The GreenDOT Policy Directive. This document established GreenDOT as a broad and comprehensive policy for promoting sustainability in the transportation sector. Through GreenDOT, MassDOT embraced the triple bottom line of sustainability: environmental, economic, and social. GreenDOT is intended to reduce greenhouse gas emissions and minimize the ecological impact of transportation operations; provide mobility for people and goods and support for smart growth development; and facilitate access to opportunity for all Massachusetts residents, workers, and visitors, while promoting public health and quality of life.

MassDOT has been aggressive in pursuing our vision for sustainability. This 2014 GreenDOT Report demonstrates our achievements to date, and our continued pursuit of greening the transportation system. This report focuses on MassDOT's efforts and initiatives, both for the transportation sector as a whole, and for MassDOT's internal operations. It summarizes the actions that MassDOT has taken, and measures the outcomes and impacts of those actions on sustainability in the transportation system.

This report is also a testament to the efforts of people in all of MassDOT's divisions. The degree to which GreenDOT succeeds is dependent upon embedding its goals into our core activities, and developing a culture of sustainability throughout the department. I would like to thank all of the MassDOT staff who have embraced the opportunity to integrate GreenDOT into the way we do business – to make it part of their jobs, instead of taking a "Not my job" approach. By continuing to work together towards GreenDOT goals, I am confident that we will create a better transportation system and a healthier environment.

Frank DePaola
Acting Secretary & CEO
Massachusetts Department of Transportation
Acknowledgments

The Massachusetts Department of Transportation (MassDOT) would like to acknowledge the effort of the many contributors to this 2014 GreenDOT Report. We would like to thank the leadership of the MassDOT divisions and shared service units, without whose help this report could not have been completed, and the many MassDOT employees who contributed both their knowledge and time:

Aeronautics Division
Christopher Willenborg, Administrator
Thomas Mahoney, Nathan Rawding, Katie Servis

Massachusetts Bay Transportation Authority
Andrew Brennan, Director, Environmental Affairs
David Barker, Michael Donaghy, Sean Donaghy, Melissa Dulles, Brian Kane, Timothy Lasker, Janice E. Ramsay, Victor Rivas, Jamaal Schoby, Dominick Tribone, Kathleen Wallace

Registry of Motor Vehicles
Celia J. Blue, Registrar
Sara Lavoie, Aric Warren

Office of Performance Management & Innovation
Rachel Bain, Assistant Secretary
Paul Fernandes, Virginia Reeder

Office of Diversity and Civil Rights
Stephanie D. Neal-Johnson, Interim Chief
Diversity and Civil Rights Officer
John Lozada, Gregory Sobczynski

Office of Energy, Technology & Management
Albert Shaw, Assistant Secretary
Nicholas Joyce, Hongyan Oliver, Judith Riley

Office of Transportation Planning
David Mohler, Deputy Secretary for Policy and Executive Director of OTP
Clinton Bench, Deputy Executive Director
Bob Frey, Eileen Gunn, Scott Hamwey, Melissa Kalicin, Josh Lehman, Kevin Lopes, Dustin Rhue, Jennifer Slesinger, Peter Sutton, Stephen Woelfel

MassRIDES: Kristin Slaton

Highway Division
Patricia Leavenworth, Chief Engineer
Thomas Tinlin, Chief, Operations & Maintenance
Russ Bond, Mark Carmichael, Stephen Collins, Heather Hamilton, William Hurton, Robert Impemba, Steven Jacques, Stephanie LeBlanc, Edmond Libsch, Steven Miller, Edmund Naras, Donald Petey, Laurene Poland, Bonnie Polin, Luciano Rabito, Beth Suedmeyer, Kevin Walsh, Leonard Walsh, Scott Wilson

Rail & Transit Division
Dr. Beverly A. Scott, Administrator and MBTA General Manager
Michael Lambert, Deputy Administrator
Price Armstrong, Thomas D. Schiavone

Office of the Chief Financial Officer
Dana Levenson, Chief Financial Officer
Bill Betts, Thom Dugan, Silvio Petraglia

Office of Real Estate and Asset Development
Jeffrey Simon, Assistant Secretary
Robin Blatt-Eisengart, William Tuttle

Office of Information Technology
Gary S. Foster, Chief Officer
Michelle Lyle, Tyrome Muscat

We would like to thank the following Regional Transit Authorities for their contributions: Brockton Area Transit, Franklin Regional Transit Authority, Greater Attleboro-Taunton Regional Transit Authority, Lowell Regional Transit Authority, Merrimack Valley Regional Transit Authority, Montachusett Regional Transit Authority, Nantucket Regional Transit Authority, Pioneer Valley Transit Authority, Southeastern Regional Transit Authority, and the Worcester Regional Transit Authority.

We are grateful to the GreenDOT Advisory Group, the Executive Office of Energy and Environmental Affairs, the Department of Environmental Protection, and the Department of Public Health for the ongoing collaboration on GreenDOT Policy goals and initiatives. This report was greatly assisted by the help of Eric Friedman and Andrea Hessenius of the Department of Energy Resources, and Julia Wolfe of the Operational Services Division.

The State Smart Transportation Initiative, a transportation research center at the University of Wisconsin, was also instrumental in its review of GreenDOT’s policy, implementation, and progress.

The Ware-Hardwick Covered Bridge in Hardwick

The 2014 GreenDOT Report was compiled and written by the GreenDOT Office team: Assistant Secretary for GreenDOT, Ned Codd, along with Shannon Greenwell, Amalia Holub, Katherine Knapp, and Jules Williams.
EXECUTIVE SUMMARY

GreenDOT Policy Background and Development

The transportation system is a critical component of the Commonwealth of Massachusetts’ infrastructure; it facilitates economic development, access to goods and services, and social interaction and enrichment. While the system has numerous benefits that our customers depend upon daily, it also contributes over one third of the Bay State’s greenhouse gas (GHG) emissions, a key cause of climate change. Sprawling development patterns and automobile dependence also contribute to physical inactivity, which is associated with various negative health outcomes, while motor vehicle pollution contaminates the air, causing respiratory and other health conditions.

In 2010, the Massachusetts Department of Transportation (MassDOT) responded to these challenges by launching its comprehensive sustainability initiative, the GreenDOT Policy. GreenDOT was born of numerous state laws and policies aimed at reducing GHG emissions, improving public health, and leading on environmental stewardship. The Global Warming Solutions Act (GWSA), which Governor Deval Patrick signed into law in 2008, set legally-enforceable goals of reducing GHG emissions by 25 percent below 1990 levels by 2020, and 80 percent below 1990 levels by 2050. The Healthy Transportation Compact, created by the 2009 Transportation Reform Law, is a coordinated multi-agency effort to encourage the healthy transportation modes of walking, bicycling, and public transit, and to ensure that public health factors are taken into account in transportation decision-making. In addition, Executive Orders 484 and 515, known as Leading by Example and Environmental Purchasing Policy respectively, require state agencies to invest public resources in ways that support environmental sustainability by conserving energy and water, implementing efficiency measures, and producing or purchasing renewable energy. Taken together, the Global Warming Solutions Act, Healthy Transportation Compact, and Leading by Example policy form the foundation for the GreenDOT Policy.

The GreenDOT Policy Directive, released in June 2010, set forth the primary goals of reducing GHG emissions; promoting the healthy transportation modes of walking, bicycling, and public transit; and supporting smart growth development. The 2012 GreenDOT Implementation Plan then outlined specific tasks and targets for achieving these goals, including the Mode Shift Goal, which calls for a tripling of the amount of walking, bicycling, and public transit ridership in Massachusetts between 2010 and 2030. The Implementation Plan also identifies a wide range of measures for improving the environmental practices of MassDOT’s internal operations.

This 2014 GreenDOT Report serves to provide a comprehensive update on the progress made toward the GreenDOT goals since the creation of MassDOT in 2009, the status of the GreenDOT Policy at the end of 2014, and plans for MassDOT’s continued development and implementation of the GreenDOT Policy and related initiatives. It includes updates on MassDOT’s specific sustainability-oriented efforts relative to the transportation sector and our internal operations; it also develops a performance-based system for tracking MassDOT’s progress toward GreenDOT goals.

Performance Management

Created by the Transportation Reform Law of 2009, MassDOT was founded on a set of principles that includes performance-based management and accountability. The Transportation Reform Law stipulates that the new department create an internal Office of Performance Management & Innovation to monitor performance, provide quantitative information on divisional performance measures, and report progress toward goals; the GreenDOT Policy is strongly influenced by this emphasis on performance management. The GreenDOT Policy is committed to measuring performance in order to track progress towards goals; improve program design and implementation; demonstrate that resources are being used efficiently and for maximum benefit; and communicate progress to stakeholders and the community. To effectively measure MassDOT’s progress towards the GreenDOT Policy goals within a complex system, GreenDOT uses an outcome model to explain how specific actions lead to results that contribute to the overarching GreenDOT mission.

The criteria used for selecting measures include validity, significance, ease of interpretation, availability, and ability to track trends over time. Such measures include metric tons of GHG emissions per year from the statewide transportation sector; vehicle miles traveled by motor vehicles; person miles traveled (PMT)
MassDOT’s primary functions are the design, construction, operation, and maintenance of the state-owned transportation system. In working to fulfill these responsibilities, MassDOT is guided by a range of different goals and objectives. With the development of the GreenDOT Policy, MassDOT added reducing GHG emissions; promoting healthy transportation and smart growth development; and supporting environmental stewardship to its priorities.

MassDOT works toward GreenDOT Policy goals through its strategic, planning, capital investments, project selection, and design guidelines. GreenDOT goals are reflected throughout MassDOT’s planning and design efforts, beginning with its strategic planning and investment plans. In January of 2014, MassDOT released the Capital Investment Plan, a listing of all transportation projects that are planned to be funded in the next five years; then in May 2014, MassDOT published the weMove Massachusetts long-range strategic plan. These documents allocate significant investment to healthy transportation modes, including transit improvement and expansion projects, shared-use paths, and Complete Streets projects that serve users of all modes and increase system accessibility. MassDOT also works with the metropolitan planning organizations (MPOs) in Massachusetts to integrate GreenDOT goals into long-range regional planning and project prioritization.

Another way that MassDOT influences travel behavior is by facilitating smart growth and transit-oriented development patterns, which enable shorter trip distances and facilitate access to sustainable modes. MassDOT’s Office of Real Estate and Asset Development and the Public/Private Development Unit within the Office of Transportation Planning work with the development community to promote smart growth and mitigate potential traffic increases through travel demand management requirements.

While focusing on GHG reduction efforts, MassDOT also recognizes the need for climate change adaptation and resiliency. In order to prepare effectively for changes in the coming years and decades, MassDOT divisions are working to understand which locations and elements of transportation infrastructure are at the greatest risk from the higher sea levels, stronger storms, greater storm surges, and more frequent flooding that are expected to accompany climate change. The Office of Transportation Planning has launched the agency-wide Transportation Asset Vulnerability Assessment; this study will build upon a number of other resiliency efforts in MassDOT’s divisions, and will identify the greatest risks and vulnerabilities of the Commonwealth’s transportation infrastructure in order to enable informed investment decisions and adaptation strategies.

MassDOT has important responsibilities for communicating with our customers. In order to support the GreenDOT Policy and to achieve the ambitious Mode Shift Goal, MassDOT will need to invest in infrastructure and system capacity projects, but also to educate and promote healthy transportation modes. MassDOT offers a free transportation demand management service, MassRIDES, that works with major employers to reduce single-occupant vehicle travel by encouraging and enabling carpooling, vanpooling, transit, bicycling, and walking. Other education and communication efforts that support GreenDOT are MassDOT’s Drive Smart and Save Campaign, which promotes eco-driving tips like eliminating rapid acceleration and inflating tires; the Registry of Motor Vehicles’ initiative to reduce trips to its branches by facilitating more online transactions; and the Safe Routes to School program, which encourages healthy and safe travel to school.

Transportation Sector Sustainability

In order to achieve its goals of promoting transportation sector sustainability and reducing GHG emissions, the GreenDOT Policy is principally concerned with the performance of the transportation sector – how much our customers travel, by what mode they travel, how much fuel their travel consumes, and how much carbon their travel releases. The sustainability of the transportation sector is determined by many factors, which MassDOT is able to influence to varying degrees.
System efficiency, of both the roadway and transit networks, is another important area in which MassDOT works to reduce GHG emissions. Decreasing congestion not only saves customers time and money, it also reduces emissions and air pollution by limiting acceleration and deceleration of motor vehicles. Using intelligent transportation systems, such as variable message signs, real-time travel monitoring, transit signal priority, and closed-circuit television cameras, MassDOT can monitor and respond to highway conditions and provide customers with valuable information to inform their travel choices. MassDOT’s Highway Division is removing all tollbooths statewide and converting to all-electronic tolling, a system whose sensors detect E-ZPass transponders for automatic toll payment or license plates for billing by mail, thereby eliminating the need for drivers to slow or stop for tollbooths.

Even as it works with its constrained finances to fund service expansion and address capacity issues, the Massachusetts Bay Transportation Authority (MBTA) tracks and works to improve on-time performance in order to enhance service and attract additional public transit riders. The MBTA also provides integration with other healthy modes through such initiatives as providing bicycle racks on 95 percent of its buses and expanding the Pedal & Park program, which enables passengers to securely park their bicycles at transit stations. MassDOT has also helped to allocate extensive federal funding for the Hubway bicycle share system, enabling customers to more easily reach transit and complete short trips in the Boston area without a car.

In addition to addressing GHG and environmental impacts of the transportation sector, the GreenDOT Policy also aims to improve public health and safety in the Commonwealth. The Healthy Transportation Compact facilitates inter-agency initiatives for expanding mobility; improving public health related to air quality and physical activity; promoting a cleaner environment; creating stronger communities; and integrating public health concerns into transportation decision-making. Examples of healthy transportation initiatives include the pilot Health Impact Assessment for the Grounding McGrath Transportation Study and the subsequent incorporation of health impact assessment requirements into MassDOT corridor planning studies. MassDOT, partnering with Regional Planning Agencies, local officials, and police departments, also launched the Bicycle and Pedestrian Safety Awareness Campaign in April 2014 to reduce the number of crashes involving cyclists and pedestrians.

As noted in the Performance Management section above, MassDOT’s efforts to improve transportation sector sustainability and public health involve the tracking of specific outcomes. MassDOT has collected data and developed outcome measures for three key indicators of overall transportation sector sustainability: Massachusetts transportation sector emissions are reduced; trips are shifted to walking, bicycling, and public transit; and a greater proportion of customers have access to transit, bicycling, and walking infrastructure. The 2014 GreenDOT Report presents the results of these measures, and establishes baselines and trends for continuing to track these key measures into the future. Moving forward, MassDOT aims to improve statewide estimates of bicycle and pedestrian personal miles traveled, since existing methods for collecting this data are either costly or provide inadequate information.

MassDOT Operations

In the spirit of Leading by Example, MassDOT also works to make each aspect of its internal operations more environmentally friendly. Areas of focus include the operation and management of fleets; snow and ice; facilities; equipment; energy; construction and materials; and ecological protection.

MassDOT owns and operates two large vehicle fleets, one related to the maintenance and management of the highway system, and the other comprising the fleet of MBTA public transit revenue and non-revenue vehicles. MassDOT has already made significant steps towards reducing the environmental impact of its fleets, in accordance with the goals outlined in the 2012 GreenDOT Implementation Plan. Such efforts include procuring hybrid and plug-in hybrid light-duty vehicles for use by the Highway Division; reducing emissions from the MBTA fleet; purchasing biodiesel fuel for all Highway Division diesel vehicles; retrofitting heavy equipment to reduce emissions and pollution; and incorporating anti-idling technology for both Highway Division vehicles and MBTA buses and commuter rail locomotives. The MBTA has installed 30 electric vehicle charging stations at park-and-ride lots, and the Highway Division has installed charging stations for its fleet at four office locations. Future plans include the installation of 12 publicly-available fast charging stations at service plazas along highways, thus helping to facilitate the public adoption of lower-emitting electric vehicles.

In order to ensure the safety and accessibility of the roadway network during snow and ice events, the Highway Division plows the state roadway network and treats the roads with de-icing agents.
most commonly salt (sodium chloride), though its use can have negative impacts on surrounding vegetation and wildlife. The Highway Division has been very active in reducing the environmental impacts of snow and ice operations through such techniques as pre-wetting salt, which improves roadway adherence and salt use efficiency; pre-treating roadways with brine, thus reducing the overall use of salt; identifying reduced salt zones to protect sensitive agricultural and groundwater recharge areas; and instituting innovative technological improvements, including friction meters, efficient salt spreading technology, and tow plows.

MassDOT is also a major owner and operator of property and buildings. MassDOT owns and operates over 700 building facilities, including office space, transit stations, fleet storage buildings, toll facilities, emergency response stations, and many more. The Office of Real Estate and Asset Development manages MassDOT’s portfolio of real estate, often leasing or jointly developing property, which provides opportunities for enhancing sustainability. Since launching the GreenDOT Policy, MassDOT has made strides in reducing the environmental impact of its facilities with actions that include conducting energy audits and upgrades; improving facility waste management and recycling; purchasing environmentally-preferable products and supplies; switching to cleaner heating fuel; and building green roofs on transit stations. In addition to this work, MassDOT is currently in the building design process to replace three aging Highway Division district headquarters offices with buildings designed to LEED standards.

In addition to the energy MassDOT uses in the operations of its vehicles and buildings, it also consumes energy for other uses such as lighting of roadways and parking facilities; ventilation systems and lighting in tunnels; and the third rail powering the MBTA rapid transit lines. In order to take advantage of efficiency opportunities, both the Highway Division and MBTA have begun specifying energy-efficient LED lighting systems for use in tunnels, along roadways, and throughout the transit system. These changes save millions of dollars in electricity costs per year, reduce demands on labor due to longer service life, and improve worker safety.

As a major property owner, MassDOT has also been able to use available land for renewable electricity generation. The GreenDOT Implementation Plan sets the goal for MassDOT to produce five percent of its total electricity demand by 2020 through renewable energy projects. The first project to install solar panels alongside highways was completed in 2012 along Interstate 91. The MBTA also installed a solar array on the roof of the Orient Heights Station, providing for 20 percent of the facility’s energy consumption. The wind turbine commissioned at the MBTA Kingston Commuter Rail Layover Facility provides for the majority of the facility’s electricity demand. MassDOT is in the process of planning and installing even more solar and wind energy-producing projects, including a major solar photovoltaic project along the Massachusetts Turnpike.

MassDOT’s construction projects use large volumes of construction materials and can generate significant waste. Demolition and disposal of concrete
and asphalt consume considerable landfill space, and production of these two commonly used materials requires large amounts of energy. To reduce such impacts, MassDOT has made changes to its construction practices. The Highway Division has shifted from hot to warm mix asphalt production, resulting in a 20 percent decrease in fuel consumption during the asphalt manufacturing process. Both the MBTA and Highway Division have specifications for recycled material in pavement projects, and MassDOT recycles tires into newly produced asphalt. For suitable projects, MassDOT uses cold-in-place recycling techniques, thus reusing the existing paving material and obviating the need for heat and the transportation of materials to the site.

The Commonwealth’s transportation infrastructure affects the surrounding natural ecology in two primary ways: by altering water quality through changing hydrology and discharging sediment and other pollutants into watersheds, and by impacting wildlife populations through diminished or separated habitats, which can put animals in danger from vehicles on roadways. MassDOT works to minimize these impacts through initiatives such as the Impaired Waters Program, in which 680 water body segments are monitored for runoff pollution and necessary improvements are planned; the restoration of six wetlands (not including mitigation-related wetlands restoration) since 2013; and the enhancement of water flow and wildlife passage through rebuilt culverts. MassDOT is conducting a review of ecological performance in order to identify further improvements to the design review and project implementation processes.

**Conclusion**

Looking ahead, MassDOT will continue to shift its sustainability focus to the transportation sector as a whole, since this is the area where GHG emissions must be reduced in order to reach the goals of the GWSA. As stipulated in the Clean Energy and Climate Plan (CECP) for 2020, which is the GWSA implementation plan, 7.6 percent of the total 25 percent reduction in GHG in Massachusetts will need to come from the transportation sector, of which 1.2 percent is expected to correspond with GreenDOT initiatives. MassDOT is working with the Executive Office of Energy and Environmental Affairs (EOEEA) to update the CECP, which is expected to be completed by the end of 2015.

As part of the implementation of the GWSA, the Massachusetts Department of Environmental Protection (DEP) has issued a draft regulation governing MassDOT actions and reporting requirements under the GWSA. This regulation requires MassDOT and the Metropolitan Planning Organizations (MPOs) to track progress towards the goals outlined in the CECP. In order to satisfy the regulation and meet our responsibilities for communicating progress on the GreenDOT Policy, MassDOT intends to measure our performance in the areas affecting transportation sector emissions: transportation system development, including long-range planning, capital investment, design standards, and support for smart growth development; traveler education and encouragement, through promotion of mode shift, carpooling, and eco-driving; and system operations, including congestion management and transit optimization.

GreenDOT goals will be further embedded into each of these areas, and improved performance metrics will be developed to track progress toward GreenDOT success. Climate change adaptation will also be of critical importance in the coming years and decades, as MassDOT strives to identify risks and protect the transportation infrastructure on which residents and visitors depend each day. By focusing on GreenDOT goals, MassDOT continues to work toward a healthier, safer, and better Bay State.