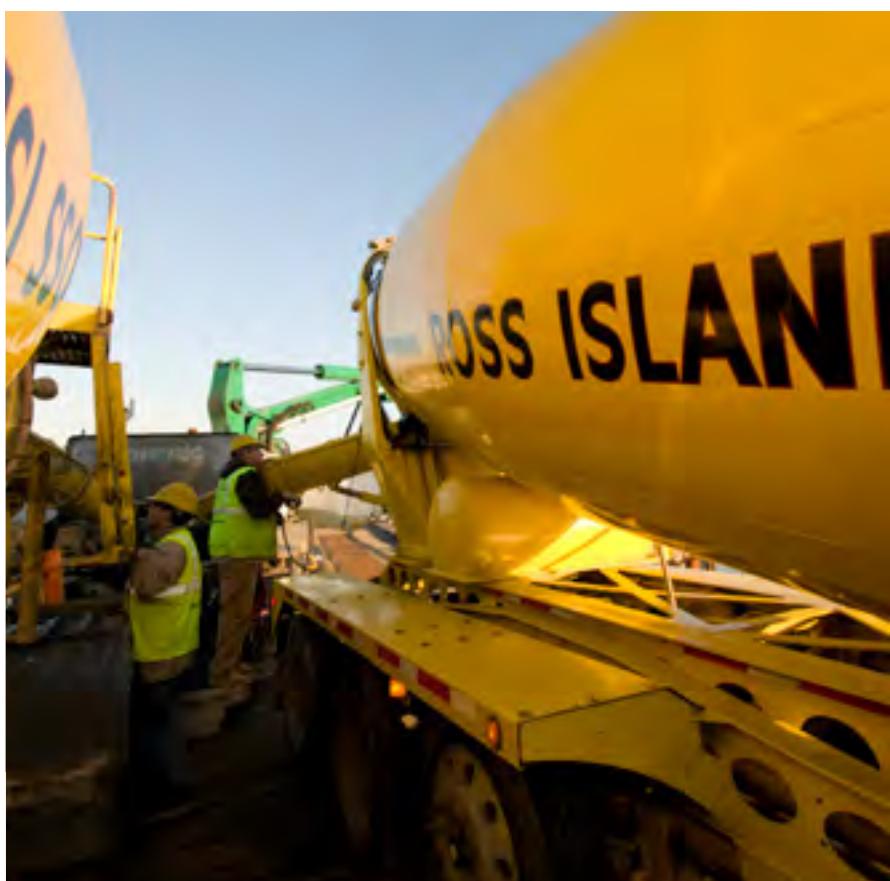
The project reduced consumption of natural resources in many ways. TriMet chose contractors committed to sustainable practices and selected construction materials that would reduce environmental impacts. Staying flexible and adaptable also proved important to respond to unexpected challenges and opportunities to reduce, reuse and recycle.

WEST SIDE CONSTRUCTION BY THE NUMBERS

More than 21,500 tons of byproduct material was salvaged during westside construction and either reused within the project or recycled elsewhere. In addition, more than 47,000 tons of recycled material was brought in after being salvaged from other construction sites, such as crushed asphalt from repaving projects.

More than
**90 percent of
construction
materials** have
been sourced from
within the local
tri-county area.

*Portland-based Ross Island Sand & Gravel
supplied concrete to the project.*



Key Practices

MOVING FROM BUILDING DEMOLITION TO DECONSTRUCTION

The project acquired more than 100 buildings in order to build the new light rail line. The standard demolition approach allows contractors to demolish buildings and dispose of materials. TriMet, however, is shifting to a deconstruction approach. This will keep more material out of landfills through a careful process of dismantling existing structures so components can be reused or recycled.

The project considered potential reuse and/or recycling of items such as doors, windows, trim, tables, cabinets, flooring, siding, fireplaces, mantels, fixtures, appliances, sinks, toilets, insulation, air conditioning units, I-beams, boilers and metal lifts. Deconstructed materials were donated to community-based organizations such Habitat for Humanity, the Rebuilding Center and ReStore.

Salvage and reuse of materials reduces resource consumption, retains embodied energy of already manufactured materials, and preserves the history and legacy of demolished buildings.



When a 19th century wooden rail car was discovered in a building scheduled for demolition, the project team partnered with the Oregon Rail Heritage Foundation to salvage it.

Key Practices

LOW-MAINTENANCE, DURABLE MATERIALS

Robust, low-maintenance materials were chosen whenever possible including:

- Unpainted stainless steel handrails and guardrails on platforms and the Tilikum Crossing bridge
- Galvanized steel with stainless steel cables
- Unpainted, natural concrete on various surfaces along the light rail line
- Durable materials and finishes on furnishings such as benches, trash bins and sign poles



Low-maintenance materials on the Harbor Structure in South Waterfront include unpainted concrete and weathered steel. The steel girders were fabricated in Tigard, Ore.

Key Practices

DEALING WITH DIRTY SOIL

Historically contaminated soils on the west side of the river were encapsulated in concrete infrastructure for the project, which eliminated the need for treatment or transport of the materials.

RECYCLED RAIL TIES

Railroad ties made of recycled plastic materials are being tested at the Tacoma Bridge to see whether they can help with soil settlement issues. Installed on either end of the bridge, the ties have lower lifetime cost than traditional wooden or concrete ties because they are more durable and resistant to the elements. Also, the material in the ties is inert, meaning it doesn't leach chemicals into the ground. Made of 100 percent recycled composite material, the ties can be fully recycled into new products at the end of their useful life.

If the recycled ties at Tacoma Bridge prove to have the expected benefits, they may become more widely used around TriMet's light rail lines.

ONGOING INITIATIVES

Reducing Paper Use: Mobile Ticketing

The MAX Orange Line will be included in TriMet's new tap-on mobile ticketing system. Mobile ticketing will reduce the waste created by paper tickets and will require less infrastructure and maintenance than the current system. The mobile ticketing system is also expected to increase transit ridership. Following testing of the tap-on mobile ticketing system, it will be incorporated into TriMet's entire light rail system.

Saving Water Resources: Smart Irrigation

The project's smart irrigation systems have sensors that detect rainfall and temperature and can be programmed to turn on only when the plants need water. All of the irrigation systems along the light rail line have been designed to maximize water conservation while remaining practical and maintainable over the long term.

Reducing Train Wash Water

Train wash recycling at the Ruby Junction Light Rail Maintenance Facility will reduce the use of potable water by seventy percent. The water used to wash TriMet trains is reclaimed from the recycling system.

Key Practices

Energy

Green energy initiatives are offsetting power usage, saving electricity and creating aesthetic design amenities. Planners and contractors increased their experience with these technologies, and TriMet hopes they will become standard for light rail projects.

SOLAR ON SHELTERS

Solar panels are incorporated on the roofs of most of the MAX Orange Line platform shelters. The bi-facial panels generate electricity from both sides, taking advantage of both direct and ambient light. Each of these shelters will have thirty 200-watt panels integrated into the shelters' glazing system.

The solar panels will help offset the power usage required at stations. A study of a similar project at CalPoly found that the solar panel installation at a single site would have a complete investment return within 12 years – much shorter than the expected lifetime of traditional panels.

The project's general contractor, Stacy and Witbeck, Inc., specifically asked to work with this initiative to increase its knowledge, as well as the expertise of local electrical subcontractors. Deamor, a skylighting contractor from Vancouver, Washington, is leading the effort and boosting their experience in this emerging industry. The project also worked with local firms O'Neill Electric, Affordable Electric, Team Electric and REC Solar.

Solar panels are installed on most of the MAX Orange Line's platform shelters.

"It's hard to overstate how much inspired and thoughtful effort has gone into the integrated shelter/solar system. This has been a joint effort between the TriMet team and half a dozen local contractors."

—Bob Hastings, TriMet Agency Architect



Key Practices

LED lights and platform signs at the South Waterfront/SW Moody Ave Station.

LED LIGHTING

All lighting in the project is LED instead of conventional metal halide bulbs. LEDs use one-sixth of the electricity and last 3.5 times as long as metal halide bulbs. In addition, they will only need to be replaced every 10 to 15 years.

REGENERATIVE ENERGY STORAGE

Regenerative energy systems capture and reuse braking energy for reuse. TriMet has successfully used forms of this technology on MAX trains since 1997. The MAX Orange Line will also take advantage of regenerative energy, though energy storage units will not be located on trains.

“This regenerative energy pilot project is positioned to bring a new and efficient technology to the U.S.”

- Dan Blocher, Executive Director of TriMet Capital Projects



Key Practices

Instead, a supercapacitor at the Tacoma substation will store energy from braking trains and feed it back to other trains for acceleration or uphill climbs.

This will spread the benefit of the regenerated energy across the system, making it more efficient overall. It will also reduce energy peaks, which often take place when electricity is the most expensive.

The substation at the SE Tacoma St/Johnson Creek Station will have the first supercapacitor in the United States to harness regenerative energy for light rail.

ELECTRIC VEHICLE CHARGING STATIONS

The project includes 23 level-2 electric vehicle chargers with universal port connections. Chargers will accommodate seven vehicles at the SE Park Ave Park & Ride and 16 vehicles at the SE Tacoma St/Johnson Creek Park & Ride (with four more chargers planned). OpConnect, a local Portland company, will provide and operate the chargers. TriMet identified potential locations for chargers prior to construction so that conduit for power and data cabling could be integrated into the parking structures.



Electric vehicle charging stations at Park & Rides will provide locations for research on travel patterns, including EV/transit linkages.

Key Practices

Photo: Urban Green Energy



Vertical-axis wind turbines (VAWTs) offer several advantages over traditional, horizontal-axis wind turbines (HAWTs). VAWTs are highly efficient and do not require as much wind to generate power, allowing them to be closer to the ground where wind speed is lower and where they can be maintained in safer and more efficient ways. They are also omni-directional, meaning they do not have to point into the wind, eliminating the need for wind-sensing and orientation equipment.

VERTICAL-AXIS WIND TURBINES

The project hopes to take advantage of the region's abundance of wind and has proposed 12 vertical-axis wind turbines (VAWTs) on approaches to Tilikum Crossing. Each may generate an average of 1,000 watts of electricity per hour (about 12 KWh). The power will offset the energy needed for lighting the bridge, and also feed into the Portland General Electric (PGE) power grid.

The wind turbines, with their highly visual aesthetic appeal, would demonstrate the region's commitment to innovation in sustainable energy generation. Their spinning, naturalistic form will herald the public's crossing of the river as they enter/leave the stations on either side of Tilikum Crossing.

The urban wind test project has excited the interest of numerous partners and is widely seen as a research opportunity into wind-generated energy in urban environments. It is being championed by TriMet, PGE, PSU and OMSI. Testing is underway to determine if sufficient wind speeds exist to advance this exciting initiative.

Key Practices

Active Transportation Improvements

The project includes more than \$65 million in active transportation improvements, a result of extensive consultation with bicycle and pedestrian groups during the planning phase.

BICYCLE IMPROVEMENTS

The project enhances the region's bicycle network by providing safe crossings of rail tracks; new connections to and across the Willamette River; key crossings over busy streets and rail lines; access to light rail stations; and on-road improvements. These include multi-use paths, connections to greenway trails, bike lanes, bike boxes, cycle tracks and sharrows, pavement markings. Space at the Clinton and South Waterfront stations will provide places for future bike share programs.

The project has provided **446 new bike parking** spaces and approximately **10 miles** of new or replaced sidewalks and **eight miles** of new or replaced bicycle facility improvements.



Cyclist uses one of the new bike lanes on SE Water Avenue near OMSI.

Key Practices

MULTIMODAL RIVER CROSSING

Tilikum Crossing is dedicated solely to transit and active transportation use. It will include two 14-foot bike and pedestrian paths, coordinating connections to existing and planned paths on both sides of the river, and dedicated bike lanes through the stations on either side. Connections to existing routes create a four-mile bicycle/pedestrian loop across the river, which will provide more options for both residents and tourists. Bike counters at either end will collect cycling data and display bike counts and visual depictions of cycling patterns to the public. Data collected by the bike counters can support future investment for bicycling transportation infrastructure.

"We believe that this is the largest active transportation investment in the U.S. related to a light rail project."

—Dan Blocher, Executive Director of Capital Projects

REGIONAL TRAIL

Working closely with local jurisdictions, the project improved a segment of the historic North Clackamas County Trolley Trail. The trail features a 12-foot asphalt pathway, pedestrian scale lighting, hundreds of new trees, and artwork made with wood salvaged from trees removed for construction. This is a key piece of the planned regional bicycle and pedestrian system linking two major multi-use trail systems with the intention of providing a safe, continuous route between southeast Portland and the Milwaukie town center.

Walking and bicycling activity may increase as a result of improved access and connections to jobs and neighborhoods. A person making a single round-trip on the added bicycling paths alone will burn an average of **529.2 calories**.

Key Practices



The multi-use path under Kellogg Bridge in Milwaukie provides a safer, more direct route for bicyclists and pedestrians.

PEDESTRIAN BRIDGES

Pedestrian crossing improvements address transportation safety and equity issues in the communities the MAX Orange Line serves.

The Kellogg Bridge over Milwaukie's Kellogg Lake includes a pedestrian bridge below the new light rail structure to connect two sides of a community that have historically been separated by geographic barriers.

The reconstructed Lafayette pedestrian bridge near the SE 17th Ave & Rhine St Station also closes gaps in essential pedestrian connections. A main goal of this station is to support existing industrial businesses while encouraging a neighborhood-oriented, multimodal transportation corridor. It is expected that the new bridge will encourage more people to walk to work—particularly commercial/industrial employees who commute from residential developments on the opposite side of the railroad tracks.

Key Practices

Habitat

Improving the urban natural environment has been a project priority, including minimizing impacts to the environment during construction, restoring habitat, and finding ways for infrastructure to interact with ecosystems in a positive way.

NEW SHORELINE HABITAT

The project contributed \$1.7 million in mitigation funds to restore shallow water habitat along the Willamette River in the South Waterfront area. The work cut industrial fill from the riverbank and removed approximately 27,000 tons of concrete, contaminated soil and debris. An innovative retaining wall was planted with native species to protect the area from erosion. The 25,500 square feet of new near-shore habitat will help restore native fish populations.

RESTORING NATURAL AREAS

The project provided funding to restore the native plant community on 10 acres of the Ross Island Natural Area. Weeding and planting by local volunteers helped enhance the quality of habitat and prevent the further spread of weeds on the island. More than 700 native trees and shrubs were planted, and 100 pounds of native seed sowed. Ecological monitoring helped measure restoration success.

Crews planting trees and landscaping near the Trolley Trail in Clackamas County.

Approximately **3,325 trees** were planted along the light rail line—nearly **four times** as many as were removed. The carbon sequestration provided by these trees is equivalent to capturing the annual greenhouse gas emissions from approximately **20 passenger vehicles**.



Key Practices



MINIMIZING POLLUTION

The project selected materials to minimize the possibility of paint toxins falling into the Willamette River. For example, transit bridge structures were built with unpainted concrete and the main body of Tilikum Crossing is unpainted concrete flanked by stainless steel railings and cables. No pesticide-treated wood was installed below the typical high-water levels, and during on-site removal of old, pesticide-treated wood piers, no debris was allowed to fall into the water.

The project removed fish from the enclosed space where Tilikum Crossing foundations were built. All recovered fish were released.

Key Practices

URBAN CREEK RESTORATION

Agency and railroad partners worked with community groups to return natural water flows and healthy habitat to three area creeks.

At Johnson Creek, large pieces of woody debris created from construction were placed in the water to restore salmon habitat. Stacy and Witbeck, the contractor, donated half of the footings for an interpretive boardwalk in the station area.

Thanks to project involvement, the City of Portland was able to undertake major habitat restoration along Crystal Springs Creek, including rehabilitating a portion of the creek bed and re-establishing more natural water flows.

The project also helped local civic leaders restore 3,000 square feet of creek wetlands and mitigate impacts of the transit bridge built over Kellogg Lake.



*Repurposed rootwads in Johnson Creek (above);
a restored portion of Crystal Springs Creek (middle);
the light rail bridge across Kellogg Lake (below).*

Key Practices

Livability

At the heart of the project is a mission to improve the quality of life for the communities the MAX Orange Line serves. From being a good neighbor by making rail quiet zones possible to incorporating community values, the project is committed to the well-being of individuals and the larger social fabric.

FIRST AND LAST MILE TRIPS

Several project amenities offer transit riders more options to complete the first and last miles of their trip. Transit ridership depends on safe and efficient access to station areas. The project worked with community members and partners to maximize station access, and include bicycle and pedestrian facility improvements. It also designates space for electric vehicle chargers, and car and bike sharing programs at various places along the route.

TRANSIT-ORIENTED DEVELOPMENT

Transit-oriented development strives to create vibrant mixed-use areas designed to maximize access to public transit.

Intermodal Cargotecture

A tiny remnant of land left over from building the Clinton/SE 12th Ave Station is slated to be turned into an innovative, sustainable development in southeast

AIR EMISSIONS AVOIDED

Due to congestion relief:
By 2030, it is estimated that the MAX Orange Line will carry an average of **22,765 weekday rides**, taking **9,100 automobiles** off the road during peak hours each day.

Due to mode shift:
By 2030, the MAX Orange Line will reduce **60,000 miles** traveled per weekday by shifting car travel to transit. This will reduce the amount of carbon dioxide pumped into the air by nearly **60,000 pounds** per day.

Due to land use patterns:
The MAX Orange Line is estimated to reduce carbon dioxide emissions by as much as **114,000 pounds per day**.



Key Practices

Portland. TriMet asked for proposals to develop the 1,000-foot x 18-foot piece of land, with the goal of re-envisioning what an industrial space can look like. The winning idea, from Portland-based Reworks Inc., will repurpose shipping containers to create a modular building system, in a building style called “cargotecture.”

If the first cargotecture development proves successful, two other lots of the same size can be made available for redevelopment.

17th Avenue Community Design

Four properties adjacent to the light rail line in Portland’s Brooklyn neighborhood may also be put to new use. Situated near the two 17th Avenue stations, the remnant properties provide an opportunity for mixed-use development oriented towards transit use and a low-car lifestyle. Community members provided suggestions for how new development can integrate with the scale of the neighborhood. Conversations with the community also led to one irregularly shaped property being proposed as a community orchard.



Proposed “cargotecture” microdevelopment at Clinton St/SE 12th Ave Station.

Key Practices

BEING A GOOD NEIGHBOR—QUIETER TRANSIT

The project will minimize noise and vibration impacts from light rail, bus, streetcar, warning bells and traffic. Initiatives include the establishment of “quiet zones” in southeast Portland and Milwaukie; sound barriers; track lubrication at curves; sound insulation; adjustable crossing bells; directional/shrouding bells; ballast mats that improve drainage and limit vibration effects; and special trackwork at crossovers and turnouts.

PUBLIC ART PROGRAM

The Public Art Program emphasizes the uniqueness of individual station areas, encouraging connectivity, stewardship and sustainability.

The Orange Lining art installation, early in the project, used required construction features (such as silt fences and sidewalks) as a canvas for poetic phrases from area writers. The installation was intended to stimulate public involvement in the new rail line, even as it was being built.



Safety modifications to rail crossings of existing streets near the Clinton St/SE 12th Ave Station qualify this area for quiet zone status, so trains do not need to regularly blow their horns as they pass. The design also provides improved crossings for bicycles and pedestrians.

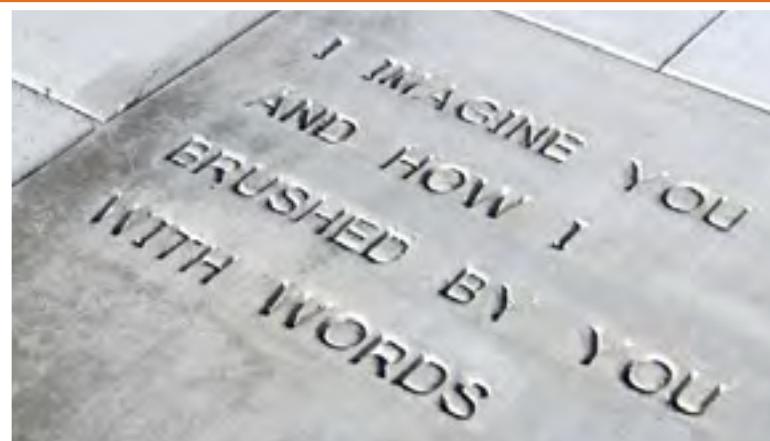
Key Practices

A monumental sculpture at the Clinton St/SE 12th Ave Station was created from decommissioned freight rail removed to make way for the light rail project.

Light rail construction along McLoughlin Boulevard/ Highway 99E in Milwaukie required the removal of several redwood, fir and cedar trees. In response to community concern about losing the trees, the project public art program commissioned six local artists to use wood from the trees to create public art pieces to be placed on site. The six sculptures have been designed to age naturally, emphasizing the natural material and the trees from which they originated.

Used bicycle and skateboard parts were arranged to resemble skeletal remains of dinosaurs in a series of eight concrete panels for the Powell Boulevard underpass.

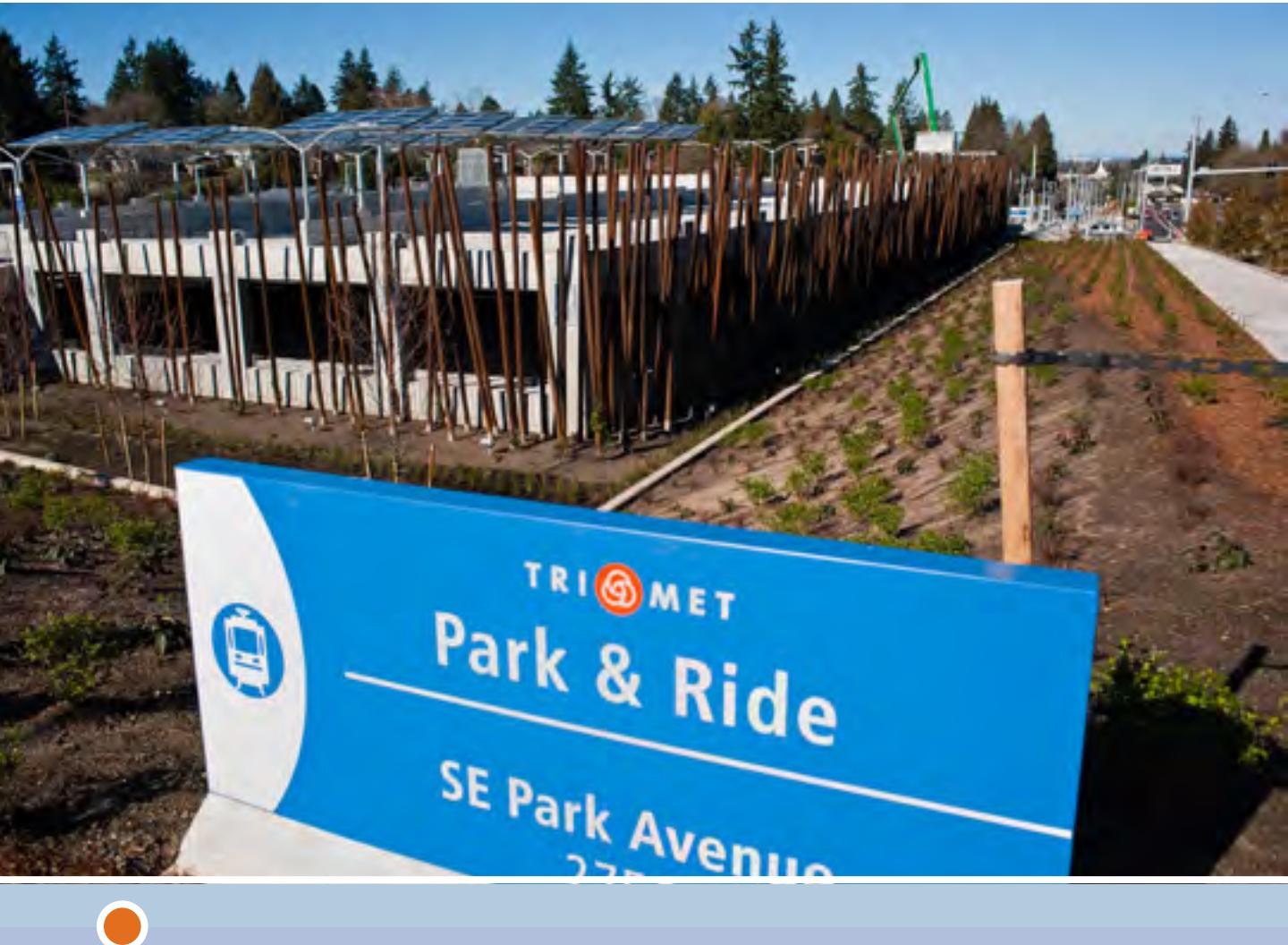
Poetry stamped in concrete as part of the Orange Lining project (top); rail sculpture at the Clinton/SE 12th Ave. Station (second); bear sculpture made from a tree removed during construction (third); “Velosaurus” (bottom).



Spotlight: SE Park Ave Park & Ride

The SE Park Ave Park & Ride is a prime example of many pieces of the sustainability program coming together as a whole. Metro, ODOT, Urban Green and community members joined the project to create this innovative neighborhood gateway. Sixty-eight percent of the garage and station area is set aside for restored habitat. Sustainable practices put into action here include:

- A public square at the facility creates a community center and links existing transit services



This new SE Park Ave Park & Ride owes its success to a shared vision and collaborative partnerships with TriMet's project team, the design/build contractors and civic leaders from the surrounding community.

Key Practices

- Invasive plants were removed and native species planted to restore former habitats
- All of the building's stormwater runoff will be captured and treated onsite
- 102 bike parking spaces are provided as well as an area for a future car sharing program
- Seven electric vehicle charging stations will be used by TriMet and PSU to research travel patterns such as EV/transit linkage and last mile trips
- Solar panels will offset all of the facility's operating functions, including elevators and lighting, allowing the building to achieve net zero energy usage
- Community members planted new trees to revive a riparian forest habitat southwest of the station



The Park & Ride includes a stormwater system that will direct rainfall runoff to onsite treatment. A living wall of vegetation can be seen as it begins to grow up the structure wall.

Conclusion

Moving Forward

By the time the first MAX train runs on September 12, 2015, TriMet's MAX Orange Line will have already created a lasting legacy by breaking new ground as a large-scale infrastructure project deeply committed to sustainability and social benefit.

The project has piloted new technologies and leveraged infrastructure to apply sustainable practices, environmental improvements, and human-scale design. Using knowledge gained during design and construction – and documented during the reporting process – TriMet plans to expand these principles into future projects and to encourage further uptake by sharing knowledge with agency and industry partners around the world.



The Lincoln St/SW 3rd Ave Station.

Conclusion

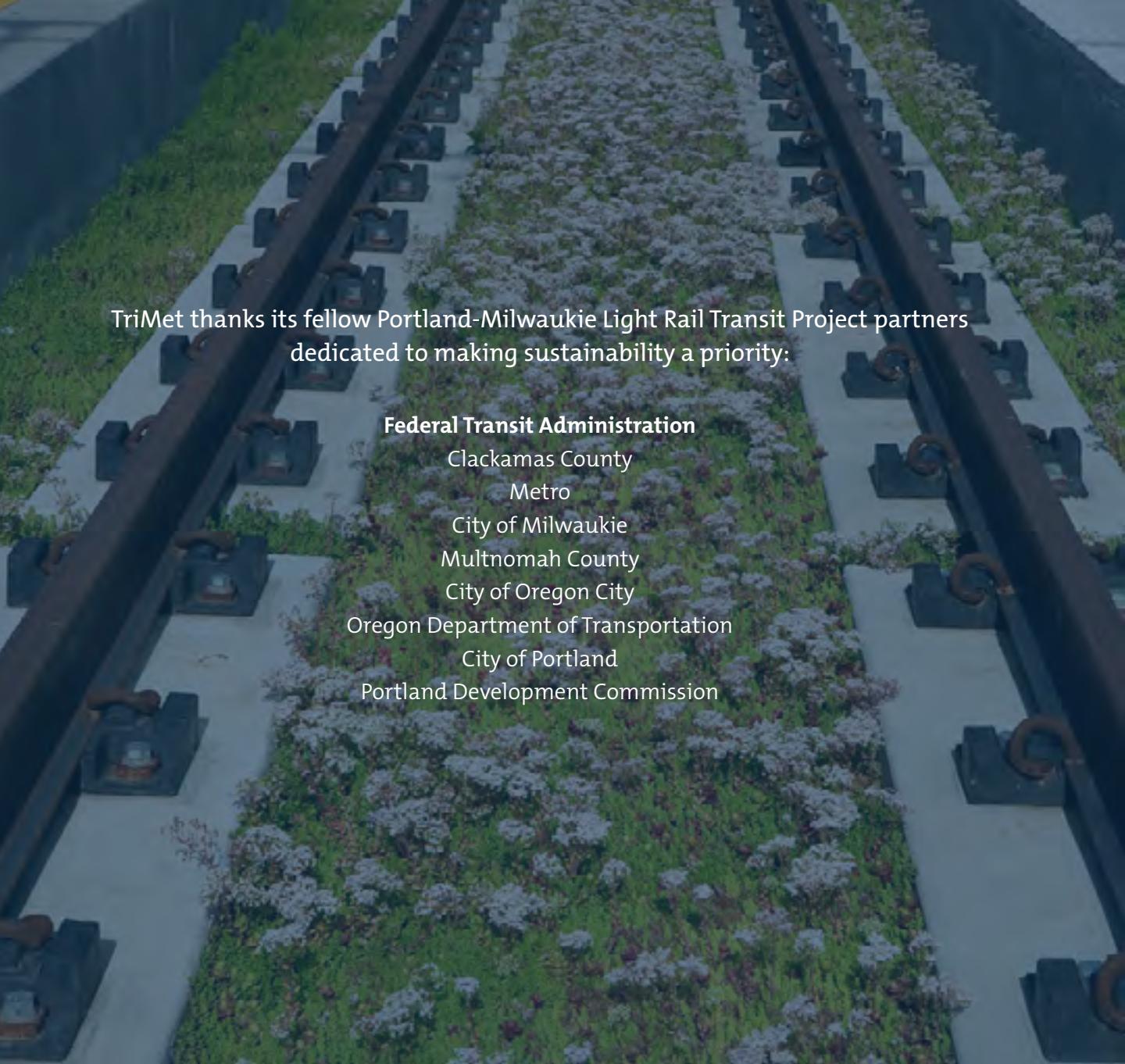
Thanks to Our Sustainability Partners

TriMet thanks these partners for contributing to our vision of a sustainable project:

- Affordable Electric
- CH2M HILL
- City of Milwaukie
- City of Portland
- City of Roses Recycling
- Clackamas County
- DeaMor Associates
- Doug Hollis and Anna Valentina Murch
- Dynalectric Company
- Energy Trust of Oregon
- Envision Sustainable Infrastructure Rating System
- Federal Transit Administration
- Greenworks
- Habitat for Humanity
- Harding Portland Foundation
- Hollywood Lights
- JLA Public Involvement
- Johnson Creek Watershed Council
- Kiewit
- Metro
- Mayer/Reed
- Milwaukie Presbyterian Church
- North Clackamas Parks & Recreation
- Oak Lodge Sanitary District
- O'Neill Electric
- OpConnect
- Oregon Health & Science University
- Oregon Museum of Science and Industry
- Oregon Department of Transportation
- Parametrix
- Peg Butler and Buster Simpson
- Portland Bicycle Advisory Committee
- Portland Development Commission
- Portland General Electric
- Portland Pedestrian Advisory Committee
- Portland State University
- Ramos, Inc.
- Raimore Construction
- Rebar Group, Inc.
- The Rebuilding Center
- REC Solar
- Reworks, Inc.
- Skanska USA
- Stacy and Witbeck, Inc.
- Tad Savinar
- Team Electric
- Transportation Research and Education Center
- Union Pacific Railroad
- U.S. Army Corps of Engineers
- Urban Green Energy
- VIA Architecture
- Washington Creek Restoration Council
- Waterleaf Architecture
- Willamette River Bridge Advisory Committee
- Zidell Companies
- Zipcar, Inc.

A special thanks also goes to members of our community, including the Citizens Advisory Committee, which provided invaluable input to create a better Portland-Milwaukie Light Rail Transit Project.

Report prepared for TriMet by JLA Public Involvement <www.jla.us.com>



TriMet thanks its fellow Portland-Milwaukie Light Rail Transit Project partners dedicated to making sustainability a priority:

Federal Transit Administration

Clackamas County

Metro

City of Milwaukie

Multnomah County

City of Oregon City

Oregon Department of Transportation

City of Portland

Portland Development Commission

