

SUSTAINABILITY PEER EXCHANGE
Center for Environmental Excellence
by AASHTO

Transportation in Service of a Sustainable Society



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Summary Report

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Sustainability Peer Exchange Summary Report

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I. Executive Summary

The Center for Environmental Excellence by AASHTO held a sustainability peer exchange at the Gallaudet University Kellogg Center May 27-29, 2009 in Washington D.C. The sustainability peer exchange afforded an opportunity for state and federal transportation agencies to share practices, explore ideas about sustainability at both the program-wide and project level, and visualize how Departments of Transportation (DOTs) may need to adapt to address emerging sustainability issues such as natural resource scarcity, energy expense, climate change, water availability and population aging and growth. Attachment A includes a list of peer exchange participants.

One of the first topics of discussion at the Sustainability Peer Exchange was how to define sustainability – both as a broad concept, but also specifically for the transportation context. Peer exchange participants discussed some of the most common broad definitions of sustainability. Participants agreed that defining sustainability at a high level is important for establishing a common language and understanding among transportation practitioners and stakeholders. They also agreed that DOTs should establish discipline-focused sustainability definitions to accommodate their own organizational needs and those definitions of sustainability should reflect the diverse functions of a transportation agency in a way that stakeholders can understand.

Participants also discussed pressing sustainability challenges for DOTs. The primary challenges identified included: (a) Defining transportation's role in a sustainable society; (b) Clarifying terms and improving communication; (c) Focusing on both broad outcomes and specific problems and solutions; (d) Using life-cycle cost evaluations in transportation decision-making; (e) Integrating sustainability principles into agency policies and practices; (f) Developing and advancing best practices for climate change adaptation and mitigation; (g) Enabling creative, mode-neutral transportation decision-making; (h) Developing programmatic and project-level metrics for outcomes; (i) Advancing sustainability voluntarily as federal and/or state regulatory requirements grow; and (j) Integrating land use planning and environmental considerations into programs and decisions.

In order to foster a more clear definition of sustainability for DOTs, participants discussed short-term and long-term sustainability goals, ways to address goals through best management practices in various DOT disciplines (planning and multimodal, design and construction and operations and maintenance) and ways to measure and track sustainability.

The peer exchange identified a list of gaps in sustainability knowledge and next steps at the state DOT-level, the state interagency level, and the interaction among federal, state, transit, and professional organizations to further understanding about transportation in service of a sustainable society. Attachment B includes copies of presentations delivered by peer exchange participants as part of the peer exchange program.

II. How can agencies define sustainability in transportation terms?

One of the first topics of discussion at the Sustainability Peer Exchange was how to define sustainability – both as a broad concept, but also specifically for the transportation context. Sustainability is a big concept – like “justice” or “freedom” – and like these concepts, it can be easier to understand than to succinctly define. Here are some key insights offered by attendees.

Defining sustainability at a high level is important for establishing a common language and understanding among transportation practitioners and stakeholders.

Peer exchange participants discussed some of the most common broad definitions of sustainability. Hundreds of definitions exist. One of the most common broad definitions is the Brundtland Commission definition (from the 1987 United Nations World Commission on Environment and Development report entitled *Our Common Future*), 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.” This definition includes an element of human or societal need. Another common broad definition frames sustainability as a “triple bottom line” – in which (a) economic and financial considerations, (b) environmental protection and stewardship, and (c) community and individual human well-being should factor into solutions to societal problems.



Participants generally noted that while it is important to have basic, broad sustainability definitions, it is critical for transportation professionals to define the relationship between sustainability and transportation. Participants discussed transportation as an integral tool for fulfilling societal needs, such as transport of food and goods, connection with employment, education and services, and/or ties to culture or family. Several participants referred to the peer exchange event byline “Transportation in service of a sustainable society” as a good way to frame a transportation agency’s role.

DOTs also should establish discipline-focused sustainability definitions to accommodate their own organizational needs.

Participants discussed both the challenge and benefit of broad definitions of sustainability for state Departments of Transportation (DOTs). Having a broad definition allows state DOTs to develop their own definitions of sustainability, and their own definitions for

specific transportation department disciplines, including Planning, Design, Construction, Operations and Maintenance.

Many state DOTs are in the process of defining sustainability for their organizations, in many cases consistent with directives from the Governor's office. These directives often reflect constituent values and are in response to changing global trends such as fresh water shortages, energy supply limits, funding constraints, global climate change or population increases. Most state DOTs represented at the peer exchange agreed that sustainability encompasses societal and economic elements as well as environmental elements.

State DOTs also discussed the need to build consensus within DOTs regarding how the organization defines sustainability. Several representatives noted that sustainability means different things to different DOTs, and definitions should depend on context. New York DOT uses the triple bottom line as a broad definition, but then adapts sustainability to different disciplines and categories, with numerical metrics for measuring sustainability performance. Oregon DOT has defined sustainability based on collective vision from elected officials and top-level decision-makers, and this buy-in lends the definition credibility. Pennsylvania DOT has discussed the need for DOT projects and operations to not only enhance but support communities. Maryland has a sustainability sub-cabinet and Colorado has a transportation environmental resource council, which help to define direction.

Definitions of sustainability should reflect the diverse functions of a transportation agency in a way that stakeholders can understand.

Participants discussed the need for a distinction to be made at three levels in order for sustainability to be understood and implemented:

- organizational sustainability (sustainability of the state DOT itself),
- transportation system sustainability (the sustainability of system-wide decisions) , and
- project-level sustainability (sustainability at a specific construction or maintenance project level).

Participants generally agreed that it is necessary to focus at both a program-wide (e.g. how funding is allocated or how programming decisions are made) and project level (e.g. what type of pavement is selected) in terms of decisions that affect sustainable outcomes to reach sustainability goals. These goals and outcomes can be communicated with stakeholders (the public, elected officials, etc.). Several participants noted the need for improved communication – with stakeholders, with state and federal agencies (e.g. resource agencies) and within state DOTs themselves.

Participants also acknowledged that it is important for state DOTs to make sustainability real for customers and employees – via case studies or specific examples of sustainable practices or processes. It is through these examples – or through specific numerical measures – that the general public is better able to understand the role transportation can play in serving a sustainable society.

III. What are the challenges?

Sustainability peer exchange participants identified a number of pressing sustainability challenges for DOTs. Among the challenges discussed by peer exchange participants were the following.

Challenge: Defining transportation's role in a sustainable society

Many participants mentioned the lack of a defined role for transportation as a tool to enable sustainable outcomes. Discussion around sustainability and transportation has not been framed in this manner – often, it instead focuses at the project level. While the project level is extremely important, discussion at just this level does not fully address the breadth of sustainability issues that transportation can help to address (e.g. accessibility, opportunities, or economic vitality).

Challenge: Clarifying terms and improving communication

Participants acknowledged that much of the language used to describe sustainability is confusing – for example, “need” in sustainability terms is about societal needs for survival and quality of life (e.g. food, shelter, clothing, employment, services), while “need” in transportation terms often refers to the mobility or safety need as defined for a specific transportation project. Participants noted that this lack of clarity leads to communication problems with stakeholders, the public and decision-makers. Language can also be a barrier when discussing issues at an inter-agency level (for example, several participants raised the issue of poor communication and decision-making collaboration between transportation and resource agencies). Participants also noted the importance of communicating sustainability through visual and physical means to give stakeholders tangible examples.

Challenge: Focusing on both broad outcomes and specific problems and solutions

Transportation projects tend to focus on transportation problems and solutions rather than on larger sustainability outcomes. Participants discussed the structure of transportation decision-making, in which mobility and safety needs drive investment. Participants discussed whether it would be appropriate in some cases (depending on context) to focus on sustainability outcomes (e.g. safer roadways, reduced carbon emissions), particularly from a programmatic perspective rather than at the project level. Most participants agreed that in order for sustainability outcomes to be achieved at a DOT level, sustainability goals and measures needed to be in place for all transportation disciplines.

Challenge: Using life-cycle cost evaluations in transportation decision-making

Throughout the peer exchange participants stressed the idea of life cycle cost decision making – where the entire life cycle of a transportation investment is taken into account rather than a “one-time” design, construction and right-of-way cost. An example of life cycle cost is accounting for the maintenance and operations cost, as well as upstream product costs (e.g. asphalt manufacturing costs; rail line or transit vehicle manufacturing costs) or downstream costs (e.g. replacement). Life cycle cost analysis can help display better the trade-offs inherent in transportation decision-making.

Challenge: Integrating sustainability principles into agency policies and practices

Most DOT manuals lay out methods by which policy is implemented on the ground. Some peer exchange participants discussed how standards are often applied without careful thinking about the reasoning behind the standards (e.g. why roadway types are specific widths) and whether the standards truly meet the context (e.g. there might be cases where standards should be applied as guidance rather than rule). Several participants asserted that their agencies need to view engineering standards through a sustainability lens – to determine whether flexibility could result in greater environmental, economic or societal gain. For example, in some cases it might be more beneficial to relax a vehicle mobility standard and accept slightly more congestion rather than construct a large roadway improvement, instead spending the money elsewhere to gain greater benefit.

Challenge: Developing and advancing best practices for climate change adaptation and mitigation

In 2008, Federal Highway Administration (FHWA) held a peer workshop on climate change adaptation. As discussed at that peer workshop, and confirmed through discussion with the AASHTO peer exchange participants, some states are developing adaptation practices (especially proactive looks at design and construction relating to evacuation routes) but there are not yet common best practices for sharing among DOTs. Several DOTs have programs targeting climate change mitigation (e.g. fleet operations).

Challenge: Enabling creative, mode-neutral transportation decision-making

Several participants spoke to the lack of structure in place to fund projects that involve multiple objectives. While funds are available for “enhancements”, sustainable solutions that involve multiple modes, and/or a set of non-transportation objectives, continue to be difficult to implement. This can result in decision-making that pits one mode or one objective against another, rather than viewing a problem holistically and coming up with the best solution - or combinations of solutions - to address it.

Challenge: Developing programmatic and project-level metrics for outcomes

Participants agreed that most DOTs lack both programmatic and project-level numerical metrics that measure success related to sustainability goals. It is often easiest to communicate the effects of sustainability goals and policies through the results – what gets measured gets managed.

Many DOTs already have metrics to measure their more traditional priorities, and some of these may be appropriate to include as sustainability measures. However, the range of existing metrics within an individual DOT usually is not broad enough to include all aspects of the triple bottom line. Some states have robust metrics programs in place, such as New York DOT. However, most DOTs have not yet decided what should be measured in order to achieve sustainability goals, or have not yet developed those sustainability goals.

Participants noted that metrics must be developed in an iterative manner in order to ensure the indicators being measured are appropriate for a specific DOT and its goals. Participants

also identified the need for state DOT staff and contractors to have the skills and funding to implement actions and measure results.

Challenge: Advancing sustainability voluntarily as federal and/or state regulatory requirements grow

Participants discussed the growing movement toward federal regulatory frameworks relating to greenhouse gases, emissions and climate change. Participants were concerned that sustainability frameworks at a federal level may not give states or state DOTs the flexibility to define sustainability goals, strategies, actions and metrics for themselves. Some participants expressed the view that it would be valuable for state DOTs to get in front of any state or federal regulation to define it.

Challenge: Integrating land use planning and environmental considerations into programs and decisions

State DOTs have no authority over local land use decisions – this authority belongs to local jurisdictions. The symbiotic relationship between land use and transportation has been well-documented. Participants noted that although in some cases transportation and land use are linked at the planning level (Pennsylvania, Maryland, and Oregon), in many other cases, coordination among DOTs and land use authorities is difficult. American values relating to property rights affect how DOTs or land use authorities make decisions, as they must answer to their constituents.

IV. Meeting the Challenges

In order to foster a more clear definition of sustainability for DOTs, seven focus areas were presented by the consultant team to help the participants move from the daunting process of clearly articulating the challenges that stand before them and charting a course towards sustainability. These focus areas are a titration of previous reviews of global sustainability management frameworks for transportation and highway departments as well as management frameworks for international corporations and specifically those that serve or act as the infrastructure providers.

The participants were asked for goals that represented three different categories:

- Ultimate goals – What direction are we going? What is the ideal sustainable end-state?
- Long term goals - What should we accomplish over the next 3 decades
- Short term goals - What can we realistically accomplish in the next decade if we are to act aggressively?

The brainstorming session was specifically framed for the participants to clearly identify how goals can change over time. It was organized to show how an organization could think about ways in which to examine policy and decision-making. The goals developed as part of the brainstorming session are included in Attachment C.

It should be noted that the goals included in Attachment C are examples only that were developed during participant brainstorming as an example exercise regarding how goals

could be developed for an organization. This example exercise was meant to be relevant to either an agency's internal operations, or how the agency manages the transportation system. The goals are not necessarily endorsed or supported by AASHTO or the participating organizations.

V. Measuring and Tracking Success

Peer exchange participants generally agreed that if a DOT decides that sustainability is integral to its mission, performance should be measured and tracked. Metrics must be linked to high-level sustainability vision and goals - as well as to specific discipline goals - in order to be effective measures of success or areas for improvement opportunity. Metrics are most useful when they are used with upper-level decision-makers for steering system-wide and organization-wide decisions.

Measuring and tracking success is a hot topic - many ongoing research efforts are focused in this area. The National Cooperative Highway Research Program (NCHRP) 08-74 project "Sustainability Performance Measures for State Departments of Transportation and Other Transportation Agencies" is examining the appropriate sustainability performance measures for DOTs. AASHTO's Standing Committee on Performance Management is examining draft goals and measures at a DOT-specific level - the Committee is also examining the idea of national performance goals (e.g. reduce the national total of roadway fatalities by 50% in 20 years).

Many DOTs have existing tools and metrics that fit under the umbrella of sustainability. These metrics fall into categories such as safety, preservation, congestion, systems operation, environment, and freight/economics. New York DOT has a robust metrics system for its Maintenance and Operations departments (GreenLites and the Maintenance Operations Program).

Brainstorming sessions resulted in a menu of measurement ideas by discipline.

At the peer exchange, participants were divided into groups by discipline to discuss potential ideas for activities and metrics relating to sustainability. It is important to note that the discussion was brainstorming only - participants acknowledged limitations of staff, resources or other feasibility issues with measuring and monitoring. The discussions captured below should be considered a partial list of existing practice and potential ideas for consideration rather than recommendations.

Conversation was focused around seven topics: (1) social well-being and responsibility; (2) material flows and management; (3) energy, fuel and climate; (4) habitat, ecosystems and stormwater; (5) economic efficiency; (6) health and safety; and (7) land use.

Planning and Multimodal (System/Program) Brainstorming Session

Peer exchange participants discussed examples of activities and metrics that could help define planning-level or system-level sustainability. Some of these activities and metrics were currently under way in some states, and some were hypothetical. Participants stressed that any metrics must be relevant and manageable to measure and monitor over time. Examples of specific ideas are included in Attachment D.

Design & Construction Brainstorming Session

Peer exchange participants also discussed examples of activities and metrics that could help define sustainability from a design and construction perspective. Participants stressed that it is important to define a focus on both the program level and the project level – measuring projects looks only at a sliver of the life cycle. Examples of specific ideas are included in Attachment D.

Operations & Maintenance Brainstorming Session

Peer exchange participants also discussed examples of activities and metrics that could help define sustainability from an operations and maintenance perspective. Participants emphasized that activities and metrics should be developed for both internal operations and the external function of the transportation system. They also believed both system operations decisions and day-to-day operations decisions should be tracked and measured. Examples of specific ideas are included in Attachment D.

VI. Summary of Sustainability Best Management Practices

Global concerns about energy use, climate change, environmental impacts, community impacts and limits to financial resources for transportation infrastructure require new and different approaches to planning, designing, constructing, operating and maintaining transportation systems and solutions. As framed at the peer exchange, sustainability best management practices (BMPs) are a collection of methods and techniques that transportation professionals are using to address sustainability issues related to transportation.

In addition to discussing the Center for Environmental Excellence by AASHTO's comprehensive on-line sustainability directory (http://environment.transportation.org/environmental_issues/sustainability/) and the transportation and sustainability best practices background paper prepared for the event, peer exchange participants shared their experiences with BMPs by discipline. The group was divided into sub-groups by transportation discipline (Planning and Multimodal, Design and Construction, and Operations and Maintenance).

Overall findings revealed that while implementation of best management practices for sustainability have many benefits in and of themselves, to be most beneficial and valuable to an agency, they should be linked to clear programmatic goals and metrics.

Planning and Multimodal BMPs.

Participant discussion regarding planning and multimodal sustainability BMPs primarily focused on the following areas:

Climate change – Some state DOTs are planning around climate change goals, but many of the approaches discussed at the peer exchange would function at the design and construction level (e.g. designing roadways for mass evacuations or changing fuel or fleet requirements to address greenhouse gas emissions). Maryland DOT is studying the implications of climate change in terms of *adaptation* (planning for climate change) for handling storms or flooding. For example, bridges may need to be raised and/or built differently to accommodate anticipated weather events. Other best practices included

culvert design and asset management – assessment of what pieces of the transportation system are vulnerable to storm events. Participants mentioned Australia, New Zealand and the United Kingdom as leading the edge in climate change planning.

Linkages between land use and transportation planning processes – Participants discussed the need to coordinate land use and transportation, as well as the importance of transit oriented development (planning for higher density mixed use land uses near transit stations). Pennsylvania DOT uses a “smart transportation” program, which is defined as “Partnering to build great communities for future generations of Pennsylvanians by linking transportation investments, land use planning and decision-making.” The approach includes early partnership with land use agencies, and also includes the Pennsylvania Community Transportation Initiative, which funds local projects that meet smart transportation goals defined by the state. Maryland DOT has developed models for land use at a state level, and promotes TOD and interchange management around the state. Oregon DOT is planning in coordination with local agencies around interchange modifications, to ensure that local land use decisions do not use up capacity at interchanges during the lifespan of the facility. North Carolina DOT has an access management policy as well as model land use ordinances.

Demand management – Specific best practices mentioned included Intelligent Transportation Systems (ITS), which are technology-based strategies that seek to optimize the operation of the transportation system (e.g. incident reader boards or trip planners), and pricing strategies (for example, using tolling or mileage-based insurance to provide driver incentives to reduce vehicle miles traveled). New York DOT uses a “511 system” which includes a public trip planner that incorporates all modes, including 60 different transit providers and AMTRAK.

Early coordination across modes and departments – Many participants cited the need to coordinate early in the planning process with other agencies and departments representing multiple modes of transport. Maryland DOT developed a multimodal (highway and transit) approach to the I-270 project that allowed the highway and transit departments to work together to solve problems. The agency also has a sustainability sub-cabinet at the state level that is mandated by law to establish priority funding areas. Colorado DOT used integrated inter-agency approaches to its T-REX (TRansportation EXpansion) design-build project, and has coordinated with FasTracks, the regional transit agency’s light rail expansion. North Carolina DOT has an interagency team (including the Secretary and Deputy Secretary levels) that focuses on work planning and goals relating to transportation and the environment. Illinois DOT has a Green Governments Coordinating Council. New York DOT has a Smart Growth Cabinet, which is led by the Department of State. It is chartered with setting direction for land use and smart growth issues, and has established goals and criteria relating to sustainability as well as initiated land use training for local communities. Some participants championed the idea of BORPSAT (bunch of the right people sitting around the table) to engender trust and better integration across departments.

Sustainability plans– Sustainability plans for DOTs are an emerging tool for working toward better internal stewardship of resources (“walking the talk”) and more sustainable transportation system management and decision-making. Oregon DOT has developed a sustainability plan with strategies to manage internal agency operations and the statewide

transportation system. The plan outlines the framework for institutionalizing the concept of sustainability and development of actions that implement sustainability goals.

Innovations in transit– Several DOTs are running their own transit agencies or partnering with transit agencies. Specific sustainability best practices mentioned by the Transit Authority of River City include: better communication tools to reach the public, hybrid and biofuel buses, pass programs to encourage ridership (e.g. with universities), and partnering with local agencies to enhance pedestrian and bicycle connections to transit lines. Best practices from the Southeastern Pennsylvania Transportation Authority include: the Go Green campaign (a clean fuel bus program that improved fuel consumption, reduced operation noise and decreased particulates by 96%), regenerative braking in rail cars, green building for facilities (motion sensor lights, LED fixtures, no-VOC paints, recycled carpeting, daytime cleaning and employee recycling programs), and targeted media campaigns around sustainability.

Design and Construction BMPs.

Participant discussion regarding design and construction sustainability BMPs primarily focused on climate change adaptation and sustainable materials, with some discussion of construction techniques and designing for vehicles of the future. This group agreed that the transportation industry needs to do a better job promoting and communicating to the public the sustainable design and construction practices that are in place.

Climate change - Most of the BMP discussion in the design and construction group focused on climate change, including both adaptation and mitigation. Climate change mitigation is generally defined as reducing greenhouse gas emissions, while adaptation is generally defined as changing practices to accommodate coming changes in physical realities under which the transportation system must continue to perform. Participants noted that transportation agencies have begun to think about preparing for climate change over the past year. Risks to manage include sea level rise, flooding, and excessive heat (affecting construction materials and duration).

Several state DOTs are examining the need to alter culvert design to accommodate greater water flow (e.g. Oregon, Washington). North Carolina DOT is looking at long-term decisions relating to bridge design in the Outer Banks in response to anticipated sea level rise and storm events; the DOT has determined that the safety benefits garnered from raising and lengthening bridges are worth the investment. Oregon DOT is using asset management to understand which infrastructure could be at risk given the anticipated effects of climate change. Participants agreed that flexibility in dealing with adaptation is key – each region may need to set its own priorities related to climate change adaptation and policy. For example, evacuation is a key concern for many coastal states.

Participants raised concern that greenhouse gas regulation is in direct conflict with how transportation projects are funded, since lessening of greenhouse gases generally means less consumption of fuel – which means less fuel tax available for funding. Broadly speaking, the group agreed that greater coordination among agencies is needed in addressing climate change.

Materials – Participants note that sustainability is not new in the realm of highway construction materials. Many DOTs design bridges and pavements with durability in mind,

and recycling is important not only for environmental reasons, but for economic reasons (general contractors do not want to pay tipping fees to landfill sites if they can avoid it). Participants recommended use of Recycled Asphalt Product (RAP), recycled fly ash, and use of recycled rubber, sand and gravel as key sustainability practices. All of the DOTs present have sustainability practices in place related to materials. Washington DOT communicates with the public about materials sustainability through brochures and website postings.

Materials sourcing policies were mentioned as a critical practice – short hauling distances not only minimize greenhouse gas emissions, but also reduce costs. Washington DOT commented on the need to coordinate materials sourcing with local land use entities – often local jurisdictions do not protect these resources for use, with the unintended consequence of increasing haul times.

Construction practices – Participants discussed several key sustainable construction practices. Key ideas included biofuels for construction vehicles, traffic management, maintenance of accesses to local business and residences, reduced contract time and construction time, and coordinated employee transport to construction sites.

Design and construction changes relating to a future transportation system – Participants discussed what vehicles might look like in the future, and whether the transportation system would need to change. Some participants thought that vehicles would increase in size (focus on transit vehicles) while others thought that vehicles would decrease in size (e.g. Smart Cars). Others thought that there would be new technology (electric cars, personal rapid transit). Larger, heavier vehicles would require different standards for design and construction. New technology would require changes to infrastructure (for example, changes to the electric grid). Participants talked about the use of shoulders for additional capacity (as used in Minneapolis and Miami) – some participants were somewhat skeptical of this technique as effective in addressing emissions compared to other options for traffic management. FHWA is developing a shoulder policy document that will be published at the end of the year.

Participants also discussed the need to rethink engineering standards. Standards were originally based on safety and highway capacity, and perhaps there are other elements that should factor into design in some cases. One idea was to promote different design standards for new construction and reconstruction, as these types of projects often have very different characteristics and contexts.

Operations and Maintenance BMPs.

Participants in the operations and maintenance discussion noted that many examples of BMPs have already been documented by the AASHTO Standing Committee on the Environment. Most participating DOTs have asset management practices in place. The session included lengthy discussion of the lack of communication avenues with regulatory agencies, and barriers inherent in the permitting process. A need was identified for placement of people with environmental knowledge in various DOT divisions and as liaison positions in state or federal resource agencies. Many participants talked about the lack of flexible maintenance funding. Participant discussion regarding operations and maintenance sustainability BMPs primarily focused on the following topics:

Fuel/Energy use– Participants discussed best practices for vehicle fuel usage and facility energy usage. Colorado DOT has an adopted mandate to reduce fuel use. Colorado is looking at replacing vehicles based on years in service instead of an arbitrary mileage cap, in the hope of reducing unnecessary mileage accumulation, and has policies to acquire more hybrid vehicles. Several states, including Maryland, have instituted idling policies. Some state DOTs are using video conferencing rather than spending dollars on travel, which also minimizes greenhouse gas emissions.

Management systems – Participants discussed the importance of wide implementation of data management systems to make operations and maintenance activities more streamlined and efficient.

Specific maintenance practices – Several state representatives discussed maintenance strategies. North Carolina DOT has strategies for pavement preservation, such as chip seals, microsurfacing and sealing joints. In Colorado, chip seal is applied after three years of pavement construction. Washington DOT uses Light Emitting Diode (LED) lighting for signal replacements, and has cutting-edge vegetation management policies. Washington, Montana and Idaho compost roadkill. Oregon has practices relating to wetland mitigation banks.

Strategic operations and maintenance approach – Many participants agreed about the need for environmental staff to be involved with operations and maintenance. New York DOT has a comprehensive sustainability approach to operations and maintenance - which is defined by a series of environmental, social and economic indicators - called the Greenlites Operations Program/Maintenance Operations Program. Staff is asked to monitor specific metrics, and successes and opportunities for improvement are documented. New York DOTs philosophy is that sustainability implementation will mostly happen on the existing system (there is not a lot of highway expansion in the state). Managers are given flexibility to change metrics over time to better address sustainability goals.

Life cycle cost analysis – Participants noted that the use of life cycle cost analysis (as opposed to first cost analysis) better reflects what it costs to build and maintain a facility and manage that asset over time. Different funding decisions might be made if the entire cost context was taken into account.

VII. Moving Forward and Next Steps

Participants identified several gaps in knowledge and needs for further analysis in the area of sustainability definitions, challenges, goals and measurement.

Specific recommendations that arose from the peer exchange to address these gaps include the following:

- Establish forums for sustainability knowledge transfer at three levels: (a) DOT-specific; (b) State inter-agency; and (c) between Federal and State agencies. AASHTO, APTA and FHWA can play a role in fostering dialogue among DOTs and between federal and state agencies.

- Develop communication visuals and techniques to communicate with the public about sustainability in transportation. It will be important to define sustainability in relation to transportation in a way that will resonate with the public and decision-makers. Peer exchange participants and other DOTs can coordinate to identify best practices around communication and community relations.
- Continue a fostering of best practices related to sustainability and transportation (use Center for Environmental Excellence by AASHTO as a clearing-house) and encourage states not represented at the peer exchange to submit practices. These best practices should focus on the areas of planning and multimodal transportation, design and construction, and operations and maintenance.
- Coordinate with ongoing studies of performance measures for state DOTs (NCHRP 08-74 and AASHTO's Standing Committee on Performance Management). DOTs can stay informed about the progress of these projects, and AASHTO can serve as a forum for discussion.
- Provide information and training on life cycle cost analysis. AASHTO and other organizations (e.g. NCHRP) can provide reports, examples and case studies regarding life cycle cost analysis methods, techniques and benefits.
- Develop a menu of best practices for climate change mitigation and adaptation. Although there is movement toward best practice around both climate change mitigation and adaptation for transportation agencies, there is not yet a comprehensive understanding of how to address these issues. AASHTO can include information on its website regarding state of the practice techniques, including changes as regulatory frameworks change over time.

VIII. Conclusions

The sustainability peer exchange afforded an opportunity for state and federal transportation agencies to share practices, explore ideas about sustainability at both the program-wide and project level, and visualize how DOTs may need to adapt to address emerging sustainability issues such as natural resource scarcity, energy expense, climate change, water availability and population aging and growth.

Discussions around the definition of sustainability, sustainability challenges for transportation agencies, sustainability goal-setting, sustainability measurement, and next steps allowed participants to share their thoughts about state of the practice techniques in the areas of planning and multimodal transportation, design and construction, and operations and maintenance. Though different transportation agencies differ in terms of their sustainability areas of focus, agencies and organizations at the state and federal level are able to participate in the advancement of best practices and improvement of communication and information sharing about sustainability and how it will be integrated into the transportation of tomorrow.