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PROGRAMMATIC ISSUES OF FUTURE SYSTEM PERFORMANCE

An Analytical Procedure for State Transportation Agencies to Assess Future Threats and Opportunities: A Guide

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1 INTRODUCTION

The changes facing society in general and state transportation agencies in particular over the next 10 to 20 years are likely to be even more profound and transformational than those in recent memory. Concurrent introduction into the transportation environment of several dramatic changes (at least compared to past trends) could create significant challenges for transportation officials. In light of such changes, systematically assessing future threats and opportunities to identify strategies and actions to prepare for such changes is one indicator of a healthy organization and effective leadership responsible for guiding its future. Such systematic assessment is the essence of strategic planning.

The purpose of this Guide is to provide state transportation officials with an agency self-assessment process that will:

- Identify priority future threats and opportunities as they relate to programmatic issues affecting transportation system performance
- Help officials understand what their agency is capable of doing to address these threats and opportunities
- Identify where new or modified strategies could be adopted and actions taken to enhance agency efforts
- Recommend steps to implement these actions

This self-assessment process Guide is just one product of NCHRP 20-126 (01). In addition, a final report and implementation plan has been prepared as part of the research. The final report provides background on the research itself and how this research led to the development of the self-assessment process. The implementation plan outlines the “who” and “what” it will take to implement both the self-assessment process in practice and in furthering the research outlined in the final report.

Areas of Interest

The self-assessment process, developed as part of NCHRP 20-126 (01): Programmatic Issues of Future System Performance, is based on some results of the early steps in this research. For example, one of the first tasks in this research was to develop a framework that characterized the likely key areas of interest for state transportation agencies over the next 10 to 20 years. The framework was based on an analysis of the issues and recommendations contained in key research reports¹ and the literature as well as input from subject matter experts on specific issue topics. This analysis resulted in six interest areas around which to organize the self-assessment process:

¹Two documents, in particular, served as the basis for developing the framework: TRB Special Report 329: Renewing the National Commitment to the Interstate Highway System: A Foundation for the Future (CIHS) and TRB’s Critical Issues in Transportation 2019.

- ***Transformational Technologies*** – Focus on vehicle automation technologies for passenger autos and freight, application-based new mobility services (e.g., connected and automated vehicles [AVs], ride sharing services), electric vehicles (EVs) and system electrification, drones, robotics and artificial intelligence in highway construction, remote and ubiquitous sensors, and telework options.
- ***System Performance and Condition*** – Focus on system management strategies relating to performance and asset condition. This could relate to design and construction challenges and the ability to project future performance given travel demands or future conditions given asset condition parameters.
- ***System Use*** – Focus on the changing characteristics of the demand for transportation and its relationship to needed infrastructure/services, including analysis tools and models for predicting future demand given different parameters.
- ***System Impacts and Externalities*** – Focus on the impacts of transportation system construction and operations on the system and on society. This category also covers the potential impacts of external stresses on the performance and condition of the transportation system (e.g., climate change-related vulnerabilities) and methods and tools to predict future impacts due to changes in the transportation system and in travel demand.
- ***Organizational Capacity and Governance*** – Focus on the workforce and analysis capabilities needed by agencies to address current and future challenges, which could include decision support for the areas listed above (e.g., system performance and condition, system use, and system impacts).
- ***Equity*** – Focus on population groups that are disproportionately affected by transportation system design, operations, and finance, including older adults, people with disabilities, low-income individuals, and minority groups. Issues could include transportation availability, access, affordability, and effectiveness of transportation operations and service.

The research identified several critical issues associated with each interest area, as well as a range of threats and opportunities that could make that issue more challenging or that represent opportunities to enhance the state transportation agency’s performance (Table 1). The self-assessment tool provides the user with an opportunity to identify which of the threats and opportunities in the tool are most relevant to their agency, or to identify other threats/opportunities that agency leadership considers to be important to future efforts. Experience with self-assessment tools such as provided in this Guide suggests that often a threat or opportunity can in fact represent both.

Table 1: Example Interest Area and Critical Issue.

Interest Area	System Use
Critical Issue	Providing connectivity and integration within and across megaregions
Threats/ Opportunities	<ul style="list-style-type: none"> • Lack of coordination on land-use transportation linkage • Limited influence over land use and zoning policy/regulation/decisions • Evolving perception of the workplace - location and need to commute/travel • Limited knowledge of increasing freight movement, temporally and spatially • Limited knowledge/oversight of technology applied to freight movement • Market influences on freight movement demand (trade alliances, supply chains, consumer demand) • Increasing shift toward an on-demand economy • Long-term impacts of COVID-19/potential for future disruption of similar scale • Limited knowledge/control of new mobility services • New mobility services' impacts on traditional services (transit) • New market-specific mobility options for underserved/difficult-to-serve populations (spatial characteristics) • New market-specific mobility options for underserved/difficult-to-serve populations (population cohorts) • New communication technologies to educate public on transportation-related benefits associated with safety, health, resource-efficiency, and affordable transportation choices • New communication technologies to inform/influence more effective/efficient system use • New TSMO technologies to influence/permit more effective/efficient system use

Undertaking a Self-Assessment

The self-assessment tool and this Guide allow state transportation officials to identify the issues and related agency strategies that are most relevant to their agency. The self-assessment approach adopted by an agency should best reflect the knowledge base found among its staff.

The effectiveness of the approach depends on:

- Having a mandate or some other form of credibility of the head of the agency
- Including experts or expertise having a good understanding of the implications of broader policy issues to the agency
- Including staff who are familiar with the current capabilities of the agency with respect to the range of issues under consideration

- Undertaking an honest assessment of the current capabilities of the agency
- Having credibility among agency staff and with agency leadership in recommending actions to enhance the agency's capabilities
- Providing feedback to executive leadership throughout the process on progress and interim findings

These characteristics could be incorporated into a range of possible self-assessment approaches, including an internal task force/committee led by a member of executive leadership or a third-party-led effort that is considered unbiased in terms of identified gaps in agency capabilities. The approach could systematically examine all issues found in the self-assessment, or one could envision a screening process that identifies which ones are most relevant to the agency.

For all approaches, there are three key participant roles:

- **Facilitator(s)** – Manages the self-assessment process and directs the use of the tool and the discussion among all participants; encourages an honest assessment and contributions from all relevant stakeholder perspectives.
- **Recorder** – Captures all data/discussion in the self-assessment tool.
- **Participants** – Multidisciplinary senior or manager-level agency staff who can offer business function-specific expertise relative to the critical issues addressed; have a role in executing any actions or strategies identified.

The facilitator(s) and recorder need to be familiar with using the interactive tool, so they know what to expect when progressing through each step and how to efficiently manage the time.

Considerations for participants' function or role include, but are not limited to:

- Leadership and strategic planning
- Project planning
- Budgeting (funding availability)
- Investment decisions, prioritization, programming
- Design (application of technology, standards, specifications, materials)
- Construction
- Procurement
- Transportation systems management and operations (TSMO) and emergency response
- Asset management/maintenance
- Fleet and equipment management
- Real property management (buildings, right-of-way)
- IT/data management

- Human resource and workforce (access to skills)
- Communications, public relations, outreach
- Equity, civil rights
- Legal and administration

Guide Organization

The Guide is organized to allow users of the self-assessment tool to apply the suggested approach in a straightforward manner. Chapter 2 provides a description of the self-assessment tool, the logic flow of the tool steps, and a step-by-step discussion of using each step. Chapter 3 provides an example application of the self-assessment tool and the process of identifying a portfolio of actions considering the results of the self-assessment. Appendix A arrays all threats and opportunities against the six interest areas. Appendix B presents a range of strategies and actions that transportation agencies could consider to enhance their capabilities in facing future threats and taking advantage of opportunities organized by issue category.

As noted earlier, the Guide and self-assessment tool are structured to provide transportation officials with the flexibility to choose the issues and actions they consider to be important, and to identify the appropriate strategies and actions. The Guide is thus intended to provide an overall framework for a self-assessment process, giving transportation officials the opportunity to modify the process to reflect their specific situation.

2 SELF-ASSESSMENT TOOL

A self-assessment tool and Guide allow the agency to conduct a self-assessment and provide a structured environment in which to consider and document critical issues, threats and opportunities, agency capabilities, and strategies and actions to take in response.

The tool is interactive and runs locally on a user's PC from a folder. It operates using a web browser but does not use Internet connectivity. Figure 1 illustrates the start screen asking the users to enter some basic information about the assessment to get started.

NCHRP 20-126(01)
Programmatic Issues of Future System Performance

About the Tool | How to Use | Guidebook ?

Programmatic Issues Of Future System Performance

An Analytical Procedure for State Transportation Agencies to Assess Future Threats and Opportunities: Self-Assessment Tool

This assessment tool and accompanying guidebook support state transportation officials through a self-assessment process that:

- Identifies priority future threats and opportunities as they relate to programmatic issues affecting transportation system performance
- Helps officials understand what their agency is capable of doing to address these threats and opportunities
- Identifies where new or modified strategies could be adopted and actions taken to enhance agency efforts
- Recommends steps to implement these actions

Enter demographic data for Action Plan report. (* required)

State DOT*

Workshop Location*

Facilitator*

Participating SMEs

Date*

START ASSESSMENT

Figure 1: Self-Assessment Tool Start Screen.

Figure 2 illustrates the logic and flow of the self-assessment process (numbered boxes) and how the tool supports it (*italicized text in brackets*). The steps are as follows:

1. Identify critical issues of interest within one or more interest area. (Note: The tool permits assessment of only one interest area at a time.)
2. Identify threats and opportunities from those built into the tool or identified by the user.
3. Prioritize and screen the top five threats and top five opportunities for assessment.
4. Assess agency capabilities to address threats and opportunities.
5. Identify strategies and actions and implementation steps to improve agency capabilities and determine agency posture to the threats and opportunities.

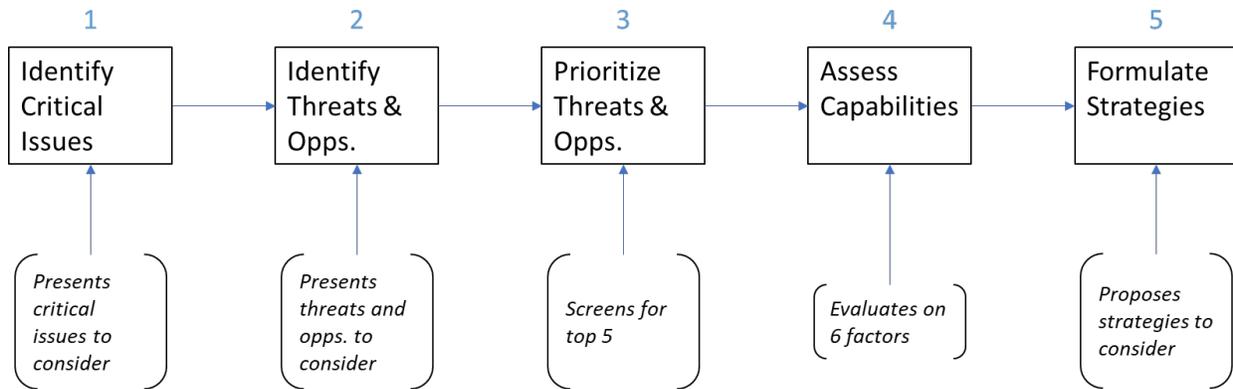


Figure 2: Self-Assessment Tool Process.

The following five sections detail each of the steps in the self-assessment process. Note that in the tool itself steps 3 to 5 have parts A and B. Parts A and B break up several of the steps for the purposes of displaying a manageable amounts of information/inputs on a single webpage. Steps 3, 4, and 5 parts B are all summaries of what is entered in their respective parts A. For step 5, parts A and B both require inputs from the user (i.e. part B is not simply just a summary of part A), but they still relate to the overall formulation of strategies that is Step 5.

1. Identify Critical Issues of Interest

Step 1 focuses the scope of the self-assessment on an interest area (taken from the six areas presented in the Introduction) and the set of associated critical issues. The research has identified sets of four to six critical issues that characterize the more specific challenge for the agency related to its mission and function. Table 2 identifies the critical issues by interest area. Users of the tool should consult a set of white papers prepared by this research on each interest area to learn about the state of the practice and critical issues associated with each.

The tool provides a simple interface with which to select the interest area and critical issue (see Figure 3). These choices will determine the sets of threats and opportunities to be prioritized and to provide the basis against which to assess agency capabilities in later steps of the tool.

A smaller set of participants who are key decision makers can determine the focus of the self-assessment in advance of the remaining steps in the process. The tool permits assessment of one interest area at a time to ensure sufficient time is available and focus is given to all relevant critical issues and threats and opportunities. Once the assessment for the selected interest area is completed, the tool permits users to return to the interest area selection step and repeat the process for another interest area.

Table 2: Critical Issues by Interest Area.

Interest Area	Critical Issues
Transformational Technologies	<ul style="list-style-type: none"> Understanding the implications or outcomes of the application of transformational technologies

Interest Area	Critical Issues
	<ul style="list-style-type: none"> • Defining roles and responsibilities of transportation agencies (federal, state, and local) • Determining strategies to foster adoption of transformational technologies • Building institutional capacity and supportive infrastructure that prepare for transformational technology implementation • Establishing partnership models for technology-enabled private mobility service providers
System Performance and Condition	<ul style="list-style-type: none"> • Leveraging technology, pricing, and other operational strategies in response to growing demand, capacity needs, and costs • Improving the life-cycle performance of infrastructure elements • Making tradeoffs to manage performance effectively and equitably in a constrained funding environment • Investment planning for resilience • Improving resilience of transportation systems • Lack of adequate national-level data and modeling tools for performance management
System Use	<ul style="list-style-type: none"> • Providing connectivity and integration within and across megaregions • Accommodating growing and shifting spatial distribution of the population • Meeting the accessibility needs of rural regions • Understanding land use policies' influence on transportation demand • Fairly serving the varying transportation preferences and needs among sociodemographic cohorts • Managing the growing demand (volume and speed) for freight movement and delivery
System Impacts and Externalities	<ul style="list-style-type: none"> • Lack of regulatory standards that address the safety, privacy, and security implications of transformational technologies • Understanding and incorporating public health outcomes in transportation decision-making • Growing significance of incorporating long-term sustainability needs in transportation decision-making • Role of transportation agencies in fostering the adoption of renewable energy-based and low-emission technologies for vehicles and other systems • Increasing role of transportation agencies in reducing the contribution of freight transportation to GHG emissions • Increasing role of transportation agencies in reducing the contribution of passenger transportation to GHG emissions

Interest Area	Critical Issues
Organizational Capacity and Governance	<ul style="list-style-type: none"> • Challenges in attracting, training, and retaining DOT workforce • Workforce inequities in recruitment and career progression • Inadequate organizational capacity to address strategic issues • Gaps in cross-border cooperation among states in planning and policy making • Institutional limitations with current transportation planning at the megaregion, metropolitan, and rural levels • Challenges with data management and sharing between public agencies and the private sector
Equity	<ul style="list-style-type: none"> • Equity implications of alternative revenue sources (e.g., user fees, tolling, etc.) on economically disenfranchised groups • Leveraging technology equitably to overcome transportation barriers • Addressing inequities among user groups in understanding and meeting their transportation service needs • Disproportionate and negative consequences of transportation policies and projects on socio-economically disenfranchised neighborhoods

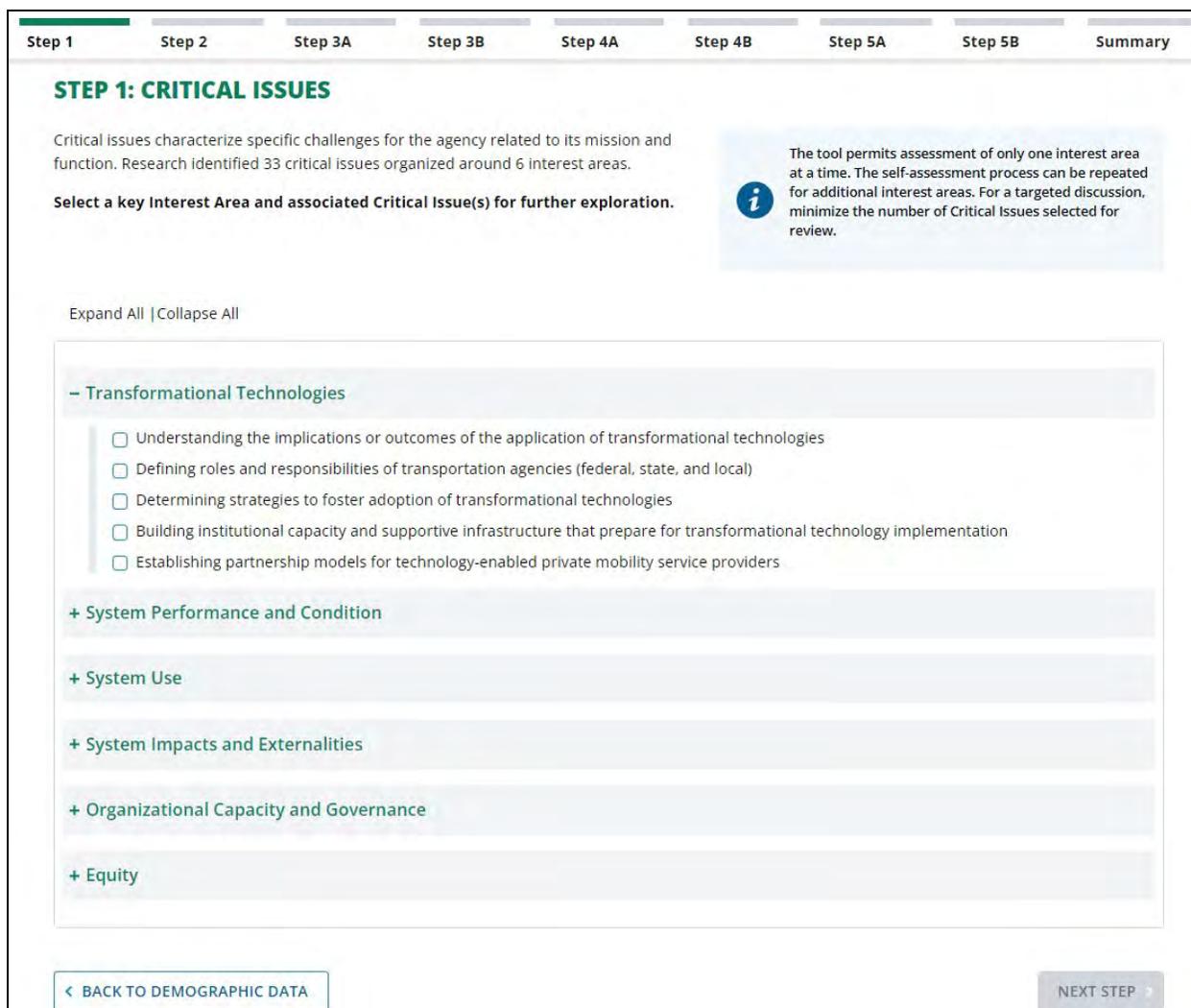


Figure 3: Interest Area and Critical Issue Selection.

2. Identify Threats and Opportunities

The second step in the self-assessment is to identify specific threats and opportunities associated with each critical issue. Research identified comprehensive lists of threats and opportunities for consideration, roughly 20 to 30 per interest area, which in turn, were mapped to each interest area’s critical issues. Agencies can identify their own threats and opportunities as well. Appendix A lists the threats and opportunities identified by the research organized by interest area. Each is not specifically identified as a “threat” or “opportunity” because, although the wording or connotation may clearly suggest one or the other, some could be interpreted as both or one or the other depending on agency context.

Selection of threats and opportunities should consider the context of the agency’s capabilities to mitigate or manage relevant threats or to capitalize on opportunities. Therefore, this step of the self-assessment consists of reviewing the list of threats and opportunities associated with each

critical issue, selecting those that the agency judges as relevant for further consideration, and specifically identifying the statement as a “threat,” “opportunity,” or both (see Figure 4).

INTEREST AREA: TRANSFORMATIONAL TECHNOLOGIES

Step 1 Critical Issues	Step 2 Threats and Opportunities	Step 3A Prioritized Threats and Opportunities	Step 3B Threats and Opportunities Summary	Step 4A Agency Capabilities	Step 4B Agency Capabilities Summary	Step 5A Identify Strategies	Step 5B Identify Post-Strategy Posture	Summary
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STEP 2: THREATS AND OPPORTUNITIES

Selection of threats and opportunities should be considered in the context of the agency's capability to mitigate or manage relevant threats or to capitalize on opportunities.

For each Critical Issue, select all items that represent a perceived threat, opportunity or both for your agency; select N/A if not applicable. Selection should include a minimum of one threat and one opportunity.

LEGEND: 👍 = Opportunity 👎 = Threat

i Review the complete list of Threats and Opportunities (matrix) in the Guidebook (Appendix A).

CRITICAL ISSUE: Understanding the implications or outcomes of the application of transformational technologies

Reduction in VMT/congestion and emissions from use of personal life technologies (telework, teleshopping, home delivery)	<input type="radio"/> 👎	<input type="radio"/> 👍	<input type="radio"/> Both	<input checked="" type="radio"/> N/A
Automated vehicles' uncertain market penetration and impact on travel behavior and travel demand estimates	<input type="radio"/> 👎	<input type="radio"/> 👍	<input type="radio"/> Both	<input checked="" type="radio"/> N/A
Apparent low willingness of the public to accept AVs	<input type="radio"/> 👎	<input type="radio"/> 👍	<input type="radio"/> Both	<input checked="" type="radio"/> N/A
Disproportionate impacts to disadvantaged communities from large-scale parking/charging infrastructure for and the routing of (electric) AVs	<input type="radio"/> 👎	<input type="radio"/> 👍	<input type="radio"/> Both	<input checked="" type="radio"/> N/A

Figure 4: Threat and Opportunity Selection.

3. Prioritize and Screen Threats and Opportunities

In general, the number of threats and opportunities selected for consideration in Step 2 will be too great to effectively evaluate or manage in the long run by taking specific actions. Therefore, the third step in the self-assessment screens and prioritizes the threats and opportunities identified in the previous step. The self-assessment recommends identifying up to the top five threats and top five opportunities (as available) for further consideration. Identification of the top five threats and opportunities must be done for each critical issue. Note, critical issues may share common threats and opportunities, especially within a single interest area.

In Step 3A, the tool asks the user to answer two questions on a scale of 1 to 10 (see Figure 5). The combination of answers will permit the threats and opportunities to be ranked in order of perceived priority and the top five of each screened for further consideration. (If fewer than five threats or five opportunities are selected, all will be prioritized.) The two questions ask to quantify the importance of the threat or opportunity and the perceived ability for the agency to

respond effectively. Table 3 presents the questions and the potential response range. Step 3B presents the screened threats and opportunities (up to the top five) for each critical issue (see Figure 6).

Table 3: Questions to Prioritize and Screen Threats and Opportunities.

Prioritization/Screening Question	Response Range (1.0–10.0)
1. How important is it to address the subject threat or opportunity? In the context of a threat, importance relates to the need to mitigate or manage it and avoid potential negative impacts. In the context of an opportunity, importance relates to the need to capitalize on the opportunity and not miss out on potential benefits.	1 = low importance 10 = high importance
2. What level of risk does the threat or opportunity pose due to the perceived ability or capacity of the agency to address it?	1 = low risk because of strong ability or capacity to address it 10 = high risk because of limited ability or capacity to address it

INTEREST AREA: TRANSFORMATIONAL TECHNOLOGIES

Step 1 Critical Issues	Step 2 Threats and Opportunities	Step 3A Prioritized Threats and Opportunities	Step 3B Threats and Opportunities Summary	Step 4A Agency Capabilities	Step 4B Agency Capabilities Summary	Step 5A Identify Strategies	Step 5B Identify Post-Strategy Posture	Summary
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STEP 3A: PRIORITIZED THREATS AND OPPORTUNITIES

Prioritizing threats and opportunities for each critical issue will reduce the overall number of considerations to a manageable list focused on top agency priorities. Consider:

1. How important is it to address the subject threat or opportunity?
2. What level of risk does the threat or opportunity pose due to the perceived ability or capacity of the agency to address it?

Rate the Overall Importance and the Agency's Ability to Respond for all threats and opportunities on a scale of 1 to 10; a default rating of 5 is displayed. (1=Low and 10=High)

LEGEND:  = Opportunity  = Threat



Rate all threats and opportunities on a scale of 1 to 10. (1=Low and 10=High)

In the context of a threat, importance relates to the need to mitigate or manage it and avoid potential negative impacts. In the context of an opportunity, importance relates to the need to capitalize on the opportunity and not miss out on potential benefits.

CRITICAL ISSUE: Understanding the implications or outcomes of the application of transformational technologies

	Overall Importance	DOT Ability to Respond
Automated vehicles' uncertain market penetration and impact on travel behavior and travel demand estimates	 8	5
Apparent low willingness of the public to accept AVs	 6	3
Disproportionate impacts to disadvantaged communities from large-scale parking/charging infrastructure for and the routing of (electric) AVs	 5	4
Lack of access to workforce skills to plan, design, and manage infrastructure and services to support or complement CAV operations	 8	7

Figure 5: Threats and Opportunities Screening and Prioritization.

INTEREST AREA: TRANSFORMATIONAL TECHNOLOGIES								
Step 1	Step 2	Step 3A	Step 3B	Step 4A	Step 4B	Step 5A	Step 5B	Summary
CRITICAL ISSUE: Understanding the implications or outcomes of the application of transformational technologies								
				Overall Importance	DOT Ability to Respond	Combined Rating	Rank	
				9	7	63	1	
			Need for improved analytical methods, tools, and data requirements to understand the equity implications of transformational technologies					
				8	7	56	2	
			Implementing effective data security and privacy programs					
				7	7	49	3	
			Unresolved legal/institutional issues around liability					
				8	6	48	4	
			Unclear paths and mechanisms to scale from CAV test bed or pilot applications to mainstream applications					
				8	5	40	5	
			Lack of access to workforce skills to plan, design, and manage infrastructure and services to support or complement CAV operations					
				9	7	63	1	
			Improved transportation system user and worker safety					
				7	7	49	2	
			Transportation system congestion reduction or improved system efficiency					
				8	6	48	3	
			Improved accessibility and mobility in underserved markets (e.g. disabled, elderly, economically disadvantaged)					

Figure 6: Threats and Opportunities Summary.

4. Assess Agency Capabilities to Address Threats and Opportunities

Step 4 is to assess each prioritized threat and opportunity for each critical issue selected against the capabilities of the agency and interpret the results. The self-assessment tool provides six assessment factors that should be discussed and quantified among the multidisciplinary agency group participating in the self-assessment exercise. The role of the facilitator or facilitation team is critical at this step. They must be familiar with the assessment factors and also understand how a critical issue and its associated threats and opportunities might relate to the assessment factors within the agency’s context. Facilitators prompt and direct relevant discussion from the larger group to best capture its collective judgment of the agency’s capabilities relative to the critical issue.

The assessment factors are based on the dimensions of capability maturity used in a number of other state transportation agency self-assessment and strategic/programmatic planning tools. These factors were identified by examining such tools, looking at the literature on organizational

effectiveness, as well as including questions concerning these factors as part of the focus groups/workshops. Table 4 summarizes the six assessment factors and recommended targets against which the agency can judge itself and (in Step 5) devise strategies to achieve the target if the current assessment indicates that the agency is falling short.

Table 5 provides the potential range for evaluating each assessment factor and a general approach to formulating strategies and actions (detailed in Step 5) given a recommended threshold for response.

Figure 7 illustrates the tool’s interface for entering the consensus evaluation for each of the six assessment factors. Thus, in this figure, the hypothetical rankings indicate that those participating in the assessment view the culture and organization of the agency as being most supportive in addressing the considering new analytical methods, tools, and data requirements (rated a 9). Similarly, supportive systems and funding, ranked a “4,” are not considered conducive to such consideration. As shown in Table 8, this would imply that the agency should identify specific shortcomings and availability of peer/state of the practice solutions for supportive systems to address them and/or an opportunity for involvement in research/solution development. This approach allows agency staff to gauge whether the capability and conducive environment exists for considering each particular strategy.

A designated recorder should capture the discussion in note form and record the group’s selection of assessment factor responses within the tool.

Table 4: Assessment Factors for Addressing Threats and Opportunities.

Assessment Factor	Target
1. <i>Activities</i> : Awareness, understanding and relevant activities underway or accomplished	<ul style="list-style-type: none"> • High level of awareness exhibited • State of the practice tracked • Demonstrable progress made • Alignment of goals recognized and incorporated into relevant strategic direction/plan/initiative • Challenges and risks understood
2. <i>Environment</i> : Legal, regulatory, and policy environment	<ul style="list-style-type: none"> • External legal and regulatory issues formally acknowledged and framed • Accommodation for law/regulation made or pathway to resolution defined to the extent feasible • Liability and intellectual property issues formally acknowledged and framed; risks understood and mitigated • Supportive or enabling policies in place or developmental pathway clear • Relevant standards established or under development

Assessment Factor	Target
3. <i>Collaboration</i> : External collaboration (interagency, academic, and private sector)	<ul style="list-style-type: none"> • Extensive peer (public agencies, academic institutions) interaction leading to collaborative, coordinated, and shared-risk approach • Agreement exists on collective priorities and actions • Resource-sharing mechanisms where appropriate • Formal coordination mechanisms in place for accessing state of the practice knowledge/experience • Private sector engagement as appropriate (outsourcing, partnerships for risk sharing / mutual developmental benefit)
4. <i>Systems</i> : Supportive systems and funding (processes, tools/models, internal functions, budgets)	<ul style="list-style-type: none"> • Active planning and/or applied research focused on emerging issues takes place • Agency-wide knowledge management system in place • Relevant models/tools used for decision making applied • Opportunity for budgetary consideration provided • Administrative and technical support readily available
5. <i>Staff</i> : Staff (champions, quantity, knowledge, skills and abilities [KSAs])	<ul style="list-style-type: none"> • Clear champion(s) with technical expertise and ability to lead • Sufficient staff capacity and KSAs (including an understanding of what they are) • Access to required education and training
6. <i>Organization</i> : Culture and organization (leadership support, organizational barriers)	<ul style="list-style-type: none"> • Strong leadership support • Widespread collaboration and teamwork • Receptivity to new ideas • Dedication to continuous improvement • Few to no organizational barriers to addressing associated threats and opportunities

Table 5: Assessment Factor Evaluation Range.

Assessment Factor	Evaluation Range (1–10)	Assessment Outcome and General Strategy Approach
1. <i>Activities</i> : Awareness, understanding and relevant activities underway or accomplished	1 = Limited 10 = Significant	If <5 Focus on state of the practice awareness, industry/organization participation, approach to assessing significance and impact to agency If >= 5 Your agency has capability to consider this critical issue and in adopting strategies identified by agency staff for doing so.
2. <i>Environment</i> : Legal, regulatory, and policy environment	1 = Minimal 10 = Strong	If <5 Focus on advocacy, state of the practice awareness, developing a business case, scenario planning If >= 5 Your agency has capability to consider this critical issue and in adopting strategies identified by agency staff for doing so.
3. <i>Collaboration</i> : External collaboration (interagency, academic, and private sector)	1 = Minimal 10 = Strong	If <5 Focus on collaborative relationships (especially at the leadership level), participation in multiagency forums, communicating the business case If >= 5 Your agency has capability to consider this critical issue and in adopting strategies identified by agency staff for doing so.
4. <i>Systems</i> : Supportive systems and funding (processes, tools/models, internal functions, budgets)	1 = Lacking 10 = Prevalent	If <5 Identify specific shortcomings and availability of peer/state of the practice solutions to address them and/or opportunity for involvement in research/solution development If >= 5 Your agency has capability to consider this critical issue and in adopting strategies identified by agency staff for doing so.
5. <i>Staff</i> : Staff (champions, quantity, knowledge, skills and abilities [KSAs])	1 = Insufficient 10 = Sufficient	If <5 Identify and cultivate champions, understand and develop KSAs, focus on needed training, recruitment, filling roles currently lacking If >= 5 Your agency has capability to consider this critical issue and in adopting strategies identified by agency staff for doing so.
6. <i>Organization</i> : Culture and organization (leadership support, organizational barriers)	1 = Lacking 10 = Prevalent	If <5 Identify and eliminate organizational barriers, build leadership awareness (business case) If >= 5 Your agency has capability to consider this critical issue and in adopting strategies identified by agency staff for doing so.

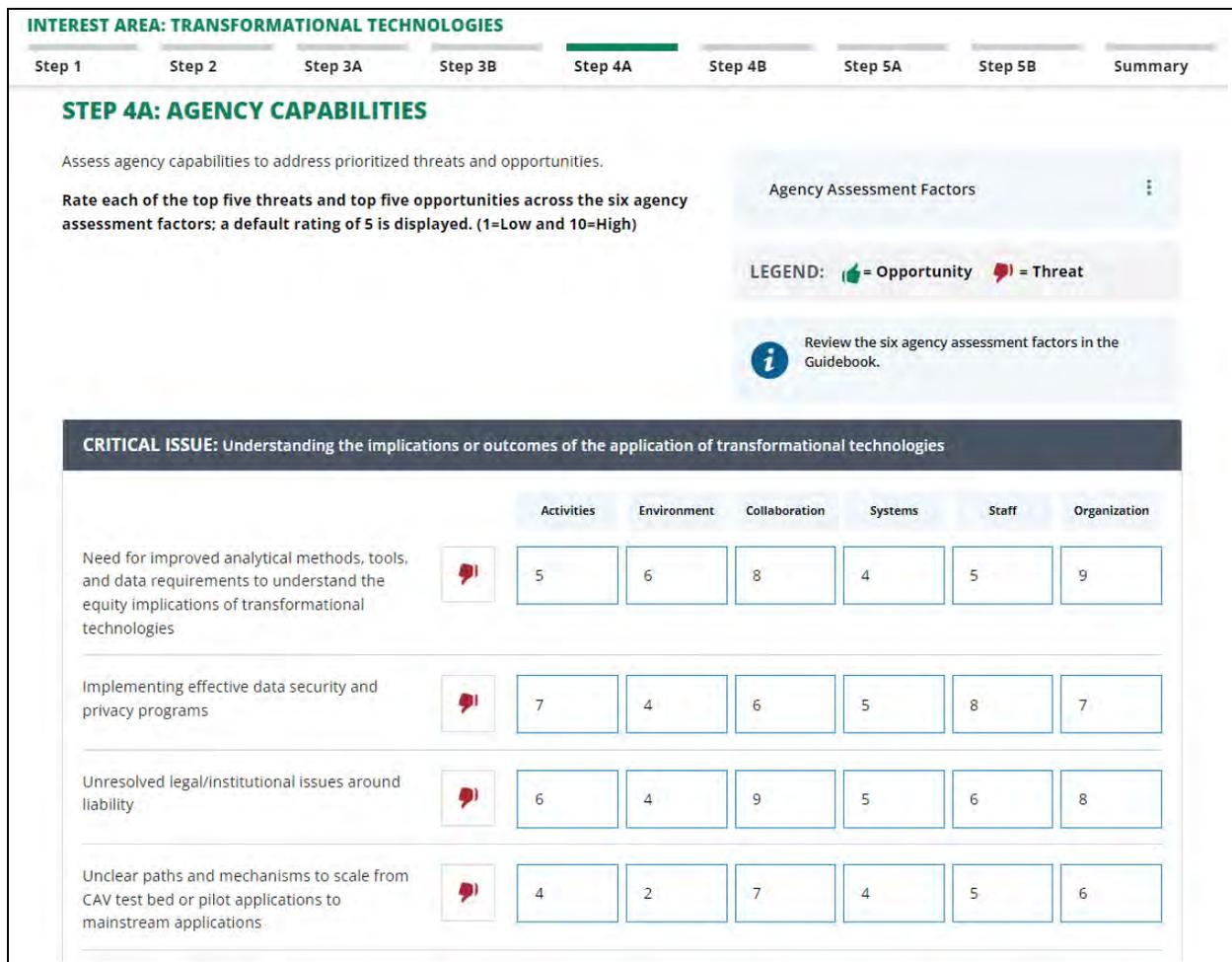


Figure 7: Assessment Factor Evaluation.

When all assessment factors have been evaluated for each threat and opportunity, the tool generates a summary evaluation matrix for each critical issue. Figure 8 presents a sample output with evaluation results (note: only the evaluations for the threats are shown). The summary includes:

- Average evaluation by threat or opportunity
- Average evaluation of each assessment factor for all threats
- Average evaluation of each assessment factor for all opportunities

Users of the tool can infer several outcomes from these average results that will help determine what strategies are most germane to addressing individual threats and opportunities, taking actions to respond to a critical issue, and improving underlying agency capabilities.

- The threat(s) with the lowest average evaluation (“Unclear paths and mechanisms...”) – agency is least capable of addressing and needs to devise strategies to respond based on low-scoring assessment factors.

- The opportunity(ies) with the highest average evaluation (not shown in the figure) – agency is best positioned to capitalize on the opportunity in the short-term, potentially improve capabilities further and/or focus on any low-scoring assessment factors to better ensure success.
- The assessment factor(s) with the lowest average evaluation (Environment for both threats and opportunities) – suggests a specific, systemic capability weakness to address all threats and/or all opportunities.

CRITICAL ISSUE: Understanding the implications or outcomes of the application of transformational technologies								
	Activities	Enviro	Collab	Systems	Staff	Org	Average	
Need for improved analytical methods, tools, and data requirements to understand the equity implications of transformational technologies		5	6	8	4	5	9	6.2
Implementing effective data security and privacy programs		7	4	6	5	8	7	6.2
Unresolved legal/institutional issues around liability		6	4	9	5	6	8	6.3
Unclear paths and mechanisms to scale from CAV test bed or pilot applications to mainstream applications		4	2	7	4	5	6	4.7
Lack of access to workforce skills to plan, design, and manage infrastructure and services to support or complement CAV operations		4	5	7	5	6	9	6
Average Capability for Addressing Threats	5.2	4.2	7.4	4.6	6	7.8	5.9	
Average Capability for Taking Advantage of Opportunities	5.6	3.4	8	5	7.2	7.4	6.1	

Figure 8: Self-Assessment Output Sample.

5. Identify Strategies

In Step 5A, the tool presents a screen to select strategies the agency can implement to better manage risk and expand upon opportunities. Users select from among strategies that directly relate to the threats and opportunities associated with each critical issue (Critical Issue Strategies) and from among strategies that directly address capability weaknesses among the six

assessment factors (Capability Improvement Strategies) (see Figure 9). The tool's proposed strategies derive as follows:

- ***Critical Issue Strategies*** – Suggestions gleaned from this project's literature review and listening sessions with subject matter experts in each critical issue area.
- ***Capability Improvement Strategies*** – Generalized capability improvement strategies adapted from prior NCHRP research that examined how to best position agencies for future trends and innovations that are, by their nature, uncertain in both definition and timing.²

The group can select the strategies as presented in the tool, modify them, or input their own. Users are encouraged to discuss the application of both sets of candidate strategies in the context of the agency's needs and circumstances. The tool's proposed strategies are detailed further in Appendix B.

With strategy selection complete for each critical issue, Step 5B presents a post-strategy implementation posture selection (see Figure 10). The group can assign an overall agency posture on each threat (eliminate, fully mitigate, partially mitigate, accept) and opportunity (exploit, enhance, wait, ignore) based on what they judge the effects of implementing the selected strategies to be.

The tool concludes with a summary (see Figure 11) that provides for each critical issue the assessment and averages for the top five threats and opportunities and the selected postures and strategies that, combined, can serve as the basis of an action plan. (Note: not all threats and opportunities are shown.) Users may wish to further consider strategy implementation and next steps by developing specific actions to carry out the strategy, assign responsibilities, estimate resource implications, and develop timeframes.

² See: [NCHRP Report 750: Strategic Issues Facing Transportation, Volume 7: Preservation, Maintenance, and Renewal of Highway Infrastructure](#) (2020).

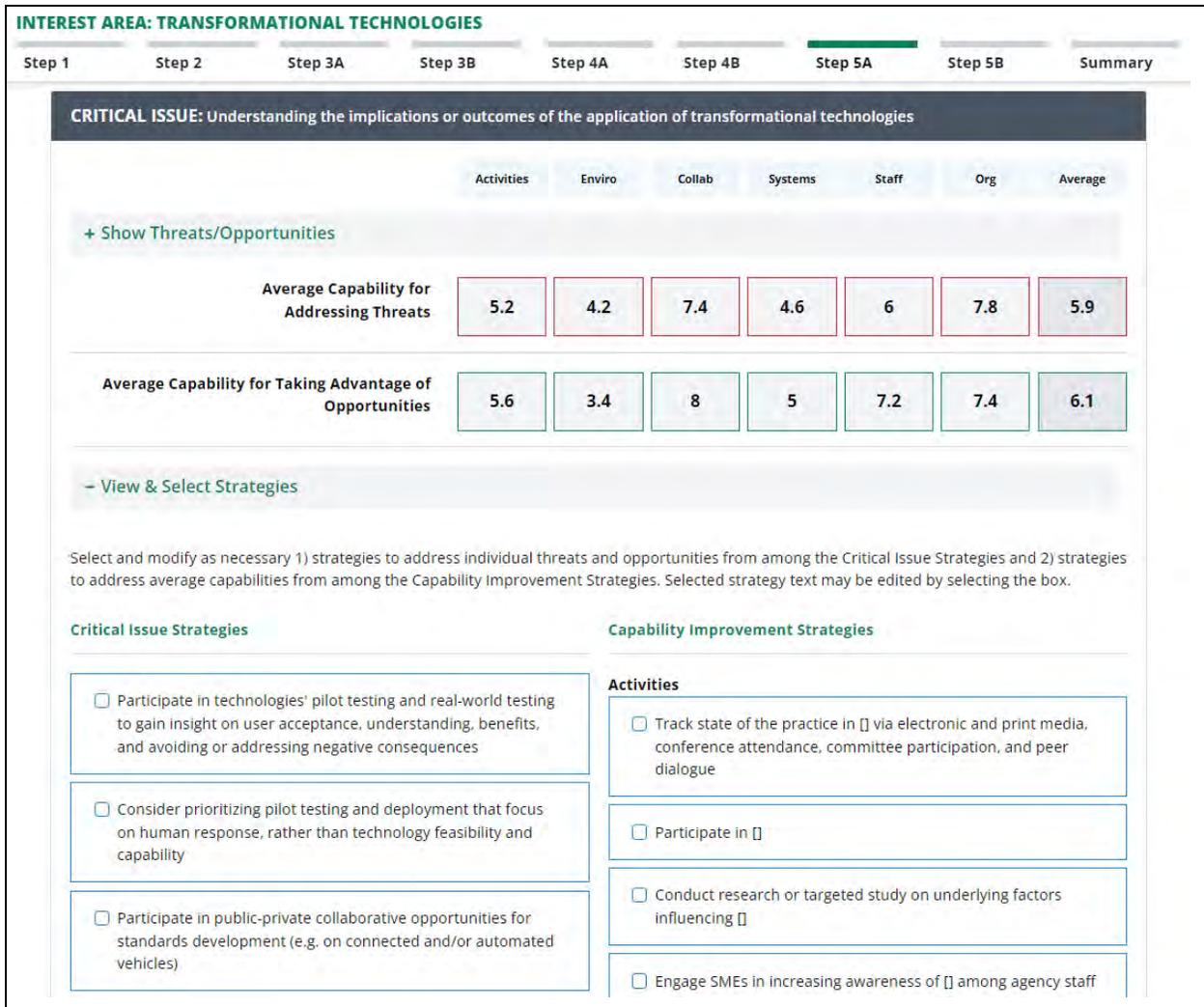


Figure 9: Strategy Selection and Input.

INTEREST AREA: TRANSFORMATIONAL TECHNOLOGIES

Step 1 Step 2 Step 3A Step 3B Step 4A Step 4B Step 5A **Step 5B** Summary

STEP 5B: IDENTIFY POST-STRATEGY POSTURE

Determine the agency's view of each threat or opportunity after applying the strategies.

Specify the agency posture for each threat and opportunity after considering the impact of implementing the selected strategies. Select the 'Previous Step' button at the bottom of the screen to review prior Steps in which the Critical Issue Strategies were chosen.

LEGEND: 👍 = Opportunity 🗨️ = Threat



Consider whether the strategies have eliminated, fully mitigated, or partially mitigated each threat or whether the agency accepts a threat in spite of any strategies implemented. Consider whether the strategies permit the agency to exploit or enhance each opportunity or whether the agency will wait to act on an opportunity or ignore it for the time being.

CRITICAL ISSUE: Understanding the implications or outcomes of the application of transformational technologies									
	Activities	Enviro	Collab	Systems	Staff	Org	Average	Posture	
Need for improved analytical methods, tools, and data requirements to understand the equity implications of transformational technologies	🗨️	5	6	8	4	5	9	6.2	Select ▼
Implementing effective data security and privacy programs	🗨️	7	4	6	5	8	7	6.2	Select ▼
Unresolved legal/institutional issues around liability	🗨️	6	4	9	5	6	8	6.3	Select ▼
Unclear paths and mechanisms to scale from CAV test bed or pilot applications to mainstream applications	🗨️	4	2	7	4	5	6	4.7	Select ▼

- Select
- Eliminate
- Fully Mitigate
- Partially Mitigate
- Accept

Figure 10: Post-Strategy Implementation Posture Selection.

INTEREST AREA: TRANSFORMATIONAL TECHNOLOGIES

Step 1 Step 2 Step 3A Step 3B Step 4A Step 4B Step 5A Step 5B **Summary**

ACTION PLAN FOR PROGRAMMATIC ISSUES OF FUTURE SYSTEM PERFORMANCE

← EXIT

NEXT INTEREST AREA ↻

PRINT 🖨

- **State DOT:** Sample DOT
- **Workshop Location:** Sample DOT Central Office
- **Facilitator:** Jane Facilitator
- **Date:** 2022-05-11

CRITICAL ISSUE: Understanding the implications or outcomes of the application of transformational technologies

	Activities	Enviro	Collab	Systems	Staff	Org	Average	Posture
Need for improved analytical methods, tools, and data requirements to understand the equity implications of transformational technologies	👎 5	6	8	4	5	9	6.2	Fully Mitigate
Implementing effective data security and privacy programs	👎 7	4	6	5	8	7	6.2	Accept
Unresolved legal/institutional issues around liability	👎 6	4	9	5	6	8	6.3	Partially Mitigate



Transportation system derived emissions reduction	👍 5	3	8	4	8	7	5.8	Wait
Application of automation to local and long-distance freight delivery as part of a sustainability strategy	👍 6	5	9	5	6	7	6.3	Wait

	Activities	Enviro	Collab	Systems	Staff	Org	Average
Average Capability for Addressing Threats	5.2	4.2	7.4	4.6	6	7.8	5.9
Average Capability for Taking Advantage of Opportunities	5.6	3.4	8	5	7.2	7.4	6.1

Critical Issue Strategies

- Participate in technologies' pilot testing and real-world testing to gain insight on user acceptance, understanding, benefits, and avoiding or addressing negative consequences
- Consider establishing an in-house testing laboratory (similar to materials testing for asphalt) to explore application and deployment questions related to connected vehicle technologies and data (e.g. lifecycle performance, interoperability) or other technologies like UAS
- Assign a staff member the responsibility of monitoring technology developments and applications with possible application to the transportation system

Capability Improvement Strategies

- Maintain state of the practice awareness and understanding of relevant business case, costs and benefits, etc.
- Conduct peer review of other agencies on agency liability concerns
- Identify appropriate partners and roles (peer agencies/pooled fund program participants, consultants, universities, etc.)
- Assess and if necessary, develop strategy for disseminating knowledge to agency staff

Figure 11: Summary Action Plan.

3 EXAMPLE APPLICATION

This chapter provides an example application using the steps presented in Chapter 2.

Application Context

The Secretary of Transportation has growing concerns about the capabilities of her agency to handle the challenges that her agency is expected to face over 10 to 20 years. She knows that some combination of refocusing existing staff capabilities, obtaining additional funding for targeted program initiatives, and perhaps some form of collaboration with partner agencies will likely be necessary. She wants to create a strategic initiative to (1) identify key issue areas that will be of concern to the agency, (2) assess current agency capabilities to address these issues, (3) understand the critical facets of these issues that could be the target of agency action, and (4) identify a priority list of actions that she can take over the next few years to prepare her agency for the challenges.

Process Structure

The Secretary has created a Strategic Directions Committee consisting of the top leadership in the agency, primarily the seven executives who are responsible for each of the functional areas in the agency. In addition, she has authorized the Committee to draw upon internal expertise for particular areas in which the agency is believed to have strong talent, and/or to contract with subject matter experts to provide the input that is needed. The Committee has decided to hire a third-party facilitator to manage the process, including using the NCHRP self-assessment tool that was developed as part of NCHRP 20-126(01).

As the facilitator explained to the Committee, the process for using the tool is for selected members of the agency, most likely the Committee members and several other key staff, to participate in the self-assessment. The tool uses a scoring process for key factors in each critical issue area. As explained by the facilitator, the scores for each factor could either be produced through facilitated in-person group meetings where the resulting scores are a consensus score of all group members, or each member could provide a rating, and the score for the factor would be the average of all the ratings. The group decided that producing a consensus score for each factor would be appropriate, in part because it required members to discuss and debate the reasons underlying their individual thoughts on what the consensus score should be.

Step 1 – Identify Critical Issues of Interest

In consultation with the Secretary and other key executives, the Committee identified several important interest areas that could present challenges to the agency in the next decade. Industry representatives, other public officials, and the agency's own staff have suggested that transportation is entering an era where transformational technologies are likely to impact in important but unknown ways how the agency will conduct business. Thus “**Transformational Technologies**” was chosen as one “interest area.” In addition, there has been a considerable level of interest in how the state can provide multimodal services to all parts of the state, with special

concern given to rural areas. In particular, the movement of freight in the state, a very important part of the state's economy, has received increasing attention from the business community and the Governor's office. A second interest area was thus "**System Use.**" A final issue area that the Secretary and other key officials felt was going to become even more important over 10 to 20 years was equity. This has been a growing concern in the state's metropolitan areas as well as in rural areas. The third interest area chosen was thus "**Equity.**"

The group decided to proceed with these three interest areas as the basis for the agency assessment.

Note: Only the System Use interest area is described in the following section. The others would follow a similar process and require going through all steps in the self-assessment for each.

The self-assessment tool was used to identify critical issues associated with the System Use interest area (see Figure 12). As the figure shows, the group identified the following critical issues as the most important for the agency self-assessment:

- Meeting the accessibility needs of rural regions
- Fairly serving the varying transportation preferences and needs among sociodemographic cohorts
- Managing the growing demand (volume and speed) for freight movement and delivery

Step 1 Critical Issues	Step 2 Threats and Opportunities	Step 3A Prioritized Threats and Opportunities	Step 3B Threats and Opportunities Summary	Step 4A Agency Capabilities	Step 4B Agency Capabilities Summary	Step 5A Identify Strategies	Step 5B Identify Post-Strategy Posture	Summary
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STEP 1: CRITICAL ISSUES

Critical issues characterize specific challenges for the agency related to its mission and function. Research identified 33 critical issues organized around 6 interest areas.

Select a key Interest Area and associated Critical Issue(s) for further exploration.

i The tool permits assessment of only one interest area at a time. The self-assessment process can be repeated for additional interest areas. For a targeted discussion, minimize the number of Critical Issues selected for review.

Expand All | Collapse All

- + Transformational Technologies
- + System Performance and Condition
- System Use
 - Providing connectivity and integration within and across megaregions
 - Accommodating growing and shifting spatial distribution of the population
 - Meeting the accessibility needs of rural regions
 - Understanding land use policies' influence on transportation demand
 - Fairly serving the varying transportation preferences and needs among sociodemographic cohorts
 - Managing the growing demand (volume and speed) for freight movement and delivery
- + System Impacts and Externalities
- + Organizational Capacity and Governance
- + Equity

Figure 12: Selecting Critical Issues by Interest Area.

Step 2 – Identify Threats and Opportunities

The second step in the self-assessment identifies threats and opportunities associated with each critical issue identified in Step 1; the tool provides a list of such threats and opportunities. For example, for the System Use interest area, Table 6 shows the threats and opportunities that the tool user may select. This full set for the System Use interest area is further filtered by critical issue within the tool. The group next identified which of the possible threats and opportunities were relevant to each critical issue identified in Step 1. This selection process is illustrated in Figure 13 for some of threats and opportunities within the first critical issue. The selected threats and opportunities will be further analyzed in Step 3.

Table 6: Possible Threats and Opportunities for the System Use Interest Area.

Threats and Opportunities
Lack of coordination on land-use transportation linkage
Limited influence over land use and zoning policy/regulation/decisions
Changing/differences among population cohort travel behavior (preferences and needs) - by generation/age
Changing/differences among population cohort travel behavior (preferences and needs) - by gender
Changing/differences among population cohort travel behavior (preferences and needs) - by economic status
Evolving perception of the workplace - location and need to commute/travel
Limited knowledge of increasing freight movement, temporally and spatially
Limited knowledge/oversight of technology applied to freight movement
Market influences on freight movement demand (trade alliances, supply chains, consumer demand)
Increasing shift toward an on-demand economy
Long-term impacts of COVID-19/potential for future disruption of similar scale
Limited knowledge/control of new mobility services
New mobility services' impacts on traditional services (transit)
New market-specific mobility options for underserved/difficult-to-serve populations (spatial characteristics)
New market-specific mobility options for underserved/difficult-to-serve populations (population cohorts)
New communication technologies to educate public on transportation-related benefits associated with safety, health, resource-efficiency, and affordable transportation choices
New communication technologies to inform/influence more effective/efficient system use
New TSMO technologies to influence/permit more effective/efficient system use

Threats and Opportunities
Reduction in VMT/congestion and emissions from use of personal life technologies (telework, teleshopping, home delivery)
Federal-aid program/federal rules' effects on investment decisions
Insufficient or ineffective mechanisms to facilitate multimodal, integrated transportation system planning
New data sources and analytics - collected/managed internally
New data sources and analytics - third-party/private sector
Automated vehicles' uncertain market penetration and impact on travel behavior and travel demand estimates

INTEREST AREA: SYSTEM USE

Step 1 **Step 2** Step 3A Step 3B Step 4A Step 4B Step 5A Step 5B Summary

STEP 2: THREATS AND OPPORTUNITIES

Selection of threats and opportunities should be considered in the context of the agency's capability to mitigate or manage relevant threats or to capitalize on opportunities.

LEGEND: = Opportunity = Threat

For each Critical Issue, select all items that represent a perceived threat, opportunity or both for your agency; select N/A if not applicable. Selection should include a minimum of one threat and one opportunity.

[Review the complete list of Threats and Opportunities \(matrix\) in the Guidebook \(Appendix A\).](#)

CRITICAL ISSUE: Meeting the accessibility needs of rural regions

Lack of coordination on land-use transportation linkage	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Both	<input type="radio"/> N/A
Limited influence over land use and zoning policy/regulation/decisions	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Both	<input type="radio"/> N/A
Changing/differences among population cohort travel behavior (preferences and needs) - by generation/age	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Both	<input type="radio"/> N/A
Changing/differences among population cohort travel behavior (preferences and needs) - by gender	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Both	<input type="radio"/> N/A
Changing/differences among population cohort travel behavior (preferences and needs) - by economic status	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Both	<input type="radio"/> N/A
Evolving perception of the workplace - location and need to commute/travel	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Both	<input type="radio"/> N/A

Figure 13: Selection of Threats and Opportunities for Critical Issues.

Step 3 – Prioritize and Screen Threats and Opportunities

As suggested in Chapter 2, the number of threats and opportunities selected for consideration in Step 2 would likely be too large to focus the actions of the agency in enhancing its capabilities. The Chapter 2 description of Step 3 explained that up to the top five threats and opportunities would be selected for further consideration in the capability assessment and action planning. In the example shown in Figure 13, the “Meeting the accessibility needs of rural regions” critical issue has more than five threats identified.

The assessment questions found in Table 3 were used to prioritize the threats and opportunities for the critical issue areas identified in Figure 13. As noted earlier, the facilitator worked with the group to develop a consensus rating for each assessment factor. In the case where there are five or fewer threats or opportunities identified, all will be evaluated for that critical issue. Figure 14 shows the results of this assessment for a portion of the first critical issue. Figure 15 indicates the results of the ranking to identify the top five threats and opportunities.

CRITICAL ISSUE: Meeting the accessibility needs of rural regions			
		Overall Importance	DOT Ability to Respond
Lack of coordination on land-use transportation linkage		5	5
Limited influence over land use and zoning policy/regulation/decisions		8	3
Changing/differences among population cohort travel behavior (preferences and needs) - by generation/age		7	5
Changing/differences among population cohort travel behavior (preferences and needs) - by gender		7	5
Changing/differences among population cohort travel behavior (preferences and needs) - by economic status		7	5
Evolving perception of the workplace - location and need to commute/travel		6	6
Insufficient or ineffective mechanisms to facilitate multimodal, integrated transportation system planning		7	8
New market-specific mobility options for underserved/difficult-to-serve populations (spatial characteristics)		8	7

Figure 14: Threat and Opportunity Assessment.

CRITICAL ISSUE: Meeting the accessibility needs of rural regions					
		Overall Importance	DOT Ability to Respond	Combined Rating	Rank
Insufficient or ineffective mechanisms to facilitate multimodal, integrated transportation system planning		7	8	56	1
Evolving perception of the workplace - location and need to commute/travel		6	6	36	2
Changing/differences among population cohort travel behavior (preferences and needs) - by generation/age		7	5	35	3
Changing/differences among population cohort travel behavior (preferences and needs) - by gender		7	5	35	4
Changing/differences among population cohort travel behavior (preferences and needs) - by economic status		7	5	35	5
New market-specific mobility options for underserved/difficult-to-serve populations (spatial characteristics)		8	7	56	1
New communication technologies to inform/influence more effective/efficient system use		6	8	48	2
New market-specific mobility options for underserved/difficult-to-serve populations (population cohorts)		7	6	42	3

Figure 15: Threat and Opportunity Prioritization Results.

Step 4 – Assess Agency Capabilities to Address Threats and Opportunities

The fourth step assesses each prioritized threat and opportunity against the capabilities of the agency for each critical issue selected. As noted earlier, the self-assessment tool provides a set of six assessment factors for the group members to discuss and quantify. The assessment factors are presented in Table 4 and Table 5 but repeated here for convenience:

1. Awareness, understanding, and relevant activities underway or accomplished
2. Legal, regulatory, and policy environment
3. External collaboration (interagency, academic, and private sector)
4. Supportive systems and funding (processes, tools/models, internal functions, budgets)
5. Staff (champions, quantity, knowledge, skills and abilities [KSAs])
6. Culture and organization (leadership support, organizational barriers)

Figure 16 shows the ratings for each of the selected threats and opportunities for the “Meeting the accessibility needs of rural regions” critical issue, based on the Table 4 and Table 5 factors.

These results could be interpreted in several ways as noted in Chapter 2:

- The threat(s) with the lowest average evaluation in a critical issue area suggests the agency is least capable of addressing and should consider devising strategies to respond based on low-scoring assessment factors.
- The opportunity(ies) with the highest average evaluation in a critical issue area suggests the agency is best positioned to capitalize on the opportunity in the short-term. Strategies should be developed to improve the agency’s capabilities further and/or focus on any low-scoring assessment factors to better ensure success.
- The assessment factor(s) with the lowest average evaluation (for both threats and opportunities) suggests a specific, systemic capability weakness to address all threats and/or all opportunities.

CRITICAL ISSUE: Meeting the accessibility needs of rural regions								
	Activities	Enviro	Collab	Systems	Staff	Org	Average	
Insufficient or ineffective mechanisms to facilitate multimodal, integrated transportation system planning		4	3	5	4	6	3	4.2
Evolving perception of the workplace - location and need to commute/travel		7	4	8	4	5	5	5.5
Changing/differences among population cohort travel behavior (preferences and needs) - by generation/age		6	2	7	5	4	6	5
Changing/differences among population cohort travel behavior (preferences and needs) - by gender		6	2	7	5	4	6	5
Changing/differences among population cohort travel behavior (preferences and needs) - by economic status		6	3	7	5	5	6	5.3
New market-specific mobility options for underserved/difficult-to-serve populations (spatial characteristics)		4	3	4	6	4	5	4.3
New communication technologies to inform/influence more effective/efficient system use		7	6	8	8	7	7	7.2
New market-specific mobility options for underserved/difficult-to-serve populations (population cohorts)		5	4	5	4	5	5	4.7
New communication technologies to educate public on transportation-related benefits associated with safety, health, resource-efficiency, and affordable transportation choices		6	6	7	7	6	6	6.3
Reduction in VMT/congestion and emissions from use of personal life technologies (telework, teleshopping, home delivery)		5	6	6	8	6	6	6.2
Average Capability for Addressing Threats		5.8	2.8	6.8	4.6	4.8	5.2	5
Average Capability for Taking Advantage of Opportunities		5.4	5	6	6.6	5.6	5.8	5.7

Figure 16: Threat and Opportunity Assessment.

With respect to the sample results shown in Figure 16, for threats, the lowest assessment score (where priority action should be considered) for the “Meeting the accessibility needs of rural regions” critical issue was “Insufficient or ineffective mechanisms to facilitate multimodal, integrated transportation system planning.” With respect to opportunities, the highest assessment score (where priority action should be considered) was “New communication technologies to inform/influence more effective/efficient system use.”

Alternatively, the group might want to know where in the agency the most improvement should be considered to enhance agency capabilities, which could be done by critical issue or across all critical issues. For example, for the critical issue “Meeting the accessibility needs of rural regions,” the lowest scoring assessment factor was Environment (Legal, regulatory, and policy environment), suggesting that efforts to improve activities that relate to this assessment factor would enhance the agency’s capabilities in this critical issue area. Although not shown in Figure 16, this factor is also at the low end of the other critical issues and thus improvements would have benefits for other critical issues as well. Improving this assessment factor would benefit the agency’s ability to address both the lowest scoring threat and highest scoring opportunity, since the Environment assessment factor was the lowest scoring factor for both.

Step 5 – Identify Strategies

The tool provides users with a selection of strategies that could be considered as part of an agency action plan for individual critical issues. Figure 17 shows an example of the Step 5A process for identifying potential strategies for one of the critical issues (“Meeting the accessibility needs of rural regions”). Strategies that address the threats and opportunities can be selected from the Critical Issue Strategies set. Strategies that address the capability assessment factors can be selected from the Capability Improvements Strategies set. The latter set is organized by assessment factor.

As shown in the self-assessment summary (Figure 18), the group members selected the following Critical Issue Strategies to specifically address the lowest scoring threat:

- Incorporate nonmotorized transportation options into rural transportation planning, development strategies, and accessibility provision
- Elevate awareness and understanding of rural needs by partnering with them during the planning process and increasing planning support resources

The group also selected the following strategy to take advantage of the highest scoring opportunity:

- Invest in software tools that facilitate and capture conversations at the community level and apply data analytics that provide input into the planning process and might otherwise go uncaptured through traditional public engagement; ensure the process reaches those who lack access to technology

In addition, the group selected the following Capability Improvement Strategies to address the lowest scoring capability improvement assessment factor (Environment). Note that the group

added their own context to the second strategy where a pair of brackets (“[]”) had indicated a placeholder:

- Maintain state of the practice awareness and understanding of relevant business case, costs and benefits, etc.
- Identify agency policy issues related to [integrating regional planning in rural regions with statewide planning] and address as appropriate

In the last step before the summary (Step 5B), the group members brainstormed about what position the agency would be in after implementing the selected strategies. They indicated their thoughts by selecting a “posture” for each of the threats and opportunities. They felt that implementing the selected Critical Issue Strategies would “Partially Mitigate” the lowest scoring threat (see Figure 18). They also felt that they could accept the other threats having implemented all the selected strategies, as indicated by the “Accept” posture. Finally, the group thought that the strategies would allow the agency to “Exploit” the highest scoring opportunity, as well as another similar opportunity.

CRITICAL ISSUE: Meeting the accessibility needs of rural regions

– View & Select Strategies

Select and modify as necessary 1) strategies to address individual threats and opportunities from among the Critical Issue Strategies and 2) strategies to address average capabilities from among the Capability Improvement Strategies. Selected strategy text may be edited by selecting the box.

Critical Issue Strategies	Capability Improvement Strategies
<input type="checkbox"/> Reframe goals and educate the public in favor of safe, healthy, resource-efficient, and affordable transportation choices	Activities <input type="checkbox"/> Track state of the practice in [] via electronic and print media, conference attendance, committee participation, and peer dialogue
<input type="checkbox"/> Dedicate staff resources to performing accessibility analyses, particularly for rural regions	<input type="checkbox"/> Participate in []
<input checked="" type="checkbox"/> Incorporate nonmotorized transportation options into rural transportation planning, development strategies, and accessibility provision	<input type="checkbox"/> Conduct research or targeted study on underlying factors influencing []
<input type="checkbox"/> Apply least-cost transportation planning principles to reduce a focus on accommodating the automobile and to consider multimodal solutions, including nonmotorized/active transportation options	<input type="checkbox"/> Engage SMEs in increasing awareness of [] among agency staff
<input checked="" type="checkbox"/> Elevate awareness and understanding of rural needs by partnering with them during the planning process and increasing planning support resources	<input type="checkbox"/> Identify how [] aligns with agency goals or adjust agency goals to align with []
	<input type="checkbox"/> Conduct peer review of other agencies on relationship between agency goals and []
	<input type="checkbox"/> Identify the scope and scale of the critical issue and associated threat and opportunities

Figure 17: Strategy Selection Process.

ACTION PLAN FOR PROGRAMMATIC ISSUES OF FUTURE SYSTEM PERFORMANCE

[← EXIT](#)

[NEXT INTEREST AREA](#)

[PRINT](#)

- **State DOT:** Example DOT
- **Workshop Location:** Example DOT Central Office
- **Facilitator:** Third-party Facilitator
- **Date:** 2022-05-11

CRITICAL ISSUE: Meeting the accessibility needs of rural regions

	Activities	Enviro	Collab	Systems	Staff	Org	Average	Posture
Insufficient or ineffective mechanisms to facilitate multimodal, integrated transportation system planning	4	3	5	4	6	3	4.2	Partially Mitigate
Evolving perception of the workplace - location and need to commute/travel	7	4	8	4	5	5	5.5	Accept
Changing/differences among population cohort travel behavior (preferences and needs) - by generation/age	6	2	7	5	4	6	5	Accept
Changing/differences among population cohort travel behavior (preferences and needs) - by gender	6	2	7	5	4	6	5	Accept
Changing/differences among population cohort travel behavior (preferences and needs) - by economic status	6	3	7	5	5	6	5.3	Accept
New market-specific mobility options for underserved/difficult-to-serve populations (spatial characteristics)	4	3	4	6	4	5	4.3	Enhance
New communication technologies to inform/influence more effective/efficient system use	7	6	8	8	7	7	7.2	Exploit
New market-specific mobility options for underserved/difficult-to-serve populations (population cohorts)	5	4	5	4	5	5	4.7	Enhance
New communication technologies to educate public on transportation-related benefits associated with safety, health, resource-efficiency, and affordable transportation choices	6	6	7	7	6	6	6.3	Exploit
Reduction in VMT/congestion and emissions from use of personal life technologies (telework, teleshopping, home delivery)	5	6	6	8	6	6	6.2	Ignore

	Activities	Enviro	Collab	Systems	Staff	Org	Average
Average Capability for Addressing Threats	5.8	2.8	6.8	4.6	4.8	5.2	5
Average Capability for Taking Advantage of Opportunities	5.4	5	6	6.6	5.6	5.8	5.7

- | | |
|--|--|
| <p>Critical Issue Strategies</p> <ul style="list-style-type: none"> • Incorporate nonmotorized transportation options into rural transportation planning, development strategies, and accessibility provision • Elevate awareness and understanding of rural needs by partnering with them during the planning process and increasing planning support resources • Invest in software tools that facilitate and capture conversations at the community level and apply data analytics that provide input into the planning process and might otherwise go uncaptured through traditional public engagement; ensure the process reaches those who lack access to technology | <p>Capability Improvement Strategies</p> <ul style="list-style-type: none"> • Maintain state of the practice awareness and understanding of relevant business case, costs and benefits, etc. • Identify agency policy issues related to [integrating regional planning in rural regions with statewide planning] and address as appropriate |
|--|--|

Figure 18: Self-Assessment Summary – Action Plan.

APPENDIX A: THREATS AND OPPORTUNITIES BY INTEREST AREA

Interest Areas:

- System Use (SU)
- Transformational Technologies (TT)
- System Performance and Condition (SP)
- System Impacts and Externalities (SI)
- Organizational Capacity and Governance (OG)
- Equity (EQ)

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
Lack of coordination on land-use transportation linkage	x					
Limited influence over land use and zoning policy/regulation/decisions	x			x		
Changing/differences among population cohort travel behavior (preferences and needs) - by generation/age	x					x
Changing/differences among population cohort travel behavior (preferences and needs) - by gender	x					x
Changing/differences among population cohort travel behavior (preferences and needs) - by economic status	x					x
Evolving perception of the workplace - location and need to commute/travel	x					
Limited knowledge of increasing freight movement, temporally and spatially	x					
Limited knowledge/oversight of technology applied to freight movement	x					
Market influences on freight movement demand (trade alliances, supply chains, consumer demand)	x		x			
Increasing shift toward an on-demand economy	x		x			
Long-term impacts of COVID-19/potential for future disruption of similar scale	x		x			x
Limited knowledge/control of new mobility services	x					
New mobility services' impacts on traditional services (transit)	x			x		
New market-specific mobility options for underserved/difficult-to-serve populations (spatial characteristics)	x					x
New market-specific mobility options for underserved/difficult-to-serve populations (population cohorts)	x					x

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
New communication technologies to educate public on transportation-related benefits associated with safety, health, resource-efficiency, and affordable transportation choices	x					
New communication technologies to inform/influence more effective/efficient system use	x		x			
New TSMO technologies to influence/permit more effective/efficient system use	x		x			
Reduction in VMT/congestion and emissions from use of personal life technologies (telework, teleshopping, home delivery)	x	x	x			
Federal-aid program/federal rules' effects on investment decisions	x					
Insufficient or ineffective mechanisms to facilitate multimodal, integrated transportation system planning	x					
New data sources and analytics - collected/managed internally	x				x	
New data sources and analytics - third-party/private sector	x					
Automated vehicles' uncertain market penetration and impact on travel behavior and travel demand estimates	x	x				
Innovative supply chain distribution strategies	x					
Increasing use of drones and other freight delivery technologies	x					
Application of distance-based tele-medicine, tele-shopping, and tele-work	x					
Apparent low willingness of the public to accept AVs		x				
New private sector partners and players with limited understanding of state DOTs' roles and requirements		x			x	
Unclear institutional roles and responsibilities in technology implementation - public agencies		x			x	
Unclear institutional roles and responsibilities in technology implementation - private vendors/firms		x			x	
Disproportionate impacts to disenfranchised communities from large-scale parking/charging infrastructure for and the routing of (electric) AVs		x				x
Limited access to wired and wireless communications services in rural and/or disenfranchised communities		x				x
Gaps in rural broadband connectivity		x				x
Lack of access to workforce skills to plan, design, and manage infrastructure and services to support or complement CAV operations		x			x	
Unresolved legal/institutional issues around liability		x			x	

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
Lack of standards that support CAV interoperability		x				
Improved transportation system user and worker safety		x				
Transportation system congestion reduction or improved system efficiency		x	x			
Transportation system derived emissions reduction		x		x		
Improved transportation agency efficiency in system condition and monitoring		x	x			
Improved accessibility and mobility in underserved markets (e.g. persons with disabilities, older adults, economically disenfranchised)		x				x
New mobility and transportation accessibility solutions from AAM (e.g. cargo/package delivery, emergency medical services, airport shuttles and air taxi)		x				x
Economic barriers and/or lack of infrastructure inhibiting EV adoption		x				x
Unclear paths and mechanisms to scale from CAV test bed or pilot applications to mainstream applications		x				
Need for new revenue models in the face of substantial changes in system definition and in response to transformational technologies		x			x	
Lack of alignment between automated freight delivery operations and DOT performance objectives		x				
Ownership assignment of digital infrastructure among public and private entities		x			x	
Uncertainty of the DOT's role in managing AV applications		x				
Uncertainty of what the DOT/public sector should appropriately regulate in relation to CV or AV applications		x				
Regulatory, design, partnership, and other barriers that limit opportunities to monetize DOTs' rights-of-way		x				
Limitations of state and national design standards (e.g. MUTCD)		x			x	
CV data specifications and data management		x				
Lack of national vision or roadmap for passenger vehicle automation		x				
Increasing acceptance of technology applications in transportation, especially among the young		x				
Increasing penetration of broadband technologies in rural areas		x				
Increasing familiarity and skills of new workers with technology applications		x				

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
Competition with the private sector for qualified staff - recruitment, retention, diversity					x	
Non-competitive salaries, limited career paths, organizational structure limitations, etc. hindering recruitment, retention, and staff diversity					x	
Challenges providing or managing the work environment expectations of younger generations					x	
Lack of leadership, cultural sensitivity, and communication skills taught in many colleges and universities					x	
Lack of staff capabilities to conduct multistate, multijurisdictional planning or megaregion planning					x	
Uncertain organizational capacity impact on core functions due to greater numbers of staff working at least partly from home					x	
Creating opportunity for and managing involvement of a greater number of partner organizations (e.g. public health) in the transportation planning process					x	
Students in non-technical fields that can provide needed skills (e.g. technology-based communications) or broaden workforce diversity					x	
New communication technologies to reach diverse groups to further agency objectives					x	x
New mobility services' appeal to a wider range of the population (than traditional services like transit)		x			x	
New partner opportunities from co-locating multiple services in the right-of-way					x	
Lack of proficiency with information technology among non-technical managers					x	x
Disproportionate/negative impacts on workforce from automation		x			x	
Need to prepare and educate workforce to respond to increased role of automation and technology					x	x
Need for effective practices to address issues of equity among underrepresented or disenfranchised groups					x	
Knowledge management challenges from current retirements and low propensity for younger generations to stay longer with an employer					x	
Limitations on workforce recruitment, retention, and diversity due to minimum technical qualifications and credentials requirements					x	
Institutional inertia limiting stakeholder engagement to address multijurisdictional challenges					x	

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
Lack of information on efficacy and outcomes of P3 business models to support CV technology deployment					X	
Unclear public sector role on efficacy and outcomes of P3 business models to support CV technology deployment					X	
Private shared-use mobility companies augmenting or filling gaps in transit service availability					X	
Continuing workplace application of new and innovative technologies					X	
Continuing public support for transportation investment					X	
Increasing familiarity of younger employees with personal use technologies					X	
Increased pressure for the transportation sector to implement strategies to meet GHG reduction targets				X		
Greater emphasis placed on projects' equity implications on disenfranchised and minority populations				X		X
Greater emphasis placed on projects' implications in the context of climate change				X		
Ability for transportation and energy infrastructure to support widespread EV use			X	X		
Public acceptance and adoption of passenger EVs			X	X		
Industry acceptance and adoption of electric trucks			X	X		
Private sector freight fleets adoption of electric trucks/EVs			X	X		
Public acceptance and adoption of AVs - security, privacy, safety concerns			X	X		
Limited control over land use policy/regulation/decisions				X		
Greater frequency and intensity of extreme weather events			X	X		
Growing awareness of environmental impacts and climate change, especially among younger generations				X		
Advancements in low-carbon/zero-carbon fuels				X		
Advancements in battery technology and EV market penetration				X		
Transition of fleets for local deliveries to EVs/electric trucks		X		X		
Application of automation to local and long-distance freight delivery as part of a sustainability strategy		X		X		
Greater prevalence of adaptive design concepts and resilient community concepts among professional practice				X		

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
Advancements in sensing and imaging technologies providing real-time capabilities to identify and respond to environmental incidents		X		X		
Insufficient energy infrastructure to support the freight sector's shift to low-carbon fuels or electricity				X		
Complexity of measuring and modeling transportation sector GHG emissions and air pollutants in the context of region-wide sustainability policies				X		
Limited understanding of the private sector truck usage market chain				X		
Unclear relationship between vehicle automation and VMT				X		
Unclear impact of automation on vehicle emissions if AVs are electrified				X		
Unclear impact of automation on freight sector GHG emissions				X		
Car-sharing services effects on VMT and emissions				X		
Market forces driving the siting of warehouse/distribution centers, distribution routes, and use of more polluting trucks (ports) in communities with disenfranchised populations	X			X		
Transportation systems as possible vectors for transmission of infectious disease				X		
Institutional incentives/policies favoring resource-intensive modes relative to more affordable and nonmotorized transportation				X		
AVs' potential to decrease in-vehicle value of time - land use, location preference, and transportation use impacts	X			X		
Lack of accessibility measures in small and non-metropolitan areas				X		X
Providing transportation mobility and accessibility options in rural regions experiencing population decline				X		X
Advancements in sensing and imaging technologies providing real-time capabilities to identify and/or predict system/facility impacts				X		
Continuing contributions to scientific understanding of environmental processes and their linkage to transportation systems				X		
Continuing professional practices toward community-oriented design				X		
Significant backlog of road asset needs (rehabilitation, reconstruction, replacement)			X			
Significant backlog of transit asset needs (rehabilitation, reconstruction, replacement)			X			

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
Incorporation of risk-based planning approaches in planning and program development that anticipate and account for disruptive future events			X		X	
Project development process delays from complying with new rules/regulations related to climate change and social justice/equity			X		X	
Project development process delays from lack of qualified staff			X		X	
Linkage between asset lifecycle considerations, asset resilience, and causes of asset deterioration			X			
Performance management requirements to support new/expanded transportation system objectives (e.g. equity, quality of life, economic development, environment, health)			X			
Quantity and types of partnerships required for state DOTs to address new issues of concern in transportation planning			X		X	
Organizational silos inhibiting holistic performance management			X		X	
Insufficient or ineffective mechanisms to facilitate multimodal, integrated transportation system operations			X			
Equity and privacy challenges of congestion pricing			X			X
Modeling and assessment of ridesharing and on-demand transportation in transportation planning and operations			X			
Implementing a data governance program		X	X			
Implementing effective data security and privacy programs		X	X			
Policy, data, analytical, and business systems enablers to facilitate cross-modal resource allocations			X		X	
Need for integrating dynamic risk management and resilience considerations in transportation asset management business processes			X	X		
Emerging technologies (e.g. building information modeling, big data applications) to support transportation asset management business processes			X		X	
Need for assessment methodologies and analytical tools to fast-track the evaluation of new materials and construction techniques and incorporate their effects into infrastructure performance modeling			X		X	
Overdependence on historical climate data in understanding the threat intensity of future severe weather events and disasters			X		X	
Methods to minimize the adverse consequences of failure in new facility design and rehabilitation			X	X		

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
Design and construction standards that incorporate resilience into the project development process			X			
Alternative funding and financing mechanisms to pay for resilience performance			X			
Need to better understand the behavior of evacuees during evacuation planning			X			
Enhanced safety prediction models from third-party data sources and big data technologies			X		X	
Insufficient understanding of the linkage between transportation and health			X			
Need for improved analytical methods, business systems, and data requirements to quantify health and mobility outcomes			X		X	
Continuing public support for infrastructure investment			X			
Increasing public awareness of climate change-related disruptions to the transportation system			X			
Introduction of new cost-effective construction materials			X			
Emerging technologies in support for performance management			X			
Growing sizes of population cohorts (e.g. older adults, minority populations) presenting specific mobility challenges	X					X
New/specific analysis and communication techniques required to equitably address the mobility challenges of growing population cohorts (e.g. older adults, minority populations)						X
Difficulty of rural road needs competing against those of urban roads						X
Gaps in rural broadband limiting work-from-home options for agency employees						X
Lack of tools or staff capabilities to assess rural equity concerns					X	X
Rural road network vulnerability to significant system disruption						X
Increasing federal emphasis on equity-related concerns reflected in policies and programs						X
Greater role of non-governmental advocacy groups raising awareness and priority of disenfranchised groups' transportation- related concerns						X
Growing number of minority individuals in transportation leadership roles					X	X
Progress and establishment of best practices in incorporating equity concerns into planning and decision making					X	X

Threats and Opportunities	SU	TT	SP	SI	OG	EQ
Lack of information to quantify transportation costs and benefits for certain population groups and communities					X	X
Quantification of equity implications to evaluate differences among rural, suburban, and urban regions						X
Mobility-impaired and technologically challenged population groups' access to new mobility services			X			X
Lack of understanding of the relationship between rural transportation, medical geography, and public health				X		X
Public involvement challenges with incorporating economically and socially disenfranchised groups in transportation planning					X	X
Incorporating equity in performance-based planning and programming					X	X
Understanding the differential impacts of different AV strategy rollouts on various population groups			X			X
Need for improved analytical methods, tools, and data requirements to understand the equity implications of transformational technologies		X				X
Lack of information to understand the relationship between tolling and transportation outcomes of economically disenfranchised groups						X
Increasing numbers of people of color in the population						X
Increasing penetration of broadband technologies in rural areas						X

APPENDIX B: STRATEGIES AND ACTIONS TO ENHANCE AGENCY CAPABILITIES

This appendix presents sets of specific strategies designed to help agencies improve their ability to address the critical issues and their associated threats and opportunities, as presented for consideration in Step 5A of the self-assessment process. The strategies consist of:

1. ***Critical Issue Strategies*** – Critical issue-specific strategies derived from a literature review and input from leaders, practitioners, and subject matter experts who participated in listening sessions as a part of the research. These strategies are illustrative and not exhaustive, however, because the critical issues and threats and opportunities are largely unresolved and at the leading edge of current agency practice.
2. ***Capability Improvement Strategies*** – Generalized capability improvement strategies to advance each of the six assessment factors toward their respective capability targets. Table 7 presents these strategies that are meant to be tailored to the agency’s context by the self-assessment process facilitator(s).

Interest Area: Transformational Technologies

Critical Issue: Understanding the implications or outcomes of the application of transformational technologies

- Participate in technologies' pilot testing and real-world testing to gain insight on user acceptance, understanding, benefits, and avoiding or addressing negative consequences.
- Consider prioritizing pilot testing and deployment that focus on human response, rather than technology feasibility and capability.
- Participate in public-private collaborative opportunities for standards development (e.g. on connected and/or automated vehicles).
- Consider establishing an in-house testing laboratory (similar to materials testing for asphalt) to explore application and deployment questions related to connected vehicle technologies and data (e.g. lifecycle performance, interoperability) or other technologies like UAS.
- Consider various forms of new mobility, including advanced air mobility strategies, alongside traditional strategies to address issues of urban mobility and congestion relief.
- Ensure consideration of community outreach when implementing new mobility strategies and technologies (e.g. on the uses and image and data capture capabilities of UAS flying over private property).
- Incorporate multimodal considerations into transportation planning and travel demand forecasting (e.g. aviation/advanced air mobility, Mobility on Demand services, connected and automated vehicles).

- Conduct a study of the technology applications currently in use on the transportation system and the equity implications of each.
- Conduct a study of how technology applications can be used to overcome equity barriers to access.
- Conduct research on future technology innovation for transportation applications to establish likely future technology possibilities and their equity implications to users of the transportation system.
- Assign a staff member the responsibility of monitoring technology developments and applications with possible application to the transportation system.

Critical Issue: Defining roles and responsibilities of transportation agencies (federal, state, and local)

- Consider parallels and lessons learned from the public sector's regulatory role in network management of other sectors like aviation (e.g. when weighing models for oversight of automated vehicle operations).
- Focus on helping the public understand the technology's capabilities and facilitating opportunities for the public to interface with the technology (e.g. automated vehicles).
- Identify the agency's appropriate role and partners in supporting EV adoption (e.g. coordination with USDOT, charging infrastructure planning and deployment or partnerships, traveler information on charging infrastructure location and availability [digital and signage]).
- Build on or model regulatory approaches after those for Mobility on Demand services.
- Develop an agency policy on the use of private-sourced data, in particular the proprietary nature of said data.

Critical Issue: Determining strategies to foster adoption of transformational technologies

- Examine the post-Covid-19 transit ridership demand of non-traditional commuter neighborhoods for targeted automated mobility, on-demand, or micromobility service needs and opportunities.
- Focus on the end customer (people), not agencies or municipalities, when considering the adoption of transformational technology and the enabling regulatory environment.
- Pursue regulatory approaches to new technologies in cooperation with relevant private service providers, vendors, or manufacturers (e.g. for automated vehicles).
- Capitalize on the current and near-term needs and implications of potentially monetizing new technology assets, using appropriate data to ensure that, from a public perspective, monetization is a substitution or replacement, and does not result in new fees or taxes.

- Focus on tailored messaging to promote technology adoption that considers local issues of concern, incentives and benefits (e.g. local environmental benefits), and that addresses equity concerns (e.g. for EV adoption).
- Identify appropriate incentives or subsidies to create greater access to technology-based mobility services for the economically disenfranchised (e.g. for EVs or EV-based mobility services).
- Collaborate with local municipalities/agencies on land use and zoning issues that impact the adoption of technology or provision of technology-based or technology-supportive services (e.g. addressing the installation of EV charging infrastructure in multiunit residential buildings).
- Leverage airports and other multimodal anchors to integrate smart technologies.

Critical Issue: Building institutional capacity and supportive infrastructure that prepare for transformational technology implementation

- Consider establishing an in-house testing laboratory (similar to materials testing for asphalt) to explore application and deployment questions related to connected vehicle technologies and data (e.g. lifecycle performance, interoperability) or other technologies like UAS.
- Participate in feasibility studies of traffic management systems for new mobility technologies (e.g. unmanned aircraft systems).
- Establish a common, thorough, and reliable framework of rules and guidelines to properly integrate transformational technologies into a multimodal system and avoid eventual rebound and undesirable effects.
- Identify professional development/training opportunities for current staff to enhance strategic analysis abilities.
- Conduct research on strategic issues facing the agency; assign agency staff to the project.

Critical Issue: Establishing partnership models for technology-enabled private mobility service providers

- Explore mobility on demand or micromobility options in neighborhoods where traditional transit alternatives do not make sense.
- Examine the post-Covid-19 transit ridership demand of non-traditional commuter neighborhoods for targeted automated mobility, on-demand, or micromobility service needs and opportunities.
- Examine the full extent of public agency collected real-time data to determine what markets exist for its use in technology-based applications and the basis for partnerships.

- Consider the parallels in use cases and private partner interests across first-mile/last-mile and micromobility solutions when analyzing microtransit and advanced air mobility service options.
- Identify the most promising highway corridors around which to partner with private entities on methods to monetize use of the DOT's right-of-way (e.g. for the provision of EV charging infrastructure).
- Participate in public-private collaborative opportunities for standards development (e.g. on connected and/or automated vehicles).

Interest Area: System Performance and Condition

Critical Issue: Leveraging technology, pricing, and other operational strategies in response to growing demand, capacity needs, and costs

- Monitor technology, pricing, and other operational strategies as they are implemented in other jurisdictions to assess their appropriateness for the transportation system.
- Encourage/require an assessment of technology, pricing, and other operational strategies as part of major project evaluations to determine level of impact on demand.
- Conduct research on innovative applications of technology, pricing, and other operational strategies to assess implementation feasibility in the transportation system.
- Join other states in supporting cooperative research on technology, pricing, and other operational strategies as they can be leveraged as part of overall project performance.
- Expose agency staff to technical conferences and workshops on innovative applications of technology, pricing, and other operational strategies to leverage overall project performance.
- Conduct peer exchanges with other agencies that have used technology, pricing, and/or other operational strategies to leverage transferable outcomes.

Critical Issue: Improving the life-cycle performance of infrastructure elements

- Monitor developments in new materials strength and durability for use in the agency's construction program.
- Conduct research on life-cycle performance of the transportation system to identify areas of concerns, and research needs.
- Conduct peer exchanges with other agencies facing similar issues with life-cycle performance in their transportation system.
- As part of a statewide system vulnerability assessment to system disruptions, identify the major causes for asset failure and strategies for reducing such events from occurring.

- Assess the agency's asset management program to ensure that resilience-related considerations are part of investment recommendations.

Critical Issue: Making tradeoffs to manage performance effectively and equitably in a constrained funding environment

- Conduct an historical analysis of the agency's investments over the past 20 years from the perspective of their contribution to enhanced system performance and equitable distribution of benefits and costs.
- Retain a third-party assessment of the criteria used for trade-off analysis to determine their appropriateness and effectiveness with respect to system performance and equity.
- Conduct a peer exchange with other states on how tradeoffs are made among investment criteria with particular attention given to system performance and equity.
- Keep track of new and innovative methods and approaches for conducting tradeoff analysis to determine their appropriateness for use in the agency.
- Provide professional development/training opportunities for the agency's staff involved in tradeoff analyses that will expose them to tradeoff analysis techniques.

Critical Issue: Investment planning for resilience

- Conduct a system vulnerability assessment of the networks the agency is responsible for to determine the level of risk to system disruption.
- Identify strategies for the agency to incorporate resilience and adaptation considerations into agency decision-making.
- Conduct a peer exchange with other states/jurisdictions facing similar types of disruptions/threats to identify examples of good practice.
- Provide training/professional development opportunities on resilience to staff who are in critical project development and investment decision-making roles.
- Examine the research on transportation system resilience and identify strategies and tools that would be most useful to staff.
- Work with federal, other state, and professional associations to identify eligible projects for different resilience-oriented funding categories.
- Make the case for resilience-related funding with the legislature and other funding agencies.
- Assess the agency's asset management program to ensure that resilience-related considerations are part of investment recommendations.

Critical Issue: Improving resilience of transportation systems

- Conduct an institutional self-assessment to identify steps to enhance the resilience-oriented activities in all of the agency's functional units.
- Review design standards and criteria with respect to their appropriateness for future environmental conditions with greater stresses being placed on transportation infrastructure.
- Conduct a peer exchange with other states facing similar threats and stresses to identify strategies for improving system resilience.
- Consider national guidance from a range of agencies that provide materials on adaptive design practices.
- Periodically assess current agency practices in emergency management to identify gaps and deficiencies, and where new technologies could help enhance response.
- Work with other agencies and jurisdictions to develop a statewide strategy for enhancing transportation system resilience.

Critical Issue: Lack of adequate national-level data and modeling tools for performance management

- Re-examine the agency's performance management system to determine if the desired information is absolutely necessary to inform decision-making.
- Study whether surrogate data or indicators will provide similar type of the information that is desired.
- Work with other states in developing data requirements and models/analysis tools in support of performance management programs.
- Advocate for national and state research in the area of data and model/tools development.

Interest Area: System Use

Critical Issue: Providing connectivity and integration within and across megaregions

- Pursue reforms to funding allocation formulas and programs as policy levers, especially to deemphasize the disproportionate focus on the automobile/highway mode.
- Adjust planning processes to favor less resource-intensive modes compared to affordable and nonmotorized transportation (not just for state DOTs, but also for local agencies, including parking options).
- Develop and apply tools that can quantify and communicate to consumers and local and state governments the full costs of automobile-based transportation and potential saving from using alternative modes and land use.

- Establish a common, thorough, and reliable framework of rules and guidelines to properly integrate transformational technologies into a multimodal system and avoid eventual rebound and undesirable effects.
- Leverage airports and other multimodal anchors to integrate smart technologies.
- Create a collaborative governance model to address urban freight movement.
- Collaborate with airports, housing, and land-use planners to enhance the service outcomes of a multimodal transportation system.
- Communicate effectively with the public to foster no regret, low regret, and incremental solutions to multijurisdictional, multimodal system development.
- Link relevant societal policies and goals to an effective multimodal transportation system.
- Integrate incident response with traffic management functions to maximize use of system elements and alternative modes.
- Provide multiagency access to integrated, interoperable traffic management center data and communication systems.
- Collaborate on megaregional scenario planning through an appropriate existing multiagency forum or a specially established working group.
- Put in place multistate agreements to streamline and harmonize potential variations in passenger and freight movement regulation.
- Train relevant DOT personnel/managers in the importance of linking transportation to land use and any relevant state or local laws and regulations. Provide input on the transportation implications of proposed changes to such land use laws and regulations.
- Continually communicate the need to support better preparedness for emergency event response and resilience that extends across state borders.

Critical Issue: Accommodating growing and shifting spatial distribution of the population

- Incorporate multimodal considerations into transportation planning and travel demand forecasting (e.g. aviation/advanced air mobility, Mobility on Demand services, connected and automated vehicles).
- Examine the post-Covid-19 transit ridership demand of non-traditional commuter neighborhoods for targeted automated mobility, on-demand, or micromobility service needs and opportunities.
- Explore mobility on demand or micromobility options in neighborhoods where traditional transit alternatives do not make sense.

- Work with employers to understand and communicate the benefits (economic, environmental, productivity, etc.) of providing a telecommuting option to accommodate those who live further from employment.
- Monitor technology, pricing, and other operational strategies as they are implemented in other jurisdictions to assess their appropriateness for the transportation system.
- Conduct research on innovative applications of technology, pricing, and other operational strategies to assess implementation feasibility in the transportation system.
- Conduct research on current and projected socio-demographic characteristics of system users and examine possible future needs with respect to transportation services.

Critical Issue: Meeting the accessibility needs of rural regions

- Reframe goals and educate the public in favor of safe, healthy, resource-efficient, and affordable transportation choices.
- Dedicate staff resources to performing accessibility analyses, particularly for rural regions.
- Incorporate nonmotorized transportation options into rural transportation planning, development strategies, and accessibility provision.
- Apply least-cost transportation planning principles to reduce a focus on accommodating the automobile and to consider multimodal solutions, including nonmotorized/active transportation options.
- Elevate awareness and understanding of rural needs by partnering with them during the planning process and increasing planning support resources.
- Invest in software tools that facilitate and capture conversations at the community level and apply data analytics that provide input into the planning process and might otherwise go uncaptured through traditional public engagement; ensure the process reaches those who lack access to technology.
- Ensure that representatives of different users of the transportation system are part of advisory groups and planning task forces.
- Conduct a study of how technology applications can be used to overcome equity barriers to access.

Critical Issue: Understanding land use policies' influence on transportation demand

- Incorporate multimodal considerations into transportation planning and travel demand forecasting (e.g. aviation/advanced air mobility, Mobility on Demand services, connected and automated vehicles).
- Incorporate travel demand management strategies into transportation planning and travel demand modeling.

- Collaborate with local municipalities/agencies on land use and zoning issues that impact the adoption of technology or provision of technology-based or technology-supportive services (e.g. addressing the installation of EV charging infrastructure in multiunit residential buildings).
- Train relevant DOT personnel/managers in the importance of linking transportation to land use and any relevant state or local laws and regulations. Provide input on the transportation implications of proposed changes to such land use laws and regulations.

Critical Issue: Fairly serving the varying transportation preferences and needs among sociodemographic cohorts

- Pursue reforms to funding allocation formulas and programs as policy levers, especially to deemphasize the disproportionate focus on the automobile/highway mode.
- Adjust planning processes to favor less resource-intensive modes compared to affordable and nonmotorized transportation (not just for state DOTs, but also for local agencies, including parking options).
- Consider various forms of new mobility, including advanced air mobility strategies, alongside traditional strategies to address issues of urban mobility and congestion relief.
- Focus on tailored messaging to promote technology adoption that considers local issues of concern, incentives and benefits (e.g. local environmental benefits), and that addresses equity concerns (e.g. for EV adoption).
- Identify appropriate incentives or subsidies to create greater access to technology-based mobility services for the economically disenfranchised (e.g. for EVs or EV-based mobility services).
- Apply least-cost transportation planning principles to reduce a focus on accommodating the automobile and to consider multimodal solutions, including nonmotorized/active transportation options.
- Conduct research on current and projected socio-demographic characteristics of system users and examine possible future needs with respect to transportation services.
- Ensure that representatives of different users of the transportation system are part of advisory groups and planning task forces.
- Assign a staff member the responsibility of being an advocate for more equitable transportation system investments.
- Conduct a study to understand the breadth and depth of disproportionate and negative consequences of transportation policies and projects on socio-economically disenfranchised neighborhoods.

- Include current issues of disproportionate and negative consequences and impacts as formal evaluation criteria in the project evaluation process. If already included, assess how effective they have been in influencing project decisions.
- Establish an advisory group to advise on disproportionate and negative consequences of transportation policies and projects on socio-economically disenfranchised neighborhoods.
- Assess the models, analysis tools, and data used as part of project evaluation as to their effectiveness in considering current issues of disproportionate and negative consequences and recommend improvements.
- Create an equity advocacy position within the executive office whose role is to identify the equity implications of new funding, policy, and program initiatives.

Critical Issue: Managing the growing demand (volume and speed) for freight movement and delivery

- Consider various forms of new mobility, including advanced air mobility strategies, alongside traditional strategies to address issues of urban mobility and congestion relief.
- Analyze and implement policies that incentivize or require off-peak freight or package deliveries in congested (typically urban) environments.
- Partner and coordinate with municipalities on the management of curb space, for example on the implementation of complementary TSMO tactics or programs for off-peak freight delivery.
- Consider and analyze the environmental justice implications of freight truck routing when shaping policies on technology adoption (e.g. electrification or clean fuels), infrastructure usage (e.g. pricing or technology-based geofencing), and land use (e.g. warehouse and distribution center siting).
- Explore partnerships with freight railroads and ports on strategies to decarbonize the freight sector.
- Apply advanced TSMO tactics to existing infrastructure to manage freight transportation demand.
- Consider policies and programs that encourage or incentivize fleet turnover and retirement of trucks powered by fossil fuels that are nearing or have reached the end of their useful life.
- Invest in real-time truck parking information systems.
- Make road weather information available to the trucking industry.
- Create a collaborative governance model to address urban freight movement.
- Leverage airports and other multimodal anchors to integrate smart technologies.

- Collaborate on megaregional scenario planning through an appropriate existing multiagency forum or a specially established working group.
- Put in place multistate agreements to streamline and harmonize potential variations in passenger and freight movement regulation.
- Invest in understanding the logistics and business influences that affect decision making among shippers, companies, ports, warehouses, etc. to improve freight planning outcomes aligned with system objectives like GHG reduction.

Interest Area: System Impacts and Externalities

Critical Issue: Lack of regulatory standards that address the safety, privacy, and security implications of transformational technologies

- Focus on the end customer (people), not agencies or municipalities, when considering the adoption of transformational technology and the enabling regulatory environment.
- Pursue regulatory approaches to new technologies in cooperation with relevant private service providers, vendors, or manufacturers (e.g. for automated vehicles).
- Participate in public-private collaborative opportunities for standards development (e.g. on connected and/or automated vehicles).
- Ensure consideration of community outreach when implementing new mobility strategies and technologies (e.g. on the uses and image and data capture capabilities of UAS flying over private property).
- Consider parallels and lessons learned from the public sector's regulatory role in network management of other sectors like aviation (e.g. when weighing models for oversight of automated vehicle operations).
- Develop an agency policy on the use of private-sourced data, in particular the proprietary nature of said data.
- Conduct peer analysis with other agencies that have successfully entered into data sharing agreements with private companies/firms.

Critical Issue: Understanding and incorporating public health outcomes in transportation decision-making

- Apply least-cost transportation planning principles to reduce a focus on accommodating the automobile and to consider multimodal solutions, including nonmotorized/active transportation options.
- Reframe goals and educate the public in favor of safe, healthy, resource-efficient, and affordable transportation choices.
- Incorporate partners from the public health community in the transportation planning process.

- Invest in software tools that facilitate and capture conversations at the community level and apply data analytics that provide input into the planning process and might otherwise go uncaptured through traditional public engagement; ensure the process reaches those who lack access to technology.
- Train relevant DOT personnel/managers in the importance of linking transportation to land use and any relevant state or local laws and regulations. Provide input on the transportation implications of proposed changes to such land use laws and regulations.
- Develop health-related system performance measures.
- Examine current planning standard operating procedures and guidelines to see if public health is listed explicitly as an evaluation concern.
- Examine such processes as health impact assessments (HIAs) to determine the extent to which some of these methods can be included in transportation planning.
- Identify possible public health benefits of the evaluation criteria already used in project assessment.
- Work closely with the state public health agency to provide multi-disciplinary perspectives on project outcomes.

Critical Issue: Growing significance of incorporating long-term sustainability needs in transportation decision-making

- Analyze and implement policies that incentivize or require off-peak freight or package deliveries in congested (typically urban) environments.
- Adjust planning processes to favor less resource-intensive modes compared to affordable and nonmotorized transportation (not just for state DOTs, but also for local agencies, including parking options).
- Apply least-cost transportation planning principles to reduce a focus on accommodating the automobile and to consider multimodal solutions, including nonmotorized/active transportation options.
- Explore partnerships with freight railroads and ports on strategies to decarbonize the freight sector.
- Conduct research on life-cycle performance of the transportation system to identify areas of concerns, and research needs.
- Reach out to sustainability groups to seek input on their concerns and desires relating to transportation investment.
- Conduct pilot studies of planning efforts that focus on sustainability outcomes.

Critical Issue: Role of transportation agencies in fostering the adoption of renewable energy-based and low-emission technologies for vehicles and other systems

- Identify the agency's appropriate role and partners in supporting EV adoption (e.g. coordination with USDOT, charging infrastructure planning and deployment or partnerships, traveler information on charging infrastructure location and availability [digital and signage]).
- Identify appropriate incentives or subsidies to create greater access to technology-based mobility services for the economically disenfranchised (e.g. for EVs or EV-based mobility services).
- Collaborate with local municipalities/agencies on land use and zoning issues that impact the adoption of technology or provision of technology-based or technology-supportive services (e.g. addressing the installation of EV charging infrastructure in multiunit residential buildings).
- Ensure the state DOT participates (if not leads) in the study and review of policy and program development for EV or other low/zero emission technology deployment and support.
- Focus on tailored messaging to promote technology adoption that considers local issues of concern, incentives and benefits (e.g. local environmental benefits), and that addresses equity concerns (e.g. for EV adoption).
- Consider adjustments to customer-focused services like rest area functions/amenities and safety service patrol to better support electric/alternative fuel vehicles (e.g. mobile fast charging).

Critical Issue: Increasing role of transportation agencies in reducing the contribution of freight transportation to GHG emissions

- Explore partnerships with freight railroads and ports on strategies to decarbonize the freight sector.
- Analyze and implement policies that incentivize or require off-peak freight or package deliveries in congested (typically urban) environments.
- Partner and coordinate with municipalities on the management of curb space, for example on the implementation of complementary TSMO tactics or programs for off-peak freight delivery.
- Apply advanced TSMO tactics to existing infrastructure to manage freight transportation demand.
- Consider policies and programs that encourage or incentivize fleet turnover and retirement of trucks powered by fossil fuels that are nearing or have reached the end of their useful life.

- Ensure that analyses of the potential for freight sector GHG reduction consider policies that encourage logistics efficiencies and not just trucks themselves (i.e. goods movement or delivery routing, frequency, and timing versus trucks' energy sources).
- Invest in expanding freight staff expertise or access to resources that help identify, analyze, and suggest actions to address freight-related challenges.
- Invest in understanding estimates of freight activity to correlate with emissions, inform impact modeling, and help formulate responsive policies.
- Invest in understanding the logistics and business influences that affect decision making among shippers, companies, ports, warehouses, etc. to improve freight planning outcomes aligned with system objectives like GHG reduction.

Critical Issue: Increasing role of transportation agencies in reducing the contribution of passenger transportation to GHG emissions

- Identify the agency's appropriate role and partners in supporting EV adoption (e.g. coordination with USDOT, charging infrastructure planning and deployment or partnerships, traveler information on charging infrastructure location and availability [digital and signage]).
- Apply least-cost transportation planning principles to reduce a focus on accommodating the automobile and to consider multimodal solutions, including nonmotorized/active transportation options.
- Conduct an assessment/benchmark on the agency's current effort to reduce GHG emissions from passenger transportation.
- Conduct a peer exchange with other state DOTs to identify best practices in linking transportation and GHG emission reduction.
- Hold periodic meetings with automobile industry leaders to hear the latest projections on GHG reducing engine technology.

Interest Area: Organizational Capacity and Governance

Critical Issue: Challenges in attracting, training, and retaining DOT workforce

- Conduct an assessment of current recruitment, professional development, and retention program to determine obstacles to attracting qualified employees.
- Reach out to universities, colleges, and community colleges to identify strategies for attracting women and minorities to the agency's workforce.
- Use the need to address emerging and strategic issues, and apply innovation and creative thinking to attract mid-level professionals seeking to change careers.
- Include younger employees in developing strategies that would attract new talent to your agency.

- Develop mentor program that pairs newer employees with long-time employees to enhance retention.
- Identify the "leaders of tomorrow" and provide professional development opportunities to stimulate their interest in staying with the organization.

Critical Issue: Workforce inequities in recruitment and career progression

- Conduct peer analysis with other agencies that have been successful in attracting and retaining women and minority populations.
- Reach out to universities, colleges, and community colleges to identify strategies for attracting women and minority populations to the agency's workforce.
- As part of an agency assessment, identify obstacles to attracting, professional development, and retention of women and minority populations.
- Work with leaders in minority communities to emphasize job opportunities at the agency.
- Work with professional and community groups that focus on minority employment to implement a recruitment strategy.
- Develop a mentor program focused on minority employees to encourage retention in the agency and to develop a staff that reflects the community.

Critical Issue: Inadequate organizational capacity to address strategic issues

- Identify professional development/training opportunities for current staff to enhance strategic analysis abilities.
- Develop a program with a university to provide graduate student employment in the agency's planning and policy offices.
- Develop a senior executive mentoring program with junior staff, with emphasis on strategic thinking.
- Create a speaker's luncheon series with policy, strategic, visionary speakers.
- Conduct research on strategic issues facing the agency; assign agency staff to the project.
- Provide opportunities for staff to attend national conferences that focus on policy and strategic issues.

Critical Issue: Gaps in cross-border cooperation among states in planning and policy making

- Create CEO-to-CEO meetings to identify strategies to enhance cross-border cooperation.
- Provide opportunities for staff to attend national or regional conferences that focuses on cross border issues.
- Hold regional meetings/workshops with border states to address cross border planning.

- Seek multi-state/corridor studies for mutual engagement on issues of concern.
- Develop short-term staff exchange with bordering state DOTs to encourage more understanding of the issues the state is facing.

Critical Issue: Institutional limitations with current transportation planning at the megaregion, metropolitan, and rural levels

- Conduct collaborative study with other megaregion agencies to identify barriers to cooperation and strategies to overcome them.
- Conduct peer analysis with other agencies that have been successful in collaborative megaregion planning.
- Conduct research on data requirements, models/analysis tools, implementation requirements that are needed to foster collaborative planning.
- Hold periodic conferences/workshops with other megaregion agencies to present studies and to further identify barriers to effective planning.

Critical Issue: Challenges with data management and sharing between public agencies and the private sector

- Seek meetings with private companies/firms at a high executive level to discuss needs and constraints.
- Develop an agency policy on the use of private-sourced data, in particular the proprietary nature of said data.
- Conduct peer analysis with other agencies that have successfully entered into data sharing agreements with private companies/firms.

Interest Area: Equity

Critical Issue: Equity implications of alternative revenue sources (e.g., user fees, tolling, etc.) on economically disenfranchised groups

- Conduct a study or synthesis of current literature/research on the equity implications of alternative revenues sources used in the agency's investment program.
- Conduct a peer exchange with other jurisdictions having similar concerns and that have identified strategies to overcome equity concerns.
- Establish a review process (perhaps with other state agencies) that considers equity implications of any new revenue sources.
- Create an equity advocacy position within the executive office whose role is to identify the equity implications of new funding, policy, and program initiatives.

Critical Issue: Leveraging technology equitably to overcome transportation barriers

- Conduct a study of the technology applications currently in use on the transportation system and the equity implications of each.
- Conduct a study of how technology applications can be used to overcome equity barriers to access.
- Conduct research on future technology innovation for transportation applications to establish likely future technology possibilities and their equity implications to users of the transportation system.
- Assign a staff member the responsibility of monitoring technology developments and applications with possible application to the transportation system.
- Ensure consideration of end users (not agencies or municipalities) when considering new strategies.

Critical Issue: Addressing inequities among user groups in understanding and meeting their transportation service needs

- Conduct a study of different communities in the state/jurisdiction to better understand their needs and desires with respect to transportation services.
- Ensure that representatives of different users of the transportation system are part of advisory groups and planning task forces.
- Conduct research on current and projected socio-demographic characteristics of system users and examine possible future needs with respect to transportation services.
- Assign a staff member the responsibility of being an advocate for more equitable transportation system investments.
- Ensure consideration of community outreach when implementing new strategies and technologies.

Critical Issue: Disproportionate and negative consequences of transportation policies and projects on socio-economically disenfranchised neighborhoods

- Conduct a study to understand the breadth and depth of disproportionate and negative consequences of transportation policies and projects on socio-economically disenfranchised neighborhoods.
- Include current issues of disproportionate and negative consequences and impacts as formal evaluation criteria in the project evaluation process. If already included, assess how effective they have been in influencing project decisions.
- Establish an advisory group to advise on disproportionate and negative consequences of transportation policies and projects on socio-economically disenfranchised neighborhoods.

- Conduct a peer exchange with other states experiencing similar concerns about the need to address disproportionate and negative consequences to identify best practices.
- Assess the models, analysis tools, and data used as part of project evaluation as to their effectiveness in considering current issues of disproportionate and negative consequences and recommend improvements.

Table 7: General Capability Improvement Strategies by Assessment Factor.

Note that [] represents context pertinent to the critical issue and threats and opportunities, to be provided by facilitator(s)/tool users.

Assessment Factor	Target	Capability Improvement Strategies
1. Awareness, understanding and relevant activities underway or accomplished	<ul style="list-style-type: none"> • High level of awareness exhibited • State of the practice tracked • Demonstrable progress made • Alignment of goals recognized and incorporated into relevant strategic direction/plan/initiative • Challenges and risks understood 	<ul style="list-style-type: none"> • Track state of the practice in [] via electronic and print media, conference attendance, committee participation, and peer dialogue • Participate in [] • Conduct research or targeted study on underlying factors influencing [] • Engage SMEs in increasing awareness of [] among agency staff • Identify how [] aligns with agency goals or adjust agency goals to align with [] • Conduct peer review of other agencies on relationship between agency goals and [] • Identify the scope and scale of the critical issue and associated threat and opportunities • Complete this assessment or similar • Articulate findings in a risk management framework
2. Legal, regulatory, and policy environment	<ul style="list-style-type: none"> • External legal and regulatory issues formally acknowledged and framed • Accommodation for law/regulation made or pathway to resolution defined to the extent feasible • Liability and intellectual property issues formally acknowledged and framed; risks understood and mitigated • Supportive or enabling policies in place or developmental pathway clear 	<ul style="list-style-type: none"> • Identify legal and regulatory issues and address as appropriate • Maintain state of the practice awareness and understanding of relevant business case, costs and benefits, etc. • Understand implications through scenario planning, including conducting a risk assessment of implications of changing policy/regulatory environment on agency operations • Articulate the appropriate entity to develop/enact the law/regulation (e.g., federal, state) and understand and devise strategy for influencing/formulating/adjusting the law/regulation through appropriate activities (advocacy, national/state/regional organization participation, business case or supporting analysis development, etc.) • Pursue advocacy of favorable legal resolution or regulation

Assessment Factor	Target	Capability Improvement Strategies
	<ul style="list-style-type: none"> • Relevant standards established or under development 	<ul style="list-style-type: none"> • Identify sources of liability and/or intellectual property and address as appropriate • Conduct peer review of other agencies on agency liability concerns • Identify agency policy issues related to [] and address as appropriate • Identify agency policies that hinder or conflict with addressing [] and document options to overcome them • Identify potential agency policies that would support addressing [], making connections to achieving agency mission/goals
<p>3. External collaboration (interagency, academic, and private sector)</p>	<ul style="list-style-type: none"> • Extensive peer (public agencies, academic institutions) interaction leading to collaborative, coordinated, and shared-risk approach • Agreement exists on collective priorities and actions • Resource-sharing mechanisms where appropriate • Formal coordination mechanisms in place for accessing state of the practice knowledge/experience • Private sector engagement as appropriate (outsourcing, partnerships for risk sharing / mutual developmental benefit) 	<ul style="list-style-type: none"> • Identify issues and functions around which peer collaboration is necessary or beneficial and pursue/enhance mechanisms (forums, agreements, planning processes, etc.) that advance mutual goals, actions, or risk-sharing • Collaborate and share knowledge with peers • Establish institutional mechanism/strategy for fostering collaboration among peers (e.g., memorandum of understanding, task force, advisory committee, and the like) • Review existing agency policies, legal constraints, and contractual mechanisms for private sector outsourcing and partnering with respect to [] • Identify the barriers to effective partnerships (e.g., legal, financial, contractual, competitive), where and how they have been overcome by peers, and appropriate mechanism for [] • Establish institutional mechanism/strategy for fostering collaboration with private sector entities (e.g., forum, task force, advisory committee, and the like)

Assessment Factor	Target	Capability Improvement Strategies
<p>4. Supportive systems and funding (processes, tools/models, internal functions, budgets)</p>	<ul style="list-style-type: none"> • Active planning and/or applied research focused on emerging issues takes place • Agency-wide knowledge management system in place • Relevant models/tools used for decision making applied • Opportunity for budgetary consideration provided • Administrative and technical support readily available 	<ul style="list-style-type: none"> • Identify appropriate planning and/or applied research approach to [] (e.g., in-house, collaborative/pooled-fund, contracted) and whether a special project/initiative is warranted) • Identify appropriate partners and roles (peer agencies/pooled fund program participants, consultants, universities, etc.) • Identify relevant sources of information/data, and parameters and protocols for applicable knowledge management system • Assess and if necessary, develop strategy for disseminating knowledge to agency staff • Gain familiarity with, develop, or track development of [] • Assess gaps in current agency analysis capabilities and develop strategy to augment current capabilities with improved analysis tools • Determine the adequacy that funding mechanisms can support investment in the critical issue and response determined by this assessment; consider special, one-time funding vs. formal, sustainable budget • Develop strategy to ensure cooperation from support functions (IT, HR, procurement, etc.)
<p>5. Staff (champions, quantity, knowledge, skills and abilities [KSAs])</p>	<ul style="list-style-type: none"> • Clear champion(s) with technical expertise and ability to lead • Sufficient staff capacity and KSAs (including an understanding of what they are) • Access to required education and training 	<ul style="list-style-type: none"> • Identify and empower champions and/or team/key roles tailored to addressing the critical issue and associated threats and opportunities where necessary or not otherwise clear within existing organizational functions • Identify and develop appropriate KSAs among existing or new staff or outsource where required • Identify and participate in relevant industry professional capacity building activities (webinars, workshops, peer exchanges)

Assessment Factor	Target	Capability Improvement Strategies
		<ul style="list-style-type: none"> • Identify opportunities to connect key agency activities with appropriate university/industry/research entity units • Identify sources of third-party training (Federal Highway Administration, associations, universities)
<p>6. Culture and organization (leadership support, organizational barriers)</p>	<ul style="list-style-type: none"> • Strong leadership support • Widespread collaboration and teamwork • Receptivity to new ideas • Dedication to continuous improvement • Few to no organizational barriers to addressing associated threats and opportunities 	<ul style="list-style-type: none"> • Build awareness and focus leadership attention using state of the practice/peer practice/business case material on [] • Collaborate and communicate internally on the significance of [] on [] • Develop reward/recognition for staff that embrace innovative ideas • Identify and eliminate organizational barriers that hinder or prevent addressing associated threats and opportunities • Cite the benefits and practices of peer agencies • Make clear the need for top management's role in advancing any initiatives to eliminate barriers and the rationale for doing so, recognizing that some barriers may be a product of longstanding institutional issues