The Role of Planning in a 21st Century State Department of þÿTransportation Supporting Strategic Decisionmaking

DETAILS

109 pages | 8.5 x 11 | PAPERBACK

ISBN 978-0-309-30836-6 | DOI 10.17226/22193

AUTHORS

þÿD Ignazio, Janet; Rhodes, Suzann; and Craig Secrest

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP REPORT 798

The Role of Planning in a 21st Century State Department of Transportation—Supporting Strategic Decisionmaking

Janet D'Ignazio
ICF INTERNATIONAL
Durham, NC

Suzann Rhodes
CDM SMITH
Columbus, OH

Craig Secrest
HIGH STREET CONSULTING GROUP, LLC
Denver, CO

Subscriber Categories
Administration and Management • Planning and Forecasting

Research sponsored by the American Association of State Highway and Transportation Officials
in cooperation with the Federal Highway Administration

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2015
www.TRB.org

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Academies was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

NCHRP REPORT 798

Project 08-36/Task 113
ISSN 0077-5614
ISBN 978-0-309-30836-6
Library of Congress Control Number 2015930911

COPYRIGHT INFORMATION

NOTICE

The project that is the subject of this report was a part of the National Cooperative Highway Research Program, conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council.

The members of the technical panel selected to monitor this project and to review this report were chosen for their special competencies and with regard for appropriate balance. The report was reviewed by the technical panel and accepted for publication according to procedures established and overseen by the Transportation Research Board and approved by the Governing Board of the National Research Council.

The opinions and conclusions expressed or implied in this report are those of the researchers who performed the research and are not necessarily those of the Transportation Research Board, the National Research Council, or the program sponsors.

The Transportation Research Board of the National Academies, the National Research Council, and the sponsors of the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of the report.

Published reports of the

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, DC 20001

and can be ordered through the Internet at:

http://www.national-academies.org/trb/bookstore

Printed in the United States of America

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. C. D. Mote, Jr., is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Victor J. Dzau is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. C. D. Mote, Jr., are chair and vice chair, respectively, of the National Research Council.

The **Transportation Research Board** is one of six major divisions of the National Research Council. The mission of the Transportation Research Board is to provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal. The Board's varied activities annually engage about 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. **www.TRB.org**

www.national-academies.org

COOPERATIVE RESEARCH PROGRAMS

CRP STAFF FOR NCHRP REPORT 798

Christopher W. Jenks, *Director, Cooperative Research Programs*
Christopher Hedges, *Manager, National Cooperative Highway Research Program*
Lori L. Sundstrom, *Senior Program Officer*
Megan A. Chamberlain, *Senior Program Assistant*
Eileen P. Delaney, *Director of Publications*
Ellen M. Chafee, *Editor*

NCHRP PROJECT 08-36/TASK 113 PANEL
Field of Transportation Planning—Area of Forecasting

Brian J. Smith, *Shelton, WA* (Chair)
Jennifer Dill, *Portland State University, Portland, OR*
Mell Henderson, *Bradenton, FL*
Patricia G. Hendren, *Washington Metropolitan Area Transit Authority, Washington, DC*
Timothy A. Henkel, *Minnesota DOT, St. Paul, MN*
W. David Lee, *Florida DOT, Tallahassee, FL*
Greg Slater, *Maryland State Highway Administration, Baltimore, MD*
Kevin M. Walsh, *Massachusetts DOT, Boston, MA*
Harlan Miller, *FHWA Liaison*
Matthew Hardy, *AASHTO Liaison*
Kimberly Fisher, *TRB Liaison*
Neil J. Pedersen, *TRB Liaison*

AUTHOR ACKNOWLEDGMENTS

Contributors to the research conducted under NCHRP Project 08-36/Task 113 include Ryan Reeves and Alanna McKeeman of ICF International.

FOREWORD

By Lori L. Sundstrom
Staff Officer
Transportation Research Board

NCHRP Report 798 examines how the planning function in state departments of transportation (DOTs) can more effectively support strategic decisionmaking in the increasingly complex environments that state DOTs operate within. A self-assessment tool provides a thoughtful and methodical approach to identifying opportunities for increasing the value of planning as well as the skill sets and expertise that planning professionals need to realize that potential. The report should be of immediate use to DOT executives, senior planning managers, and educators.

Transportation agencies are responding to a wide variety of global and domestic events and trends—economic, environmental, political, safety, social, and technological—that impose new challenges and present new opportunities. The rate at which various issues and events are complicating the preservation, operation, and improvement of transportation system elements is accelerating. State DOTs increasingly find themselves competing with other societal priorities for limited financial resources. In response to shrinking operating budgets, many DOTs are downsizing as well as developing and implementing new service delivery systems that involve the private sector in unfamiliar ways. Transportation planning has historically played an influential role in transportation decisions, but planning's role, and the practices and tools used by transportation planning professionals, must continue to evolve to provide maximum value to transportation agencies that are making decisions on infrastructure and service investments under demanding economic, social, and environmental conditions.

Transportation planning—performed by professionals with the necessary knowledge and expertise—can play a key role in helping agencies making transformative changes by supporting and enabling them to successfully address the complex issues facing state DOTs.

Under NCHRP Project 08-36 (113), ICF International, Inc., was asked to explore and provide guidance on how the planning function in a state DOT can best contribute to and support future strategic decisionmaking to positively affect transportation services, operations, and project delivery. The report addresses the continuing and emerging challenges facing transportation including (1) policy drivers such as constrained resources, energy supply and cost volatility, demographic trends, technology, state of the economy, sustainability, and climate change; (2) state DOT internal organizational, structural, and cultural challenges; (3) state and federal statutory and regulatory frameworks; and (4) ways in which transportation agency roles and governance responsibilities are evolving, shifting, or changing. The research also provides general guidance on identifying the core planning-related competencies, knowledge, skills, and abilities will that be needed by transportation professionals in the future. The research results should be of immediate use to state DOT executives, transportation planning managers, educators, and professional certifying organizations.

CONTENTS

Note: Photographs, figures, and tables in this report may have been converted from color to grayscale for printing. The electronic version of the report (posted on the web at www.trb.org) retains the color versions.

SUMMARY

The Role of Planning in a 21st Century State Department of Transportation—Supporting Strategic Decisionmaking

Today the secretary of any state department of transportation (DOT) faces a daunting task. Money to maintain the infrastructure it owns is insufficient; public and political leaders want to construct new projects to reduce congestion and provide better access to rural areas; governors are promising more jobs and economic vitality and they are expecting their DOTs to step up and support that agenda; cities and counties want more control over how their mobility and accessibility needs are met; and advocates concerned about an extensive list of non-transportation issues—everything from energy dependency to childhood obesity to climate change to land conservation—want the DOT's investments to support non-transportation goals and outcomes. In addition to the pressures that nearly all DOTs have in common, each one faces an added number of issues and challenges that are unique to that state.

Externally, DOT leaders are under pressure from diverse public and private sources for the transportation system to "do more"—create jobs, provide transportation options, support each community's unique quality of life, and enhance the environment. DOT leaders are beleaguered by groups and individuals whose primary message is "the DOT doesn't get it." These groups are pushing to shift both decision-making authority and funding to other agencies—local government, metropolitan planning organizations, and the private sector. Many DOTs today are finding themselves in "reactive" mode, and they are unable to drive the state's transportation strategy and goals effectively.

The mission of the DOT in the 21st century, however, has evolved. The Interstate is built, transportation revenue is less stable and less predictable, the public has little desire for new

21st Century Planning—What Is Different Today?

- Public expectations are different
- The missions of the DOTs are changing
- DOTs are expanding their partnerships and adopting a customer-focused perspective
- DOTs are moving toward performance-based planning
- Demand is growing for outcomes and accountability
- Collaboration and communication have become more important
- The programs, projects, and plans needed from planners are changing

roads if paying for them means new taxes, and demographics and travel patterns are shifting. The priority for most DOTs today is maintaining and operating the system—a more tactical than strategic view of the agency's purpose. Due in part to uncertainty in the funding stream, as well as more frequent changes to the laws and regulations that govern how transportation infrastructure is planned and built, asset management, system reliability, and resiliency are the transportation issues that engage DOT leaders today.

The Value of Planning

DOT chief executive officers (CEOs) and executive leaders can use all the help they can get. In many DOTs, the planning team is an underutilized resource that could help meet these challenges. Planning provides a state DOT with the skills to define a consensus-based, collaborative, long-term vision for transportation reflecting the perspectives of both internal and external stakeholders. Transportation planning in the 21st century is not a wholesale change from the past, but the focus of transportation has broadened significantly. As a result, changes in strategic direction, planning processes, communications, and data may be needed to take the DOT to the next level. The planning office can support DOT executive leadership in moving toward the 21st century vision.

During the Interstate era of the 20th century, the planning department was central to the DOT's core mission—essentially, building new roads. In this era, planners were critical for projecting transportation needs, recommending capital solutions, and identifying revenue shortfalls to address these solutions. State legislatures and Congress used this information to debate and approve federal and state funding to complete the Interstate system and build complementary state highway systems. With their long-term, strategic view, planners were at the table with the state's leaders, the secretary, the governor, and the legislature—advising them on policy and implementation strategies.

While many DOT offices and functions are focused on meeting short-term needs, the planning office by definition is fundamentally responsible for thinking about the future. As futurists, planners can help CEOs and executive leaders think about the trends and emerging issues that will shape the agency over the long term. Continued investment in future-oriented planning skills will be more important than ever to help DOT leadership prepare the agency to adapt quickly in the face of continued change in demographics, economics, financing, and technology. The planning office can also help DOT leadership with building the relationships and partnerships that will be needed to move forward with a broader multidisciplinary and customer-focused mission. Relationships with the public, advocacy groups, and state and local government will be important for forging connections and building support for the DOT mission, especially as it evolves to support broader societal

Why Is Planning Important to the DOT?

- Planning provides a future-oriented focus to support CEO strategic decision-making, addressing benefits, trade-offs, and outcomes for future scenarios
- Planning offices establish partnerships and are relationship-builders, facilitating consensus around integrated visions
- Planning communicates with internal and external stakeholders on how transportation fits within the context of other agency and societal goals

goals. Finally, planners can support DOT leadership by providing the complex data analysis and performance measurement that is increasingly important to inform decisionmaking and to demonstrate DOT accountability to the public and elected officials. Timely, accurate data are needed to account for the use of public dollars and to help CEOs make sound decisions.

As the DOT mission and strategic focus shifts and evolves, planners may find that their responsibilities are no longer aligned with the core agency issues of today; planners often do not have the information or authority they need to address most of the challenges their agency faces. Many DOT staff and even planners themselves define the role of planning narrowly: producing the federally mandated state long-range transportation plans (LRTPs) and the state transportation improvement programs (STIPs). Where the DOT's revenue is highly constrained, these plans are no longer driving most of the major investment decisions.

Although their responsibilities may have changed over time, planners should continue to have an important role to play in supporting strategic decisionmaking. While DOT leaders are dealing with more tactical responsibilities and overseeing the day-to-day operation of the department, they need planners who can stay ahead of the emerging issues, consider the "what if?" scenarios, lead thoughtful evaluations of strategic trade-offs, and communicate the importance of the DOT to the state's economy and quality of life. Relationships with partners and stakeholders are increasingly important to a DOT's success, and the agency should be leveraging and strengthening the long-term relationships that the planners already have to help the DOT to identify how transportation can realistically support broader state, community, and societal goals.

In some cases, the planning office may be well prepared to support the CEO in moving the DOT into the 21st century, but in others, investment in training will be needed to enable planners to keep pace with changing demand for planning products. With any change, a clear management plan is needed. New structures, processes, and relationships may be needed. CEOs can approach this by considering what 21st century planning means for their state. Developing this vision will help them define the steps needed to move the planning office forward in supporting this vision. A "21st Century Planning Readiness Assessment and Roadmap" is included in *NCHRP Report 798* to help the planning director, in conjunction with the CEO and the executive leadership team, assess the strengths and gaps of the DOT planning office as it works to support the 21st century DOT. *NCHRP Report 798* also includes information about what is different about 21st century planning and provides suggestions on how to close the gap between current planning practice and the new requirements. Although changes can occur incrementally and may take time, it is important to recognize that the world in which DOTs are operating is dynamic, and the planning function will need to change in order to support the agency's ever-evolving mission.

Academia's Role

University planning programs have an important role to play in preparing the next generation of planners to be effective practitioners in the 21st century. The training provided in academic planning programs will shape the skills and competencies of planners that will lead our transportation agencies in the future. Although the mission of many state DOTs has changed and continues to evolve, many planning programs have been successful in keeping up with the pace of change. Many DOTs have become more multimodal, visionary, and customer-focused in response to changing demographics, emerging technology, and a new political and economic landscape. With these changes comes a need for creative, multidisciplinary planners who can help support the state's ever-evolving transportation mission.

The 21st Century Planner Should Be

- Multimodal
- Multidisciplinary
- Creative
- Consensus oriented
- Technologically savvy
- Skilled in data collection and analysis
- Skilled in communication

In many ways, academic planning programs have kept pace with the evolving nature of the planning field, and they have also been at the forefront of championing these changes. The planning programs of today are multimodal and innovative, encouraging future planners to understand that transportation affects the quality of life of every community and encouraging innovative and creative outreach to tap into the core vision and values that reflect that quality of life. Planning programs teach many of the skills and techniques needed for a robust public involvement process, including consensus building and conflict resolution. These skills are especially important today in light of changing avenues of communication, such as social media and other new technological advances.

Research conducted for *NCHRP Report 798* validated many of the core skills and competencies that underlie existing planning curricula. Planning programs can help enhance skills in communication, consensus building, and strategic thinking to prepare students to be 21st century state DOT planners. DOTs need planners who can build strong relationships both internally and externally, working to facilitate consensus among stakeholders for a common goal. They need planners who can help figure out how to "do more" with the transportation system, supporting social and environmental goals beyond traditional transportation missions, and advancing the system's reliability and resiliency.

Planning programs can also help prepare planners with the new skills expected to be needed in the 21st century. DOTs will need planners that have an external awareness and holistic perspective on topics and factors traditionally considered outside of the transportation field (such as public health). With the increasing pace of technology and public expectations for fast results, planners will also need strong decision-making skills. They will need to define problems quickly and produce results much faster than in the past. Perhaps most importantly, planners should be trained as fast-paced futurists who can anticipate changes and adapt quickly to them.

Academic leaders in the planning field can continue to have a profound effect on the direction of planners for decades to come.

About *NCHRP Report 798*—How Planning and the Role of Planners Should Evolve in the 21st Century

NCHRP Report 798 describes how a DOT CEO and senior leadership can consider changes needed to support a 21st century vision of the DOT and how the planning office can best support this vision. It will also help academia ensure that it continues to lead in preparing the next generation of practitioners. The report will help planners understand how to support the changing work of the DOT, including what changes should be made to meet the new challenges of today. *NCHRP Report 798* is not a general "how to" for conducting planning at the state DOT level. Rather, it describes why and how planning should adjust in the 21st century. As already described, at the national, state, regional and local level, changes in finance, the political environment, the economy, technology, and demographics and society are impacting the landscape in which planners are working. Planners are key players in shaping and determining the success of the DOT's adaptation to these changes.

The focus of the guidance is framed by the evaluation of 12 fundamental strategic decisions that effective 21st century planners will need to support. These decisions range from relatively technical to very broad and conceptual, which further emphasizes the need for planners to

be broad and visionary thinkers. Many of the decisions will be familiar to planners, but the changing role of DOTs will require changes in what planning and planners do. Other strategies are new and have been developed in response to the challenges and drivers that DOTs are facing. DOTs will already have made some of the changes described, but they may not be ready to make others. The strategic decisions provide useful guidance to agencies throughout the spectrum of transition to a more 21st century-oriented approach.

The strategic decision portion of *NCHRP Report 798* was written to enable readers to focus on those strategies and changes that will be most relevant to the individual agency. Each strategic decision begins with a concise description of "What Is Different?" from the traditional planning process or approach. For each decision, *NCHRP Report 798* addresses (1) the changes that will affect how the decision is made; (2) key issues, components, or steps involved in the decision; (3) processes that should be changed, improved, or added to allow for effective decisionmaking; (4) data, tools, and analyses that will be needed to formulate an approach to the decision; (5) relationships needed and stakeholders that should be involved to ensure effectiveness and alignment across departments and agencies; and (6) the key challenges 21st century planners will likely encounter in supporting the decision.

The 12 strategic decisions are the following:

- Aligning DOT and Statewide Goals, Priorities, and Performance
- Agency Visioning and Goal Setting
- Identifying Performance Outcomes
- Defining State, Regional, and Local Roles
- Internally Integrated Planning
- Externally Integrated Planning
- Revenue and Financial Planning
- Investment Strategy Resource Allocation
- Linking Performance Measures to Outcomes
- Program-Level Resource Allocation
- Aligning Project-Level Decisionmaking
- Feedback—Monitoring and Reporting Agency Performance

It is clear that there will be no "one size fits all" approach to planning in the 21st century. A few key characteristics, however, will be critical to meeting today's challenges. Effective 21st century planners should encourage state DOTs to think broadly in considering a variety of societal goals, think critically in addressing challenges and turning data into meaningful information, and forge effective collaboration with other agencies, entities, communities, and stakeholders to address challenges that the DOT cannot solve alone.

CHAPTER 1

Introduction

Transportation supports the vitality of every community and is essential to quality of life. In the last half of the 20th century, transportation system planning has become reactive to increasingly uncertain long-term funding streams and significant changes in laws and regulations that govern how transportation's infrastructure is planned and built. Although many state departments of transportation (DOTs) have invested in innovations through partnerships, processes, tools, and technologies in response to specific aspects of this changing context, few, if any, have been able to get ahead of the pace of change to provide the long-term comprehensive support for the strategic decisions DOTs need to make in the 21st century.

The uncertainties of the 20th century are still with us but added to these are new unknowns—broadening public expectations about the form and purpose of transportation infrastructure and services, significant shifts in demographic patterns and life style choices, and intermingling of driver and vehicle technologies. These and other changes represent fundamental shifts in the traditional drivers of transportation demand and supply.

We can rarely predict or anticipate the future with accuracy. Our level of certainty decreases the farther into the future we look. Incremental, reactive planning will not work in the 21st century. Planners should support the DOT by being able to stay ahead of change by defining problems, conducting fact-based analysis, and anticipating potential questions and answers before critical situations occur.

NCHRP Report 798: The Role of Planning in a 21st Century State Department of Transportation—Supporting Strategic Decisionmaking is not a general guide on how to conduct transportation planning at a state DOT. Resources that describe planning processes and the technical aspects of planning practices are available from the FHWA, AASHTO, and the Association of Metropolitan Planning Organizations (AMPO). In addition, the Strategic Highway Research Program 2 (SHRP 2) and NCHRP continue to provide information about new approaches to address a variety of transportation planning issues. Instead, this report describes why and how planning should be different in the 21st century. This report

- Describes why planning is important to a state DOT in the 21st century and provides guidance for communicating the "case for change" in planning to the agency's Chief Executive Officer (CEO) and senior executives.
- Addresses the question, "What's different?" about state DOT planning in the 21st century.
- Describes what is changing and what changes planners should make to meet the challenges and leverage the opportunities DOTs are facing.
- Identifies specific strategic decisions that planning and planners can help inform.
- Provides state DOTs with a framework to assess where they are in the process of adapting to meet the needs of planning in the 21st century.

CHAPTER 2

Why Is Planning Important to the State DOT?

Planning provides a state DOT with a team of individuals who have the skills and responsibility to define a long-term vision for transportation that integrates the perspectives of the many and varied stakeholders across modes, sectors, and jurisdictions.

Visioning

Although staff at the DOT and at other state agencies are tasked with focusing on short-term needs and responsibilities, the job of the planning office is to focus on the future. Because of this future-oriented focus, planners can provide information that is critical to the strategic decision-making of the CEO and executive leaders of the 21st century DOT. Planning's role is to provide DOT leadership with an understanding of trends and emerging issues that will affect the success of the agency over the short, middle, and long term. Planners should identify future scenarios and assess their possible benefits, trade-offs, and outcomes. Planners can also help DOT leadership understand the visions and expectations of other agencies as they relate to transportation goals and decisions. Planners have the knowledge and competencies to identify and interpret trends related to demographics, economics, land use, legislation/regulations, financing, and technologies at the national, state, regional, and local levels.

Establishing Relationships

Transportation supports every sector of the economy and quality of life in every community within the state. The challenge for planners is to help the DOT leadership understand how transportation fits within the context of other agencies' and jurisdictions' visions and missions. DOT planners should establish relationships and partnerships with a wide range of external and internal agencies, programs, and staff (including the public); key advocacy and stakeholder groups; politicians and their staffs; state, regional, and local public and private nonprofit planning agencies (e.g., metropolitan planning organizations [MPOs], local government, economic development, and environmental and emergency management); and U.S. DOT regional, resource center, and national staff. With strong relationships in place, planners can help facilitate an integrated vision of transportation that fits with broader political and public values and priorities.

Communicating the DOT's Mission and Role in Supporting Communities

Through relationships with internal and external decision makers and key staff, planners can help educate the DOT's partners about the DOT's mission and how that DOT's mission supports broader societal goals. In addition, planning can help communicate the significant

challenges the DOT faces in trying to meet the needs of its customers and partners, as well as its own needs. These challenges may include the following:

- Identifying and assessing emerging issues or trends affecting transportation and the state.
- Accommodating a complex and multiagency-driven transportation decision-making process.
- Operating with limited and often restricted funding and financing.
- Achieving consensus among a broad range of stakeholders on the outcomes expected from transportation investment.
- Evaluating the trade-offs in alternative plans and investment strategies to achieve the expected outcomes.

When new leaders come to the DOT with little or no transportation experience, planners can help them learn the DOT's organization and organizational history, the various programs and departments, transportation revenue sources, and the DOT's different modal responsibilities—essentially, how all the pieces of the transportation puzzle come together.

Establishing Strategic, Long-Range, and Mid-Term Plans That Address Emerging Trends

Transportation planning is more than preparing the long-range transportation plan (LRTP) or the state transportation improvement program (STIP)—planning is about providing direction for today and the future. Planners establish strategic, long-range, and mid-term plans to respond to trends and context, including the following:

- Establishing consensus on goals, objectives, and expected performance outcomes to implement a vision.
- Developing strategies to support implementation.
- Providing the technical underpinning of analytic methods to ensure that attaining the stated goals and objectives leads to expected outcomes.
- Identifying and assessing risks to successful implementation of plans and strategies at the enterprise and program levels.
- Monitoring and reporting outcomes to demonstrate accountability.

CHAPTER 3

What Drives Transportation Change?

Change is multidimensional and has several interrelated drivers. Changing conditions, problems, and issues in one area often have a ripple effect, impacting other areas. As shown in Figure 1, transportation change is driven by politics, finance, technology, demographics and societal factors, economics, and environment and energy.

At national, state, regional, and local levels, the landscape in which transportation planners work is changing in terms of finance, politics, economics, technology, environment and energy, and demographics and societal factors. These changes are a combination of revolutionary (fundamental and paradigm), evolutionary (over time), and incremental (small) shifts and are anticipated to continue throughout the 21st century. This chapter discusses some of the primary changes identified through interviews, research, and workshop discussions conducted for NCHRP Project 08-36/Task 113 during 2013 with planners and decision leaders from all levels of government throughout the United States. How these changes are interrelated and how they affect transportation planning is discussed. With each change, transportation planning faces new and often multidimensional challenges.

Finance

Issues in finance are described below:

- **Unpredictable funding.** Funding for the transportation system is no longer predictable. Federal transportation legislation reauthorizations are relatively short term. The future of the Highway Trust Fund is in doubt. With more energy-efficient vehicles on the roads now and more anticipated in the future, revenues from motor fuel taxes may decline.
- **Public financing.** Methods for generating funding for transportation in the future are being debated. Raising motor fuel taxes or indexing them to inflation currently has limited support, as does implementing taxes on vehicle miles traveled, which would require significant investments in technology. Tolling seems to be gaining popularity among many transportation agencies and elected officials. However, tolling may not remain the method of choice because of public opposition to paying tolls on roads that it believes should be "free" or roads with capital costs that have already been paid for through taxes.
- **Increasing gap between transportation needs and revenues.** In almost every state, identified needs are significantly higher than projected revenues, meaning that strategic, and often very difficult, choices will need to be made about which facilities to maintain and how to invest scarce resources.
- **Private financing.** New and more flexible funding and financing opportunities are available. As tolling is becoming more politically acceptable, private-sector interests are seeking opportunities to invest in transportation projects. State and federal financing regulations are

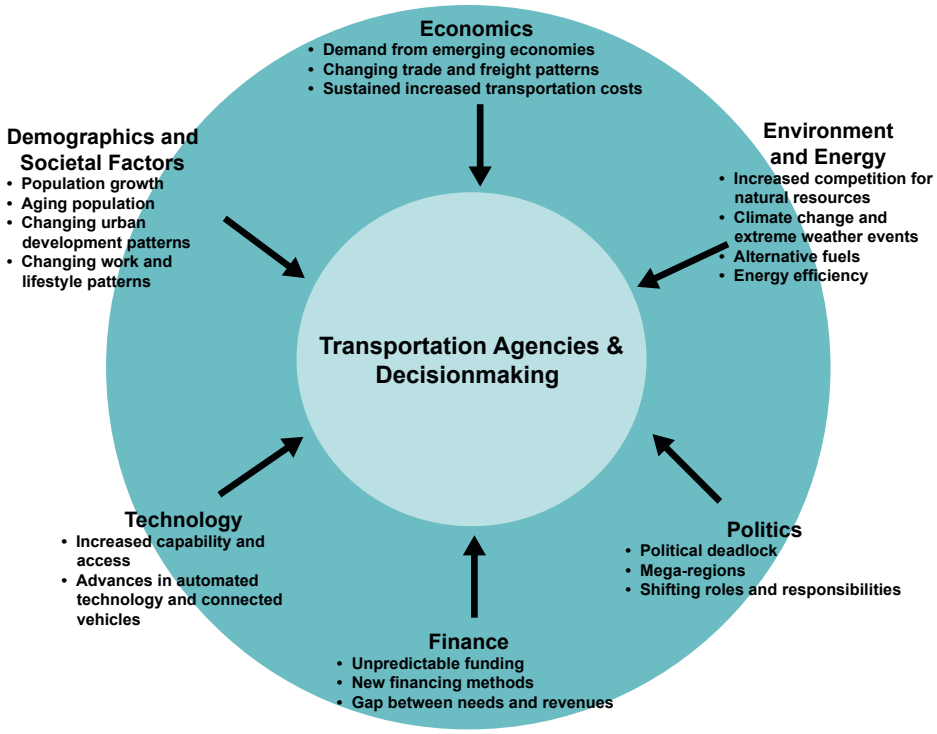

Figure 1. Drivers of change.[1]

changing to allow for more flexible use of funding for alternative modes and program areas. Understanding how this new flexibility can be implemented is still in its infancy.

- **Global financial pressures.** Inflationary pressures caused by the demand for construction materials created by other countries' growth and modernization can raise the cost of constructing infrastructure here at home.

Politics

Political issues are described below:

- **Political deadlock.** How the government should work and the level of government involvement in the economy are highly debated questions that can be answered only by the electorate. Today's national, state, and local political issues are complex. Most political issues, potential projects, programs, or policy changes have more than two sides. Nonetheless, the country is becoming more divided, and elected officials more closely aligned with their political parties. Responses to issues seem to be split into two categories: "for" or "against," "right" or "wrong." Little debate or discussion is put into compromising and finding win/win options. Decisionmaking at the national and, in some cases, the state and local levels has become deadlocked.
- **Mega-regions and multistate.** Transportation issues and needs are no longer just rural and urban. The economy and, therefore, travel patterns are creating mega-regions—multistate regions which compete (within mega-regions as well as between mega-regions) for limited funding. The lack of correspondence between jurisdictional boundaries and on-the-ground realities is challenging traditional decision-making processes. Demographic changes complicate the issue of where and how funding is distributed to new growth areas or spent on maintaining existing infrastructure.

[1]Figure 1 is adapted from ICF International, October 17, 2008, "Long-Range Strategic Issues Facing the Transportation Industry: Final Research Plan Framework," prepared for NCHRP Project 20-80, Task 2.

- **Divesting system responsibilities.** Although DOT modal responsibilities likely will continue to increase, many states are moving toward divesting some of their infrastructure assets (both road and bridge) to focus their ownership on the system of statewide interest. "Divesting" includes turning over to local governments or the private sector, or both, a combination of the ownership, operations, and maintenance of parts of the state transportation system. Divesture to local government or to the private sector has political implications that can make implementing new ownership responsibilities very challenging.
- **Shifting roles and responsibilities.** Financial pressures and increasing desire to make transportation improvements more responsive to local needs are creating pressure on DOTs to share decisionmaking with regional agencies and even large cities or to divest it to them. In some cases, local areas are willing to tax themselves to have more control over transportation plans and priorities. At the same time, state DOTs and MPOs will need to collaborate more closely to demonstrate progress toward the national goals identified in MAP-21. All of these factors contribute to national and statewide debates about the role and responsibilities of the state DOT in planning, funding, and managing the state transportation system.

Economy

Economic issues are described below:

- **Global economic recovery.** The pattern of recovery from the 2008 recession appears to be creating a "new normal." According to futurist Glen Hiemstra, "We are likely to see continued economic growth in places like China of nearly 10%, in the U.S. of 3–4% and in Europe of 2–3%. In the U.S. this will mean job growth on the order of 1.5 to 2 million new jobs, still far short of 'normal' growth after a recession, but as much as twice as good as 2010. . ."[2] Still, many workers who have resumed work after job losses due to the 2008 recession earn less than they did prior to the recession.
- **Economic bifurcation.** Hiemstra also notes that another critical economic change is the continued bifurcation of the population into the very wealthy and the poor, with a loss of the middle class.[2] Job growth has been highest in sectors that require very highly skilled workers and sectors that require minimally skilled workers, with little new demand for workers that fall between these poles on the employment spectrum. Although handfuls of Americans are seeing unprecedented growth in wealth, most Americans have seen no significant standard of living increase in decades.
- **Growth of the middle class in developing countries.** In many developing countries such as China, India, and Brazil, the middle class is growing. As a result, demand in these countries for cars, gasoline, and other consumer products is increasing. In addition, previously export-driven economies may transition to having a greater focus on domestic consumption. As wages in developing countries grow, their cost advantage in manufacturing (vis-à-vis developed countries such as the United States) could diminish, and manufacturing might return to developed countries. These trends have significant implications for global oil prices, freight demand and patterns, and both local and global environmental impacts.
- **Freight.** Freight is described as the economy in motion. As businesses reduce inventories and the supply chain continues to shift to a "pull" system, more and more products are being shipped for just-in-time delivery. Maintaining a reliable transportation system is critical to these shipments. Freight movements are expected to grow by 2 percent per year[3] resulting in nearly 27 billion tons of freight moved by 2035. This growth means additional capacity demands on the highway, rail, air cargo, and marine systems.

[2]Glen Hiemstra, "Outlook 2011," 2011. Available at http://www.futurist.com/articles-archive/.
[3]IHS-Global Insight, Inc., 2007 TRANSEARCH data and economic projections.

Technology

Technology issues are described below:

- **Communication.** Social media increasingly influence discussions and opinions across the United States. People of all ages and economic statuses have access to and use mobile devices such as smart phones to receive and share information. Communication is constant.
- **Data.** Data are received and processed on the fly with mobile devices. Decisions such as which route or mode of transportation to take are made based on real-time congestion information available through these devices. This is possible because data can now be collected, analyzed, and distributed immediately. Existing and future technologies enable state planners to collect real-time data from various devices that the public and businesses routinely use. Thus, it will continue to be important for state planners to understand the protections and confidentiality needed for proprietary and personal information that may be collected. Further, with an abundance of data available but limited resources for storing and analyzing data, it is increasingly important to find cost-effective approaches to turning data into meaningful information.
- **Intelligent Transportation Systems (ITS) and new vehicle technologies.** Advances in ITS technology that leverage the vehicle as part of the communication chain, including vehicle-to-infrastructure (V2I) technologies and vehicle-to-vehicle (V2V) communication, are being tested and implemented. Assisted-driving cars are already available. For example, cars that can automatically parallel park are currently on the market. In the next 10 to 20 years, self-driving cars and "Smart Roadways" are anticipated to be widely available.

Environment and Energy

Environment and energy issues are described below:

- **Resiliency and climate change.** In the short term, DOTs are responding to the impact of natural disasters on the transportation system. For states that have a longer term outlook, climate change is driving discussions of proactive strategies for addressing infrastructure resiliency. This issue is of particular concern to coastal states that are more susceptible to the negative effects of climate change.
- **Energy efficiency.** Alternative modes, alternative fuels, zero-emission vehicles, hybrid cars, and alternative-fuel cell automobiles will be increasingly available. Although these alternatives will not cause the end of the automobile era, they will be the beginning of significant improvements in energy efficiency for transportation, helping to address transportation-related air quality issues and redefining environmental sustainability for the transportation industry.

Demographics and Societal Factors

Demographics and societal factors are described below:

- **Shifting population and travel patterns.** In 2000, approximately 79 percent of the U.S. population lived in urban areas. That number is expected to grow to 85.2 percent by 2025 and continue to grow throughout the 21st century. In 2025, 56 U.S. cities are anticipated to have populations over one million, compared to 44 today.[4] The values and lifestyle choices of the next generation differ in many ways from those of the generation that built the Interstate. This shift is demonstrated in the growing success of urban bikeshare and carshare programs;

[4]Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2010 Revision* and *World Urbanization Prospects: The 2011 Revision*, December 10, 2013.

people of all ages, and particularly younger people, are moving back to cities, including into small urban centers, where many lifestyle amenities are available within walking distance. Young people are delaying getting a driver's license as they seek other transportation options and will continue to do so, potentially leading to continued reductions in vehicle miles traveled per capita.

- **Aging population.** The aging of the population will affect transportation trends. The design of transportation infrastructure and services offered will need to change to ensure safe mobility and access for an increasingly large population of senior citizens. The retirement of baby boomers is expected to impact the demand for travel during peak periods.
- **Land use changes.** Land use and development patterns are widely recognized as profoundly affecting transportation options and behavior. Transit, walking, and bicycling are more viable transportation options where activity and population density are higher and roads are built on a "human scale" and designed to provide safer facilities for these modes (bicycle lanes, cross walks, and so forth). State DOTs rarely have control over land use; nonetheless DOTs are increasingly recognizing that they can consider the relationship between transportation and land use in planning and collaborate with partners such as local governments.

CHAPTER 4

Characteristics of Planning and Effective Planners in the 21st Century

What Is Different Today?

Definition of Planning

Planning provides the factual, analytical, and collaborative basis for reaching decisions to improve multimodal transportation system performance. Effective planning results in cost-effective, cooperative, and responsive transportation solutions that achieve desired societal outcomes by balancing costs and benefits to communities, the economy, and the environment.

At the end of the 20th century, transportation planners described their role in terms of producing planning products, especially the state LRTP and the STIP. In the 21st century, transportation planners should redefine their role as supporting the DOT's real-time and long-term strategies. Certainly some of this support will be documented in the required planning documents, but planners should look beyond these documents as they redefine their responsibilities. Transportation planners should adapt or redesign their traditional processes and analytical support so that they provide timely and relevant information and recommendations to decision makers inside and outside the DOT. In the 21st century, the DOT is facing challenges that cannot be managed without the types of perspective, skills, and information that planners have within their reach. The 21st century definition of planning does not focus on process; it focuses on decisions and solutions. This key difference is important in establishing planning offices as key players in the success of the DOT in the 21st century.

Higher Public Expectations

Just as businesses have quickly adapted to financial, political, economic, societal, demographic, and, most visibly, technological changes, political leaders are expected to adapt to change proactively so that the public can travel easily throughout the transportation system. The public expects transportation leaders to integrate technology changes into transportation facilities and provide information about travel conditions in real-time so that transportation users can make informed choices about when and how to travel from place to place on a variety of modes for both work and recreational purposes. The public, not always aware of funding shortfalls, also expects transportation leaders to determine how to pay for transportation services and facilities.

The public is rarely aware of which agency or entity owns a roadway, rail line, or transit line. The public expects a transportation system that functions efficiently and seamlessly. In addition, some members of the public are beginning to understand the links between transportation and economic development, environmental concerns, and social justice. Some residents are aware of the many opportunities for public involvement and expect transportation projects to reflect their needs. Most, however, are not likely to spend significant time attending meetings or learning about transportation issues. Communications technologies have increased the speed with which businesses and public agencies can collect information and respond to changing circumstances. When a question or problem arises, the public wants to receive answers that are understandable

and supported by concise and reliable information quickly and often through new media like text messages and tweets.

State DOT planning should adjust to higher public expectations by

- Recognizing and going beyond capital projects to address the linkages between transportation and other societal goals.
- Addressing strategies for operating, managing, maintaining, and financing the area's transportation system.
- Redefining planners' roles within the agency and externally as they work with stakeholders and the public.
- Engaging with stakeholders and the public through a variety of media.

Changing Mission of the DOT

DOT responsibilities are no longer primarily focused on building roadway systems. As funding from traditional revenue sources declines, many DOTs are turning to the private sector to build new segments of the transportation system as well as to operate and maintain their extensive existing networks. DOTs are adjusting their missions to reflect their changing role in operating and maintaining a safe, integrated, and multimodal system efficiently. At the same time, recognition is growing that transportation impacts a wide range of societal goals that cut across jurisdictional boundaries; transportation in many cases is a means to an end, such as enhanced quality of life, rather than an end itself. In recent years, transportation goals, studies, projects, and program analyses have increasingly addressed the impacts of transportation investments on economic development; climate/severe weather; health; land use; environmental impacts; sustainability/livability; and asset management, including operations and maintenance.

State DOT planning should adjust to the changing mission of the DOT by

- Serving as the DOT's futurists, understanding potential external disruptors and evaluating the opportunities and challenges created for the DOT.
- Addressing all modes and intermodal connectivity in plans and studies.
- Integrating multimodal benefit/cost, asset management, and lifecycle cost analyses into plan and program decisionmaking and prioritization.
- Integrating risk assessment and evaluation into plan and program decisionmaking.
- Identifying and integrating operational, safety, and maintenance needs into plans and programs.

Shared Mission/Partner and Customer Focus

As DOTs expand their missions to reflect their contribution to broader societal goals, they also are expanding their partnerships with other state, regional, and local agencies to ensure that transportation plans, programs, and investments meet multiagency goals. In addition, like businesses, DOTs are adopting a customer-focused perspective in their decisionmaking. Planners, as facilitators of partner collaboration and stakeholder outreach, should play an important role in understanding and communicating the needs and wants of these partners and the public to agency leadership and decision makers. Planners can also be a source of timely and accurate information about agency programs, projects, and success to customers and partners.

State DOT planning should adjust to shared mission/partner and customer focus by

- Recognizing the local context of issues and concerns and communicating this to DOT leadership to help define a common vision.
- Building strong relationships and actively engaging MPOs, regional planning organizations (RPOs), and other external agencies (e.g., economic development, land use planning, environmental, and health) to achieve both transportation and non-transportation goals.

- Providing tools, data, products, and information that add value to discussions with partners, including state agencies, MPOs, RPOs, and other organizations.
- Developing feedback loops and monitoring processes that add transparency to partner relationships and credibility to public outreach.

Performance-Driven Decisionmaking

Customer demands, as well as federal requirements, are leading DOTs to adopt a strong performance-based decisionmaking process. The adjustments listed below include some of the key steps of performance-based planning and programming such as goal- and objective-setting, identification of performance measures, setting targets for performance, allocating resources, and monitoring and evaluating performance.

State DOT planning should adjust to performance-driven decisionmaking by

- Working with communities to identify desired outcomes and priorities.
- Identifying and integrating outcome-based and measurable performance metrics and performance targets that reflect community priorities into needs identification and investment prioritization processes.
- Developing clear policies and processes to link plan goals and performance outcomes to resource allocation and projects.
- Facilitating the development of cross-jurisdictional or interagency collaboration in identifying performance measures and targets.
- Including benefit/cost, lifecycle, and risk assessment as a standard part of analyses.
- Assessing and evaluating the impact of risks, the probabilities of failure, and the resilience of the system.

Focus on Outcomes and Accountability

The demand for real-time data is growing, as is the ability of the DOT to share that data with other state agencies and MPOs. The public is increasingly interested in quantitative information about system performance and the outcomes or successes of programs and projects based on how funds have been spent. A wealth of data is available about the transportation system, but determining which data are most relevant to agency decisionmaking is often difficult.

State DOT planning should adjust to a focus on outcomes and accountability by

- Identifying the data needed to support decisionmaking and effectively analyzing data to understand and explain changes and trends in transportation system performance.
- Filtering data available from multiple public and private sources to achieve cost-effective support for data-driven decisions.
- Becoming the agency's integrator and communicator of data, working with the various DOT offices and divisions to avoid redundancy in data collected, and learning to use and trust data collected by others.
- Summarizing data, assumptions, and explanations clearly and concisely for DOT leaders, stakeholders, partners, and the public.
- Building internal technical capacity in the latest computer programs for geographic information systems (GIS), data management, visualization/graphics, and social media.

Greater Need for Communication and Collaboration

Establishing trust internally and externally through transparent decisionmaking will be expected. Collaboration will become more important as it becomes more routine for project

funding to be shared by a variety of internal program areas and external partners, including MPOs, rural planning organizations, the private sector, local governments, and neighboring states. An increased likelihood of collaboration necessitates clear communication of the DOT's mission and priorities to internal and external decision makers.

State DOT planning should adjust to a greater need for communication and collaboration by

- Leading or facilitating the development of clear and consistent DOT strategic messages about the goals of the agency.
- Communicating using traditional methods and contemporary social media technology to reach as many participants as possible.
- Breaking down DOT silos and establishing trust with internal partners by developing planning policies and processes that integrate all partners' needs into decisionmaking.
- Establishing collaboration with external partners by developing mutually supportive decision-making processes that are transparent and accountable.
- Communicating with other agencies to learn about and discuss other issues, such as housing, education, job creation, conservation, tourism, and land use.

Products: Programs, Projects, and Plans

Just as the type of projects conducted by the DOTs has changed from being primarily capital highway projects to being operational, maintenance, and multimodal projects, so too have the types of products needed from planners. Although development of a sustainable transportation system requires planning efforts that focus 10 to 20 years in the future, the political "buy-in" for these plans must be developed much earlier and renewed for each election cycle because the potential for political turnover is on a 4-year election cycle, if not sooner. Capital programs belonging to the various state and local agencies must be linked to gain strength and support. Prioritizing investments across new construction, operational improvements, and modes will promote a more cost-effective and sustainable transportation system. The contribution of transportation investments to achieving overall statewide, regional, and local goals should be demonstrated. Elected officials will continue to be involved in setting priorities for highway programs and projects, but they will face greater demand from both the public and the federal government for accountability and transparency in how funds are spent and decisions are made.

State DOT planning should adjust to the need for new kinds of products by

- Looking at the entire multimodal system, regardless of ownership.
- Developing plans that focus 10 to 20 years in the future and being prepared to justify these plans for political buy-in on 4-year election cycles, if not more often.
- Within long-term plans, having "layered" short-term plans with components that can be implemented during an election cycle.

Characteristics of the 21st Century Transportation Planner

Planners should redirect their skills or add new skills and competencies to support 21st century planning. As the focus shifts from the planning process to supporting DOT decisionmaking, the 21st century planner should be a multimodal, multidisciplinary, consensus builder who is technologically savvy, skilled in data collection and analysis, and communication and can identify and evaluate creative solutions for transportation problems and needs.

The 21st Century DOT and Its Staff Should Be

- Multimodal
- Multidisciplinary
- Creative
- Consensus oriented
- Technologically savvy
- Skilled in data collection and analysis
- Skilled in communication

Multimodal, Multidisciplinary, and Creative

A 21st century transportation planner should be knowledgeable about and able to work across all modes of transportation, as well as on issues typically considered external to the DOT (such as public health and quality-of-life issues). A planner should be able to work individually and collectively with multiple public- and private-sector partners and offices internal and external to the DOT, as well as have an understanding of the overall transportation industry. Planners should embrace a holistic perspective on transportation, considering how it fits into larger environmental and community concerns. Developing a broad understanding of political processes and how they affect planning projects, programs, and plans will be necessary. A planner should actively work to overcome silo-style planning and decisionmaking by creating multimodal processes and decisionmaking, encouraging the sharing of information and data, and establishing formal and informal cross-functional communication systems.

A planner should identify and evaluate combinations of multimodal, land use, operational, and demand management solutions, as well as other creative solutions, to transportation deficiencies. The planner should have the ability to assess and evaluate the potential trade-offs of the economic, environmental, and societal impacts of solutions. Planners should be able to anticipate changes, quickly adapt to them, and make adjustments in creative ways to meet new requirements that arise.

Consensus Builder

Planners should recognize that the DOT is *a* player but not *the* player in identifying transportation goals for the state, its urban and rural regions, and local areas and should support transportation solutions that contribute to broader regional and community quality-of-life goals. Planners should be skilled in fostering collaborative relationships, facilitating communication among stakeholders, and finding opportunities for collaboration within and outside the DOT. Planners should be able to work with MPOs, RPOs, local governments, and other state governmental agencies to manage conflict and build consensus by integrating transportation planning with non-transportation goals and performance measures that may include, for example, metrics related to economic development, the environment, public health, and social justice.

Technology Literate and Skilled in Data Analysis

Problem solving will involve determining what information to use and how to analyze it. In a world of overabundant data, planners should be able to recognize what data are critical, interpret the data in a way that effectively informs decisionmaking, and refrain from focusing on data that are not relevant. Planners should define problems and produce results much more quickly than they have in the past, simply to keep up with the increasing pace at which the public expects results. Such decision-making acuity will allow planners to respond rapidly to changing demands in the transportation planning landscape. Particularly with how technology is driving change, 21st century planners should be prepared to do "just-in-time" planning, which includes the ability to collect, analyze, and communicate data quickly to respond to all types of questions. New tools and methods may be needed to effectively respond to the evolving demands of planners. Some specialization may be needed too, such as in GIS, to keep up with new requirements for planning.

Skilled Communicator

Possibly the most important characteristic of 21st century planners will be their communication skills. To build and nurture strong relationships, planners should be skilled at listening carefully and communicating DOT needs clearly and respectfully. Planners should be able to

speak persuasively and provide rationales for decisions and recommendations. They should be able to facilitate consensus among internal and external partners while ensuring that DOT needs are being addressed. Although strong one-on-one and group communication skills are essential, planners should also be able to adapt to changing avenues of communication, such as social media.

In addition, as performance outcomes and reporting become more routine, the ability to develop feedback evaluation loops that involve tracking and reporting performance will become increasingly important to the DOT. Especially important will be planners' ability to clearly communicate the decision-making processes and final decisions when changes are based on performance reports. The DOT's interpretation of performance reports and how the DOT intends to respond to them should be communicated clearly and concisely.

CHAPTER 5

Integrating Planning into Strategic Decisionmaking

Transportation planners of the 21st century will bring their perspective and skills to a broad range of strategic decisions facing the DOT. These decisions range from relatively technical to very broad and conceptual, so planners should be visionary thinkers who have the technical savvy to evaluate how these visions will impact the outcomes the agency strives to achieve.

This chapter of *NCHRP Report 798* is organized around 12 strategic decisions facing DOTs for which planners of the 21st century should provide support. Many of these strategic decisions are familiar to planners, but the changing role of the agency and transportation planning in the 21st century will impact the type of support that planners should provide to DOT decision makers. Other listed strategic decisions are new and have been developed to respond to the challenges and drivers of change that DOTs are facing. The 12 strategic decisions are the following:

1. Aligning DOT and Statewide Goals, Priorities, and Performance
2. Agency Visioning and Goal Setting
3. Identifying Performance Outcomes
4. Defining State, Regional, and Local Roles
5. Internally Integrated Planning
6. Externally Integrated Planning
7. Revenue and Financial Planning
8. Investment Strategy Resource Allocation
9. Linking Performance Measures to Outcomes
10. Program-Level Resource Allocation
11. Aligning Project-Level Decisionmaking
12. Feedback—Monitoring and Reporting Agency Performance

The description of each strategic decision identified above is organized to respond to the following six questions:

1. What is expected to change in the 21st century that has implications for how this decision should be made?
2. What are the key issues, components, or steps involved in the decision?
3. What processes should be changed, improved, or added to effectively make the decision?
4. What is required to effectively approach and make the decision?
5. What relationships will be needed and which stakeholders should be involved to ensure that connections to other societal goals, investments, and priorities are considered in making the decision?
6. What will the key challenges be for 21st century planners as they support DOT leadership in making this decision?

In the 21st century, planning will not be "one size fits all." In contrast to the past, when every DOT's strategic focus was on completing the Interstate, today, each DOT is developing its vision

and mission to reflect the needs and desires of its citizens and their elected representatives. The strategic decisions outlined below reflect emerging issues and practice within the industry as identified by industry leaders and new MAP-21 requirements. Nearly every DOT already will have made some of the changes described, but few, if any, will be ready to make every change described.

This chapter of *NCHRP Report 798* has been written, therefore, so that it is easy to focus on those strategic decisions and changes that will be most relevant to the individual agency. Each section describing a strategic decision begins by answering the question "What is different?" from the traditional planning process or approach.

A "21st Century Planning Readiness Assessment and Roadmap" is included in Chapter 6. Although all DOTs have taken some steps to adjust planning in ways described in this report, for any DOT to try to align its planning with all of the suggestions would require a significant commitment of time and resources. The "21st Century Planning Readiness Assessment and Roadmap" is designed to help DOT planning directors efficiently identify the information in this report that will be most beneficial given the issues and challenges the DOT and its planning office face.

Strategic Decision #1: Aligning DOT and Statewide Goals, Priorities, and Performance

What Is Different?

The transportation system influences the quality of life of every community and every state. Governors and legislators recognize this connection, and both they and the public expect transportation to support community and societal goals. In addition, the state DOT is required to develop an LRTP. Under new federal requirements, the LRTP will be tied to performance outcomes. This combination of factors creates a unique opportunity for DOT planners to support both the DOT and their state by serving as facilitators for a multiagency planning process. This process has the potential to bring agencies together to identify common interests and mutual goals that transportation in some way can affect.

To respond to this change, 21st century transportation planners should

- Understand the direction and vision of the governor and take an active role in interagency coordination, as well as coordination within the state DOT.
- Understand the missions, goals, and strategies of other agencies and how they relate to transportation. Developing an understanding of the needs of other agencies will enable planners to advise DOT leadership effectively on approaches for building or modifying the DOT strategy to link successfully with other agencies' strategies. Such coordination will allow for more effective implementation of the governor's direction and vision.
- Develop strong facilitation, team-building, and consensus-building skills and the ability to communicate how agencies' goals relate to both transportation and non-transportation goals.
- Incorporate societal goals and nontraditional criteria into decisionmaking.
- Communicate the overall state vision and direction to other units within the state DOT and facilitate and support DOT internal teams as they develop short-, mid-, and long-range DOT plans. Doing so will ensure that the resulting plans are consistent with statewide and community planning and decisionmaking.
- Remove or work around silos by facilitating a holistic planning approach for the short term and mid-term that coordinates asset management, operational improvements, targeted new construction improvements, and funding that supports all modes of transportation.
- Make effective use of funding by eliminating duplicative data collection and analysis by state agencies and within the state DOT.

Introduction

State leaders recognize that their state's economy and demographics will be shaped by the "transportation of the future," which should align DOT plans and priorities with the overall statewide vision. In most cases, a state's overall vision is defined by the governor's office in collaboration with other state-elected officials and state agency secretaries. Statewide goals today often focus on economic development, education, health care, social justice, environmental concerns, and growth. Because transportation connects to each of these goals, transportation improvements are often a key part of the strategy to achieve statewide goals.

Statewide goals often focus on economic development, education, health care, social justice, environmental concerns, and growth.

Every state DOT CEO is appointed by and serves "at the pleasure of" the governor or the state transportation board or commission. Many state DOT CEOs or state transportation board chairpersons also have a seat on their governor's cabinet and participate in discussions outlining the administration's goals and strategizing about how each state agency can advance statewide goals. In addition to aligning DOT goals with statewide goals, state DOT CEOs may be expected to support specific initiatives or focused project improvements committed to by the governing administration.

DOT planners can help the state's leaders understand the implications of transportation for both individual agencies' visions and the state vision as a whole. DOT planning staff can provide technical support for their CEOs through explaining to the governor how the DOT's programs and projects can be aligned to address statewide issues, priorities, vision, and needs. DOT planners can analyze current and historic data to identify trends and provide information to leadership to support a data-driven decision-making process. The federally required statewide transportation plan provides a structure and a process for aligning statewide and DOT vision and goals with those of the MPOs, as well as a broad range of stakeholders. DOT planners understand that the measure of success in achieving goals is more than simply building a priority project. Success means that the priority satisfies the overarching goals of a community, the region, and the state. As DOT planners develop a proactive process, they should also communicate often and effectively with leadership to build credibility and trust and obtain buy-in from the governor and all other relevant decision makers.

Today, state transportation agencies are expected to do more than just keep the state highway system operating efficiently. A state's ability to move people, resources, and freight is tied to the state's ability to maintain and expand existing business and attract new business. Governors and their electorates expect state DOTs to take the lead in providing a seamless multimodal transportation system, regardless of the ownership of physical transportation assets.

The role of state DOT planners in aligning goals and performance categories for transportation can occur at two levels. DOT planners can provide technical information and support to CEOs to help shape statewide goals. At a deeper level, DOT planners can facilitate the development of consistent and mutually supportive statewide goals and then support the alignment of this agenda within the DOT and across its planning partners.

Processes Needed to Support the Strategy

DOT planners should be highly skilled in engaging stakeholders at all levels and developing a vision and goals. DOT planners should have the ability to forecast where the state's economy may evolve under different conditions. DOTs retain planning staff with training, knowledge, and depth of experience that exist in few other state agencies. Other state agencies rarely produce comprehensive long-range plans comparable to those required by FHWA and produced by a state DOT. The transportation planning staff can therefore provide a valuable service not only

to the DOT CEO, but also to other state agencies and the governor by helping to identify and interpret national, state, regional, and local trends in areas such as population demographics, the economy, legislation/regulation/public policies, environmental/community resources, financing, technology, and communication.

In the 21st century, one of the most important responsibilities of a DOT planner is developing relationships with other state agencies. DOT planners should understand other agencies' priorities and strategies and how those priorities and strategies relate to transportation in order to advise DOT leadership on approaches for building or modifying the DOT strategy. DOT planners can facilitate discussions to help reach a consensus with other state agencies on goals, objectives, and expected outcomes. Once a consensus is reached, the DOT should continue coordination with other agencies so as to adequately monitor the progress of goals. DOT planners should regularly review other agencies' goals, objectives, and strategies to ensure that plans and programs continue to be supportive of not only transportation goals, but also the broader needs of the state overall. Rapid change and emerging issues may require DOT planners to take the lead in identifying changes that necessitate a review of the DOT's goals. Planners also can identify and work to implement processes for ensuring continuous alignment between agencies.

To serve in this role, a DOT planner should have outstanding facilitation and consensus-building skills and the ability to communicate the bigger picture of how state agencies' activities relate to transportation and each other.

Required for Success

Cross-jurisdictional and interagency planning require data sharing. An abundance of data is available instantaneously through the web and other sources. A DOT planner should work with other agencies to identify available data and build consensus on the use of it, as well as develop data-sharing protocols for a broad range of data that can be used to evaluate the effect of transportation improvements on mutually accepted goals. Analyzing data from agreed-to data sources and thus creating information to support collaborative decisionmaking is a task that the DOT planner can perform for a multiagency team. Data analysis can help identify emerging trends, and this identification can inform all agencies' planning efforts and support the governor and legislators in decisionmaking. Much of this data also can be shared publicly, helping build the public's understanding and trust in a data-driven, knowledgeable decision-making process that supports effective investment of tax payers' money.

Relationships and Stakeholders Involved

The collaborative planning process needed for this strategic decision requires effective communication. Effective communication is based on relationships in which the partners acknowledge and are willing to support both individual and collective goals. Where these relationships do not already exist, planners should facilitate the development of formal processes such as memoranda of understanding, joint policy statements, and decision-making protocols that will set the institutional framework for working together.

Transportation agencies are well versed in the stakeholder involvement techniques used in developing LRTPs. In the 21st century, however, engaging stakeholders through traditional outreach activities can be difficult. Moreover, the techniques used for outreach should deliver information and solicit opinions much more "time efficiently" than traditional outreach activities have. Twenty-first century outreach techniques may include online public meetings (as were used in the "I-70 Corridor of the Future" study), virtual advisory committees (as used by Michigan DOT), and scheduled project chat rooms (similar to those used by the Kentucky

Transportation Cabinet). The SHRP 2 product Transportation—Visioning for Communities (T-VIZ)[5] can be a helpful "how-to" guide in working with statewide stakeholders and developing a vision. Additional best technology examples from T-VIZ may be found at http://www.transportationforcommunities.com/shrpc01/kdp_step/4/0/2.

In the 21st century, social media provide an important means of communication. Public opinion about transportation is tweeted, blogged, or posted on social media like Facebook. The traditional media and statewide leaders cannot and do not ignore stakeholder desires and concerns expressed through social media; indeed, this information is taken into account in setting goals and agency performance expectations. The public expects political leaders to listen to the public's concerns and define problems and goals in a way that reflects an understanding of those concerns. Public opinion surveys and polling are becoming less costly because of advances in technology; as a result, data are more robust, inclusive, current, and statistically valid than they were in the past.

Challenges

In aligning DOT goals or general performance categories with broader statewide and public goals, DOT planners may face several challenges:

- Most state agencies operate independently of each other, placing emphasis on internal processes as they work toward accomplishing their own goals. The reality, however, is that there are both positive and negative aspects to interagency cooperation, and these should be understood.
- DOTs are typically funded differently than other state agencies. In most states, funding typically comes from dedicated state motor fuel taxes, federal motor fuel taxes, and other direct user sources. In some states, even those with dedicated revenue sources, transportation must compete for funding with education, Medicaid, prisons, health care, and human services when transportation funds are diverted to help support these purposes.
- Dedicated transportation funding typically heightens expectations for accountability by the governor and residents of the state. Although flexibility in the use of federal transportation funds is increasing, care will be needed to ensure that statewide transportation goals are consistent with federal goals, and that state funding restrictions and requirements do not pose unnecessary barriers to goal attainment. Depending on what future trends and priorities are identified, state laws on funding use (such as single-purpose highway funds) may need to be modified to provide for a more multimodal transportation system.
- Although the mission of the DOT in the 21st century has evolved to include social, economic, environmental, and community goals, the DOT remains responsible for the preservation and maintenance of existing transportation infrastructure. The limited funding for transportation usually cannot meet all the needs of the transportation system, and the high priority given to maintenance of the transportation infrastructure by the DOT often is not well understood by public and elected officials. The DOT should advocate for the transportation system among competing demands from various parties for a variety of transportation and nontransportation improvements.
- A governor may choose not to establish a cross-agency agenda or may focus specifically on individual political priorities that are inconsistent or potentially in conflict with existing DOT goals and priorities. State DOTs should be prepared to adapt to such an agenda without entirely moving away from goals aligned with those of regional and local partners.
- Gathering and interpreting broadbased public and stakeholder input can be more difficult when some groups and individuals have access to technology or venues and other groups and individuals do not. Planners have to be diligent in ensuring that data-driven decisions reflect

[5]For more information about T-VIZ, a SHRP 2 product, see: http://shrp2visionguide.camsys.com/.

a balance of sometimes different community values and desires, regardless of individuals' technological proficiencies.
- Ownership of transportation facilities and partnerships with local governments and private-sector owners are evolving. Identifying goals that balance the priorities of the public, various levels of government, and private-sector investors will be critical.
- Communication and collaboration with other actors and agencies is critical to effective planning, which involves coordination with the efforts of other agencies in furthering societal goals affected by transportation. Problem solving is effective only when analyses and ideas are turned into reality, which is much more likely to happen through collaboration with other entities.

Strategic Decision #2: Agency Visioning and Goal Setting

What Is Different?

The 21st century DOT's vision and goals will support multimodal transportation system improvements that will result in traditional transportation outcomes, and they will support the achievement of broader state and community goals such as growth and development, economic vitality, social justice, the environment, and public health.

To respond to this change, 21st century transportation planners should

- Be the "futurists" for the DOT by staying current with the societal and technological changes that are likely to impact the future of transportation.
- Understand the overarching goals and vision established by statewide leadership, including the governor or the transportation commission to whom the DOT CEO reports.
- Provide data-driven information and analyses to help decision makers evaluate the complementary and competing trade-offs among transportation and non-transportation outcomes.
- Look beyond the DOT for data and develop processes and techniques to organize this data into meaningful and succinct information that can help DOT executives and state leadership understand the broad issues and trade-offs that affect transportation decisionmaking.
- Become proficient in a range of traditional and new communication techniques and technologies in order to maximize opportunities to collaborate with and engage public and private stakeholders.

Introduction

Successful CEOs and leaders in both private-sector businesses and public-sector agencies must be able to formulate and articulate a vision and goals to define their agency's purpose, provide direction for their agency and staff, and measure their agency's performance. Although some leaders may choose to develop their agency's vision and goals alone or with a small circle of trusted advisors, others reach out to a group consisting of department or agency leaders, critical customers, and individuals to whom they report. Whatever process is used to develop the agency's vision and goals, they should be "owned," embraced, and advanced by the DOT leadership and approved by political leaders at the highest levels of state government.

State DOT planners have the skills and experience to support DOT agency leaders in conducting agency-wide visioning and goal setting. Visioning and goal setting are among the first steps in any planning process, including preparing a federally required statewide transportation plan. Nonetheless, planning staff cannot support DOT leaders in visioning or goal setting unless DOT planners have the trust and confidence of the DOT CEO and senior leadership team.

State DOT planners should understand that the ultimate products of visioning and goal setting should be a vision and goals that the DOT's senior executives can support. Planners earn the

trust and confidence of DOT senior leadership by demonstrating that they understand the issues of primary concern to the DOT's leadership and placing those concerns within the context, trends, and emerging issues that affect the performance of the DOT. Planners should demonstrate an understanding of the agency's short-, mid- and long-term goals and priorities and the consequences of policies and resource allocation decisions. DOTs typically follow an outreach process for visioning and goal development that includes involvement from many stakeholders and transportation partners. Thus, planners should also understand the overarching goals and vision established by statewide leadership. To gain the trust of leadership, this process should expand beyond the DOT to other layers of government and include the vision and goals of the elected and appointed officials. Planners should include in their outreach the input of elected officials.

The 21st century DOT vision and goals will be broader than traditional transportation plan visions and goals, which have typically identified specific strategic decisions that planning and planners can help inform. To meet the expectations of the public, stakeholders, and political leadership, the state DOT's vision and goals should reflect broader issues such as transportation's impacts on livability, sustainability, the environment, the economy, and social justice.

Processes Needed to Support the Strategy

Planners can support the DOT CEO and state transportation commission in the development of the agency vision and goals. Planners have the relationships, skills, and experience to develop a collaborative process involving a broad range of state and local stakeholders and agencies. Planners' skills include the following:

- An understanding of the multimodal aspects of transportation and how each mode can work together.
- An understanding of the societal and technological changes that are likely to impact the future of transportation.
- The ability to define future scenarios.
- Establishment of processes for broadbased outreach.
- Analysis of current and future demographic and transportation conditions data.
- Facilitation.
- Establishment of prioritization processes to evaluate competing needs.

A 21st century process for agency visioning and goal setting involves activities that can be detailed and administered by statewide planning staff. These activities include determining:

- **Who should be involved in the DOT's goal-setting and visioning processes?** Those to consider including are
  - The DOT CEO and leadership team.
  - The DOT district leadership teams.
  - Statewide elected and appointed officials and state transportation commission members.
  - Policy and technical representatives from other state agencies.
  - Representatives of other public modal agencies.
  - Representatives of regulatory agencies.
  - Private transportation facility and service owners and users from all modes.
  - Traditional transportation partners such as MPOs, RPOs, FHWA, development agencies, neighboring state transportation agencies, the public, public special-interest groups, and other public and private stakeholders with an interest in transportation and its impacts.
- **What visioning tools should be used?** A variety of visioning tools can be used by DOTs and other agencies to support visioning. These tools are often supported by technology that enables consideration of non-transportation issues such as the environment, social justice,

resiliency, and energy efficiency. Techniques such as scenario planning can help decision makers and stakeholders articulate and evaluate significantly different versions of the future.

- **What should the process be for developing the vision?** The process for engaging stakeholders and the public in visioning and goal setting should be tailored to the specific participants in and the particular context of the planning process. Many guidance materials are available through FHWA and AASHTO to help planners design the most effective process for their particular purpose. In the 21st century, however, processes for engaging the public and an increasingly diverse group of stakeholders clearly should be subject to continuous improvement to ensure that a broad range of perspectives are considered during visioning and goal setting. For example, the Transportation: Visioning for Communities (T-VIZ) tool[6] is a "how-to" guide for working with statewide stakeholders and developing a vision. T-VIZ describes a variety of processes and tools that can be used to develop a vision and goals.
- **How can a prioritization process be developed to address use of revenues and program and project selections?** Visioning and goal setting cannot be done in a vacuum. They should involve consideration of how trade-offs among goals will be determined, and they should result in a shared understanding of how decisions related to investment priorities will be made. Sharing information about anticipated funding levels and alternative revenue-generating options among all planning partners can help establish realistic expectations for how quickly plans can be implemented and outcomes can be achieved.

Required for Success

In the 21st century, it will not be enough for transportation planners to simply establish a baseline of existing conditions and conduct a trend line analysis. Twenty-first century planners should serve as the "futurists" for their DOT, looking out and assessing how changes in the world—technology, demographics, and the economy—might impact the DOT in the mid-term and long term. Recent and emerging trends, such as broadbased acceptance of telecommuting, real-time consumer information about traffic conditions, and self-driving cars, are significantly affecting how the transportation system is managed today. These and other changes are creating a "new normal" that planners should articulate to decision makers and the public as part of facilitating the development of the agency's vision and goals. That all of the "big picture" changes discussed by future-looking industry leaders will come to pass is unlikely; planners should investigate technology changes and "next-generation" societal changes to understand their impacts on the future of transportation.

Today, a wealth of transportation data is available from a variety of sources. State leaders want to make data-driven decisions and be able to report on the impacts of their decisions. Planners can easily overwhelm state leaders and a DOT CEO with a vast amount of complex data that are incomprehensible to those not familiar with transportation data and technical analyses. Twenty-first century planners should select data from sources that include the most current data, ensuring that the data are unbiased and updated on a regular cycle. Presenting carefully selected, manageable amounts of data in formats that are easily interpretable and that will allow DOT leadership to easily and quickly compare existing conditions with future expectations is essential to selecting the right set of quantitative and qualitative goals.

New data sources continue to become available as technology advances, providing additional opportunities for data collection and usage. For example, data from cell phones and vehicle transponders that display real-time traffic patterns have been shown in a variety of forums and are setting a standard for what is expected. In addition, stronger partnerships with private-sector stakeholders may allow for the negotiation of data-sharing arrangements with private-sector

[6]For more information about T-VIZ, a SHRP 2 product, see http://shrp2visionguide.camsys.com/.

entities, such as freight providers. Because planners have the ability to consider both transportation and societal issues broadly, they are well suited to identify opportunities for expanding data sources and to think critically about the value provided by additional investment in data collection and analysis. Planners should increasingly look beyond their own agencies for data and be able to analyze and share their findings with DOT leadership in a meaningful manner.

Relationships and Stakeholders Involved

As today's transportation system becomes more intermodal and multimodal and ownership of transportation assets becomes more diverse, it is more important than ever to align the statewide vision that is typically led by governors and the statewide transportation plan vision and goals with the visions and goals of a diverse group of transportation partners. Collaboration with public and private stakeholders is critical, as is collaboration with statewide and agency leadership (private-sector stakeholders may be owners of roadways created or managed through a public-private partnership, port owners, intermodal transfer facility owners, owners and operators of bikeshare and carshare services in urban areas, and others). As more stakeholders communicate with the DOT and each other, greater transparency is essential.

In addition, because DOTs tend to be large organizations with hundreds or even thousands of employees in multiple locations, the quality and frequency of communication within the agency can vary. If the quality of communication between units at the DOT is not as effective as it might be or is not occurring frequently, they could be working at cross purposes. Ensuring that everyone within the agency is on the same page with respect to the agency's overarching goals is critical for attaining these goals.

The convenience of electronic communication is gaining favor with stakeholders, and the DOT must develop new approaches to communication and outreach that use social media to its advantage. Telephone surveys have given way to Twitter surveys and open houses have evolved to include online public forums. Planners should keep abreast of changes to social media tools and continue to look for new opportunities to engage stakeholders.

Challenges

State DOT planners are faced with several challenges when supporting the development of a statewide transportation vision:

- Planners should embrace the role of "DOT futurist" and develop the skills needed to identify, screen, evaluate, and communicate emerging trends and their potential impact on the transportation system.
- Shrinking funding for transportation and transportation planning and the uncertainties of how elected officials will shape future funding streams can have a substantial effect on setting and successfully implementing a vision and goals. Planners should be prepared to help the DOT adapt its vision and goals to fiscal reality.
- Many DOTs are facing a significant staff turnover through retirement of experienced planners. The loss of experienced planners can be a challenge when the individuals have the consensus-building skills and relationships needed to support 21st century planning.
- As stakeholders expand to include additional modes and owners and operators of privately owned transportation facilities, planners should consider expansion of current outreach efforts.
- As the MAP-21 requirements for performance-based planning evolve, state DOT planning should adapt by adjusting current processes and existing staff skills.
- Planners should change the way that data are synthesized and communicated so that leaders, partners, and stakeholders are not overwhelmed with "data overload."

Strategic Decision #3: Identifying Performance Outcomes

What Is Different?

State DOTs are held accountable for reporting on not only transportation system performance, but also how the system supports and improves quality of life in the state and for its individual communities.

To respond to this change, 21st century transportation planners should

- Quantify system performance as it relates to social, economic, and environmental conditions, as well as mobility, safety, access, and other transportation conditions.
- Adapt to continuous changes in technology and data information, which will result in planning efforts that have a 3- or 4-year life span.
- Filter the abundance of available data to focus on what is useful for transportation decisionmaking.
- Set the direction for proactive planning through data-driven performance measures with measurable threshold targets.
- Define problems and potential solutions quickly by identifying critical needs before they become a major problem.

Introduction

Transportation is a factor in people's choices about where to live, where to work, and where to play, supporting and affecting the quality of life in every state and community.

State DOTs are no longer just held accountable for the transportation system; they are also held accountable for how the system supports and improves quality of life for communities. In the past, congressional earmarks often lined the pages of many state DOT transportation programs. As Congress has stepped away from earmarks, they have reminded state DOTs that the public expects transportation dollars to be invested wisely. Congress is defining expectations by mandating that state DOTs establish threshold targets for the performance measures identified by the U.S. DOT. Publicly sharing the state DOT's performance outcomes demonstrates the accountability from the state DOT that the public deserves for how the transportation system supports and improves quality of life for communities.

Processes Needed to Support the Strategy

Performance outcomes should indicate whether the allocation of funds is resulting in noticeable improvements in the transportation system. A performance-based planning process is most effective when planners work with communities, land use planning agencies, MPOs, and RPOs to establish desired performance outcomes. A planning process based on performance information and outcomes builds on traditional planning processes while incorporating additional performance-based considerations and analyses. Several steps, outlined below, are typically part of a performance-based planning process.

First, planners work with DOT leadership, stakeholders, and the public to identify the strategic direction of the organization, which is based on a vision for the future. In this strategic direction phase of the process, planners identify goals and objectives that support the state's vision and play a key role in shaping planning priorities. During this strategic direction phase, planners also consider and identify the performance measures that can be used to indicate progress in meeting goals and objectives—these measures serve as a basis for comparing alternative strategies for improving the transportation system.

In the next phase of the planning process, the analysis phase, planners address the question of how the vision, goals, and objectives identified in the strategic direction phase will be achieved. Answers to this question are driven by data on performance as well as public involvement and policy considerations. In this phase, planners are involved in identifying performance trends and targets, identifying strategies and analyzing alternative investment approaches, and developing investment priorities based on this analysis.

The third phase of the performance-based planning process, the programming phase, involves selecting specific investments to include in the state's transportation improvement program. Programming decisions based on performance outcomes should be made to support attainment of the state's vision and goals. The development of an investment plan and project prioritization or selection criteria can be used to identify investments that will further performance outcomes.

The final phase of the planning process, which ultimately informs the next planning cycle, involves implementation of projects identified in the programming phase as well as monitoring of performance outcomes to evaluate the extent to which investments have achieved desired performance outcomes. Once appropriate data are identified and collected, the data can be analyzed to assess current performance. Current results and historical data can be used to compare performance trends to performance targets. A transportation system "report card" can be completed by identifying where targets were met or exceeded and where targets were not met. Providing information about the causes of performance changes along with performance results is useful for contextualizing results for the public, stakeholders, and decision makers.

Required for Success

Before the advent of computers and routine Internet access, obtaining data was expensive and time consuming, and often the data were not available by the time a decision had to be made. Technology has shifted this paradigm. Today, the problem is more likely to be too much data. Transportation planners should be able to identify which data are most useful to support transportation decisionmaking. Planners should understand which data are relevant and appropriate and which data are not necessary for measuring a DOT's performance. The data elements needed to support each performance measure should be identified and incorporated into a systematic, regular collection effort, and then communicated transparently to other potential users. State DOT planners are well positioned to lead these efforts because of their broad understanding of transportation and its impacts. If, however, planners are leading such an effort, they should consult with technical staff, who can provide specialized expertise. The traditional silos within state DOTs can contribute to inefficiencies, duplicated efforts, and disjointed data; thus, to the extent possible, planners should take an active role in streamlining data collection and analysis.

In addition, state DOT planners should quantify system performance as it relates to social, economic, and environmental conditions, as well as mobility, safety, access, and other transportation conditions. Relating transportation outcomes to non-transportation goals is an emerging area of practice. Planners should stay current with the research and best practice information in this area as it develops. The FHWA resource centers and website and the AASHTO Center for Environmental Excellence are two sources that will provide information on emerging practice as new tools and analysis methods are developed.

DOTs already collect significant amounts of data on asset management and condition. Tools for measuring and tracking asset condition continue to improve, which provides an opportunity

for planners to work across the agency with asset management staff to identify opportunities for collaboration, streamlining, and investments in timesaving data and tools.

DOTs should decide how to present the performance measures and targets to demonstrate public accountability for the transportation system, including how the DOT uses its funding to improve the system and how the system supports and improves quality of life for communities in the state. Many state DOTs are using a "dashboard" that reports updated or near-real-time performance of the system in relation to performance goals and targets. Data sensitivity and liability risk are considerations in deciding what information will be available for public viewing and what to reserve for internal decision-making purposes.

Relationships and Stakeholders Involved

State DOT planners should set the direction for proactive planning through data-driven performance measures with measurable threshold targets. For this to be successful, planners should have relationships with partners internal and external to the DOT. Within the DOT, planners should work with the various functional areas to understand their needs and priorities. Through the development of relationships with staff throughout the DOT, planners can convey the value in using additional data collection and monitoring tools to reach decisions. In some cases, DOT staff may be reluctant to engage in more extensive data collection efforts, fearing that the data may not adequately reflect the value their department brings to the organization. Ensuring that staff understand how the use of enhanced data collection and analysis techniques can benefit the entire agency, as well as specific departments, is critical to obtaining internal support for data- and performance-driven decisionmaking.

Externally, planners should work with other state agencies, MPOs, RPOs, and communities to determine how the DOT can support their vision, mission, and goals. Planners can use this information in the development of performance measures. Working with local communities and the public through the MPOs and RPOs will enable DOT planners to understand public needs and expectations of the transportation system in supporting local goals. With this knowledge, state DOT planners may make recommendations on DOT priorities and funding distributions that have positive performance outcomes for both the state DOT and its partners.

Challenges

As performance measures are established and outcomes are evaluated, several challenges to having a fully implemented, performance-measure-based program can arise:

- Understanding how to establish meaningful quantitative or even qualitative performance measures and targets for non-transportation goals and objectives is in its infancy. Developing best practice examples that transportation agencies can begin to adapt to their state will take time.
- Understanding how to establish reasonable targets for transportation measures is also in its infancy. Planners will need to manage expectations while the agency is piloting various processes and techniques for evaluating the outcomes that result from a resource-constrained decision-making process.
- Unavailability of certain types of data (such as travel speed information) can make setting adequate threshold targets for those areas almost impossible. Without historical data, a state DOT will have to make a reasonable assumption for a given situation and then adjust the target over the next few years as more data become available for the decision-making process.

- Determining how to store large databases of information and still adapt to technological change continues to be a challenge for DOTs. Some organizations are purchasing servers just for data storage, while others are pursuing database cloud storage through private vendors that specialize in storing data.

Strategic Decision #4: Defining State, Regional, and Local Roles

What Is Different?

For more than 100 years, the role of most state DOTs was to build, operate, and maintain the state highway system. In some states, the system was relatively small and "high mobility," while in others it included most of the mileage within the state. In contrast, 21st century DOTs face a wide range of conflicting pressures that are affecting their role and responsibilities vis-a-vis the transportation system. For some DOTs, this evolution in role and responsibilities is apparent in changes in their vision and mission that reflect the multimodal nature of the 21st century transportation system. Other DOTs, although they are nominally "transportation" agencies, are struggling to identify their role in a transportation system that includes non-highway modes that are planned, owned, and operated by other public agencies or the private sector. In an era of uncertain revenue streams and increasing demands for accountability, for a state DOT to commit to broadening its mission by funding non-road investments is challenging.

Some DOTs face a different challenge—pressure to narrow the DOT mission to include responsibility for only the most strategic roads within the state. This can mean looking for strategies that will enable the agency to divest portions of the road system to local agencies or contracting out responsibility for core operating and maintenance functions, with the agency becoming more of a broker of services than a direct provider.

Whatever its mission is, the state DOT of the 21st century cannot delegate its leadership role in ensuring that the state's transportation system functions to support quality of life for its citizens. Planning in the 21st century should support DOT executive leaders as they grapple with the difficult challenges faced by the DOT. Effective support requires a comprehensive planning process that is both mode and ownership neutral. State DOT planners can take a leadership role in bringing the variety of transportation providers in a state or region together and facilitating a neutral evaluation of the state's transportation needs and the potential solutions. This approach is significantly different from the compartmentalized, needs-based planning of the 20th century.

To respond to this change, 21st century transportation planners should

- Serve as transportation visionaries addressing "big picture" issues in transitioning to an integrated, "multimodal" agency.
- Understand their role in administering the state's transportation system in collaboration with other state and local agencies and private-sector transportation vendors and contractors.
- Understand their state's governance as it relates to the DOT's multimodal roles, whether in terms of ownership, regulations, investment, policy influence, or merely "interest."
- Efficiently manage and assess the quality of outside vendors hired to build or operate transportation facilities.
- Continue to break down the "modal silos" operating within state DOTs.

- Gather and present multimodal needs and information in understandable terms to decision makers, stakeholders, partners, and private-sector transportation facility owners and operators.
- Communicate critical information regarding the outcomes, benefits, and consequences of investing resources across modes.
- Communicate expected performance outcomes to be achieved with available funding to modal partners, the public, and other levels of government.
- Identify opportunities to improve the interaction, coordination, and interoperability of various modes, leading to a more integrated transportation network and stronger relationships with local, regional, and private-sector transportation agencies.

Introduction

Across the United States, many state DOTs are still evolving from being highway departments to becoming multimodal agencies. Nearly all state DOTs are seeing their roles change with respect to various modes.

Many state DOTs are evolving from being highway departments to becoming full-service transportation agencies that assume a responsibility in other modes and interact with private-sector transportation facility owners and operators. Revenue issues continue to complicate the dialogue about multimodal roles. States may need to be ready to take on a larger role in transit, rail, and other modes at a time when state DOTs are struggling financially to maintain their existing system and assets, which usually consists of the state highway system.

DOTs will continue to struggle with defining what a "multimodal" agency might be. Currently, many states have sections or offices within the DOT or separate (non-DOT) agencies that deal with modes. Their role in non-highway modes will continue as regulator (e.g., truck size and weight or rail crossing regulations), policy partner, funding provider or funding distributor if monies come from federal agencies (e.g., the FAA, the FTA, or the FRA), advocate, or partner. Fewer modal offices or sections, however, will be operating as silos with independence from state DOT offices. Coordination between these modal offices and state planning staff can and will continue to vary. Statewide planners should help their agency transition into an integrated multimodal agency, as they are able to look at the "big picture," while others may focus only on their mode or organizational activities.

DOTs will continue to try to leverage funds with local, regional, and private partners. DOTs will look to make the best use of limited or diminishing staff resources by considering outsourcing the design, construction, operation, and maintenance of facilities they own and operate. Although they may also outsource some planning activities, the state DOT roles and responsibilities for defining vision and goals and for regulating the system and service providers should increase in importance.

Today and in the future, local governments, private-sector investors, and modal providers (such as railroads and airports) are contributing larger percentages of funding to advance their preferred projects. When they are bringing money to the table, they expect to have a role in state's transportation decision-making processes. DOT partnerships with other public and private entities should be accompanied by a transparent negotiation of decision-making roles and responsibilities.

The discussion of roles between a DOT and its partners (ownership, investment, policy influence, or merely "interest") should also include a conversation about governance. Governance involves identification of the primary policy champion and decision maker for facilities within a jurisdiction. Currently, a common dialogue regarding governance involves the state's role and influence within larger MPO areas. Many MPOs want more decision-making authority over

ADOT's role is defined in terms of both decision-making and funding responsibility. The roles reflected in the Plan are not necessarily the role that ADOT has in 2011; rather, they are roles ADOT will undertake by 2035 to implement the Plan. Four distinct roles were identified:

- **Owner-operator:** ADOT is responsible for maintaining, operating, and enhancing infrastructure to achieve the goal and related objectives.
- **Partner:** ADOT will partner with others and will share a role in funding and decisionmaking to achieve the goal and related objectives.
- **Participant:** ADOT will support public and private transportation delivery entities by providing policy support, guidelines, and/or complementary and opportunistic funding to advance the goals and objectives of the Plan.
- **None:** ADOT does not participate in funding or decisionmaking and will not engage in this over the life of the Plan.

Figure 2. Example of LRTP to define roles from ADOT.[7]

a range of important areas that influence the transportation system. Local agencies are closer and more accountable to community leaders and stakeholders and feel a need to have a strong influence on areas that impact the performance of the transportation system, including transportation project implementation, land use, education, and taxation. State DOTs, on the other hand, are responsible for the statewide transportation program and often retain ownership of major roads and bridges. Because of this ownership and responsibility, state DOT leaders can be reluctant to share policy influence and decision-making authority over their system with other agencies. Finding the right balance of decision-making authority can be difficult and requires careful discussion and area-by-area negotiation.

Governance discussions have taken place in several states, including Georgia, North Carolina, Pennsylvania, Illinois, Arizona, and California. In the future, states can expect more dialogue on this topic during development of LRTPs as advocates for multimodalism have greater participation in the planning process. Planners will need tools and policies to address questions regarding governance with answers that are in the public's best interest. Arizona is a recent example of a state that used its LRTP update to initiate a public dialogue over the Arizona DOT's (ADOT's) future role in each mode (see an excerpt from the ADOT plan in Figure 2). Table 1 shows an excerpt of ADOT's LRTP goals and shows how ADOT identifies its role by mode within each goal area. ADOT recast the discussion of its financial responsibility by focusing the discussion on the appropriate long-term role for the DOT in various modes. This explicit discussion of its future role enabled the ADOT to define both its intent to provide funding in the future and its corresponding expectation for a role in decisionmaking.

Processes Needed to Support the Strategy

State DOTs need information for the discussion of roles by mode. State DOT planners should provide this information, bring the stakeholders to the table, and frame and encourage discussions of the following:

- **Modal silos.** Planners should work diligently to break down modal silos and encourage discussions among planners at all levels of government.

[7]Material in Figure 2 is excerpted from ADOT, *What Moves You Arizona: Long-Range Transportation Plan|2010–2035*, November 2011, p. 32.

Table 1. Excerpt showing ADOT's identification of its role by mode in a sample of LRTP goal areas.[8]

Plan Goal	ADOT's Role
Improve Mobility and Accessibility	
Implement critical and cost-effective investments in infrastructure to expand access to transportation and optimize mobility and reliability in the transportation of passengers and freight.	Highways: Owner/Operator Urban Transit: Participant Rural Transit: Partner Passenger Rail: Participant Freight Rail: Participant Air: Participant Bicycle/Pedestrian: Partner
System Preservation and Maintenance	
Maintain, preserve, and extend the service life of existing and future State Transportation System infrastructure.	Highways: Owner/Operator Urban Transit: None Rural Transit: Partner Passenger Rail: None Freight Rail: None Air: Participant Bicycle/Pedestrian: None
Support Economic Growth	
Develop and operate a State Transportation System that provides predictable freight and people movement throughout the State to create/retain jobs and support a competitive and thriving economy for Arizona.	Highways: Owner/Operator Urban Transit: Participant Rural Transit: Participant Passenger Rail: Participant Freight Rail: Participant Air: Participant Bicycle/Pedestrian: Participant

- **Cost efficiencies.** Planners should evaluate the benefits and risks associated with how the transportation system of the future should be funded, built, and operated.
- **Needs estimation.** Critical to the discussion of roles and responsibilities is the extent of long-range needs by mode, especially for the non-highway modes.
- **Financial planning.** Decision makers and stakeholders need information about available funding and the financial commitments the DOT is willing to make. This includes information on the revenue sources for non-highway modes; available funding for the short term, mid-term, and long term; whether private investment is a possibility; and in the case of private capital use, the amount of debt that exists. The 21st century planner should be prepared to supply this information.
- **Mode-neutral investment scenarios.** Planners should find ways to express the critical information and talk about the outcomes and consequences of investing resources across modes.

Required for Success

Various types of data, tools, and analysis are needed by the 21st century DOT transportation planner:

- Needs analysis for each mode and how they affect each other, including the need to integrate the plans of the various modes (capital improvement, service, and long range where they

[8]Table 1 is adapted from Table 3-2: bqAZ Goals, Plan Goals, and ADOT's Role, ADOT, *What Moves You Arizona: Long-Range Transportation Plan|2010–2035*, November 2011, p. 33.

exist). This analysis can be both a source of data and an opportunity to eliminate silos and create partnerships and processes to ensure consistency and coordination among the modes for both transportation improvements and funding.
- Revenue estimation models—spreadsheet-based models that are flexible and transparent.
- Revenue constraints—information on not only the maximum yield on current revenue streams but also the political and economic realities of making changes to and adding new revenue streams.
- Cost efficiency analysis—evaluating who can build or operate a transportation facility most cost efficiently.
- Political knowledge of existing roles in governance and the potential evolution of these governance roles.

Relationships and Stakeholders Involved

The move toward a more active state DOT role in other transportation modes requires buy-in from system owners and operators, private partners and stakeholders, and in some cases the public. Stakeholders (and the public) generally are not aware of which entity owns and operates various modes of the transportation system; they just want it to work. Thus, introduction of a significant change in the state DOT role in other modes can be met with public and stakeholder concern about what such a change might mean for them. Attempting to shift/change roles requires stakeholders' understanding and state DOT agreements. Even financial contributors who do not expect a share of decision-making authority for their contribution may want to have a say in deciding outcomes to be achieved.

States and operating authorities must be able to explain benefits, risks, and other challenges in terms the public can understand and view as an overall gain. If having a stronger state role in passenger rail, for example, means improved/expanded service and a sustainable funding stream, the concept stands a better chance of being embraced. If the impact is negligible and translates only into administrative duties that have little effect on the quality of the transportation service (as perceived by the public), agencies can expect minimal interest or significant pushback. Alternatively, if the stronger state role in another mode results in a significant unexpected reduction in funding for highways without serious dialogue and building of consensus with stakeholders, DOT agencies can expect serious resistance.

Critical to the stakeholder discussion is the identification of a plan champion—a person in a position of authority at the state DOT who is held in high regard and will carry the banner for what the LRTP and planning represent. Planners must also demonstrate that the plan links to the state's vision and goals. Even in a scenario that includes outsourcing, the role of the DOT is to set the vision for the transportation system.

Challenges

Several challenges will emerge for those state DOTs that explore expanding their role in other modes or divesting the DOT of responsibility for some of the highway infrastructure:

- Revenue remains a central issue. As 21st century planning evolves, adequacy of revenues and the accurate prediction of future revenues are the most important issues affecting the effective use of transportation revenues and the role states can and should assume on the investment or ownership side.
- Presenting revenue information to stakeholders can be a challenge. Questions surrounding legal, even state constitutional, constraints for providing or funding each mode or divesting parts of the system must be presented in clear and understandable terms. Stakeholders should

be able to grasp the effect on their immediate transportation service quality and how changes might impact their quality of life.
- Replacing the historic knowledge and skill sets of retiring, experienced state DOT planning staff and other technical staff may be a challenge, as will be enhancing contract management and quality control assessment skills for state DOT staff.
- Creating mode-neutral project prioritization processes that will allocate limited funds across a broad range of competing needs will be difficult.
- Strong and consistent high-level leadership will be needed to bring the broad range of public and private providers to the table for a robust, policy-driven discussion of governance roles and responsibilities.

Strategic Decision #5: Internally Integrated Planning

What Is Different?

Traditional DOT departmental and modal silos are beginning to disappear. Individual offices and divisions, previously working independently on projects, programs, or analysis, are beginning to recognize that advancing the agency's vision and goals requires sharing information and setting a complementary direction or multimodal, coordinated action plan. Mid-range plans are needed by state DOTs to bridge the gap between the long-range planning (20+ years) developed by statewide planners and the short-range operational budgetary planning (1 to 3 years) completed by the functional units. The information-sharing and decisionmaking vital to the development of these mid-range plans must be integrated across the agency rather than remain in departmental or modal silos.

To respond to this change, 21st century transportation planners should

- Broaden planning from the traditional long-range focus on new road construction to incorporate consideration and integration of maintenance, preservation, and modernization of existing facilities across modes and into mid- and long-range plans.
- Facilitate discussions among DOT offices and divisions and provide analysis and technical assistance for coordinated short-, mid-, and long-range planning and the resulting decisionmaking efforts.
- Remove or work to remove silos by facilitating a holistic mid-range planning approach that coordinates asset management, operational improvements, targeted construction improvements, and funding while including all modes of transportation.
- Identify duplicative efforts in data collection and analysis that can be consolidated to save limited funding and staff resources for other important issues.

Introduction

To adequately prepare the transportation system to accommodate the social, environmental, economic, and transportation needs of 25, 35, or more years in the future, state DOTs should take a deep look at their internal structure. Agencies should visualize what DOTs of the 21st century will look like. A DOT can no longer be an organization managed by a loosely coordinated group of independent departments, each addressing only a small part of the entire multimodal transportation system. The DOT organization should be integrated and coordinated, with every department office and division working in unison to achieve the same systemwide transportation vision and goals.

> Change is no longer an option—it is a necessity—if the current generation of transportation leaders and staff are to provide a modern transportation system over the next 20 to 30 years that is equal to the one they inherited.

Emerging trends indicate that transportation in the 21st century should be more inclusive of all modes of transportation rather than just focused on highways, as it has traditionally been. Further, even for highways, the focus is shifting from new construction or new alignment to maintenance, preservation, modernization, and targeted capacity expansion of existing facilities. In the 21st century, DOTs should improve operational uses of new technologies, such as automated vehicle guidance systems, to "squeeze out" the remaining capacity of the system. In the 21st century, scenarios should be analyzed with the most current data and information, using fewer staff resources, to make more time-sensitive decisions. State DOTs should respond to the general public's and specific community's interests by providing planning and financial support for "less traditional" improvements, such as sidewalks, multiuse paths, and paratransit services.

Planning has traditionally focused on the long term (20+ years). Most often, the operations and maintenance functions of the state DOT have focused on short-term planning, usually a budgetary cycle with 1- to 3-year time frames. Grasping the relevance of long-range planning to their day-to-day responsibilities may be difficult for operations and maintenance staff. Focusing on the development of a mid-range plan or plans can address the question: "How can the state DOT improve in the future by coordinating asset management, operational improvements, and targeted capital improvements and what funding is necessary to make that happen?" Planners have the skills and the organization-wide perspective to bring the various parts of the DOT together to look more holistically at this mid-range planning.

In the 21st century, it is essential that state DOT planners involve representatives from operations, maintenance, and modal offices in developing the vision, goals, and performance measures for the DOT during development of the LRTP. Involving these representatives can occur through an internal team or stakeholder process. However it is accomplished, staff from these areas of the state DOT must bring their knowledge of short-term needs and priorities to long-range planning and understand how their processes need to be coordinated with both mid-term and long-term planning.

Processes Needed to Support the Strategy

To help develop plans that bridge the gap between long-range planning (20+ years) and short-range operational budgetary planning (1 to 3 years), a state DOT planner should either own or actively support several different tasks or processes. With new requirements for performance-based planning, state DOT planners should have a role in ensuring that all offices within the state DOT understand the statewide transportation goals and objectives advanced by leadership and presented in the LRTP. All offices should develop and implement their programs accordingly. Planning offices should establish processes to assess the outcomes achieved from programs and projects implemented throughout the DOT. State DOT planners can take the lead by serving as conveners and facilitators, including designing a coordination process and providing protocols to coordinate the analyses required to fully integrate planning into all aspects of a state DOT and across all planning timeframes. The 21st century planner can expand on traditional planning processes to consider additional areas of emphasis, including (but not limited to):

- **Expectations and constraints.** State DOT planners must have open communication with top leadership to understand and adapt to the expectations and constraints of the DOT leadership team.
- **Opportunities for data sharing.** State DOT planners should lead efforts to coordinate the sharing of geospatial and other data to expedite analysis and decisionmaking for the DOT when examining programs or projects.
- **Linking planning and operations.** In the 21st century, state DOT planners must incorporate the full range of strategies available to address transportation problems. Operational

improvements, from small-scale bottleneck improvements to major technology investments, can make a significant contribution to improving short-, mid- and long-term reliability of the overall transportation system. Planners can take the lead in developing the processes, revenue/financial planning tools, analysis techniques, and data protocols to integrate operational strategies into mid- and long-range plans with a primary focus on answering the question of how much of the existing congestion or reliability problem can be addressed with an operational fix.

- **Mid-range financial planning.** Operations staff often struggle with identifying funding needs and revenue sources beyond the short-term budget cycle. Because of their experience in developing financial plans for LRTPs, state DOT planners can assist or take the lead in developing financial models to support the implementation of operational strategies that are included in mid-range plans.
- **Integrating transportation asset management (TAM).** Working as part of a team performing TAM, a state DOT planner can help facilitate discussions concerning the data collection needs and the accuracy and timeliness of the data collected. In addition, in cooperation with TAM staff, state DOT planners can develop service life and service standards that will enable lifecycle cost projections to be developed to support mid- and long-range resource allocation recommendations.
- **Data sharing.** Compartmentalized data collection and maintenance processes must be redesigned or eliminated. Data sharing should become the norm because it can result in costs savings for the DOT, which is especially important when resources are scarce. Data sharing will also eliminate the chances of data discrepancies between various parts of the agency.
- **Coordinating the LRTP process internally.** State DOT planners should coordinate with all internal offices to ensure that they understand the importance of their participation in the LRTP process, which can enhance consideration of their needs. State DOT planners should share ownership of the LRTP with other offices in the DOT, which will enhance the importance of the document. Rather than completing the LRTP just to satisfy the federal mandate, state DOT planners should ensure that the LRTP serves as the foundation for multimodal decisionmaking across the DOT.
- **Addressing risks to the transportation system.** DOTs should continue to provide a core need: the ability to travel easily to meet the daily needs of the individual, the community, the state, and the nation. Many factors or events can place this ability at risk—whether a short-term delay related to a breakdown in a congested corridor or a major cost overrun on a project that affects the ability to make other improvements. To prepare for such scenarios, the DOT of the future should embed a "risk management" mentality in every decision made. State DOT planners in the 21st century should integrate risk assessment techniques into the traditional planning process. The consideration of alternatives and policy debate over investment strategies must include a discussion of what happens if conditions change or assumptions are not correct. DOTs also should take a more proactive approach to preparing for unforeseen events. State DOT planners can advocate for and facilitate DOT participation in emergency management planning at the state level and potentially support regional DOT office participation in more locally focused emergency planning. Such participation would help ensure that the DOT is prepared to respond effectively in any emergency. In addition, such participation can help planners understand and incorporate proactive or preventive strategies into mid- and long-term plans to help minimize the potential adverse impacts of unforeseen events on the transportation system.

Required for Success

Many state DOTs have invested in sophisticated management systems to help inventory conditions and provide information to support their decisionmaking. For internally integrated

planning, *having data is not the issue.* The real issues to be addressed in the future are determining which of the many data sets available should be used; establishing the processes and protocols to share these data; and identifying the analysis techniques that allow the data to be communicated effectively to inform policy decisions about program funding allocation and project selection to maximize the overall system benefits.

With performance-based planning, this integrated decisionmaking will continue to be an emerging area of practice. Some agencies have made progress in linking planning-level goals and investment strategies to mid- and short-term program allocations and project selection. The Minnesota DOT and the Maryland State Highway Administration are two examples. As performance-based planning and programming evolve, more information regarding successful practices will be available from FHWA and AASHTO.

Relationships and Stakeholders Involved

A 21st century planner will need to work with all internal offices within a state DOT. Building relationships between the state DOT planners and other internal offices will allow for meaningful, open dialogue that can help in identifying common project and program strategies that will optimize the outcomes that can be achieved with limited funding. With staff reductions becoming increasingly common at DOTs, it has become important to leverage the relationships between the state DOT planning office and other DOT offices.

Collaborative efforts facilitated by state DOT planners can also help all internal offices within a state DOT better understand non-transportation priorities established through collaboration with other state and local agencies. DOT decisionmaking is no longer just about transportation: it is about the bigger picture of how transportation supports the goals of other agencies and jurisdictions. As such, the state DOT planner can bring external discussions of vision, mission, and goals into the DOT so that staff across the agency better understand the DOT's position vis-a-vis other statewide and community plans. This coordination can result in better cooperation at the project staff level for permitting, easements, and other responsibilities involving other state agencies.

Challenges

State DOT planners may encounter several challenges when trying to integrate planning across the agency and into other internal DOT processes:

- Overcoming silos and the "This is the way we have always done it" syndrome.
- Adapting to new organizational structures that may emerge as the internal working relationships evolve.
- Fear of sharing information/data that would result in a "loss of control" within the organization.
- Insufficient data, inadequate data, or multiple sets of data from different sources.
- Unwillingness to house data in an accessible common location for internal use across the agency.
- Unwillingness to participate in redesigning processes and restructuring responsibilities to achieve alignment.
- Advocating and communicating the importance of establishing new relationships with a broad range of state and local partners.
- Staffing issues, including turnover of experienced staff and how to manage new responsibilities with constrained staff resources.
- Funding constraints or reduced funding.
- Transitioning to "multimodal" thinking.

Strategic Decision #6: Externally Integrated Planning

What Is Different?

In the 21st century, decision makers and the public expect investments in transportation to advance a broad range of both transportation and non-transportation goals. Understanding how transportation can advance economic development, environmental, or public health goals, for example, should begin in planning where the expectations for these non-transportation outcomes can be balanced with investments in desired transportation performance. Coordination and collaboration with state agencies, local governments, and federal funding partners, as well as private-sector transportation providers, are essential. DOTs and MPOs are more likely to achieve outcomes as required in MAP-21 if they work together in developing their goals, objectives, performance measures, and targets.

Planners in the 21st century should be prepared to bring other agencies and partners into their planning process and be willing to participate in planning led by their partners. Planners should recognize and support the diverse missions of all the players and help facilitate the discussions needed to coordinate goals and outcomes in order to maximize the investments for society as a whole.

To advance externally integrated planning, 21st century transportation planners should be able to

- Communicate and work with transportation and non-transportation agencies and stakeholders at various levels to understand their issues and concerns.
- Develop new planning tools to create multiple future scenarios that are quickly responsive to changing conditions in the economy, society, logistics, and government to aid decision makers and contribute to the development of coordinated national, statewide, and local visions and planning efforts.

Introduction

Externally integrated planning is about linking transportation planning with the visions, goals, performance outcomes, and plans of a wide range of related planning processes. The SHRP 2 PlanWorks[9] website describes integrated planning as "a way to make transportation decisions that will be supported because they are based on the community's vision and goals as well as protecting and enhancing the human and natural environment."[10]

Some examples of related and external processes to include in integrated planning are

- Land use
- Natural environment
- Capital improvements
- Economy
- Human environment
- Air quality conformity
- Safety
- Security
- Greenhouse gas
- Freight

[9]The SHRP 2 PlanWorks is currently known as "Transportation for Communities: Advancing Projects through Partnerships (TCAPP)."
[10]http://www.transportationforcommunities.com/shrpc01/subapplications/2/0.

This list is not comprehensive—in some states and regions, other specific external processes exist or may emerge in the future.

Conducting external outreach and performing integrated planning should lead to transportation decisions that will be supported by communities because they are based on community visions and goals and are designed to proactively address regulations that protect and enhance the human and natural environment. Transportation planning inherently incorporates external collaboration by recognizing the critical links between transportation and other societal goals. To understand these societal goals now and in the future, the state DOT should reach outward to meaningfully engage agencies and communities to understand their plans, and engage stakeholders to understand their viewpoints, perspectives, and agendas. Coordination and collaboration within the DOT, with other agencies (state, local, and federal), and with interested parties can improve the contribution of the transportation system to achieving future livability, sustainability, economic prosperity, education, human services, environment goals, as well as other goals and visions.

Transportation can both drive and support the achievements, depending on the focus and vision of the state's governor, the local government vision for the community, and legislative initiatives. For example, transportation improvements in rail, transit, traffic operations efficiencies, and vehicle emissions, in concert, can support air quality improvements and a reduction in greenhouse gases, which contribute to climate change. Just reducing highway construction without understanding its role and contributions to solving non-transportation problems, however, may not achieve the desired results. Transportation improvements can also drive growth. An example of this would be the development of the Appalachian Highway System in the second half of the 20th century. Areas of Appalachia where four-lane highway improvements were made saw reductions in poverty levels and improvements in quality-of-life parameters ranging from education to medical care.

Processes Needed to Support the Strategy

External collaboration during planning can help identify agency goals and priorities and stakeholder opinions; can determine trade-offs between alternative solutions: and can provide forward-looking intelligence on emerging issues, changing demographics, and new technologies. To make external collaboration happen, 21st century planners should understand how to communicate and work with all types of agencies and stakeholders at various levels by being aware of their issues and concerns, both those related to transportation and those that are not. Planners should be able to bridge technology gaps between those who are technically savvy and those who are challenged by technologies. Communication of transportation information should effectively balance the need for contextual information with the need to be concise and clear. Information may sometimes need to be packaged into just a few sentences for delivery through social media channels; in these cases, considering how to communicate the right amount of information to support the DOT's key goals is especially important. For better or worse, opinions shared through social media can rapidly influence policy direction, and this process is expected to move even faster in the future as social networking becomes more sophisticated and farther reaching.

Sometimes DOT staff are invited to participate in a related planning process as a stakeholder. Common examples include development of an MPO long-range transportation plan, land use or economic development plans, or conservation plans. DOTs should commit the time to participate in the development of these plans. When the DOT is represented as a stakeholder in a related planning process, the final plan is more likely to be consistent and coordinated with transportation solutions and outcomes, making it easier to integrate the products and decisions of that related plan into the transportation plan.

When the DOT is developing its LRTP, the DOT should ensure that it is building on plans developed by its partners, whether or not the DOT was a stakeholder in that planning process. The integrated planning applications available in PlanWorks provide specific examples of how the data, analysis, and decisions that are developed during a related planning process can be used to inform long-range, corridor, and National Environmental Policy Act (NEPA) planning processes. Processes and tools for both external outreach and integrated planning and links to additional resources can be found on the FHWA PlanWorks website. The site has many examples demonstrating why 21st century planners should care about multidisciplinary topics. A few examples are provided below:

- **Land use and smart growth.** Land use and transportation directly impact one another: The location and density of development affects travel demand, and the number and location of access points influence land development patterns and growth. Anticipated changes in land use patterns can result in increased demand for transportation capacity. Collaborative participation of land use stakeholders in transportation decisionmaking, and vice versa, is necessary to ensure that land use and transportation decisions are mutually supportive.
- **Natural environment.** Federal regulations require planners to "protect and enhance the environment." Although major transportation projects must comply with the provisions of NEPA, the broader goal for environmental integration is streamlined transportation decisions with better outcomes for the natural environment. Outreach and integration can result in preventing impacts on priority conservation areas during pre-NEPA planning; mitigation that achieves the greatest benefit to multiple resources; and more efficient and effective compliance with resource protection laws.
- **Capital improvement.** Capital improvement planning identifies and prioritizes investments in local infrastructure, such as utilities, sidewalks and bike ways, schools, transit capital, and locally funded roads. DOT collaboration with this local planning effort ensures that long-range and corridor planning and funding decisions are coordinated with locally planned investments. In addition, partnering can help stretch limited funding to meet common needs and goals.
- **Human environment.** Human environment encompasses the issues of community characteristics, values, and vision that affect human well-being, including health and quality of life. Integration of human environmental data and information helps ensure local support for plans and projects. Linking human environmental analyses with transportation decisionmaking allows for sharing information at key decision points for planning and environmental review.
- **Economic development.** Transportation connects workers, consumers, businesses, and resources—key components of economic activity. Nevertheless, changes in transportation facilities and services can produce both winners and losers. Collaboration with economic development stakeholders enables transportation decisionmaking and economic development efforts to align, maximizing investments in both.

More information on the rationale for and benefits of an integrated approach for these external plans/issues can be found at PlanWorks.[11]

Required for Success

As new issues emerge, planners will need to identify the effects *of* transportation on an issue, the effects *on* transportation of the issue, and transportation's response to the issue while also understanding the financial implications of any range of responses. Although planners do this today, new tools will need to be developed that can quickly create multiple future scenarios that are responsive to rapid changes in the economy, society, logistics, and government to aid

[11]http://transportationforcommunities.com/.

decision makers and contribute to the development of national, statewide, and local visions and planning efforts.

Planning offices normally house considerable amounts of data and can develop forecasting methods and processes to make that data useful and available to external state agencies, MPOs and RPOs, and internal DOT offices. All these stakeholders have a similar interest in planning products: they want answers (if not answers, then scenarios) regarding what changes can be expected in the future, how those changes affect their interests, and how transportation contributes to future changes.

Sharing geospatial databases (e.g., GIS) can expedite analysis and decisionmaking by agencies when they are examining the effects of transportation on agency programs or projects. In order to share data, agencies should have secure common platforms to view and analyze the information and must trust the data, its sources, and users.

In addition to accessing data that are in the public domain, planners should find sources of and ways to access and analyze private-sector transportation data (e.g., freight shippers' manifests and logistics information) without jeopardizing proprietary rights. Developing strong relationships and trust are critical for gaining access to these data. Alternatively, a DOT could negotiate data purchase agreements that satisfy private-sector concerns by placing restrictions on data use.

In addition to the data needs identified above, 21st century DOT planners should develop new skills or enhance current skills. In addition to their traditional professional planning skills, 21st century planners should be highly proficient in GIS analysis, political science, journalism, and marketing to support robust external outreach. Good communication skills—including listening, speaking, and both technical and nontechnical writing abilities—along with dispute resolution training, computer proficiency, and media marketing are more valuable than ever for DOT planners.

DOT customers and stakeholders are a diverse cross-section of the population and thus have different preferences in terms of communication, including preferred language and media type. During the next 50 years, the United States is projected to become more culturally diverse. To address this diversity, planners will evolve from using simple paper documents to communicate planning information to more visual and multilingual presentations. Part of this evolution will involve the use of social media, which presents a new opportunity to transportation agencies. Social media will bring real-time communications to large groups of virtual subscribers. This technology continues to evolve rapidly to meet the demands of diverse users, redefining how people spend time and access information, and revolutionizing how businesses interact with their client base.

State and local agencies have visions and goals that transportation can support or influence, depending on the benefits and consequences. Planners must understand these visions and goals and the acronyms and "techno-speak" of various agencies, as well as how transportation can support an agency's goals (e.g., improve water quality with a reduction of transportation-related pollutants from highway runoff) or influence their goals (e.g., proactively engaging with development interests to optimize transportation infrastructure).

Relationships and Stakeholders Involved

External planning integration requires developing relationships to engage stakeholders and partners and facilitating discussions among a wide range of diverse partners, a process that will be much more complex than the already complex planning process in place today. The number and range of issues related to transportation are increasing, and each new topic brings its own unique stakeholders that should be tapped for their perspectives and interests. Planners should be proactive in addressing emerging issues by evaluating who needs to be involved in the

planning process, understanding their individual interests, and creating a process that allows all to be included while still managing to deliver plans and STIPs within defined deadlines. Planners should think more expansively, engage in creative outreach processes, and monitor best practices and new approaches to develop the externally integrated plans that will be required in the 21st century. The PlanWorks website includes a stakeholder assessment tool that can help agencies think more broadly when identifying and working with new stakeholders.

It will be particularly important to develop relationships with technical professionals across a spectrum of disciplines. These individuals have access to the data and understand the technical underpinnings of the plans that have been produced. Not only will developing these types of relationships support coordination during the planning processes, but doing so will also leverage existing data and analyses, potentially saving time and money during transportation planning.

Challenges

State DOT planners may encounter several challenges when trying to integrate transportation planning with external planning processes:

- Bringing distinct but related processes together involves considerable integration of data and technical processes. "Smoothing the differences" among processes, data, and technical analyses can be difficult, and planners will need to be technically creative and open and transparent about the assumptions and limitations of their efforts.
- Technical planning processes can be integrated, but doing so does not necessarily mean that transportation decision makers will give non-transportation considerations much weight in their policy decisionmaking. Leadership champions and advocates in planning will need to explain the benefits of integrated planning to DOT decision makers.
- Well-planned, well-executed partner and stakeholder involvement efforts require a substantial commitment of time, money, and staff resources.
- Across all DOT processes, there is a greater expectation of transparency; this increases demands, expectations, and the visibility of external integrated planning efforts.
- Local officials, other agencies, and planners in other fields may be reluctant to partner with the DOT to integrate their decisionmaking. Commonly, this reluctance is due to poor relations in the past or limited resources. This reluctance to partner may challenge planners in creating and maintaining the relationships necessary to successfully reach out and integrate with other areas. Transportation planners may need to design an incremental approach to building or rebuilding relationships, and the DOT will need to demonstrate that investments in this kind of planning will tangibly benefit both agencies.

Strategic Decision #7: Revenue and Financial Planning

What Is Different?

DOT plans and programs are based on estimates of future revenue. Traditionally, transportation funds for building and maintaining infrastructure have been generated by dedicated state and federal transportation-related taxes. These relatively stable and predictable sources of funding enabled agencies to estimate the level of funding that would be available to support their annual budgets, the lives of their STIPs, and even the timeframe of their 20- to 30-year long-range plans. Over the past 15 years, these revenue sources have become much more unpredictable. Revenue generated from gasoline taxes has declined because of the tightening of Corporate Average Fuel Economy standards and the increasing shift to alternative-fuel vehicles. It is predicted that neither trend will level off in the foreseeable future.

In the 20th century, the public and politicians were generally amenable to increasing taxes to support transportation. In the 21st century, however, federal transportation-related taxes and fees are no longer sufficient to maintain stable funding from the Highway Trust Fund, which now requires transfers from the General Fund to stabilize outlays year to year. Yet politicians and the public have shown little appetite for increasing state or federal taxes to support transportation improvements.

In the 21st century, revenue planning is more complex. DOTs should be prepared to demonstrate good stewardship of existing funds, develop creative partnerships to generate new non-tax revenue, and communicate to the public and politicians accountability for existing funds and a fact-based estimate of needs before any increase in taxes will have a chance for success.

To respond to these changes, 21st century transportation planners should encourage and support a more holistic DOT approach to revenue and financial planning that includes the following:

- Demonstrating **efficient and effective operational management** by
  - Emphasizing transparency and accountability, including implementing dashboards or other techniques to communicate measurable results of investment of current revenue.
  - Understanding and communicating cost savings from the implementation of concepts such as practical design, practical solutions, least-cost planning, and project "right sizing."
  - Implementing and communicating cost savings from organizational management improvements, such as process streamlining, reducing duplication in functions, waste reduction, and energy efficiency.
- Demonstrating **strong and credible financial management**, such as
  - Using revenue estimation models (spreadsheet-based models that are flexible and transparent to predict revenue streams).
  - Using cash flow models (spreadsheet-based models that estimate the spend-out of the capital program to predict cash needed to pay agency expenses and invoices).
  - Providing credible data to support financial analyses that are transparent, thorough, and comprehensible, and include all modes.
  - Communicating revenue forecasts and future revenue generation ramifications to policy and decision makers, elected officials, stakeholders, and the public in a concise and understandable way.
- Demonstrating **strong local and regional funding partnerships** by
  - Communicating the need for and implementing strategies that expand funding participation in transportation projects at the local and regional levels.
  - Being prepared to adapt decision-making roles and responsibilities to accommodate the priorities and needs of new funding partners.
- Demonstrating an understanding of the full suite of **innovative and private-sector financing** techniques and the pros and cons of applying them within the state.

Introduction

At the core of transportation delivery are the questions "How much money do we have to fulfill our mission?" and "Will this available funding sufficiently provide for 21st century transportation?" Certainly these questions are more complicated given the conditions of today's transportation infrastructure. Recent studies have indicated that America's infrastructure is crumbling and will continue to do so in the future.[12,13] State DOTs will likely continue to face

[12] *Improving the Nation's Freight Transportation System*, Findings and Recommendations of the Special Panel on 21st Century Freight Transportation, House Committee on Transportation and Infrastructure, October, 2013, p. 47.
[13] *Building America's Future: Falling Apart and Falling Behind, Transportation Infrastructure Report 2012.* http://www.bafuture.org/pdf/Building-Americas-Future-2012-Report.pdf.

questions and challenges regarding the right or best way to allocate scarce revenues among capital, maintenance, and operating demands, as well as financial directions from executive and legislative political leaders.

The federal gas tax has not been increased since 1993, and since then few states have been able to maintain the buying power of the revenues received from their state gas taxes and user fees. Lack of public support for increasing gas taxes requires DOTs to think more holistically about their strategy for generating revenue. First, DOTs should be able to demonstrate strong operational and financial management. The public needs to be convinced that current revenue is used wisely. A critical reexamination of the full range of DOT programs and services, the realignment of the organization, a redesign of core processes to eliminate duplication and waste, and thoughtful adjustment standards and policies are essential first steps in demonstrating accountability for current revenue.

Second, the DOT should be open to finding new partnerships for funding transportation improvements. In some cases, local jurisdictions are willing to contribute to transportation improvements that align with their local goals. In discussions of shared funding partnerships, a DOT should be open to finding a solution that is optimal for the DOT and the local area even when the solution is not entirely consistent with their original concept. Use of practical design/solutions, acceptance of Complete Streets concepts, and potentially even improvements to support a multimodal solution may bring local funding to the table and address all or part of the DOT agenda. The DOT should be prepared to reconsider decision-making roles and responsibilities to establish a more stable and long-term partnership with local jurisdictions for funding transportation improvements.

Third, the DOT should demonstrate that it has explored and evaluated every potential nontax strategy for paying for transportation improvements. The most common examples include the following:

- **Federal innovative finance tools**, such as Grant Anticipation Revenue Vehicles, advance construction, tapered match, bond conversion, and Transportation Infrastructure Finance and Innovation Act.
- **State financing approaches**, such as infrastructure banks, bonding, cash flow financing, public/private initiatives, and tolling.
- **Local financing measures**, such as increased local government funding participation in projects, and local and regional tax initiatives for both specific transportation/infrastructure improvements and programs.

Increased use of nontraditional and innovative financing methods and partnerships can be expected to become more common during the 21st century. DOT planners should support their leadership by being familiar with the current and emerging financing strategies, how they work, and how much revenue could be generated. In addition, planners should be able to evaluate the pros and cons of applying these financing strategies within their unique state political, economic, and transportation context.

Processes Needed to Support the Strategy

Internal state DOT processes that support revenue and financial planning for transportation will continue to evolve, but no "cookie cutter" combination will work in every state. Each DOT should evaluate its unique set of actors and context to design a revenue generation approach that has the highest potential for success. Practices or tools that could be used are listed below under the general areas of internal operational and financial management, public and private partnerships, and user fee increases.

Internal Operational and Financial Management

Some practices or tools supporting revenue generation in the area of internal operational and financial management are

- **Increasing state DOT accountability.** The state DOT should increase political, stakeholder, and public trust by being accountable for its use of existing revenue through strengthening financial controls and internal auditing, reducing overhead costs, using private-sector contractors for design and implementation effectively, and improving procurement methods.
- **Applying the "right" design.** The decision to use reduced roadway design (called practical design, practical solutions, or project right sizing) or least-cost planning approaches is often a difficult one, but these approaches can provide a successful means of using existing funds more effectively. Reduced roadway design approaches accept a lower level of service on a facility by reducing number of lanes, lane width, design year/life, or design speed. Least-cost planning factors in all costs, including the cost of long-term maintenance, to assess more accurately the real cost of various options for addressing a transportation need. In addition to these design concepts, the "Complete Streets" design approach is a "Practical Solution" that focuses on the safe movement of people of all ages and abilities along and across streets in a community, regardless of their mode of travel. DOT planners can expect that applying the "right" multimodal design approach for project investments will be an emphasis throughout the 21st century.
- **Developing revenue estimates for longer time frames.** Many states are and will continue to be handcuffed by the inability to predict funding availability beyond a few years. Planners can develop the tools to estimate available revenues for a longer horizon.
- **Creating transparent and understandable models.** Revenue estimation models need not be complicated. They should be transparent and easy to explain to elected officials, policy makers, and stakeholders. That each state has complicated laws and policies that regulate the generation and allocation of revenues to a variety of uses is recognized; each process can be documented.
- **Applying cash flow models.** Conversion to a cash flow basis creates a one-time capital program increase, while reducing the visibility of funds on hand; these models reduce funds on hand. Other public officials may incorrectly view funds on hand as "available" without realizing that the funds are already committed to pay existing contracts.

Public and Private Partnerships

Some practices or tools supporting revenue generation in the area of public and private partnerships are

- **Increasing funding participation at the local and regional levels.** Local and regional tax option initiatives for both specific transportation/infrastructure improvements and programs must be embraced by state, regional, and local governments as a substantial element of cooperatively financing projects.
- **Creating public-private partnerships.** Several forms of public-private partnership may continue in the future; however, they can be expected to meet only a small part of the transportation sector's overall revenue and financing needs:
  - Persuading the private sector to build and operate new toll roads under concession agreements.
  - When toll revenues do not cover all costs, forming a public-private partnership under which the private sector collects as much money as possible through tolls, while the public sector provides the balance of the required revenues.
  - Using the revenue from a public toll road to borrow private financing on the domestic or international capital market.

- Partially or fully securitizing an existing public toll road (i.e., selling some or all of the financial interest in the toll road[s] to private-sector interests).
- Entering into lease-back agreements with the private sector under which the private sector builds the road and leases it back to government.
- Encouraging groups to own and operate their own (private) roads through local roads associations.

User Fee Increases

Some practices or tools supporting revenue generation in the area of user fee increases are

- **Using tolling.** Tolling is an effective tool only on facilities with high traffic volumes. Tolling in combination with public or private partnerships for project funding may continue to be a viable option on the next tier of high-volume roadways.
- **Increasing user fees.** Targeted increases in user fees rather than a broad tax increase may be a politically acceptable approach when elected officials understand the need for additional revenue and have public support for increased revenues. This strategy is based on identifying and implementing increases for particular user groups or situations where the rationale can be communicated to tax-averse political leaders. Examples include heavy trucks, congestion pricing, or local option taxation.

Required for Success

Three key technical tools can help planners support strong financial management at DOTs:

- Revenue estimation models, that is, spreadsheet-based models that are flexible and transparent in identifying the predictability of revenue streams as funding sources.
- Cash flow models to estimate the spend-out of the capital program so DOTs can predict how much cash will be needed to pay agency expenses and contractor invoices.
- Performance dashboards to communicate the transparent and effective use of current revenues.

The most basic criterion for judging effective financial planning practice is the rigor and clarity of technical methods. To provide credible, understandable information that will be valuable in the planning process, financial analysis must be thorough and comprehensible, including all categories of system costs, a reasonable expected estimate of future available revenues, forecasting methods, and supporting assumptions. In addition to these technical tools, DOT planners should demonstrate to the public and elected officials that the DOT is being accountable for using revenues as effectively as possible. Accountability can be communicated by using data that show how project investments have improved the performance and safety of the transportation system. More DOTs are using public-facing dashboards to summarize and communicate how current revenue is being invested and the impact that investment is having on the transportation system. DOT planners should be able to help identify the right outcome-focused measures, create the dashboards to report them, and craft the message of DOT accountability and effectiveness supported by data that are understandable and relevant.

Relationships and Stakeholders Involved

Clear communication with stakeholders, partners, and policy makers is an essential part of holistic revenue management. These groups need to understand all the actions that the DOT is taking to address the shortage of funds. Time and cost savings from operational efficiencies should be tracked and reported so that the DOT can build credibility in its stewardship of existing revenue. A proactive approach to communicating the DOT's good financial stewardship should include a comprehensive communications plan that aligns and leverages all of the DOT's external

communications. This role is often filled by the DOT communication or public information office where expertise in public relations, marketing, and communications typically is available. DOT planners can partner with the communication professionals to develop a comprehensive communications campaign and can support these staff by translating planning data into simple, "non-techno-speak" information that will resonate with the various external audiences.

Because of their local contacts, understanding of multimodalism, and strong communication skills, DOT planners also can lay groundwork and help negotiate funding partnerships with local and regional governments. Because the DOT planning staff typically have a key role in working with MPOs and RPOs to develop their Transportation Improvement Program (TIP) requests, planners understand the priorities and needs of these local jurisdictions. In addition, DOT planning staff often participate in or attend local MPO and RPO board meetings and, therefore, have additional information on the potential openness of various local areas to considering state-local funding partnerships.

Finally, implementing public-private partnerships usually results in the DOT forming a team of internal experts who can help identify and evaluate the set of public-private financing mechanisms that are most applicable to its state. DOTs also will need to have or contract for financing experts who can calculate the potential revenue generation expectations for various types of financial mechanisms. Often, special enabling legislation is required to permit tolling or authorize certain types of bonding. The DOT CEO, executive team, and legislative liaison will need to be involved in developing the political strategy necessary. Planners have the analytical and "big picture" thinking to support these efforts.

Challenges

Revenue, properly supported by sound information and analytical tools, will remain the central issue to the delivery of transportation solutions in the future. As 21st century planning evolves, the accurate prediction of future revenues, effective use of existing revenues, cash management techniques, and traditional and innovative techniques to leverage other revenue sources will become the centerpiece of a state's LRTP, capital program, and operating budget.

Equally important will be the way in which this information is presented to policy makers and decision makers, elected officials, and stakeholders. Planners are often accused of thinking about "more money" as the easy answer to transportation investment challenges. A skeptical public will continue to be very reluctant to consider increasing revenues without the state DOT first "making the case" for why more money is needed in an understandable manner. Planners also are sometimes accused of presenting needs estimates that are so large no state could reasonably meet them. This "sky is falling" approach must be scaled back to a realistic, understandable, and defensible program with reasonable project estimates presented along with low-cost policy moves that increase the efficiency and effectiveness of available funding. Other challenges include the following:

- Transparency in financial planning will be a critical attribute. Developing the technical analysis required to provide a comprehensible basis for assessing the impacts and trade-offs of different investment decisions might be difficult.
- Declining revenues caused by tightening fuel efficiency standards and the increasing number of alternative-fueled vehicles will increase the gap between needs and revenues.
- Most local governments also have increasing demands on their public dollars. Making the case that they should begin to pay for transportation improvements that in the past have been paid for fully by state and federal funding will be difficult.
- Defining decision-making roles and authority with new public and private partners could be challenging.

- More than any other strategic decision highlighted in this guidance, holistic revenue management and generation requires the active participation and leadership of the DOT CEO and the alignment of the entire executive team if it is to be implemented successfully.

Strategic Decision #8: Investment Strategy Resource Allocation

What Is Different?

With limited funding and much of the states' highway system built out, investment strategies in the 21st century are evolving through a mode-neutral process that focuses on the lower cost investments needed to improve operations and to preserve and maintain both highway-related and modal transportation assets. The traditional core products of transportation planning (the LRTP and capital program) are expected to evolve into a systematic, holistic, data- and goal-driven process in which resources are allocated to achieve a set of policy-driven performance outcomes.

To respond to this change, 21st century transportation planners should be able to

- Build a strong linkage between the LRTP and capital program using the programmatic investment strategy concept for crafting a plan that includes mode-neutral resource allocation by improvement type without specifically identifying projects.
- Build agreement between the DOT and MPOs regarding levels of investment and expected performance outcomes.
- Facilitate sharing and coordinating project selection criteria between the DOT and MPOs to implement the selected investment strategy.
- Present investment choices in real, understandable, and technically sound terms.
- Obtain data and information regarding other modes (e.g., transit fleets, supporting transit facilities, rail lines, bicycle facilities, intermodal terminals, and water ports) for mode-neutral investment strategies.
- Gain familiarity with new, sophisticated, data-based investment tools developed by the private sector and investment bankers for evaluating risks for public-private partnership projects.

Introduction

In the past 20 years, the traditional core products of transportation planning (the LRTP and capital program) have evolved and are expected to continue to evolve into a systematic, data- and goal-driven process in which resources are allocated to achieve a set of policy-driven performance outcomes. Programmatic investment strategies are a consistent way for planners and agencies to evaluate performance outcomes that result under various trade-off allocations of available dollars.

A variety of terms are used for the concept of programmatic investment strategies, including "Investment Scenarios," "Service Packages," and "Investment Choices." They all mean the same thing: a methodology that allocates long-term projected funding to different investment types, from which performance outcomes can be determined, and the consequences of choice understood. Investment-level resource allocation represents the strategic analysis of macro-level outcomes that can be achieved with the projected long-term revenue. While goals can drive outcomes, and performance measures are being developed to track performance against those goals, the data and analytical techniques needed to implement performance measurement are inadequate to the task. Therefore, even at this very early and strategic

A programmatic investment strategy is a methodology used to understand investment needs and implement consistent and transparent choices to achieve desired system outcomes.

stage of evaluating trade-offs, planners should communicate to decision makers how strategic investment decisions will impact program, and eventually project-level, decisionmaking.

Traditionally, the LRTP and the programmatic investment strategies were primarily highway-oriented capital program activities. Today, many states, with limited funding and much of their highway systems built out, have developed a mode-neutral process—evaluating not only highway capital investments but also the lower cost investments needed to preserve and maintain a range of transportation assets. Transportation funding is allocated to various investment types, the outcomes predicted, and system performance gauged—all without identifying specific projects. For many states using this approach, typical investment categories include the following:

- **Maintenance/operations—**minimal impact, low-cost investments that preserve a facility. Typical improvements are traffic system management, routine maintenance, and facility operation.
- **Preservation—**low-cost improvements that extend service life. Typical improvements include highway resurfacing and rehabilitation; bridge deck rehabilitation; or replacement of deficient bridges, outdated transit vehicles, or railroad track.
- **Modernization—**improvements that impact the functionality, safety, and efficiency of a facility without adding new capacity. Typical improvements include intersection improvements, safety improvements, lane widening, shoulder widening, bridge widening, reconstruction, bi-directional turn lanes, upgrading or adding bikeways and pedestrian accommodations, and integrating ITS-type technology into the system.
- **Expansion—**new facilities to provide better connectivity or major investments that increase capacity. Typical improvements include adding lanes; extending the coverage or level of service for transit; or new light, commuter, or high-speed rail service.

New funding categories may be added to this list in the future as transportation technologies and investment types evolve. In any case, it is likely that fewer dollars will go to traditional highway expansion program areas—a trend that is already underway in many states and regions. Unless federal funding legislation is passed that commits funding availability for longer periods, strategic investment strategies will become short-term plans.

Processes Needed to Support the Strategy

An overall "investment strategy" is created when available resources are assigned to the categories listed above and other investment categories. The performance outcomes associated with each allocation can be calculated. Evaluating choices or trade-offs requires the development of alternative investment strategies and calculating the overall impact on the system (e.g., development of one strategy that emphasizes highway preservation, another that emphasizes expansion, and one that emphasizes multimodal investments). For example, investing transportation resources in Strategy A will result in a 50 percent reduction in the backlog of rough roads and bad bridges, but increase congestion by 25 percent, while Strategy B will reduce congestion by 60 percent, but the backlog of rough pavements and bad bridges will increase by 75 percent. Comparing these choices provides decision makers and the public with tangible evidence of the fiscal and performance realities that the state DOT faces.

An effective programmatic investment strategy defines who holds the authority in setting programmatic investment levels and why.

A critical element of an investment strategy in the 21st century is performance. The strategy then becomes a guide for transportation investment decisions. A strategy that emphasizes highway capacity investments will have decidedly different performance attributes than one that emphasizes highway maintenance or alternative modes. The planning approach that uses the programmatic investment strategy concept as its centerpiece allows the crafting of a plan that includes resource allocation by improvement

type without specifically identifying projects. This approach builds a strong linkage between the plan and capital program, something many states struggle to establish. Project selection becomes a follow-on process in which the project mix in the capital program reflects the plan but is adaptable and provides flexibility to implementers to select individual projects provided the anticipated outcomes are achieved. Improvement in system performance is predictable and expected and is the basis for communicating accountability to both decision makers and the public.

Required for Success

Technical information that is timely and accurate is critical to making informed strategic decisions about resource allocation. Today, with volumes of data seemingly available, decision makers and stakeholders expect quantitative comparisons about investment impacts. Benefit/cost analysis is expected and often required by decision makers before approving investment recommendations. Planning is all about choices and trade-offs, but those choices must be presented in real, understandable, and technically sound terms. Although basic asset management involves determining the current condition of a state's roads and bridges and—somewhat more complicated—projecting deterioration rates far into the future, obtaining similar information about transit fleets, supporting transit facilities, rail lines, bicycle facilities, intermodal terminals, and water ports is a complex challenge. This challenge will have to be solved in order to enable programmatic investment strategies that are multimodal.

New, sophisticated, data-based investment tools are being developed by the private-sector business community and investment bankers pursuing public-private partnership projects for which evaluation of the potential risks involved with investing in transportation facilities is needed. As these tools are refined and shared with the public sector, they will improve the ability to compare investment strategies to identify improvements that make the most financial sense.

Relationships and Stakeholders Involved

Choices about how to invest limited resources can be discussed and debated by the public and policy makers; a recommended investment strategy can become the baseline of the LRTP, and the capital program decisions must be respected and reflected in the plan. Information about the impacts and outcomes that could result from various investment alternatives is best gathered and analyzed during LRTP development by both DOT decision makers and stakeholders. This is the heart of the trade-off process: different investment strategies can be compared, expected performance analyzed, and information presented so that decision makers and policy makers can make informed choices based on the state's direction (goals), input from stakeholders, and sound performance analysis.

Dialogue and consensus building with MPOs within the state also are clearly needed. Particularly with the new focus on performance-based planning and programming, states and MPOs need to be in much closer agreement regarding levels of investment and expected performance outcomes. Both entities also need to share and coordinate project selection criteria to implement the selected investment strategy.

Challenges

As 21st century planning evolves, the mode-neutral resource allocation process will become the centerpiece of a state's LRTP and capital program, provided it is properly supported by sound information and analytical tools. Equally important is the way in which this information is presented to stakeholders. Planners are often accused of speaking in tech-heavy lingo and using terminology that is difficult for the layperson to understand. Planners should strive to present information in a way that can be understood by an informed, educated group of

stakeholders. This may not be possible to fully achieve when presenting highly technical information; nonetheless, an effort should be made to translate such information for the lay audience.

The availability of timely and accurate information about all modes is the supreme challenge in developing the mode-neutral analyses needed to compare the expected outcomes of various investment options, a cornerstone of programmatic investment strategies. Common challenges include the following:

- How to quantify benefits and compare highway improvements versus transit, rail, freight, and bicycle/pedestrian improvements.
- Reaching consensus on level of service standards.
- Creating tools to measure deterioration rates over time (to estimate future/accruing needs).
- Deciding on the criteria by which candidate project types will be analyzed—smart agencies have a transparent process through which the criteria are decided, which negates criticism when data are added to the mix.
- Ensuring that data analyzed by a "needs process" like the Highway Economic Requirements System (for states) or the National Bridge Investment Analysis System are accurate and fresh.
- Finding ways to quantify needs for those improvement categories that are not generated by a Highway Economic Requirements System type software—items like new facilities, interchange modifications, intersection improvements, signals, and so forth.

Other challenges include the following:

- Identifying smart performance measures at the planning level that will enable performance outcomes to be quantified and the most effective investments to be chosen.
- Understanding the advantages and disadvantages of a "worst first" mind-set versus a "least-cost" mind-set.
- Measuring the potential benefits for criteria that are more difficult to quantify, for example, quality of life, sustainability, health.
- Controlling costs—often planning is the "gatekeeper" that monitors scope creep and instills budget and cost-control measures.

Strategic Decision #9: Linking Performance Measures to Outcomes

What Is Different?

DOTs have been trying to establish outcome-based performance measures for some time. Under MAP-21, all state DOTs and MPOs are required to link performance measures in each national goal area to outcomes, so much more coordinated and cooperative goal setting, performance measures, and target setting will be needed. Performance measures may have a greater influence on funding decisions as the 21st century progresses because of decision maker and public expectations for accountability and transparency in government. Outcome-based performance measures are the "glue" that holds together linkage from the LRTP to investment strategy resource allocation, program-level resource allocation, and eventually the projects selected for implementation. Without performance measures, demonstrating that dollars invested in projects are actually achieving the goals identified in the LRTP is impossible.

To respond to this change, 21st century transportation planners should be able to

- Implement performance monitoring related to outcomes for air, rail, water, bicycle, pedestrian, highway, and transit in all plans to allow for unbiased comparison and allocation of funding across all modes.

- Select the right performance measures, defined as a reasonable number of measures that are directly relevant and sensitive to transportation decisionmaking, can be easily explained to decision makers and stakeholders, and are supported by available data.
- Use LRTP goals to align strategic (investment strategy resource allocation), tactical (program resources allocation), and operational (project selection) decisions through the use of performance measures that will accurately demonstrate progress toward achieving LRTP goals.
- Work with partners and stakeholders to link non-transportation goals and performance measures to project selection and performance monitoring.
- Establish clear protocols to collect and analyze only the data needed to support technical and policy decisionmaking.
- Develop the message that lawmakers and leaders should be prepared to trust and use the outcomes of the performance measurement process to guide prioritization of funding to programs and projects that improve the performance of the transportation system.

Introduction

In evaluating the effectiveness of specific decisions related to system maintenance, performance measurement may serve as a report card for identifying one of four possible outcomes:

- Performance results indicate no additional funding is necessary.
- Performance results indicate the current funding should be continued to maintain the status quo.
- Performance results indicate that improvement is in the intended direction but insufficient progress has been made. Additional funding will be required to increase the rate of improvement.
- Performance results indicate that the strategies have not produced the intended outcomes and the measure, the targets, and the implementing strategies need to be revisited.

In the case of a state DOT, the question initially asked is, "Where and what investments should be made?" Since the beginning of the 21st century, an expectation has evolved that government (and especially the DOT) should demonstrate that funding expenditures are allocated efficiently and effectively. Expenditure decisions are expected to be made through an informed, data-driven decision process. Performance measures can be set to reflect the actions of the DOT as a whole agency, decisions made under individual programs and projects, or even the role of each DOT employee in satisfying the agency's strategic plan. Increasingly, the question that DOTs need to answer is "Did the investments produce the desired outcome?"

What identifying performance measures really means to both the DOT and the state, however, is important to consider. Performance measures must be clear, concise, and easily interpreted; have a specific intended outcome or "threshold target"; and be ultimately actionable. At the strategic level, measures and targets should inform resource allocation decisions.

The effectiveness of a performance measure depends on the measure's sustainability over time, allowing it to be analyzed for the short, mid, and long terms. As DOTs begin embracing a much more multimodal transportation system, long-term performance measures for the 21st century will need to include goals and performance measures with identified outcomes for rail, water, bicycles, pedestrians, and transit. Ultimately, transportation goals and associated performance measures should supersede modal silos by allowing for unbiased comparison and allocation of funding across modes.

Because MAP-21 mandates reporting on national goals for performance, strategic transportation investments that are based on performance measure outcomes are starting to be accepted by most DOTs. As the public and the media place greater pressure on the DOT to be accountable

for and transparent about their actions, performance measures may become the go-to mechanism for making funding decisions as the 21st century progresses. The amount of data available today and the availability of technology to quickly analyze that data are exponentially greater today than they were 10 years ago. This expansion in data availability and interpretability allows planners to use performance measures to develop a tactical plan for implementing the state DOT's vision and goals that addresses current transportation needs while also considering future needs. Based on this information about expected performance, funding can then be allocated to programs and projects that improve the performance of the transportation system.

Current available funding in most state DOTs is not sufficient to address existing needs, let alone future needs. Therefore, state DOT planners should initiate discussions with state DOT leadership to define different investment strategies that could meet performance measure threshold targets. Without overall increases to the total transportation budget, increasing funds to improve one performance measure target usually results in a decreased ability to meet another performance measure target.

Processes Needed to Support the Strategy

Measuring performance requires the use of quantifiable indicators (performance measures) that evaluate program effectiveness and efficiency as a means of determining progress toward specific, predefined state DOT goals. In a broad context, "effectiveness" measures whether the right program elements are being executed, while "efficiency" measures whether the execution of program elements is being done in the right way. Performance measures are items for which the state DOT collects and analyzes data to evaluate the effectiveness or outcome of a decision aimed at improving the transportation system and the efficiency of the actions taken to achieve that outcome.

Using historical trends, a DOT planner can look at funding scenarios that would benefit the specific measurements and then make recommendations to the DOT's executive leaders. Using the historical information, a realistic, sustainable target value can be identified, setting a threshold for a particular performance measure. For example, DOT planners might analyze historical data and determine that investing $500 million over 5 years to rehabilitate or replace structurally deficient bridges would improve 20 percent of the currently deficient structures statewide to a rating over 70. Alternatively, investing $750 million over 5 years would fix 25 percent of the currently deficient bridges and allow for preventive maintenance to keep additional bridges from becoming deficient for the next 10 years.

DOTs demonstrate good stewardship of taxpayer money when they use data to make informed decisions about investments that are then validated when the threshold target is met or exceeded and the success can be sustained over time. When measured performance falls below its threshold target, this is an indication that the strategies chosen to implement the plan goals were not successful. When the targeted level of performance is not met, the outcome might still be considered successful if progress is being made, even if it is not to the extent expected.

Required for Success

Timely and reliable data allow performance measures to lead the decision-making process. As advances in technology allow for faster and more accurate data collection and interpretation, DOT planners should refine and summarize data into meaningful information that will be useful to DOT leaders as they make decisions.

The specific data and tools needed to measure and analyze performance will vary based on the performance measures used by a DOT. DOT management systems (such as those for pavement and bridges) provide the foundation for understanding asset condition and needs, as well

as identifying whether targets for asset performance are being met. Project databases that connect with performance information can also be a useful tool for determining the likely effect a particular project will have on performance. Increasingly, geospatial and real-time data and tools are being integrated to allow for better analysis of the effect of on-the-ground changes on performance. Most importantly, data and tools should be used in a way that facilitates critical thinking—the information provided should allow planners to make links between changes and performance outcomes—data and tools alone cannot make these connections.

Of increasing importance for DOTs in weighing competing priorities (e.g., safety versus quality of life versus public health), will be the ability to compare performance in various areas against each other. One of the challenges today is that some of these areas are more conducive to quantitative measurement than others. Thus, finding ways to provide meaningful measurements of qualitative factors may vastly improve planners' ability to evaluate different types of benefits.

The information technology in most state DOTs provides a modern computerized tool for performing analysis and presenting results in a simplified manner so that nontechnical persons can understand the meaning and implications of data analysis (e.g., a dashboard on the DOT or state government website). As non-transportation goals and coordination with other state agencies and MPOs become increasingly important, data should also be available for conditions and needs beyond highway transportation.

Relationships and Stakeholders Involved

Identifying, establishing, and evaluating performance measures require continuous collaboration among state DOT planners; other internal transportation partners; and external partners, such as other state agencies and MPOs. Performance measures should also resonate with users of the transportation system, so 21st century planning should be based on expanded outreach or customer data collection techniques (such as consumer polling or focus groups). The planning-operation link should be encouraged starting in the office of the DOT CEO. The planning and operations offices are usually responsible for most of the asset information necessary to establish performance measures that are effective and sustainable over time.

The collaborative efforts of state DOTs working with MPOs and RPOs serve several purposes involving funding allocations and performance measure evaluations. All three partners share the common cause of advancing the 21st century transportation system in their respective jurisdictions. Performance measures and threshold targets have to be coordinated and consistent among the DOT, MPOs, and any adjacent RPO in order to achieve performance outcomes. If measures and targets are not closely coordinated, the MPO and DOT can be working at cross purposes. Collaboration is an important means of ensuring consistency in the transportation philosophy and intended outcomes. Relationships with external state government stakeholders, such as state economic development, tourism boards, environmental agencies, and others are also necessary to identify and evaluate performance measures that ensure that transportation investments are helping to advance broader goals and outcomes developed during a collaborative statewide visioning and goal-setting process.

Challenges

Outcome-based performance systems face several challenges as DOTs work toward a more efficient transportation system with transparent outcomes:

- Implementing outcome-based performance systems requires a significant shift in the traditional processes and culture of a DOT. Aligning goals, performance measures, and targets internally and externally will be difficult.

- While Congress and state legislatures are demanding improved transportation system performance at all levels, lawmakers and leaders should be prepared to trust and use the outcomes of the performance measurement process to guide prioritization of funding to programs and projects that improve the performance of the transportation system.
- The success of the DOT in demonstrating measurable transportation system improvements will be directly proportional to the success of the DOT planner in working with politicians to provide adequate levels of funding and DOT leaders in allocating funds to programs and projects consistent with the adopted goals and threshold targets. This approach requires a shift in thinking internally and externally that will be difficult to achieve in the short term.
- Data relating to all modes and non-transportation issues and measures may not exist or be easily available.
- Availability of data and data security are also a challenge. Much of the data related to travel by individuals and freight transport may be protected by law and thereby difficult to obtain. If state DOT planners can obtain and use these data in performance measure assessments, the rights of the individuals and businesses must be protected and the data protected from misuse and hacking.
- Siloed expertise, staff shortages, and the loss of experience and institutional knowledge from retirement and turnover will continue to present challenges well into the 21st century.
- In some cases, DOT staff may be reluctant to engage in extensive data collection efforts, fearing that data may be used in a way that is not beneficial to their departments, or even in a way that is hostile. The purpose of data collection should be clearly communicated to ensure a clear understanding of needs and, in turn, more informed decisionmaking.

Strategic Decision #10: Program-Level Resource Allocation

What Is Different?

Program-level resource allocations have always reflected the tactical decisions of assigning available funding to categories or types of transportation improvements. Before the passage of MAP-21, most funding categories were preset by federal legislation and represented a myriad of core and special programs. Often state legislation would mirror this approach as political leaders predetermined how funding should be allocated, sometimes based on political negotiation rather than any careful analysis of needs and outcomes.

MAP-21 brought two fundamental changes. First, the number of federal funding programs has been significantly reduced, creating greater flexibility to allocate funds based on documented needs. Second, MAP-21 requires states and MPOs to be more accountable for achieving outcomes by establishing national goals and requiring tracking and reporting of progress toward those goals. These changes in federal law are combined with the 21st century expectation that state DOTs will leverage their funding to contribute to a variety of non-transportation social, economic, and environmental goals.

To respond to this change, 21st century transportation planners should be able to

- Determine assignment of the program categories (e.g., safety, capacity additions, asset management, maintenance, rehabilitation, modal, and snow and ice removal) to the appropriate investment strategy categories (e.g., expansion, modernization, preservation, and maintenance/operations) to best link short-term funding levels to the LRTP-defined long-term investments.
- Assist in identifying the level of program-level funding (e.g., safety, capacity additions, asset management, maintenance, rehabilitation, modal, and snow and ice removal) that will optimize performance outcomes and implement statewide goals.

- Facilitate decision-making processes that answer the question, "What transportation and non-transportation performance outcomes are expected based on the level of funding available?"
- Use outcomes and performance measures identified in the LRTP to link tactical program funding decisions (e.g., STIP and operating budget program allocations) to both the chosen investment strategy and operational level project selection.
- Facilitate the development of cross-jurisdictional or interagency processes to achieve consensus on the state and local program funding levels needed to achieve the agreed-to performance outcomes. Decipher what data are available, understand how they are relevant to the metrics of the program, and determine how to appropriately analyze them for developing options and scenarios for decisionmaking.
- Understand the legal ramifications regarding privacy, proprietary information, and liability of sharing data with the public as more data become more accessible.
- Understand how to use GIS and future technologies for collecting and analyzing data more effectively and efficiently and how to communicate results in a concise, understandable way.

Introduction

Programs define the categories for assigning available funds to capital plans (the STIP) and operating budgets. In the past, programming was driven by state and federal regulatory restrictions limiting the use of certain funding streams to specific types of projects or activities.

Program investments are the implementation of the strategic direction that is set in the governor's plans and the DOT's LRTP and investment strategy. More than ever, DOTs are likely to be held accountable by the governor, legislators, stakeholders, and the public for their programmatic decisions and strategies. DOTs are and will continue to be expected to develop and implement programs that will serve as the tactical plan for addressing goals and objectives but also the goals and objectives of cross-agency statewide strategic plans addressing environmental, economic, and social issues.

Processes Needed to Support the Strategy

The capital program (STIP) and the annual or biennial budget are the two primary processes involved in program-level resource allocation. In the past, program and operating budget levels often were allocated funds based on percentages of historic spending or, in the case of new programs, based on the priority or urgency of the perceived need. To have a more holistic approach in how funds should be shared among programs and resulting projects, state DOT planners should prepare information in an understandable way and coordinate with other offices within the DOT. Rather than having each office simply take funds into their own silo to make decisions, offices should meet as a team to evaluate asset information, needs, and potential outcomes, and, on the basis of this evaluation, make recommendations to DOT leadership that optimize the effective use of every dollar. State DOT planners can take the lead in facilitating this process.

The collaborative integration among the various offices will allow for a team approach that can also serve as a check and balance to ensure that important issues are not missed. Program-level decisionmaking is not intended to define specific projects, but rather to determine the level of investment that will achieve desired outcomes. As part of this process, the controlling factors for a program should be determined. Such items might include the project eligibility criteria, objectives to be accomplished, the expected outcomes, and, if the option exists, the amount of funding required for the program. Objectives and outcomes should be measurable and include identification of appropriate performance metrics.

Required for Success

Data needed to address program-level resource allocation are the same as the data needed to address system performance measure outcomes, as discussed in Strategy #9. State DOT planners should be able to quantify system performance as it relates to the state DOT vision and goals, as well as social, economic, and environmental conditions and goals. DOT planners should present each of these to the public to demonstrate that investments will have positive outcomes for a targeted program without negatively impacting the overall performance of the system and other programs.

Planners can support the gathering of information from internal agency sources and from external agencies, such as economic development agencies, natural resources councils, or Census data centers through data-sharing partnerships. Screening and deciphering available data, determining the applicability of data, and analyzing them are the tasks of a DOT planner. By analyzing and interpreting the data, planners can provide meaningful and understandable information to DOT leadership to help them make better informed, data-based decisions.

Relationships and Stakeholders Involved

In the 21st century, state DOT planners will increasingly need to involve themselves in the public discussions and planning efforts of other agencies to gain information and bring a broader perspective to the development of various transportation programs. Program funding allocations must be consistent with agreed-to performance outcomes and targets. If a disconnect between the allocated resources and anticipated outcomes exists, showing progress and accountability for the state's investments will be difficult.

Programs and the level of funding connected with them often generate public interest through both news media and social media conversation regarding funding, or lack of funding, at the statewide or national level. Larger programs may be kicked off through some type of media event or press conference by the governor, the DOT CEO, and other elected officials. High-publicity programs can provide a great opportunity to celebrate success, or they can become an embarrassment if the program fails to accomplish the publicized results. With increases in use of social media, opportunities for reaching the public will grow and could bring more intense positive or negative reactions to how state DOTs are spending their funding.

Challenges

As demonstrated in MAP-21, the 21st century will offer greater flexibility in using funding sources to address transportation modes and needs. The flexibility to shift funds among programs will be a key to meeting performance goals and a state's transportation vision. Many challenges also will arise in implementing program-level strategies and direction and aligning these with state DOT and statewide decisionmaking:

- The perception of needs and priorities is continuously changing for the public, stakeholders, and elected leaders and will most likely fluctuate more in the future depending on political, social, and economic conditions. Setting targets and allocating funds consistent with those targets over a sufficient time to demonstrate progress could be very difficult.
- Balancing multimodal programs, projects, and operational improvements with other planned and required expenditures for preservation and maintenance of the existing system will be difficult. Allocating funding for new programs while trying to maintain successes of past programs that are worthy of being continued will always be an issue.
- Pressure from local governments and special-interest groups to guarantee funding levels through the creation of single-purpose special programs will continue.

- Breaking down the effect of silos within many DOTs will be a challenge. Even today, when many programs have targeted funding, the silos within the DOT may compete with each other for funding from a single source. As funding becomes more flexible, this "competition" will become more pronounced.
- As program decisions are connected to data
  - Data accuracy, storage, and security (especially for proprietary and personal information) will continue to present a challenge for planners.
  - The sheer quantity of new data will tempt DOT planners to dive deeper into data analysis and review than is necessary. Determining the appropriate level of data collection and analysis in a rapidly changing world will be a challenge. More data and analysis do not necessarily equate to better results.
  - Encountering legal issues regarding liability, privacy, and proprietary information when sharing data with the public will be an increasing challenge.
- Optimizing outcomes that can be achieved with limited and increasingly scarce resources will be difficult. Scarce resources can create a "rob Peter to pay Paul" mentality where showing short-term gains in performance for one program might be at the expense of longer term losses for another.

Strategic Decision #11: Aligning Project-Level Decisionmaking

What Is Different?

Project-level decisionmaking is the follow through on aligning overall goals, objectives, and targets and implementing performance-based monitoring and accountability. If project selection and implementation are not consistent with the decisions made regarding the overall direction of a DOT's efforts, the DOT will be unable to demonstrate the effectiveness of its plans and programs. Transportation projects seldom have a single benefit. Most projects are undertaken to meet multiple transportation and non-transportation goals. A single project can enhance safety, mobility, access, and asset condition. The same project can also contribute to achieving non-transportation state and community goals. State DOTs will need to communicate to executive leaders, stakeholders, and the public a nontechnical rationale for their project choices, highlighting the many transportation and non-transportation benefits of their project choices and why the projects are good investments of public dollars. State DOTs will need to link projects to quantifiable outcomes.

To respond to this change, 21st century transportation planners should be able to

- Develop clear policies and processes for assigning project benefits and linking LRTP goals and performance outcomes to project selection decisions.
- Develop processes to evaluate whether implemented projects delivered the anticipated results.
- Assess and communicate how projects support societal goals, linking transportation's contribution to broader state and local visions and values.
- Obtain input that fully represents the diversity of stakeholder and public opinion, whether these opinions are communicated using the most advanced technology or more traditional forms of communication.

Introduction

Governors, elected officials, business and political leaders, DOT CEOs, MPOs, and most stakeholders view project delivery as a key function of a state DOT. Many governmental and nongovernmental entities are involved in the lengthy, multiyear process of building new infrastructure.

State DOT projects and program areas can include maintenance, preservation, modernization, and capacity expansion and can involve all modes of transportation.

In these cases, it is particularly important that performance outcomes have been defined for the project that can be used to demonstrate its impacts to the economy, the environment, jobs, health, and other statewide and societal goals.

For years, aligning the projects being advanced with the goals, policies, and investment decisions made during the development of the statewide plan has been a significant challenge for DOTs. This alignment will be even more challenging for the 21st century DOT as a requirement to report measurable outcomes becomes the norm. Part of the difficulty is that the responsibility for project development involves multiple DOT offices, including planning, environmental, design, programming, and leadership staff in both the DOT district and central offices. DOT staff across the organization should not only understand but also be committed to the connection between individual projects and the anticipated LRTP outcomes so that decisions made during the project development process do not dilute the expected and often multiple benefits that were anticipated when the project was selected. In the 21st century, planners can no longer afford to "let go" as projects are selected and moved through the development process. Monitoring and feedback between planning offices and the various DOT offices involved in project development are essential to ensure that anticipated outcomes are achieved if adjustments are made.

The question then becomes, "How in the 21st century can project-level decisionmaking be aligned with statewide and program-level processes and decisionmaking?" Breaking down the organizational silos separating planning, project selection, and project development is one solution. Integrating planning staff's skills, knowledge, and resources into the project selection and project development processes can benefit DOT district and central office environmental, engineering, and design staff, as well as project-level decision makers in several ways:

- Planning staff can inform project-level decision makers of the higher level strategic decisions, providing an understanding of the DOT CEO's priorities. Planning staff can provide the rationale for projects; stakeholder and agency perspectives; an understanding of the overall and long-term financial limitations of the DOT; and intelligence on emerging issues, technology changes, and changing local context or conditions that may impact transportation projects.
- Planning staff can provide information on how changing demographics are affecting travel demand in a project area, thereby introducing new perspectives on potential transportation solutions.
- Planning can also provide predictive information on system performance outcomes of various types of projects. This can help to quantify trade-offs between project types and modes.

Processes Needed to Support the Strategy

Project selection criteria are at the heart of project-level decisionmaking. Developing criteria and an associated process that reflects decisions made during earlier phases of decisionmaking—everything from aligning the DOT to the governor's agenda through the STIP and budget decisions that set the stage for project selection—should be considered when the project selection process is designed and implemented. In addition, this process should be transparent to internal and external decision makers, partners, and the public in order to build credibility and trust in the DOT's commitment to providing projects and services that contribute to agreed-to outcomes.

At the project decision-making level, planners are some of the most knowledgeable DOT staff about the local vision and values. Planners should be charged with the outreach and consensus building needed to identify and implement projects that meet state and local needs. To perform outreach and build consensus, planners should communicate effectively with stakeholders and agencies. Planners have the ability to assess and communicate how a project will benefit the local community, acting as a translator to integrate DOT processes with broader state and local visions and values. Planners can work both within the state DOT and with stakeholders and

other agencies to find opportunities for preventing and resolving conflicts with other statewide, regional, or local plans. Using their understanding of the original intent or purpose and need for a project, planners can identify trade-offs between alternative solutions, and provide forward-looking intelligence on emerging issues, changing demographics, and new technologies. Through these efforts, planners can help the state DOT develop "better" projects that meet transportation needs while meeting the expectations and goals of the region and local stakeholders.

Stakeholder Involvement/Identifying Measures of Success

Planners are adept at working with stakeholders and discovering the issues that matter to them that may not be readily apparent. Planners can support environmental, engineering, and design staff by helping them understand non-transportation concerns such as the importance of aesthetic design, slowing traffic because of safety concerns, avoiding key local or environmental resources, interest in other modal solutions (such as adding buses to relieve congestion), a need for pedestrian or bicycle facilities, keeping project costs low, or attracting jobs.

Defining the Problem—Understanding Existing and Future Conditions

Statewide comparative data on existing and future conditions are typically available through state DOT planners. While engineering and design staff may quickly find an engineering solution for a project, planning staff can bring an understanding of demographic and land use changes in the area that may have a long-term impact on future capacity needs in the area. DOT planners can identify the need for a project from both the statewide and regional level. This skill can help with developing a "right-sized" project and communicating the reasons and necessities behind the "right sizing."

Identifying and Evaluating Alternative Solutions

Planners will need to work with DOT environmental and, at times, engineering staff to integrate modal alternatives, quality-of-life issues, cost controls, and changes in technology to projects. Today and in the future, evaluating alternative projects is more than just meeting the transportation need. The evaluation should include meeting broader societal, economic, and environmental goals. Planners should be involved in alternative evaluation efforts by integrating these goals into the overall DOT performance measures and desired outcomes for the process. Planners should encourage stakeholder perspectives and involvement in defining measures of success for project evaluation. Understanding how stakeholders define success and the definition of success for performance measure outcomes will help provide support for the project alternative selected.

Selecting the Alternative

DOT planners can assist by communicating the process and reasons for the selected alternative for implementation in a clear, succinct, and understandable manner.

Required for Success

Data and tools available for analysis are expected to increase. Each day more data become available through ITS technology and global positioning system receivers/connectivity on phones, cars, trucks, planes, maritime vessels, and trains. These new technologies are providing an overwhelming quantity of information. Data are collected by various private sources and available for a state DOT to purchase for analysis. With this data, planners can determine travel times, travel speeds, congestion levels, and the movements of people and commodities on all types and modes of vehicles. The challenge will be in selecting the most timely and accurate data and not wasting resources by collecting the same data from multiple sources. Likewise, planners should recognize the need to protect privacy in collecting data from individuals and businesses.

Planners should keep current on data sources, availability, quality, strengths, and weaknesses; assess the reliability of the data from each source; and know how best to use each data set and source. GIS, mapping tools, and real-time data will be needed and used as stakeholders expect to assess a problem quickly and visually. At the project level, visualization tools can be used to provide quick, visual assessments of current problems and potential solutions.

One role of planners will be to continue to provide both transportation and comparative data from across the state. With multiple data sources available, however, groups or individuals with opposing positions can easily challenge the DOT data by providing alternative data and analysis from other, non-DOT sources. These alternative data will be used to challenge the agency's technical analysis justifying the construction of specific projects. Planners should be able to provide a clear rationale for their choice of data sources and their analysis while maintaining the privacy of the data of individuals and businesses.

With more budget scrutiny and constrained funding, project evaluation and selection factors will need to include financial analysis of the benefit and cost trade-offs. Planning-level cost estimates will need to consider inflation, schedules, risks, and future uncertainties.

Relationships and Stakeholders Involved

The move by many DOTs to use electronic and virtual communication outreach techniques and receive stakeholder input via a variety of electronic formats will continue. Until all stakeholders have access to the technology needed to communicate electronically, however, it will fall to planners to ensure that stakeholder involvement and input are fully representative.

In addition to crafting an understandable project message, planners will need to understand how to counter—professionally and politely—alternative information presented by project opponents.

Information in the 21st century should be provided in clear and concise messages. For mass media sources, information needs to be packaged in short sound bites written in nontechnical language. Planners will need to learn how to present only the most critical and relevant data. Input from the public will be received primarily through social media. The predominance of this avenue of public input may mean a socio-demographic change in the stakeholders reacting to DOT project information. Stakeholders may include younger, more technologically savvy, and politically active individuals. Advocacy groups that are well organized through electronic listservs or linked chat groups may encourage their members to focus on sending a single message. Planners should scrutinize the messages that they are sending to stakeholders more closely and assess stakeholder input more carefully to determine whether the message reflects a concern of the overall public or a special-interest group. In addition to crafting an understandable project message, planners will need to understand how to counter—professionally and politely—alternative information presented by project opponents.

It will become critical to help stakeholders understand and reach a consensus on what is actually needed, not just wanted, as DOTs struggle to meet all the wants and needs with even less funding as the 21st century progresses.

Challenges

The 21st century brings new challenges to aligning project selection and development with statewide, corporate, and program-level processes and decisionmaking. Project-level decisions will be impacted by the social and technology changes rapidly happening in our society:

- The pressure to find solutions that break down silos and promote internal communication and alignment will significantly increase in the 21st century. While DOT senior leaders recognize the challenge of coordinating and communicating across the traditional silo organization, few, if any, have found the ideal solution.

- With the public's ability to access information through the web and social media, each project will receive greater scrutiny by the public and decision makers.
- An approved project is expected to move quickly into implementation and, when it does not, impatience increases. Project delivery will need to be more nimble.
- The demand to be heard and to be involved will be greater. Stakeholders are demanding more accountability, and those who understand the regulatory requirements for public outreach will expect to be heard and to see tangible results of their opinions addressed in project selection and delivery.
- DOTs will need to adapt to rapidly emerging technologies that can change how people travel. As the reality of "self-driving" vehicles comes closer, highway and bridge projects will be expected to keep pace and be ready to incorporate these new technologies into capital improvements.
- The business climate will be vital for project identification and selection. Business success depends on logistics, and logistics depends on a reliable transportation system. With the recent recession, every governor and mayor is acutely aware of the importance of good jobs to the economic vitality of their state and community. This focus on economic development is becoming increasingly important in setting project priorities.

Strategic Decision #12: Feedback—Monitoring and Reporting Agency Performance

What Is Different?

In the 21st century, feedback on and monitoring of the state DOT's performance will be formal, structured, and constant, and will need to be communicated to decision makers, stakeholders, and the public using both electronic media and traditional means of communication. Stakeholders, the public, and elected leadership will continue to demand increasing accountability for and transparency in transportation programs and projects and expect real-time, relevant data that demonstrate progress toward performance goals. This feedback and monitoring will be connected to LRTP goals and performance outcomes. Regular reports will be provided to the U.S. DOT modal agencies, elected officials, state DOT leaders, and the public in a relevant, concise manner. State DOTs will be expected to respond quickly—incorporating feedback into decisions and making mid-course adjustments as needed to meet performance outcomes.

To respond to this change, 21st century transportation planners should be able to

- Monitor performance at designated interim points in the development process and make mid-course adjustments as needed to avoid undesirable outcomes and surprises.
- Analyze and interpret the results of the feedback and monitoring, showing the results in a format that is easily, succinctly communicated to leadership for actions, prioritization, and decisionmaking.
- Develop monitoring processes and feedback loops that add transparency and credibility by using both traditional means and the latest technology to obtain feedback from a broad spectrum of partners, stakeholders, and the public.
- Identify whether performance measures, targets, actions, and funding strategies accurately reflect the agency's goals or need adjustments.

Introduction

In the 20th century, measuring, reporting on, and receiving feedback on DOT performance consisted of the following:

- Measuring output (e.g., miles of road surfaced, new roads constructed, crashes, traffic delays, and funds spent).

- Lack of connection to the goals of the organization.
- Some attempt to gauge customer satisfaction (e.g., through comments provided by citizens in reaction to projects at public meetings, through the media, by letters to the governor or state DOT, and even through mail surveys and telephone interviews).
- Inconsistent reporting of results to the public and politicians.

In the 21st century, government programs at all levels are expected to be more accountable. In response to stakeholders and the awareness that impacts of transportation projects extend beyond the right-of-way, states began to ask their citizens questions such as:

- "Is the transportation system performing better than it did 5 years ago?"
- "Is the transportation system meeting your needs?"
- "How can transportation be improved?"

Through social media technologies and better statistical validation of samples, states can now poll their citizens and receive answers to these questions almost immediately.

In the 21st century, feedback will have to be structured, formal, and immediate, and comprehensively tied to goals, measures, and targets. Feedback will need to be monitored at various points and levels to avoid surprises, and consistently reported to FHWA, political leadership, and the public. In many ways, having this real-time feedback by stakeholders is beneficial. Adjusting public policy in response to this feedback, however, must be balanced with a need to maintain consistent statewide visions and create tactical plans to implement a statewide vision for transportation.

Even with these issues, monitoring and receiving feedback on performance is important for success. Governors, transportation commissions, legislatures, and state DOTs want to demonstrate that they are delivering the most cost-effective services possible using the public funds they have received. Ensuring that every tax dollar spent generates the best results and advances the short- and long-term interests of the state as articulated in the state leadership's vision is more important than ever.

Processes Needed to Support the Strategy

State leaders are expected to make transportation policy and spending choices based on reliable, understandable data about what works and what does not. Unless states have clearly defined, goal-driven, performance measures and good performance data, however, it will be difficult for leadership to program and prioritize transportation investments to effectively manage transportation assets, target scarce resources, foster economic growth, and address other important issues. The results of performance monitoring must be communicated to internal and external stakeholders in a clear, concise, and understandable manner that invites both positive and negative feedback. Stakeholder feedback is crucial because it helps answer the questions, "How are we doing?" and "What could we do better?" Solicitation of feedback should be timely so that it can be used during the decisionmaking that affects short-, mid- and long-term outcomes.

Required for Success

In the 21st century, all levels of government will have the data and the tools to monitor and report performance. The methods for collecting data will continue to evolve well into the 21st century. Real-time data collected from remote sensors in the physical infrastructure, vehicles, and individual electronic devices will be continuously transmitted to databases for analysis. Asset management programs can collect data that are used for monitoring. Predictive models will take these continuous streams of data, analyze them, and provide information necessary for decisionmaking. Planners should be able to analyze and interpret this information and place it

in a format that is easily, succinctly communicated to leadership for decisionmaking and prioritization and to stakeholders for demonstrating effectiveness and responsiveness in addressing problems and issues.

Communicating progress on long-term and short-term priorities may take many forms depending on the intended audience. These forms may include written reports, GIS files, visualization graphics, computer animation, dashboards on websites, media releases, Facebook posts, tweets, and "yet-to-be-created" electronic media communications. Planners should stay current with technology and social media and use all these communication tools to reach transportation stakeholders.

One-way communication will not be sufficient to move future transportation programs and projects forward. Two-way communication, including feedback from leadership and stakeholders, will be critical for the DOT success. Feedback should be acted on to sharpen the mission and goals of state DOTs, to replace low-value performance measures with more meaningful indicators of performance, and to foster collaboration and resource-sharing across organizational lines of various levels of government. Planners—as the collectors, analyzers, and communicators of data—have a key role to play by recommending procedural and policy changes necessary to answer the questions "How are we doing?" and "What could we do better?" for both now and in the future.

Relationships and Stakeholders Involved

Everyone has an opinion. Social media brings interactive, real-time communications to large groups of virtual subscribers. Opinions can be viewed by millions of people instantly. Stakeholders expect information to be available instantly and accessible with minimal effort and will provide feedback only when doing so is equally easy. The key to eliciting meaningful responses from stakeholders is quickly demonstrating that a piece of information relates to a stakeholder and that their response will make a difference. By extension, if a solicitation for feedback is not attention grabbing and does not clearly relate to the interests of the stakeholder, the solicitation will be quickly dismissed and overshadowed by other, competing messages. Even with more traditional forms of communication, unless legal requirements or leadership direction exists, requests for feedback may also fall into this abyss of competing requests.

As planners use social media for communication with stakeholders, they should learn more about what piques the interest of stakeholders and what can make the DOT's message stand out. Being responsive to stakeholder feedback helps build a strong reputation for state DOTs. Stakeholders want to know that time spent offering feedback is justified by making a difference in the DOT's performance.

Planners can often call on relationships created as a result of the LRTP process and other data- or information-sharing efforts to request feedback on the DOT's performance. Nearly all state agencies are working under the mandate of doing more with less staff. As a result, to get good feedback from agencies, relationships must evolve into partnerships. Partnerships can be developed by not just asking for feedback after implementing a plan or action, but asking for involvement as a state DOT plan or process is being developed and then reciprocating when other agencies develop their plans. Demonstrating the win-win scenario for other agencies will help them to see that time invested in attending meetings and responding to surveys and questions not only contributes to DOT success, but also to their own.

Challenges

Monitoring and feedback are essential but often neglected parts of any decision-making process. As planners work to keep up with more frequent demands for information and analyses

from decision makers and the public, they often lack the time and resources needed to create a meaningful feedback system. The challenges to data-driven monitoring and feedback include the following:

- Data used to measure performance will need to be reliable and consistently available. Data should be carefully screened and monitored to ensure accuracy so that they do not skew performance reporting.
- Performance measures should be developed that are understandable, measurable, replicable, and meaningful at the statewide, corporate, program, and project levels. Performance measures should not conflict with one another and should be understandable to stakeholders and the public. Developers of performance measures should take into account new transportation methods and technologies as their use becomes commonplace.
- Performance measures should be closely linked to asset management. Analytical approaches should be developed to clearly demonstrate positive and negative impacts to modal facilities, based on how resources are allocated.
- The challenge for planners will be making government performance information transparent to and more easily understood by the public. To do this, planners should be able to identify important information, tell a story succinctly, communicate using traditional and cutting-edge media, and solicit feedback strategically.
- When feedback is received, it should be analyzed and recommendations should be made to leadership on how to respond and what actions to take. Leadership should also be prepared for potential stakeholder reactions to their decisions. Does the action require a statewide response, corporate response, program response, project response, or no response? Communication to stakeholders on what was done with their feedback will be vital to maintaining public and agency confidence that the state DOT is listening and is willing to improve what it does to advance transportation in the 21st century.

CHAPTER 6

The 21st Century Planning Readiness Assessment and Roadmap

The strategic decisions discussed in Chapter 5 of this report summarize common trends and emerging issues as identified through interviews with and feedback from DOT executives, planning directors, and planning partners. Although all DOTs have taken some steps to adjust planning in the ways described herein, for any DOT to try to align its planning with all of the guidance presented would be a significant commitment of time and resources. The 21st Century Planning Readiness Assessment and Roadmap is designed to help DOT planning directors screen the information in this guidance to efficiently identify which parts will be most beneficial to them given the issues and challenges the DOT and its planning office face. The roadmap is designed to be followed in three sequential steps, shown in Figure 3. Each step is described in more detail below.

Step 1: Screen the Strategic Decisions to Assess Your DOT and Planning Office

The purpose of Step 1 is to identify the four or five strategic decisions that have the greatest potential to advance 21st century planning efficiently and effectively. A short self-assessment is available below as "Self-Assessment Tool—Screening the Strategic Decisions."

The questions in the assessment are intended to inform a thoughtful consideration or discussion of where planning is consistent or inconsistent with 21st century planning approaches. Completing the tool does not result in a "score." The scale is designed to help point the planning director to the strategic decisions that might be most useful for this DOT.

This step should be led by the DOT planning director. Although the self-assessment tool can be completed individually by the planning director, the assessment will be significantly more meaningful if a variety of perspectives are collected. It would be particularly helpful to ask key planning office managers and executive leaders to provide their perspectives. This broader input can be collected by distributing the tool to selected participants or by bringing the group together in a facilitated discussion.

The assessment tool includes a "Summary Worksheet" at the end that the respondent should use to total the number of times each strategic decision received a score of "not at all," "to some extent," and "extensively." Strategic decisions that have the most "not at all" responses or a significant number of "not at all" and "to some extent" responses represent the opportunities for highest potential improvement.

A summary table that cross-references each strategic decision to the individual self-assessment questions follows the "Summary Worksheet."

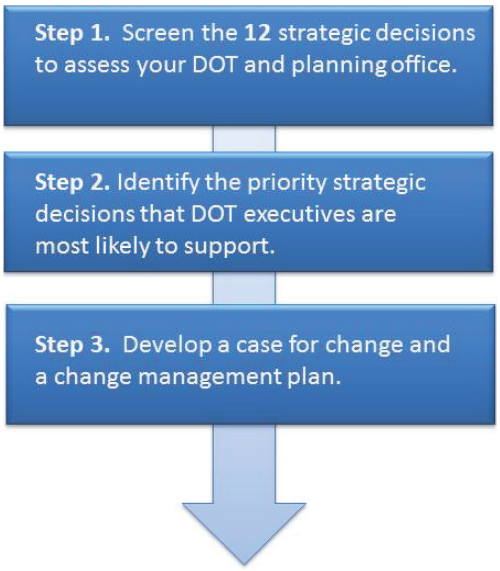

Figure 3. Conducting the 21st century planning readiness assessment.

Self-Assessment Tool—Screening the Strategic Decisions

The following assessment tool has 12 sections, one for each of the 12 strategic decisions presented in Chapter 5. Each section includes several questions. In some cases, the same question will appear in multiple sections. Note that results for each section can be recorded in the "Summary Worksheet" that follows the 12 sections. Instructions for completing the self-assessment are the following:

1. For each question, mark in the assessment section to what degree your DOT aligns with the characteristics described. You can mark each question as: *not at all*, *to some extent*, or *extensively.*
2. After each section, record the sum of each of your responses (the number of times you answered *not at all, to some extent*, or *extensively.*)
3. Record the number of responses from each strategic decision in the "Summary Worksheet" to indicate how often you answered "not at all," "to some extent," or "extensively."

Strategic Decision #1. Aligning DOT and statewide goals, priorities, and performance.

Assessment Questions	Not at all	To some extent	Extensively
1. Does your DOT have multiple documents and/or processes that establish strategic direction? If so, are the key elements (goals, objectives, and performance measures) aligned?	☐	☐	☐
2. How familiar are you with the full range of state and local strategic documents that should influence your DOT's strategic direction and planning processes? Are these integrated into your LRTP?	☐	☐	☐
3. Does your planning process include communications approaches, strategies, and developed channels to engage transportation agencies, non-transportation agencies, and stakeholders on the broader implications of plan direction and recommendations?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #2. Agency visioning and goal setting.

Assessment Questions	Not at all	To some extent	Extensively
1. Does your DOT have multiple documents and/or processes that establish strategic direction? If so, are the key elements (goals, objectives, and performance measures) aligned?	☐	☐	☐
2. How familiar are you with the full range of state and local strategic documents that should influence your DOT's strategic direction and planning processes? Are these integrated into your LRTP?	☐	☐	☐
3. Do you have strategic-level visioning tools and, if so, how effective are they?	☐	☐	☐
4. How well are your long-range, mid-range, and short-range planning and programming processes connected?	☐	☐	☐
5. How well do your planning processes take into account non-improvement needs such as asset management and operations?	☐	☐	☐
6. How well are performance measures integrated into department-wide decisionmaking?	☐	☐	☐
7. How well does your planning office stay abreast of relevant current and emerging trends? Do you have the knowledge, capabilities, data, and other resources to ensure that this is occurring routinely?	☐	☐	☐
8. What is your ability to develop future scenarios, assess trade-offs, and forecast the impact of different investment strategies on transportation and non-transportation outcomes?	☐	☐	☐
9. How adequate is your ability to inventory and define existing transportation system conditions/performance?	☐	☐	☐
10. How well does your planning department recruit, develop, and plan for succession?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #3. Identifying performance outcomes.

Assessment Questions	Not at all	To some extent	Extensively
1. Does your DOT have multiple documents and/or processes that establish strategic direction? If so, are the key elements (goals, objectives, and performance measures) aligned?	☐	☐	☐
2. How well do your planning and programming cycles accommodate changing trends and emerging issues?	☐	☐	☐
3. How thoroughly are social, economic, and environmental conditions incorporated into your decision-making frameworks?	☐	☐	☐
4. Does your DOT consider data quality as part of its decisions? If so, how robust are efforts to ensure the maturity of your data management/stewardship practices (such as the reliability, accuracy, timeliness, and consistency of data programs)?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #4. Defining state, regional, and local roles.

Assessment Questions	Not at all	To some extent	Extensively
1. How well and at what level are your agency's roles and responsibilities defined? How well do these definitions support anticipated or potential changes in mission?	☐	☐	☐
2. Has your agency established a formal understanding of the technical and policy-related roles and responsibilities with planning partners (MPOs, RPOs, transit agencies, tribes, etc.)?	☐	☐	☐
3. Are planning recommendations and products informing the decisions made by the CEO and executive leadership team?	☐	☐	☐
4. How well does your agency understand and manage its current and potential revenue sources?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #5. Internally integrated planning.

Assessment Questions	Not at all	To some extent	Extensively
1. Does your DOT have multiple documents and/or processes that establish strategic direction? If so, are the key elements (goals, objectives, and performance measures) aligned?	☐	☐	☐
2. How broadly are agency goals, objectives, etc. known and embraced throughout the department?	☐	☐	☐
3. How well connected are your long-range, mid-range, and short-range planning and programming processes?	☐	☐	☐
4. How well do your planning processes consider non-improvement needs such as asset management and operations?	☐	☐	☐
5. Does your DOT consider data quality as part of its decisions? If so, how robust are efforts to ensure the maturity of your data management/stewardship practices (such as the reliability, accuracy, timeliness, and consistency of data programs)?	☐	☐	☐
6. Does your DOT have a centralized data function? If so, to what degree does duplication or overlap exist?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #6. Externally integrated planning.

Assessment Questions	Not at all	To some extent	Extensively
1. How thoroughly are social, economic, and environmental conditions incorporated into your decision-making frameworks?	☐	☐	☐
2. Does your planning process include communications approaches, strategies, and developed channels to engage transportation agencies, non-transportation agencies, and stakeholders on the broader implications of plan direction and recommendations?	☐	☐	☐
3. What is your ability to develop future scenarios, assess trade-offs, and forecast the impact of different investment strategies on transportation and non-transportation outcomes?	☐	☐	☐
4. How familiar are you with the full range of state and local strategic documents that should influence your DOT's strategic direction and planning processes? Are these integrated into your LRTP?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #7. Revenue and financial planning.

Assessment Questions	Not at all	To some extent	Extensively
1. How well does your agency understand and manage its current and potential revenue sources?	☐	☐	☐
2. How strong is your agency's ability to forecast revenues, cash flow, etc.?	☐	☐	☐
3. How strong are your agency's capabilities to use "innovative approaches" to reduce costs and deliver projects/programs more effectively?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #8. Investment strategy resource allocation.

Assessment Questions	Not at all	To some extent	Extensively
1. How well connected are your long-range, mid-range, and short-range planning and programming processes?	☐	☐	☐
2. How well are performance measures integrated into department-wide decisionmaking?	☐	☐	☐
3. Are your project selection processes transparent, consistent, and understood internally and externally?	☐	☐	☐
4. What is your ability to develop future scenarios, assess trade-offs, and forecast the impact of different investment strategies on transportation and non-transportation outcomes?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #9. Linking performance measures to outcomes.

Assessment Questions	Not at all	To some extent	Extensively
1. How well do your current performance measures enable you to predict outcomes, link decisions to goals, and report results?	☐	☐	☐
2. How thoroughly are social, economic, and environmental conditions incorporated into your decision-making frameworks?	☐	☐	☐
3. Does your DOT have multiple documents and processes that establish strategic direction? If so, are the key elements (including goals, objectives, and performance measures) aligned?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #10. Program-level resource allocation.

Assessment Questions	Not at all	To some extent	Extensively
1. Does your DOT have multiple documents and processes that establish strategic direction? If so, are the key elements (goals, objectives, and performance measures) aligned?	☐	☐	☐
2. How familiar are you with the full range of state and local strategic documents that should influence your DOT's strategic direction and planning processes? Are these integrated into your LRTP?	☐	☐	☐
3. How broadly are agency goals, objectives, etc. known and embraced throughout the department?	☐	☐	☐
4. How well connected are your long-range, mid-range and short-range planning and programming processes?	☐	☐	☐
5. How well do your current performance measures enable you to predict outcomes, link decisions to goals, and report results?	☐	☐	☐
6. How well are performance measures integrated into department-wide decisionmaking?	☐	☐	☐
7. How thoroughly are social, economic, and environmental conditions incorporated into your decision-making frameworks?	☐	☐	☐
8. Does your planning process include communications approaches, strategies, and developed channels to engage transportation agencies, non-transportation agencies, and stakeholders on the broader implications of plan direction and recommendations?	☐	☐	☐
9. What is your ability to develop future scenarios, assess trade-offs, and forecast the impact of different investment strategies on transportation and non-transportation outcomes?	☐	☐	☐
10. How adequate is your ability to inventory and define existing transportation system conditions/performance?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #11. Aligning project-level decisionmaking.

Assessment Questions	Not at all	To some extent	Extensively
1. Does your DOT have multiple documents and processes that establish strategic direction? If so, are the key elements (goals, objectives, and performance measures) aligned?	☐	☐	☐
2. How familiar are you with the full range of state and local strategic documents that should influence your DOT's strategic direction and planning processes? Are these integrated into your LRTP?	☐	☐	☐
3. How broadly are agency goals, objectives, etc. known and embraced throughout the department?	☐	☐	☐
4. How well connected are your long-range, mid-range, and short-range planning and programming processes?	☐	☐	☐
5. How well do your current performance measures enable you to predict outcomes, link decisions to goals, and report results?	☐	☐	☐
6. How well are performance measures integrated into department-wide decisionmaking?	☐	☐	☐
7. Does your planning process include communications approaches, strategies, and developed channels to engage transportation agencies, non-transportation agencies, and stakeholders on the broader implications of plan direction and recommendations?	☐	☐	☐
8. What is your ability to develop future scenarios, assess trade-offs, and forecast the impact of different investment strategies on transportation and non-transportation outcomes?	☐	☐	☐
9. How adequate is your ability to inventory and define existing transportation system conditions/performance?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Strategic Decision #12. Feedback—monitoring and reporting agency performance.

Assessment Questions	Not at all	To some extent	Extensively
1. How well do your current performance measures enable you to predict outcomes, link decisions to goals, and report results?	☐	☐	☐
2. How well are performance measures integrated into department-wide decisionmaking?	☐	☐	☐
3. Does your planning process include communications approaches, strategies, and developed channels to engage transportation agencies, non-transportation agencies, and stakeholders on the broader implications of plan direction and recommendations?	☐	☐	☐
Total the "*not at all,*" "*to some extent,*" and "*extensively*" responses indicated.			

Self-Assessment Tool—Summary Worksheet

Record the number of responses from each strategic decision in the "Summary Worksheet" (see below) to indicate how often you answered "not at all," "to some extent," or "extensively."

Strategic decisions that have the largest number of "not at all" responses or a significant number of "not at all" and "to some extent" responses represent opportunities with the highest potential for improvement.

Strategic Decisions—Summary Sheet	Not at all	To some extent	Extensively
1. Aligning DOT and Statewide Goals, Priorities, and Performance			
2. Agency Visioning and Goal Setting			
3. Identifying Performance Outcomes			
4. Defining State, Regional, and Local Roles			
5. Internally Integrated Planning			
6. Externally Integrated Planning			
7. Revenue and Financial Planning			
8. Investment Strategy Resource Allocation			
9. Linking Performance Measures to Outcomes			
10. Program-Level Resource Allocation			
11. Aligning Project-Level Decisionmaking			
12. Feedback—Monitoring and Reporting Agency Performance			

Summary Reference for Assessment Questions

The table shows which of the 12 strategic decisions are included in each individual self-assessment question. In the table, self-assessment questions are grouped into five categories: strategic direction, planning processes, communications, analytics and data, and management.

	Strategic Decision											
Self-Assessment Question	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Strategic Direction												
Does your DOT have multiple documents or processes that establish strategic direction? If so, are the key elements (goals, objectives, and performance measures) aligned?	1	2	3		5					10	11	
How familiar are you with the full range of state and local strategic documents that should influence your DOT's strategic direction and planning processes? Are these integrated into your LRTP?	1	2								10	11	
Do you have strategic-level visioning tools and, if so, how effective are they?		2										
How broadly are agency goals, objectives, etc. known and embraced throughout the department?					5					10	11	
How well, and at what level, are your agency's roles and responsibilities defined? How well do these definitions support anticipated or potential changes in mission?				4								
Are planning recommendations and products informing the decisions made by the CEO and executive leadership team?				4								
Planning Processes												
How well do your planning and programming cycles accommodate changing trends and emerging issues?			3									
How well connected are your long-range, mid-range, and short-range planning and programming processes?		2			5			8		10	11	
How well do your planning processes consider non-improvement needs such as asset management and operations?		2			5							
How well do your current performance measures enable you to predict outcomes, link decisions to goals, and report results?									9	10	11	12
How well are performance measures integrated into department-wide decisionmaking?		2						8		10	11	12
How thoroughly are social, economic, and environmental conditions incorporated into your decision-making frameworks?			3			6			9	10		
Are your project selection processes transparent, consistent, and understood internally and externally?								8				

(continued on next page)

	Strategic Decision											
Self-Assessment Question	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
How familiar are you with the full range of state and local strategic documents that should influence your DOT's strategic direction and planning processes? Are these integrated into your LRTP?						6						
Has your agency established a formal understanding of the technical and policy-related roles and responsibilities with planning partners (MPOs, RPOs, transit agencies, tribes, etc.)?				4								
Communications												
Does your planning process include communications approaches, strategies, and developed channels to engage transportation agencies, non-transportation agencies, and stakeholders on the broader implications of plan direction and recommendations?	1					6				10	11	12
Analytics and Data												
How well does your planning office stay abreast of relevant current and emerging trends? Do you have the knowledge, capabilities, data, and other resources to ensure that this is occurring routinely?		2										
What is your ability to develop future scenarios, assess trade-offs, and forecast the impact of different investment strategies on transportation and non-transportation outcomes?		2				6		8		10	11	
How adequate is your ability to inventory and define existing transportation system conditions/performance?		2								10	11	
How well does your agency understand and manage its current and potential revenue sources?				4			7					
How strong is your agency's ability to forecast revenues, cash flow, etc.?							7					
Does your DOT consider data quality as part of its decisions? If so, how robust are efforts to ensure the maturity of your data management/stewardship practices (such as the reliability, accuracy, timeliness, and consistency of data programs)?			3		5							
Does your DOT have a centralized data function? If so, to what degree does duplication or overlap exist?					5							
Management												
How well does your planning department recruit, develop, and plan for succession?		2										
How strong are your agency's capabilities to use "innovative approaches" to reduce costs and deliver projects/programs more effectively?							7					

Step 2: Identify the Priority Strategic Decisions That DOT Executives Are Most Likely to Support

Based on the self-assessment tool "Summary Worksheet," the planning director or team should focus on the three to five strategic decisions that corresponded with the most "not at all" or "to some extent" responses. These strategic decisions have been screened as most relevant to the DOT.

If the list of potential changes identified in Step 1 seems too ambitious, the planning director or team should prioritize the strategic decisions. Many criteria can be used, such as the following:

- Which of the changes, or strategic decisions, should be addressed in tandem to achieve the full benefit of the change? For example, several strategic decisions are related to implementing performance-based planning and so can be prioritized together.
- Which of the strategic decisions is likely to provide the greatest benefit for the least investment of staff or financial resources?
- Where applicable, are the likely partners willing to participate in making the changes identified in the strategic decisions?
- Are there significant risks to implementing the change or strategic decisions? Are there ideas for how these significant risks could be mitigated?

The team may identify different or additional criteria for screening the list of potential strategic decisions, but the aim is to identify a list of three to five strategic decisions that the planning director will recommend to the DOT executive team.

As part of the process of prioritizing the strategic decisions, the planning director or team should review the "What Is Different?" section of each strategic decision discussion. This will help to

1. Confirm the planning director's/team's understanding of what changes are involved in implementing that strategic decision.
2. Indicate what is already in place to support the recommended 21st century planning approach.
3. Determine whether this strategic decision should be included as a part of the "case for change" that is recommended to the CEO and the executive leadership team.

The list of priority strategic decisions that results from this process will be used in developing a case for change in meeting with DOT executives.

Step 3: Develop a "Case for Change" and a "Change Management Plan" for Meeting with DOT Executives

Making the most of the changes in the 12 strategic decisions highlighted in this guidance will likely require support from the DOT secretary and executive leaders across the organization. They will need to be committed to a new way of doing business and allocating the time and potentially the financial resources needed to support the design and implementation of specific changes. The section "Change Management" in Chapter 7 provides more information on the role of executives in implementing change.

No single approach to engaging executive leaders appears in this discussion. The approach will depend on the relationships, organizational structure, and "protocols" of the DOT. Some standard elements should be covered with every executive team, as described below.

Identify an Executive-Level Champion

A committed member of the executive team should be willing to recommend the change agenda to the executive team. If the planning director is a member of the executive team, he/she can

be the champion. If not, someone else, most likely the deputy secretary responsible for planning, should support the change agenda.

Develop a Well-Crafted Case for Change

Executive leaders need to be convinced of the benefits of the change. A discussion of what is driving the need for change is the starting point for creating a case for change, but the planning director and executive champion need to tailor this case for change to specifically reach an executive leadership audience. In preparing this case for change, the following questions should be considered:

- **Who are the opinion leaders within the executive team?** What rationale will be most compelling to the CEO and any other opinion leaders on the team? Identifying the benefits that will appeal to these individuals will help build credibility and support for the change agenda.
- **Which of the executive leaders will have to be involved directly in the design and implementation of the change?** The implementation of some changes will require participation of staff from other parts of the DOT. For executive leaders in these areas to not only buy-in but also be willing to commit resources is essential.
- **What types of information does this group typically respond to?** A case for change developed by planning managers may not be as compelling to executives. What benefits will they be looking for? Time savings, cost savings, improvements in key partnerships, and clear commitment to the governor's agenda are all possible selling points, but "knowing your audience" and tailoring the case for change to the issues that will resonate with them are essential.
- **Be as specific as you can with regard to what is needed from each member individually and the executive leadership team as a whole.** Executives will not commit to a change agenda without a general understanding of what is needed from them personally and collectively. At this point, the change agenda will not be designed fully, but the recommendation should highlight the role and the general level of effort expected from executive leaders, the planning staff, staff from other parts of the DOT, and others external to the DOT.

The desired outcome of presenting the case for change to the executive team is their commitment to implementing the strategic decisions that will advance 21st century planning most effectively at the DOT.

As part of implementing the changes identified, your planning team and the executive leadership can review "Change Management" in Chapter 7.

CHAPTER 7

Implementation

Implementing a 21st century approach to planning will evolve over time. Several complex and supportive actions and interrelated changes must occur. Several of these overarching implementation issues are highlighted below.

Change Management

Introduction

Planning for the 21st century has a strong foundation. Many of the current planning processes and planner competencies and much of the technical support will continue to be essential in the future. Nonetheless, 21st century transportation planning can no longer be narrowly focused on highways, as it was throughout most of the 20th century; 21st century transportation planners must consider a wider range of transportation modes and facilities, a broader set of transportation-related goals, and a more diverse traveling public. DOTs will face the challenge of identifying the set of changes that will help transportation planning move into the 21st century. Once a DOT has identified what change is needed, the department's executive leaders should be committed to implementing a change management approach that will support the planning office and its staff as they develop the strategy and actions needed to implement changes as smoothly as possible.

Many of the changes described in this guidance reach well beyond the DOT. Twenty-first century planning encourages an integrated and multimodal approach that requires intra- and interagency collaboration. These broadbased changes will be overwhelming if too much is taken on simultaneously. The planning director and DOT executive leadership team should thoughtfully consider the challenges facing their agency and what changes to the planning function are most essential to support agency, and potentially statewide, strategic decisionmaking.

Organizational change is really about communicating new expectations for how work should be done and holding people accountable for implementing those new expectations. Change only occurs when the people who are responsible for executing the day-to-day processes actually implement new procedures. Three critical success factors for institutionalizing change are the following:

1. Leaders of change should help those who are impacted understand why they need to change (the case for change), what about their job is changing (the changing expectations), and what the change will look like when it is complete (the change vision).
2. Leaders should provide employees with the resources and skills needed to design and execute change.
3. Leaders should empower managers to implement change and hold managers accountable for seeing change through completion.

These success factors are significant challenges for any executive leadership team that is serious about implementing change, so DOT leaders need to work with managers who are as committed to these critical success factors as the leadership team is. This leadership-management partnership is particularly critical when the proposed changes affect multiple organizational units, require new working relationships or processes, are expected to be implemented while maintaining current production or performance levels, or are planned to be implemented simultaneously. All of this will be true for any DOT that decides to implement any major element of 21st century planning. The role of managers during this type of complex change process is to ensure that the change vision is translated into action plans; to reinforce with the staff the case for change and the change vision developed by the executive team; to ensure timely and complete implementation of the action plans; and to monitor, measure, and provide feedback to executives about both the implementation progress and the overall success of the change agenda.

Successful change management is complex. It requires that all steps of the change management plan are completed and implemented and that change enablers are in place. Change enablers are the resources, training, incentives and disincentives, and robust communication that must be in place for changes to be successful. Often, leadership assumes that existing management structures, relationships, and processes are sufficient to guarantee change implementation. This is rarely the case. The current management system is in place to handle the current day-to-day work. Weaknesses in the current management and communications processes are often the root causes for the change agenda in the first place. In addition, an organization rarely has the luxury of reducing performance or production while implementing change. Change must be implemented while maintaining performance and production levels. This overload can strain the existing management structure, and such strain can create a feeling of organizational chaos. To mitigate this sense of chaos, one objective of implementing a change management process should be to manage explicitly and thoughtfully all aspects of the change management plan and the change enablers.

Elements of a Change Management Plan

A formal, structured change management approach, documented through a formal change management plan, can help leaders and managers structure a thoughtful change process. The elements of a change management plan are the following:

- **A case for change.** A clear, concise, and compelling case for change is one of the responsibilities of the DOT executive team. This case for change can be drafted by the DOT planning director, but given the scope of potential changes it should be endorsed and actively supported by the full leadership team, including the secretary.
- **A change vision.** A change vision is a statement that communicates what the major differences will be in operations, management, and so forth, once the changes have been implemented. Like the case for change, the change vision should be clear, concise, and compelling. The planning director can also take the lead in developing a change vision, but, as with the case for change, the change vision should be endorsed by the full leadership team.
- **A change strategy.** The change strategy provides the framework for implementation. It translates the concepts of the vision into high-level implementation actions.
- **Critical success factors.** Critical success factors are the factors in a change initiative that absolutely must succeed, or the entire initiative will fail. Identification of critical success factors is a risk management strategy. As the lynchpins for success, the critical success factors should be identified explicitly, and risk management strategies should be developed to manage the inevitable pitfalls that will emerge during implementation of the change initiative.
- **Detailed action plans.** Detailed action plans provide specifics about implementation by defining tasks, schedules, assigned responsibilities, and resources. When many changes are being implemented simultaneously, the action plans should be integrated into an overall change

"project" management plan. This coordinated management plan identifies the priorities of the change initiative and allocates limited resources to its most essential elements.

- **An accountable management structure.** Everyone should understand and fulfill their roles and responsibilities. An explicit management structure ensures that implementation failures can be addressed and corrected, whether those failures are based on inability to perform or basic resistance to change.
- **Performance measures.** Performance measures serve two functions in a change initiative: (1) they relate to the basic project management of the implementation (i.e., whether it is on time and within budget), and (2) they indicate the status of progress toward achieving the change vision. The measures of progress toward achieving the vision need to indicate whether the implementation actions, individually and collectively, are moving the organization in the right direction.
- **A monitoring and feedback system.** The goal of the formal monitoring and feedback system is to ensure that the progress and performance measures are discussed regularly, and action is taken as needed. This monitoring institutionalizes the implementation by establishing the expectation and communicating upfront that the planning director and executive team will be paying attention to the change agenda.

Change Management Enablers

In addition to a structured change management plan, the executive team and the planning director should pay attention to the change enablers. Change enablers (resources, training, incentives and disincentives, and robust communication) are ongoing support activities or actions that must be in place if the change initiative is to succeed:

- **Resources.** Thinking that change can be implemented without the commitment of time and money is unrealistic. Resources are always constrained, so setting priorities by modifying the scope or time frame of changes to match available resources is essential.
- **Training.** Change implementation usually requires a modification of individual process steps and tasks. The people executing those steps and tasks need to be trained in the new way of working. If staff do not know how to do their job differently, they are likely to become frustrated and resistant to change. Training should be an integral part of every action plan. The team developing the action plan is in the best position to understand the extent of the intended change and, therefore, the scope of the training program needed.
- **Incentives and disincentives.** These are the mechanisms that hold the accountability structure together. If failure to change has no consequences, no accountability is built into the system. Changing individual actions and behaviors can be difficult, particularly if the change agenda is large or complex. When the planned changes are significant, individuals can easily feel that no one will notice if they do their jobs as they always have. Incentives and disincentives are the way that the organization can reward willingness to change or discourage resistance to change.
- **Communication.** Significant organizational change often feels like chaos to employees. Frequently, these employees do not understand the big picture. All they see is that their job has been targeted for change. It is a rare employee who does not feel some anxiety or even pain associated with changes to their day-to-day work. The best way to minimize the anxiety is to communicate with employees regularly, openly, and honestly. This communication should go both ways: accurate information should be provided to employees, and employees should be provided an opportunity to ask questions and give feedback.

Significant change should be undertaken thoughtfully and designed around an ultimate vision of what the end state will be. Implementation of that vision can and usually should occur incrementally. The guidance herein will help planning directors and DOT executive leadership teams define what 21st century planning means for their state and their state DOT. Using

a change management approach can provide them with the structure to tailor this vision and define the steps needed to move the planning office to a strategic decision-making role.

Organizational Silos

Reducing the siloed management and decisionmaking at a DOT is essential to improving the effectiveness of the agency in the 21st century. Although planners and other transportation experts often talk about the need to break down silos to create a more integrated organization, agency leaders typically find this difficult to achieve in practice. Some approaches to consider in moving toward a structure oriented around workflow include the following:

- **Take an incremental approach.** The transformation from a traditional, silo-based organization to a workflow structure cannot be achieved overnight. Agencies may wish to consider hybrid or matrix-based structures that maintain some level of functional silos, but take advantage of opportunities to establish multidisciplinary teams for projects and program delivery.
- **Reframe the agency mission.** Treat the agency's mission as a shared responsibility that crosses across all organizational boundaries, e.g., "asset management."
- **Establish multidisciplinary leadership teams and cross-functional project managers.** Leadership teams can ensure senior management commitment to team-based approaches that work to improve communications across organizational structures. Project managers or ombudsman-type positions that cut across silos can help solve problems.
- **Provide team-based training.** Avoid providing training that isolates staff by skill or discipline. Instead, develop training programs that bring together staff and managers from across the agency and promote team-based approaches to problem solving.
- **Promote employee empowerment.** Empower employees to give them the flexibility to develop processes and solve problems in innovative ways that transcend traditional, silo-based approaches.

Risk Assessment and Risk Management

How planning evolves to address the challenges of the 21st century is not the only major change initiative that DOTs are facing. The same challenges that are driving change in planning have an impact on design, construction, maintenance, and operations. In the 21st century, every part of the DOT needs to reach out more effectively to partners and stakeholders, establish more accountability and transparency, and work across silos to understand and incorporate agency thinking into their daily decisionmaking. The increasing complexity of relationships and decision-making is raising the visibility of every decision the DOT makes and, in this age of instantaneous communication, even a small misstep can become a major public issue.

CEOs at state DOTs have recognized the challenges of managing the DOT in the 21st century and are beginning to understand how risk assessment and risk management should be incorporated into DOT decisionmaking at the project, program, and enterprise level. NCHRP Project 08-36 (74), "Executive Strategies for Risk Management by State Departments of Transportation" highlighted the importance of project and program risk management as building blocks for enterprise risk management, which was defined in that research as "the consistent application of techniques to manage the uncertainties in achieving DOT strategic objectives." NCHRP Project 08-93, "Managing Risk Across the Enterprise: A Guidebook for State DOTs," will help state DOTs understand and embed risk assessment and management into decisionmaking at all levels of the DOT.

Most often, DOTs consider risk as an event that has negative impact on the organization. In fact, risk and opportunity are two sides of the same coin. One benefit of risk management is that it not only identifies cross-cutting risks that might have negative impacts, but it also

identifies and captures opportunities that might otherwise be missed. In determining which priority changes are needed to align the DOT with 21st century planning principles, executives and planning directors should evaluate the risks and potential rewards of each proposed change.

Risk assessment and management should be applied at two levels as DOTs incorporate 21st century planning principles into their strategic decisionmaking. The first level is as a part of the change management plan itself. The overarching risk assessment questions in designing the change management program are the following:

- What are the risks and rewards for the planning office, the DOT, or the state of implementing this specific change?
- How can we design the change initiative to maximize the benefits and minimize or mitigate the risks?

The answers to these two questions are essential in preparing the change management plan. The information gathered and the executive leader discussions on each question will help determine both the overall change strategy and the priorities and sequencing of the action plans, will help to define the critical success factors, and will influence the design and implementation of various enabling supports.

The second level of risk consideration is for each of the 12 individual strategic decisions discussed in this guidance. Executives should charge planning directors and their staff with integrating risk assessment and management into any changes to current planning practice. At the individual decision level, risk is often assessed by asking a series of "What if?" questions such as, "What if the governor doesn't have a clear vision?" "What if the DOT is not internally aligned?" or "What if a new gas tax is passed?" Scenario evaluation is an excellent technique for helping to assess risk in strategic decisions supported by planning. The purpose is to evaluate the consequences of different actions or decisions.

DOTs that ask hard questions and evaluate both the potentially positive and negative consequences of their strategic decisionmaking can develop contingency plans and mitigation strategies so that the agency is better prepared to act decisively when unforeseen events occur. In implementing 21st century planning, the integration of a risk approach into each of the 12 strategic decisions described herein should be built into the change management action plans. The action plans should identify the "when, how, and who" for an explicit risk assessment and should describe how the results of the assessment will be carried forward so that risk management is embedded in the ongoing decision-making process.

Integrating risk management into 21st century planning has multiple benefits. Risk assessment and risk management provide immediate payoffs for the department (actual risks avoided, better-aligned practices, improved communication, common organizational values, etc.) and for customers and stakeholders (better reliability, improved transparency, etc.). The provision of internal and external benefits saves money and provides a sense of accomplishment, but the real payoff comes over the longer term. When enterprise risk awareness becomes embedded in department culture, avoiding very and moderately frequent risks becomes a part of everyday practice, and more attention can be focused on efficient, systematic avoidance of high-impact/low-probability risks that could have devastating impacts. Similarly, the department may recognize high-payoff opportunities that might otherwise have been missed.

Data

The foundation of 21st century planning is data-driven decisionmaking. No other single issue is as critical to the successful implementation of performance-based planning, internally and externally integrated planning, and public and elected official trust in the DOT as the agency's

ability to show efficient and effective use of public dollars. Timely, accurate, and cost-effective data collection is undoubtedly the foundation for success. Many DOT planners may struggle with identifying which data are most relevant to planning and how limited resources should be spent to collect and analyze relevant data. The data collected and analyzed should correspond to the performance measures that have been selected; inform and be sensitive to decisionmaking; and be easy for decision makers, stakeholders, and the public to understand.

As the importance of data increases, so too does the need to implement sound data management practices to ensure the quality, integrity, and security of data. Data must be accurate, and collection/calculation methods must be transparent. That departments and agencies collaborate and share data, and trust each other's data, is important. Key steps that agencies can take to ensure that they manage and use their data resources efficiently and effectively include the following:

- Establish a chief technology or information officer to oversee overall agency data collection and management in close coordination with planning staff. This person should be responsible for DOT data integrity and security and ensure that the agency is well positioned to take a *central* role in promoting interagency coordination and ensuring system interoperability to facilitate better and more efficient data collection, sharing, and analysis.
- Assess agency data management practices, either through self-assessment or an external review, to *evaluate* how well existing data resources align with strategic needs and identify where gaps exist in agency approaches to data administration (i.e., data management policies and practices) and data quality (e.g., accuracy, consistency, reliability, timeliness, and integrity). NCHRP Project 08-36 (100) provides guidance on data management practices at state DOTs.
- Based on the results of the data management assessment, develop a comprehensive agency data management plan.
- Promote and enable data-sharing both within the DOT and between DOTs and MPOs, RPOs, and other state and local agencies.
- Broaden the range of data that is used in transportation planning, such as incorporating public health, crime, or other non-transportation data to help understand and integrate consideration of broad statewide and societal goals.
- Conduct strategic hiring and train existing staff to improve the agency's overall data management capabilities, including awareness of the full range of resources available and the effective use of these data sources to inform agency decisionmaking.

Staffing/Planner Skills and Competencies

Planning in the 21st century will require new skills and competencies. Some general description of what will be needed can be drawn from the interviews and discussions that informed the development of this guidance. This information is not a comprehensive competency profile; rather it provides insights into what will be needed based on a limited number of interviews.[14]

Current Planner Responsibilities

Seven key competencies describe the responsibilities of today's transportation planner. All will remain important for planners in the future, so DOTs should continue to focus on these

[14]The information included in this section provides an overview of competency categories that are expected to be required for planners, but this list might not be exhaustive. A more in-depth study could shed light on the specific competencies and level of proficiency required for each of those competencies based on transportation planner job type.

competencies as part of staff development, recruiting, and workforce planning. The seven planning competencies are the following:

1. **Visioning and strategic thinking.** With changes that are occurring in state DOTs, planners should have an understanding of broader statewide goals, direction, and vision. Broader statewide vision and plans should be incorporated into all aspects of planning. For planners to be effective, they should be able to help facilitate interagency and cross-jurisdictional integration.
2. **Fostering collaborative relationships.** Since transportation planning is expected to become more multimodal and integrated, relationship building with new individuals and agencies will be essential. Planners will need to interact with a variety of people to be successful: others within their DOT; staff at MPOs and other state, local, and federal agencies; and elected local officials. Planners can help to bring people together to meet common goals and, in essence, may need to become the facilitators for communication among various agencies and stakeholder groups.
3. **Communication.** Given the increased focus on relationship building, planners should have strong communication skills needed to build relationships and social networks across a wide spectrum of formal and informal groups. Planners will need to develop the ability to speak persuasively and provide the rationale for actions taken and decisions made on the job. Additionally, as the avenues for communication continue to evolve (e.g., social media), planners should build competence in communicating effectively through these various channels. Planners may need to move beyond traditional message delivery technologies and methods.
4. **Leading people.** Planners should be able to lead both internal and external stakeholders to understand and support an integrated vision of transportation. In communicating why and how decisions need to be made, planners can remove silos to more holistically facilitate integrated planning. As new workers enter into planner jobs, they should be trained to be proficient in facilitation, building employee engagement, and communication skills so as to effectively lead others within their organization.
5. **Analysis and problem solving.** In the future, problem solving in planning will be focused on determining the type and content of available information and how to analyze and understand the data. Because of the overabundance of data, planners will need to be able to filter available information—determining what is relevant and useful for their purposes. Planners will also have to be able to determine how to present information in a readily understandable way to supervisors, leaders, and the public.
6. **Specialized transportation planning expertise.** With the new requirements set forth in MAP-21, planners should understand and use performance measures to make decisions and evaluate the success of programs. Planners will continue to need their specialized knowledge, such as GIS and related analyses.
7. **Transportation industry awareness.** Planners should understand the overarching picture of the transportation industry in order to help state DOTs evolve into more multimodal agencies. Knowledge of the industry overall and an understanding of various public and private stakeholders will be important for planners moving forward.

New Competencies Needed for Planners

To adapt to planning in the 21st century, planners should possess a broader range of skills and competencies than those currently required of planners in the workforce. These additional competencies include the following:

- **External awareness.** Because the transportation industry is becoming more multimodal, planners should have knowledge of some topics and factors that were not always linked with transportation in the past. These issues include land use, health, the economy, and quality of

life for communities. Planners should embrace a more holistic perspective, one that considers how transportation fits into larger environmental and community concerns.

- **Decision-making acuity.** With the increasing utilization and speed of technology, people expect results quickly. This expectation will push planners to define problems and produce results much more quickly than they have in the past. Rapid changes can occur in situational factors, and planners should be able to "think on their feet" and provide support quickly and effectively.
- **Change readiness.** As transportation systems continue to evolve, planners should be able to anticipate changes, quickly adapt to them, and adjust their work and processes as needed. Not all changes can be accurately projected, so planners will need to be prepared to meet any new requirements that arise. New tools and methods may need to be developed by planners to respond to rapid changes in the economy, society, or government.

A variety of organizations and agencies have invested heavily in developing and providing information, training, and technical resources to transportation agencies and staff. The National Highway Institute, AASHTO, FHWA, FTA, TRB, and many other agencies regularly publish resources such as guidebooks, assessment tools, and software programs and hold events such as peer exchanges, workshops, and conferences to educate transportation professionals about developments in the field and advances in data and tools. Increasing knowledge about cutting-edge resources and new developments enables transportation professionals to perform their jobs more effectively and ultimately improve their agencies' effectiveness.

Strategies to Attract, Recruit, and Retain Planners in the 21st Century

With the changes that are occurring for planners, DOTs should align their recruitment and retention strategies with the competencies needed in the future planner workforce. Some strategies are described below.

Implement employee mentoring program. Mentoring programs enable senior employees to share experiences and expertise with more junior staff. The mentoring experience is one way that junior staff can learn to overcome obstacles to career success and better understand how to be effective in their job. Mentors who are experienced in transportation planning can support their mentees by helping them understand required competencies and how to best execute their work. The meetings can also help junior employees successfully navigate a career in planning.

Implement a rewards program for high performers. Recognizing the accomplishments of high-performing employees can help improve performance by incentivizing employees to produce high-quality work. Employees can be recognized with awards or publicly acknowledged for high-quality work. To ensure that rewards programs are well received by employees, the rewards should recognize a particular behavior or outcome and be distributed in a way that is seen as fair. Also, a clear rationale for the reward should be provided.

Create advancement within positions. Even in a fairly flat organization, advancement opportunities can be developed to help retain employees. State DOTs could work to create advancement opportunities by developing separate tiers or blocks (e.g., beginner, expert) within a position. Within the tiers, employees can be compensated for the competencies or skills that they demonstrate and, when qualified, can be advanced to the next tier. By creating within-position tiers, the organization can avoid becoming too hierarchical and yet still recognize staff for development.

Recruit nontraditional applicants. With changes that are occurring in the workforce, DOTs may struggle to find sufficient numbers of quality employees within the traditional candidate pool. Having organizations implement programs that recruit applicants from groups

that may not be traditionally associated with transportation is valuable. For example, focusing on attracting applicants with work experience (e.g., military, business), demographic background (e.g., minority candidates), and life experience (e.g., single parents, retirees) that differ from those of individuals who have spent their careers in transportation can be valuable. Programs aimed at recruiting nontraditional employees can help increase the visibility of jobs and bring in more qualified applicants to fill open positions.

Provide a Realistic Job Preview. Because of the changing job requirements for planners, potential candidates for planning positions may not fully understand the nature of the job or what will be required of them in these positions. Without this understanding, DOTs risk hiring employees who are not ready to perform the job as needed or who do not fit well within the planning environment. To give applicants an understanding of job requirements, a Realistic Job Preview (RJP) can be used. An RJP is a recruiting approach that previews the actual day-to-day work in a job and communicates important aspects of the work and requirements to applicants. The information provided in an RJP helps applicants gain a full understanding of what a job will require and allows them to form more accurate expectations. An RJP can take many forms, such as virtual videos or printed materials, and can incorporate information, questions, and answers regarding the job.

Utilize social networking for recruitment. Social media is becoming an increasingly used and valued form of communication among individuals. Social media can also be a way to reach potential new employees and share information about planner jobs, job requirements, and why individuals would want to work for a specific state DOT or organization. Facebook, Twitter, LinkedIn, and CareerBuilder are all being used effectively by organizations to share information and recruit needed employees.

APPENDIX A

Stakeholder Outreach Summary

Research Approach

Each state DOT has over time created its unique "transportation provider" mission, organization, and culture in response to its own customer expectations, financial resources, political landscape, and physical context. NCHRP Project 08-36 (113), "The Future of Transportation Planning in State DOTs," aimed to address the question of how planning can maintain its relevancy and meet the unique demands and challenges of transportation in the 21st century. This appendix provides a brief summary of the research approach.

Significant stakeholder involvement, from a broad range of transportation industry leaders, provided direction for this guidance. In addition to the **NCHRP Panel**, an **Advisory Team** of six state DOT leaders was created to provide input and guide decisions throughout the project, particularly as the scenario workshop plans were developed. A series of 18 **interviews** with state DOT planners, executives, internal and external "customers" of state DOT planning, and federal staff was conducted early in the project to identify the role of planning at DOTs and initial ideas on ways in which planning is expected to evolve in response to a variety of future changes. **Outreach** was then conducted by the research team to AASHTO's Standing Committee on Planning and other national organizations to inform these groups of the project activities and to obtain additional feedback about the findings and scenarios under development. A **scenario workshop**, the centerpiece of the project, involved professionals from a variety of transportation-related fields offering their perspectives on how planning would be most relevant under three scenarios and identifying changes that would be required of planning under all scenarios. The findings from all of these activities informed the contents of this guidance.

Outreach Plan

In addition to coordination with the NCHRP project panel, the following outreach was conducted to gather input and direction for the products:

- **Advisory Team.** Six state DOT leaders participated on an advisory team to provide input and guide decisions throughout the project, particularly as the scenario workshop plans were developed.
- **Interviews.** A series of 18 interviews with state DOT planners, executives, internal and external "customers" of state DOT planning, and federal staff was conducted early in the project to identify the role of planning at DOTs and initial ideas on ways in which planning is expected to evolve in response to a variety of future changes.
- **Industry Involvement.** Additional outreach was then conducted by the research team to AASHTO's Standing Committee on Planning and other national organizations (including the National Association of Development Organizations [NADO] and the Association of

Metropolitan Planning Organizations [AMPO]) to inform these groups of the project activities and gather additional feedback about the findings and scenarios under development.
- **Scenario Workshop.** The centerpiece of the project, the scenario workshop, involved professionals from a variety of transportation-related fields offering their perspectives on how planning would be most relevant under three scenarios and identifying changes that would be required of planning under all scenarios.

The findings from all of these activities informed the contents of this guidance. Outreach participants and participating organizations are listed in Tables A-1 and A-2, respectively, and more details on the outreach approach follow.

Advisory Team

The Advisory Team provided feedback from a state DOT leadership perspective. Specifically, the Advisory Team provided the research team with valuable feedback on the themes and key findings from the baseline research. The Advisory Team reviewed the scenarios drafted for the workshop.

Interviews

One-on-one telephone interviews were conducted with state DOT CEOs, state DOT planning directors, non-planning staff from state DOTs (internal "customers"), external "customers" of state DOT planning products (e.g., MPO staff), and FHWA staff. Interviews were scheduled for between 30 and 45 minutes and consisted of the questions listed below. The purpose of the interviews was to identify the value that state DOT planning currently brings to the DOT and external customers, as well as ways in which interviewees felt that planning's value could be enhanced. Interview questions are listed below according to interviewee category (CEOs, planning directors, FHWA staff, internal customers, external customers):

CEOs

1. What do you envision as the most important mission of your agency? How does planning currently support that mission?

Table A-1. Outreach participants.

Tom Barry	Donna Gardino	Amy Kessler	Jim Ritzman
Wayne Berman	Peter Gregory	Carrie Kissel	Steve Rudy
Carlos Boa	Ned Hacker	Michael Lamprecht	Dennis Simpson
Peter Buchwald	Paula Hammond	David Lee	Michael Skipper
David Carlson	Michael Hancock	Grant Levi	Greg Slater
Tom Cole	Matthew Hardy	Jeff Lindley	Brian Smith
Gene Conti	Jane Hayse	Mike McCoy	Peter Stephanos
Paul Degges	Mell Henderson	Jody McCullough	Kirk Steudle
Rich Denbow	Patricia Hendren	Deb Miller	Muggs Stoll
Jennifer Dill	Tim Henkel	Harlan Miller	Ed Strocko
Steve Etcher	Julie Hunkins	Nancy Olson	Kevin Walsh
Chris Evilla	Ashby Johnson	Neil Pedersen	Lynn Weiskopf
Chris Fetzer	Greg Johnson	Tom Reinauer	Mark Wilkes
Kimberly Fisher	Crystal Jones	Robert Ritter	
Mike Franchini	Eric Kalivoda		

Table A-2. Participating organizations.

AASHTO	Idaho DOT	Parsons Brinckerhoff
AMPO	Louisiana DOT	Parsons Engineering
Atlanta Regional Commission	Maryland State Highway Administration	Pennsylvania DOT
Boonslick Regional Planning Commission (MO)	Maryland Transportation Authority	Portland State University (OR)
California Strategic Growth Council	Massachusetts DOT	San Diego Association of Governments
Cambridge Systematics	Miami-Dade MPO (FL)	Southern Maine RPC
Capital District Transportation Committee (NY)	Michigan DOT	St. Lucie TPO (FL)
Chatham County-Savannah MPC Coastal Region MPO (GA)	Mid-America Regional Council (Kansas City, MO)	Tennessee DOT
Cheyenne MPO (WY)	Minnesota DOT	TRB
Denver Council of Governments	NADO	Two Rivers-Ottauquechee Regional Commission (VT)
Fairbanks Metropolitan Area Transportation System (AK)	Nashville MPO	Waco MPO (TX)
FHWA	North Carolina DOT	Wasatch Front Regional Council (UT)
Florida DOT	North Central Pennsylvania Regional Planning and Development Commission	Washington DOT
Houston-Galveston MPO (TX)	Northern Arizona Council of Governments	Washington Metropolitan Area Transit Authority (Washington, DC)

2. How does your planning staff support your strategic decisions (e.g., overall organization direction and strategy, revenue generation strategy, resource allocation, federal or state law or regulation, strategic partnering, organizational structure)?
3. Some have expressed the opinion that planning's relevance to strategic DOT decisionmaking has declined. What is your reaction to that opinion? If you agree, what do you think can be done to increase the relevance of planning to the department's strategic decisionmaking?
4. How do you think the role of the DOT might change over the next 5–10 years? As the agency evolves, how will the role of planning change?

Planning Directors

1. What are the three most important work products the planning office provides in support of strategic decisions made by the DOT?
2. Some have expressed the opinion that planning's relevance to strategic DOT decisionmaking has declined. What is your reaction to that opinion? If you agree, what do you think can be done to increase the relevance of planning to the department's strategic decisionmaking?

3. What key agency policy decisions (e.g., resource allocation, project selection, strategic partnering, federal reauthorization positions, organizational structure, institutional capacity investment) does planning in your agency currently support?
4. In which issue areas should planning influence strategic decisionmaking, but currently does not? What do you see as the main barriers to planning influencing these areas and how could the barriers be eliminated or reduced?
5. What is your agency's asset management philosophy or approach? Is planning involved? If yes, how?
6. If you could change one thing about the way our industry does planning, what would it be, and why?
7. When you are hiring planners for your agency, what skills and competencies are most essential? For your mid-career planning professionals, what skills and competencies are most essential?
8. What are some of the greatest deficits in skills and competencies you see among planners?

FHWA Staff

1. What traits do you consider important to a strong state DOT planning department?
2. Some have expressed the opinion that planning's relevance to strategic DOT decisionmaking has declined. What is your reaction to that opinion? If you agree, what do you think can be done to increase the relevance of planning to the department's strategic decisionmaking?
3. Where do you think state DOT planning should influence strategic DOT decisionmaking, but for most agencies does not? What do you see as the main barriers to planning influencing these areas?
4. How can FHWA improve planning's relevance to strategic transportation decisionmaking?
5. If you could change one thing about the way our industry does planning, what would it be, and why?

Internal Customers (Chief Engineers, Maintenance, Asset Management Staff, etc.)

1. Do you directly or does your staff work with staff from the planning office to develop recommendations in support of the department's strategic decisions (e.g., resource or investment allocations, project selection, strategic partnering, external relationship building)? If yes, on what type of decisions and how is it structured (formal teams or committees, informal one-on-one relationships, information exchange)?
2. What products or services is the planning office currently providing to your part of the organization? (Probe for information about the relationship between planning and engineering sides of the organization related to asset management.)
3. Are there activities, services, or products you think the state DOT planning staff could be providing to you that they are not? If so, what are those and how would they help you?
4. Some have expressed the opinion that planning's relevance to strategic DOT decisionmaking has declined. What is your reaction to that opinion? If you agree, what do you think can be done to increase the relevance of planning to the department's strategic decisionmaking?

External Customers (MPOs and Industry Stakeholders)

1. Do you work routinely with your state DOT planning staff? If yes, what services or products do they provide to you? What products and services do you provide to your state DOT planning office?
2. Do state DOT planning products or services add value to your decisionmaking? In what ways do they help you do your job better?
3. Are there activities, services, or products you think the state DOT planning staff could be providing to you that they are not? If so, what are those and how would they help you?

4. Some have expressed the opinion that planning's relevance to strategic DOT decisionmaking has declined. What is your reaction to that opinion? If you agree, what do you think can be done to increase the relevance of planning to the department's strategic decisionmaking?
5. In what issue areas do you see state DOT planning doing a good job at communicating information to decision makers and stakeholders?
6. If you could change one thing about the way state DOTs do planning, what would it be, and why?

Industry Involvement

Significant outreach was conducted through facilitated discussions designed to gather information on challenges and opportunities that DOT planning faces today. In addition, participants were asked to provide their thoughts on strategic decisions that planning should support and the core competencies planners need.

SCOP Outreach

On August 12–15, 2013, the research team met with the AASHTO Standing Committee on Planning. The meeting involved a number of members of the Standing Committee on Planning as well as representatives of MPOs and consultants who support state DOT planning. The attendees had the opportunity to validate and supplement the information collected during the outreach phase of the project. In addition, these participants were asked to identify the three most important challenges and opportunities. The team provided a 5-minute overview of the project and used the remaining time to ask for perspectives on the key issues that would arise in development of the scenarios for the workshop.

National Organization Outreach

In addition to the Standing Committee on Planning outreach, webinars were held with the boards of directors of key external customers and partners, including AMPO, NADO, and key TRB committees. In these sessions, participants were asked about the role of state DOT planning in supporting, or potentially hindering, the strategic decisions made by these organizations.

Scenario Workshop

The centerpiece of this project was the scenario workshop. To organize the workshop, the research team formulated three significantly differentiated and thought-provoking scenarios that were designed to engage the participants in imagining how planning could and should change over the next decade or more to be more relevant and provide value not only to the agency, but also to the state and the wide range of planning partners that transportation touches in a substantial way. The scenarios were designed to serve as vehicles to help participants think about new and emerging planning demands, constraints, and opportunities. The purpose of the workshop was to build on the research and analysis conducted previously in the project by determining the likely implications of each scenario for planning in the 21st century. Descriptions of the three scenarios are provided below.

Scenario #1: Incremental Mission Change

The Scenario: Peggy Smith is the new Planning Director for a State DOT who has just returned after a 10-year hiatus. Once at the DOT, she discovers that the roles and responsibilities of the

agency have not radically changed since she left a decade ago. The division of state DOT, MPO, modal agency, and local government functions is generally the same as when she left. Her agency is primarily responsible for developing projects to improve the state highway system from concept to completion, as well as maintaining and operating the system. At the same time, her agency has continued to have a limited role in multimodal planning, land use coordination, and funding investment in non-state transportation assets.

The changes that have occurred to the DOT's mission have generally been incremental rather than transformational and mostly relate to either the agency's shifting investment emphasis or how the agency goes about its business. Due to the combination of deferred preservation spending, an aging system, and a failing transportation financing system reliant on declining motor fuel tax revenues, there is increased attention to preservation, optimizing investment, and operating the system more efficiently. The federal focus on performance management and achievement of national goals has created new demands for (1) transparency and analytical rigor in planning and programming processes; (2) system performance accountability across goal areas that compete for scarce transportation dollars; and (3) greater interagency coordination as state DOTs and partner agencies must work together to align their investments with national goal areas. Meanwhile, the state legislature is pushing the DOT to focus more on the economic benefits of individual projects, stakeholders have become more parochial and want to be more engaged in decisionmaking, and a broad definition of "customers" has emerged that is pushing the DOT to provide better and more comprehensive transportation-related data for various purposes.

Peggy recognizes that most of the current and emerging demands on agency planning are not entirely new, but rather reflect evolutionary changes to traditional planning products, services, and processes in response to shifting agency focus and business practices. To make her planning division relevant, Peggy has established the following goals that her division must achieve:

- **Performance-based planning.** Development of long-range plans is significantly more data and analytically driven than plans of the past. The development, analysis, and selection of alternative investment scenarios is largely based on predictive tools that help decision makers understand the short- and long-term trade-offs in overall system performance outcomes between different investment allocations. The selection of final plan investment strategies includes target setting for national goal areas.
- **Programming.** Long-range plans are directly linked to programming processes in a number of ways. For example, annual and multiyear budgeting and resource allocation activities are strongly influenced by the recommended investment scenario in the long-range plan, and project selection criteria are closely tied to performance metrics used to develop and assess plan scenarios.
- **Asset management.** The agency must continue to move beyond "worst first" approaches to system preservation decisionmaking and integrate the use of asset management systems and practices that help decision makers optimize expenditures on pavement, bridge, and other types of asset management investment. The results of these analyses should heavily influence planning and programming decisions.
- **Plan implementation.** The increase in both transparency and federal focus on system performance outcomes requires a much stronger link among planning, programming, and project implementation. This means that annual and/or multiyear allocations of resources for the DOT and MPOs, program structures, project selection process, and project development must be consistent with plan investment strategies and associated policies defined in the plan. Failure to do so could place federal funding at risk or, at a minimum, reduce the flexibility the DOT and MPOs have to control how funds are spent.

Assessment: Adapting agency planning practices to meet the demands of the current DOT operating environment has been greatly aided by the incremental nature and rational pace of

changes Peggy has needed to make. The preexisting division of responsibility among state DOTs, MPOs, and local agencies and the associated legal/institutional definition of decision-making roles are largely the same and have generally been supportive of the emerging planning paradigm. Similarly, the agency's well-defined process for creating plan strategic frameworks (i.e., goals, objectives, and performance measures) has enabled broader implementation and application of performance-based planning, enabled establishment of long-term goals for operating and managing the system, and helped pave the way for improved coordination between Peggy's DOT and local agencies with respect to development and implementation of additional accountability measures and integration of environmental considerations in the planning process.

On the other hand, there are a few characteristics about preexisting planning processes that have created barriers to reforms. In particular, maintaining the highway-centric focus of the DOT (and associated organizational culture), with local governments assuming multimodal planning responsibilities, has continued to lead to fragmented, uncoordinated planning and created barriers to true performance-based planning and programming. Similarly, the reactive nature of the prior planning process created a lack of process adaptability and a shortage of planner competencies/skills to respond to new external drivers, such as diversifying funding sources, emerging issues, planning integration opportunities, and new partners/stakeholders. Lastly, there is a disconnect between the national goal areas and the interests of state and local elected officials, which is causing state legislators to consider imposing greater restrictions on how state transportation funding can be spent.

Scenario #2: Strategy-Aligned Model

The Scenario: After close to a decade of efforts to revamp the way it approaches transportation infrastructure and services, the state of Nirvana created a new, more holistic statewide framework for planning transportation investment and delivering associated programs. For the state DOT (Nirvana DOT), this has meant expanding the agency's narrow mission from owning and operating the state highway system and selected multimodal facilities (e.g., ferries and a commuter rail line) to now include significant new planning leadership responsibilities. Specifically, Nirvana DOT is now charged with facilitating development of a cross-agency, cross-jurisdictional, and multimodal statewide strategy to align economic, transportation, and environmental vision, goals, and objectives.

The Nirvana DOT, in coordination with MPOs and RPOs, is responsible for establishing, monitoring, and reporting on statewide transportation performance targets and measures that align with national performance goals and are meant to drive or at least influence a broad range of state and local transportation, land use, and environmental decisionmaking. At the same time, the state shifted responsibility for leading development of long-range plans and project selection for all transportation investments within urbanized areas (not just those funded through selected federal programs) to MPOs. In rural areas, Nirvana DOT continues to lead plan development and project selection, but now does so in close cooperation with RPOs, many of which have recently been established. The development and implementation of Nirvana DOT's expanded mission required statutory changes to redefine the authority, responsibilities, and requirements of several state and local agencies involved with transportation, economic development, and environmental protection. The transition to the new framework has also been accompanied by significant change management initiatives to reorganize agency organizational structures, redefine interagency relationships, and revise business practices associated with planning, programming, and other strategic decision-making processes. Key changes that have come out of the reforms include the following:

- **Long-range planning.** Nirvana DOT's long-range planning process is now much more collaborative than it was in the past. The plan no longer simply focuses on transportation system

outcomes, but instead includes goals related to both transportation and issue areas such as economic development, air quality and other environmental factors, land use, and citizen quality of life. The state also now uses a least-cost planning approach that facilitates broader consideration of both alternative investment strategies and the lifecycle cost implications of implementing them. Development of the plan is still led by Nirvana DOT, but a wide array of organizations play a strong role in establishing the plan's direction and content, including the State Economic Development Board, the State Department of Environmental Quality and other regulatory agencies, the State Department of Local Affairs, MPOs/RPOs, the Chambers of Commerce, and the Nirvana Municipal League.

- **Budgeting and programming.** Nirvana DOT leads development of annual resource allocation decisions, but they are closely aligned with the target distribution of resources defined in the long-range plan (or, if not, the key partners that participated in the plan are consulted before the budget is finalized). Projects of "statewide" significance and rural initiatives on the state system are still selected by Nirvana DOT, but largely based on plan guidance and/or with strong RPO input. The selection of projects in urban areas is controlled by MPOs, who are then held accountable for achieving regional performance targets that align with overall plan goals and objectives.
- **Asset management.** As part of the process of developing Nirvana's new transportation planning framework, Nirvana DOT and its planning partners (including the MPOs/RPOs) agreed to make preservation of transportation assets a high priority and established minimum asset management thresholds (many of which were driven by national performance management requirements) that had to be achieved before state transportation resources could be spent on other purposes.
- **Plan implementation.** The overall impact of these changes is that while the DOT is still largely in charge of project development and implementation, project conception, long-range planning and programming are now shared responsibilities and are much more integrated. While this has made planning more complex and increased the challenge of getting to consensus, programming and project development have become streamlined since much of the "battle" has already been fought in plan development to strike the right balance between national goal alignment and addressing competing state/local priorities.

Assessment: The success of Nirvana's efforts to reform its planning process largely hinged on its ability to build from legacy processes for establishing goals and objectives that were established more than a decade ago. The primary benefits of Nirvana DOT's refined mission and the associated new statewide planning framework are (1) the DOT has expanded authority to coordinate across all agencies to ensure that high-level network performance metrics are achieved, (2) strong partner buy-in is established for achieving targets, and (3) there is greater conceptual and process support for linking transportation to "other societal goals."

While the transition to the new planning framework has generally been a success, the new approach has also had its shortcomings. The reforms have (1) created the need for new relationships among various planning players, processes, and outcomes, and sorting these out has not always gone smoothly; (2) some partners believe they have lost influence and control under the new approach; and (3) the reforms also have led to a much more complex and resource-intensive planning process that is difficult for lay people to understand and can sometimes overshadow plan implementation considerations.

Aligning MPO long-range plans, statewide needs, and overall network performance objectives has not been easy, and there are places where finding the right balance has created interjurisdictional tensions, particularly in regions where asset management needs leave limited resources for other investments and activities. With respect to programming, there has been some creeping parochialism in urban areas, with growing amounts of state and federal resources

going to projects that arguably offer limited statewide mobility performance benefits. This in turn has reduced some of the benefits of more holistic planning—given the interdependencies of the long-range plan, failure of one or a few agencies to follow the strategy can create problems for all.

Scenario #3: Network Manager Model

The Scenario: In response to the growing challenges of funding needed transportation improvements and delivering programs and services efficiently, the state of Altoidia made a radical change to redefine how transportation programs are delivered. Over the last 5 years, the state's DOT (AltDOT) has been revised to focus on managing the network, with a separate "Implementing Agency" (largely carved out of the old DOT) that is responsible for funding/financing new construction and contracting with private contractors to design and construct new capacity and other major capital improvements. AltDOT is responsible for overall planning and managing both the existing system and new facilities once they are completed. Operations/maintenance of nearly all fully access-controlled state highways and related agency assets (e.g., traffic operations centers) is outsourced, all limited-access state highways are privatized, and portions of the old system that no longer serve a primarily national, state, or regional mobility function have been devolved to local governments.

The bulk of AltDOT's new mission centers on policy development, planning, rate setting, and oversight. In particular, the agency is responsible for establishing state system goals and performance outcomes, establishing associated policies and standards needed to achieve them, selecting projects and coordinating with the Implementing Agency to deliver them, and then managing its private partners in the maintenance and operations of the system. AltDOT leads plan development and project selection (in cooperation with RPOs) and focuses on statewide/multistate connectivity considerations. In urban areas, MPOs are still responsible for developing long-range plans, project selection, and monitoring performance outcomes based on state standards

The transition from a traditional state DOT structure (i.e., owns and operates the state highway system) to a "network manager" has required AltDOT to undergo significant changes in mission, organizational structure, businesses processes, relationships, and culture. The agency is now much smaller and agile, but in many ways has a more diversified, complex, and important planning role that includes the following:

- **Long-range planning.** Long-range planning now defines the new purpose and need for any expansion of the system (new lanes or new right-of-way) and establishes how the system will be maintained and operated. AltDOT still leads the development of the plan and works with all of its traditional partners (e.g., MPOs, RPOs, regulatory agencies, interest groups, etc.) to develop goals, objectives, measures, and policy direction that reflect the needs of the state and align with national performance management requirements. In addition, the agency's private sector partners are now an important part of the planning process. As a result, business considerations such as return on investment, lifecycle costs, and revenue growth (for toll roads) are now key considerations that must be balanced against the interests of traditional partners.
- **Budgeting and programming.** As with planning, AltDOT's budgeting and programming activities now integrate input from its private-sector partners, which supply data and information to inform decisionmaking, as well as drive much of the timing and phasing of projects since they control much of the project financing. The nature of the project development pipeline has also significantly expanded to include not just typical preconstruction activities such as design, utilities, and NEPA clearance (these are outsourced by the Implementing Agency), but also studies associated with toll feasibility and/or facility management implications.
- **Asset management.** The contracts for system operation include "state of good repair" requirements that the contractor must meet. AltDOT continues to inspect their infrastructure annually to ensure adherence to these standards.

- **Plan implementation.** AltDOT now effectively controls what can get handed off to the Implementing Agency for project development and construction, thus ensuring plan implementation. The department has developed a range of new institutional capabilities to properly oversee facility management contracts and privatization agreements. These include greater performance monitoring and utility regulation-type functions to evaluate and make decisions regarding rate setting for maintenance and operations funding sources, and toll rate setting on privatized toll roads. Similarly, the planning division has developed approaches to help it assess trade-offs between meeting public/social needs and increasing costs/reducing profits for private-sector partners.

Assessment: The Altoidia DOT's new network manager model has defined a clear role for private-sector involvement that has helped to attract investment, greatly accelerate the delivery of much-needed infrastructure improvements, and created economic incentives for safe, efficient operation and management of the system. The model has helped to de-politicize project selection and established a greater focus on network-level performance, data-driven decisionmaking, operating efficiencies, and the economic development value of investments. It also has effectively institutionalized sound asset management practices and has simplified multijurisdictional decision-making roles once a plan is adopted.

On the other hand, the new approach has been highly controversial (1) because of agency downsizing/reorganization that needed to occur, (2) because of the state's new relationship with private sector organizations, and (3) because of the large financial burden shifted to local governments as a result of devolution. A significant amount of time and resources have been spent to placate people and organizations resistant to the changes, and there is residual skepticism that AltDOT is now "in the hands of the private sector" and no longer as focused on social needs. The agency and its partners also continue to struggle with how to manage and oversee "unprofitable" segments of the system. While local governments have received additional state funding to maintain and operate devolved facilities, they are finding it difficult to maintain acceptable performance levels on these facilities with the resources provided. Lastly, the learning curve for many of AltDOT's new planning roles and responsibilities has been steep, and the agency has struggled to find and retain the right levels of knowledge and expertise.

On September 11, 2013, the research team conducted the scenario workshop. The workshop, held at the Keck Center of the National Academies, was attended by invitees representing MPOs, DOTs, FHWA and other industry members, NCHRP panel members, and TRB staff. The morning and early afternoon sessions of the workshop comprised three breakout discussion rounds. Workshop participants discussed each scenario:

1. What strategic decisions should planning help inform?
2. What new processes will be needed? What current processes could be eliminated?
3. What new relationships will be required?
4. What primary new data, planning tools, and analytic tools will planning need to support the agencies' strategic decisionmaking?

APPENDIX B

Additional Research

Overview

Each state DOT has over time created its unique "transportation provider" mission, organization, and culture in response to its own customer expectations, financial resources, political landscape, and physical context. The approach for this project focused on involving a broad range of transportation industry leaders in a dialogue about the strengths and gaps in the planning function at state DOTs in supporting the agency's evolving mission. It was clear in the responses received that transportation planning processes within the agency have not always kept pace with evolving DOT missions. As a result, planning at DOTs is often perceived as out of touch with the primary concerns of the agency's CEO and executive leaders. The diminished role of planning has been caused in part by a significant shift in leadership focus to a more tactical, "managing what we have" DOT mission as a response to unpredictable and often declining funding. *NCHRP Report 798* is designed to highlight the importance of bringing a more strategic perspective to the tough decisions DOTs face today. The report summarizes the importance and relevance of planning processes, skills, and data and provides guidance for making strategic focus a reality at a state DOT.

In the process of developing this guidance, however, it became clear that there are gaps in current planning practice that should be filled if planners are to be successful in implementing 21st century planning at state DOTs. Additional research identified includes the following:

- A detailed description of how to validate the preliminary planner competencies identified in this guidance and
- A short description of areas for follow-up research that would expand upon NCHRP Project 08-36 (113)'s objective of supporting the evolving strategic decisionmaking at state DOTs.

Competencies

The scope of work for this research included a high-level cursory analysis of the impact of transportation planning changes on planner competency requirements. The purpose of this section is to provide recommended next steps to further develop competency profiles.

Preliminary Findings

Based on a review of current job descriptions and requirements and a comparison of these with potential future job requirements identified in interviews and discussions with industry stakeholders, it is clear that the competencies that planners should have are changing. The

competency categories identified as important for planners in the 21st century included the following:

- Visioning and strategic thinking
- Fostering collaborative relationships
- Communication
- Leading people
- Analysis and problem solving
- Specialized transportation planning expertise
- Transportation industry awareness
- External awareness
- Decision-making acuity
- Change readiness

While these competency categories provide insight into anticipated new needs, they likely do not form an exhaustive list of required competency categories for planners, nor do these categories detail the precise nature of the required competencies, such as the skills, knowledge, abilities, behaviors, or other characteristics that will be needed. Detailed and precise descriptions of these competencies are important for developing human resources strategy and designing valid assessment tools for talent selection and development.

A comprehensive competency profile will help DOTs

- Refine their human resources strategy to maximize the use of existing resources (ensure cost-effectiveness).
- Leverage existing talent where possible to minimize skill gaps.
- Respond swiftly to new industry, state, and metropolitan-level demands.
- Maintain efficient and effective operations.

Specifically, by being fully informed about the implications of transportation planning changes for workforce competency needs, DOTs can engage in targeted recruitment, retention, succession planning, performance management, and professional capability building strategies that will have a high return on investment (ROI).

Additional Competency Research Needed

A more comprehensive competency study is needed to more fully address the question of the skills, knowledge, and abilities that will be needed for the 21st century planner. By knowing the precise competencies required for transportation planners in the future, DOTs can begin to anticipate where skill gaps are likely to emerge, take on more significance, or even diminish in importance. Having this knowledge will allow DOTs to strategize wisely in areas such as developing a workforce, planning for job assignments, and selecting leaders.

A comprehensive competency study would require the use of cross-industry best practices, scientific research methodologies, and rigorous analysis to ensure that identified competencies and capabilities, as well as knowledge, skills, and abilities (KSAs) are identified. Such a study could also be used to develop associated selection or performance-management tools that are valid, fair, and legally defensible. To precisely identify the competencies and provide key human resources information, a competency study should identify the following:

- **Critical competencies.** Critical competencies are the grouping and association among competencies including how they are operationalized in practice (i.e., KSAs and other core capabilities). Critical competencies also include statistical support for the competency's validity and merit in human resources strategy and workforce assessments.

- **Competency profiles.** Some of the same competencies are likely necessary across levels and types of transportation planner jobs and across DOTs; however, the relative importance of those competencies compared to one another and the level of proficiency required for each competency could vary by job, function, or organization. Thus, profiles specify the relative importance and proficiency levels required for each desired grouping (i.e., rank). Required proficiency levels can be compared to current staff proficiency levels to estimate skill gaps and inform workforce planning practices.
- **Associated behaviors.** These behaviors demonstrate how the competencies are applied and serve as content for scale development and measurement of staff proficiency as needed for workforce planning, selection, and development.
- **Validation evidence.** Validation evidence is scientific support that the competencies map to the foundational components of the job tasks, activities, and duties. Content validity can be provided to support a full competency model.

This appendix lays out a recommended research approach that will result in the comprehensive competency study just described—identification of required competencies. One way in which identified competencies may be used immediately is in training existing employees so that they are better able to perform in their current positions. The identified competencies can also be used to develop hiring exams to select new talent who will bring the competencies required for successful job performance.

Value of Transportation Planner Competencies

Planner competencies can be used to inform various organizational strategies. For example, the competencies can be used to better align the planner workforce with overall DOT goals and strategies because it will be easier to identify overall shortfalls or missing skills when the competencies for planners are well understood. Competency models also help organizations in the areas of performance measurement, succession planning, and talent management. With a common understanding of what is required of planners, as well as which planners demonstrate these competencies, organizations are better able to manage and utilize their workforces. Along these lines, competencies and competency profiles can be used to determine the magnitude of employee skill gaps by assessing the difference between current employee competency levels and the required proficiency level as well as the relative importance of the competency. Once the type and magnitude of employee skill gaps are determined, the training necessary to close the gaps can be identified. Additionally, training and development opportunities specific to the identified competencies can be established.

Recommended Research Plan

This section lays out the steps that could be used to conduct a scientifically grounded competency study for the transportation planner position in a DOT. The steps are

- Step 1: Identify job requirements (current and future).
- Step 2: Identify critical competencies and capabilities.
- Step 3: Develop competency measurement scales.
- Step 4: Gather validation evidence.

Each step is described further in the following sections.

Step 1: Identify Job Requirements

The competencies required of planners will be dependent upon their job requirements. As such, the first step in a competency study should be to review documentation related to the job

requirements for planner positions. While this may be difficult given the variability in planner responsibilities across state DOTs, it is recommended that a general overview be developed of those job requirements that are consistent across DOTs. This task could begin with a review of existing job descriptions for planner positions from various state DOTs and a synthesis of this information. Then, resources for future-oriented information, such as industry reports, market research, or DOT strategy documents, could be reviewed to provide an overview of the expected direction of the planner position. Resources from MPOs, progressive metropolitan cities and counties, and the private sector could also be helpful in understanding how related entities are driving innovation in the planning field. Information gathered in the NCHRP Project 08-36 (113) interviews and focus groups would be another valuable source of this future-oriented information. The purpose of this step is to gain a clear understanding of extant planner responsibilities, how consistent they are across organizations, and how these responsibilities might change in the foreseeable future. In addition, this step can expedite future data collection and minimize the time required for state DOT staff to provide this information because the research team will gain a basic understanding of what typical job requirements may be through the review of existing position descriptions.

As a next step, it is important to capture the knowledge of current transportation planners about both current and future job requirements. Current requirements are typically identified through more traditional job analytic techniques. One such technique, strategic job analysis, would involve the research team gathering data from high-performing planner incumbents across a representative selection of state DOTs, MPOs, cities and counties, and private-sector planning consultants. Valuable insights can be gained from looking both within and outside of the DOT. For national association or industry-wide competency studies, sampling statisticians can articulate a sampling plan that is representative of the total population of DOTs across the country (i.e., percent rural, urban, small, large, unionized). The purpose of collecting data from incumbents is to identify which tasks transportation planners currently perform, including how frequently they are performed, and to determine which tasks are important to conducting the job. The initial synthesis of job descriptive information can serve as a stimulus for discussion in these incumbent data collections. Focus groups, interviews, or virtual workshops can be used to engage incumbents. Through a series of structured questions, incumbents can be asked to describe daily, monthly, and yearly tasks that they must perform and to identify the KSAs and other characteristics necessary for performing the tasks. Stimuli for discussion in the focus groups can include draft requirements identified through the previous document review. Based on the information gathered from existing documents and from incumbents in the focus groups, a comprehensive list of current job requirements and associated KSAs is developed.

Future job requirements are typically identified through a review of strategic documents and structured dialogue with senior leaders and industry stakeholders. A technique called "futuring" can be used with senior leaders to identify the likely future state of specific jobs. This "futuring" technique provides a structured approach to estimating the impact of plausible future transportation demands or even extreme circumstances on competency needs. The information needed could be gathered at a workshop for senior leaders and stakeholders. To incorporate "futuring" into a workshop, the research team should create variable scenarios that represent plausible situations that could occur in the industry within a specified period of time (e.g., 5 to 7 years) and are likely to have implications for DOT planners. The purpose of such scenarios is to stimulate a structured discussion with leaders about how competency needs might change or grow over time for the job.

To identify the frequency and importance of job requirements (both current and future), data gathered via web surveys or worksheets can be used to compute a criticality score that helps refine the list of job requirements into final form. Finally, the summary of the current and future

job requirements becomes the foundational criteria upon which competencies should be identified and human resources strategy built in order to ensure that talent and training are properly aligned with work demands.

Step 2: Identify Required Competencies and Capabilities

Competencies can be operationalized by clustering KSAs and other capabilities required for current and future (within some specified timeframe) job performance. Accordingly, for each competency identified as important for the planner job, the definition of the competency will be made up of multiple, associated capabilities and KSAs.

Step 2 should be accomplished using both *bottom-up* (i.e., the specification of competencies needed to perform the specific job tasks in the planner position) and *top-down* (i.e., the specification of competencies required to achieve the strategic vision for organizations) elements. Using the bottom-up approach, detailed information about critical transportation planner roles can be collected and incorporated into competencies developed for these positions. The job requirements and preliminary KSAs identified in Step 1 can serve as stimuli for discussion about the KSAs and other capabilities needed to respond effectively given current job requirements.

The information gathered for *NCHRP Report 798* regarding future expectations regarding state DOT planning jobs could serve as the basis for the top-down approach. Each of the 12 strategies described in the report, which describe changes in the planner role at state DOTs, could be included as stimuli for discussions of planner KSAs and other capabilities. The outcome of the "futuring" activity in Step 1 could also help identify competencies needed in the future. Subject matter experts (SMEs) could be asked to describe the KSAs and capabilities required to address each of the 12 strategies detailed in this report and each of the scenarios identified via "futuring."

Finally, rating data can be gathered from SMEs on the KSAs identified via both the bottom-up and top-down approaches. These ratings serve to identify which KSAs are important and perhaps needed at entry (Note: This rating is essential if the competencies will later be used in selection assessments). Linkage ratings are also often gathered to provide additional validation evidence. Linkage ratings involve having SMEs indicate the job requirements (present and future) with which each of the KSAs/capabilities align. KSAs should align with at least one of the foundational job requirements to remain in the final list.

KSAs identified as important for the planner job would then be clustered, based on their commonalities, to form preliminary competency statements. While these core competencies will be the same across DOTs, they may be manifested differently or vary in level of importance or required level of proficiency. As discussed previously, to complete the competencies, profiles could be established for the transportation planner job to differentiate competency requirements by specific job groupings.

Step 3: Develop Competency Measurement Scales

Once the required competencies are finalized, measurement scales can be developed so that current or potential employees can be evaluated on each competency. As such, these measurement scales could be used both for employee selection and performance management. For these purposes, Behaviorally Anchored Rating Scales (BARS) can be created. These types of scales provide behavioral anchors that are assigned to specific scale points to serve as a frame of reference for evaluating performance with regard to the competency.

As a first step in developing the BARS, SMEs would be asked to provide examples of high-, moderate-, and low-effectiveness behaviors for each competency related to the planner job. After all of the identified behaviors are gathered, they can be compiled, after which, another set

of SMEs can indicate the competency with which each behavior aligns. The SMEs must agree that a behavior aligns with the intended competency for the behavior to be retained; this serves to ensure that identified behaviors are, in fact, indicators of the correct competency. Following this competency retranslation, another set of SMEs could be asked to rate the effectiveness of each behavior. This serves to confirm that the identified behaviors are truly high-, moderate-, or low-effectiveness manifestations of the competencies and helps in selecting the behaviors best suited to serve as indicators in rating competence. Behaviors that do not match their intended effectiveness level are removed from the list of behaviors.

Once appropriate behaviors for each level of rating are identified, behavioral statements can be created to populate the BARS. Each behavioral statement should start with an action verb, explain what the behavior is, and describe why the behavior is conducted. Further, each behavioral statement should refer to a single behavior to ensure that the rating is based solely on that behavior. When creating the BARS, a wide variety of behaviors will be included to help raters understand where an employee or job candidate stands on the competency.

Step 4: Gather Validation Evidence

A final step in the competency study would be to conduct a content validation study to confirm that the identified competencies match the planner job requirements for both the current job and the expected future of the job and that the developed assessments accurately measure the competencies. To conduct this validation study, a new representative sample of state DOT SMEs should be selected and asked to participate. Involving a new set of SMEs at this juncture works to ensure that the identified competencies and measurement scales will be applicable across a variety of situations and organizations. The SMEs should be asked questions to determine whether the competencies match the requirements of the planner position. Example questions (structured as statements) that could be asked of the SMEs, who would be asked to respond on a five-point, agree-to-disagree scale, include

- Is this competency essential to the transportation planner job?
- Does this competency contribute to overall performance in the transportation planner job?

Similarly, the developed BARS should be evaluated using content validation. To assess whether the developed scales accurately measure competency levels, the same SMEs should be asked to respond on a five-point agreement scale to questions such as the following:

- Does performance on this scale demonstrate application of the competency?
- Would an employee/candidate scoring on the high end of this scale perform better in the planner job than someone scoring on the low end of the scale?

Based on responses to these questions and the list of competencies, the associated BARS can be finalized and used to better prepare planners for their jobs in the 21st century.

Cost Factors for Industry-Wide Competency Study

The cost for a comprehensive competency study as described above could vary significantly depending on the following factors:

- **Level of granularity—**(i.e., breadth of competencies and applicability across levels and job types).
- **Breadth and degree of generalizability desired—**highly generalizable studies require large samples for data collection.
- **Number of competency profiles—**for how many levels, job types, and organization types should competency profiles be created; having more profiles requires additional data collection to establish relative importance and required proficiency levels.

- **Uses of the competency model—**if the competencies will be used for assessment purposes such as selection (i.e., hiring) or development, scales would need to be developed. The process for scale development is previously described. Further, when creating competency-based assessments, it is important to pay close attention to the professional standards that must be followed to demonstrate legal defensibility (e.g., the Uniform Guidelines). Validation evidence would also need to be gathered for assessment use. However, if the competencies are only to be used to inform curriculum development, scales may not be a necessary step.

Conducting a valuable industry-wide competency study, without measurement needs, may cost from $350,000 to $700,000; this rough order of magnitude estimate varies in large part due to the scope of data collection needed for this to be industry-specific and the extent to which recommendations and human resources strategies could be derived. Action plans with focused implementation steps could be created and provided as part of this type of study.

Using Competencies to Drive Training—Additional Opportunities

Once the competencies and associated knowledge, skills, and abilities that will be required of planners in the future have been identified, developed, and validated, it will be important to train current planners so that they are able to display these competencies. A variety of strategies have been effectively used in transportation organizations for employee training and development. These strategies can be used to help employees develop the skills needed for planning jobs of the future as well as to help employees develop stronger communication skills. Some of these training and development strategies are described below.

Leverage Existing Training, Development Programs, and Opportunities

There are several state and national industry organizations that offer training and development courses for transportation organizations (e.g., APTA, National Transit Institute, and FTA). Once required competencies are identified, it would be beneficial to first conduct a market study to identify viable consumer-off-the-shelf training programs for teaching the competencies prior to investing in ground-up development of new training curricula. As with all training programs, it is important to make sure that learning objectives in the identified training programs map onto the competencies that planners will need to develop. Further, it is important that the curriculum is engaging for participants and at the level of complexity necessary to meet the required proficiency for the competency's profile. Leveraging existing trainings can help transportation organizations use technology in training delivery that may otherwise be too costly for a single organization to develop and implement. When customized training is needed, training can be designed that is job relevant, competency-specific, and applies adult learning principles to instructional techniques.

Address Training Needs in Conjunction with Performance Appraisals

Because performance appraisals give employees feedback regarding their performance and identify skill gaps, they can also be used to identify training needs for employees. If required competencies are measured in the performance appraisals and employees show deficits on any of the required competencies, training can be provided to employees on those specific competencies. While linking performance appraisals to skill attainment is beneficial, individual development plans should be kept separate from performance appraisal decisions (e.g., promotions, salary increases) to encourage employees to candidly self-evaluate and identify their own weaknesses or desired areas for improvement.

Ensure That Transfer of Training Occurs

To ensure that training programs have a positive effect, it is important to develop them so that the knowledge and skills gained during training can be applied in the actual work setting

once training is complete. This transfer of training to the job is more likely to occur when the objectives of the training align with job requirements. As such, creating training that focuses on developing required competencies and ensuring that participants are aware of this connection will help employees to use the skills gained in training on the job. Also, employees who are made aware of the relevance of a training to their jobs and required competencies are more likely to take the training seriously. Additional steps to help ensure that transfer of training occurs include allowing significant time for practice during training, providing feedback to training participants, using knowledgeable training instructors, removing obstacles to the implementation of training material in the workplace, showing supervisor and executive leader support for the training, providing reference aides to use following training, and encouraging participants to form a network of peer support following the training program.

Suggested Future Research

Questions for suggested future research on addressing the evolving role of planning at state DOTs are provided below.

1. **What guides, case studies, and web tools exist that planners can use to implement the changes needed in their profession for the 21st century?** There are a variety of current research program resources available from NCHRP, SHRP 2, and FHWA that could help planners at DOTs understand the changing professional environment and how they can respond. A synthesis report to identify these resources and reference them in the appropriate section of this guide would help planners advance the planning practice more quickly.
2. **How does a DOT planner become a "futurist"?** One of the defining characteristics of the 21st century planner is being able to anticipate changes and respond or adapt quickly to them. Most DOTs do not have a systematic approach or process for identifying relevant emerging trends and projecting their mid- to long-term impact on the DOT. The product of research on how to become a "futurist" would be a set of recommended practices with associated existing resources that could help DOT planners embed more "futurist" thinking into their support for DOT leaders.
3. **What changes in stakeholder involvement will be needed to meet the changing needs of the 21st century?** Effective stakeholder involvement is a critical success factor for implementation of the 21st century approach to planning. DOTs will need to be proactive in reaching out to link their transportation plans and programs to broader societal goals. At the same time, shifting demographic patterns, the choices people make about housing and transportation, and new driver and vehicle technologies, mean that what matters to the public is different today than in the past. The stakeholder involvement process may need to adapt to these external changes to better understand transportation needs and desires as well as to communicate transportation issues. Moreover, what has worked before may not work in the future. Technology has changed the way we communicate, and so the transportation industry needs to leverage experience in other fields to identify the practices, methodologies, and tools that contribute to effective communication with stakeholders. The product of research in this area would be a 21st century guide to stakeholder involvement.
4. **What is the role of qualitative policy analysis in a performance-based planning and programming approach?** With the passage of MAP-21, there is an underlying assumption that outcomes can be quantified and the majority of decisions, if not all of them, can be based on a clear and concise presentation of quantitative data. Planning is not that simple. While there is significant benefit in providing planning recommendations that are informed by excellent data analysis, sometimes planning is driven by policy decisions. As quantitatively focused planning processes become more defined and rigorous, there is a need to ensure that

non-quantifiable issues are not ignored. The product of research in this area would be a guide for planners that would discuss the role of qualitative decisionmaking in the 21st century performance-based planning environment. In addition, the research product would provide a systematic process and define the skills needed to support that process.

5. **Do planners have the right tools to do multimodal trade-off analysis of projects?** Multimodal trade-off analysis has been a long-standing research need. While there has been progress in this area, more research is needed to identify and document the range of practices and tools that are most effective in long-, mid- and short-range planning. Planning in the 21st century introduces new, non-transportation factors more explicitly into this trade-off analysis. This research would build on past and any current research that may be underway to synthesize the most effective practices and tools available to support 21st century planning.
6. **What would the DOT as a "broker of services" look like?** As an alternative to new funding, various political and stakeholder groups are advocating a broad range of solutions that would fundamentally change the role of the DOT from what it traditionally has been, having direct owner-operator responsibilities, to becoming a broker of services. There is a need for research that would synthesize the various proposals for the DOT as a broker of services and actual DOT experiences with this role to explore what the broker-of-services model would look like, including roles, responsibilities, and structures. The research product would be a report that would help DOT executives and planners better understand the concepts, opportunities, and risks associated with the model.
7. **What advances in data collection and management will be needed to support 21st century planning?** It is clear that good data are essential for implementing 21st century planning. NCHRP has produced research over the last several years that examines various aspects of data assessment, collection, and management. Twenty-first century planning would benefit from the continued support for research that will help transportation agencies enhance their data management practices.

Abbreviations and Acronyms

ADOT	Arizona Department of Transportation
AMPO	Association of Metropolitan Planning Organizations
BARS	Behaviorally Anchored Rating Scales
CEO	Chief executive officer
DOT	Department of transportation
GHG	Greenhouse gas
GIS	Geographic information systems
ITS	Intelligent transportation systems
KSA	Knowledge, skills, and abilities
LRTP	Long-range transportation plan
MPO	Metropolitan planning organization
NADO	National Association of Development Organizations
NEPA	National Environmental Policy Act
RJP	Realistic job preview
ROI	Return on investment
RPO	Rural planning organization
SHRP	Strategic Highway Research Program
SHRP 2	Strategic Highway Research Program 2
SME	Subject matter expert
STIP	State transportation improvement program
TAM	Transportation asset management
TCAPP	Transportation for Communities: Advancing Projects through Partnerships
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIP	Transportation Improvement Program
T-VIZ	Transportation—Visioning for Communities
V2I	Vehicle-to-infrastructure
V2V	Vehicle-to-vehicle

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation