

Growing a Culture of Transportation Sustainability in Massachusetts

Submitted to Transportation Research Board

Submission date: November 15, 2014

Words: 6,122

Tables and figures: 2

Total word count: 6,622

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ABSTRACT

The transportation sector is a growing focus of sustainability efforts, given the large scale of its impacts, and yet it remains one of the more difficult sectors to reform. Private automobiles powered by petroleum-based fuels dominate transportation in the U.S. and the primary mission of most transportation agencies for many decades has been to facilitate safe, unencumbered automobile use. This singular focus is reflected throughout agency culture, making sustainability efforts a challenging undertaking.

The Massachusetts Department of Transportation (MassDOT) is among a growing number of state agencies tackling this issue and its approach offers valuable lessons for others. This paper traces the evolution of MassDOT's sustainability efforts, beginning with its revised Project Development and Design Guide, published in 2006, and ultimately encapsulated in its ongoing GreenDOT program, launched in 2010. These efforts represent the combined actions of state legislators, agency leaders, and personnel at all levels of MassDOT.

The GreenDOT program provides a useful framework for achieving sustainability goals both within the agency and throughout the state. It enabled greater agency-wide communication and coordination, which has led to substantial improvements in efficiency at MassDOT. Paired with subsequent and ongoing policies and programs, it is also changing how the agency views its role in influencing statewide travel impacts, such as in the range and types of options it provides to travelers throughout Massachusetts.

Growing a Culture of Transportation Sustainability in Massachusetts

Sustainable practices are increasing throughout the U.S., with particular attention being paid to the transportation sector. Yet transportation remains one of the more challenging sectors to reform due to its overlap with so many social and economic activities and its heavy reliance on petroleum-based fuels. Many transportation agencies, particularly state departments of transportation (DOTs), have come to embrace sustainability principles and now face the challenging task of integrating a sustainability program throughout agency operations.

State agencies, including those in Oregon, Pennsylvania, and Washington, have employed a variety of strategies to incorporate new programs and procedures into their day-to-day and year-to-year operations. Massachusetts DOT (MassDOT), in particular, launched a comprehensive sustainability policy and bolstered that policy through subsequent supportive policies and directives. In this paper, we focus mainly on that policy by tracking its evolution and implementation, describing its early successes, and drawing lessons for any transportation agencies interested in developing agency- and jurisdiction-wide sustainability programs. As this paper demonstrates, the success of MassDOT's sustainability initiative is tied to the following:

- Supportive policies and legislative actions;
- A comprehensive, agency-wide sustainability framework;
- An implementation strategy that incorporates agency operations, longstanding policies and programs, investment priorities, and effects on statewide travel demand;
- An ongoing commitment to improvement.

BACKGROUND

The modern concept of sustainability is often traced back to a 1987 report by the Brundtland Commission, which defines sustainable development as that which “meets the needs of the present without compromising the ability of future generations to meet their own needs” (1). Researchers and policymakers have since focused increasingly on the sustainability of transportation sector activities.

As with many facets of sustainability, transportation sustainability is commonly viewed in terms of three primary dimensions: the environmental (transportation systems limit waste, emissions, and resource consumption), the social (transportation systems provide safe and equitable access), and the economic (transportation is affordable and efficient) (2, 3).

Many researchers note that sustainability is a useful paradigm for addressing an issue as complex and interconnected as transportation, but that it is also a difficult area in which to implement sustainability policies (4–6). One major reason for this difficulty is that many transportation agencies focused for decades on facilitating efficient automobile travel, while sustainable transportation policies tend to focus on reducing automobile travel and reducing or mitigating its harmful impacts. Implementing sustainable practices therefore requires a major shift in perspective and mission, which requires actively engaging the agency's customers—the traveling public—as well as many stakeholders, both internal and external.

Goldman and Gorham identify four system-based policy approaches for moving toward sustainable transportation, which they refer to as New Mobility, City Logistics, Intelligent System Management, and Livability, but they also note that the successful implementation of these policies typically requires a “shift in organizational culture” (6). Similarly, Banister states that the “sustainable mobility approach requires actions to reduce the need to travel (less trips), to encourage modal shift, to reduce trip lengths and to encourage greater efficiency in the

transport system,” (4) which, he explains, depends on key stakeholder engagement. In her study of sustainable transportation implementation in the U.K., Hull concludes that the responsibility for sustainable policies must be shared among and throughout all public agencies and governments, for them to be effective (5).

Recognizing these challenges and the need for transportation agencies to support sustainable practices, NCHRP Report 708 describes a performance measure-based implementation approach and identifies the various scales and stages of decision-making that influence sustainability (7). The report recommends that agencies set broad sustainability goals (e.g., provide a safe transportation system, or protect and enhance environmental systems), specific objectives to meet those goals, and performance measures to track progress toward meeting each objective. These objectives can be met at various phases of project development and infrastructure maintenance including during the planning, design, construction, operation, or maintenance of facilities, during environmental reviews, during short-range programming, and during long-range planning. This framework also serves as a valuable means of communicating anticipated outcomes and tracking progress during coordination with stakeholders.

To further their sustainability goals, many state transportation agencies have begun to move away from their historical, conventional demand-responsive approaches to more systems-level, management-focused approaches. In addition to improving sustainable practices in internal operations, these new approaches address infrastructure and operational needs, paying increased attention to offering modal options for travelers. Because most DOTs have been charged historically with developing the highway systems of the twentieth century, they must first address issues of organizational culture, stakeholder outreach, and public sector partnerships before tackling the much larger question of statewide travel impacts.

As this paper shows, even those agencies leading some of the more advanced efforts in the nation still have not moved far beyond making this initial shift in culture. However, they have made organizational changes that are helpful in integrating sustainability principles into agency practice, and some have developed valuable sustainability frameworks that can eventually encapsulate a wider range of sustainability goals, including social and economic aspects.

SUSTAINABILITY AT STATE TRANSPORTATION AGENCIES

Many transportation agencies across the country are re-evaluating their operations and service delivery procedures and are beginning to institute policies and programs through a more sustainable lens. Though not always referred to explicitly as sustainability or environmental stewardship programs, they share common themes relating to cultural change, performance measurement, and public accountability. The State Smart Transportation Initiative (SSTI) has worked with several state transportation agencies in areas related to sustainability. Some key programs in those states are outlined below.

Pennsylvania DOT

The Pennsylvania DOT (PennDOT) was an early actor among state transportation agencies in changing its internal culture, focusing specifically on its fiscal responsibilities and its relationship with stakeholders. While the PennDOT program, called Smart Transportation, was not viewed explicitly as a sustainability initiative, it was an important step in moving the agency toward a performance-driven approach, characteristic of sustainable practices. Before the program was initiated, the agency faced deteriorating infrastructure and limited funds for new

construction. Meanwhile, a 2004 report by the Brookings Institution found that policies and infrastructure investments in the state facilitated low-density development in outlying areas that ultimately hurt its economic competitiveness (8).

The Smart Transportation program, which began taking shape in 2004, continued advancing a competitive and transparent project selection process, shifted funding toward the operation and maintenance of existing infrastructure, and led to design procedures that are context sensitive and responsive to community needs. It also represents one of the more comprehensive agency-wide cultural reform efforts among state DOTs (9). Smart Transportation has now been incorporated into most processes at PennDOT, to the extent that it is no longer called out explicitly in agency literature.

Washington State DOT

State legislation and executive orders helped jumpstart a sustainability program at Washington State DOT (WSDOT). WSDOT formalized several important sustainability initiatives, consciously seeking to establish a culture of sustainability throughout the agency, from division heads through staff on the ground, rather than establishing a stand-alone program that might be more easily marginalized.

WSDOT's Interim Sustainability Plan, released in 2003, was an early step toward developing a culture of sustainability. The agency's efforts gained greater momentum, however, as the state increasingly prioritized actions to address climate change. Beginning in 2007, a series of executive orders and legislative directives established statewide, agency-specific greenhouse gas reduction targets, vehicle travel reductions targets, and alternative fuel pilot projects. WSDOT was also an early adopter of Context Sensitive Solutions and, in 2011, produced a guide to sustainable roadside design and management. Further legislative action established an electric vehicle corridor pilot and outlined a sequence of steps to reduce carbon pollution in Washington, improve energy independence, and increase use of clean energy.

Building on this momentum, WSDOT completed its Sustainable Transportation Action Plan in 2014, which it plans to update at least every two years. The plan, intended for both internal and external audiences, outlines ongoing and future actions, sets a strategic direction, and encourages WSDOT employees to promote sustainable transportation (10). To assist in the implementation, the agency has assigned several managers from different divisions to ensure decisions are made with sustainability as a consideration. In addition, WSDOT as an agency has aligned its goals with the statewide goal of improving Washington's infrastructure and building a more sustainable transportation system.

Oregon DOT

The Oregon DOT (ODOT) first released a Sustainability Plan in 2004, which emphasized three main goals: 1) improving safety, 2) moving people and goods efficiently, and 3) improving Oregon's livability and economic prosperity. It then released an updated plan in 2008 and subsequent progress reports in 2010 and 2012. The updated plan emphasizes eight focus areas, which include health and safety, environmental stewardship, and economic health. It also includes short- and long-term goals for each focus area, strategies for meeting those goals, and performance measures for tracking progress. According to its 2012 report, ODOT made substantial progress toward meeting goals such as renovating and consolidating its buildings; improving access for its employees by walking, biking, and transit; reducing its overall energy use; reducing paper use; contracting and purchasing locally; and improving employee safety. It

exceeded its goal of transitioning to biofuel and continues to refine its goals and performance measures.

ODOT has also led the nation in piloting a mileage-based road user charge program (RUCP), with the primary goal of establishing a steady revenue stream for transportation projects in lieu of declining gas tax revenues. The agency launched pilot programs in 2006 and 2012. Oregon Senate Bill 810, which passed in 2013, authorized a limited-scale, operational RUCP demonstration that will prove whether the program is prepared to transition to a mandated program for funding transportation projects in the state. ODOT plans to launch the demonstration in 2015.

KEY SUSTAINABILITY POLICIES IN MASSACHUSETTS

The evolution of MassDOT's current sustainability program, GreenDOT, can be traced back through a number of laws and policies in the Commonwealth of Massachusetts. These laws and policies, outlined below, reflect the state and agency's commitments to an increasingly comprehensive view of transportation sustainability and their growing awareness of how agency projects and practices influence climate change, livability, economic opportunities, and public health. Many, if not most, of the policies and laws require partnering with multiple agencies. These policies and partnerships—the most critical of which are the statewide implementation of the Global Warming Solutions Act, passed in 2008, and the consolidation of disparate state transportation agencies to create MassDOT in 2009—led to the collaborative effort MassDOT is now actively engaged in. Each of the following policies contributed to or helped set the stage for the GreenDOT policy, as ultimately adopted by MassDOT.

Project Development and Design Guide, 2006

In 2006, MassHighway (now a division of MassDOT) released a revised departmental design manual, the Project Development and Design Guide, which fundamentally reformed the agency's design philosophy to espouse a Complete Streets approach. According to the guide, the state's roadway system "should safely accommodate all users of the public right-of-way," including pedestrians, bicyclists, drivers, and passengers. The guide, which fully integrates multiple modes and context sensitive design principles, reshaped the way multimodal projects are approached throughout the state (11).

Executive Order 484: Leading by Example, 2007

Executive Order 484 calls for all state agencies to "lead by example" in reducing energy consumption, principally through the use of clean energy and building efficiency. Executive Order 515, issued in 2009, broadened the scope of the Leading by Example effort by including agency procurement and product specification practices.

Global Warming Solutions Act, 2008

The Global Warming Solutions Act (Chapter 298 of the Acts of 2008, the Climate Protection and Green Economy Act) calls for economy-wide reductions in greenhouse gas emissions. It established goals of a 25 percent reduction below 1990 levels by 2020 and an 80 percent reduction by 2050. The transportation sector accounts for more than one-third of emissions in Massachusetts (12), requiring major reductions in transportation GHG emissions and giving MassDOT an important role to play in meeting the state's goals.

Transportation Reform Law, 2009

The Transportation Reform Law of 2009 created MassDOT by combining the state's major transportation agencies—including MassHighway, the Massachusetts Turnpike Authority, the Massachusetts Bay Transportation Authority, the Aeronautics Commission, the Registry of Motor Vehicles, and regional transit authorities—into one unified, multimodal state agency. Part of MassDOT's new role is to maintain a strong focus on serving the needs of its customers and on supporting economic development, environmental sustainability, and quality of life. The creation of the new, consolidated, multimodal MassDOT also provided a mandate for a comprehensive review of agency mission and policies that helped to create the opportunity for new approaches like GreenDOT.

Healthy Transportation Compact, 2009

The Healthy Transportation Compact—a product of the Transportation Reform Law of 2009 that created MassDOT—is a coordinated multi-agency effort to encourage and enable active transportation modes such as walking and biking. The legislative requirement aims to ensure that agencies take public health into account through the coordination of transportation, land use, and public health policies and decision-making.

GreenDOT Sustainability Policy, 2010

The GreenDOT sustainability policy is MassDOT's comprehensive environmental responsibility and sustainability initiative, launched in 2010. The initial policy statement describes the program's vision and goals and it describes high-level action items, which have guided MassDOT in the years since. The GreenDOT policy and implementation plan, along with subsequent activities and programs, are the primary focus of this paper.

GREENDOT AS A SUSTAINABILITY FRAMEWORK

The GreenDOT policy, which built upon many of the principles identified in the earlier programs and policies described above, emerged directly from inter-agency coordination on enacting the Global Warming Solutions Act of 2008, and was closely coordinated with the Clean Energy and Climate Plan for 2020, an inter-agency implementation plan for the Global Warming Solutions Act. In addition to formally establishing MassDOT's goal of reducing greenhouse gas emissions, however, the policy embodies broader sustainability principles. The policy focuses on three primary goals: 1) reduce greenhouse emissions, 2) promote the healthy transportation options of walking, bicycling, and public transit, and 3) support smart growth development. The GreenDOT policy's approach for achieving these goals is through integrating sustainability into all aspects of MassDOT's responsibilities, from the way that it plans, design, builds, operates, and maintains its facilities to the ways that facilities are used by customers. The policy states:

The Massachusetts Department of Transportation will be a national leader in promoting sustainability in the transportation sector. Through the full range of our activities, from strategic planning to construction and system operations, MassDOT will promote sustainable economic development, protect the natural environment, and enhance the quality of life for all of the Commonwealth's residents and visitors. This will enable MassDOT to use resources in a manner that serves its existing customers while preserving our resources for future generations. (13)

GREENDOT IMPLEMENTATION

One of the key components of GreenDOT is the GreenDOT Implementation Plan, which MassDOT released in 2012. The plan is meant to further the three primary objectives outlined in the agency's GreenDOT policy, described above, by integrating them throughout the agency's five divisions.

GreenDOT began in 2010 as a broad strategy to get MassDOT and its divisions to conceive and implement ways to pursue the GreenDOT policy goals, and to improve the transportation system's environmental orientation and performance. The GreenDOT Implementation Plan was drafted in order to identify specific actions that would help to realize these objectives both in terms of how MassDOT operates as an agency, and in terms of how the public makes use of the transportation system. Staff in MassDOT's Office of Transportation Planning and its operating divisions responded by organizing the GreenDOT principles into major themes for pursuing environmental sustainability and developing what became a long list of proposed implementation actions.

The plan identifies 16 broad goals, which correspond to seven different focus areas:

- Air
- Energy
- Land
- Materials
- Policy, planning and design
- Waste
- Water

The Implementation Plan also identifies specific tasks under each goal and indicators under each task, reflecting the goal-objective-performance measure structure recommended in NCHRP 708 and described above. In addition, as shown in Figure 1, the plan indicates an appropriate time scale and the relevant agency divisions for each indicator. Some items, such as reducing building electricity use, apply to all divisions, while others apply mainly to one or two divisions. For example, making improvements to highway operational efficiency applies primarily to the Highway Division.

Goal ▶ Consume less energy				Implementing Divisions					
Horizon ▶		2013	2015	2020					
Task ▶ Reduce building electricity use									
Indicators ▶	Electrical + HVAC use of all buildings + facilities audited	●			●	●	●	●	●
	Office electrical equipment shutdown program implemented	●			●	●	●	●	●
	Employee education and incentive programs established to encourage energy use reduction	●			●	●	●	●	●
	All buildings not updated in 10 years renovated / overhauled / consolidated		●		●	●	●	●	●
	Motion sensor/occupancy lighting installed in all buildings		●		●	●	●	●	●
	Electricity purchased by MassDOT reduced by 35%				●	●		●	●
	Electricity purchased by the MBTA reduced by 20% per passenger mile				●		●		
Goal ▶ Promote healthy transportation + livable communities				Implementing Divisions					
Horizon ▶		2013	2015	2020					
Encourage walking, biking, + transit as active transportation									
Indicators ▶	MassDOT Bay State Bike Week facilitated + promoted annually in partnership with MassBike	●				●	●		●
	All office locations have visible bicycle parking locations for visitors near entrances	●			●	●	●	●	●
	Selection of public meeting venues prioritizes locations with transit, pedestrian + bicycle access	●			●	●	●	●	●
	Information on transit, bicycle + pedestrian travel provided on public meeting announcements	●			●	●	●	●	●
	MassDOT sidewalks + bicycle facilities are cleared of snow + ice simultaneously with vehicle lanes		●			●	●		
	40% of elementary + middle schools reached through Safe Routes to Schools program				●		●		●
	Navigational signage to transit stations expanded along local roads and highways		●			●	●		●
	Employees + contractors required to use transit, walk, bike or carpool to meetings whenever location + service schedules allow	●				●	●	●	●

FIGURE 1 Sample goals with tasks and indicators from GreenDOT Implementation Plan

In addition to providing a framework for achieving and measuring specific sustainability outcomes, the plan serves as a way of integrating a culture of sustainability throughout the various MassDOT divisions. The plan was developed based on input from personnel at all levels of the agency, which required opening new lines of communication and engaging various divisions. It also helped to ensure that the product reflected the agency’s many varied interests and made the staff involved participants and stakeholders.

Agency Efficiency and Facility Operations

Many early MassDOT actions on GreenDOT implementation entailed internal improvements in agency efficiency and the operation of its facilities (14). The various modal divisions focused on “quick wins” that also helped to facilitate change in the agency’s internal culture.

Some of the earliest changes implemented include institutionalizing the purchase of environmentally preferred products and reducing electricity use from the operation of facilities and buildings. Each division identified specific ways to help achieve the latter. For example, the Massachusetts Bay Transportation Authority (MBTA) has saved an estimated 19.6 billion kilowatt-hours through lighting and mechanical energy retrofits since the GreenDOT policy was first announced (15). The MBTA, the Aeronautics Division, and the Highway Division have also participated in photovoltaic solar projects with a combined capacity of more than 8.1 megawatts. The Highway Division also targeted asphalt production as a key area to make changes,

recognizing that by phasing out hot mix asphalt in favor of warm mix asphalt (WMA), it could reduce fuel consumption, minimize traffic delays, and cut greenhouse gas emissions during production and installation. In 2013, an estimated 68 percent of asphalt installed by MassDOT was WMA (14).

MassDOT has also taken steps to improve the efficiency of vehicles on its roads through a combination of intelligent transportation systems (ITS), investment in alternative fuel vehicles for state fleets, and incentives and improved infrastructure to support the use of alternative fuel vehicles by the traveling public. The Highway Division is currently piloting the use of all-electronic tolling, which eliminates congestion at tolling stations, and plans to implement the system statewide over the next three years. MassDOT has also implemented real-time traffic information systems and infrastructure, which provide travelers with travel time information for improved decision-making. The information is accessible online and communicated through roadside variable message signs. MassDOT is also working with agencies from seven other states to put three million electric vehicles on the road by 2025. MBTA and the Highway Division have installed, or plan to install, more than 50 electric vehicle charging stations around the state (14).

Statewide Influence: Mode Shift and Transportation Demand Management

As the GreenDOT internal initiatives were creating significant changes in its operations, its purchasing, and its general awareness of its environmental impacts and responsibilities, MassDOT also worked to develop strategies for reducing greenhouse gas emissions resulting from travel by its customers. State and agency leaders recognized that achieving the goals outlined in the Global Warming Solutions Act would require statewide changes in mode choice and travel behavior, as reflected in its GreenDOT goals, and that MassDOT plays a key role.

MassDOT recognizes that while it does not have direct influence over mode choice and travel decisions, that its investments, its policies, and its programs can promote greater travel choices and potentially facilitate a reduction in statewide VMT. The leveling off of total statewide vehicle miles traveled (VMT) began around 2004 in Massachusetts as it did nationally (shown in Figure 2). This trend, which may be attributable in part to changes in driving behavior among younger and older Americans and to stronger demand for livable neighborhoods, indicates the potential for a balanced, multimodal investment strategy. Based on long-term trends, VMT is projected to increase only moderately and then flatten out in coming decades. From an institutional perspective, this will mean investing more in transit, bicycle, and pedestrian projects throughout the state to provide a wider range of travel choices, while also providing appropriate information to the public about those choices and programmatic offerings to encourage travelers to use healthier transportation modes, such as the new MassDOT-funded Bicycle and Pedestrian Safety Awareness and Enforcement Program.

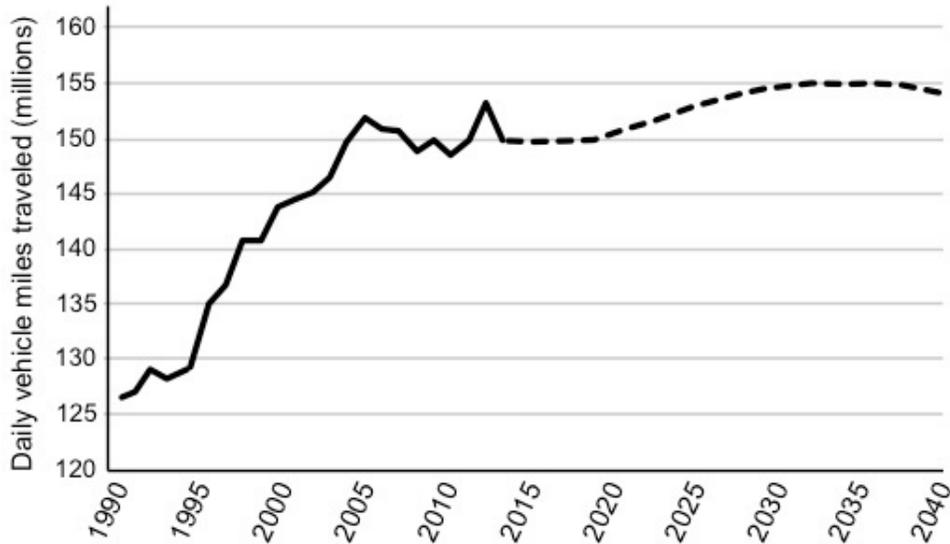


FIGURE 2 Historical daily vehicle miles of travel (VMT) in Massachusetts and projected VMT needed to achieve greenhouse gas emissions reduction goals

Following the launch of GreenDOT, a series of key policies solidified MassDOT’s commitment to mode shift and VMT reductions. The first was its mode shift goal, announced in 2012, which established a target of tripling the number of passenger miles traveled by walking, bicycling, and public transit by the year 2030. The Healthy Transportation Policy Directive, issued in 2013, requires that “all MassDOT projects are designed and implemented in a way that all [MassDOT] customers have access to safe and comfortable healthy transportation options at all MassDOT facilities and in all the services [MassDOT] provide[s]” (16). That directive also identifies actions that must be taken during project review and design to meet those objectives, including encouraging mode shift on all projects, ensuring that facilities are responsive to their surrounding context, conducting safety audits at high-incident sites, and using appropriate, context-oriented guidelines during project design. The Healthy Transportation Engineering Directive, issued in 2014, provides comprehensive and detailed guidance on multimodal features and design standards for different project contexts (17). The mode shift goal and the healthy transportation directives were essential milestones for the agency in committing to its sustainability goals—particularly its greenhouse gas reduction emissions reduction goals—partly because they built upon and strengthened existing programs, but also because they led the agency to take additional steps, as described below.

Longstanding Policies and Programs

MassDOT’s Project Development and Design Guide serves as the primary resource for ensuring that the state’s transportation system accommodates and encourages travel by walking, bicycling, and transit. As described above, the guide fully integrates Complete Streets and context sensitive design principles to ensure that all modes are considered during each phase of implementation, beginning early in project planning. This document now serves as a particularly valuable asset to the agency as it implements its healthy transportation directives.

MassDOT also supports efforts to improve commuter travel options and manage transportation demand through two large-scale programs that operate across the Commonwealth of Massachusetts. MassRIDES is the statewide commuter travel education and coordination

program. Through this program, which was originally launched as Caravan for Commuters in 1978, MassDOT works with 325 major employers to provide general information about travel options, online trip planning and ride matching services, a guaranteed ride home program for those who choose not to drive to work but experience an emergency during the day, and other commuter services. MassDOT also supports and coordinates with the state's 11 transportation management associations (TMAs)—non-profit associations that work with a total of 350 businesses in different geographic areas. These two programs serve a combined total of more than 750,000 employees throughout the state. MassDOT estimates that participants saved nearly 12,000 tons of greenhouse gas emissions in 2013 by choosing to walk, bicycle, take transit, or ride-share (14).

MassDOT established its Safe Routes to School (SRTS) program in 2006, following a successful pilot program in the city of Arlington in 2000 (one of only two federal SRTS pilots in the nation). The SRTS program supports healthy transportation options for students through in-school education and infrastructural projects that improve access and safety for walking and bicycling. Through this program, MassDOT works with more than 620 partner schools, which make up more than 40 percent of elementary and middle schools in the state. This rate of participation is more than twice the national average. The agency has completed or nearly completed 20 infrastructure projects in selected communities and it plans to fund approximately 20 more by 2018 (14).

Investment Priorities Under GreenDOT

MassDOT has built upon its commitment to multimodal transportation in the state over the past decade through its project planning and design procedures, operations, and educational outreach. Then in 2014, MassDOT integrated the GreenDOT goals and principles into its long-range strategic transportation planning documents weMove Massachusetts (WMM) and the Capital Investment Plan (CIP). Together, these two documents constitute MassDOT's Long-Range Transportation Plan, comprising a strategic vision, investment methodology, and programmed projects.

WeMove Massachusetts (WMM) is the state's long-range strategic transportation plan, released in January 2014. WMM introduces a new scenario planning tool called Planning for Performance, which MassDOT now uses to prioritize investments and ensure that they align with its policy goals, including those identified in GreenDOT. The agency is currently working to develop and refine quantifiable metrics so that it can evaluate how different funding strategies help it meet its mode shift, emissions reduction, and congestion mitigation goals.

In an early effort to align its investment strategies with its policy goals, MasDOT's CIP for the 2014 through 2018 fiscal years represents a growing commitment to asset management and multimodal transportation. In addition to \$6.5 billion of highway system investment over five years, the CIP includes more than \$3.7 billion for rail and transit, which will allow it to bring more of the state's transit vehicles, tracks, bridges, signals, and facilities up to a state of good repair and ensure quality transit service in the state. It also includes \$144 million for its bicycle and pedestrian pathways, representing an historic increase. At the current level of spending, the agency plans to bring its statewide bicycle network from 31 to 87 percent complete by 2023 (18).

Ongoing Development and Implementation Efforts

Despite the early successes attributable to the GreenDOT Policy and Implementation Plan, those programs are intended to grow and evolve as MassDOT continues working toward meeting its sustainability goals. MassDOT, working through its Office of Transportation Planning and its new GreenDOT Office, have taken important steps needed to move GreenDOT into its next phase and align with other key programs implemented within the agency and the state.

GreenDOT Advisory Group

In April 2014, MassDOT convened the GreenDOT Advisory Group to work with the new GreenDOT Office and to advise MassDOT on the continuing development and implementation of the GreenDOT Policy. The Advisory Group includes members from all of MassDOT's operating divisions and several shared-services units; staff from other public agencies at all governmental levels; and representatives from non-governmental organizations with interests in the transportation and sustainability sectors.

The GreenDOT Advisory Group facilitates communication and information sharing among MassDOT staff, representatives from other public agencies at all governmental levels, and non-governmental organizations with interests in the transportation sector and sustainability initiatives. Group members solicit feedback on GreenDOT initiatives and progress from key MassDOT personnel and offer guidance related to GreenDOT implementation and the development of performance measures for formally tracking progress. Importantly, the Advisory Group has formed work groups to focus on the following elements of GreenDOT:

- Data and performance measures;
- Strategies for promoting healthy transportation and encouraging mode shift;
- Best practices for achieving sustainability among transportation agencies and other key actors;
- Communication, educational strategies, and technology transfer.

Performance Management

MassDOT's GreenDOT Office is focusing on in-depth coordination among agency divisions to identify and formalize the GreenDOT implementation strategies that are most important for each division. To assist in performance tracking, MassDOT is reviewing existing data collection and developing performance management practices that it can use to track progress. It is also developing a clear and concise reporting procedure, described below, to convey GreenDOT implementation status and agency performance—particularly in key areas such as greenhouse gas impacts, mode shift, safety, health, and quality of life.

GreenDOT Progress Reporting

The GreenDOT Office plans to produce a series of data- and performance-driven progress reports on GreenDOT and related initiatives, which it will release on a regular basis. The reports will provide updates on the status of key MassDOT activities that support GreenDOT goals, as well as broad outcomes related to GHG emissions, mode split, and access to different modes. The reports will also address key successes, lessons learned, and future plans for meeting goals. These measures will also provide input to MassDOT's legislatively-created Office of Performance Management & Innovation, which will include key GreenDOT metrics in its agency-wide reporting.

The progress reports will be intended specifically for use by policymakers and stakeholders in Massachusetts, but will also contain useful information to inform sustainability initiatives in other states. In the spirit of transparency and with an eye toward meeting MassDOT's customer service and public relations goals, the progress reports will be written in a way that they can be read and understood by a broad audience, including the general public.

Project Selection Advisory Committee

Through its role in the project selection process, including its position as chair of Massachusetts' 13 MPOs as well as the implementing agency for most transportation spending in the Commonwealth, MassDOT plays an important role in influencing how its customers, the end users of the system, can choose to travel. With this in mind, the Project Selection Advisory Committee, formed in July 2013, is developing rigorous, data-driven, project selection criteria to be used in setting funding priorities and in the development of the state's comprehensive multimodal transportation plan. The legislatively mandated selection criteria include, at minimum, the following factors: engineering, the condition of existing assets, safety, economic impact, regional priorities, and the anticipated costs of projects. This legislated list of factors, however, is not comprehensive, nor exclusive. MassDOT expects to include other factors, including environmental sustainability, modal choice, greenhouse gas reduction, and climate adaptation.

LESSONS AND CONCLUSIONS

Legislation and Agency Leadership

While the GreenDOT Policy had a number of important precursors—chief among them being MassHighway's Project Development and Design Guide and its Complete Streets policy—state legislation was largely responsible for initiating and enabling MassDOT's sustainability initiative. The Global Warming Solutions of Act of 2008 mandated agency action to reduce greenhouse gas emissions from its own operations and, ultimately, from statewide travel. Moreover, the Transportation Reform Law of 2009, which established MassDOT as a multi-division agency, allowed full integration of GreenDOT throughout most of the state's transportation-related functions. However, it was only through agency leadership and coordination that MassDOT was able to set clear internal goals, develop an implementation plan, and begin to change its culture. Through that process, the GreenDOT policy and Implementation Plan came to represent a much broader range of sustainability goals in addition to reducing greenhouse gas emissions. Those include social and economic considerations encapsulated in related initiatives such as MassRIDES and WMM.

Intra-agency Coordination and Communication

The first main achievement of GreenDOT is that its development and implementation provided opportunities for MassDOT to open up new lines of communication, facilitate internal coordination among the operating divisions, and build consensus around broad agency goals focusing on transportation sustainability. In contrast to a strictly top-down approach—which might tend to only impact selected facets of agency operations—the integrated GreenDOT policy touches upon all agency functions. Perhaps more importantly, its implementation is built upon both top-down leadership and bottom-up input and it is constantly reevaluated to strike an effective balance between the two. By setting specific performance measures, MassDOT plans

ultimately to be able to track progress toward meeting goals, making informed decisions, holding personnel accountable, and communicating with the public.

Agency's Role in Statewide Travel Behavior

The second main achievement is that GreenDOT provides a policy framework for influencing changes in statewide travel behavior needed to meet the state's long-term sustainability goals. MassDOT has incorporated into its policies and programs an implicit recognition that its investments and operations directly influence statewide travel behavior and that it plays an important role in providing appropriate travel options, supporting sustainable travel choices, and educating the public on the availability and benefits of healthy transportation options. The initial effect is reflected throughout the agency. MassDOT has increased funding for transit, bicycle, and pedestrian infrastructure in its CIP; it requires specific actions be taken to consider all modes during project development and design; and it provides real-time data to road users, allowing them to make more informed travel decisions. Over time, MassDOT divisions can coordinate to influence a substantial mode shift, mitigate VMT growth, and fulfill many of its sustainability goals, without causing a detriment to any particular mode of travel or class of road user.

Ongoing Integration of GreenDOT Principles

While GreenDOT is still evolving, it has proven to be both integrated and adaptable and it has been shown to lead to measurable outcomes within the agency. Because MassDOT has outlined clear linkages between the GreenDOT policy and existing programs such as purchasing, scenario planning, Complete Streets and transportation demand management, it provides a fairly clear framework for organizing a range of agency functions around the sustainability concept. Yet, there are still opportunities to better align MassDOT systems and processes with GreenDOT policies and goals. For example, the agency is ahead of many other state DOTs in reviewing its project selection procedures, but has yet to fully develop performance measures to evaluate project outcomes as they pertain to specific policy goals. The GreenDOT Policy also serves as an impetus for the agency to better evaluate the tradeoffs associated with congestion mitigation—specifically, when those investments lead to improved system efficiency versus where they encourage additional vehicle travel. MassDOT also has additional data and performance measurement needs in order to enable robust tracking of progress toward GreenDOT goals. These are issues that few agencies have begun to tackle with much success, but whose objectives can be made clearer through broad sustainability policies like GreenDOT.

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