# STRATEGIC PLANNING FOR A SUSTAINABLE TRANSPORTATION SYSTEM: A SWOT-BASED FRAMEWORK FOR ASSESSMENT AND IMPLEMENTATION GUIDANCE FOR TRANSPORTATION AGENCIES

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# STRATEGIC PLANNING FOR A SUSTAINABLE TRANSPORTATION SYSTEM: A SWOT-BASED FRAMEWORK FOR ASSESSMENT AND IMPLEMENTATION GUIDANCE FOR TRANSPORTATION AGENCIES

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| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| ALDOT | Alabama DOT |
| Caltrans | California Department of Transportation |
| CSS | Context Sensitive Solutions |
| CST | Centre for Sustainable Transportation |
| DOT | Department of Transportation |
| EIA | Environmental Impact Assessment |
| EJ | Environmental Justice |
| EU | European Union |
| FHWA | Federal Highway Administration |
| FTA | Federal Transit Administration |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GHG | Green House Gas |
| GreenLITES | Leadership In Transportation and Environmental Sustainability |
| HIA | Health Impact Assessment |
| HUD | United States Department of Housing and Urban Development |
| ITS | Intelligent Transportation System |
| LEED | Leadership in Energy and Environmental Design |
| LRP | Long Range Plan |
| LCA | Life Cycle Assessment |

| | |
|---|---|
| LCCA | Life Cycle Cost Analysis |
| MDSHA | Maryland State Highway Administration |
| MnDOT | Minnesota Department of Transportation |
| MPO | Metropolitan Planning Organization |
| MTKN | Midwest Transportation Knowledge Network |
| NCHRP | National Cooperative Highway Research Program |
| NJDOT | New Jersey Department of Transportation |
| NYSDOT | New York State Department of Transportation |
| NZTS | New Zealand Transport Strategy |
| ODOT | Oregon Department of Transportation |
| OECD | Organization of Economic Cooperation and Development |
| PennDOT | Pennsylvania Department of Transportation |
| SOP | Standard Operating Procedure |
| SSA | Strategic Sustainability Assessment |
| SSTI | State Smart Transportation Initiative |
| TDM | Transportation Demand Management |
| TfL | Transport for London |
| TIP | Transportation Improvement Program |
| TRB | Transportation Research Board |
| USDOT | United States Department of Transportation |
| USEPA | United States Environmental Protection Agency |
| WSDOT | Washington State Department of Transportation |

# SUMMARY

Based on a national survey of State Departments of Transportation (DOTs), it was determined that such agencies are engaged in a variety of activities to address sustainability issues associated with transportation planning, design, and operations. These activities range from piecemeal environmental practices like roadside mowing policies to comprehensive planning frameworks. However, state DOTs in general do not have sufficient policies or practices in place to evaluate and prioritize investment options that will promote sustainable development. For this research, a mixed-methods research design employing an expert panel and case studies of individual State DOTs was used to develop, test, and evaluate the value of a strategic planning tool that can help DOTs evolve more sustainable practices.

The main contribution of this research is a methodology for transportation agencies to develop or refine their organizational frameworks to be more oriented toward sustainability, which could lead to transportation infrastructure investments that can be better maintained and operated over their service life, reduce environmental impacts and fossil fuel dependence, promote economic development, and meet the needs of growing and changing populations more effectively.

A self-assessment tool was designed to guides agencies through (1) identifying internal strengths and weaknesses (or gaps) in their planning frameworks and organizational structure and culture, (2) characterizing features of the external environment as opportunities or threats, (3) prioritizing areas for strategy development, and (4) developing strategies that link the internal and external environments. Such a tool can also be used to monitor progress over time. The tool was tested by seven state DOTs

who completed the assessment and provided feedback on the content, format, and process. Based on evaluation of the assessment responses and feedback received from these state agencies, recommendations are made for improving the tool and for future applications.

# CHAPTER 1

# INTRODUCTION AND BACKGROUND

## 1.1 Introduction

Transportation infrastructure investments have long-lasting implications not only on the transportation system but also on the larger environmental, economic, and social systems with which transportation interacts. As stated on the sustainability webpage of the American Association of State Highway and Transportation Officials (AASHTO), the sustainability of the transportation system is critical because this sector is responsible for 10 percent of the world's gross domestic product, 22 percent of global energy consumption, 25 percent of fossil fuel burning, and 30 percent of global air pollution and greenhouse gases. The United States accounts for only five percent of the world's population but produces 45 percent of the global warming pollution from vehicles (EDF 2008).

To quote the popular Brundtland Commission definition, sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their needs (OECD 1987). Although sustainable development and sustainability are often used interchangeably in discourse, a simple distinction can be made that sustainable development is the process of pursuing sustainability. Sustainability is the desired endpoint – a state that finds the environmental, social, and economic systems in harmony. In this sense, sustainable development can take different paths toward sustainability depending on a community's starting point (Chambers et al. 2000). It can also change over time to reflect changing values or threats to a community.

Achieving sustainability of the transportation system is a critical component of sustainable development. Benfield and Replogle (2002) explain that a sustainable transportation system is essential because transportation is a "prerequisite to development in general" and a cause of many environmental and land use problems. In other words, transportation is both a tool for and a constraint on sustainable development. As a point of clarification, sustainable transportation used in this document will to refer to the sustainability of the transportation system.

## 1.2 Background

This thesis builds upon research completed for a project sponsored by the Federal Highway Administration (FHWA), *Sustainability Evaluation and Planning Guidance for Transportation Systems*. Prior to that study, there was no comprehensive documentation of the state of practice in the US or challenges/barriers that may prevent transportation agencies from implementing sustainability practices. The objectives of the project were to:

- Explore domestic and international best practices in sustainable transportation planning,
- Examine issues of data collection and availability,
- Provide guidance to transportation agencies through a catalog of practices and case studies, and
- Disseminate information on sustainability practices to state DOTs and other transportation agencies.

The project resulted in several significant deliverables including a literature review of then-current domestic and international policies and practices, a survey of the

50 state DOTs, and in-depth case studies of sustainability "best practices". All of those pieces plus additional research were synthesized into the *Transportation Planning for Sustainability Guidebook*, which was released by FHWA in January 2011. This guidebook presents critical issues involved in planning for sustainable transportation systems and then reviews current practices in the US and abroad that address these issues. One of the major challenges in implementing sustainability assessment for planning relates to data availability, so a chapter describes potential data sources and examples of how data has been used in sustainability-related initiatives. The fifth chapter in the guidebook consists of case studies of sustainability practices that have been implemented by US transportation agencies or comparable agencies abroad. The chapter also describes cutting-edge evaluation methods that have not been widely applied by transportation agencies, but could greatly advance sustainability evaluation and planning (FHWA 2011).

The Guidebook's literature review and survey results generated considerable amounts of information that provided a foundation for this present research. The literature review took a broad look at policies, planning processes, and assessment methodologies for sustainability of the transportation system in the US and abroad. The review first looked at definitions of sustainable transportation, determining that there are many examples from transportation agencies and other organizations that address transportation. It then reviewed policies and practices in the US (including sustainability plans, green transportation rating systems, climate action plans) as well as more comprehensive frameworks that had been developed in Europe and New Zealand. CHAPTER 2 provides a broader discussion of this transportation sustainability literature.

To supplement the literature review and explore practices at US agencies, the 50 state DOTs were surveyed. The survey revealed that implementation efforts in the US range from piecemeal "green" practices to comprehensive sustainability programs. From discussions with DOT and local government representatives during the survey process and at subsequent conferences, it is clear that sustainability issues (especially economic and financial ones currently) are forefront in their minds. Further, transportation agencies are eager for methods to address those issues better in their policies and planning practices.

The survey was conducted from November 2008 to May 2009 to characterize current activities in sustainable transportation. Survey questions were open-ended to allow for discussion and to cover fully the three primary areas of sustainability, and the survey was administered via telephone interview and/or written response. The effort achieved a 94 percent response rate with all but three state DOTs participating. Respondents were usually a director or manager in the planning or environmental unit, and had knowledge of sustainability initiatives being carried out by the agency.

The survey revealed several general observations about state-level transportation planning and sustainability. To begin with, DOT actions were driven by federal requirements *and* state priorities, and for that reason, each DOT had a slightly different package of policies and programs to help it achieve national objectives. All state DOTs addressed environmental planning in some way, though the initiatives ranged from environmental stewardship agreements to planning-level environmental screening and operations and maintenance practices like roadside planting/mowing. Climate change is an important piece of environmental sustainability, which was gaining attention across

the country. Nearly one-third of the state DOTs reported being involved in or developing a climate change initiative, though most of the climate change initiatives were stimulated by state policies (e.g., a greenhouse gas budget) or a Governor's directive. That proportion has probably increased since completion of the survey. As of December 2010, 36 states had a climate action plan and twelve states had a climate change adaptation plan, and transportation agencies were often involved in creating those plans (Pew Center 2010).

In terms of economic concerns, states were beginning to follow Washington State DOT's (WSDOT) lead with an interest in freight planning. There was also a predominant concern about the future of transportation funding, and many state DOTs were exploring ways to prioritize transportation investments better to meet user needs and sustain the system. State DOTs reported the least activity in assessing social sustainability, beyond environmental justice policies. However, with a growing USDOT emphasis on "livability," social sustainability as a topic was starting to attract more attention and new sustainability efforts were beginning to address equity, health, and other social issues. Only five state DOTs reported having a formal sustainability plan or program, which represents a comprehensive way to address all of the aforementioned issues.

Agencies were clearly focused on a range of activities with various levels of engagement in sustainability practice. Examples of planning and analysis tools to address sustainability in transportation planning included scenario planning, GIS-based tools, prioritization and performance measurement, climate action plans, health impact assessments, and green rating systems. The range and depth of activities seemed to be influenced in part by factors external to the DOT. For example, several common practices

were observed based on regional classifications, reflecting similar concerns. The regional similarities may also have related to better communication and sharing among neighboring DOTs. The Northeast was in general very active in climate change and land use coordination. In particular, they recognized common challenges like air quality and sprawl and had embarked on collaborative efforts to address them. Coordinating planning efforts among Northeastern state DOTs was necessary in part due to the merging of metropolitan centers. Overall, DOTs in the Pacific Northwest were most active in sustainability, reporting comprehensive programs to address multiple sustainability problems. The survey also indicated that many state DOTs had relatively little knowledge about peer activities addressing sustainability in transportation, but were interested in sharing their experiences and learning from their peers.

The survey and literature review together were used to identify best practices that were then expanded into case studies using additional interviews and reviews of policies, plans, and other documents. Chapter 4 contains brief summaries of these case studies and discusses key findings that informed the research for this dissertation.

## 1.3 Motivation and research questions

This dissertation research was motivated by the following observations:

- Transportation infrastructure investments have long-lasting impacts on the larger environmental, economic, and social systems with which transportation interacts.

- Other countries have made considerable progress on sustainable transportation, guided by specific definitions and national policies.

- US transportation agencies have only recently begun to consider the development of processes and tools to analyze the sustainability of infrastructure investments.

- Individual states and metropolitan areas have begun to develop their own policies, programs, and methodologies for improving transportation system sustainability, but there is a lack of peer exchange.

- State DOTs would benefit from guidance on incorporating sustainability into their planning processes and organizational structure.

- New rating tools (e.g., FHWA's Sustainable Highways self-assessment tool and NYSDOT's GreenLITES) capture sustainability at a project-level, but are not comprehensive diagnostic tools at a systems planning or organizational level.

- Pathways to sustainability are context-driven: each agency will determine its own priorities and constraints and then customize an implementation plan that is locally relevant. However, these contextually-driven plans must ultimately address regional, national, and global sustainability priorities in order for them to be achieved.

These observations, in turn, led to two related research questions:

(1) What is an appropriate framework for evaluating sustainability in a strategic way at the organizational level?

(2) How can a strategic, organizational-level sustainability assessment be effectively applied by state DOTs?

Accordingly, the primary research goals were to: (1) leverage previous work on the development of the FHWA Guidebook to help agencies identify and implement sustainability practices that are best suited to their priorities and limitations, (2) develop a self-assessment framework to guide agencies in that process and provide a means for monitoring progress, (3) apply the tool in selected DOT case studies, and (4) evaluate the strengths and limitations of the assessment framework and common DOT issues based on case study applications.

## 1.4 Expected outcomes

Based on the motivation and objectives for this research and the background investigations summarized above, the intended outcomes were:

- A framework for evaluating the extent to which DOT policies, plans, and organization are oriented to sustainability principles, which will result in identification of strategic issues and a roadmap for making progress.
- Applications of the evaluation framework to specific state DOTs (and other transportation agencies).
- Creation of a practical tool that a DOT can use to base its sustainability discussions and planning efforts on and that will allow it to monitor progress toward a sustainability-oriented organization.

Ultimately, it is expected that DOTs organized around sustainability principles will be able to achieve outcomes such as operating transportation infrastructure more efficiently over its service life, reducing greenhouse gas emissions, promoting economic development, and meeting the needs of a growing and changing population. The research

process also led to other substantive results and future opportunities that are discussed in Chapters 7 and 8 of this dissertation.

# CHAPTER 2

# LITERATURE REVIEW SYNTHESIS: SUSTAINABILITY AND TRANSPORTATION

The development of the self-assessment tool was informed by the basic concept of sustainability as well as deep and shallow ecology, strong and weak sustainability, and the soft systems approach. Section 2.1 describes each of those concepts while section 2.2 focuses specifically on the sustainable transportation literature.

## 2.1 Review of sustainability concepts

The term sustainable development originated at a time when environmental degradation was the primary concern in the U.S. and other developed countries. However, at the global level, the sustainable development movement was motivated by social problems that were negatively impacting the environment, like poverty and rapid growth. In the two decades since the term originated, the U.S. and other developed countries have expanded from an emphasis on the environment to optimizing environment, economy, and society among other factors (Counsell 1999; FHWA 2001; WCED 1987). Those three factors are often referred to as the Triple Bottom Line or Three Pillars of sustainability/sustainable development. Critics of the sustainable development concept point out the importance of "understanding sustainable development as a 'work in progress' of sorts which must be adapted to serve the needs of particular locales" (Beetz et al. 2001). Relating the whole story requires value judgments on what should be sustained and how to sustain it.

Three schools of thought offer perspectives on the three main areas of sustainability/sustainable development: environment (deep ecology), economy (strong sustainability), and society (soft systems).

Deep ecology rejects the notion that nature's (or the non-human world) value derives from its utility to humans (i.e., "shallow ecology") and instead posits that it has intrinsic value. Further, humans are excessively interfering with the non-human world's ability to renew itself, which will eventually threaten the human world. Deep ecology encourages an ideological shift from pursuing higher standard of living to appreciating life quality of both humans and non-humans (Hinchman & Hinchman 1989; Khisty 2006) in the pursuit of development, however one may define it. Sustainability is arguably more anthropocentric than deep ecology, though it does reflect respect for the natural environment and an understanding of the interplays between the human and non-human worlds. The deep ecology concept provides a basis for distinguishing between short-term quick fixes such as recycling and increased fuel efficiency for vehicles versus longer-term life cycle approaches such as changes to the entire cradle-to-cradle operations of agencies and changes in the behaviors of system users that will result in longer lasting impacts.

Strong versus weak sustainability originated as a debate among environmental economists. It essentially deals with intergenerational equity and the substitutability of "manufactured capital" for "natural capital". Weak sustainability holds that "manufactured capital" is a good substitute for "natural capital" as long as there is no diminishment in consumption (or happiness from an economist's view) from one generation to the next. Strong sustainability takes a much more holistic view - rather than

simply striving to sustain consumption levels, we should strive to conserve human, technological, and natural capital. Strong sustainability recognizes that some environmental components and processes cannot be replenished or replaced (Ayres et al. 1998; Neumayer 2010). Again, these concepts offer a basis for distinguishing among the quality of alternative actions to achieve progress toward sustainability. In essence, strong sustainability can be paired with deep ecology conceptually, while weak sustainability aligns with shallow ecology.

Khisty (1995) contrasts the soft systems approach to the traditional "hard" systems modeling approach, positing that the latter addresses the planning and engineering dimensions of transportation (or other) decision making but fails to address the social and political (soft) dimensions. In the hard systems approach, objectives are established, alternative systems are designed to achieve those objectives, and then the best alternative is selected. The hard systems approach breaks down when there is not general agreement on the system's objectives, as is often the case with matters of public policy. The soft systems approach, which is what Khisty calls a "process of learning", is better able to deal with the open-ended, "wicked" problems that face transportation engineers and planners. The soft systems approach essentially incorporates debate and subjectivity into the hard systems approach. Based on earlier discussions of the value judgments needed to define sustainability and sustainable transportation, planning for a sustainable transportation system requires a soft systems methodology. Soft Systems Methodology (SSM) has a wealth of literature to support the structuring of real world complex systems problems (Checkland 1984; Jackson 1991).

## 2.2 Sustainability and transportation concepts, definitions, and practices in the literature

As an application of the sustainable development concept in the transportation sector, sustainable transportation definitions have common elements but also differences that reflect community or agency priorities (Gilbert 2006; Jeon & Amekudzi 2005; Zhou 2009). The definitions of sustainable transportation are generally derived from the Brundtland Commission's definition of sustainable development (Beetz et al. 2001; FHWA 2001; Gilbert 2006; Zietsman & Rilett 2002) but reflect multiple objectives related specifically to the development of transportation systems. Current definitions of sustainable transportation are comprehensive and include certain commonalities that reflect a conceptual understanding of what sustainable transportation entails. Table 1 contains a sample of sustainable transportation definitions. The Centre for Sustainable Transportation's 2003 definition is the most commonly cited one in the literature. There appears to be general agreement that sustainable transportation should at the minimum address the three concerns of sustainable development – environment, economy, society – while enhancing performance of the transportation system and addressing long-term implications of decisions (Deakin 2001; Jeon and Amekudzi 2005; Litman 2009; TAC 2007; Zhou 2009; Zietsman & Rilett 2002).

**Table 1. Definitions of sustainable transportation – examples (FHWA 2011)**

| Source | Definition |
|---|---|
| Ministry for the Environment, New Zealand (2009) | Sustainable transport is about finding ways to move people, goods and information in ways that reduce its impact on the environment, economy and society. Some options include: (1) using transport modes that use energy more efficiently, such as walking or cycling, and public transport; (2) improving transport choice by increasing the quality of public transport, cycling and walking facilities, services and environments; (3) improving the efficiency of our car use, such as using more fuel efficient vehicles, driving more efficiently, avoiding cold starts, and car pooling; (4) using cleaner fuels and technologies; (5) using telecommunications to reduce or replace physical travel, such as tele-working or tele-shopping; (6) planning the layout of cities to bring people and their needs closer together, and to make cities more vibrant and walkable; and (7) developing policies that allow and promote these options, such as the New Zealand Transport Strategy. |
| Centre for Sustainable Transportation (2003) | A sustainable transportation system is one that (1) Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations; (2) Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy; (3) limits emissions and waste within the planet's ability to absorb them, minimizes consumption of nonrenewable resources, reuses and recycles its components, and minimizes the use of land and the production of noise. |
| Organization of Economic Cooperation and Development (Environment Directorate) (1999) | Environmentally sustainable transportation is transportation that does not endanger public health or ecosystems and that meets needs for access consistent with (1) use of renewable resources at below their rates of regeneration and (2) use of non-renewable resources below their rates of regeneration |
| European Commission, PROSPECTS: Developing Sustainable Urban Land Use and Transport Strategies (2003) | A sustainable urban transport and land use system: (1) Provides access to goods and services in an efficient way for all inhabitants in the urban area; (2) protects the environment, cultural heritage and ecosystems for the present generation, and (3) does not endanger opportunities of future generations to reach at least the same welfare level as those living now, including the welfare they derive from their natural environment and cultural heritage. |
| The Sustainable Transportation Action Network (Sustran), The Urban Environmental Management Research Initiative (UEMRI), Global Development Research Center (GDRC) (2012) | Sustainable transportation concerns systems, policies, and technologies. It aims for the efficient transit of goods and services, and sustainable freight and delivery systems. The design of vehicle-free city planning, along with pedestrian and bicycle friendly design of neighborhoods is a critical aspect for grassroots activities, as are telework and teleconferencing. It is more about accessibility and mobility, than about 'transportation'. |

In the literature, sustainability is identified as a key concept for transportation in Europe, New Zealand and other international locations, and is an increasingly important concept in the US (FHWA 2001; Janic 2006; TRB 2005). Other countries have conducted research on transportation and sustainability for several years and as a result, international experiences can provide several valuable lessons. Considering formal sustainability policies, several governments in Europe, Canada, and Australasia clearly define sustainability and use it as a framework for transportation policies, research, and planning (EC 2008; FHWA 2001; Janic 2006; NZ 2008; TRB 2005). Those governments define national or regional goals that are translated into targets and action plans by state or local governments. The US lacks a national policy statement on sustainability and transportation, though recent transportation conferences, research efforts, and even government initiatives have recognized its importance as a planning principle (Amekudzi & Meyer 2005; TRB 2005).

Several federal and state agencies have funded projects to develop tools and methods for incorporating sustainability considerations into project planning and design. Two such examples are the Transit Investments for Greenhouse Gas and Energy Reduction (TIGGER) grant program included in the American Recovery and Reinvestment Act, and a partnership between the US Department of Transportation (USDOT), the US Department of Housing and Urban Development (HUD), and the US Environmental Protection Agency (EPA) for the Sustainable Communities Initiative (or Livable Communities Partnership). The partnership in particular represents a national movement toward collaboration among appropriate agencies to pursue sustainability more comprehensively, as prior legislation and federal directives were focused on

environmental protection and environmental justice. Additional state and local policy guidance is provided by the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) through periodic publications, workshops, and online resources. Sustainable transportation is gaining considerable momentum at all levels of government, but there is currently no comprehensive national framework to guide US transportation agencies such as there is in New Zealand or the United Kingdom (U.K.).

Another indicator of growing attention in the US is the inclusion of sustainability principles in over half of state DOT mission statements as of 2011 (FHWA 2011), which was a significant increase from 2005 when approximately one-quarter reflected sustainability (Jeon & Amekudzi 2005). While no two were identical, several addressed impacts on the economy, environment and social quality of life. However, only two DOTs actually included the term "sustainable", and each uses unique wording and combination of principles. It is also true that not all agencies with missions that incorporate elements of sustainability can point to formal initiatives for implementing them. At the same time, there are agencies that have formal initiatives and programs for addressing sustainability, but have mission statements that say very little or nothing at all about sustainability. Table 2 shows a sample of DOT mission statements with elements of sustainability.

**Table 2. Sustainability principles in the mission statements of state DOTs as of January 2011 (FHWA 2011)**

| State | Mission Statement |
|---|---|
| **Alabama** | To provide a safe, efficient, environmentally sound intermodal transportation system for all users, especially the taxpayers of Alabama. To also facilitate economic and social development and prosperity through the efficient movement of people and goods and to facilitate intermodal connections within Alabama. ALDOT must also demand excellence in transportation and be involved in promoting adequate funding to promote and maintain Alabama's transportation infrastructure. |
| **Florida** | Provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity and preserves the quality of our environment and communities. |
| **Hawaii** | To provide a safe, efficient, accessible, and inter-modal transportation system that ensures the mobility of people and goods, and enhances and/or preserves economic prosperity and the quality of life |
| **Iowa** | Advocates and delivers transportation services that support the economic, environmental and social vitality of Iowa. |
| **Illinois** | To provide safe, cost-effective transportation for Illinois in ways that enhance quality of life, promote economic prosperity, and demonstrate respect for our environment. |
| **Kentucky** | To provide a safe, efficient, environmentally sound and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life in Kentucky. |
| **Maryland** | Efficiently provide mobility for our customers through a safe, well-maintained and attractive highway system that enhances Maryland's communities, economy and environment. |
| **Nebraska** | We provide and maintain, in cooperation with public and private organizations, a safe, efficient, affordable, environmentally compatible and coordinated statewide transportation system for the movement of people and goods. |
| **New Hampshire** | Transportation excellence enhancing the quality of life in New Hampshire. Transportation excellence in New Hampshire is fundamental to the state's sustainable economic development and land use, enhancing the environment, and preserving the unique character and quality of life. |
| **Tennessee** | To plan, implement, maintain and manage an integrated transportation system for the movement of people and products, with emphasis on quality, safety, efficiency and the environment. |
| **West Virginia** | To create and maintain for the people of West Virginia, the United States and the world a multi-modal and inter-modal transportation system that supports the safe, effective and efficient movement of people, information and goods that enhances the opportunity for people and communities to enjoy environmentally sensitive and economically sound development. |

Including sustainability in the mission statement is an important first step, but needs to be followed up by incorporating those principles into agency goals, activities, and performance measures; essentially, integrating sustainability into the entire planning process.

In terms of specific sustainability tools and practices, there have been several recent studies on performance measurement and methodologies for developing sustainability indicators (Amekudzi et al. 2009; Chi & Stone 2005; Halverson et al. 2008; OECD 1999; Pearce & Vanegas 2002; UN-DSD 2005), as well as planning methods like scenario planning (FHWA 2008; Lindquist 1999). Both of these practices are being used to some extent by transportation agencies. There are also assessment tools and methods that are described in the literature but not used widely in practice, particularly in the US transportation sector. Examples include Multi-criteria Decision Making (MCDM) tools (Jeon et al. 2007; Zietsman et al. 2003) and sustainability life cycle assessment (Barba-Guttierez et al. 2005; Chester & Horvath 2007; Hendrickson et al. 2006; Phillips et al. 2005).

Examples of international experiences that might be of interest include a wide range of planning and analysis tools, including Spatial Planning, Backcasting and Strategic Sustainability Analysis (SSA). Spatial planning techniques consider spatial relationships within the context of a wide range of planning criteria, for example, jobs/housing locations to promote economic development, environmental preservation and social quality of life (Healy 2004; Williams 2005). Backcasting is an analytical tool that recasts the decision-making environment to understand better potential futures by deciding on the desired status of selected critical factors related to social quality of life,

environment, and economy. Policies are then developed and implemented to promote technological innovation as well as the behaviors to achieve the desired future state (Barrella & Amekudzi 2011; Guers & van Wee 2004; Guhnemann & Rothengatter 1999; Robinson 1982). SSA, used by both Germany and OECD to assess transportation impacts, is a model-based methodology for analyzing complex transportation decisions with long-term time horizons; interlinked with environmental, economic, and social systems; and with a spatial scope above the project-level (ASTRA 2000; Schade & Rothengatter 2001; Schade & Schade 2001). These types of techniques when applied at broader geographic scales, such as regionally or mega-regionally, tend to have more potential to promote global and regional economic competitiveness and set a general context for activities at state, county, or city levels of decision making.

# CHAPTER 3

# TOWARD A FRAMEWORK FOR STRATEGIC PLANNING PROCESS – FORM

This chapter examines a potential "form" for the sustainability evaluation tool by reviewing the literature on organizations and strategic planning. Chapter 4 is a companion to this chapter, examining potential "substance" for the tool by focusing on the best practices that were highlighted in the FHWA Guidebook (FHWA 2011).

## 3.1 Organization and strategic planning literature

A primary goal of this research is to help transportation agencies transition to a sustainability-oriented organizational framework; in essence, to change their organizational culture. Accordingly, this section begins with a review of the literature on organizations and organization change. It then explores strategic planning as a way to initiate and implement the change, in particular focusing on the identification of strategic issues and strategies by applying SWOT analysis. The section concludes with examples of how SWOT analysis has been applied in the areas of transportation/infrastructure and sustainable development.

## 3.2 Organizations and organization change

An organization is as a social creation designed for the pursuit of specific objectives. Over time, those objectives can change due to external pressures, organizational development, personnel changes, or new leadership. In response to changing objectives, the organization can either survive and thrive (adapt) or it can fail. Organizations are by nature "open systems" that take energy/resources from the outside and then transform those inputs into outputs like a service (Burke 2011; Hatch 1997).

Therefore, the most drastic organizational changes are usually the result of significant changes in the external environment, or paradigm shifts. For example, in the 1970s the environmental movement put enormous pressure on public and private entities alike to address environmental management within their institutional structure. In the 1980s and 1990s, globalization emerged as the new paradigm and forced organizations to examine closely if and how they could operate on an international scale. Today, transportation agencies are faced with a new operating paradigm – sustainability – that will greatly affect the way they do business over the next few decades. The sustainability paradigm poses a significant challenge to transportation agencies because it is multi-faceted and the future it projects is quite uncertain. The sustainability paradigm will manifest itself in different ways over time depending on the dominance of one or more critical issues, so transportation agencies need to make changes now to improve adaptability in the future.

According to Staber and Sydow (2002), an organization's ability to survive is related to how well it is adapted to current conditions, and more importantly its ability to adapt to changes in the future. The authors call this ability to adapt "organizational slack", a concept that may be counterintuitive during tough economic times but crucial for an organization's sustainability. Staber and Sydow consider adaptation to be a reactive process in which managers assess an organization's threats and opportunities, develop strategies that are consistent with the current environmental context and then change organizational structures and processes to align with those strategies. Adaptability, or having adaptive capacity, is a proactive approach that allows organizations to deal with uncertain futures through a dynamic process of continual learning and change. Adaptive capacity can be built in (at least) three areas:

- Multiplexity refers to the number and diversity of relations between actors in organizations or interorganizational networks;
- Redundancy provides the ability to cope with unforeseen challenges through resource slack related to the distribution of information, tasks, and relations. Resource slack can include surplus employees, unused productive capacity, overlapping responsibilities, parallel communication channels, et cetera.
- Loose coupling means that control is decentralized in such a way that various units and activities are relatively independent and can adjust to changing demands in different ways.

Adaptability emphasizes having an open organizational structure that encourages experimentation, organizational self-reflection, and institutional learning. Organization's that build adaptive capacity are able to "reconfigure themselves quickly in changing environments rather than merely identify existing demands and then exploit available resources" (Staber & Sydow 2002).

Adaptability allows an organization to change in response to external shifts (refer to the aforementioned critical sustainability issues). However, this change can occur in a variety of ways and may not always be a smooth process. Organization change in transportation is particularly challenging because transportation planning and policymaking is a process that occurs at multiple levels (federal, state, regional, metropolitan area, local, et cetera) by agencies with overlapping responsibilities, authorities, and jurisdictions. In addition, transportation agencies are subject to the influence (restrictions and demands) of private institutions, other organizations, and individuals. The transportation decision-making process itself can be characterized as (1)

pluralistic and transparent because of its public nature, (2) resource allocative in an environment with limited resources, (3) consensus-seeking or constituency building to develop a policy support system, (4) problem simplifying due to limited time and information, and (4) uncertainty avoiding because we want to know what the end result will be. The process is both technical and political. As a result, the common barriers to transportation decision making include organizational constraints, inter-jurisdictional issues, and resource limitations (Meyer & Miller 2001). Any attempts to change transportation agencies will need to recognize the unique and complex environment in which they operate.

Organization change can focus on different aspects of the organization, which operates as a series of flows. Structural changes will result in changes in these flows, which include:

1. Flow of Formal Authority – the vertical and horizontal management structure;

2. Flow of Regulated Activities – formal sharing of information through monthly meetings, guidelines/design standards, work orders, vision statements, memoranda, et cetera;

3. Flow of Informal Communications – sharing of information not through a regulated activity;

4. Set of Work Constellations – groups that work together for a specific task and relationships that have to occur to accomplish a "work purpose"; and

5. Flow of Ad-Hoc Decision Processes – the informal authority structure that results from people controlling different resources like the budget or information flows. (Meyer 1978)

These "flows" are of course people-oriented because organizations are social constructs. For this reason, organizations tend to be resistant to change. While there are many reasons for resistance, Kaufman (1971) suggests four main categories: (1) collective benefits of stability, (2) calculated opposition, (3) inability to change due to "mental blindness", and (4) inability to change due to systemic obstacles. Transportation agencies are likely to face one or more of these obstacles as they try to adapt to the demands of sustainability. In the survey of state DOTs for the FHWA Guidebook, several common challenges in implementing sustainability-related initiatives were observed. One of the most commonly cited issues was prioritizing funds for new initiatives when existing programs are already competing for limited funds (representing a systemic obstacle). The issue is compounded by concern (usually unfounded in the long term) that green design or CSD will add costs to projects. Another issue cited was institutional inertia, which relates to the arduous task of getting the different DOT divisions on-board with new or innovative policies (a matter of collective benefits of stability or calculated opposition). Similarly, local governments are often resistant to new policies, particularly ones that they perceive as a threat to their power, and can pose obstacles to policy implementation. Overcoming the internal or external resistance often takes leadership, coordination, education and time.

Organization change has occurred before in transportation due to the environmental movement, and specifically due to federal legislation mandating

consideration of environmental impacts in project planning and design. Transportation agency change usually results from a pilot study or experiments, temporary management (e.g., task forces) to make recommendations, and education and training. More drastic change can also occur by replacing staff or making structural changes. Based the survey of state DOTs for the FHWA Guidebook, over 60 percent of the responding DOTs reported that a new team, position, department, or arrangement resulted from incorporation of a new environmental sustainability initiative. Common institutional changes included:

- Bringing environmental specialists and planners together under one division;
- Creating a new office or staff positions to manage large-scale programs;
- Forming new teams/interdisciplinary groups for special initiatives such as climate change or "green" programs;
- Allocating dedicated funds for sustainability activities; or
- Revising "standard operating procedures" that dictate roles and activities.

A few of these changes (usually reorganization or combination of departments) occurred in the 1970s because of federal legislation, but many have occurred within the last decade. Such a considerable time lag in addressing future external pressures could be detrimental to transportation agencies.

In terms of effective practices that transportation agencies could employ, Fernandez and Rainey (2006) distilled eight change strategies from the research literature on organizational change in the public sector. Those eight strategies are:

1. Ensure the need by crafting a vision for change and effectively communicating it to employees;

2. Provide a plan for implementing change, including a set of clear, specific goals and a clear linkage between the planned change and intended outcomes;
3. Build internal support for change and overcome resistance by creating a sense of urgency, using widespread engagement, and encouraging employee feedback during implementation;
4. Ensure top management support and commitment, in particular from career civil servants who can provide leadership continuity and stability;
5. Build external support from politicians and other key stakeholders;
6. Provide resources to support the process from planning through implementation;
7. Institutionalize change by incorporating new policies or innovations into daily routines so that new patterns of behavior develop.
8. Pursue comprehensive change by making systemic changes to the subsystem of the organization, not just to mission and vision, and being cognizant of connections among subsystems.

These change strategies are also supported by Burke's extensive coverage of organizational theory and change literature (Burke 2011). Salem (2008) focuses on the communication reasons that change is not successful, suggesting that each of these strategies requires careful attention to communication so that management, employees, and external stakeholders all buy into the process. In focusing on implementation of sustainability strategies in a corporate setting, Crewe (2010) defines five leadership challenges, which reflect many of Fernandez and Rainey's change strategies. The five challenges (which can be translated into strategies) are:

1. Stakeholder involvement, working to integrate the stakeholder groups (those interested in profit, planet, people) rather than appeasing them;
2. Creating the culture by explaining the purpose of the change so that employees value the reasons and changing mission, vision, and values to reflect sustainability;
3. Holistic thinking, recognizing the considerable uncertainty in a sustainability approach that has to address multiple objectives and the role of organic growth and innovation;
4. Organizational learning at all levels; and
5. Integrating performance measurement into strategy formulation and implementation.

## 3.3 Strategic planning

For public and private agencies, change can be managed by a strategic planning process (even if it is initiated by a mandate from state or federal government). Beerel (1998) defines strategic planning as "a formal process designed to interpret the organization's environment for the purpose of identifying its adaptive challenges and guiding its responses so as to optimize longer term competitive advantage" (p. 163). A strategic planning process generally consists of three phases: strategy formulation, strategy implementation, and strategy evaluation. Corporate strategic planning has been in practice since at least the early 1900s and was spurred on by the development of different models. Corporate strategic planning was adopted by public sector agencies starting in the late 1970s, spurred by the need for economic development planning (Bryson & Roering 1987; Kaufman & Jacobs 1987). Because this dissertation focuses on

public sector agencies, the literature in this section primarily concerns public-sector models and applications of strategic planning. The public sector approach emerged out of private sector strategic planning and so took advantage of many "lessons learned" from decades of application. This section also reviews studies specifically on applications in transportation agencies, though the literature in this area is limited (Berry & Wechsler 1995; Cameron et al. 2009; Compin 2008; Meyer 1988; Obeng & Ugboro 2008; Poister 2004; Poister & Van Slyke 2002).

Bryson (1988) provides the most cited model of strategic planning for public and non-profit agencies. The model draws heavily on the Harvard Model (which introduced SWOT analysis) but was also influenced by other private sector approaches including strategic planning systems, stakeholder management, content approaches, strategic issues management, and process strategies (Bryson & Roering 1987). The public sector model involves ten steps (though it is not a linear process):

1. Development of initial agreement concerning strategic planning effort;
2. Identification and clarification of external mandates;
3. Development and clarification of mission and values;
4. External environmental assessment, including political, economic, social, technological trends/events;
5. Internal environmental assessment, including organizational resources, present strategy, and current performance;
6. Strategic issue identification, or fundamental policy questions affecting the organization's mission, values, resources, organizational design, etc.;
7. Strategy development to address strategic issues from step 6;

8. Description of the organization in the future if the strategies are successfully implemented;
9. Identifying actions and decisions to implement strategies; and
10. Evaluation of results.

In Bryson's model, a strategy is defined as "pattern of purposes, policies, programs, actions, decisions, and/or resource allocations that define what an organization is, what it does, and why it does it" (p.77). Steps one through eight cover strategy formulation, step 9 is strategy implementation, and step 10 is strategy evaluation. Public-sector strategic planning models described by other authors (Grewe et al. 1989; Kaufman & Jacobs 1987; Poister & Van Slyke 2002) are generally consistent with Bryson's model, though often do not include steps 9 and 10, which are considered part of a strategic *management* approach. Strategic management involves managing an agency's strategic agenda on a continuous rather than episodic basis, linking the strategic agenda to resource management (i.e., budgets), and ensuring that the strategies are implemented effectively. Monitoring the implementation of strategies can be achieved by linking strategic management with a performance measurement system. Moving forward, both Poister (2010) and Bryson (2010) view the linkage of strategic management with performance management as a necessary step in order to solidify linkages across mission, policies, budgets, actions, and results. The need for this integration has been recognized before and will be a particularly important step for transportation agencies that face significant resource challenges and greater demands for accountability (Compin 2008; Meyer 1988; Poister 2004). According to Poister and Van Slyke (2002), state DOTs were more advanced that other public agencies in the area of strategic management because they

already had experience with planning, gathering, and analyzing quantitative data in order to evaluate projects, allocate resources, and manage programs. However, the authors recognized that there was still considerable progress that could be made in fully linking the processes.

There have been numerous studies on the benefits and effectiveness of strategic planning in the public sector (Berry & Wechsler 1995; Bryson 1988; Bryson 2010; Kaufman & Jacobs 1987; Ketokivi & Castaner 2004; Kissler et al. 1998; Meyer 1988; Obeng & Ugboro 2008; Poister 2004; Poister & Van Slyke). The findings are generally consistent across different types of public sector agencies, including transportation agencies. A summary of the findings on benefits includes:

- Promotion of strategic thinking, acting, and learning;
- Improved decision making and group problem solving;
- Establishing a common vision;
- Educating external stakeholders;
- Enhanced organizational effectiveness, responsiveness, and resilience;
- Enhanced effectiveness of broader societal systems;
- Expanded ownership of the strategic agenda; and
- Direct benefits for the people involved (including improved morale and competency).

(Bryson 1988; Kaufman & Jacobs 1987; Poister & Van Slyke 2002; Bryson 2010)

Many of the benefits of strategic planning are dependent on an effective process. A summary of effective practices that have been distilled from public sector case studies include the following:

- Taking both a top-down and bottom-up approach (for example, top management prescribing the process and each unit or division developing its own action plan);
- Demonstrating commitment by carrying out action plans;
- Ensuring the involvement and commitment of top-level management;
- Including multiple stakeholders in the process;
- Focusing on an agency's responsiveness to external factors like customer demands;
- Identifying and exploring areas of future growth opportunities;
- Conducting feasibility assessments of proposed strategies;
- Employees must understand established procedures for strategic planning; and
- Using a management approach that fits the style of top-level managers. (Berry & Wechsler 1995; Bryson 1988; Bryson 2010; Kaufman & Jacobs 1987; Ketokivi & Castaner 2004; Kissler et al. 1998; Meyer 1988; Obeng & Ugboro 2008; Poister 2004; Poister & Van Slyke)

## 3.4 SWOT analysis

A key step in strategy formulation is identifying strategic issues, which are a function of both the internal and external environments (Bryson 1988; Koch 2000). A SWOT analysis is a tool commonly used in the private sector to help identify strategic issues and corresponding strategies and has also been applied by public and non-profit organizations (Bryson 1988; Haberberg 2000; Kaufman and Jacobs 1987; Koch 2000;

Proctor 1997; Weihrich 1982). In Bryson's model of public sector strategic planning described in section 3.1.2, SWOT analysis is represented by steps 4 and 5 (Bryson 1988). SWOT stands for Strengths, Weaknesses, Opportunities, and Threats, with Strengths and Weaknesses referring to the internal environment and Opportunities and Threats referring to the external environment (Koch 2000; Weihrich 1982). Panagiotou (2003) succinctly explains the goal of using this approach: "SWOT analysis is concerned with the analysis of an organization's internal and external environment with the aim of identifying internal strengths in order to take advantage of its external opportunities and avoid external (and possible internal) threats, while addressing its weaknesses (p. 8)."

SWOT analysis originated at Harvard Business School in the 1920s to analyze case studies and developed over the 1950s and 1960s into a key component of the Harvard Model for strategic planning. A 1963 business policy conference at Harvard discussed SWOT as a major advance in strategic thinking. The Harvard Model has been widely applied and studied in both the private and public sectors, thereby leading to the popularity of SWOT analysis for identifying strategic issues (Bryson 1988; Panagiotou 2003). SWOT is particularly attractive because it is easily understood by users, can be applied without extensive information systems (because it relies on human capital), and is capable of structuring a mixture of quantitative and qualitative information (Piercy & Giles 1989).

Despite the popularity and widespread use of SWOT, it has weathered criticism over the years. While some have criticized the simplicity of the approach itself (Haberberg 2000; Panagiotou 2003), most productive critiques are concerned with how to improve the way SWOT analysis is applied, both in terms of its output (content) and its

process (Hill &Westbrook 1997; Koch 2000; Pickton & Wright 1998; Piercy & Giles 1989; Valentin 2001; Weihrich 1982). Common criticisms include the following:

- Long lists of factors (S,W,O,T) that are often very general or vaguely described;
- Factors are not verified;
- Factors are not categorized, weighted, or prioritized;
- Identified factors are not linked to implementable strategies.

Essentially, the internal and external factors are poorly defined and often ignored in later phases of the strategic planning process (Hill & Westbrook 1997; Koch 2000). If properly applied, SWOT analysis provides a basic framework for strategic analysis of sustainability issues facing transportation agencies.

Key recommendations for improving applications of SWOT analysis focus on what types of factors are considered (Houben et al. 1999; Panagiotou 2003; Renewal Associates 2003; Weihrich 1982), how the analysis is carried out (Koch 2001; Nigel & Piercy 1989; Pickton & Wright 1998), and the quality/usefulness of the output (Panagiotou 2003; Pickton & Wright 1998; Weihrich 1982). In terms of the types of factors to consider, Renewal Associates (2003) recommended PESTLE for evaluating the external environment though still acting within a SWOT process. PESTLE stands for Political, Economic, Social, Technological, Legal, and Environmental factors, which seems to be based on the concept of sustainability or at least aligned with it. Renewal Associates also recommend identifying the implications of external factors and the relative importance of those implications. There are numerous suggestions for how to improve the SWOT process, which include:

- Recognizing the importance of SWOT/strategic planning as a management process,
- Focusing SWOT on a particular critical issue or area,
- Working toward a shared vision in a group setting, and
- Involving the top management team in addition to subordinates.

(Koch 2001; Nigel & Piercy 1989; Pickton & Wright 1998)

In order to improve the quality of the output (which also follows from an improved process), researchers and practitioners suggest:

- Providing relevant supporting evidence for factors, both quantitative and qualitative;
- Emphasizing a customer or stakeholder orientation in order to clearly differentiate between strength/weakness or opportunity/threat;
- Clearly distinguishing internal from external factors (the latter being out of the organization's direct control);
- Prioritizing factor lists (e.g., scoring significance and level of importance); and
- Engaging in structured strategy generation.

(Panagiotou 2003; Pickton & Wright 1998; Weihrich 1982)

The TOWS (Threat, Opportunity, Weakness, Strength) Matrix developed by Weihrich (1982) is a commonly cited tool for structuring strategy generation. It essentially facilitates systematic identification of relationships between internal and external factors and developing strategies to address the linked factors. The matrix itself (depicted in Table 3) acts as a strategies generator (Piercy & Giles 1989; Weihrich 1982). Panagiotou (2003) proposes modifying the TOWS matrix by removing the W-T (i.e.,

Weaknesses-Threats) and W-O (i.e., Weaknesses-Opportunities) strategies while adding S-W strategies. Developing strategies that address how a current internal strength could be used to enhance or overcome a weakness is a valuable suggestion since so many internal factors interact with one another.

**Table 3. Example of TOWS matrix for a sustainability and transportation application (adapted from Weihrich 1982)**

| | **Internal Strengths**<br>S1: Sustainability outcomes are transparent and easily identifiable by stakeholders | **Internal Weaknesses**<br>W1: Agency promotes a consistent sustainability message or brand internally |
|---|---|---|
| **External Opportunities**<br>O1: Transportation fuel prices | **SO: Max-Max**<br>Strategy S1O1: Establish VMT reduction target and initiate commuter rewards program to encourage alternative commuting<br>Strategy S1O1: Implement performance measurement and reporting program | **WO: Min-Max**<br>Strategy W1O1: Establish commuter rewards program for DOT employees<br>Strategy W1O1: Establish a program to recognize and reward staff for innovative design or planning activities |
| **External Threats**<br>T1: Political climate toward transportation | **ST: Max-Min**<br>Strategy S1T1: Establish a program to recognize and reward staff for innovative design or planning activities | **WT: Min-Min**<br>Strategy W1T1: Conduct internal outreach to educate staff about sustainability initiatives and solicit new ideas |

Other studies suggest methods for quantifying SWOT analysis (to reduce subjectivity) by using techniques such as fuzzy membership functions, analytical hierarchy process, and other mathematical analysis to weight and prioritize factors (Ghazinoory 2007; Houben et al. 1999; Huang et al. 2009; Lee et al. 2000; Shinno et al. 2006). However, these approaches downplay the process benefits of SWOT analysis – engaging leadership, consensus building, etc. – that are emphasized by other researchers (Koch 2001; Pickton & Wright 1998; Piercy & Giles 1989) and are consistent with the organization change literature.

While most suggestions focus on ways to improve applications of SWOT, Panagiotou (2003) pushes for replacing SWOT with a more complex framework called TELESCOPIC OBSERVATIONS, which essentially builds on the concept of the TOWS matrix but includes additional categories for analysis and uses a two-step process to "funnel out" the important areas. The critiques of SWOT analysis cited in this section were influential in shaping the sustainability assessment tool developed in this dissertation. Chapter 5 describes the process of developing the tool and explains how the critiques were addressed.

As mentioned earlier, SWOT analysis has been applied in the transportation and other infrastructure sectors as well as the area of sustainable development. Many of these applications demonstrate the issues reported in the strategic planning and business management literature concerning how SWOT is used. Applications by transportation agencies (Caltrans 2007; Iowa DOT 2008; LDTD 2010; MoDOT 2007; NFRMPO 2010) tend to feature a poor distinction between internal and external environments, vague descriptions of factors, a lack of prioritization of factors, and poor linkages between factors and potential strategies. One notable exception is North Front Range MPO's SWOT analysis of its transportation system, which was intended to identify how Transportation Demand Management (TDM) strategies could be used to address weaknesses and threats. In particular, the North Front Range MPO used the opportunities identified in the SWOT analysis to inform recommendations for transportation system improvements (NFRMPO 2010). However, the agency viewed strengths/weaknesses as current factors and opportunities/threats as potential factors of the transportation system thereby mixing the internal and external environments. It is important to note that the

applications in transportation concern strictly infrastructure or system analysis, whereas this dissertation focuses more on organizational analysis.

In addition to applications by transportation agencies, SWOT has also been used to evaluate energy systems (Terrados et al. 2010), a community's sustainable development (Agenda Institute 2008), a mega-project (Zeybek & Kaynak 2008), and implementation of zero emission vehicles (Deffner et al. 2010). Notably, the study of zero emission vehicles involves looking at combinations of factors (similar to the TOWS matrix approach) to develop local strategies for using the vehicles.

Beyond the evaluation of infrastructure projects, there is a growing body of trade and academic literature on corporate sustainability planning, some of which address the role of SWOT analysis (Crews 2010; Gibson 2006; IKEA 2009; Jamali 2006; Modrak & Dima 2010; Perrini & Tencati 2006; Robinson 2000).

The next chapter reviews sustainability and transportation best practices to inform the substance of the sustainability assessment tool developed in this dissertation.

# CHAPTER 4

# TOWARD A FRAMEWORK FOR SUSTAINABILITY ASSESSMENT - SUBSTANCE

This chapter provides brief descriptions of a variety of best practices that state Departments of Transportation (DOTs) and other transportation agencies have implemented to introduce sustainability principles into transportation planning activities. The key features of these practices and the factors that led to their success provided a foundation for the contents of the SWOT framework described in CHAPTER 5. Each practice reflects the implementing agency's critical priority(s), such as climate change, rural economic development, congestion reduction, etc., which may have been guided by state mandates. The practices also cover different phases of the transportation planning process (for example, vision and goals, performance measures, or design guidelines). In Table 4 on page 48, the best practices are classified by critical issue(s) addressed, phase of the planning and project development process affected, and the type of tool or practice described. These practices employ a range of strategies that transportation agencies use to achieve sustainability goals and fill gaps. When combined with each other or with new strategies/approaches, these practices cover all of the components of transportation system sustainability (environment, economy, society, system performance) and span the entire planning and project development process. The package put together by each DOT will look different based on the agency's critical issues, available resources (both financial and personnel), and previous experiences with sustainability. In order to effectively implement many of the practices described in this chapter, DOTs need to

evaluate carefully their policies and programs to ensure a consistent message and consider whether organizational barriers may prevent long-term success.

A more detailed description of each best practice including references for more information is available in Chapter 5: Case Studies of the *Transportation Planning for Sustainability Guidebook* (FHWA 2011). The FHWA Guidebook provides descriptions of additional sustainability practices as well.

### 4.1 Common program/policy features in sustainability best practices

There are certain program features and policies that can help all DOTs strategically advance planning for sustainable transportation, regardless of differences between urban and rural areas or between regions. These program features and policies include organizational change; sustainability targets, not standards; interagency and intra-agency collaboration; sustainability laws and directives; a comprehensive education campaign; integrity in the planning process; and sustainable funding sources. These common features were distilled from successful sustainability practices at transportation agencies in the US and abroad and can be considered "opportunity" areas for transportation agencies to build capacity and incorporate sustainability into their planning processes. The following pages provide descriptions of each program feature.

#### Organization/culture change

One of the most important challenges faced is the necessity of institutional change for developing and implementing effective sustainable transportation policies and programs. A related issue is institutional inertia, which relates to the arduous task of getting the different DOT divisions on-board with new or innovative policies. Similarly, local governments are often resistant to new policies, particularly ones that they perceive

as a threat to their power. In order to incorporate sustainability into planning processes, transportation agencies need to create a culture of sustainability by engaging in capacity building (see Education below) and making temporary and/or permanent changes to the organizational structure and succession planning.

**Sustainability targets, not standards**

The term "standards" implies inflexibility. Rather than being limited by standards, transportation agencies could develop targets, or actionable goals, and then determine how best to achieve them. For example, the EU and New Zealand use this strategy. In the EU, targets for emissions reductions or mode splits are set for the entire union and then translated down to the member states. In addition to establishing targets, transportation agencies need to monitor progress toward achieving them, as the New Zealand Ministry of Transport does with its indicator framework.

**Sustainability laws and directives**

As was observed in the literature review, countries like the U.K. and New Zealand, which are viewed as sustainable transportation leaders, have strong national policies that guide planning. Similarly, transportation agencies that are considered leaders (by FHWA, AASHTO, DOTs), have mandates or strong support from state lawmakers for sustainable transportation planning. The policymaking process can help generate critical support for state DOT activities that do not explicitly relate to mobility. Further, it can help prioritize new DOT initiatives at a time when financial resources are limited. Land use policies are a common way states attempt to make transportation planning more sustainable. Although, as a result of the authority of local governments to determine land

use policies, only a few of these policies actually provide the state transportation agencies with power to influence land use decisions.

Recently, there has been a wave of state policies related to climate change, some of which are in response to regional efforts to reduce greenhouse gas emissions. Those states with Smart Growth legislation, comprehensive planning requirements, climate change mandates, etc. are better able to focus on and plan for the impacts of transportation infrastructure development on other systems. Being involved in the policymaking process as opposed to being engaged merely as implementers after the fact can have a significant impact on a DOT's ability to help achieve sustainability outcomes in the broader community context. This closely relates to having the institutional capacity and funds available to implement effectively new legislative requirements.

**Intra-agency and interagency collaboration**

Collaboration was a key message of the first Green Streets and Highways Conference hosted by the Transportation & Development Institute (T&DI) of ASCE in November 2010. Successful sustainability initiatives require collaboration because most transportation sustainability problems cross-jurisdictional boundaries and influence multiple systems (environment, economy, community life, etc.). Working toward sustainability of the transportation system first requires collaboration within a transportation agency among the various departments and work groups. This may require temporary or permanent institutional changes such as the introduction of a sustainability task force, a sustainability director or program manager, or an entire sustainability department.

At another level, sustainability initiatives require interagency collaboration, which takes two forms: relationships between multiple transportation agencies (different levels of government, different modes, and different states) and relationships between multiple disciplinary agencies (environmental resources, economic development, historic preservation, etc.). Such relationships are vital during all phases of the planning process, providing better and more comprehensive data, a consistent message to the public and policymakers, and implementation assistance.

**Comprehensive education campaign (internal and external)**

As with any new idea, sustainability needs "champions" to push it forward and form a critical mass to support it. A comprehensive education campaign aimed at different stakeholder groups (transportation professionals, the public, policymakers, etc.) is a necessary step and supports the organization/culture change and collaboration pieces described above. For example, NYSDOT tackled the transportation-land use connection by holding annual conferences to explain new policies or programs to other state agencies and local governments. NYSDOT also launched a "smart planning" website that presents all of its land use/smart growth policies and programs in one place and advertises training and hands-on assistance. When PennDOT embarked on the Smart Transportation movement, the agency made a major push to educate stakeholders. A unique feature of the movement is considerable outreach both internally (to PennDOT employees) and externally (to local governments, transportation professionals, civic groups, Pennsylvania residents) to explain Smart Transportation and how stakeholders can work together to accomplish goals.

### Integrity in the planning process

To truly address sustainability problems, there needs to be integrity in the transportation planning process, meaning sustainability must be integrated throughout the entire process. A general planning framework includes visioning, the development of goals and objectives, the generation of project alternatives, the development of alternative transportation plans, and performance measurement. There are many examples of individual practices that can incrementally transform the planning process. Examples include establishing "sustainability indicators" rather than traditional mobility indicators, which transforms the "performance measurement" stage to align with sustainability goals and objectives. Agencies can also "establish targets" as an explicit stage of the process to move toward more active and dynamic assessment of sustainability. In addition to these practices, there are examples of state DOTs that have developed comprehensive frameworks, like PennDOT and Caltrans. Developing new practices can refine even comprehensive frameworks. For example, social sustainability analysis is still lacking in several sustainability frameworks. One way to address this gap is to use Health Impact Assessment (HIA) as a long-range planning tool.

### Sustainable funding sources

As pointed out in earlier discussions, limited resources hinder the implementation of new sustainability initiatives. One of the most challenging public policy issues facing federal, state, and local officials is providing transportation funding sufficient for maintaining the existing transportation infrastructure and expanding capacity to meet future travel demands. Given the diversity of funding contexts at all levels of government, the most likely descriptor of future transportation funding programs is that

they will be “menus” of different funding and financing strategies. In addition to finding new, sustainable funding sources, transportation agencies can also develop new processes for allocating funds to projects in a way that ensures progress toward more sustainable transportation systems. There are already examples of prioritization and allocation processes based on sustainability goals. Oregon DOT (ODOT) develops investment scenarios as part of its long-range planning process, which explore the impacts that different funding and policy packages would have on the transportation system. The packages are developed around different themes or emphases that could reflect sustainability goals. Minnesota DOT (MnDOT) and Washington State DOT (WSDOT) use performance-based planning aided by comprehensive performance measurement and reporting frameworks. Several research efforts have recently concluded or are underway to designate sustainability indicators for incorporation into those frameworks (for example, DeFlorio et al. 2011).

### 4.2 Critical issue areas in transportation system sustainability

Transportation agencies usually tackle multiple objectives, such as setting strategic goals and priorities, measuring and monitoring progress, prioritizing initiatives to best use limited funds, and addressing new challenges like climate change and freight system capacity. In addition to the opportunity areas described on the previous pages, the best practices are examples of how to address critical issues of transportation system sustainability.

#### Strategic Planning

Strategic planning is the development of a vision, mission, and strategic objectives, and the creation of a system for evaluating progress. An agency’s strategic

plan shapes its activities over a multi-year period. Therefore, incorporating sustainability principles during the strategic planning process can be an effective way to implement sustainable practices for facility design, operations, and maintenance. While sustainability is addressed commonly as a section or set of goals within a strategic plan, a better approach is to transform the strategic plan into a sustainability plan within an overall sustainability framework for planning. Scenario planning (especially by backcasting) or spatial planning are helpful processes for creating a strategic plan. Sustainability plans are important because they provide a comprehensive and coordinated way to address sustainable transportation within the agency and across complementary state agencies.

**Fiscally-constrained Planning**

In the near future, one of the largest challenges facing federal, state, and local transportation agencies is generating enough funding to maintain existing infrastructure and expand capacity to meet future travel demand. With serious concerns about the solvency of the Highway Trust Fund and state governments struggling to balance budgets, transportation agencies are turning to menus of different funding sources and financing strategies, including user fees and public-private partnerships. Even with new funding sources and financing strategies, transportation funding will be limited and agencies will need to make tough decisions about the best investments in system improvements. By identifying sustainability criteria and exploring different funding scenarios, transportation agencies and political leaders can make well-informed investment decisions (for example, ODOT uses Investment Scenarios in its statewide transportation plan). Life cycle cost analyses can also inform long-term funding priorities

by quantifying not only initial costs and impacts, but also costs incurred later in a facility or program's life span.

**Performance Measurement, Management, and Performance-based Planning**

In addition to collecting traditional mobility and environmental performance measures, transportation agencies will need to begin developing and monitoring measures of sustainability so they can weigh impacts on the larger social and economic systems in their investment decisions. Effective performance-based planning for sustainability is dependent on two things: (1) defining meaningful and acceptable performance measures that can gauge the results of sustainable development initiatives and practices and (2) developing a framework for evaluating and monitoring performance and then using that feedback to influence future planning efforts.

**Climate Change Adaptation and Mitigation**

Climate change is an important element of environmental sustainability, one that is gaining attention across the country and internationally. Nearly one-third of the state DOTs reported involvement in or development of a climate change initiative in a national survey conducted in 2008-2009. Recently, there has been a wave of state policies related to climate change, some of which are in response to regional efforts to reduce greenhouse gas (GHG) emissions while others have followed state legislation or executive orders. Climate change initiatives focus mostly on mitigation; however, there is growing attention to adaptation needs. For example, Caltrans and other state agencies have sponsored a sea-level rise study to identify potential impacts to critical infrastructure, and FHWA is sponsoring a major study of the Gulf Coast's vulnerability to climate change.

### Freight Planning

AASHTO named freight as one of the top 10 transportation issues in 2011. Citing problems like congested freeways and ports with limited access, AASHTO views planning for more efficient freight movement as one of the keys to economic competitiveness in the future. There are a few examples of transportation agencies planning specifically for freight movement, and one in particular (Transport for London) uses a sustainability framework for planning.

### Social Sustainability Assessment

Transportation agencies both in the US and abroad struggle most with assessing social sustainability, one of the three major objectives of sustainability. This may be due to difficulty in defining social sustainability or to a lack of appropriate data to conduct the analyses that provide meaningful information for decision-making. Environmental Justice (EJ) and Context Sensitive Solutions (CSS) policies are the most common ways US agencies address social equity, through consideration of the local context and an extensive public involvement process. Comprehensive assessment methodologies are needed to evaluate the actual impacts of EJ and CSS policies. HIAs are an example of such a method, and are starting to be used for transportation planning and project evaluation in both the US and abroad.

## 4.3 Descriptions of best practices from FHWA Guidebook

Table 4 provides a summary of the best practices that are described in more detail (and with references for more information) in Chapter 5 of the FHWA Guidebook. The table shows how the best practices reflect the findings described in the previous section.

**Table 4. Summary of best practices**

| Best practice | Critical Issue(s) | Phase(s) of Planning Process | Type of Practice or Tool |
|---|---|---|---|
| Caltrans Smart Mobility Framework & Regional Blueprint Planning | Strategic Planning; Performance Measurement | Goals and Objectives, Performance Measures, Evaluation | Sustainability Planning, Performance Measurement, Land Use and Transportation Planning |
| PennDOT Smart Transportation | Strategic Planning | Goals and Objectives, Alternative Improvement Strategies | Context-Sensitive Solutions, Transportation & Land Use Coordination, Multi-modal Planning; Inter-Agency Cooperation |
| New Zealand Ministry of Transport 2008 Transport Strategy | Strategic Planning; Performance Measurement | Goals and Objectives, Performance Measures, Evaluation | Sustainability Plan; Performance Measurement Framework |
| NJDOT New Jersey Future In Transportation (NJFIT) | Strategic Planning | Goals and Objectives, Alternative Improvement Strategies, Performance Measures, Evaluation | Context-Sensitive Solutions, Transportation & Land Use Coordination, Multi-modal Planning |
| NYSDOT GreenLITES | Climate Change (Green Design) | Evaluation | Green Transportation Standards |
| WSDOT Gray Notebook | Performance Measurement | Evaluation, Performance Measures | Performance Measurement |
| ODOT Investment Scenarios | Fiscally-constrained Planning | Alternative Improvement Strategies, Evaluation | Financial Sustainability; Multi-criteria Decision Making; Scenario Planning |
| Health Impact Assessment | Social Sustainability Assessment | Data, Analysis Methods, Evaluation | Social Sustainability |
| NYSDOT Climate Change and Energy Efficiency Team | Climate Change | Goals and Objectives, Data, Analysis Methods, Evaluation | Climate Change; Energy Use/Efficiency |
| Caltrans Climate Action Program | Climate Change | Goals and Objectives, Alternative Improvement Strategies, Evaluation, Performance | Climate Change |

**Table 4 continued**

| | | | |
|---|---|---|---|
| WSDOT Climate Change Initiatives | Climate Change | Goals and Objectives, Alternative Improvement Strategies, Evaluation, Performance Measurement | Climate Change, GHG Emissions Monitoring |
| London Sustainable Freight Distribution Plan | Freight Planning | Goals and Objectives, Alternative Improvement Strategies | Freight Planning |
| WSDOT Freight Planning | Freight Planning | Goals and Objectives, Alternative Improvement Strategies | Freight Planning |
| Comprehensive Life Cycle Assessment for Sustainability | Strategic Planning; Performance-based Planning | Alternative Improvement Strategies, Evaluation | Financial Sustainability; Multi-criteria Decision Making |

### Caltrans Smart Mobility Framework and Regional Planning

Caltrans' vision for the 2025 California Transportation Plan is of the three Es of sustainability -- environment, economy, and equity. In 2007, the agency was one of six recipients of Smart Growth Implementation Assistance (SGIA) from the USEPA. With EPA's assistance, Caltrans developed the Smart Mobility Framework (SMF) to assess how well plans, programs and projects meet smart mobility principles and objectives. The SMF is designed to help Caltrans address State mandates to find solutions to climate change and reduce greenhouse gas emissions, the need to reduce per capita vehicle miles traveled, the demand for a safe transportation system that gets people and goods to their destinations, and the commitment to create a transportation system that advances social equity and environmental justice, as set forth in Caltrans' California Transportation Plan.

The SMF for transportation planning and project development centers on six principles reflective of sustainability: Location Efficiency, Reliable Mobility, Health and

Safety, Environmental Stewardship, Social Equity, and a Robust Economy. The Smart Mobility principles will be integrated into Caltrans' day-to-day operations through a wide range of DOT and partner activities including: Planning and Programming, Standards and Guidelines, Transportation Projects and Programs, Development and Conservation Projects and Programs, Decision Support, and Performance Measures. The entire framework and implementation plan are described in a guidebook, but three unique features of the Smart Mobility program are Smart Mobility Place Types, the California Interregional Blueprint, and a detailed Action Plan that contains performance measures.

**PennDOT Smart Transportation framework and design guidance**

Smart Transportation is a planning framework that links land use and transportation planning, focuses on system maintenance and preservation, balances priorities among all transportation modes, requires collaboration with planning partners, and emphasizes true fiscal responsibility. In 1999, Pennsylvania recognized that the state's historic pattern of land development and transportation investments was no longer sustainable for a variety of financial, environmental, and social reasons. Further, public funding for all transportation improvements was limited and costs for new infrastructure were soaring. In response to these challenges, PennDOT embarked on the Smart Transportation movement to use transportation funds efficiently and achieve design flexibility, choices, safety, and land use coordination.

The cornerstone of Smart Transportation is collaboration with other agencies, states, and local communities to make financially, environmentally, and socially sustainable decisions. For example, in March 2008, PennDOT and NJDOT released their collective report entitled "Smart Transportation Guidebook: Planning and Designing

Highways and Streets that Support Sustainable and Livable Communities". The guidebook, which received a 2008 FHWA & FTA Transportation Planning Excellence Award, capitalizes on the flexibility of AASHTO Green Book standards and includes matrices that match land use contexts to appropriate design standards and roadway treatments.

As of March 2010, PennDOT was transforming its long range planning process to include project selection criteria for the next program that incorporate Smart Transportation themes. At the project planning level, Smart Transportation principles are incorporated into every stage, beginning with the definition of the project problem and continuing through development of project alternatives, environmental approvals, final design, and advancement of future funding phases. Since the release of the guidebook, PennDOT has engaged in an extensive internal and public campaign to make Smart Transportation the standard operating procedure for transportation planning and design in the state. In addition to the education efforts and revision of design manuals and the project development process, PennDOT also set aside a small amount of funding to support Smart Transportation projects through the Pennsylvania Community Transportation Initiative (PCTI).

**New Zealand Ministry of Transport's 2008 Transport Strategy**

The 2008 New Zealand Transport Strategy (NZTS) is an example of a national transportation strategy and monitoring system based on sustainability principles. The plan is an update of the 2002 Transport Strategy and outlines a vision for a sustainable transportation system, to be operationalized by objectives, measurable targets, and indicators. The Ministry also included a mechanism to periodically review and revise its

framework as progress is made or new data becomes available for indicators. While the NZTS is non-statutory, it is supported by a statutory document called the Government Policy Statement on Land Transport Funding.

To demonstrate progress towards achieving the targets, the Ministry created a Transport Monitoring Indicator Framework, which is a monitoring and review process that covers accountability for delivery of the strategy, a monitoring framework, how gaps in knowledge will be dealt with, proposals for strengthening targets, and a review cycle for the strategy. Further, the indicators are available to the public via an online interactive version to allow for easy and transparent tracking. In terms of implementing new policies and practices to achieve the targets, the NZTS outlines "strategic priorities" to achieve the plan's objectives.

The NZTS is not a static document - in 2010, the strategy's effectiveness was assessed and many of the targets were revised and strengthened. After that initial review, the strategy is to be reviewed every six years to monitor performance and revise strategies to account for uncertainty in some of the external drivers like population growth and transport fuel prices. Over time, the Ministry of Transport hopes that all national transportation targets adopted by other agencies will be consistent with the NZTS.

**New Jersey Future in Transportation (NJFIT) program**

NJDOT's New Jersey Future in Transportation (NJFIT) program is a sustainability initiative focused on transportation and land use planning. The program emphasizes working with local communities and agencies to connect and develop existing transportation corridors. This approach is intended to provide more and higher

quality transportation options and stimulate context-sensitive development while limiting tax expenditures and satisfying needs of all stakeholders. The NJFIT program and other smart growth initiatives are managed by the DOT's Office of Transportation and Sustainable Communities within the Statewide Planning Department. NJFIT emphasizes re-investment in and transformation of roadways and transit centers using a variety of tools rather than construction of new facilities. It has led to three notable initiatives, which have been recognized nationally for tackling coordination of transportation and land use for both roadway and transit projects.

In 1999, NJDOT implemented the first program, the Integrated Land Use and Transportation Corridors. The program is a community-based initiative using visioning exercises to study the relationship between transportation projects and the surrounding built environment. The visioning leads to corridor plans that guide future decisions about the roadway design and development. The second program, also started in 1999, is the Transit Villages Initiative that involves coordination with ten other state agencies for "placemaking" around New Jersey's transit stations. The goal of the initiative is to revitalize communities by making transit facilities a focal point for both transportation and daily life. The newest initiative is the Mobility and Community Form program started in 2006 to provide guidance for municipal planning, visioning processes, and form-based codes (an alternative to traditional land use zoning).

**NYSDOT GreenLITES Certification Program**

In 1998, the U.S. Green Building Council introduced Leadership in Energy and Environmental Design (LEED), a green rating system for buildings. The LEED system, while not required, has led to marked improvements in the environmental sustainability

of buildings, and certification has become a great marketing tool for new developments due to positive public perception. In 2008, NYSDOT introduced the first operational green rating system for transportation facilities and agency activities and called it GreenLITES (or Leadership In Transportation and Environmental Sustainability). Different levels of NYSDOT, including planning and project development, design, construction, maintenance and operations, are implementing GreenLITES certifications tailored to their specific program areas. The GreenLITES Project Design Certification Program, based on LEED, is a self-certification program that is used primarily for internal management for NYSDOT to measure performance, recognize good practices, and identify areas for improvement. The program also provides a way for NYSDOT to demonstrate sustainability achievements to the public.

In addition to the project design certification, NYSDOT launched the GreenLITES Operations program, which recognizes and increases awareness of sustainable methods and practices already incorporate into NYSDOT's daily operations and to expand use of those practices and other innovative alternatives to improve transportation sustainability. Then in 2010, NYSDOT released a draft GreenLITES Regional Assessment Rubric that would assess all projects, residencies, and activities across the DOT's regions. This rubric represented an expansion of the GreenLITES program to include more transit, pedestrian, and rail projects. GreenLITES concepts are also being incorporated into the planning process by including environmental sustainability goals in long-range plans and the development of the Department's capital program. At the local level, NYSDOT has introduced a Project Solicitation Tool that

allows project sponsors to review and rate the sustainability of proposed transportation projects.

GreenLITES is designed to be flexible and will evolve over time as new sustainability practices are developed. Project certifications will be recognized internally and presented in an annual report to the DOT Commissioner. In addition to its effects on NYSDOT, GreenLITES is influencing sustainability practices at other transportation agencies. For example, Illinois DOT modeled its Illinois – Livable and Sustainable Transportation (I-LAST) Rating System after the GreenLITES system, and the Pennsylvania Turnpike Commission adapted GreenLITES to analyze the design and construction phases of new or expanded facilities.

**WSDOT Gray Notebook**

The "Gray Notebook", so called for its gray cover, provides a quarterly, in-depth report of goals and measures and a "Performance Dashboard" of key indicators for WSDOT. In addition to informing DOT staff, the Gray Notebook also provides accountability to the state government and citizens. The Gray Notebook is more than a performance report – it is representative of WSDOT's commitment to performance-based planning and a framework that could be used to monitor achievement of sustainability goals.

WSDOT started publishing *Measures, Markers, and Mileposts* (or the "Gray Notebook") in 2001 and released its 44$^{th}$ Edition in February 2012. The Gray Notebook (GNB) is published in February, May, August, and November and provides in-depth reports on DOT and transportation system performance. It is a tool for internal monitoring and for public and legislative communication. The GNB's sections are

organized around WSDOT's five legislative and strategic policy goals, which reflect sustainable transportation principles: Preservation, Safety, Mobility, Environment, and Stewardship. Over 100 performance measures are linked to each of the goals and reviewed at least annually.

The GNB is widely distributed to subscribers, including all legislators, the Governor, the Transportation Commission, interest groups, city and county governments, national academic and research organizations, national partners, AASHTO members, and international colleagues. Additionally, WSDOT takes advantage of its website to distribute the information to citizens and other interested parties. In addition to metrics, performance management at WSDOT includes state-of-the-art performance assessments of projects and programs, referred to as "before and after" studies.

The Gray Notebook has led to important internal and external outcomes. Internally, system indicators are tracked and the DOT tries to determine what causes an indicator to change so corrective or preventative actions can be taken. This performance monitoring helps agency executives and senior managers with decision-making and performance measurement, and has become part of the culture at WSDOT because producing the GNB necessarily involves conversations among staff about performance. Externally, the largest impact of such transparent measuring and reporting of performance results was the increased confidence of the Governor, Legislature and public in the projects and programs managed by WSDOT.

**Oregon DOT's Investment Scenarios**

With competing goals and declining funds, ODOT needed a way to investigate the impacts of its investment decisions and establish key strategies for implementing the

Oregon Transportation Plan (OTP). To accomplish this, ODOT analyzed seven system scenarios and then packaged them into three investment scenarios. The scenario analysis allowed ODOT to consider both system impacts and broader sustainability implications.

The OTP, adopted in September 2006, assesses seven policy scenarios and three investment scenarios to determine how the level and type of investment will influence system performance. Based on a needs assessment, ODOT determined funding priorities and three types of scenarios: a reference scenario, sensitivity scenarios, and policy scenarios. The reference scenario includes projects that could be funded if the DOT's purchasing power remained level through 2030. It was used as a baseline for comparison with the other six scenarios. The two sensitivity scenarios consider the impacts of increasing fuel prices and relaxing land use policies. The four policy scenarios (flat funding or decreasing purchasing power, maximum operations, major improvements, and pricing) examine impacts of potential transportation policy decisions involving revenue levels, sources, and priorities. The scenarios were assessed based on eight criteria: (1) mobility and accessibility, (2) economic vitality, (3) effectiveness and efficiency, (4) equity, (5) public support for the system and financial feasibility, (6) reliability and responsiveness, (7) safety, and (8) sustainability. Potential impacts were analyzed by mode to determine whether there had been improvement or decline over time.

Results of the policy scenario analysis influenced creation of the implementation and investment plans. In particular, the investment framework includes three investment scenarios that illustrate how the publicly-supported transportation infrastructure and services would respond to different levels of funding. The investment scenarios are combinations of the policy scenarios discussed previously. ODOT analyzed system

impacts by transportation sector for each of the investment scenarios in terms of maintenance, preservation, operations, and system expansion.

ODOT developed the policy and investment scenarios to quantify potential impacts of transportation decisions on infrastructure conditions and the state's economy. Investigating trade-offs among the different scenarios helped decision-makers identify priorities and establish key strategies for implementing the OTP.

**Health Impact Assessment**

Health Impact Assessment (HIA) is a methodology for assessing the social impacts of transportation projects and policies. HIAs are used to determine impacts of transportation on public health and wellness, including physical and mental health. HIAs can also analyze the social equity implications of projects and policies by focusing on underserved or vulnerable populations such as the elderly, youth, carless or low-income households, and racial minority groups. HIA can be applied at the project or planning level, and can be used prior to or following construction/implementation.

HIA recognizes that there are numerous health determinants and the built environment (including transportation infrastructure) has a significant influence on individual and collective health or healthy behaviors. In the past, HIA was used as a way to ensure that health impacts were considered in the Environmental Impact Assessment (EIA) process. Today, HIA provides a way to combine issues of environmental and social sustainability and to directly influence decision making by bringing health to the forefront. Unlike EIA, an HIA is a voluntary process in US transportation planning.

HIA generally follows six steps (screening, scoping, evaluating health impacts, disseminating results, acting on results, and monitoring outcomes) and there are three

main types of HIA, which increase in scope, complexity and required resources: (1) Rapid Health Impact Appraisal, (2) Health Impact Analysis, and (3) Health Impact Review. Regardless of the type of HIA used, each one is "place-based" or customized to the community in question by establishing metrics for measuring and monitoring health impact.

Several HIAs have been conducted in the US and internationally over the past two decades, and they used a variety of assessment methods such as literature review, expert panels, GIS mapping, public involvement (interviews or surveys), analysis/forecasting of travel and census data, and review of existing programs or planning documents. Most of the HIAs include recommendations for changing the proposed policy or program. The effectiveness of HIAs is often a function of the commitment, in terms of time and monetary resources, and buy-in from transportation officials, the public, and politicians.

**NYSDOT Climate Change and Energy Efficiency Team**

NYSDOT's Climate Change and Energy Efficiency Team coordinates internal and external initiatives including the following: reporting greenhouse gas emissions for transportation improvement programs (TIPs) and long-range plans; analyzing emissions at the project level to compare alternatives; identifying ways to reduce transportation energy costs for the public; promoting energy efficient programs and projects; and reducing NYSDOT's carbon footprint.

In response to the state's energy and climate change directives, NYSDOT established a Climate Change & Energy Efficiency team (CC/EE Team), which consists of approximately 70 members representing departments from throughout the agency. The team is supported at the Executive level and is charged with institutionalizing climate

change/energy efficiency into everything DOT does. The team's mission is to assist the DOT in its efforts to have the DOT and the State's transportation sector reduce their greenhouse gas emissions and reliance on petroleum. The initiative is coordinated by the Office of the Environment and the Policy and Planning Division. To reduce greenhouse gas emissions and energy use from the transportation sector, NYSDOT has strategies on four fronts (commonly called the four-legged stool): vehicle technology, fuels, vehicle miles traveled (VMT)/demand management, and vehicle/system operations. Proposed activities range from shaping major policy and project directions to influencing actions of individual DOT employees.

NYSDOT's climate change initiatives address both planning and project development. At the planning level, the DOT compares the direct and indirect energy requirements of the no-action scenario with the TIP or LRP Scenario. Project-level analysis is conducted for major projects, and includes a comparison among different alternatives including the no-build scenario. Project-level calculations cover construction, operational, and maintenance aspects of the projects. Another notable CC/EE initiative is the Clean Air NY campaign. It is a year-round program that seeks to improve air quality in the New York metropolitan area by educating residents and organizations about simple ways they can change their travel behavior. For example, NYSDOT representatives serve on the NYS Climate Action Council's Transportation and Land Use Technical Work Group and the Adaptation Technical Work Group, which are helping to develop the NYS Climate Action Plan and each work group is contributing data to the state greenhouse gas inventory The true impact of NYSDOT's CC/EE initiatives will be seen over time with the release of future greenhouse gas emission inventories. However, from an institutional

standpoint, benefits are already being seen from better collaboration between NYSDOT, other state agencies, local agencies, and private sector partners.

**Caltrans Climate Action Program**

In response to the serious economic and environmental threats posed by climate change, the California Governor's Office and State Legislature issued a series of directives for dealing with greenhouse gas emissions and climate change impacts. Caltrans' Climate Action Program (CAP) was developed as an interdisciplinary approach to address both emission reduction and adaptation measures to prepare for climate change impacts. The purpose is to make climate change a part of day-to-day activities and to promote, facilitate, and coordinate implementation of strategies with partner agencies. The CAP serves as a resource for technical assistance, training, information exchange, and partnership-building opportunities. Guided by the CAP, Caltrans is working in two areas: building a more efficient transportation system and providing cleaner, more energy efficient transportation operations. The first approach focuses on reducing, managing, and eliminating trips that cause congestion and emissions by investing in ITS, demand management, value pricing, smart land use, and market based strategies. The second approach will incorporate energy efficiency and GHG reduction measures into the planning, design, construction, operations and maintenance of transportation facilities, fleets, and buildings.

In fulfillment of a work product, Caltrans was one of the first state agencies to successfully certify its GHG inventory with the California Climate Action Registry, a private nonprofit organization that promotes early actions to reduce emissions and develops credible, accurate, and consistent GHG reporting standards. On the adaptation

side, Caltrans conducted a sea-level risk assessment with the California Resources Agency to investigate the impacts and potential costs from changes in temperature and precipitation level, and commissioned a more extensive study with the National Academy of Sciences. Caltrans is also working with University of California-Davis to develop "hot-spot maps" that will identify critical transportation infrastructure located throughout the entire state that will need to be adapted or reconstructed in preparation for sea level rise. In addition, Caltrans provides guidance and will assist regional agencies to incorporate GHG reduction strategies into Regional Blueprint plans.

**WSDOT's Moving Washington**

WSDOT has compiled several initiatives and projects to address climate change within Washington State. Many of WSDOT's climate change initiatives are part of the agency's congestion mitigation program, Moving Washington. Moving Washington was developed as a 10-year program to address the findings of a congestion performance audit of the Puget Sound region. The purpose of Moving Washington is to enhance mobility and improve future system efficiency by reducing congestion. WSDOT's approach to limiting congestion falls into three categories: (1) add capacity strategically, (2) operate efficiently, and (3) manage demand.

WSDOT enhances the capacity of its road system by reducing the number of serious "traffic-flow bottlenecks". However, simply adding more roads is not a long-term sustainable solution, so WSDOT also explores multi-modal solutions. For example, the WSDOT Freight Plan suggests capacity improvements to rail facilities as well.

In order to prevent system congestion, WSDOT implements innovative traffic technologies to maintain high system efficiency and safety. For example, they use Active

Traffic Management (ATM), which uses sensors embedded in the roadway to adjust speed limits on electronic signs according to road conditions. These dynamic signs also inform drivers of changes in the road conditions, such as accidents, and re-routes drivers to prevent congestion from building up. WSDOT has also piloted High Occupancy Toll (HOT) Lanes.

To manage demand, WSDOT employs a Transportation Demand Management (TDM) program that provides alternatives for commuters such as riding the bus or train, vanpools, and carpools to reduce single occupant vehicle traffic while at the same time increasing the carrying capacity of Washington's transportation system. The TDM program includes the Commuter Trip Reductions (CTR) program, Trip Reduction Performance Program (TRPP), and the Vanpool Investment Program. All three programs were created by the Washington State Legislature but are implemented and managed by WSDOT.

**London Sustainable Freight Distribution Plan**

The London Sustainable Freight Distribution Plan identifies the challenges posed by the growth of London and climate change, and details how freight transportation intersects with both challenges. The Plan explains the strong need for partnership among public and private entities to achieve a vision of sustainable freight distribution, and proposes actions for addressing the challenges. The Plan also reveals the shortage of freight data and outlines a strategy to collect better data. In order to monitor progress on proposed actions, the Plan includes performance measures and a framework for annual reporting.

Transport for London (TfL) recognizes that proactive measures and partnerships with freight operators are necessary for a sustainable freight system. TfL coordinates the London Sustainable Distribution Partnership (LSDP), a group charged with identifying strategic freight investments for London.

In order to achieve LSDP's sustainability vision for London's freight system, TfL embarked on a strategic freight planning study. The Plan explicitly lays out seven goals in terms of the three dimensions of sustainable development: economy, environment society. TfL is working on implementation of the plan with multiple partners: the UK Department for Transport, London Councils, British Waterways, Port of London Authority, Learning and Skills Council, Greater London Authority, Thames Gateway Development Corporation, Olympic Delivery Authority, and London's Freight Quality Partnerships. In order to achieve its goals, the LSFDP identifies four projects to be completed from 2008 to 2018. The Plan quantifies the economic, environmental, and social impacts of each project and establishes specific milestones over the 10-year period. Progress toward the vision is going to be reported annually by seven main "progress measures" that reflect the three areas of sustainability: economy, environment, society. Additional measures will be added under each main measure as data sources are developed.

**WSDOT Freight Planning**

Freight is a national concern in the US and WSDOT is being proactive with planning in order to position itself for future state and federal investments in the freight system. Freight is also a big and vital industry in Washington. WSDOT's Freight Division is responsible for trucking, rail, and marine freight movement in three ways:

1. Developing the state's strategic investment plan for freight, which is based on the Washington Transportation Plan (WTP) Freight Report.
2. Building regional participation and support for the freight investment plan by working together with freight system partners.
3. Managing the state's freight and passenger rail capital programs and operations.

As part of the Washington Transportation Plan for 2007-2026, the Freight Systems Division completed a Freight Report that identified challenges and strategic investments for improving freight movement within and through the state. The Freight Report is a multi-modal study focusing on roadway, rail, water, pipeline, and air transport. The freight planning process started with data collection on population, freight movement, economic impacts, traffic conditions, highway features that may impede truck movement, and detailed rail freight statistics. The Freight Division then used GIS files to map the freight network and key resources. The planning process also involved extensive stakeholder outreach, including numerous focus groups with state, regional, local, and federal partners.

Based on all of the analysis, WSDOT identified twelve "highly productive investments" in the freight network to deal with identified bottlenecks and weather or maintenance-related deficiencies in the system. Washington State's freight planning is a best practice because it examines how the freight system affects the environment (emissions, dredging waterways), the economy (manufacturers and freight companies), and society (way-of-life for Washingtonians who rely on freight-related industries and Tribal Freight Needs).

In addition to its own planning efforts, WSDOT also participates in notable public private partnerships. The *Regional Freight Mobility Roundtable* is a nationally recognized public-private forum to define and recommend actions serving freight mobility needs in and through the central Puget Sound region. WSDOT was also an original partner in the Freight Action Strategy (FAST) Corridor Program. FAST is an innovative partnership that is working to improve the movement of freight along the Everett-Seattle-Tacoma corridor.

**Life Cycle Analysis for Sustainability**

The environmental, economic, and social implications of transportation infrastructure are not fully experienced until long after construction is completed. Over the course of its design life, infrastructure leads to considerable costs for annual maintenance and periodic repairs. It also costs money to monitor infrastructure for potential environmental or social impacts. Even at the end of its 20, 30, or 50-year design life, transportation infrastructure has considerable impacts including potential safety issues, demolition costs, and waste recycling or disposal. By considering the full costs of transportation projects over their design life, transportation agencies can prioritize capital and operating funds better or identify future funding gaps. Figure 1 depicts the concept of life cycle engineering.

Life Cycle Cost Analysis (LCCA) or Life Cycle Costing (LCC) is a tool for evaluating the overall long-term economic efficiency of a system, product, or service. LCCA is valuable for comparing alternatives; however, it does not examine environmental or social impacts. LCCA used extensively for infrastructure asset management and by many state DOTs for pavement selection. Life Cycle Assessment

(LCA) is a method for assessing the total environmental impact of a system, product or service. It can be a valuable tool for the sustainability evaluation of competing alternatives (e.g., policies, plans, projects etc.) and has been used for a range of applications in infrastructure decision making, including a couple of analyses of transportation infrastructure.

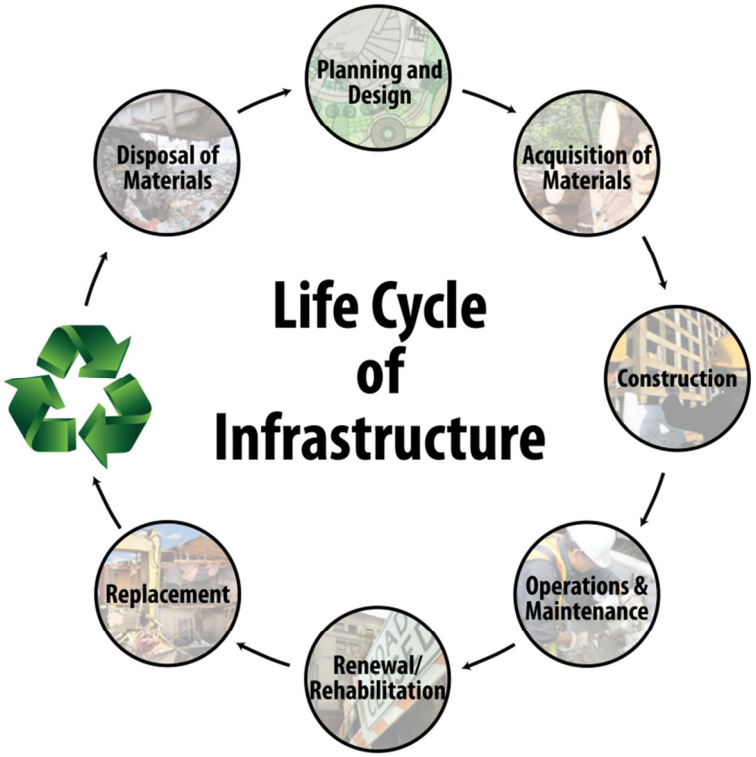


**Figure 1. Life Cycle Engineering (FHWA 2011)**

In order to consider sustainability over the entire lifecycle of a transportation project or program, an integrated approach to LCA and LCCA could be applied. There are also tools like HIA that could be integrated into an LCA process to assess broader social impacts. The integration of LCCA with Environmental LCA and Social LCA could help transportation agencies analyze the full range of sustainability impacts though there may be a curve with data gathering or collection.

The next chapter describes the research design and methodology used to develop the sustainability assessment tool. The information reviewed in this chapter and Chapters 2 and 3 significantly influenced the design of the tool.

# CHAPTER 5

# RESEARCH DESIGN AND METHODOLOGY

## 5.1 Overview of research design

A mixed-methods research design employing an expert panel and case studies was used to investigate two related research questions that arose from the development of the *Transportation Planning for Sustainability Guidebook* and involvement with the State Smart Transportation Initiative (SSTI), which is an effort to assess sustainability efforts at state DOTs and share best practices. The first research question is: what is an appropriate framework for evaluating sustainability at a strategic, organizational level? During the survey and case study research for the guidebook, it was observed that sustainability was being siloed at most state DOTs. This means that sustainability efforts were often coordinated by a special unit within a Planning and/or Environment division, and sustainability efforts were often topical and narrowly focused (for example, greenhouse gas emissions). Except for a few initiatives, sustainability efforts were mainly focused at the project planning or project development level. This research focused on developing a framework that will facilitate discussions, visioning, decision making, and supporting analysis at the Executive and upper management level so that sustainability becomes a part of the agency's culture and is not limited to distinct practices or to specific units. Such a framework needs to first capture an agency's status with respect to addressing sustainability and then identify gaps. The goal of this assessment is to lead to culture change and system-level adjustments while allowing for both top-down and bottom-up approaches. Accordingly, the second research question is how can a strategic, organizational-level sustainability assessment be applied effectively at state DOTs? In

other words, what should the process look like? Who should be involved? What are expected outcomes? This group of questions addresses the issue of "process" which is just as important as "content" in a strategic planning effort.

During the research process, additional questions were formulated that were either addressed immediately or that will inform future research. For example, do the factors as a whole describe an agency that is capable of planning, designing, building, and operating a sustainable transportation system? What are the *most important* factors for transforming an agency's culture to a sustainability culture? Are the factors applicable to a range of DOTs? Finally, what are appropriate organizational performance measures and outcome measures to monitor success of specific strategies?

The mixed-methods approach was motivated by a pragmatist world-view, which posits that research always occurs in social, historical, political, and other contexts that can change, and thus truth is what works at the time. Pragmatist research is problem-centered, pluralistic, real-world practice-oriented and focused on consequences of action. Such a worldview can lead to mixed-methods approaches (combining quantitative and qualitative data analysis), or whatever approach provides understanding of the research problem (Creswell 1998; Creswell 2009). The participants in this research represent experts in the transportation field, and their position and the organization that employs them shape their perspective on sustainability. For this research, personal characteristics of the participants were not important but rather the context of the organization that they represent.

Qualitative components of the research included the expert panel and literature-based design of the SWOT framework along with semi-structured interviews as part of

the case study process. The interviews utilized open-ended questions to explore how the SWOT assessment was completed and how the tool could be applied by state DOTs. The other key component of the case studies was the actual responses to the assessment. The responses constitute both quantitative (for example, categorical priority rankings) and qualitative (for example, evidence to support designations) data, hence a mixed-methods approach was warranted. However, it is important to note that due to the case study approach which included a small sample size, statistical analysis was not appropriate and the case studies cannot be generalized to represent all state DOTs. However, when considered in tandem with the previous survey data (from the FHWA Guidebook) and the literature, the assessment responses and interviews offer insights into how the tool could improve institutionalization of sustainability at transportation agencies.

The primary audience for the sustainability assessment framework is state DOTs. This audience was selected to limit the scope of the initial research effort and to build on previous research that was also focused on DOTs. However, most factors included in the framework are generalizable enough that MPOs, transit agencies, or local transportation departments could apply the SWOT tool internally or collaborate with a DOT to complete it.

## 5.2 Methodology

Following an extensive literature review of strategic planning and sustainability concepts and applications in transportation (Chapters 2-4), the research progressed through five steps: (1) determining the type of framework to develop, (2) developing a generic framework or template, (3) validating and revising the framework through expert panel review, (4) conducting and analyzing case studies to test the framework, and (5)

compiling a set of performance measures to monitor strategies. Steps 4 and 5 occurred concurrently. The research process is described in more detail on the following pages.

### 5.2.1 Step 1: Determining the type of framework

The goal of this research was to develop a strategic assessment framework, so different strategic planning methods (refer to literature review) were considered as a foundation for the framework. As indicated by the literature review, SWOT analysis is an accepted and commonly used tool for strategic planning. SWOT was selected as the framework's foundation in part because of the familiarity that staff in public agencies have with it and the intuitiveness of the conceptual framework. The cognitive demands of completing the assessment could therefore be placed on the use of the framework to evaluate institutionalization of sustainability rather than defining and understanding a complex strategic planning approach. This is particularly important because the target audience for the tool is transportation professionals (engineers, planners, administrators) rather than management scientists. Despite the strengths of SWOT, the literature cited numerous criticisms that were addressed throughout the development of the framework in order to create a more robust assessment. The resulting framework requires value judgments, analysis, and critical discussions in order to identify and prioritize strategic issues.

In addition to considering the strategic planning literature, self-assessment tools being used in transportation or related fields were studied to determine an effective format, types of questions/statements, and a preliminary scoring methodology. Reviewing examples of existing self-assessment and rating tools was important for informing the development of the strategic planning tool and for ensuring that the work does not

duplicate an existing effort. As Table 5 illustrates, there are several tools available to transportation agencies to evaluate various policies and programs, and each one uses a different scoring approach.

The FHWA Sustainable Highways tool (called INVEST) is particularly relevant to the proposed research effort because to an extent it addresses sustainability at the system planning level. However, it is important to note that the system-planning portion of the tool is not very extensive or comprehensive in comparison to the assessment areas discussed in Chapter 4. Further, the FHWA tool emphasizes planning content (rather than process) and seems to prioritize the environmental aspects of sustainability rather than taking a balanced approach. NYSDOT's GreenLITES program (described in Chapter 4) includes a planning tool that is designed as a checklist for local governments/agencies to complete before submitting a project for the state TIP. The GreenLITES planning tool covers material similar to the FHWA tool but in a more qualitative format. Other "green" rating tools (such as Greenroads, the Sustainable Transportation Access Rating System (STARS), and the Illinois – Livable and Sustainable Transportation (I-LAST) Rating System) are project-level assessment tools that are modeled after the LEED rating tool.

**Table 5. Examples of self-assessment and rating tools for transportation**

| | Assessment Areas | Rating Scale | Notes |
|---|---|---|---|
| 1.FHWA Sustainable Highways Self Evaluation Tool (INVEST)<br>Source: http://www.sustainablehighways.org/122/browse.html | • Comprehensive and Integrated Planning<br>• Environmental Management System<br>• Context Sensitive Solutions<br>• Equity Analysis<br>• Land Use Planning Integration<br>• Multimodal Transportation<br>• Professional Development<br>• Travel Demand Management<br>• Safety Management<br>• Air Quality and Greenhouse Gas Emissions<br>• Climate Change Effects<br>• Noise Reduction Management Plan<br>• Financial Sustainability | Points for different levels of implementation: 1 pt for having a plan, 3 points for measuring performance, 6 points for setting and achieving goals<br><br>Similar to LEED and GreenLITES for Projects in terms of credits and assigning achievement levels (bronze, silver, gold) | • On-line self-evaluation tool for roadway project development, operations and maintenance, and systems planning.<br>• Demo version of the project development tool is available online for review.<br>• Project development and operations and maintenance tools are more extensive/ comprehensive and objective. |
| 2. NYSDOT GreenLITES for Planning<br>Source: https://www.nysdot.gov/programs/greenlites/GreenLITES%20Planning | • Consistent with current local comprehensive plans<br>• Support many livability principles<br>• Protect and enhance the environment<br>• Support the economic vitality of the affected area<br>• Minimize adverse environmental impacts<br>• Contribute toward increasing accessibility and mobility options<br>• Employ unique financing arrangements<br>• Use methods that will lead to a longer life of the facility | Planning tool is a checklist for local governments to complete before proposing a project for a TIP. | Project Solicitation Tool (long-range planning) developed in cooperation with several NYS MPOs |

**Table 5 continued**

| | | | |
|---|---|---|---|
| 3.Self-Assessment Tool in the Asset Management for Transportation Guide<br>Source: http://downloads.transportation.org/AMGuide.pdf | • Policy goals and objectives<br>• Planning and programming<br>• Program delivery<br>• Information and Analysis | 1 – 4 (Strongly Disagree – Strongly Agree)<br>4 = benchmark<br>Score = average for subcategories | Used survey to determine benchmarks and identify common gaps<br>Instructions encourages use of leader and core team to discuss results and build consensus |
| 4.Traffic Incident Management (TIM) Self-Assessment<br>Source: http://ops.fhwa.dot.gov/eto_tim_pse/preparedness/tim/self.htm | • Strategic (formal policies, partnerships, performance measures)<br>• Tactical (response and clearance practices, traffic control)<br>• Support (Interagency communications, data sharing, ITS and traveler info) | Low, Medium, High (level of activity) – supplemental scores for Low/Medium to clarify | Annual assessment in each urban area; informs national TIM policy<br>Excel format and online entry; good for benchmarking and monitoring |
| 5. Traffic Signal Operation Self-Assessment (for National Report Card)<br>http://www.ite.org/selfassessment/background.asp | • Management<br>• Signal operation at individual intersections<br>• Signal operation in coordinated systems<br>• Signal timing practices<br>• Traffic monitoring and data collection<br>• Maintenance | Scored from 1 to 5 (Not being done to Outstanding efforts with excellent results) then combined by review group, converted to 100-point scale, and given letter grade on report card | Agency benefits: increasing national and local awareness of need for improved signal operation; identifying strengths and opportunities; providing benchmark for performance |
| 6.Georgia Department of Community Affairs' Quality Community Objectives Local Assessment<br>http://www.dca.ga.gov/development/PlanningQualityGrowth/programs/downloads/PQGAssessment.pdf | Planning and quality growth checklist (total of 15 objectives):<br>• Development patterns (incl. infill, transportation alternatives, sense of place)<br>• Resource conservation (including open space, environment, heritage)<br>• Social and Economic Development<br>• Governmental Relations (regional cooperation) | Statements that are rated as "yes" or "no". "No" answers indicate where to focus planning and implementation efforts to meet quality community objectives. | To be used at the beginning and end of comprehensive planning process.<br>References planning and technical approaches; can receive assistance from DCA to apply those approaches. |

The sustainability SWOT tool is not intended to be used as a rating system or survey. Rather, it was designed as a decision-support tool to help agencies start identifying the best opportunities for advancing sustainability. The tool can be used to guide discussion and build consensus around sustainability priorities, organizational strengths and weaknesses, and appropriate strategies/actions for moving forward. It can also be used periodically to monitor implementation of strategies and to evaluate progress toward a more sustainability-oriented organizational framework. Therefore, assessments three through six in Table 5 were more relevant for determining a scoring approach.

Determining strength/weakness or opportunity/threat requires more than just a "yes" or "no" – it entails analysis and judgment of what the DOT is currently doing, how effective their practices are, and what the DOT could do better (if anything). In this sense, a "yes" could still be a weakness of the agency because the practice is not advancing the agency's goals. The assessor has to grapple with whether or not a particular factor is making the agency more successful in planning, designing, building, and operating a sustainable transportation system. Similarly, some external factors can be easily classified as either an opportunity or a strength, but for others the designation may need to be qualified by conditions (for example, high fuel prices may be a threat because of negative public perception of transportation, or it could be an opportunity for transportation agencies to push more fuel-efficient modes). The strategies that an agency develops will be directed by their value judgments on the factors and which sustainability issues to pursue first. Ultimately, a tool that can credibly link these value judgments with measurable impacts will help inform the decisions of agency officials.

The basic framework for the SWOT tool involves internal factors, external factors, and strategies that take into account interactions between internal and external factors. Internal factors can be directly controlled by the agency and are classified as either a Strength or a Weakness. External (situational) factors are those that the agency has little or no direct control over but can significantly influence the mission and operations of a transportation agency. External factors are classified as Opportunities or Threats and require a response from the agency. A strategy is an action-oriented approach to addressing the strategic issues revealed by the internal and external factors.

Each internal factor will first be designated as a strength or weakness of the organization. A strength can be defined as a factor internal to the organization that represents an advantage for addressing external factors (opportunities/threats) or other internal factors. On the other hand, a weakness is a factor internal to the organization that represents a limitation or disadvantage for addressing external factors. The factor may be absent altogether or require overcoming a significant barrier in order to be considered a strength. The next step is to designate each internal factor as a high, medium, or low-level priority for the agency to act on. Priority should be designated based on importance to promoting a sustainability culture in the organization, suitability as the "next step" for the organization, and expected scale of the impact. Evidence then needs to be provided to support the designation and priority ranking for each factor (or at a minimum for each high priority factor). Evidence should refer to a policy, plan, program, other document, data/performance measures, or an organizational feature. Alternatively, in the case of a "weakness", evidence could also be an explanation of barriers to implementation (staff expertise, financial resources, data availability, technology, etc.). Providing evidence will

facilitate discussions with other department managers or program leads when discussing overall priorities for the organization and potential strategies for moving the organization forward.

Each external factor will be designated as a current opportunity or threat to the organization. An opportunity is a factor external to the organization that could be leveraged to improve the organization's ability to plan, design, and implement a sustainable transportation system. A threat is a factor external to the organization that poses a particular challenge to the sustainability of the transportation system and to the activities of the organization. Each opportunity or threat should then be designated as an immediate, short-term, or long-term priority. This designation should be based on the level of urgency, or the need to act on the opportunity/threat quickly because there is a chance that it will change/occur and significantly impact the organization and its mission. It is important to consider urgency because an agency is more likely to act on an imminent threat or available opportunity due in part to public and political pressures. However, from a sustainability perspective, it is also very important to identify long-term factors that may warrant early planning or continual monitoring. As with the internal factors, discussions about strategic priorities will be aided by explanations of data/trends, research, legislation, etc. that support the designation and priority ranking for each factor (or at a minimum, immediate factors). Often there is a gap between an agency's goals and what is actually implemented, so a thorough and honest self-assessment will require explanation and verification (i.e., documentation) of existing practices.

Based on the concept of Weihrich's TOWS Matrix (explained in Chapter 3), a strategy should be developed to (a) leverage a strength to take advantage of an

opportunity, (b) utilize a strength to mitigate a threat, (c) strengthen a weakness to take advantage of an opportunity, or (d) minimize the weakness to protect against the threat. In order to support the implementation of strategies, initial consideration should be given to who should be responsible for implementing the strategy and what performance measure(s) could be used to monitor its effectiveness. A performance measure is defined as a quantifiable indicator of performance that can be used to evaluate progress toward achievement of a goal or objective. Development of strategies will take into account the prioritization of internal and external factors.

### 5.2.2 Step 2: Generating content for the self-assessment tool

Based on knowledge of the transportation planning process and the current state of sustainability practices at US transportation agencies, the next step was to develop the self-assessment statements using a SWOT approach. The statements (or factors) assess how well an agency incorporates sustainability into their policies, processes, and organizational structure/culture. They are intended to capture the current state and provide a roadmap for future efforts. The format (as described in Step 1) and content of the tool evolved over time because of feedback from the Expert Panel and Committee Members.

In general, the development of factors was guided by the following conceptual definition of sustainability and what it means for transportation systems and agencies:

> Sustainable development, as traditionally defined, is development that meets the needs of the present generation without compromising the ability of future generations to meet their needs. It is essentially the pursuit of sustainability in development, or the desired state that finds a protected natural environment and

resources, a vibrant and diversified economy, and at least a minimum acceptable quality of life for all citizens. Those three dimensions (environment, economy, and society/equity) are often referred to as the "triple bottom line" or three-legged stool of sustainability. The sustainability of the transportation system is a critical component of sustainable development for the community that owns and uses the system. Achieving sustainability requires evaluating the transportation system based on the triple bottom line and considering the long-term impacts of investments and the financial health of transportation agencies.

A list of potential internal factors was first generated from the literature, specific best practices highlighted in the FHWA Guidebook, peer review reports from SSTI, and recent research efforts to define sustainability performance measures. The initial brainstorming process resulted in over 100 internal factors, which were then reviewed in rounds to remove or refine vague factors, duplicative factors, factors at an inappropriate level (like the project level), and factors not linked directly to sustainability. An effort was also made to balance the number of factors representing different phases of long-range planning, programming, project development, operations, and maintenance. After this process, the framework contained 51 internal factors in four categories:

- 9 factors describing a "Sustainability Framework",
- 19 factors addressing "Organizational Culture and Structure",
- 9 factors related to "Collaboration and Communications", and
- 14 factors addressing "Sustainability in Standard Operating Procedures (Plans and Design Guidelines) - Institutionalizing Sustainability."

The four categories are reflective of key findings from the FHWA Guidebook (see Chapter 4) and the organization change literature. External factors were identified from similar sources as the internal factors, though current events, policy, and the broader sustainability literature were also influential. Twenty-two distinct external factors were identified to reflect political, economic, environmental, and social conditions that DOTs face.

### 5.2.3 Step 3: Expert panel reviews

An expert panel was recruited to validate and guide refinement of the content and format of the assessment framework. The eight panelists are current transportation practitioners that average over 25 years of experience in transportation and/or sustainability. The panelists have educational and professional backgrounds that cover engineering, planning, law, and policy. They have each held a variety of positions in the public, private, and non-profit sectors with all but one panelist having served as a high-level manager or executive of a state DOT. The panelists are also representative of geographic areas from across the United States. The expert panelists and their qualifications are described in Appendix A. In terms of validating and refining the framework's content, the panel focused on defining the most important or critical factors and making the tool accessible to a variety of DOTs while still pushing an ambitious sustainability agenda. In terms of refining the format, the panel focused on the clarity and functionality of the Excel-based assessment framework.

*Review 1 – December 8, 2011*

For the first review, panelists reviewed the basic format of the assessment and the internal and external factors. The original format for both sets is similar to the final

format found in Appendix B. Panelists provided feedback on the content in the following areas:

- Assess whether or not each factor is specific, clear, descriptive, and distinct (from other factors).
- Identify factors that could be cut (less critical to promoting sustainability or lacks broad applicability).
- Identify factors that should be added.
- Is the number of factors (currently 51 Internal, 22 External) manageable? If not, what would be a more manageable number?

They also provided feedback on the general format. Feedback was gathered through written comments and a conference call. Overall, the panel offered positive feedback on the comprehensiveness and overall design (including the four content areas for internal factors and the prioritization requirement). They also noted that the framework was distinct from other sustainability evaluation methods like FHWA INVEST and GreenLITES. However, there was agreement that there were too many factors and that some were less critical than others or overlapped with factors in other sections. Suggestions were made for which factors could be combined, removed, revised, or re-classified. One strategy for combining factors was to embed checklists (for example, select the types of organizations to collaborate with). The panel also discussed ways to manage the time commitment for completing the assessment (particularly during the testing phase) and agreed that providing evidence/explanation should only be "required" for the highest priority factors. While the total number of factors needed to be cut, there were a few areas that the panel agreed would require more emphasis:

operations and maintenance, programming and performance measurement, multi-modal, land use, and data availability/needs.

*Review 2 - Feb 15, 2012*

Based on feedback from the first review, the SWOT factors were revised, combined, re-classified, cut from and added to. The internal factor list was reduced from 51 to 33, and the factors were redistributed amongst the categories as follows: nine in Sustainability Framework, eight in Organizational Culture and Structure, six in Communication and Collaboration, and 10 in Sustainability in Standard Operating Procedures. Factors were added to address explicitly operations/maintenance and to link programming and planning. Other factors were revised to incorporate more explicitly multi-modal development and performance management. In addition, two of the factors had dropdown menus added to them in order to provide options for further focus. For example, "degree of collaboration with environmental agencies" could focus on the local, state, federal, or all levels. These options were offered because collaboration could vary across those levels (for example, it could be a strength at the local level but a weakness at the state level), or potential strategies for addressing collaboration could vary across the levels. In addition to the dropdown menus, two open slots were added so that DOTs would have the opportunity to identify additional factors that they felt were critical to their agency. The 22 external factors were reduced to 13, with four dropdown lists added and two open slots for additional factors. The reduction in external factors was in part achieved by clearly distinguishing those factors that were out of the DOTs' direct control, thereby reducing redundancy between the internal and external factor lists.

The expert panel again reviewed the factors for clarity, comprehensiveness, and importance. The overall factor lists were approved, though it was suggested that some of the factors needed more specific language and/or examples to clarify meaning. Within the internal factors, the panel recommended identifying clearer expectations for executives/managers and for employees and expanding "transit" to refer to both public and private operators.

After discussing the factors, the expert panel walked through how the assessment would be filled out and discussed options for generating strategies. The framework was developed in Microsoft Excel, which provided a familiar, accessible platform. The panel agreed that it was valuable to have the internal and external factors linked before discussing a strategy. However, instead of the tool suggesting strategies (documented in the literature and previous research), it was decided that DOTs would benefit more from developing their own strategies without prompting. By generating their own strategies, DOTs could identify more innovative solutions (since the state of the practice continues to change) and grapple with what the internal and external factors mean specifically to their organization. In addition, that exercise would be an opportunity to collect emerging practices and share with the transportation community. Those emerging practices would continue to add to the body of best practices that have already been documented. A concern was raised that although generating factors would be a more beneficial exercise, it would also take a considerable amount of time and effort. Thus, the panel discussed options for limiting the number of inputs required for that process.

*Review 3 - March 15, 2012*

For the third review, the panel was provided with a full draft of the framework,

which was Excel-based and used simple programming. The full draft included introductory material, instructions, definitions, dropdown menus, and warning messages (indicating improper inputs). As mentioned previously, the framework was designed to address several of the critiques of SWOT analysis as cited in Chapter 3. First, the internal and external factors are clear and well-defined (as confirmed by the expert panel). Second, in order to complete the assessment, the factors must be prioritized, and the priority ratings feed directly into the generation of strategies. Third, the designations and priority ratings must be validated with evidence. Fourth, interactions between internal and external factors are taken into account when generating strategies.

The framework was designed to walk assessors through a series of tabs that provided information and required certain inputs. Figure 2 illustrates the process of moving through the tabs and the inputs required at each tab (denoted in blue text). Tab 6 is programmed to automatically pull the "priority factors" from Tabs 4 and 5, so these do not have to be manually input. Also, note that respondents can go back and forth between Tab 6 and Tabs 4 and 5 to adjust ratings as needed.

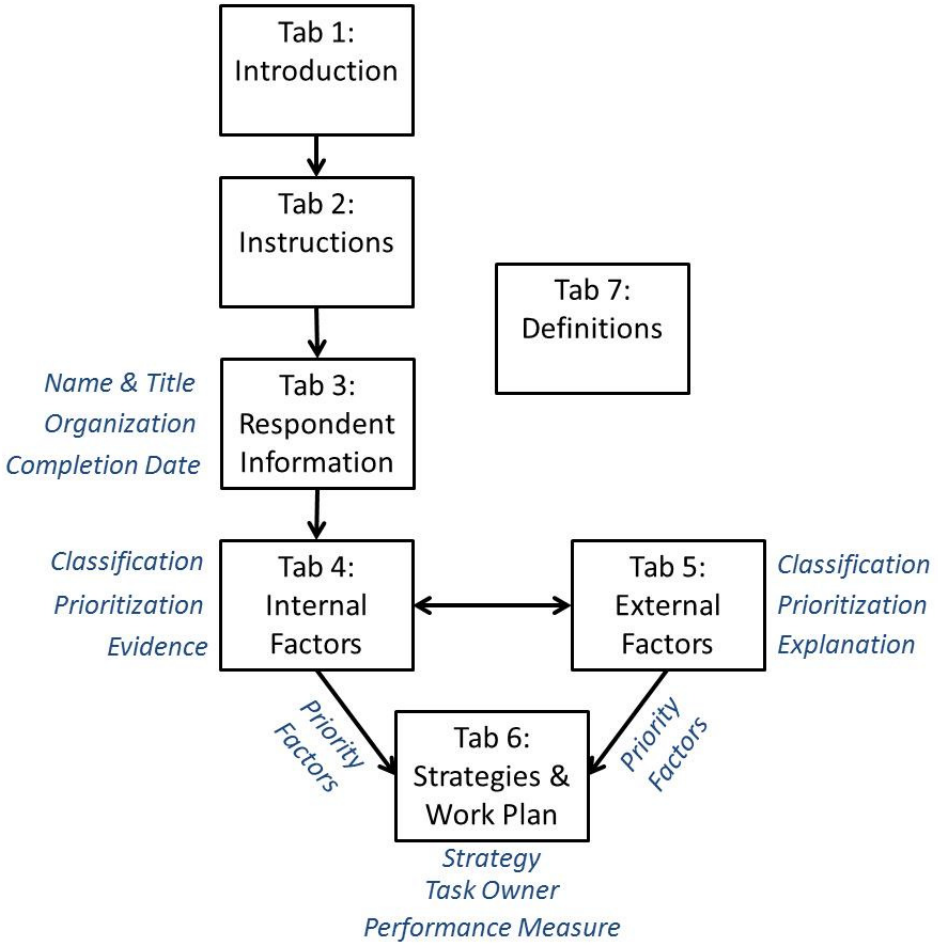


**Figure 2. Structure of tool and process for completing assessment**

The final design of the framework is in Appendix B and is nearly identical to the components described next.

*Tab 1: Describes the purpose and overview of the tool*

*Tab 2: Provides instructions for completing assessment*

*Tab 3: Requires respondents to input information including name, position, agency, and date of completion*

*Tab 4: Provides lists of internal factors and requires classifying each as strength or weakness, rating priority (high, medium, low), and providing evidence.*

The 32 internal factors are divided into four sections (as described below) and two factors feature drop-down lists with options designed to narrow the focus (see factor 23 as an example). There is also an opportunity for the agency to develop additional factors that are considered strategic issues.

(A) Sustainability Ethic - The first step in transitioning to a sustainability-oriented framework for planning, programming, project development, and operations is establishing a clear vision and goals based on sustainability principles. The vision and goals can then be consistently applied to all of the agency's activities to ensure a sustainability ethic permeates throughout the organization. Factors include the following:

I-1. Sustainability is recognized as an ethic or guiding principle for the organization.

I-2. The organization has defined the concept of sustainability or sustainable transportation.

I-3. Organization’s mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society

I-4. Organization’s sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each)

I-5. Short-term, strategic goals are consistent with long-term sustainability goals

I-6. Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system

I-7. Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure

I-8. Policies and system planning promote operational improvements and demand management (e.g., ITS, variable tolling, VMT reduction) over new capital investments

I-9. Sustainable transportation policies, programs, and project evaluation are well documented

(B) Institutionalizing Sustainability - As transportation agencies strategically commit to sustainability as a guiding framework, they need to adopt appropriate policies, tools, and methods for assessing sustainability. In order to ensure that those policies, tools, and methods are used consistently, changes should be made to an agency's standard operating procedures, or to the documents that dictate roles, responsibilities, and activities. Factors include the following:

I-10. Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e., long-range transportation plan or strategic plan)

I-11. Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items

I-12. Coordination between state, regional, and local transportation plans to achieve sustainability objectives

I-13. Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision)

I-14. Selection criteria for programming reflect the goals/objectives in the long-range plan

I-15. Performance measures and selection criteria address sustainability objectives (select from list below: environmental impacts, economic benefits, safety, equity, lifecycle costs, other, all)

I-16. Performance management system measures progress toward sustainability targets and goals

I-17. Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase because of revised selection criteria, availability of alternative funding sources, etc.)

I-18. Percentage of funds allocated for operating and maintaining existing infrastructure (may increase because of revised selection criteria, availability of funds, etc.)

I-19. Sustainability ethic and policies are translated into concrete guidance for planning and project development (e.g., flexible design standards, green rating system)

(C) Communication and Collaboration with External Stakeholders – A necessary part of any organization change is effectively communicating new goals and processes to all external partners and stakeholders. Open communication facilitates buy-in from affected parties and could lead to more productive partnerships (i.e., can help in achieving common/interdependent goals or measuring progress). Factors include the following:

I-20. Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public)

I-21. Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g., local zoning boards, MPOs, housing or community development agencies)

I-22. Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities )

I-23. Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below: local level, state level, federal level, all levels)

I-24. Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.)

I-25. Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.)

I-26. Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities.

(D) Organizational Culture and Structure – Transitioning to the type of agency that promotes sustainability will require champions to support the effort and a critical

mass to move the effort forward. Achieving a commitment to sustainability from employees at all levels is critical and can be facilitated by a variety of initiatives. Factors include the following:

I-27. Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices)

I-28. Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations

I-29. Sustainability initiatives are organized across functional areas, departments, etc. (e.g., partnership between planning and operations/maintenance) through teams, task forces, or working groups

I-30. Employees understand what sustainability means to the agency and for their specific roles (i.e., sustainability is part of recruitment, hiring, and compensation for all employees)

I-31. A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations

I-32. Organization actively monitors external factors including new legislation and public opinion in order to inform future strategic planning.

*Tab 5: Provides a list of external factors and requires classifying each as opportunity or threat, rating urgency (immediate, short-term, long-term), and providing an explanation*

The 16 external factors cover economic, environmental, social, political, and technological pressures that transportation agencies face. Five of the factors contain dropdown options.

E-1. Political climate regarding transportation (select level below: local level, state level, federal level, all levels)

E-2. Political climate regarding sustainability (select level below: local level, state level, federal level, all levels)

E-3. Public climate regarding transportation

E-4. Public climate regarding sustainability

E-5. Legislative requirements related to (select from list below: transportation planning, transportation investment, sustainability)

E-6. Change in government administration resulting in redirection of priorities and policies related to sustainable transportation

E-7. Availability of federal transportation funding (select category below: formula, discretionary, flexible, all types)

E-8. Availability of other funding (select level below: state, local, private)

E-9. Economy

E-10. Deployment of new technologies (smart phones, GPS, etc.)

E-11. Changing demographics of transportation users (e.g., total population, age, income, spatial distribution)

E-12. Housing options (e.g., affordability, density, location)

E-13. Employment (types, wages, availability)

E-14. Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures)

E-15. Transportation energy supply and sources

E-16. Transportation fuel prices

*Tab 6: Populates automatically with highest priority factors from Tabs 4 and 5 then requires matching an external factor with internal factor and for each pair identifying an appropriate strategy, task owner, and performance measure.*

As discussed with the panel during the second conference call, the Strategies tab was designed to link internal and external factors and guide DOTs in developing implementable strategies. In order to limit the number of inputs and time required to complete the assessment, the Strategies tab was programmed to populate the first column with the eight high priority factors that were designated on Tab 4. The second column was programmed to list the three immediate external factors designated on Tab 5 in a dropdown menu. Before developing a strategy, each internal factor needs to be matched with the most relevant external factor (selected from the dropdown menu). This design was intended to focus attention on the highest priority factors while limiting the amount of data that needs to be considered. After linking the factors and identifying a strategy, respondents must then identify a task owner and performance measure(s).

It is important to note that Tabs 5 and 6 were programmed with error messages to remind respondents to designate only eight high priority factors and three immediate factors. The messages do not prevent respondents from making errors, but raise awareness that there are errors that could impact the output. Restricting inputs to prevent errors is possible using macros, however programming with macros could lead to difficulties in opening and using the template, particularly in older versions of Excel.

*Tab 7: Provides definitions of key terms used throughout the assessment*

For the third and final review, the expert panel walked through the draft template and approved the format and content, with only minor refinements suggested to a couple

of factors and to the instructions for completing the assessment. Appendix B contains the full draft template.

### 5.2.4 Phase 4: Case studies

Once the expert panel approved the draft template, state DOTs were recruited to complete the assessment and provide feedback on their responses, the experience of completing the assessment, and potential applications for the framework at their agency. The template was distributed to nine DOTs that were specifically recruited because of their commitment to or interest in sustainability and with geographic diversity as a consideration. While the sample was neither randomly selected nor statistically representative of all state DOTs, the participating DOTs represented a range in years of experience with sustainability, types of sustainability initiatives, and comprehensiveness of approaches (as demonstrated by the survey for the FHWA guidebook and other documented efforts). Most DOTs were initially contacted through the top executive who then identified a primary contact to lead and coordinate the assessment.

Each DOT was sent the full template contained in Appendix B, which included an introduction to frame the use of the tool and full instructions for how to complete each tab. DOT contacts were encouraged to ask questions for clarification purposes as they completed the tool. They were also encouraged to consult with colleagues as needed, though this was not required. Specific instructions were not provided about who should complete the assessment or what the process should look like. This allowed DOTs to customize their own experience and provided an opportunity to collect feedback on multiple approaches.

Following completion of the assessment, respondents participated in a brief interview that was intended to provide context for who completed the assessment and discuss the content and format of the tool and the process of completing the assessment. This interview involved a discussion of results as well as potential limitations of the tool. Respondents also suggested potential applications for such an assessment framework at the DOT. The interview protocol is reproduced below and respondents' feedback is discussed in Chapter 6.

1. Please describe your position and responsibilities at the DOT.
2. What is a sustainable transportation system? Please define.
3. Does the tool address all aspects of sustainability pertinent to transportation? If not, what should be added? Any content that should be clarified, revised?
4. Was the assessment tool easy to understand and use? If not, what are its limitations?
5. Approximately how much time was required to complete the assessment? Was the time required to complete the assessment a) too long, b) too short, c) about right?
6. Did completing the assessment require consultation with colleagues? If so, who was consulted? (Position title/role is sufficient.)
7. Does your DOT conduct Strategic Planning activities? If so, briefly describe the process. How often? Who is involved (internally and/or externally)? What method(s) are used?
8. Could this tool be useful as part of a strategic planning process? Please explain briefly.
9. Besides strategic planning, how could this tool be applied at your DOT?

The open-ended questions allowed respondents to focus on their experience completing the assessment, both in terms of the responses they provided and the strengths and limitations of the tool. Respondents were often given additional prompts to explain how or why they took a certain approach or reached a certain conclusion about a factor. The results of the case studies are discussed in the next chapter.

### 5.2.5 Phase 5: Compile set of performance measures

The identification of performance measures has been cited as one of the most challenging parts of developing and implementing sustainability initiatives (NCHRP Report 708; FHWA 2011). Therefore, the fifth phase of this research project was to identify a set of performance measures/indicators that potentially could be used to monitor outcomes of strategies that relate directly to the internal and external factors in the assessment framework. This phase drew on two sources: (1) sustainability performance measures proposed in NCHRP Report 708 *A Guidebook for Sustainability Performance Measurement for State Transportation Agencies* and (2) organizational and system indicators that are already in use by DOTs and have been compiled by the Midwest Transportation Knowledge Network (DeFlorio et al. 2011; MTKN 2012). These two sets of measures capture both internal organizational changes and external outcomes. Additional measures were developed as needed to supplement these two sources. These performance measures are presented in Chapter 7.

# CHAPTER 6

# RESULTS OF SWOT ASSESSMENTS AND INTERVIEWS

## 6.1 Overview of case studies

The case studies consisted of two parts: the detailed completion of the sustainability SWOT assessment and a follow-up interview to discuss the responses and process of completing the assessment. The case studies were conducted on condition of confidentiality such that responses could not be linked back to individual respondents or to their DOTs. For that reason, the agencies are referred to as DOT 1, DOT 2, DOT 3, and so forth. The numbering does not indicate any type of rating or ranking, but rather the order in which the assessments were completed. Respondent names and titles are not revealed, but general characteristics about their position and the DOT that they work for will be described in this section. Responses to the assessments (found in Appendix C) have been modified to remove details that could be linked back to a particular agency while maintaining the integrity of the information provided. Edits were made to the "Evidence" field on Tab 4, the "Explanation" field on Tab 5, and each of the input fields on Tab 6. This chapter will describe the process that each DOT followed to complete the assessment and summarize the feedback received during the assessment process and in the follow-up interview. It will also provide a summary of the assessment responses and observations about common themes. Chapter 7 offers a higher-level discussion of what was revealed by the case studies and the implications for future development of the sustainability SWOT tool.

As mentioned in the methodology section, the assessment template was distributed to nine purposefully recruited DOTs. Seven assessments were completed and

debriefed within the timeline required for this dissertation. As was intended, the responding agencies represent a range of experiences with sustainability, with some in the early stages of identifying and implementing programs while others are documented leaders. In general, the case study respondents were the "sustainability people" at their respective agencies, either directly due to position title or indirectly due to their responsibilities. The respondents' backgrounds varied (transportation planning, land use planning, public administration, political science, engineering) but all were currently working in a planning division, bureau, or comparable business unit. Many of the respondents were hired or assumed their current position within the past two years, which reflects the newness of sustainability efforts at many DOTs. However, some respondents have been with their DOT for twenty, thirty or more years and brought considerable institutional knowledge to the completion of the assessment. For clarity and simplicity, the respondents are classified according to a modified version of Mintzberg's organizational structure (Mintzberg 1979; Hatch 1994). Mintzberg defined five components of organizations:

- Strategic apex consisting of top managerial positions which are primarily concerned with the organization's relationship with its external environment, so the commissioner/secretary and deputies at a DOT;
- Operating core which is directly involved in the organization's basic work, so the engineers and planners at a DOT;
- Middle line which includes the managers who link the apex to the core through supervision and implementation;

- Technostructure consisting of staff analysts who work on standardized work, outputs, and skills; and
- Support staff who provide support to the operating core.

For this particular research, respondents are classified as either middle line or operating core. Based on Hatch's (1994) descriptions of hierarchical levels, the middle line was further divided into middle managers (responsible for coordinating and integrating the activities of several subunits) and the lower level managers or supervisors (responsible for a particular subunit). While this classification does not exactly match each DOT's organizational structure, it does allow respondents to be roughly classified based on their roles and responsibilities. Table 6 provides a summary of each DOT's respondent(s) and the process that they used to complete the assessment.

**Table 6. Case study respondents and process by DOT**

| DOT | Respondent(s) | Description of process |
|---|---|---|
| DOT 1 | Operating Core | Completed individually, approximately 2 hours |
| DOT 2 | Operating Core | Completed individually but consulted with an environmental engineer on operations side, approximately 4 hours |
| DOT 3 | Middle manager | Completed individually, approximately 4-4.5 hours |
| DOT 4 | Lower level manager | Completed individually due to time and scheduling limitations, approximately 3 hours |
| DOT 5 | Operating Core | Completed individually but discussed implementation steps with two managers, over 3 hours |
| DOT 6 | Operating Core, Lower level manager | Primarily completed by OC in consultation with LLM, 3 hours and 0.5 hours respectively |
| DOT 7 | Operating Core, 2 Lower level managers, Middle manager | Prepared individually then worked through assessment jointly, 3 hours together with additional individual preparation time |

## 6.2 Summary of responses

This section summarizes the assessment results while Section 5.3 summarizes the feedback from the follow-up interviews. The detailed responses from each DOT are reproduced in Appendix C.

### 6.2.1 Designation of factors and prioritization

As shown in Table 7, four out of seven DOTs identified more strengths than weaknesses. On average, DOTs designated 17 strengths and 15 weaknesses, though the median was 14 strengths and 18 weaknesses. Interestingly, very few strengths were considered "low priority". Besides that observation, there was considerable variability from DOT to DOT in how strengths and weaknesses were designated and prioritized. For example, even though DOT 2 and DOT 5 each designated thirteen strengths and nineteen weaknesses, only half of the factors received the same designation from both DOTs. It is also important to note that a couple of DOTs rated more than eight factors as high priority, which resulted in only the first eight high priority factors being listed in the Strategies Tab. Thus, the strategies developed may not address the highest priorities for some of the agencies. DOTs were able to rate more than eight high priority factors due to a limitation of the tool, which is addressed in Section 6.2.3.

It is necessary to note that all of the factors are important for creating a sustainability-oriented agency, thus the priority ratings are relative to one another. "Low" priority does not indicate that a factor is unimportant but rather that it was not the top priority for the agency at the time the assessment was completed.

**Table 7. Summary of responses for internal factors by DOT**

| | DOT 1 | DOT 2 | DOT 3 | DOT 4 | DOT 5 | DOT 6 | DOT 7 |
|---|---|---|---|---|---|---|---|
| Strengths | 29 | 13 | 14 | 8 | 13 | 21 | 20 |
| Weaknesses | 3 | 19 | 18 | 24 | 19 | 11 | 12 |
| High | 24 | 4 | 8 | 8 | 23 | 8 | 7 |
| Medium | 5 | 7 | 17 | 18 | 9 | 24 | 22 |
| Low | 3 | 21 | 7 | 6 | 0 | 0 | 3 |

On average, DOTs identified nine opportunities and seven threats, which are also the median values. As shown in Table 8, two DOTs selected an incorrect number of "Immediate factors" (i.e., not 3). For DOT 1, that meant only having one option for matching external to internal factors on the Strategies Tab. Accordingly, the respondent had difficulty identifying a strategy for each pair of factors because the one external factor did not have a strong, direct connection with each internal factor. On the other hand, DOT 5 selected more than three factors that resulted in only the first three being available on the Strategies Tab. While this did not prevent the respondent from completing the assessment, the strategies may not represent the highest priorities for the agency (see Section 6.2.3 for discussion of this limitation).

**Table 8. Summary of responses for external factors by DOT**

| | DOT 1 | DOT 2 | DOT 3 | DOT 4 | DOT 5 | DOT 6 | DOT 7 |
|---|---|---|---|---|---|---|---|
| Opportunities | 10 | 3 | 10 | 8 | 8 | 12 | 9 |
| Threats | 6 | 13 | 6 | 8 | 7 | 4 | 7 |
| Immediate | 1 | 3 | 3 | 3 | 9 | 3 | 3 |
| Short-term | 0 | 1 | 6 | 9 | 4 | 8 | 9 |
| Long-term | 15 | 12 | 7 | 4 | 2 | 5 | 4 |

The next four tables summarize how the DOTs classified and prioritized each internal factor. Each table represents one of the four themes: *Sustainability Ethic, Institutionalizing Sustainability, Communication and Collaboration with External*

*Stakeholders,* and *Organizational Culture and Structure*. By looking at responses to each factor, common strategic issues among the participating DOTs were identified. First of all, the DOTs generally seemed to have policies and practices in place demonstrating a sustainability ethic (Table 9) and for managing communications and collaborations with external stakeholders (Table 11). On the other hand, internal promotion of a sustainability culture seems to be the weakest area for the agencies (Table 12). The two factors that directly address employee commitment to and involvement in sustainability initiatives (I-30 and I-31) were classified by all respondents as weaknesses and for most DOTs were not considered high priority. In addition, factors I-15 and I-16 related to performance measurement and performance management were also cited as weaknesses by most of the DOTs. DOTs 4, 5, 6, and 7 each classified I-15 and I-16 as weaknesses but indicated that this is an area that they are actively working on. For example, DOT5 indicated that sustainability performance goals will be incorporated into the project development process in the near future and a performance management system will be launched soon.

For the most part, high priority factors differed across the DOTs with the exception of I-6 (multi-modal investment) and I-7 (maintenance and rehabilitation), which were both highly rated by most respondents. Those two factors are reflective of current trends in the transportation industry: a shift from highway construction/expansion to maintenance of existing infrastructure and the need to coordinate multiple modes, both passenger and freight. It is important to point out that factors I-6, I-7, and I-8 (operations) are related to factors I-17 and I-18. Ratings for the former indicate that DOT policies promote multi-modal investment, maintenance of existing infrastructure, and operational

improvements. However, the latter factors indicate that there may be a disconnect between some DOTs' policies and plans and actual allocation of funds to those areas.

**Table 9. Summary of responses for internal factors (Sustainability Ethic)**

| Ref No | Internal Factor | S | W | H | M | L |
|---|---|---|---|---|---|---|
| I-1 | Sustainability is recognized as an ethic or guiding principle for the organization. | 5 | 2 | 4 | 2 | 1 |
| I-2 | The organization has defined the concept of sustainability or sustainable transportation. | 4 | 3 | 2 | 4 | 1 |
| I-3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | 5 | 2 | 3 | 3 | 1 |
| I-4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | 3 | 4 | 1 | 5 | 1 |
| I-5 | Short-term, strategic goals are consistent with long-term sustainability goals | 4 | 3 | 4 | 1 | 2 |
| I-6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | 5 | 2 | 5 | 2 | 0 |
| I-7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | 5 | 2 | 6 | 1 | 0 |
| I-8 | Policies and system planning promote operational improvements and demand management (e.g., ITS, variable tolling, VMT reduction) over new capital investments | 5 | 2 | 4 | 3 | 0 |
| I-9 | Sustainable transportation policies, programs, and project evaluation are well documented | 2 | 5 | 2 | 4 | 1 |

Key: S = Strength; W = Weakness; H = High; M = Medium; L = Low

**Table 10. Summary of responses for internal factors (Institutionalizing Sustainability)**

| Ref No | Internal Factor | S | W | H | M | L |
|---|---|---|---|---|---|---|
| I-10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e., long-range transportation plan or strategic plan) | 3 | 4 | 3 | 3 | 1 |
| I-11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | 3 | 4 | 4 | 2 | 1 |
| I-12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | 4 | 3 | 1 | 4 | 2 |
| I-13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | 4 | 3 | 3 | 4 | 0 |
| I-14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | 4 | 3 | 4 | 3 | 0 |
| I-15a | Performance measures and selection criteria address sustainability objectives | 1 | 6 | 2 | 3 | 2 |
| I-15b | All categories – 4, Safety – 1 | | | | | |
| I-16 | Performance management system measures progress toward sustainability targets and goals | 1 | 6 | 2 | 3 | 2 |
| I-17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | 3 | 4 | 3 | 2 | 2 |
| I-18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | 4 | 3 | 2 | 4 | 1 |
| I-19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (e.g., flexible design standards, green rating system) | 2 | 5 | 3 | 2 | 2 |

Key: S = Strength; W = Weakness; H = High; M = Medium; L = Low

Note: Factors with parts (a) and (b) denote presence of dropdown menu. Line (b) indicates the option selected from the dropdown.

**Table 11. Summary of responses for internal factors (Communication and Collaboration with External Stakeholders)**

| Ref No | Internal Factor | S | W | H | M | L |
|---|---|---|---|---|---|---|
| I-20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | 3 | 4 | 1 | 4 | 2 |
| I-21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system | 5 | 2 | 2 | 4 | 1 |
| I-22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities | 6 | 1 | 2 | 4 | 1 |
| I-23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | 7 | 0 | 2 | 5 | 0 |
| I-23b | All levels – 4, State and Federal - 1 | | | | | |
| I-24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | 4 | 3 | 3 | 3 | 1 |
| I-25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | 5 | 2 | 1 | 4 | 2 |
| I-26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | 6 | 1 | 2 | 5 | 0 |

Key: S = Strength; W = Weakness; H = High; M = Medium; L = Low

Note: Factors with parts (a) and (b) denote presence of dropdown menu. Line (b) indicates the option selected from the dropdown.

**Table 12. Summary of responses for internal factors (Organizational Culture and Structure)**

| Ref No | Internal Factor | S | W | H | M | L |
|---|---|---|---|---|---|---|
| I-27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | 3 | 4 | 1 | 3 | 3 |
| I-28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | 3 | 4 | 3 | 2 | 2 |
| I-29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | 2 | 5 | 2 | 4 | 1 |
| I-30 | Employees understand what sustainability means to the agency and for their specific roles (i.e., sustainability is part of recruitment, hiring, and compensation for all employees) | 0 | 7 | 1 | 2 | 4 |
| I-31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | 0 | 7 | 2 | 2 | 3 |
| I-32 | Organization actively monitors external factors including new legislation and public opinion in order to inform future strategic planning | 7 | 0 | 2 | 5 | 0 |

Key: S = Strength; W = Weakness; H = High; M = Medium; L = Low

The next table (Table 13) summarizes the classification and prioritization of the external factors which addressed the political, economic, social, and technological environment in which transportation decisions are made. As mentioned before, the DOTs had an overall positive view of current conditions, citing more opportunities than threats. However, it is important to point out that some of the factors were classified conditionally and could have been classified differently if viewed through a different lens. For example, DOT 6 stated with respect to External Factor 9: Economy that it was "probably a threat, but also an opportunity because it means we need to do things differently and in a strategic manner, which is a great opportunity to integrate

sustainability principles into what we do. This is probably an immediate threat, but since we can only [choose] three had to classify it as something else."

**Table 13. Summary of responses for external factors**

| Ref No | External Factor | O | T | I | ST | LT |
|---|---|---|---|---|---|---|
| E-1a | Political climate regarding transportation | 3 | 4 | 5 | 1 | 1 |
| E-1b | All levels – 4, State - 1 | | | | | |
| E-2a | Political climate regarding sustainability | 4 | 3 | 0 | 3 | 4 |
| E-2b | All levels – 2, Federal – 1, State - 2 | | | | | |
| E-3 | Public climate regarding transportation | 3 | 4 | 3 | 2 | 2 |
| E-4 | Public climate regarding sustainability | 6 | 1 | 0 | 2 | 5 |
| E-5a | Legislative requirements related to transportation planning and investment and/or sustainability | 2 | 5 | 2 | 2 | 3 |
| E-5b | Transportation investment - 5 | | | | | |
| E-6 | Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | 5 | 2 | 1 | 4 | 2 |
| E-7a | Availability of federal transportation funding | 2 | 5 | 3 | 2 | 2 |
| E-7b | All types - 6 | | | | | |
| E-8a | Availability of other funding | 5 | 1 | 1 | 3 | 2 |
| E-8b | Local – 1, State – 2, Private – 2 | | | | | |
| E-9 | Economy | 2 | 5 | 1 | 4 | 2 |
| E-10 | Deployment of new technologies (smart phones, GPS, etc.) | 7 | 0 | 3 | 2 | 2 |
| E-11 | Changing demographics of transportation users (e.g., total population, age, income, spatial distribution) | 5 | 2 | 0 | 1 | 6 |
| E-12 | Housing options (e.g., affordability, density, location) | 5 | 2 | 1 | 3 | 3 |
| E-13 | Employment (types, wages, availability) | 6 | 1 | 0 | 3 | 4 |
| E-14 | Climate-related impacts on transportation infrastructure | 0 | 7 | 1 | 1 | 5 |
| E-15 | Transportation energy supply and sources | 2 | 5 | 2 | 2 | 3 |
| E-16 | Transportation fuel prices | 3 | 4 | 2 | 2 | 3 |

Key: O = Opportunity; T = Threat; I = Immediate; ST = Short-term; LT = Long-term
Note: Factors with parts (a) and (b) denote presence of dropdown menu. Line (b) indicates the option selected from the dropdown.

The example points out the difficulty of differentiating between high and medium or immediate and short-term factors – some DOTs cited that if given the opportunity to identify additional high priority or immediate factors, they would have done so.

Based on the responses in Table 13, there is general agreement among the participating DOTs that public climate regarding sustainability, deployment of new technologies, and employment are all opportunities for state DOTs. However, these are not necessarily the most urgent external factors for DOTs to address. Three DOTs did consider deployment of new technologies such as ITS and GIS to be immediate opportunities. For example, DOT2 explained that they are "already using mobile technologies to improve data gathering and provide real-time traffic information." In terms of threats, all DOTs viewed climate-related impacts to be a threat but most viewed it as a long-term issue. DOT4 explained, "there is an appreciation at some levels of management and staff on this issue, but it is not something that will be easily addressed in the short term since the threat is not politically imminent." The DOT that cited it as an immediate threat has already started to see climate-related impacts due to severe weather.

### 6.2.2 Evidence

The evidence/explanations varied in level of quality (or specificity) and quantity both within individual assessments and across assessments. As an example of lower quality evidence, a respondent may indicate a strength and then cite a policy or program but not specifically address the sustainability component. Evidence and explanations were only "required" for high priority internal factors and immediate external factors respectively, but many respondents justified other factors as well. This was particularly true when the respondent had difficulty choosing a classification or prioritization. Also,

respondents were more likely to provide evidence for lower priority strengths than weaknesses.

The evidence and explanations verify the factor classifications and prioritizations and so are critical components of the assessment. In a more authentic strategic planning process (involving multiple participants from across the department), it is possible that the quality of evidence/explanations would be consistently high in order to facilitate discussions. Other potential reasons for poor or lack of evidence include:

- the topic being addressed was outside the scope of that respondent's roles and responsibilities, for example, performance measurement is managed by a different business unit);
- respondent viewed the factor as unclear or redundant and thus felt it did not require additional explanation; or
- respondent faced fatigue towards the end of the assessment (for example, DOT7 provided evidence/explanations for most factors but there was an obvious drop-off towards the ends of the factor lists).

Changes in process, such as convening a working group from across the agency and spreading the assessment out over a longer time period, would likely diminish these issues.

### 6.2.3 Strategies and work plan

All of the DOTs were able to complete the process of linking internal and external factors and begin to identify strategies. However, most had difficulty designating a task owner and possible performance measures. In the follow-up interviews, respondents explained that additional time and/or collaborating with managers and staff from other

units would have enabled them to identify a strategy for each pair of factors and indicate an appropriate task owner and performance measure(s). The strategies section garnered the most feedback and suggestions during the follow-up interviews, which is discussed in the next section.

## 6.3 Feedback on content, format, and process

### 6.3.1 Content

Overall, respondents reported that the framework was comprehensive and covered a broad range of sustainability issues at a high-level. Many of these issues (including economic factors, integration of planning and programming, asset management safety, communications) are at the forefront with many DOTs. However, some of the factors could be more specific or "dig deeper" to push forward innovations, particularly when it comes to actually implementing sustainability initiatives. In terms of other limitations, there were a few suggestions for individual factors that need to be clarified as well as factors that could be added. Specific areas that were suggested for new internal factors include the following: routine or continual education programs, environmental sustainability as part of the procurement process, and additional statements about implementation (construction, operations, etc.). Internal education programs such as training sessions or access to educational materials could be strategies to address I-30. With respect to I-30, one respondent commented that it is difficult to measure something qualitative like cultural acceptance of sustainability. While it may be difficult to effectively capture "cultural acceptance," participation in a rewards/innovation program or responses to employee satisfaction surveys could be indicators.

On a different note, a few respondents suggested additional attention to the transportation/land use nexus in both the internal and external factors. In this tool, land use was positioned as an external factor (captured by E-11, 12, and 13) because it is out of the direct control of DOTs. However, transportation and land use coordination is a very important strategy for developing a sustainable transportation system and can lead to outcomes including reduced vehicle-miles traveled per capita, increased modal options, and reduced transportation costs. Collaboration with land use agencies was also included as an internal factor. The land use-related factors will be re-examined to ensure that the tool directs users to make explicit the connection between sustainability and transportation-land use coordination.

### 6.3.2 Structure/format

The SWOT framework generated positive feedback from the respondents, though certain limitations were identified. Respondents found the framework to be well-organized and structured in a useful way for addressing sustainability. Moreover, since a basic SWOT approach is used by many DOTs for strategic planning activities, the concept was already familiar to many respondents. In addition, respondents appreciated the ability to customize the tool by adding their own factors and recognized that they could "set their own course based on individual needs or states of readiness." A final observation that was made by a couple of respondents is that this is not a rating system or a survey. It is not about competition with other business units or agencies, but rather adding value by generating strategic goals.

A few limitations of the tool became apparent during the testing phase based on questions that were asked. For example, there were questions about opening the file in an

older version of Excel and loss of functionality (which was minimal and not critical to the assessment). There were also questions about Tab 6 (strategies), including how it is populated and why there were a limited number of options. Most of the questions related to Tab 6 stemmed from an input error on Tab 4 or 5, for example, not selecting three immediate factors or selecting too many high priority factors. Another question concerned what was expected in the "performance measures" column. After restating the definition listed in the glossary and providing an example, the respondent was able to proceed.

Other limitations (most related to those described above) were identified during the follow-up interviews and suggestions were made for addressing them. First, with respect to Tab 6, some respondents recommended better explaining how the previous inputs from Tabs 4 and 5 feed into it. In addition, there was not an automatic cut-off when designating too many priority factors, rather there was a warning message on the next tab. This forced some respondents to go back and reconsider ratings. It was suggested to "hard code" the warnings so that a respondent could not proceed with an incorrect number of inputs. Respondents also commented that they had difficulty matching internal and external factors in order to generate strategies. Upon further inquiry, respondents revealed that the difficulty stemmed from the limited number of external factors that were available options. Therefore, allowing more immediate factors to be designated and/or providing a larger list of external factors to choose from (i.e., not limited to just immediate factors) would make the tool more flexible and perhaps lead to more meaningful strategies.

The dropdown menus were the other major limitation of the tool. Respondents suggested clarifying the purpose of the dropdown lists in both the internal and external tabs, and making them easier to visually identify. It was also suggested to make the dropdowns more flexible by increasing the number of options or allowing multiple responses (as in, the state climate with respect to sustainability is a threat whereas the federal climate is an opportunity). This situation could also be addressed within the existing framework by taking advantage of the empty slots at the bottom of the factor list.

The draft framework was built in Excel in order to be easily accessible to state DOTs. There were some inherent limitations in building the framework that could only have been overcome by using more complex programming. However, that may have led to other difficulties, particularly in older versions of Excel. The future direction for this tool (discussed in Chapters 7 and 8) is to provide more options through a more dynamic, flexible platform, particularly concerning the dropdown menus and strategies tab. It must be noted that structural/format issues affected the process in some circumstances and so addressing some of the feedback in this section could improve the assessment process discussed in the next section.

### 6.3.3 Process

As explained at the beginning of this chapter, DOTs were not given specific instructions about the process for completing the assessment or who should be involved. However, the research motivation was to provide a basis for consensus-building throughout the organization. While none of the DOTs conducted that type of process (in part because of time constraints), a couple of respondents engaged in consensus-building within their own office and many respondents recognized that the tool would be more

meaningful in that type of context. This section reviews the DOTs' feedback on the process that they used and how they could improve that process for future applications.

First, each DOT recognized that a different respondent or consultation with other colleagues would have provided a different interpretation of the factors and thus different responses. In particular, the interpretation would differ based on which business unit the new respondents represented. DOT 7 commented that although the respondents represented different backgrounds and could offer different perspectives (engineering versus planning), they all worked in the same unit. Thus some of their strengths/weaknesses or priorities may not represent the agency as a whole, even though the group made an effort to consider the entire DOT. Observations about different perspectives led many respondents to suggest convening a group to review the factors. Consultation with managers from other divisions would also be helpful for developing strategies and identifying performance measures since many of the strategies would cut across divisions.

Another common observation was that some factors could be clearly delineated as a strength versus a weakness or an opportunity versus a threat, but others had to be decided on a scale relative to one another. In general, respondents found it easier to designate the internal factors than the external factors. The external factors were more complex and distinguishing between opportunity or threat often depended on the respondent's viewpoint (i.e., optimistic or pessimistic). For some factors both standpoints could be justified depending on what aspect of the factor was considered. The dropdown menus were intended to help break down some of the factors into simpler issues, though most factors did not have a dropdown.

In addition to commenting on the process that they used, all of the DOTs identified ways that the tool could be applied in strategic planning and most suggested other ways that the tool could be useful. In terms of a strategic planning process, possible applications include:

- engaging the strategic planning team, performance measures group, or other units in the completion of the Strategies Tab;
- distributing the tool to multiple participants from across the DOT to develop a mission, goals, and performance measures first for individual business units and then for the entire agency;
- working through different scenarios by adjusting priority ratings to align with different emphases and observing how strategies would change; and
- facilitating discussions with other state agencies about common strategic goals and developing an interagency strategic action plan.

As a follow-up to a strategic planning process, one respondent suggested using the tool to stimulate discussion with executive leadership and managers about whether the sustainability culture was actually permeating through the agency. Another observed that the tool could be used to monitor progress towards strategic goals by continuously updating the internal factors and periodically checking the external factors. This type of monitoring could help identify whether there is a culture shift over time and where barriers are being encountered.

In terms of other applications, respondents observed the tool's usefulness for guiding development of a new long-range transportation plan (or confirming an existing one) or for developing a separate sustainability plan or policy. In addition, the tool could

be used to inform discussions with external audiences – for example, providing a way to frame customer survey questions or to develop a questionnaire for outside reviewers.

All of the DOTs also expressed interest in learning about the strategies that the other DOTs proposed or had found successful. The output from this tool could help DOTs monitor and learn from what their peers are doing to incorporate sustainability into policy and day-to-day work.

# CHAPTER 7

# DISCUSSION OF FINDINGS AND RECOMMENDED PRACTICES

## 7.1 Themes and findings

Three important themes were prominent in the case studies and related to findings from the literature review: (1) poor internal communication of the need and nature of change, (2) lack of integration between sustainability policies and implementation, and (3) the importance of process in addition to content.

### 7.1.1 Lack of integration

Integration is another key theme that came out of the case studies and is present in the strategic management and performance management literature. Multiple respondents suggested that some of the factors were redundant, particularly with respect to the "Sustainability Ethic" factors. "Redundancy" was used intentionally to help identify gaps or disconnects between high-level sustainability policies and actual implementation of those policies through system planning, programming, and project development. For example, the disconnect between a policy promoting maintenance of existing infrastructure and the actual funds allocated for maintenance was pointed out in Section 6.2.1.

As another example of a lack of integration, there seems to be a disconnect between the sustainability ethic established by the top leadership and employee understanding of how that ethic translates into day-to-day activities. This is related to the communications discussed in the previous theme and the observation that sustainability is siloed at state DOTs. The observation that the "sustainability people" were assigned to complete the assessment and that their positions were in planning divisions is consistent

with findings from the 2008-9 survey for the FHWA Guidebook. This siloing of sustainability can create a disconnect between who is developing sustainability initiatives and who will implement the required changes in daily work. Organization change and strategic planning literature posit that successful efforts engage employees at all levels and across functions in conversation early in order to generate buy-in. These observations support sustainability efforts occurring as part of a strategic planning process and perhaps moving "sustainability people" to the director/commissioner's office.

As a final example of integration, respondents had difficulty identifying performance measures to monitor proposed strategies (see Section 7.3 for example performance measures). The area of sustainability performance measures will be a priority for many DOTs in light of impending federal requirements for performance-based planning and the growing demands of the public and politicians for accountability. It is really what ties together the planning, programming, and organization pieces. The tool itself promotes performance management. In addition to having respondents link strategies to performance outcomes/measures, the performance measures can then feed back into the process by providing evidence when the assessment is conducted in the future. In future work on this tool, attention will be given to better tie together planning and programming processes with actual project delivery (procurement, construction, operations, maintenance) to draw more attention to issues of integration.

### 7.1.2 Poor internal communication

First, there seems to be a general weakness in internal messaging of sustainability as indicated by Factors 30 and 31. Based on the organization change literature, this is really a critical area for creating a sustainability culture – generating buy-in through an

inclusive process and engaging the engineers, planners, and other staff whose day-to-day work will change. A related critical weakness is Factor 19 (translating sustainability into policy and design manuals) because changing actions through those standard operating procedures (SOPs) is perhaps the most effective way to change culture.

Culture change can also be aided by engaging employees from across units and districts (if relevant) in the strategic planning process. Engaging employees could be an effective way to not only generate buy-in but also identify innovations that are already in place though may not be recognized by staff as falling under the sustainability umbrella. This is particularly true in the areas of project delivery and maintenance, where multiple practices can lead to significant sustainability outcomes when considered collectively. After DOTs identify these practices, they can then incorporate them into SOPs and apply them across all projects or corridors.

A related issue is the lack of agency definitions of sustainability or at least the clear presence of sustainability principles in mission, vision, and value statements (which represent an operational definition). Having a clear and consistent message is a key initial step in effectively communicating a desired organization change.

### 7.1.3 Importance of process

Overall, respondents viewed the content of the tool as comprehensive and clear. Most of their suggestions related to the process of using the tool and how structural changes could improve that process. Many of the possible applications identified by respondents would require an expanded process for completing the tool, both in terms of the number/type of participants and the timeframe. The expanded scope would be consistent with a strategic planning processes that can last weeks or months and should

involve participants from across the organization. Involving multiple positions would require an iterative process for designating factors and establishing priorities in order to build consensus. The exercise of "choosing sides" or "making judgments" is a strong point of the framework, forcing respondents to analyze, consider evidence, and defend their positions. That exercise provides a foundation for a consensus-building process. Interestingly, the iterative process of revisiting the priority ratings in order to designate the appropriate number was described as a disturbance by some respondents, but recognized by others as a valuable exercise in debating priorities. Potential applications for the tool (informed by the research motivation, literature review and case studies) are described in more detail in Section 7.2.

The themes and observations from the case studies lead to the idea of maturity levels for DOT approaches to sustainable transportation. The case studies seem to fall out in groups along a continuum. On the left are the DOTs just getting started with sustainable transportation as a concept for the organization. They do not have a formal structure or program in place to address sustainability but are starting to explore what sustainability means in general and in their specific context. This exploration is generally supported by top executives, but can be accelerated by commitment at lower levels. The agency probably has practices in place that support individual sustainable transportation objectives but have not yet organized them into a comprehensive framework. The next stage along the continuum is the DOTs that have really committed to the concept of sustainability and have a formal structure and program in place to coordinate their efforts. At this step, the agency is trying to develop a consistent message about their sustainability ethic and activities, working aggressively on the transportation and land use

connection, and starting to think about sustainability performance measures. At the next stage, the DOT has defined what sustainability means to the agency and communicates it consistently both internally and externally. They also address land use in a meaningful way, have policies and procedures in place, and have established measures to monitor progress. The agency emphasis is now on fully integrating sustainability across organizational levels and functions. Once that integration has been achieved, the agency will be at the far right of the continuum. The agency will no longer need a formal structure or separate program to coordinate sustainability efforts because it has permeated the organization's culture. However, since sustainable development is an on-going process, continual monitoring and performance evaluation is important even after a DOT has organized itself around sustainability principles. Therefore, a DOT with a high level of maturity (at the far right of the continuum) will still need to monitor performance measures and track external factors to ensure that the organization continues to respond effectively to changing environments.

## 7.2 Potential applications of the tool

Within the context of strategic planning, the sustainability SWOT tool developed for this dissertation could be applied at a variety of organizational levels and through different processes. This section describes three scenarios for how the tool could be applied in the future (though effective application may depend on the future work described in Chapter 8).

In the first scenario, the tool could be used to guide strategic planning activities for an individual business unit, such as the one charged with developing a sustainability plan or policy or as preparation for overall agency strategic planning effort. At the

business unit level, the SWOT analysis and development of strategies would be coordinated by the unit manager and involve program leads and other staff to create an inclusive process. The tool would help the unit develop a vision, identify strategic issues, and begin strategy development. At this level, the assessment results would likely be focused on the functions of the individual unit rather than the interests of the entire organization. Nevertheless, this would be a useful scenario for introducing concepts of sustainability and initiating analysis of what it means for individual business units.

Application of the tool could be scaled up from the business unit level to the organization level. Essentially, multiple participants representing different divisions or business units would participate in a consensus-building process to identify strategic issues for the entire agency. Ideally, participants would be high-level managers and would prepare their own assessment ahead of time. Then in a facilitated workshop session, participants could discuss and debate differences (with support from the evidence and explanations that they already identified individually). Agreeing on the factor designations and priorities for the entire agency would likely take multiple iterations. This activity would be valuable for evaluating the extent to which a sustainability commitment is trickling down from the executive level to the staff in different units. Managers would have an opportunity to identify barriers to implementation at different levels or across functions so that appropriate and feasible strategies can be developed. With representatives of different units in the room, the strategic planning group should be able to identify an appropriate task owner and performance measure for each strategy. In the future, the strategic planning team could reconvene on a regular basis to update the SWOT assessment and monitor progress toward achievement of strategies. The

performance measures identified in the original assessment could feed into the update as evidence to demonstrate progress that has been made. This update would require much less time than the original assessment unless there are significant changes in the internal or external environments.

A third potential application would be to use the tool externally to facilitate discussions with executive leadership of multiple state agencies or with local or regional transportation partners to develop a joint transportation strategy or a strategic corridor plan. This application would also involve a consensus-building process, and would benefit from an independent facilitator. While it may be difficult for external partners to judge all of the internal factors, having such broad participation would be invaluable for identifying collaboration opportunities for both implementing strategies and measuring progress (many sustainability indicators require data that is not collected in-house by DOTs).

A couple of variations could be explored for any scenario. First, a backcasting approach could be used wherein the internal and external factors are designated first for the present situation and then for a future desired state (for example, the situation in five years). Essentially, the desired future state would indicate what the high priority factors are and the strategies be developed to bridge the present and future states (represented by internal factors) or to avoid future challenges (posed by external factors). A second variation would be to develop scenarios based on different emphases of external factors or internal factors to see how strategies change. The final package of strategic issues and strategies could correspond to one emphasis area or to a combination of emphases.

### 7.3 From strategic planning to strategic management

As indicated by the literature, linking a strategic planning process to specific actions and to performance measures for monitoring those actions are vital steps toward strategic management. Identifying sustainability performance measures was identified as a significant challenge for DOTs in the 2009 survey, and as indicated by the case studies it is still a challenge but an area that several DOTs are working on.

In order to demonstrate that the SWOT tool can guide transportation agencies toward actions with measurable sustainability outcomes, performance measures were identified for each factor. As mentioned in the methodology section, these measures were primarily drawn from recently completed research studies on sustainability measures for transportation. Some of the measures are already being gathered by one or more state DOTs whereas others are proposed measures that could reasonably be collected.

The list of measures in this section is not exhaustive but rather representative of the types of measures that could be used to monitor implementation of a sustainability shift and its impact on the transportation system. The actual measures that a DOT selects will depend on the specific strategic goals that they identify and their chosen strategies, and would be a combination of those found in Table 14 and Table 15. In addition, some of the measures are not sufficient to capture change when considered individually; however, when evaluated in conjunction with other measures, the explanatory power increases. Performance measurement/management in transportation is not a perfect science – as with other techniques dealing with soft systems, it is an art.

Note that most measures were drawn from either (1) NCHRP Report 708: Guidebook for Sustainability Performance Measurement for Transportation Agencies or

(2) Midwest Transportation Knowledge Network's State Department of Transportation Benchmarks, Facts, and Statistics. The source is indicated in parentheses after the measure.

**Table 14. Possible performance measures corresponding to internal factors**

| Factor | Performance Measure(s) |
|---|---|
| I-1. Sustainability is recognized as an ethic or guiding principle for the organization | • Indicated by collection of performance measures elsewhere in this table |
| I-2. The organization has defined the concept of sustainability or sustainable transportation | • Yes or no – is the concept defined or a definition referenced |
| I-3. Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | • Yes or no – mission statement addresses environment, economy, society<br>• Yes or no – vision addresses environment, economy, society |
| I-4. Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | • Sustainability objectives are applicable to entire state OR<br>• Separate objectives are developed for urban and rural areas |
| I-5. Short-term, strategic goals are consistent with long-term sustainability goals | • Short-term strategic goals are defined AND<br>• Long-term goals sustainability goals are defined AND<br>• Short-term and long-term goals are consistent |
| I-6. Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | • Lane miles of new access improvements to intermodal and port facilities (1, pB-59)<br>• Change in planned miles of transit routes, pedestrian facilities, designated bike facilities, population within 1 mile of transit, connectivity index (pedestrian facilities, bike facilities, transit routes) (1, pB-59) |
| I-7. Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | • Proportion of projects subjected to life cycle cost analysis (LCCA) (1, pB-36)<br>• Proportion of projects with maintenance costs within planned budget (1, pB-38) |
| I-8. Policies and system planning promote operational improvements and demand management (e.g., ITS, variable tolling, VMT reduction) over new capital investments | • Proportion of projects with operational costs within planned budget (1, pB-38)<br>• Number of toll projects<br>• Percent of area traffic signals retimed during past three years, percent of area traffic signals within coordinated signal systems recoordinated during past three years (1, pB-67) |
| I-9. Sustainable transportation policies, programs, and project evaluation are well documented | • Agency website is easy to navigate and provides descriptions of new initiatives<br>• Annual performance reporting |

**Table 14 (continued)**

| | |
|---|---|
| I-10. Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e., long-range transportation plan or strategic plan) | • Yes or no – agency has a sustainability plan<br>• Yes or no - sustainability goals/objectives are identified in long-range or strategic plan |
| I-11. Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | • Number of sustainability initiatives included in business unit plans<br>• Action plan to implement sustainability programs, policies, and plans |
| I-12. Coordination between state, regional, and local transportation plans to achieve sustainability objectives | • Consistency requirement for regional and local plans<br>• Goals/objectives of other plans are consistent with state DOT's goals/objectives |
| I-13. Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | • Change in percentage of transportation system covered by consistent and accessible regional ecosystem framework(s) or spatially related ecological database (1, pB-39)<br>• Existence of a policy or specification prioritizing the use of sustainable materials (1, pB-54) |
| I-14. Selection criteria for programming reflect the goals/objectives in the long-range plan | • All modes (automobile, transit, pedestrian, bicycle) accommodated or improved by program (1, pB-15)<br>• Change in cost of shipment per ton/mile, by mode, due to program (1, pB-32) |
| I-15. Performance measures and selection criteria address sustainability objectives | • Change in number of programmed projects with highest reduction in crashes out of all alternatives (1, pB-3)<br>• Change in travel time (by mode) to schools, health services, grocery stores, civic and public spaces, recreation due to project(s) (1, pB-9)<br>• Change in cost of shipment per ton/mile, by mode, due to program (1, pB-32)<br>• Change in the percentage of projects programmed on the basis of achieving priority ecological outcomes (1, pB-40)<br>• Proportion of projects subjected to life cycle cost analysis (LCCA) (1, pB-36) |
| I-16. Performance management system measures progress toward sustainability targets and goals | • Preparation of an annual performance report on trends and achievements against agency sustainability policies and goals (revised from 1, pB-39)<br>• An asset management system is actively operated (1, pB-47) |

**Table 14 (continued)**

| | |
|---|---|
| I-17. Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | • Change in percentage of funds allocated for transit, bicycle, pedestrian<br>• Change in the percentage of person miles traveled by non-motorized modes, emissions (1, pB-67)<br>• Relative change in the percentage of disadvantaged population with convenient access to high-quality transit service (1, pB-14)<br>• Change in multimodal LOS (using HCM measures) (1, pB-20) |
| I-18. Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | • Change in percentage of funds allocated for operational improvement projects or research<br>• Change in percentage of funds allocated for maintenance projects<br>• Number of projects incorporating the use of innovative TSM and ITS solutions that address human factors considerations (1, pB-2)<br>• Change in percentage of roadway/transit infrastructure achieving state of good repair (1, pB-20) |
| I-19. Sustainability ethic and policies are translated into concrete guidance for planning and project development (e.g., flexible design standards, green rating system) | • Existence of a purchasing plan that establishes priority for sustainable materials (1, pB-53)<br>• Design standards revised to incorporate sustainable practices<br>• Percentage of projects earning a "green" rating |
| I-20. Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | • Number and types of promotional materials describing DOT's sustainability approach<br>• Affirmative response to public opinion survey |
| I-21. Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g., local zoning boards, MPOs, housing or community development agencies) | • Change in the number of jobs within reasonable travel time (by mode) for region's population (1, pB-8)<br>• Change in zoned residential density levels around essential service hubs (1, pB-59) |
| I-22. Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | • Annual express transit ridership in millions (2)<br>• Percentage of federal transit grants successfully won<br>• Number of jointly developed corridor plans<br>• Annual new miles of transit constructed |

**Table 14 (continued)**

| | |
|---|---|
| I-23. Degree of collaboration with environmental agencies for plan and project evaluation | • Change in the number of formalized working partnerships (e.g., memorandums of understanding) with public and private environmental stakeholders (1, pB-39) |
| I-24. Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | • Number of projects involving public-private partnership<br>• Number of lawsuits |
| I-25. Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | • DOT benchmarks itself against peer agencies<br>• Individual or unit responsible for monitoring research and practice at peer and partner agencies |
| I-26. Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | • Number of participants attending public workshops and hearings (2)<br>• Social media used to communicate with the public |
| I-27. Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | • Change in total energy consumed by DOT facilities (should relate to quantity of facilities) (1, pB-53)<br>• Number of proactive communication efforts initiated specifically to advocate for key transportation issues (2) |
| I-28. Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | • Inclusion of sustainability in performance reviews for employees at all levels<br>• Sustainability ratings of executives and managers on performance evaluations<br>• Number of executives/managers involved in sustainability-related activities at DOT, state, national level |
| I-29. Sustainability initiatives are organized across functional areas, departments, etc. (e.g. partnership between planning and operations/maintenance) through teams, task forces, or working groups | • Existence of an agency-wide environmental management system (1, pB-39)<br>• Percent of employees who crosstrained in multiple disciplines (2) |
| I-30. Employees understand what sustainability means to the agency and for their specific roles (i.e., sustainability is part of recruitment, hiring, and compensation for all employees) | • Change in share of agency staff that have received appropriate emergency training (1, pB-26)<br>• Availability of regular training and educational materials concerning sustainability<br>• Percentage of employees enrolled in alternative commute program<br>• Percent of new hires who complete sustainability training |

**Table 14 (continued)**

| | |
|---|---|
| I-31. A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | • Percent of employees who agree or strongly agree that Caltrans employees are encouraged to try new ideas and new ways of doing things to improve Caltrans (2)<br>• Number of external awards received (2)<br>• Number of internal awards given |
| I-32. Organization actively monitors external factors like new legislation and public opinion in order to inform future strategic planning | • Individual or unit is assigned to monitor external environment<br>• Number of engagements between Missouri's congressional members, statewide elected officials and legislators (2) |

**Table 15. Potential performance measures corresponding to external factors**

| Factor | Performance Measure(s) |
|---|---|
| E-1. Political climate regarding transportation | • Percent of positive news reports (2) |
| E-2. Political climate regarding sustainability | • Percent of positive news reports (2) |
| E-3. Public climate regarding transportation | • Customer satisfaction rates and opinions<br>• Availability of educational materials on transportation issues like funding or performance<br>• Percent of positive news reports |
| E-4. Public climate regarding sustainability | • Customer satisfaction rates and opinions<br>• Availability of educational materials on transportation issues like climate change, active transportation, etc. |
| E-5. Legislative requirements related to transportation planning and investment and/or sustainability | • Number of transportation-related legislative issues (2) |
| E-6. Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | • New Governor's political agenda and policy record |
| E-7. Availability of federal transportation funding | • Proportion of projects subjected to life cycle cost analysis (LCCA) (1, pB-36)<br>• Motor vehicle tax revenues by source |

**Table 15 (continued)**

| | |
|---|---|
| E-8. Availability of other funding | • Project-level cost/benefit ratio for proposed alternatives/policies, including freight (1, pB-36)<br>• Percent of annual transportation funding needs that can be met with annual revenues (1, pB-36)<br>• Motor vehicle tax revenues by source<br>• Relative Value of Motor Fuel Tax (due to inflation) (2) |
| E-9. Economy | • Change in travel time of goods to essential markets (region wide) (1, pB-8)<br>• Change in LOS on key freight routes or change in truck volume-to-capacity (V/C) ratio (1, pB-20)<br>• Change in person hours of recurring delay, by mode (1, pB-20) |
| E-10. Deployment of new technologies (smart phones, GPS, etc.) | • Number of projects incorporating the use of innovative TSM and ITS solutions that address human factors considerations (1, pB-2) |
| E-11. Changing demographics of transportation users (e.g., total population, age, income, spatial distribution) | • Relative change in the transportation cost index (1, pB-8)<br>• Cost per user/vehicle/household of taxes and fees dedicated to transportation (1, pB-36) |
| E-12. Housing options (affordability, density, location) | • Change in jobs/housing balance (1, pB-8)<br>• Change in zoned residential density levels around essential service hubs (1, pB-59) |
| E-13. Employment (types, wages, availability) | • Change in the number of jobs within reasonable travel time (by mode) for region's population (1, pB-8)<br>• Net change in jobs/income associated with transportation plan implementation (1, pB-31) |
| E-14. Climate-related impacts on transportation infrastructure (e.g., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | • Mitigation: Change in trips, vehicle trips, vehicle miles traveled (VMT), percent non-driver, tons of emissions per day (1, pB-59) |
| E-15. Transportation energy supply and sources | • Change in the amount and percentage of green energy purchased (1, pB-53)<br>• Change in the number (or value) of investments in operational technologies to reduce fuel consumption (1, pB-53) |
| E-16. Transportation fuel prices | • Changes in fuel prices<br>• Changes in motor fuel tax revenues |

# CHAPTER 8

# IMPACT AND IMPLICATIONS

## 8.1 Contribution

The main contribution of this research is a methodology for transportation agencies to develop or refine their organizational frameworks and processes to be more oriented toward sustainability, which could lead to transportation infrastructure investments that can be better maintained and operated over their service life, reduce environmental impacts and fossil fuel dependence, promote economic development, and meet the needs of growing and changing populations more effectively. The tool was developed to take a balanced approach to sustainability assessment, rather than emphasizing environmental sustainability. This research is also novel because it focuses on sustainability in transportation at a strategic, organizational level, addressing institutional barriers that can inhibit an integrated approach to sustainability assessment. Other sustainability assessment tools in transportation focus on the project level and to a limited extent system planning. In contrast with other sustainability assessment tools, the SWOT tool is not a rating system but rather adds value by leading to a list of strategic goals and actions for addressing sustainability.

Another key contribution was identifying and synthesizing the key internal factors that can lead to or inhibit successful change to a sustainability culture in transportation agencies. Those factors address the themes of sustainability ethic, institutionalizing sustainability, communications and collaboration, and organization structure/culture. These factors were identified through survey results, organization change and performance management literature, sustainability literature, and expert guidance.

This research is also significant because the methodology improves on the way SWOT analysis is often carried out in practice to create a systematic way to identify institutional barriers and help DOTs shape a comprehensive change strategy (see explanation in Chapter 5). When combined with the survey of DOT sustainability practices, the findings of this study identify a significant barrier to creating an integrated sustainability culture at DOTs: sustainability efforts are siloed. The development of sustainability policies and plans is led by a planning unit or separate "sustainability" group. If the planning of sustainability efforts continues to exclude the implementers (design engineers, programmers, public works, etc.), broad-based support for a culture change will not be achieved and the efforts will not be as effective as they could be. Planning for sustainability needs to be conducted at the organizational level and can be accomplished through an inclusive strategic planning process.

It is possible that the present siloed efforts indicate an earlier level of maturity in addressing sustainability in state DOTs. However as agencies evolve to more mature levels, the evolution should be characterized by a broader-based and more inclusive process for more effective results. The idea of sustainability maturity levels is another contribution of this research, though one that requires additional work. Such a model can help agencies to benchmark themselves and continue pushing toward a sustainability culture. The case studies showed the importance of benchmarking and self-awareness – the DOTs that are most advanced in organizing for sustainability did not necessarily report the greatest number of internal strengths, but rather were self-critical and recognized the areas that they still needed to work on.

## 8.2 Limitations of research

The first limitation is a limitation of the tool itself that is not discussed explicitly elsewhere in this dissertation: sustainability outcomes are not measured or directly linked to the SWOT factors. The suggested performance measures in Chapter 7 could be used to connect the assessment with system outcomes, which are very important to monitor in the long-term. As part of completing the assessment, an agency should provide "evidence" for how they designate different factors; this evidence could include outcome measures. However, a DOT could identify a large number of strengths but not have sufficient evidence to support them. Additionally, a DOT's self-assessment could conflict with actual state trends such as rising greenhouse gas emissions or a widening gap between maintenance needs and funds allocated for maintenance activities. This is because planning for change is important, but implementing and monitoring changes in organizational structure and processes is critical to achieving outcomes. Although the tool itself does not capture the outcomes, it does provide a framework for DOTs to evaluate their own progress and provide evidence to support claims of strengths versus weaknesses. Currently, it would be difficult to identify a common set of meaningful sustainability measures that could be used to compare the case study DOTs. This is due in part to lack of data and in part to the length of time it takes for changes in both transportation agencies and the transportation system to manifest themselves. The ability to evaluate the connection between changing organizational structure/culture and achieving sustainability outcomes will improve over time as more DOTs commit to sustainability and collect and report sustainability-related performance measures. Future

work could compare responses to the SWOT assessment with achievement of outcomes over time.

In addition to the limitations of the tool itself, a few limitations in the research process deserve attention. First, the case study approach did not use a random selection of participants nor lead to a large enough sample size to conduct statistical analysis or generalize results. However, as was mentioned previously, this was not the intended outcome of testing the SWOT tool. In the future, if a larger number of DOTs use the tool, their results may be used to generalize the challenges that DOTs overcome to create a sustainability culture.

Another potential limitation with respect to the sample is that respondents were not consistent in terms of their tenure at or position within the agency that limits the ability to compare across the DOTs, and potentially will continue as long as the agencies are at different stages in the development of their sustainability cultures. Most respondents commented that someone else within the organization would have likely provided different responses. From a research standpoint, this suggests standardizing the assessment process for more comparable results. However, that is not a practical approach since each agency has a slightly different structure and is likely at a different stage in the process, and strategic planning is not a one-size-fits-all process.

Directly related to the idea of "process", the research timeframe did not allow agencies to truly simulate a strategic planning process which can last several weeks and involve participants from across the DOT. The timeframe for completing case studies was limited to eight weeks, and initial recruitment took two to three weeks depending on

the DOT. Nevertheless, valuable feedback was obtained concerning both the process used and potential applications for the SWOT tool.

## 8.3 Future work

Although this work provides a contribution to practice and to the sustainability/management literature, there are several opportunities for future work to improve the framework and inform related research. The first priority for future work is to refine the tool's content and structure to address limitations (see Chapter 6). In terms of content, it will be necessary to explore in more depth what sustainability means for project procurement, design, and construction in order to direct more attention toward the implementation of sustainability policies. Those areas are indirectly addressed by a few internal factors, but the current tool as a whole is more focused on the planning and programming functions of DOTs. New factors can be developed to ensure that DOTs address those areas. Another content area that needs attention is the "redundancy" that some DOTs cited. Although overlapping factors were for the most part intentional, the factors will be revisited and perhaps refined in order to distinguish them from one another. An explanation for the intended redundancy could be provided in the introductory materials, but may lead users to look for the redundancies and shape responses accordingly.

Another serious structural limitation is that the tool does not explicitly allow DOTs to identify internal factors that may interact with one another. For example, in developing a strategy for a weakness, a DOT may be able to identify a strength that could be leveraged. This important interaction was identified in the literature (Panagiotou 2003; Piercy & Giles 1989). While this could be done within the description of a proposed

strategy, it may be helpful to "guide" agencies through that step. A more flexible, web-based tool could address that limitation and allow DOTs to further customize their assessment by dynamically adding factors (for example, by making multiple selections from a dropdown) and building strategies that address multiple factors at once. The tool could also be designed to guide respondents through an iterative process of designating and reviewing factors and to facilitate a consensus-building process by providing the ability to work through/combine multiple assessments completed by individuals (or business units).

A web-based tool would also be appropriate for providing a database of successful or innovative strategies updated on a continuing basis. DOTs that complete the assessment could then access examples of others' strategies. Through the survey effort in 2009, it was apparent that DOTs lacked awareness of what their peers were doing in the sustainability arena but had a desire to learn from them, a sentiment that was echoed by the case studies in this effort. While there is a lot of information available about sustainability, it is often spread out across multiple sources and requires considerable effort to access. It also tends not to describe the successful strategies that have been used but rather the end-product. A web-based database linked to the SWOT tool would provide an opportunity to consolidate the information in one place and focus on the actual steps that can be taken to achieve change. It would also provide a great resource for future research on the common challenges that transportation agencies face and how policy could better address those challenges. Finally, this resource in addition to a maturity or generational model would help DOTs benchmark themselves and continue to advance.

The next step after revising the tool and developing a more usable format would be to organize facilitated case studies of the possible scenarios described in Chapter 7. These new cases would serve as pilot demonstrations for DOTs and other transportation agencies as they consider how to apply the tool. A couple of the DOTs in this study indicated that the tool could be useful for sustainability efforts that they have underway, and so they could serve as pilot demonstrations. The pilots should include an internal or external facilitator in order to control the process and provide a means for evaluating its effectiveness. The opportunity to evaluate the effectiveness of strategic planning at DOTs is a research gap that was identified in the literature (see Poister et al 2010, Cameron et al 2009, Poister 2010). In addition to state DOTs, this tool is probably applicable to transit agencies, metropolitan or regional planning organizations, city DOTs, and other transportation agencies. Therefore, demonstrations at other types of agencies should be conducted.

Another area for future work, which was addressed in the previous section, is to link responses from the SWOT assessment to actual transportation system outcomes. This work is critical for demonstrating in the long-term that a transportation agency orienting itself around sustainability and progressing through maturity levels can achieve actual outcomes such as operating transportation infrastructure more efficiently, reducing greenhouse gas emissions, promoting economic development, and meeting the needs of a growing and changing population. These outcomes reflect sustainability concepts like strong sustainability and deep ecology, which were described in Chapter 3.

A couple of related research areas were stimulated by this research effort. First, researchers need to build a business case for sustainability (and not just fiscal

responsibility) by demonstrating the benefits of each component of the triple bottom line and how the synergies among them can be utilized to create additional benefits. Building a business case will empower DOT executives to communicate better the need for change to their employees and external stakeholders, thereby increasing the likelihood of a successful shift to a sustainability culture. This is not always easy to do and may communicate conflicting results because sustainability payoffs tend to be in the longer term while costs are incurred in the short term. Making a business case is therefore a function of the level of maturity of the agency in addressing sustainability, and should be considered in that context.

A second research area addresses a concern of many DOTs: succession planning. DOTs are moving into a new era characterized by increased funding constraints and a shift from building highways to operating and maintaining existing infrastructure and multi-modal development. They also face significant turnover in their workforce due to retirements or lay-offs, which poses a threat in terms of losing institutional and technical knowledge but this could also be a great opportunity. Hiring decisions will become increasingly important and represent an opportunity for culture change, leading to two research questions: (1) how can a DOT or other transportation agency recruit new hires whose attitudes and skills will support the agency's sustainability culture and strategic goals and (2) how can universities attract and effectively prepare students to fill those positions.

## 8.4 Conclusion

While agencies are not identical in their approaches to addressing sustainability, there is clear indication that transportation agencies are evolving their processes.

Advancing the consideration of sustainability in state DOTs can be aided by understanding the nature of the evolution or maturation of practices and how that process can be useful for peer-to-peer benchmarking. It is also useful to learn from both best and less effective practices. This research is therefore applicable to a range of transportation agencies because of its potential to stimulate and guide discussion of sustainability.

The current trend of siloing sustainability in transportation agencies as part of the maturing process suggests that planners and engineers within those agencies should collaborate in planning for a sustainable transportation system so that the culture can be created throughout the agency. Engineers, planners, and other staff are all implementers and targets of sustainability initiatives thus they should all be involved in directing the agency's strategic direction. In the long-term, full integration of sustainability principles into a transportation agency's culture, functions, and stakeholder relationships should result in a more robust, affordable, efficient, and safe transportation system. Ensuring that the agency continues to develop and maintain a sustainable transportation system will require continual monitoring of the changing external environment as well as the functioning of internal programs and processes.

# APPENDIX A.

# EXPERT PANEL

**Allen Biehler**, P.E., has over 30 years of multimodal expertise in transportation engineering and planning. Biehler served as Secretary of the Pennsylvania Department of Transportation from 2003 to 2010 where was responsible for a $7 billion budget, approximately 40,000 miles of roads, more than 11,000 employees and 25,000 bridges. He is known for his innovative approach to transportation policy, having introduced the concept of "Smart Transportation." Prior to serving as Secretary, he was a Vice President with the consulting firm DMJM+Harris and served as director of planning, engineering and construction at the Allegheny County Port Authority. Biehler served as president of AASHTO in 2009. He is currently a visiting professor of transportation policy at Carnegie Mellon University's Heinz College and on the Executive Committee of the State Smart Transportation Initiative.

**Douglas Foy**, J.D., is an environmental lawyer and transportation expert who served as a super-secretary in Governor Mitt Romney's cabinet. As super-secretary, Foy oversaw transportation, housing, environment, and energy agencies, with combined annual capital budgets of $5 billion, and a total workforce exceeding 11,000. This unique position enabled him to put into practice many of the policies he developed over twenty-five years as head of the Conservation Law Foundation, New England's premier environmental advocacy organization. Widely acknowledged as a leading environmentalist, Doug received the President's Environmental and Conservation Challenge Award, the country's highest conservation award, the Woodrow Wilson

Award for Public Service and an honorary "Officer of the Order of the British Empire". Foy is currently the President of Serrafix, a strategic consulting group advising clients on ways to save energy, improve transportation systems, and implement smart growth. He also serves on the executive committee of the State Smart Transportation Initiative.

**Astrid Glynn**, J.D., has over 35 years of experience in law and has been a transportation leader and policy maker for more than a decade. From 2007 to 2009 she served as Commissioner at the New York State Department of Transportation (NYSDOT) with charge of a workforce of over 9500 employees, some $1.7 billion in new construction projects begun annually, and a range of multimodal programs receiving state and federal support. While in NY, she created the first state standards for sustainable road and bridge designs and for highway construction and maintenance practices, and chaired the Standing Committee on Rail Transportation at the American Association of State Highway and Transportation Officials (AASHTO). Before going to New York, Glynn was Deputy Secretary at the Massachusetts Office of Commonwealth Development, which combined oversight of Transportation, Environment, and Housing. She also led the Office of Transportation Planning at the Massachusetts Executive Office of Transportation (now Mass DOT), which produced the state's first multimodal long range plan. As an attorney, she practiced in Pennsylvania and Massachusetts, representing shipping companies and their underwriters. Glynn is currently a Principal with the Transportation Planning and Resource Group (TPRG) and an Associate at Serrafix, a sustainability consulting group.

**Matthew Hardy**, PE, PhD, has transportation experience in the academic, private, and nonprofit sectors. Hardy is the Program Director for Planning and Policy at the American Association of State Highway and Transportation Officials (AASHTO). In this capacity, he supports a number of technical committees related to transportation planning, transportation asset management, and transportation performance management. In addition, he helps develop AASHTO transportation policy related to planning. Prior to AASHTO, he was a Principal in the Transportation Division of Noblis serving as project lead and technical expert, supporting the U.S. Department of Transportation on projects including work zone modeling and analysis, IntelliDrive, transit common data formats, and mileage-based user fees. Hardy is also an Adjunct Professor at George Mason University in the Department of Civil, Environmental, and Infrastructure Engineering He uses his experience in public transportation, computer modeling, and decision making to teach undergraduate and graduate level courses.

**Timothy Henkel** has almost 30 years of experience in transportation and transit. He is currently the Division Director of Modal Planning and Program Management at Minnesota DOT, and has worked at MnDOT for over 25 years. His experiences at MnDOT have covered Transportation Planning, Preliminary Design, Final Design, and Program Management. Prior to becoming Division Director, Henkel served as the Director of Metro District's Office of Program Management and Passenger Rail. Prior to joining MnDOT, Henkel worked in the private sector and in local government. His educational background is in geography, civil engineering, and land surveying.

**Julie Hunkins**, PE, serves as Manager of the Quality Enhancement Unit within the Technical Services Division at the North Carolina Department of Transportation where she is responsible for the value management and continuous improvement functions within the department. The unit fosters innovation by providing internal consulting services for intra-and inter-departmental, interdisciplinary, collaborative problem solving and action planning to support strategic departmental initiatives, key projects and services. Ms. Hunkins also serves as a facilitator to integrate sustainability, livability, energy and climate change considerations into departmental programs, processes and services. In that role, she is the project manager for NCDOT's Sustainability Blueprint, which is an effort to institutionalize sustainable principles and practices throughout all phases and functions of the DOT. Prior to leading the Quality Enhancement Unit, Ms. Hunkins served as Assistant State Highway Administrator and Director of the Office of Environmental Quality. Ms. Hunkins received her BS in Civil Engineering from North Carolina State University, and in addition to being a licensed Professional Engineer, she is a Certified Public Manager.

**Gloria Shepherd**, Ph.D., J.D., was named Associate Administrator for Planning, Environment, and Realty at Federal Highway Administration in 2007. Previously Shepherd served as Director, Office of Planning, where she was the FHWA's principal advocate for metropolitan and statewide planning and programs. Gloria joined FHWA in 1999 as a career member of the Senior Executive Service. Prior to joining FHWA, she held key positions with the Maryland Department of Transportation (MDOT). She served as Staff Director of MDOT's Transportation Solutions Group and Deputy Director, Office

of Planning and Preliminary Engineering. She also served as Chief of Staff at the New York State Department of Transportation.

**Brian Smith**, AICP, has almost 30 years of experience in transportation planning at state and local levels. As the Strategic Planning and Programming Director at Washington State DOT, Smith oversees the work of seven offices responsible for the statewide Washington Transportation Plan, WSDOT's system planning and construction program development, economic analysis and financing strategies, strategic planning and performance reporting, regional planning, urban planning, transportation system data, and geographic and cartographic services. Prior to joining the WSDOT team in 2005, Brian served for five years as the Deputy Director for Planning and Modal Programs at the California Department of Transportation (Caltrans). While there, he oversaw the activities of six divisions, including Aeronautics, Local Assistance, Mass Transportation, Rail, Transportation Planning, and Transportation System Information. Brian also serves on the Transportation Research Board's Statewide Multimodal Planning and Metropolitan Policy, Planning and Processes Committees and on the Strategic Highway Research Program 2-Technical Coordinating Committee for Capacity Research. He is also WSDOT's representative on the American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Planning.

# APPENDIX B. SUSTAINABILITY SWOT TOOL TEMPLATE

# Strategic Planning Tool for Transportation System Sustainability

## What is sustainability or sustainable development?

Sustainable development, as traditionally defined, is development that meets the needs of the present generation without compromising the ability of future generations to meet their needs. It is essentially the pursuit of sustainability, or the desired state that finds a protected natural environment and resources, a vibrant and diversified economy, and at least a minimum acceptable quality of life for all citizens. Those three dimensions (environment, economy, society/equity) are often referred to as the "triple bottom line" or three-legged stool of sustainability. The sustainability of the transportation system is a critical component of sustainable development for the community that owns and uses the system. Achieving sustainability requires evaluating the transportation system based on the triple bottom line and considering the long-term impacts of investments and the financial health of transportation agencies.

## How does this tool evaluate sustainability?

This tool uses a SWOT Analysis framework for evaluating, prioritizing, linking, and acting on the internal and external factors that promote a balanced, integrated approach to sustainability assessment of the transportation system. Internal factors can be directly controlled by the agency and are classified as either a Strength or a Weakness. External (situational) factors are those which the agency has little or no direct control over, but can significantly impact the mission and operations of a transportation agency. External factors are classified as Opportunities or Threats and require a response from the agency. For this assessment, the internal factors are grouped into four categories:

(A) Sustainability Ethic - The first step in transitioning to a sustainability-oriented framework for planning, programming, project development, and operations is establishing a clear vision and goals based on sustainability principles. The vision and goals can then be consistently applied to all of the agency's activities to ensure a sustainability ethic permeates throughout the organization.

(B) Institutionalizing Sustainability - As transportation agencies strategically commit to sustainability as a guiding framework, they need to adopt appropriate policies, tools, and methods for assessing sustainability. In order to ensure that those policies, tools, and methods are used consistently, changes should be made to an agency's standard operating procedures, or to the documents that dictate roles, responsibilities, and activities.

(C) Organizational Culture and Structure – Transitioning to the type of agency that promotes sustainability will require champions to support the effort and a critical mass to move the effort forward. Achieving a commitment to sustainability from employees at all levels is critical and can be facilitated by a variety of initiatives.

(D) Communication and Collaboration with Stakeholders – A necessary part of any organization change is effectively communicating new goals and processes to all external partners and stakeholders. Open communication facilitates buy-in from affected parties and could lead to more productive partnerships (i.e., can help in achieving goals or measuring progress).

## How should this tool be used?

This tool is not intended to be used as a rating system or survey. Rather, it is designed as a decision-support tool to start identifying the best opportunities for advancing sustainability. The tool can be used to guide discussion (and consensus-building) about sustainability priorities, organizational strengths and weaknesses, and appropriate strategies/actions for moving forward. It can also be used to periodically monitor implementation of strategies and to evaluate progress toward a more sustainability-oriented organizational framework.

**Resources**

AASHTO Center for Environmental Excellence, "Sustainability", http://environment.transportation.org/environmental_issues/sustainability/

Federal Highway Administration, Transportation Planning for Sustainability Guidebook, http://www.fhwa.dot.gov/hep/climate/resources.htm#sustain

Transportation Research Board, NCHRP Report 708: A Guidebook for Sustainability Performance Measurement for Transportation Agencies, http://www.trb.org/Main/Blurbs/166313.aspx

# INSTRUCTIONS

## General Instructions

Prior to beginning the assessment, fill in Tab 3 to identify the primary respondent and others who will help complete the assessment (if applicable). Then proceed through the assessment, starting with Tab 4. After completing Tabs 4 and 5 (see specific directions below), Tab 6 will be partially populated based on your inputs into the previous tabs.

## Tab 4 - Internal Factors: Designating Strengths and Weaknesses

(1) For each internal factor, determine whether it is currently a **strength** or **weakness** for your organization. A strength is a factor internal to your organization that represents an advantage for addressing external factors (opportunities/threats) or other internal factors. Strengths should be formally adopted and utilized. A weakness is a factor internal to your organization that represents a limitation or disadvantage for addressing external factors. The factor may be absent altogether or require overcoming a significant barrier in order to be considered a strength.

(2) Designate each factor as a **high, medium, or low-level priority** for your department/agency to act on. Priority should be designated based on importance to promoting sustainability culture in organization, suitability as the "next step" for the organization, and expected scale of the impact. At most, designate **four (4) high priority strengths** and **four (4) high priority weaknesses**.

(3) Provide **evidence** to support the designation and priority ranking for each factor (or at a minimum for each high priority factor). Evidence should refer to a policy, plan, program, other document, data/performance measures, or an organizational feature. Or in the case of a "weakness", evidence could also be an explanation of barriers to implementation (like staff expertise, financial resources, data availability, technology, etc.). Providing evidence will facilitate discussions with other department managers or program leads when discussing overall priorities for the organization and potential strategies for moving the organization forward.

## Tab 5 - External Factors: Determining Opportunities and Threats

(1) For each factor, determine whether it is currently an external **opportunity** or **threat** to your organization. An opportunity is a factor external to the organization that could be leveraged to improve the ability of your organization to plan/design a sustainable transportation system. A threat is a factor external to your organization that poses a particular challenge to the sustainability of the transportation system and to the activities of your organization.

(2) Next, designate each factor as an **immediate, short-term, or long-term priority**. This designation should be based on the level of urgency, or the need to act on the opportunity/threat quickly because there is a chance that it will change/occur and significantly impact the organization and its mission. Designate **three (3) immediate opportunities/threats**.

(3) Provide an **explanation** to support the designation and priority ranking for each factor (or at a minimum, for each immediate factor). The explanation should be supported by data/trends, research, legislation, etc. Providing this type of support will facilitate discussions with other department managers or program leads when discussing overall priorities for the organization and possible strategies.

**Tab 6 - Strategies and Work Plan**

(1) For each high priority strength/weakness (which will be populated automatically based on previous inputs), select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness.

(2) Indicate a strategy that could be used to (a) leverage the strength to take advantage of the opportunity, (b) utilize the strength to mitigate the threat, (c) strengthen the weakness to take advantage of the opportunity, or (d) minimize the weakness to protect against the threat. You can provide more than one strategy per pair of factors and the same strategy can be listed more than once.

(3) Indicate who should be responsible for implementing the strategy and what performance measure(s) could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the **primary task owner** and **performance measures** (with possible data sources). If relevant, indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTES: All **orange** cells represent dropdown menus with limited choices. All **green** cells require user-provided information. Any **red** text indicates an error - follow instructions for resolving the problem.

**RESPONDENT INFORMATION**

| | Respondent 1 | Respondent 2 | Respondent 3 |
|---|---|---|---|
| **Name:** | | | |
| **Title:** | | | |
| **Organization:** | | | |

| | |
|---|---|
| **Date of Completion (mm/dd/yy):** | |

## INTERNAL FACTORS: DESIGNATING STRENGTHS AND WEAKNESSES

For each factor, determine whether it is an organizational **strength** or **weakness** (refer to Tab 7 Definitions). Then designate each factor as **high**, **medium**, or **low** priority. At most, designate four (4) high priority strengths and four (4) high priority weaknesses. In the **evidence** column, provide support for designating each factor as a strength versus weakness and for priority rankings. At a minimum, provide evidence for each high priority factor. After completion, proceed to Tab 5 External Factors.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| | **Sustainability Ethic** | | | |
| 1 | Sustainability is recognized as an ethic or guiding principle for the organization. | | | |
| 2 | The organization has defined the concept of sustainability or sustainable transportation. | | | |
| 3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | | | |
| 4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | | | |
| 5 | Short-term, strategic goals are consistent with long-term sustainability goals | | | |
| 6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | | | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | | | |
| 9 | Sustainable transportation policies, programs, and project evaluation are well documented | | | |
| | **Institutionalizing Sustainability** | | | |
| 10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | | | |
| 11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | | | |
| 12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | | | |
| 13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | | | |
| 14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | | | |
| 15a | Performance measures and selection criteria address sustainability objectives (select from list below) | | | |
| 15b | | | | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 16 | Performance management system measures progress toward sustainability targets and goals | | | |
| 17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | | | |
| 18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | | | |
| 19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | | | |
| | **Communication and Collaboration with Stakeholders** | | | |
| 20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | | | |
| 21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | | | |
| 22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | | | |
| 23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | | | |
| 23b | | | | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | | | |
| 25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | | | |
| 26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | | | |
| | **Organizational Culture and Structure** | | | |
| 27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | | | |
| 28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | | | |
| 29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | | | |
| 30 | Employees understand what sustainability means to the agency and for their specific roles (i.e. sustainability is part of recruitment, hiring, and compensation for all employees) | | | |
| 31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | | | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 32 | Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | | | |
| | **Other Internal Factors (user provided, not required)** | | | |
| 33 | (Insert additional factor, optional) | | | |
| 34 | (Insert additional factor, optional) | | | |
| 35 | (Insert additional factor, optional) | | | |

## EXTERNAL FACTORS: DETERMINING OPPORTUNITIES AND THREATS

For each factor, determine whether it is currently an external opportunity or threat to your organization (refer to Tab 7 Definitions). Then designate each factor as an immediate, short-term, or long-term priority. Designate three (3) factors as immediate, indicating the importance of quickly addressing them. Finally, provide an explanation to support the designation of each factor as an opportunity versus threat and the assigned urgency ranking. Upon completion, proceed to Tab 6 Strategies and Work Plan.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 1a | Political climate regarding transportation (select level below) | | | |
| 1b | | | | |
| 2a | Political climate regarding sustainability (select level below) | | | |
| 2b | | | | |
| 3 | Public climate regarding transportation | | | |
| 4 | Public climate regarding sustainability | | | |
| 5a | Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | | | |
| 5b | | | | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 7a | Availability of federal transportation funding (select category below) | | | |
| 7b | | | | |
| 8a | Availability of other funding (select level below) | | | |
| 8b | | | | |
| 9 | Economy | | | |
| 10 | Deployment of new technologies (smart phones, GPS, etc.) | | | |
| 11 | Changing demographics of transportation users (e.g. total population, age, income, spatial distribution) | | | |
| 12 | Housing options (e.g. affordability, density, location) | | | |
| 13 | Employment (types, wages, availability) | | | |
| 14 | Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | | | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 15 | Transportation energy supply and sources | | | |
| 16 | Transportation fuel prices | | | |
| 17 | (Insert additional factor, optional) | | | |
| 18 | (Insert additional factor, optional) | | | |
| 19 | (Insert additional factor, optional) | | | |
| 20 | (Insert additional factor, optional) | | | |

## STRATEGIES & WORK PLAN

For each high priority strength/weakness, select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness. Then indicate a strategy that could be implemented, who within the organization should be responsible for that strategy, and what performance measures could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the primary task owner and performance measures (with possible data sources). Be sure to indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 8 | | | | | |

**Equity**: Fair and equal distribution of impacts (positive and negative) of transportation projects geographically and by socioeconomic grouping.

**Multi-modal**: Transportation system consists of different modal networks (roads, bus, rail, bicycle, pedestrian, air, ports, telecommunications, marine/ferry, etc.) that facilitate travel (of people, goods, information, etc.) from one place to another; intermodal connections allow travelers to transfer from one modal network to another in order to complete a trip. An integrated multi-modal system provides high levels of both mobility and accessibility.

**Opportunity:** Factor external to the organization that could be leveraged to improve the ability of your agency to plan/design a sustainable transportation system.

**Performance management**: ongoing process of selecting measures, setting targets, and using performance data to inform decision-making (including planning and programming)

**Performance measure:** a quantifiable indicator of performance that can be used to evaluate progress toward achievement of a goal or objective

**Selection (or prioritization) criteria**: measures used to evaluate and prioritize projects during programming. Should be a direct linkage between the goals of the transportation planning process and the selection criteria.



**Strategic planning**: A process for establishing and achieving a vision for the organization in the future. The process involves identifying strategic issues, formulating strategies to address those issues, implementing the strategies, and evaluating the effectiveness of the strategies for achieving the organization's vision.

**Strength:** Factor internal to the organization that represents an advantage for addressing external factors (opportunities/threats) or other internal factors. Strengths should be formally adopted and utilized.

**Sustainability**: The desired state that finds the environmental, social, and economic systems in harmony.

**Sustainable development**: The pursuit of sustainability, or process for achieving sustainability. Commonly defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their needs.

**Sustainable transportation**: Transportation that contributes to the sustainable development of the community that owns and uses the system. In addition to technical sufficiency, the performance of the transportation system should be evaluated according to the triple bottom line of sustainability: economic, social, and environmental impacts.

**SWOT Analysis**: an approach commonly in strategic planning to help identify strategic issues and corresponding strategies. It involves identifying the organization's internal strengths and weaknesses and the external opportunities and threats that influence the organization's ability to achieve its vision/goals.

**Threat:** Factor external to the organization that poses a particular challenge to the sustainability of the transportation system and to the activities of the agency.

# APPENDIX C. SWOT RESULTS

**RESPONDENT INFORMATION**

| | Respondent 1 | Respondent 2 | Respondent 3 |
|---|---|---|---|
| **Name:** | | | |
| **Title:** | Operating Core | | |
| **Organization:** | DOT 1 | | |

**Date of Completion (mm/dd/yy):**

## INTERNAL FACTORS: DESIGNATING STRENGTHS AND WEAKNESSES

For each factor, determine whether it is an organizational **strength** or **weakness** (refer to Tab 7 Definitions). Then designate each factor as **high**, **medium**, or **low** priority. At most, designate four (4) high priority strengths and four (4) high priority weaknesses. In the **evidence** column, provide support for designating each factor as a strength versus weakness and for priority rankings. At a minimum, provide evidence for each high priority factor. After completion, proceed to Tab 5 External Factors.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| | **Sustainability Ethic** | | | |
| 1 | Sustainability is recognized as an ethic or guiding principle for the organization. | Strength | High | Providing the Public with a sustainable transportation program is part of the Department's mission statement; touches on environmental, economic, and social aspects |
| 2 | The organization has defined the concept of sustainability or sustainable transportation. | Strength | High | |
| 3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Strength | High | |
| 4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | Strength | High | |
| 5 | Short-term, strategic goals are consistent with long-term sustainability goals | Strength | High | |
| 6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Strength | High | Vision statement strives for intermodal system and reflects other sustainability principles |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Strength | High | Maintenance funding (roadway, interstate, bridge, etc) is setside each year (significant amount) |
| 8 | Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Strength | High | The Department recently created Performance Management Office to coordinate data-driven decision support process |
| 9 | Sustainable transportation policies, programs, and project evaluation are well documented | Strength | High | The Department has many documents supporting and documenting sustainable transportation policies, such as the Statewide Strategic Transportation Plan, Statewide Transportation Plan, the State Transportation Improvement Program, board policies, etc. |
| | **Institutionalizing Sustainability** | | | |
| 10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | Strength | High | The Department has many documents supporting and documenting sustainable transportation policies, such as the Statewide Strategic Transportation Plan, Statewide Transportation Plan, the State Transportation Improvement Program, board policies, etc. |
| 11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | Strength | High | The Department recently created Performance Management Office to coordinate data-driven decision support process |
| 12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | Strength | Low | There are some instances where the State's interpretation of "sustainable" is different than a local's government. |
| 13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | Strength | High | The Department has the Statewide Transportation Plan (SWTP) which assesses the current and future performance of all major transportation modes in the state. |
| 14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | Strength | Medium | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 15a | Performance measures and selection criteria address sustainability objectives (select from list below) | Strength | High | |
| 15b | All categories | | | |
| 16 | Performance management system measures progress toward sustainability targets and goals | Strength | High | The Department recently created Performance Management Office to coordinate data-driven decision support process |
| 17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | Strength | High | Percentage, but that does not include roadway/bridge projects that have sidewalks and other pedestrian projects, as part of the overall roadway/bridge projects. |
| 18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | Strength | High | One could argue that 100% of the Department's funding goes towards operating and maintaining existing infrastructure. A roadway widening project is, by nature, assisting in the operation of the roadway. In my opinion, this is hard to measure as the Department has so many different "funding pots" and transportation programs for instance; bridge painting is a maintenance activity that helps preserve infrastructure. If you add Interstate Maintenance, Bridge replacement, Congestion Mitigation, and Highway Safety Improvement categories, about 25% of the Department's overall yearly expenditures goes to those categories. |
| 19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | Strength | High | The Department went through a project priortization effort a few years ago. Those results are used to assist Executive Management with programing decisions. |
| | **Communication and Collaboration with Stakeholders** | | | |
| 20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | Strength | Medium | Department could promote our mission statement more |
| 21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | Strength | High | The Department has a high degree of collaboration with agencies that make land use decisions. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | Strength | High | |
| 23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | Strength | High | |
| 23b | All levels | | | |
| 24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | Strength | High | |
| 25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | Strength | High | Groups like AASHTO, SASHTO, NCHRP, TRB, etc help all the nations's State DOTs share information |
| 26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | Strength | High | The public involement for the STIP, for which the Department has authority over, is very extensive, offering around 14 meetings to the public. The Department also presents a meeting opportuinty to every elected offical in non-MPO areas, throught the state, to discuss the STIP. |
| | **Organizational Culture and Structure** | | | |
| 27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | Weakness | Low | I doubt that the majority of the Department's empolyees are aware of the mission and/or vision statement |
| 28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | Strength | Low | |
| 29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | Strength | Medium | There are some instances of disconnection between offices |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 30 | Employees understand what sustainability means to the agency and for their specific roles (i.e. sustainability is part of recruitment, hiring, and compensation for all employees) | Weakness | Medium | It is doubtful that employees understand what sustainability means to the agency |
| 31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | Weakness | High | No rewards are given, and only a few are recognized for anything, much less sustrainable innovations |
| 32 | Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | Strength | Medium | |
| | **Other Internal Factors (user provided, not required)** | | | |
| 33 | (Insert additional factor, optional) | | | |
| 34 | (Insert additional factor, optional) | | | |
| 35 | (Insert additional factor, optional) | | | |

## EXTERNAL FACTORS: DETERMINING OPPORTUNITIES AND THREATS

For each factor, determine whether it is currently an external opportunity or threat to your organization (refer to Tab 7 Definitions). Then designate each factor as an immediate, short-term, or long-term priority. Designate three (3) factors as immediate, indicating the importance of quickly addressing them. Finally, provide an explanation to support the designation of each factor as an opportunity versus threat and the assigned urgency ranking. Upon completion, proceed to Tab 6 Strategies and Work Plan.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 1a | Political climate regarding transportation (select level below) | Threat | Long-term | Transportation funding levels are up in the air, and congress can't agree on the way to fund future transportation projects…because the current way (gas tax) is no longer enough for all the improvements needed |
| 1b | All levels | | | |
| 2a | Political climate regarding sustainability (select level below) | Opportunity | Long-term | Allows for the Department to find more affordable transportation solutions |
| 2b | All levels | | | |
| 3 | Public climate regarding transportation | Opportunity | Long-term | Currently the public is open to innovative transportation solutions, allowing transportation officals to be more creative. |
| 4 | Public climate regarding sustainability | Opportunity | Long-term | |
| 5a | Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | Threat | Long-term | The Federal and state investment levels for transportation is critical |
| 5b | Transportation investment | | | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 6 | Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Opportunity | Immediate | |
| 7a | Availability of federal transportation funding (select category below) | Threat | Long-term | A decision on funding availabilty is a critical |
| 7b | All types | | | |
| 8a | Availability of other funding (select level below) | Opportunity | Long-term | Current local funding initiative, if passed, presents a great opportunity for funding |
| 8b | Local | | | |
| 9 | Economy | Threat | Long-term | |
| 10 | Deployment of new technologies (smart phones, GPS, etc.) | Opportunity | Long-term | Advancement in technology presents endless opporutintes that would allow transportation officals to enhance many areas of transportation. |
| 11 | Changing demographics of transportation users (e.g. total population, age, income, spatial distribution) | Opportunity | Long-term | |
| 12 | Housing options (e.g. affordability, density, location) | Opportunity | Long-term | |
| 13 | Employment (types, wages, availability) | Opportunity | Long-term | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 14 | Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | Threat | Long-term | |
| 15 | Transportation energy supply and sources | Opportunity | Long-term | |
| 16 | Transportation fuel prices | Threat | Long-term | Has the potentail to affect transportation funding. |
| 17 | (Insert additional factor, optional) | | | |
| 18 | (Insert additional factor, optional) | | | |
| 19 | (Insert additional factor, optional) | | | |
| 20 | (Insert additional factor, optional) | | | |

## STRATEGIES & WORK PLAN

For each high priority strength/weakness, select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness. Then indicate a strategy that could be implemented, who within the organization should be responsible for that strategy, and what performance measures could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the primary task owner and performance measures (with possible data sources). Be sure to indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 1 | Strength: Sustainability is recognized as an ethic or guiding principle for the organization. | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | If the administration changed the priorites and/or the policies related to susntrainable transportation, the Department would have to readdress the mission statement. A new mission statement, has the potentail to change the way the Department does business. | Exectutive Management | A measurement of policy would be in order, as this would be a change of policy, which could lead to many changes..too many to predict |
| 2 | Strength: The organization has defined the concept of sustainability or sustainable transportation. | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | | | |
| 3 | Strength: Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | | | |
| 4 | Strength: Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | | | |
| 5 | Strength: Short-term, strategic goals are consistent with long-term sustainability goals | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | | | |
| 6 | Strength: Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | | | |
| 7 | Strength: Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | | | |

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 8 | Strength: Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | | | |

**RESPONDENT INFORMATION**

| | Respondent 1 | Respondent 2 | Respondent 3 |
|---|---|---|---|
| **Name:** | | | |
| **Title:** | Operating Core | | |
| **Organization:** | DOT 2 | | |

**Date of Completion (mm/dd/yy):**

## INTERNAL FACTORS: DESIGNATING STRENGTHS AND WEAKNESSES

For each factor, determine whether it is an organizational **strength** or **weakness** (refer to Tab 7 Definitions). Then designate each factor as **high**, **medium**, or **low** priority. At most, designate four (4) high priority strengths and four (4) high priority weaknesses. In the **evidence** column, provide support for designating each factor as a strength versus weakness and for priority rankings. At a minimum, provide evidence for each high priority factor. After completion, proceed to Tab 5 External Factors.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| | **Sustainability Ethic** | | | |
| 1 | Sustainability is recognized as an ethic or guiding principle for the organization. | Weakness | Low | Sustainability is achived through cost saving measures and efficiencies |
| 2 | The organization has defined the concept of sustainability or sustainable transportation. | Weakness | Low | The Department doesn't have an operations definition of sustainability |
| 3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Strength | Medium | Mission describes an integrated system that promotes economic development and quality of life. |
| 4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | Weakness | Low | There isn't a difference between sustainability activities in rural or urban counties. |
| 5 | Short-term, strategic goals are consistent with long-term sustainability goals | Weakness | Low | The Department does not have long-term sustainability goals |
| 6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Strength | Medium | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Strength | High | The Department has developed a considerable asset management database which allows operations to focus on applying the "right fix at the right time" to the road network. This provides the department with accurate information to perform maintenance and rehab work, it is our highest priority. |
| 8 | Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Strength | High | In an effort to reduce congestions, improve safety and operate an efficient transportation network, the Department has invested in demand technologies such as ITS, Variable message signage (real-time travel info), and mobile data collection. |
| 9 | Sustainable transportation policies, programs, and project evaluation are well documented | Weakness | Low | There are several informal list of sustainable activities conducted around the Department, again based on cost saving more than environmental sustainability |
| | **Institutionalizing Sustainability** | | | |
| 10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | Weakness | Low | A sustainability plan is not a part of DOT's long-range plan |
| 11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | Weakness | Low | There aren't specific sustainability factors |
| 12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | Weakness | Low | None |
| 13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | Strength | High | The long-range plan addresses mobility, environment, economic, and social objectives although sustainability is not directly mentioned |
| 14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | Strength | High | the long-range plan is policy document that guides the decision making process for selecting projects |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 15a | Performance measures and selection criteria address sustainability objectives (select from list below) | Weakness | Low | Performance measures are important in directing the operations of the DOT however there isn't a sustainability PM |
| 15b | All categories | | | |
| 16 | Performance management system measures progress toward sustainability targets and goals | Weakness | Low | The Department has aggressive performance measure however sustainability is not a focus of that effort |
| 17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | Weakness | Low | % dictated by state constitution |
| 18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | Weakness | Low | |
| 19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | Weakness | Low | |
| | **Communication and Collaboration with Stakeholders** | | | |
| 20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | Weakness | Low | |
| 21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | Strength | Medium | The Department operates in close partnership with State resource agencies as well as local goverments and MPOs |
| 22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | Strength | Medium | The Department participates with numerous agencies through partnerships and agreements |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | Strength | Medium | Environmental agencies are invovled in project approval through regulatory processes and their input is solicited through the public involvement process |
| 23b | All levels | | | |
| 24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | Strength | Low | The Department has numerous staff invovled in partnerships with the private and non-profit sectors in the areas of research policy planning, etc, these are valuable to the state. |
| 25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | Strength | Low | |
| 26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | Strength | Medium | The Department has a "context sensitive solution" public invovlement process that goes beyond minimum requirements |
| | **Organizational Culture and Structure** | | | |
| 27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | Weakness | Low | This would be a valuable activity however at this time it isn't feasible due to inconsistent message from higher (federal) offices |
| 28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | Weakness | Low | |
| 29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | Weakness | Low | |
| 30 | Employees understand what sustainability means to the agency and for their specific roles (i.e. sustainability is part of recruitment, hiring, and compensation for all employees) | Weakness | Low | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | Weakness | Low | |
| 32 | Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | Strength | Medium | |
| | **Other Internal Factors (user provided, not required)** | | | |
| 33 | (Insert additional factor, optional) | | | |
| 34 | (Insert additional factor, optional) | | | |
| 35 | (Insert additional factor, optional) | | | |

## EXTERNAL FACTORS: DETERMINING OPPORTUNITIES AND THREATS

For each factor, determine whether it is currently an external opportunity or threat to your organization (refer to Tab 7 Definitions). Then designate each factor as an immediate, short-term, or long-term priority. Designate three (3) factors as immediate, indicating the importance of quickly addressing them. Finally, provide an explanation to support the designation of each factor as an opportunity versus threat and the assigned urgency ranking. Upon completion, proceed to Tab 6 Strategies and Work Plan.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 1a | Political climate regarding transportation (select level below) | Threat | Immediate | Funding transportation is a major issue |
| 1b | All levels | | | |
| 2a | Political climate regarding sustainability (select level below) | Threat | Long-term | Needs to be decided at a federal level before states can act with confidence |
| 2b | Federal level | | | |
| 3 | Public climate regarding transportation | Threat | Long-term | Funding takes priority over all other components of transportation at this time and for the foreseeable future |
| 4 | Public climate regarding sustainability | Opportunity | Long-term | Public opinion on sustainability changes frequently |
| 5a | Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | Opportunity | Long-term | |
| 5b | Transportation investment | | | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 6 | Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Threat | Short-term | It is always a challenge when new adminstrations come into office and have different priorities |
| 7a | Availability of federal transportation funding (select category below) | Threat | Long-term | Lack of flexibility in transportation funding as dictated by state or federal laws is a challenge for transportation |
| 7b | All types | | | |
| 8a | Availability of other funding (select level below) | Threat | Immediate | Inability to match federal or private funding with state funds is a problem |
| 8b | State | | | |
| 9 | Economy | Threat | Long-term | Population is not expected to grow and VMT is often related to population |
| 10 | Deployment of new technologies (smart phones, GPS, etc.) | Opportunity | Immediate | Already using mobile technologies to improve data gathering and provide real-time traffic information |
| 11 | Changing demographics of transportation users (e.g. total population, age, income, spatial distribution) | Threat | Long-term | Only a threat if revenue continues to be associated with fuel. |
| 12 | Housing options (e.g. affordability, density, location) | Threat | Long-term | Only a threat if revenue continues to be associated with fuel. |
| 13 | Employment (types, wages, availability) | Threat | Long-term | Only a threat if revenue continues to be associated with fuel. |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 14 | Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | Threat | Long-term | Greater intensity of rain is a concern where drainage is not designed to handle large volume of water. Extreme high temperatures impacts construction as well as infrastructure. |
| 15 | Transportation energy supply and sources | Threat | Long-term | |
| 16 | Transportation fuel prices | Threat | Long-term | Fuel price is a threat to sustainability only if revenue is tied to fuel sales. |
| 17 | (Insert additional factor, optional) | | | |
| 18 | (Insert additional factor, optional) | | | |
| 19 | (Insert additional factor, optional) | | | |
| 20 | (Insert additional factor, optional) | | | |

## STRATEGIES & WORK PLAN

For each high priority strength/weakness, select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness. Then indicate a strategy that could be implemented, who within the organization should be responsible for that strategy, and what performance measures could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the primary task owner and performance measures (with possible data sources). Be sure to indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 1 | Strength: Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Threat: Availability of other funding (select level below) | Our insufficient funding threatens our ability to preserve our existing system at level of service that travellers and business demands | | Maintain condition data of pavement and bridges on the state system to ensure that they remain in fair to good condition. |
| 2 | Strength: Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Opportunity: Deployment of new technologies (smart phones, GPS, etc.) | Continue to capitalize on the benefits of technology in traffic demand management. | Operations | develop a system to track travel speeds during incidents to see if electronic technologies improve traffic flow and safety |
| 3 | Strength: Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | Threat: Availability of other funding (select level below) | When conducting long-range plan activities continue to look at current sustainability trends and cost saving measures that could be included in future projects and policies | Planning | Periodically re-visit the long range plan to determine if progress is being made or if adjustments are required to meet the changing conditions in transportation |
| 4 | Strength: Selection criteria for programming reflect the goals/objectives in the long-range plan | Threat: Availability of other funding (select level below) | Continue to look at cost savings and efficiencies related to sustainability when selecting, designing, and constructing projects. | Operations | Periodically re-visit the selection criteria for the five year program to ensure it meets the needs of the long range plan and the public. |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 8 | | | | | |

**RESPONDENT INFORMATION**

| | Respondent 1 | Respondent 2 | Respondent 3 |
|---|---|---|---|
| **Name:** | | | |
| **Title:** | Mid level manager | | |
| **Organization:** | DOT 3 | | |

**Date of Completion (mm/dd/yy):**

## INTERNAL FACTORS: DESIGNATING STRENGTHS AND WEAKNESSES

For each factor, determine whether it is an organizational **strength** or **weakness** (refer to Tab 7 Definitions). Then designate each factor as **high**, **medium**, or **low** priority. At most, designate four (4) high priority strengths and four (4) high priority weaknesses. In the **evidence** column, provide support for designating each factor as a strength versus weakness and for priority rankings. At a minimum, provide evidence for each high priority factor. After completion, proceed to Tab 5 External Factors.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| | **Sustainability Ethic** | | | |
| 1 | Sustainability is recognized as an ethic or guiding principle for the organization. | Strength | Medium | DOT is currently working with a national non-profit on a demonstration project which encompasses sustainability as a guiding principle. |
| 2 | The organization has defined the concept of sustainability or sustainable transportation. | Strength | Medium | Same Comment as Above |
| 3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Strength | High | Mission addresses each dimension |
| 4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | Weakness | Medium | Vision more clearly defined for Urban areas; however, planning and project development do try to coordinate with Urban Growth Boundary provisions. |
| 5 | Short-term, strategic goals are consistent with long-term sustainability goals | Weakness | Low | |
| 6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Strength | High | Emphasis currently being given to integration of freight mobility in the transportation system |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Strength | High | Was clearly identified as a priority in recent Customer Satisfaction Survey. |
| 8 | Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Strength | Medium | |
| 9 | Sustainable transportation policies, programs, and project evaluation are well documented | Weakness | Medium | |
| | **Institutionalizing Sustainability** | | | |
| 10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | Weakness | High | Most current LRTP was a "Vision" Plan with a mulit-year program for strategic investments |
| 11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | Weakness | Medium | |
| 12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | Strength | Medium | |
| 13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | Weakness | Medium | |
| 14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | Strength | Medium | Current initiative to develop both quantifiable and well as qualatative evaluation criteria that addresses safety, mobility, environmental awareness as well as local government and community support. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 15a | Performance measures and selection criteria address sustainability objectives (select from list below) | Weakness | Low | |
| 15b | | | | |
| 16 | Performance management system measures progress toward sustainability targets and goals | Weakness | Low | |
| 17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | Strength | Medium | |
| 18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | Strength | Medium | |
| 19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | Weakness | Low | |
| | **Communication and Collaboration with Stakeholders** | | | |
| 20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | Weakness | Medium | |
| 21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | Weakness | Medium | Will be addressed with the creation of a new office within a planning division to manage community transportation |
| 22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | Strength | Medium | Have completed two statewide Interstate Corridor Studies with one underway and another to be developed |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | Strength | Medium | Have developed and are implementing an agreement with multiple agencies |
| 23b | | | | |
| 24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | Weakness | High | |
| 25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | Weakness | Low | |
| 26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | Strength | High | DOT has developed and adheres to an extensive Public Involvement Plan. |
| | **Organizational Culture and Structure** | | | |
| 27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | Weakness | Low | Currently message is probably more inherent within the Headquarters offices with lesser degree of priority within regional offices responsible for construction and maintenance activities. |
| 28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | Weakness | High | State Government is just now implementing performance evaluations, which may translate to sustainability as a specific "outcome" vs. "activity" |
| 29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | Weakness | Medium | |
| 30 | Employees understand what sustainability means to the agency and for their specific roles (i.e. sustainability is part of recruitment, hiring, and compensation for all employees) | Weakness | Low | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | Weakness | High | State Government is just now implementing performance evaluations, which may translate to sustainability as a specific "outcome" vs. "activity" |
| 32 | Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | Strength | Medium | |
| | **Other Internal Factors (user provided, not required)** | | | |
| 33 | (Insert additional factor, optional) | | | |

## EXTERNAL FACTORS: DETERMINING OPPORTUNITIES AND THREATS

For each factor, determine whether it is currently an external opportunity or threat to your organization (refer to Tab 7 Definitions). Then designate each factor as an immediate, short-term, or long-term priority. Designate three (3) factors as immediate, indicating the importance of quickly addressing them. Finally, provide an explanation to support the designation of each factor as an opportunity versus threat and the assigned urgency ranking. Upon completion, proceed to Tab 6 Strategies and Work Plan.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 1a | Political climate regarding transportation (select level below) | Opportunity | Short-term | In terms of support for additional funding to support transportation improvements, positive climate indentified as a priority in recent Customer Satisfaction Survey. |
| 1b | | | | |
| 2a | Political climate regarding sustainability (select level below) | Threat | Long-term | Recent state legislative activity opposing certain sustainable development policies |
| 2b | | | | |
| 3 | Public climate regarding transportation | Opportunity | Short-term | In terms of support for additional funding to support transportation improvements, positive climate indentified as a priority in recent Customer Satisfaction Survey. |
| 4 | Public climate regarding sustainability | Threat | Long-term | Recent state legislative activity opposing certain sustainable development policies |
| 5a | Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | Threat | Long-term | Same Comment as Above |
| 5b | | | | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 6 | Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Opportunity | Short-term | Leadership (both Governor & Commissioner) are supportive |
| 7a | Availability of federal transportation funding (select category below) | Threat | Immediate | Current uncertainty of federal transportaion re-authorization beyond September 30, 2012. Impedes ability to effectively and efficiently budget. |
| 7b | | | | |
| 8a | Availability of other funding (select level below) | Opportunity | Long-term | Unaware of other sources, other than public-private partnerships, which heretofore, have been few. |
| 8b | | | | |
| 9 | Economy | Opportunity | Short-term | American Recovery & Reinvestment Act (ARRA) was successful in clearing a backlog of "shovel ready" projects. Lowered construction costs resulting in projects being completed under budget with funds remaining to cover over-runs on other projects. |
| 10 | Deployment of new technologies (smart phones, GPS, etc.) | Opportunity | Immediate | Seems to prove to be envaluable tool to aid motorists during both recurring and non-recurring congestion. |
| 11 | Changing demographics of transportation users (e.g. total population, age, income, spatial distribution) | Threat | Long-term | DOT is probably behind the eight ball in terms of preparing to serve the mobility needs of an aging population who will require specialized transportation. |
| 12 | Housing options (e.g. affordability, density, location) | Opportunity | Short-term | In the major urban areas of the state, there is currently an in-fill of housing in the inner city |
| 13 | Employment (types, wages, availability) | Opportunity | Long-term | In certain areas the ability to "telecommute" may have a small impact on traffic congestion. |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 14 | Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | Threat | Long-term | Certain urban areas are addressing land use changes in response to a recent historic flood. |
| 15 | Transportation energy supply and sources | Opportunity | Short-term | Not sure of the intent of this question |
| 16 | Transportation fuel prices | Opportunity | Immediate | Legislation approved for fuel hedging with DOT |
| 17 | (Insert additional factor, optional) | | | |

## STRATEGIES & WORK PLAN

For each high priority strength/weakness, select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness. Then indicate a strategy that could be implemented, who within the organization should be responsible for that strategy, and what performance measures could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the primary task owner and performance measures (with possible data sources). Be sure to indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 1 | Strength: Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Work currently underway to alter current Mission Statement with an eye toward addressing a more multi-modal system of transportation with an emphasis on spurring economic development | To Be Determined (Will be a cooperative effort among multiple Bureaus/Divisions) | Unknown at this time |
| 2 | Strength: Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Same as Above | To Be Determined (Will be a cooperative effort among multiple Bureaus/Divisions) | Unknown at this time |
| 3 | Strength: Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Threat: Availability of federal transportation funding (select category below) | Reliance on Maintenance Management System (MMS) will become even more critical. Anticipated Customer Satisfaction Survey follow-up in near future may serve to reinforce public and political support for such initiatives. | To Be Determined (Will be a cooperative effort among multiple Bureaus/Divisions) | Number of lane miles resurfaced vs. number of lane miles constructed. Data Source: Maintenance Management System. |
| 4 | Weakness: Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | A number of recommendations stemming from a 7-month "top-to-bottom" assessment of the agency are being implemented, which will re-evaluate the long-range transportation planning process to include sustainability considerations. | To Be Determined (Will be a cooperative effort among multiple Bureaus/Divisions) | Unknown at this time |
| 5 | Weakness: Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | Threat: Availability of federal transportation funding (select category below) | DOT is currently working with a national non-profit on a demonstration project which encompasses sustainability as a guiding principle. | To Be Determined (Will be a cooperative effort among multiple Bureaus/Divisions) | Unknown at this time |
| 6 | Strength: Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | No plans to significantly alter current Public Involvement Plan; however, will most likely undertake a new Customer Satisfaction Survey in near future. | To Be Determined (Will be a cooperative effort among multiple Bureaus/Divisions) | Unknown at this time |
| 7 | Weakness: Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | State Government is just now implementing performance evaluations, which may translate to sustainability as a specific "outcome" vs. "activity" | To Be Determined (Will be a cooperative effort among multiple Bureaus/Divisions) | Unknown at this time |

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 8 | Weakness: A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | Opportunity: Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | State Government is just now implementing performance evaluations, which may translate to sustainability as a specific "outcome" vs. "activity" | To Be Determined (Will be a cooperative effort among multiple Bureaus/Divisions) | Number of employees whose merit pay is tied to sustainable transportation initiatives. Note: This system would not be operational until summer 2013. |

**RESPONDENT INFORMATION**

| | Respondent 1 | Respondent 2 | Respondent 3 |
|---|---|---|---|
| **Name:** | | | |
| **Title:** | Lower level manager | | |
| **Organization:** | DOT 4 | | |

**Date of Completion (mm/dd/yy):**

## INTERNAL FACTORS: DESIGNATING STRENGTHS AND WEAKNESSES

For each factor, determine whether it is an organizational **strength** or **weakness** (refer to Tab 7 Definitions). Then designate each factor as **high**, **medium**, or **low** priority. At most, designate four (4) high priority strengths and four (4) high priority weaknesses. In the **evidence** column, provide support for designating each factor as a strength versus weakness and for priority rankings. At a minimum, provide evidence for each high priority factor. After completion, proceed to Tab 5 External Factors.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| | **Sustainability Ethic** | | | |
| 1 | Sustainability is recognized as an ethic or guiding principle for the organization. | weakness | medium | Sustainability is starting to be recognized but is not yet embedded. The agency has been taking steps to define a meaning and develop a focus on sustainabililty - i.e. will be developing a guidebook this year, have a dedicated staff person for sustainability, have been discussing the creation of a Sustainability Council, have participated in FHWA INVEST pilot test for systems planning module. |
| 2 | The organization has defined the concept of sustainability or sustainable transportation. | weakness | high | The concept has not been formally defined and with increasing attention on the concept, especially in federal programs, the agency would like to hone a definition. The Office of Environmental Services is also in the process of developing environmental policies for the agency and has identified sustainability as policy to be defined under new initiative. |
| 3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | weakness | low | The agency's mission statement does not address the three dimensions explicilty but rather implicitly to simplify. However, there is a concern about the risk of not having the environment and sustainability more readily captured. However, the statewide plan is the planning vision guiding the future of transportation investment and that plan does touch on the 3 dimensions. |
| 4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | weakness | medium | Not having a sustainability definition or plan yet for the agency, this is a weakness. However, it will be a priority to ensure the appropriate context for both urban and rural areas when we do move forward with related planning efforts because State is known as a *one size does not fit all* state. |
| 5 | Short-term, strategic goals are consistent with long-term sustainability goals | strength | high | Developing policies for sustainability, developing a Guidebook, linking planning to programming through a performance based system, developing an asset management system, working on making considerations for multimodal mainstream |
| 6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | weakness | high | See evidence above. While it is still a weakness now, we are working on getting mulitimodal and integrating with bike and pedestrian planning. This is a department priority as evidenced by our new LRTP. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | weakness | high | Our new LRTP is shifting from expansion to a focus on system preservation. We will be developing a Guidebook to help us be more efficient and strategic. |
| 8 | Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | weakness | high | In order to help us make this investment shift, we will need to rely on a menu of revenue and implementation options, including transportation demand management approaches. We anticipate our new Performance Based Programming Process and the Guidebook that are being developed to be valuable tools. |
| 9 | Sustainable transportation policies, programs, and project evaluation are well documented | weakness | medium | Guidebook and new Performance Based Program will be integral tools for moving agency in this direction |
| | **Institutionalizing Sustainability** | | | |
| 10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | weakness | medium | LRTP touches on concept, but it is anticipated the Guidebook will address |
| 11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | weakness | medium | Guidebook and new Performance Based Program will be integral tools for moving agency in this direction |
| 12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | weakness | medium | |
| 13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | weakness | medium | |
| 14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | weakness | high | New Performance Based Program will be integral for moving agency in this direction |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 15a | Performance measures and selection criteria address sustainability objectives (select from list below) | weakness | medium | An essential component for the scope of our developing new Performance Based Program |
| 15b | All categories | | | |
| 16 | Performance management system measures progress toward sustainability targets and goals | weakness | medium | We do not have a performance based management program for sustainability yet - again hope that it can be captured as we develop the new Performance Based Program |
| 17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | weakness | medium | It is anticipated that this will be a result of the new Performance Based Program |
| 18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | weakness | medium | A clear result of the LRTP and It is anticipated that this will be a result of the new Performance Based Program |
| 19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | weakness | high | Definitely a weakness at this time. Only done ad hoc. The goal of the a new Guidebook will be to address. |
| | **Communication and Collaboration with Stakeholders** | | | |
| 20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | weakness | low | An outcome of the Guidebook helping DOT define a meaning for sustainability will be also to move forward a consistent message. |
| 21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | strength | low | DOT has been making strides in this arena through collaborations like an innovative and groundbreaking public-private partnership to educate and help local public officials plan and build thriving, sustainable communities. Partners include Urban Land Institute, the State Departments of Transportation and Housing, the State chapter of American Planning Association (APA), the State Association for Economic Development (AED), the state's League of Cities and Towns (League), and the state's association for county officials. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | strength | low | DOT has been making strides in this arena through collaborations like a corridor partnership to create a robust vision for a corridor needing improvements, and also with a neighboring state DOT looking at a new multimodal interstate corridor |
| 23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | strength | medium | DOT has created a new Planning Environmental Linkages (PEL) process that has been very well received with input from our local, regional and federal partners. We also have a very strong partnering program with our land management agencies and with our wildlife department for wildlife connectivity. |
| 23b | All levels | | | |
| 24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | strength | high | DOT's P3 program has been very successful getting off the ground. We also have a strong relationship with the private sector who are very sensitive to the current situation regarding the widening funding gap. |
| 25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | strength | medium | DOT participates in peer exchanges whenever possible and is commited to sharing information and seeking best practices in all departments. |
| 26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | strength | medium | Recognized for going above and beyond and used a multitude of innovative involvement techniquest to engage stakeholders in LRTP development. Public engagement is a dynamic area where DOT is very committed to progress and success. |
| | **Organizational Culture and Structure** | | | |
| 27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | weakness | medium | The goal of the Guidebook is to help DOT define a meaning for sustainability and to institutionalize a new way of doing business internally. |
| 28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | weakness | medium | The goal of the Guidebook is to help DOT define a meaning for sustainability and to institutionalize a new way of doing business internally. |
| 29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | weakness | medium | The goal of the Guidebook is to help DOT define a meaning for sustainability and to institutionalize a new way of doing business internally. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 30 | Employees understand what sustainability means to the agency and for their specific roles (i.e. sustainability is part of recruitment, hiring, and compensation for all employees) | weakness | low | |
| 31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | weakness | low | |
| 32 | Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | strength | medium | |
| | **Other Internal Factors (user provided, not required)** | | | |
| 33 | (Insert additional factor, optional) | | | |
| 34 | (Insert additional factor, optional) | | | |
| 35 | (Insert additional factor, optional) | | | |

## EXTERNAL FACTORS: DETERMINING OPPORTUNITIES AND THREATS

For each factor, determine whether it is currently an external opportunity or threat to your organization (refer to Tab 7 Definitions). Then designate each factor as an immediate, short-term, or long-term priority. Designate three (3) factors as immediate, indicating the importance of quickly addressing them. Finally, provide an explanation to support the designation of each factor as an opportunity versus threat and the assigned urgency ranking. Upon completion, proceed to Tab 6 Strategies and Work Plan.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 1a | Political climate regarding transportation (select level below) | Threat | Immediate | With funding shrinking and demands increasing, it is imperative that partnerhips are developed with the business community to address funding gap to advance the economy in the state. |
| 1b | | | | |
| 2a | Political climate regarding sustainability (select level below) | Threat | Short-term | Addressing this issue continues to be a political problem due to misunderstanding of the concept and perception that it is a more liberal issue. The key is finding common ground and understanding that the concept will advance the economy. Understanding longer term return on shorter term investment is important. |
| 2b | | | | |
| 3 | Public climate regarding transportation | Threat | Immediate | Funding for transportation is shrinking but public demand for better infrastructure is increasing, so it is important to communicate needs effectively and to manage expectations. |
| 4 | Public climate regarding sustainability | Opportunity | Short-term | There are numerous grassroots coalitions forming statewide to promote sustainability objectives. It is a great opportunity to harness the will and leverage nontraditional partnerships. |
| 5a | Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | Threat | Short-term | Federal funding criteria are rapidly changing toward sustainabilty objectives so it is increasingly important for DOT to get a handle on the concept if we want to be competitive for funding. |
| 5b | Transportation investment | | | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 6 | Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Opportunity | Short-term | While it is not necessarily a threat at present, sustainable transportation is not a priority with the current administration. A change in administration always presents an opportunity (or a challenge) for new direction, so sustainable transporation could become a cornerstone of a future political agenda. |
| 7a | Availability of federal transportation funding (select category below) | Threat | Immediate | Federal funding criteria are rapidly changing toward sustainabilty objectives so it is increasingly important for DOT to get a handle on the concept if we want to be competitive for funding. |
| 7b | All types | | | |
| 8a | Availability of other funding (select level below) | Opportunity | Short-term | DOT's new P3 program has been seeking solicitations to fund new facilities. |
| 8b | Private | | | |
| 9 | Economy | Opportunity | Short-term | The current economic downturn presents an opportunity to expand the understanding of how transportation supports a healthy economy. Working with the business community to address the funding gap may advance an agenda for future revenue. |
| 10 | Deployment of new technologies (smart phones, GPS, etc.) | Opportunity | Short-term | Innovation and new technololgy always present an opportunity for efficiency. ITS, solar, and materials have been helping DOT advance in many ways. |
| 11 | Changing demographics of transportation users (e.g. total population, age, income, spatial distribution) | Opportunity | Long-term | We know that shifting demographics in the state to more aging and younger population cohorts will need to evolve transportation policy toward less SOVs, less driving, and greater modal choices. |
| 12 | Housing options (e.g. affordability, density, location) | Opportunity | Short-term | Similarly, state's housing boom came at great costs to our state, so there is a current shift to more close-in, multiuse, multifamily development that is well connected by transit and transportation options. |
| 13 | Employment (types, wages, availability) | Opportunity | Short-term | Connecting jobs to housing is a focus right now to create location efficiency, to ensure people can live and work in the same community, and reduce the need to *drive until you qualify.* |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 14 | Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | Threat | Long-term | Addressing this issue continues to be a political problem due to misunderstanding of the concept and perception that it is a more liberal issue. However, there is an appreciation at some levels of management and staff on this issue, but it is not something that will be easily addressed in the short term since the threat is not politically imminent. Communiticating the urgency is a challenge. |
| 15 | Transportation energy supply and sources | Threat | Long-term | Addressing the energy future is a threat for many DOTs since our current funding schematic is dependent on a dying framework largely reliant on petroleum sources. Understanding and shifting policies toward new energy frameworks will be both a challenge and an opportunity. |
| 16 | Transportation fuel prices | Threat | Long-term | Already a challenge as people are finding need to get around differently than they had before because they cannot afford to drive. This is daunting for an agency like DOT shifting toward a multimodal focus in a current climate of shrinking funding. |
| 17 | (Insert additional factor, optional) | | | |
| 18 | (Insert additional factor, optional) | | | |
| 19 | (Insert additional factor, optional) | | | |
| 20 | (Insert additional factor, optional) | | | |

## STRATEGIES & WORK PLAN

For each high priority strength/weakness, select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness. Then indicate a strategy that could be implemented, who within the organization should be responsible for that strategy, and what performance measures could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the primary task owner and performance measures (with possible data sources). Be sure to indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 1 | weakness: The organization has defined the concept of sustainability or sustainable transportation. | Threat: Availability of federal transportation funding (select category below) | Develop Guidebook to integrate sustainability concept into the way we do business. This will help DOT be for efficient and competitive for future federal funding opportunities. | Planning Division | Sustainability is a guiding principle or ethic at DOT - survey and increase in federal funding opportunities. |
| 2 | strength: Short-term, strategic goals are consistent with long-term sustainability goals | Threat: Political climate regarding transportation (select level below) | Work with business community to address funding gap and invest multimodally | Executive Leadership Team | Successful transportation funding initiative |
| 3 | weakness: Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Threat: Public climate regarding transportation | Work with business community to address funding gap to ensure that we can preserve the assets that we have to ensure system efficiency and meet the public demands for increased service and infrastructure | Executive Leadership Team | Successful transportation funding initiative |
| 4 | weakness: Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Threat: Availability of federal transportation funding (select category below) | Work with business community to address funding gap and expectation that funding will continue to decrease at the federal level. Need to increase revenue options to address local and state infrastructure needs | Executive Leadership Team | Successful transportation funding initiative |
| 5 | weakness: Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Threat: Political climate regarding transportation (select level below) | Gap between needs and funding is large. Developing a performance programming process will help prioritize needs to toward goals | Planning Division | Percentage of funds allocated for more sustainable modes and for operating and maintaining existing infrastructure |
| 6 | weakness: Selection criteria for programming reflect the goals/objectives in the long-range plan | Threat: Public climate regarding transportation | Public is demanding more but resources are less. Develop sustainability performance measures in ADOTs new programming process and use the Smart Transportation to educate new opportunities and ways of doing business | Planning Division | Selection criteria for programming reflect the goals and objectives in the LRTP |
| 7 | weakness: Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | Threat: Public climate regarding transportation | Public is demanding more out of transportation infrastructure (choices, connectivity, more modal choices, less congestion), but resources are less. Develop sustainability performance measures in DOT's new programming process and use the Guidebook to educate internally new opportunities and ways of doing business to promote efficiency | Planning Division | Project scopes change and project managers becoming advocates for new ways of doing business |

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 8 | strength: Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | Threat: Political climate regarding transportation (select level below) | Work with business community to address funding gap to ensure that we can preserve the assets that we have | Executive Leadership Team | Successful transportation funding initiative |

**RESPONDENT INFORMATION**

| | Respondent 1 | Respondent 2 | Respondent 3 |
|---|---|---|---|
| **Name:** | | | |
| **Title:** | Operating Core | | |
| **Organization:** | DOT 5 | | |

**Date of Completion (mm/dd/yy):**

## INTERNAL FACTORS: DESIGNATING STRENGTHS AND WEAKNESSES

For each factor, determine whether it is an organizational **strength** or **weakness** (refer to Tab 7 Definitions). Then designate each factor as **high**, **medium**, or **low** priority. At most, designate four (4) high priority strengths and four (4) high priority weaknesses. In the **evidence** column, provide support for designating each factor as a strength versus weakness and for priority rankings. At a minimum, provide evidence for each high priority factor. After completion, proceed to Tab 5 External Factors.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| | **Sustainability Ethic** | | | |
| 1 | Sustainability is recognized as an ethic or guiding principle for the organization. | Strength | High | DOT Goal: Stewardship |
| 2 | The organization has defined the concept of sustainability or sustainable transportation. | Weakness | Medium | |
| 3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Weakness | Medium | Mission includes economy and quality of life |
| 4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | Weakness | Medium | |
| 5 | Short-term, strategic goals are consistent with long-term sustainability goals | Strength | High | Implementation Plan for environmental sustainability program recently drafted |
| 6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Weakness | High | Transportation planning |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Opportunity: Political climate regarding transportati | High | Performance management office |
| 8 | Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Weakness | High | ITS programs ramping up, variable pricing program and tolling studies underway |
| 9 | Sustainable transportation policies, programs, and project evaluation are well documented | Weakness | High | Upcoming sustainability effort to be implemented and integrated into performance management system |
| | **Institutionalizing Sustainability** | | | |
| 10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | Weakness | High | Both plans (sustainability and statewide strategic plan) are currently being worked on aggressively |
| 11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | Strength | High | Current draft is very actionable |
| 12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | Weakness | High | MPO's asked to address GHG and sustainability in RTP's and TIP criteria. Focused effort underway to coordinate however many local autonomy is strong. Some regions and localities have accelled ahead of state effort, others will resist |
| 13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | Weakness | High | Statewide strategic plan and policy to encourage active modes will revise processes |
| 14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | Weakness | High | Statewide strategic plan will revise processes |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 15a | Performance measures and selection criteria address sustainability objectives (select from list below) | Weakness | High | Sustainability program goals to be added into project development process in the near future |
| 15b | | | | |
| 16 | Performance management system measures progress toward sustainability targets and goals | Weakness | High | New performance management system to be launched in summer, will include sustainability. Environmental management system recently published by highway devision |
| 17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | Strength | High | Diverse transit funding sources are in place but inadequate. Goal for active transportation modes will potentially revise priorities |
| 18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | Strength | Medium | Maintenance of aging system is the focus of most investments |
| 19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | Strength | High | Highway design guide sets flexible Complete Street standards. State green building policy applies to building designs. To be strengthened through sustainability plan |
| | **Communication and Collaboration with Stakeholders** | | | |
| 20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | Weakness | High | Sustainability policy has been messaged heavily however external understanding is limited. Sucessful messaging on renewable energy and bike planning. Revamped website. |
| 21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | Weakness | Medium | Land use decisions are very localized. Some MPO's have promoted smart growth. Collaboration on transit investments improving however highway project priorities sometime conflict. |
| 22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | Strength | High | Transportation reform has led to changes in organizational structure. Regional transit authority still acting independantly. Funding priorities still inconsistent |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | Strength | High | State's environmental policy act, wetland delination, species protection require close coordination. Conservation commisions influence designs locally |
| 23b | All levels | | | |
| 24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | Weakness | Medium | Advocacy groups have frequently had adversarial relationship, but improving. Collaboration varies by project, system is mostly built out |
| 25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | Strength | Medium | Participate in many regional collaborative processes regarding GHG, researched other DOT's for sustainability program. Participation in TRB and climate initiative |
| 26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | Weakness | Medium | Statewide strategic planning process included extensive public outreach however level of public participation in design varies by project. Avenue for public engagement often highly reactive. |
| | **Organizational Culture and Structure** | | | |
| 27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | Strength | High | Sustainability program |
| 28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | Strength | High | Concepts are supported, some divisions making clear investment and procedure priorities |
| 29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | Weakness | High | Working group organization to be developed |
| 30 | Employees understand what sustainability means to the agency and for their specific roles (i.e. sustainability is part of recruitment, hiring, and compensation for all employees) | Weakness | High | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | Weakness | Medium | |
| 32 | Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | Strength | High | State sustainability policies and goals taken seriously. Very responsive to public opinion |
| | **Other Internal Factors (user provided, not required)** | | | |
| 33 | (Insert additional factor, optional) | | | |
| 34 | (Insert additional factor, optional) | | | |
| 35 | (Insert additional factor, optional) | | | |

## EXTERNAL FACTORS: DETERMINING OPPORTUNITIES AND THREATS

For each factor, determine whether it is currently an external opportunity or threat to your organization (refer to Tab 7 Definitions). Then designate each factor as an immediate, short-term, or long-term priority. Designate three (3) factors as immediate, indicating the importance of quickly addressing them. Finally, provide an explanation to support the designation of each factor as an opportunity versus threat and the assigned urgency ranking. Upon completion, proceed to Tab 6 Strategies and Work Plan.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 1a | Political climate regarding transportation (select level below) | Opportunity | Immediate | Transit fare increase has brought transportation funding into political arena |
| 1b | State level | | | |
| 2a | Political climate regarding sustainability (select level below) | Opportunity | Short-term | Strong state policies and goals for sustainability and GHG however economic and fiscal issues have made these issues take a priority step back |
| 2b | State level | | | |
| 3 | Public climate regarding transportation | Threat | Immediate | Geographic priorities vary, metropolitan areas verses rest of the state. Past project delivery has eroded trust |
| 4 | Public climate regarding sustainability | Opportunity | Long-term | Environmental protection has strong political backing however economic issues are the short term priority. Understanding of sustainability issues, lifestyle choices and land use implications vary. Renewable energy is a very visable issue. |
| 5a | Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | Threat | Immediate | Transportation planning |
| 5b | Transportation investment | Opportunity: Political | | Performance management office |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 6 | Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Opportunity | Long-term | ITS programs ramping up, variable pricing program and tolling studies underway |
| 7a | Availability of federal transportation funding (select category below) | Threat | Short-term | Shift in formulas for funding likely will hurt state, funding programs to upkeep and invest in old systems (especially transit) are limited. |
| 7b | All types | | | |
| 8a | Availability of other funding (select level below) | | | |
| 8b | | | | |
| 9 | Economy | Threat | Immediate | Slow recovery has not helped any government revenue sources |
| 10 | Deployment of new technologies (smart phones, GPS, etc.) | Opportunity | Immediate | Customer information systems for transit or roadway users are expanding |
| 11 | Changing demographics of transportation users (e.g. total population, age, income, spatial distribution) | Opportunity | Short-term | Younger workforce and immigrant populations chosing transit and bike options. Aging population in suburbs represents a challenge to serve. |
| 12 | Housing options (e.g. affordability, density, location) | Threat | Immediate | Affordablity in metro areas is significant issue. Housing costs near transit are very high. Resistance locally to density increases reduces supply. Many infrastructure investments serve low density areas |
| 13 | Employment (types, wages, availability) | Opportunity | Short-term | Job development picking up in metro area. Strength in bio-technology, medical, and IT. |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 14 | Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | Threat | Immediate | Extreme weather events past two summers |
| 15 | Transportation energy supply and sources | Threat | Immediate | High electricity costs represent burden for transit providers |
| 16 | Transportation fuel prices | Opportunity | Immediate | Gas prices have encouraged transit and biking when available, however have also made funding reform more challenging |
| 17 | (Insert additional factor, optional) | | | |
| 18 | (Insert additional factor, optional) | | | |
| 19 | (Insert additional factor, optional) | | | |
| 20 | (Insert additional factor, optional) | | | |

## STRATEGIES & WORK PLAN

For each high priority strength/weakness, select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness. Then indicate a strategy that could be implemented, who within the organization should be responsible for that strategy, and what performance measures could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the primary task owner and performance measures (with possible data sources). Be sure to indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 1 | Strength: Sustainability is recognized as an ethic or guiding principle for the organization. | Threat: Public climate regarding transportation | Aggressive marketing of current plans and policies to demonstrate sustainability as DOT priority | Transportation Planning | Low cost polling through statewide plan to measure public understanding of DOT objectives. Inventory public comments at Board meetings related to sustainability objective. Monitor press coverage. |
| 2 | Strength: Short-term, strategic goals are consistent with long-term sustainability goals | Opportunity: Political climate regarding transportation (select level below) | Complete various plans and require policies and metrics to be integrated into internal performance measurement objectives for divisions and wrtten into MPO planning documents to deepen the institutionalization of sustainability | Transportation Planning and MPO Activities | Track budget requests for sustainability related improvements, require sustainability metrics in bid submissions and contracts - follow measures through self reporting |
| 3 | Weakness: Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Opportunity: Political climate regarding transportation (select level below) | Connect policies into investment proiritization through statewide planning tool | Transportation Planning | Utilize planning tool - track multi-modal score against actually funding priorities |
| 4 | Strength: Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Threat: Public climate regarding transportation | Emphasize up keep of existing roadway and transit network through innovative programs such as bridge maintenance program. Duplicate program and transfer these best practices to all project development | Highway and Transit | Track project inventory and TIPs comparing maintenance to expansion. |
| 5 | Weakness: Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Opportunity: Political climate regarding transportation (select level below) | Current fiscal climate provides opportunity to pursue demand management policies - establish pilot programs and test public response | | Follow TIP project prioritization, funds for supply side expansion verses maintenance, transit, Complete Street. Track response to tolling and other alternative financing programs |
| 6 | Weakness: Sustainable transportation policies, programs, and project evaluation are well documented | Opportunity: Political climate regarding transportation (select level below) | Integrate sustainability policy into performance management | Performance management office | Indicator - all plans completed in 2012 and embedded in practices. Project Tracking forms and databased are updated to reflect new measures. |
| 7 | Weakness: Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | Opportunity: Political climate regarding transportation (select level below) | Complete the in-progress planning and policy goals. Advertise these programs as best practices locally and nationally | Transportation planning | Repeated Indicator - all plans completed in 2012 and embedded in practices. Project Tracking forms and databased are updated to reflect new measures. |

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 8 | Strength: Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | Opportunity: Political climate regarding transportation (select level below) | Integrate sustainability policy into performance management | Performance management office | Measure sustainability program indicators via proposed report card |

**RESPONDENT INFORMATION**

| | Respondent 1 | Respondent 2 | Respondent 3 |
|---|---|---|---|
| **Name:** | | | |
| **Title:** | Operating Core | Lower level Manager | |
| **Organization:** | DOT 6 | DOT 6 | |

| | |
|---|---|
| **Date of Completion (mm/dd/yy):** | |

## INTERNAL FACTORS: DESIGNATING STRENGTHS AND WEAKNESSES

For each factor, determine whether it is an organizational **strength** or **weakness** (refer to Tab 7 Definitions). Then designate each factor as **high**, **medium**, or **low** priority. At most, designate four (4) high priority strengths and four (4) high priority weaknesses. In the **evidence** column, provide support for designating each factor as a strength versus weakness and for priority rankings. At a minimum, provide evidence for each high priority factor. After completion, proceed to Tab 5 External Factors.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| | **Sustainability Ethic** | | | |
| 1 | Sustainability is recognized as an ethic or guiding principle for the organization. | Strength | High | Sustainability is listed as one of the values of the agency, as part of the overall agency mission. |
| 2 | The organization has defined the concept of sustainability or sustainable transportation. | Strength | Medium | Sustainability and sustainable transportation are defined in the statewide transportation plan, as well as are addressed in a Sustainability Plan. |
| 3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Strength | Medium | Between mission and values, all three aspects of sustainability are covered. |
| 4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | Strength | Medium | The Statewide Transportation Plan addresses the needs of both urban and rural areas of the state. |
| 5 | Short-term, strategic goals are consistent with long-term sustainability goals | Weakness | High | Still working on the best ways to implement the long-term vision of sustainability as outlined in the Statewide Transportation Plan. Great strides have been made in the internal operations and while there are many initiatives and programs at DOT that support aspects of sustainability, we haven't necessarily done the best job of tying them together and figuring out what that means for an overall sustainable transportation system. We are beginning that process with continuing development of sustainability plan. |
| 6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Strength | High | The Statewide Transportation Plan and other modal plans highlight these alternative modes. Additionally with the creation of a new business unit, the agency is making further commitments to these types of investments. This of course is always a work in progress, but we are on our way to working towards this. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Weakness | Medium | Working to develop strategic planning and prioritization for maintaining existing infrastructure. |
| 8 | Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Strength | Medium | The Statewide Transportation Plan and state code require each community in the state to reduce VMT by using operational improvements and demand management. |
| 9 | Sustainable transportation policies, programs, and project evaluation are well documented | Strength | Medium | DOT does a very good job of documenting sustainability policies and programs both in the Statewide Transportation Plan and the Sustainability Plan, but in other documents as well. The agency is working on how to better document sustainability information at the project level, however there are some project delivery Operational Notices that address the themes of sustainability and the hope is to get those updated soon. |
| | **Institutionalizing Sustainability** | | | |
| 10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | Strength | Medium | One of the Goals in the Statewide Transportation Plan is sustainability, additionally the agency has a Sustainability Plan. Would probably mark this as a high priority, but are only allowed to mark four high priority strengths. |
| 11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | Weakness | High | In some areas we may be stronger than others, although on a whole sustainability is still something that champions across the agency take ownership of, as opposed to having process and outcome owners and specific performance measures and action items for each sustainability effort. |
| 12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | Strength | Medium | There are strong mechanisms in place to facilitiate and encourage the coordination between all levels of government, such as a sustainability board and the interagency network. DOT participates in these groups. However sometimes the extent of the coordination could be stronger. |
| 13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | Strength | Medium | Overall, our long-range planning efforts look to provide direction for the planning and management of the integrated statewide transportation system by developing and maintaining multimodal and modal policy, planning, and guidance, developing and utilizing analytical models and tools, develop and deliver training, economic data analysis, and leading, coordinating, or partnering in delivering statewide programs. Would probably mark this as high, but are only allowed four high priority strengths. |
| 14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | Weakness | High | We are working on updating the STIP criteria which will include more criteria to emphasize sustainability, livable communities, and active modes like biking and walking. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 15a | Performance measures and selection criteria address sustainability objectives (select from list below) | Weakness | Medium | DOT is in the process of looking at how to develop better Key Performance Measures to address sustainability. Right now, DOT only measures bridge culverts (salmon) and biking and waking infrastructure to measure sustainability. In the part of the Sustainability Plan which is focused on the internal operations of the agency, we have established performance measures in the focus areas of sustainability which cover energy and climate change, materials, environmental stewardship, land use, economy and jobs, health/safety. Would like to rank this as our fifth high priority, but have moved it to meduim since we are only allowed four high priority weaknesses. |
| 15b | All categories | | | |
| 16 | Performance management system measures progress toward sustainability targets and goals | Weakness | Medium | In some areas, mainly for some of the internal operations sustainability initiatives as addressed in the sustainability plan have performance measures, however this is an area where we need improvement on. |
| 17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | Weakness | High | Through work at the agency we are working on combining some of our funding programs, including developing consistent selection criteria and processes, in hopes that funding can increase to the more active modes of transportation. |
| 18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | Weakness | Medium | This is a discussion that is occurring and we are moving towards a process where the agency prioritizes maintaining and preserving the existing system. Of course funding is always an issue, so more funding might not be coming but they way we prioritize may elevate this existing infrastructure. |
| 19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | Weakness | Medium | DOT piloted sustainability rating tools. The agency has a committee that is working on how to incorporate the lessons learned from these pilots into our project delivery line, however at this time we have not developed formal guidance for project delivery and construction, although work is being done in this area. We would normally rank this as a high priority, but since we are limited in the number of high priority weaknesses we can select and because work is being done in the area, we've given this a lable of medium. |
| | **Communication and Collaboration with Stakeholders** | | | |
| 20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | Strength | Medium | Through the sustainability program we are able to produce a pretty consistent message about sustainability at DOT. This of course is also aided by the fact sustainability is listed as one of the values of the agency and is a goal in the Statewide Transportation Plan. Additionally, through the sustainability program website and other documents, the message is able to stay consistent. |
| 21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | Strength | High | DOT is a leader in planning for both land use and transportation. DOT was one of the first states in the country to have an integrated land-use model, and the state code requires that every city in the state must consider land use in their transportation planning. DOT works closely with the state land use agency on a wide-range of programs. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | Strength | Medium | DOT has a Transit Division, and a Public Transit Advisory Committee and we work closely with rural providers on funding and planning. However, the relationships with the transit providers have not been fully leveraged to develop multimodal corridor plans and estabalish funding opporunities. |
| 23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | Strength | Medium | DOT has a uniquely collaborative relationship with the environmental agencies thorugh the working group, where standard permits are negociated for all DOT projects. The vairous sections throughout the agency, including the Environmental unit and the Maintenance and Operations unit have a very close working relationship with environmental agencies of all levels. |
| 23b | All levels | | | |
| 24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | Strength | Medium | Have established some key public - private partnerships around energy/environment initiatives. But there are other areas where we need to increase our partnerships with the private sector. |
| 25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | Strength | Medium | We very much look for opportunities to collaborate with other DOTs, especially those in our region. Additionally we partner with university research and other research centers in the area on work that will help inform our efforts for sustainability. |
| 26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | Strength | Medium | Our planning process includes extensive consultation and collaboration with a diverse set of committees, organizations, and other stakeholders throughout the state. In fact one of the agency value statements prescribes collaborating to develop solutions to problems. |
| | **Organizational Culture and Structure** | | | |
| 27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | Strength | Medium | We promote a consistent message of sustainability throughout the agency, but the challenge is to continue to get that message out there. We are doing a pretty good job through the sustainability program's involvement on a number of key programs and initiatives, but there is always more communication needed. |
| 28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | Strength | High | Sustainability is very much supported by the executive level of the agency. And overall many managers at all levels across the agency support sustainability, of course there are those who may not be as supportive of it as others, but on a whole sustainability concepts, initiatives and programs are supported. |
| 29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | Strength | Medium | DOT has a Sustainability Council which is comprised of high and mid level managers. Additionally DOT has some other committees that relate to sustainability including:executive staff, project delivery, climate change. Some DOT office buildings have their own "green teams" which meet about sustainability issues that pertain to their individual office. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 30 | Employees understand what sustainability means to the agency and for their specific roles (i.e. sustainability is part of recruitment, hiring, and compensation for all employees) | Weakness | Medium | This is probably where we are weak in terms of communicating about sustainability, especially internally. We need to do a better job reaching out to all departments and addressing what sustainability means to DMV, to Motor Carrier, etc. Obviously the work of some departments is a pretty clear connection to sustainability, but for those departments where that link is not clear, a better job in communication is needed. |
| 31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | Weakness | Medium | Although informally staff and groups are recognized, there is no formal internal process for recognizing good works in sustainability and innovation. |
| 32 | Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | Strength | Medium | We are very engaged at the state and federal level in legislation that may impact our work in transportation and sustainability. |
| | **Other Internal Factors (user provided, not required)** | | | |
| 33 | (Insert additional factor, optional) | | | |
| 34 | (Insert additional factor, optional) | | | |
| 35 | (Insert additional factor, optional) | | | |

## EXTERNAL FACTORS: DETERMINING OPPORTUNITIES AND THREATS

For each factor, determine whether it is currently an external opportunity or threat to your organization (refer to Tab 7 Definitions). Then designate each factor as an immediate, short-term, or long-term priority. Designate three (3) factors as immediate, indicating the importance of quickly addressing them. Finally, provide an explanation to support the designation of each factor as an opportunity versus threat and the assigned urgency ranking. Upon completion, proceed to Tab 6 Strategies and Work Plan.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 1a | Political climate regarding transportation (select level below) | Threat | Immediate | Funding issues are a potential threat to all transportation initiatives. |
| 1b | All levels | | | |
| 2a | Political climate regarding sustainability (select level below) | Opportunity | Long-term | State as a whole is pretty supportive of sustainability. In recent years due to the economic climate there has been some pushback especially in the legislature. |
| 2b | State level | | | |
| 3 | Public climate regarding transportation | Opportunity | Short-term | The public supports modal choices and wants reliable, cost effective, and alternative modes of transportation. It is the public that are going to be the biggest advocates for these aspects, and it is more the political and economic climates that are going to stand in the way. |
| 4 | Public climate regarding sustainability | Opportunity | Short-term | I would say overall the public is pretty supportive of sustainability especially when framed in the way of cost savings, health benefits and other types of co-benefits. And again we can use them as advocates. Of course sustainability can mean different things to different people which can sometimes be a hurdle, but not impossible to overcome. |
| 5a | Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | Opportunity | Immediate | The State Legislature recently passed comprehensive legislation that, not only raised the gas tax in State, but included many sustainability initiatives related to energy/GHG emissions and alternative funding options. |
| 5b | | | | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 6 | Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Opportunity | Short-term | |
| 7a | Availability of federal transportation funding (select category below) | Opportunity | Short-term | Funding issues are a potential threat to all transportation initiatives. |
| 7b | All types | | | |
| 8a | Availability of other funding (select level below) | Opportunity | Short-term | Being able to capitalize on private - public funding partnerships is a key for state DOTs, especially in the realm of sustainability related projects and programs. |
| 8b | Private | | | |
| 9 | Economy | Threat | Short-term | Probably a threat, but also an opportunity because it means we need to do things differently and in a strategic manner, which is a great opportunity to integrate sustainability principles into what we do. This is probably an immediate threat, but since we can only chose three had to classify it as something else. |
| 10 | Deployment of new technologies (smart phones, GPS, etc.) | Opportunity | Long-term | New technology is key to DOT's efforts in finding alternative funding sources for transportation, especiall with respect to a VMT Tax. It will also be key in many of the TDM stradegies that DOT is either using or plans to use, such as TriNew technologies will be a ture asset in the future, from helping connect users to transportation options to aiding the DOT in alternative user fee endeavors. |
| 11 | Changing demographics of transportation users (e.g. total population, age, income, spatial distribution) | Opportunity | Long-term | |
| 12 | Housing options (e.g. affordability, density, location) | Opportunity | Long-term | State is a leader in land use and housing planning; however we could do a better job of taking into account affordable housing when we make transportation decisions. Of course, more density and more housing locations near transportation options, will be beneficial to the system as a whole. Density goes hand in hand with developing livable communities and complete street type concepts. |
| 13 | Employment (types, wages, availability) | Opportunity | Long-term | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 14 | Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | Threat | Short-term | Climate impacts are already effecting the transportation infrastructure and system in the State, and it is projected that many of these impacts will increase in both frequency and magnitude. Road closures and constant road repairs have a negative economic impact on State's economy and the budget of the DOT. |
| 15 | Transportation energy supply and sources | Threat | Immediate | Again this could be classified as either a threat or opportunity, however given that this isn't necessarily in the complete control of a DOT and given the current political atmosphere, we are classifying this as a threat. Continued reliance on fossil fuels, and rising cost in these fuels will have dramatic impacts on the travelling public but also on the DOT. Our projects get more expensive when fuel cost rise. |
| 16 | Transportation fuel prices | Opportunity | Short-term | Provides us an opportunity to market and show the benefits (especially the personal economic benefits) of alternative transportation options. Although, of course less overall fuel use currently means less gas tax which is a major revenue source. Again, we would have classified this as immediate, but could only select three. |
| 17 | (Insert additional factor, optional) | | | |
| 18 | (Insert additional factor, optional) | | | |
| 19 | (Insert additional factor, optional) | | | |
| 20 | (Insert additional factor, optional) | | | |

## STRATEGIES & WORK PLAN

For each high priority strength/weakness, select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness. Then indicate a strategy that could be implemented, who within the organization should be responsible for that strategy, and what performance measures could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the primary task owner and performance measures (with possible data sources). Be sure to indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 1 | Strength: Sustainability is recognized as an ethic or guiding principle for the organization. | Opportunity: Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | We have accomplished this at least in the documentation stage and are well into the implementation stage, sustainability is one of the values in our agency Mission statement, it is a goal of the State Transportation Plan, and we have a comprehensive Sustainability Plan. | DOT sustainability staff, although all divisions and sections are working to conintue and uphold the vision of sustainability. | |
| 2 | Weakness: Short-term, strategic goals are consistent with long-term sustainability goals | | The continued development of our Sustainability Plan, where we address the sustainable management of the broader transportation system, should help link up our many sustainability related initiatives and programs and start establishing short-term goals that will build towards a long-term vision of sutainability at DOT. | DOT Sustainability Council and program staff in consultation with key departments will devleop plan. | |
| 3 | Strength: Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Opportunity: Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | The recent/ continuing reorganization of the agency is the best next step for developing policies and system plans that emphasize multi-modal investment and the integration of modes. | The new section and really the whole agency as this continued reorginzation occurs. But specifically those program managers in the new unit. | |
| 4 | Weakness: Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | | We have been pretty successful with internal sustainability plan at developing short-run and long-run goals, as well as strategies and performance measures for the various focus areas identified in the plan. Additionally, we have established some key focus area leads for each one. The next step is to continue this work for our internal operations and develop a similar process for our work in external efforts. | Sustainability Council and staff identified key lead groups and departments. | |
| 5 | Weakness: Selection criteria for programming reflect the goals/objectives in the long-range plan | Threat: Political climate regarding transportation (select level below) | This is currently being worked on in our STIP stakeholder committee as well as some of the statewide programs in the new unit. | STIP Stakeholder Committee, new unit | |
| 6 | Weakness: Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | Threat: Political climate regarding transportation (select level below) | We are in the process of combining some of our funding programs, including devloping consistent selection criteria and processes, in hopes that funding can increase to the more active modes of transportation. We specifically are just beginning a sort of pilot where we are combining the criteria and application process for our Bike & Ped and Transportation Enhancement programs. This pilot will help inform next steps, and hopefully we can bring more money or re-allocate money for these types of multimodal projects in leiu of potential federal funding and policy decisions that may or may not be made. | Bike & Ped Program, Transportation Enhancement Program, etc. | |
| 7 | Strength: Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | Opportunity: Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | DOT is a leader in this area and works closely with the state land use agency, however changing legislation related to transportation planning and sustainability could provide more opportunities to leverage this relationship and DOT relationship with MPOs to develop a more integrated and sustainable transportation system in State. | | |

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 8 | Strength: Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | Opportunity: Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | We currently have very strong support from the agency's executive team and many high level managers. The next step really is to continue communication and coordination with managers and employees at all levels of the agency. Successfully integrating sustainability is both a top-down and bottom-up process at DOT and the Sustainability Program needs to keep fostering this at all levels. | Sustainability Program | |

**RESPONDENT INFORMATION**

| | Respondent 1 | Respondent 2 | Respondent 3 |
|---|---|---|---|
| **Name:** | | | Respondents 3 and 4 |
| **Title:** | Lower level manager | Mid level manager | Lower level manager & Operating Core |
| **Organization:** | DOT 7 | DOT 7 | DOT 7 |

| | |
|---|---|
| **Date of Completion (mm/dd/yy):** | |

## INTERNAL FACTORS: DESIGNATING STRENGTHS AND WEAKNESSES

For each factor, determine whether it is an organizational **strength** or **weakness** (refer to Tab 7 Definitions). Then designate each factor as **high**, **medium**, or **low** priority. At most, designate four (4) high priority strengths and four (4) high priority weaknesses. In the **evidence** column, provide support for designating each factor as a strength versus weakness and for priority rankings. At a minimum, provide evidence for each high priority factor. After completion, proceed to Tab 5 External Factors.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| | **Sustainability Ethic** | | | |
| 1 | Sustainability is recognized as an ethic or guiding principle for the organization. | Strength | High | Guidebook was developed to address sustainability focus of policies and investments. |
| 2 | The organization has defined the concept of sustainability or sustainable transportation. | Strength | Medium | Guidebook was developed to address sustainability focus of policies and investments. |
| 3 | Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Strength | High | Long Range Plan includes sustainability goal which encompasses all three dimensions. The Plan is supported by strategies and objectives. |
| 4 | Organization's sustainability vision can be defined for both urban and rural areas (may require distinguishing between sustainability objectives for each) | Strength | Medium | DOT recently issued updated Long Range Transportation Planning Guidance to the Metropolitan Planning Organizations. One of the key changes included the incorporation of livability and sustainability themes. |
| 5 | Short-term, strategic goals are consistent with long-term sustainability goals | Strength | Medium | Draft Strategic Planning goals focus on integrating land use and transportation, as well as asset management to provide a sustainable transportation system. |
| 6 | Policies and system planning emphasize multi-modal investment and integration of modes to achieve a sustainable transportation system | Strength | Medium | Draft Strategic Planning goals focus on multi-modalism and aligning priorities and funding at all levels. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 7 | Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Strength | High | Current Financial and General and Procedural Guidance focuses investments on existing infrastructure. |
| 8 | Policies and system planning promote operational improvements and demand management (eg., ITS, variable tolling, VMT reduction) over new capital investments | Strength | Medium | DOT recently initiated a new Red Light Running Program and Corridor Management Plan. A future opportunity is development of a corridor modernization program to prioritize investments. |
| 9 | Sustainable transportation policies, programs, and project evaluation are well documented | Weakness | Medium | While policies and programs are well documented, project evaluations are not. |
| | **Institutionalizing Sustainability** | | | |
| 10 | Agency has developed a sustainability or sustainable transportation plan or clearly identifies sustainability objectives in other plans (i.e. long-range transportation plan or strategic plan) | Strength | Medium | Guidebook was developed to address sustainability focus of policies and investments. DOT's Long Range Plan includes a sustainability goal which encompasses all three dimensions. Draft Strategic Planning goals focus on integrating land use and transportation, as well as asset management to provide a sustainable transportation system. |
| 11 | Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | Strength | High | DOT's Long Range Plan includes a sustainability goal which encompasses all three dimensions. The Plan is supported by action items, strategies and objectives. |
| 12 | Coordination between state, regional, and local transportation plans to achieve sustainability objectives | Strength | Medium | DOT issued guidance for transportation elements of local and county comprehensive plans to enhance effective land use/transportation planning and collaboration among all levels of governments. DOT's Long Range Planning Guidance also includes the requirement of collaboration among statewide, regional, and local planning efforts. |
| 13 | Long-range planning balances mobility, environmental, economic, and social objectives through designation of appropriate goals and targets (should be consistent with agency's stated mission or vision) | Strength | Medium | DOT's Long Range Plan includes goals which encompass mobility and aspects of sustainability. The Plan is supported by action items, strategies and objectives. |
| 14 | Selection criteria for programming reflect the goals/objectives in the long-range plan | Strength | Medium | DOT's procedural programming guidance includes specific language to emphasize sustainability in project selection and prioritization. Additional environmental and asset-related tools are now available to planning partners for project identification, selection, and prioritization. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 15a | Performance measures and selection criteria address sustainability objectives (select from list below) | Weakness | Medium | DOT is initiating an update to the Statewide Long Range Transportation Plan, which will include a robust performance monitoring component. |
| 15b | Safety | | | |
| 16 | Performance management system measures progress toward sustainability targets and goals | Weakness | Medium | DOT is initiating an update to the Statewide Long Range Transportation Plan, which will include a robust performance monitoring component. |
| 17 | Percentage of funds allocated for transit, bicycle, pedestrian, and other more sustainable modes (may increase as a result of revised selection criteria, availability of alternative funding sources, etc.) | Weakness | Low | DOT is initiating an update to the Statewide Long Range Transportation Plan, which will include a robust performance monitoring component. This item is highly dependent on the availability of additional revenue. |
| 18 | Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | Strength | High | Current Financial and General and Procedural Guidance focuses investments on existing infrastructure. |
| 19 | Sustainability ethic and policies are translated into concrete guidance for planning and project development (eg., flexible design standards, green rating system) | Weakness | Medium | While DOT has design flexibility and sensitivity to land use, community, and environmental issues inherent in our design standards, no performance measures have been adopted to monitor progress. |
| | **Communication and Collaboration with Stakeholders** | | | |
| 20 | Agency promotes a consistent sustainability message or brand externally (to decision-makers, partner agencies, and the public) | Strength | Medium | DOT has branded the sustainability themes. |
| 21 | Degree of collaboration with agencies that have jurisdiction or influence over land use decisions and development patterns that support a sustainable transportation system (e.g. local zoning boards, MPOs, housing or community development agencies) | Strength | Medium | DOT has collaborated with the Statewide organizations that represent counties and municipalities in developing and providing training on the sustainability message. In addition, DOT has collaborated extensively with local governments in the development and training of local land use tools. |
| 22 | Degree of coordination with other transportation entities (public transit providers, private transit providers, port authority, freight railroads, etc.) to leverage opportunities (e.g., develop multi-modal corridor plans, identify funding priorities ) | Weakness | Medium | DOT has initiated collaboration with Transit and Freight providers, however greater effort will be required as we update the statewide long range plan. |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 23a | Degree of collaboration with environmental agencies for plan and project evaluation (select applicable levels below) | Strength | Medium | Regional Long Range Plans are now reviewed at a resource agency meeting. |
| 23b | State level | | | Drop-down should allow opportunity to select more than one answer. In this case, both State and Federal would apply. |
| 24 | Relationships with private sector and non-profit organizations (concerning funding, system planning, project delivery, etc.) | Weakness | Medium | Recently enacted Public-Private-Partnership legislation may have an impact on futures collaboration in this area. |
| 25 | Organization identifies and learns from sustainable transportation efforts and research at comparable state DOTs, other transportation agencies (transit providers, MPOs, etc.), and partner agencies (environmental protection, housing, etc.) | Weakness | Medium | |
| 26 | Transportation system planning process includes extensive, constructive public involvement (beyond legislated guidelines) to identify stakeholders' priorities. | Strength | Medium | DOT public involvement efforts during development of the current Statewide Long Range Transportation Plan was recognized nationally. |
| | **Organizational Culture and Structure** | | | |
| 27 | Agency promotes a consistent sustainability message or brand internally (all units of central and regional/district offices) | Strength | Medium | DOT has branded the sustainability themes. |
| 28 | Sustainability is supported by executives and managers at all levels and across units as demonstrated by performance evaluations | Weakness | Medium | DOT has initiated efforts to incorporate performance metrics into performance evaluations, however this is not fully evolved. |
| 29 | Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | Weakness | High | |

| Ref No | FACTOR | Strength or Weakness | Priority (High, Medium, Low) | Evidence? |
|---|---|---|---|---|
| 30 | Employees understand what sustainability means to the agency and for their specific roles (i.e. sustainability is part of recruitment, hiring, and compensation for all employees) | Weakness | Low | |
| 31 | A system is in place to recognize and reward organizational achievements and/or staff for sustainable transportation innovations | Weakness | Low | |
| 32 | Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | Strength | High | |
| | **Other Internal Factors (user provided, not required)** | | | |
| 33 | (Insert additional factor, optional) | | | |
| 34 | (Insert additional factor, optional) | | | |
| 35 | (Insert additional factor, optional) | | | |

## EXTERNAL FACTORS: DETERMINING OPPORTUNITIES AND THREATS

For each factor, determine whether it is currently an external opportunity or threat to your organization (refer to Tab 7 Definitions). Then designate each factor as an immediate, short-term, or long-term priority. Designate three (3) factors as immediate, indicating the importance of quickly addressing them. Finally, provide an explanation to support the designation of each factor as an opportunity versus threat and the assigned urgency ranking. Upon completion, proceed to Tab 6 Strategies and Work Plan.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 1a | Political climate regarding transportation (select level below) | Opportunity | Immediate | Governor's special committee formed in 2011 to identify transportation funding opportunities for both short and long term revenue enhancements. |
| 1b | All levels | | | |
| 2a | Political climate regarding sustainability (select level below) | Opportunity | Short-term | Current Federal Agency collaboration (FHWA, EPA, HUD) is directed towards improved coordination and the ability to break-down funding silos that exist today. |
| 2b | All levels | | | |
| 3 | Public climate regarding transportation | Threat | Immediate | Governor's special committee formed in 2011 to identify transportation funding opportunities for both short and long term revenue enhancements. |
| 4 | Public climate regarding sustainability | Opportunity | Long-term | Current initiatives involve education of the public on the value of sustainable planning and investments. |
| 5a | Legislative requirements related to (select from list below) transportation planning and investment and/or sustainability | Threat | Short-term | Planning in our state is the responsibility of local municipal governments which creates the challenge of competing economic and sound land use interests. |
| 5b | Transportation investment | | | Drop-down should allow opportunity to select more than one answer. |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 6 | Change in government administration resulting in redirection of priorities and policies related to sustainable transportation | Threat | Long-term | |
| 7a | Availability of federal transportation funding (select category below) | Opportunity | Immediate | All indications at this time point towards level or reduced funding, which means state DOTs must evaluate their approach to investments to ensure sustainability of the transportation infrastructure. |
| 7b | All types | | | |
| 8a | Availability of other funding (select level below) | Opportunity | Short-term | Governor's special committee formed in 2011 to identify transportation funding opportunities for both short and long term revenue enhancements. |
| 8b | State | | | |
| 9 | Economy | Threat | Short-term | |
| 10 | Deployment of new technologies (smart phones, GPS, etc.) | Opportunity | Short-term | GIS technologies are providing opportunities to conduct greater evaluation of existing conditions in planning to develop better and more predictable transportation solutions. |
| 11 | Changing demographics of transportation users (e.g. total population, age, income, spatial distribution) | Opportunity | Long-term | |
| 12 | Housing options (e.g. affordability, density, location) | Opportunity | Short-term | |
| 13 | Employment (types, wages, availability) | Opportunity | Short-term | |

| Ref No | FACTOR | Opportunity or Threat | Urgency (Immediate, Short-term, Long-term) | Explanation? |
|---|---|---|---|---|
| 14 | Climate-related impacts on transportation infrastructure (i.e., due to sea level rise, storm intensity and frequency, flooding, extreme temperatures) | Threat | Long-term | |
| 15 | Transportation energy supply and sources | Threat | Short-term | |
| 16 | Transportation fuel prices | Threat | Short-term | |
| 17 | (Insert additional factor, optional) | | | |
| 18 | (Insert additional factor, optional) | | | |
| 19 | (Insert additional factor, optional) | | | |
| 20 | (Insert additional factor, optional) | | | |

## STRATEGIES & WORK PLAN

For each high priority strength/weakness, select an urgent external factor (from the dropdown options) which could be influenced by the strength/weakness. Then indicate a strategy that could be implemented, who within the organization should be responsible for that strategy, and what performance measures could be used to monitor implementation of the strategy and its effectiveness. Be as specific as possible when indicating the primary task owner and performance measures (with possible data sources). Be sure to indicate any external partners that could help with implementing the strategy or provide data for performance measures.

NOTE: **Orange** boxes indicate dropdown menus. **Green** boxes indicate user-provided text.

| | Internal Factor (High Priority) | Related External Factor (select most relevant) | Proposed Strategy | Primary Task Owner | Performance Measure(s) & Data Source(s) |
|---|---|---|---|---|---|
| 1 | Strength: Sustainability is recognized as an ethic or guiding principle for the organization. | Opportunity: Political climate regarding transportation (select level below) | Continue close coordination with Interagency Consultation Group (ICG) on plan, program and projet level air quality and climate change issues. The ICG is comprised of DOT, FHWA, FTA, EPA and DEP. | Planning & Programming | Number of transportation conformity analyses and PM 2.5 Hot Spot analyses completed |
| 2 | Strength: Organization's mission statement or vision touches (at a minimum) on the three dimensions of sustainability: Environment, Economy, Society | Threat: Political climate regarding transportation (select level below) | | | |
| 3 | Strength: Policies and system planning prioritize maintenance and rehabilitation of existing infrastructure | Opportunity: Availability of federal transportation funding (select category below) | | | |
| 4 | Strength: Sustainability planning efforts are action-oriented, meaning sustainability activities are assigned to process and outcome owners who manage implementation and performance measurement through specific action items | Threat: Political climate regarding transportation (select level below) | | | |
| 5 | Strength: Percentage of funds allocated for operating and maintaining existing infrastructure (may increase as a result of revised selection criteria, availability of funds, etc.) | Opportunity: Availability of federal transportation funding (select category below) | | | |
| 6 | Weakness: Sustainability initiatives are organized across functional areas, departments, etc. (ex: partnership between planning and operations/maintenance) through teams, task forces, or working groups | Threat: Political climate regarding transportation (select level below) | | | |
| 7 | Strength: Organization actively monitors external factors like new legislation and public opinion (see Tab 5) in order to inform future strategic planning | Threat: Political climate regarding transportation (select level below) | | | |

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