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PROGRAMMATIC ISSUES OF FUTURE SYSTEM PERFORMANCE

Final Implementation Plan

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PROGRAMMATIC ISSUES OF FUTURE SYSTEM PERFORMANCE: IMPLEMENTATION PLAN

Introduction

NCHRP Project 20-126(01), *Programmatic Issues of Future System Performance*, developed a unified framework for characterizing the interests of state transportation agencies related to the issues and recommendations in two major reports: *Renewing the National Commitment to the Interstate Highway System: A Foundation for the Future (CIHS)* (National Academies of Sciences, Engineering and Medicine 2019) and the Transportation Research Board (TRB) Executive Committee-sponsored periodic *Critical Issues in Transportation 2019* (TRB 2019). Interests were also identified through a critical review of literature from TRB and others. These efforts identified key threats and opportunities facing transportation as a sector and, for the CIHS, identified challenges facing one of the most important infrastructure investments in the Nation's history, the interstate highway system. In addition, the project included listening sessions with subject matter experts covering a range of subjects identified in the research. Two major products of these research efforts included: (1) the identification of research problem statements that could lay the foundation for a new NCHRP research series to assist state departments of transportation (DOTs) and other transportation agencies in grasping and responding to the implications of the identified issues, and (2) the development of a self-assessment tool that could be used by state DOTs to identify strategies for addressing those issues that were considered most important to their agencies.

The purpose of this plan is to recommend steps to implement the results of this research project. The results of this research have the potential to affect whether and how state DOTs (and other transportation agencies) across the country adequately prepare for and take specific actions to mitigate the risks associated with the range of issues identified in the research project. The plan is organized into four major sections:

1. Implementing a national research series (a very different challenge from introducing a new policy tool into a transportation agency).
2. Discussing typical challenges in implementing new analysis procedures and tools in an agency's decision-making process.
3. Describing a strategy for disseminating the self-assessment tool and encouraging its use in state DOTs and other agencies.
4. Providing education and training opportunities for improving the skills and talents of today's professionals and better preparing future professionals.

The audience for the results of this project will include:

1. State DOT and other transportation agency leaders who are responsible for the strategic direction of their agency, formulating policies and embracing plans, making organizational and implementing decisions, and allocating the necessary resources.
2. Managerial and technical staff who are responsible for applying the necessary resources and implementing actions.

3. Managers and staff of non-transportation agencies responsible for the strategic direction of their agency.
4. University researchers and others responsible for identifying research needs (e.g., Federal Highway Administration [FHWA] and Federal Transit Administration [FTA]), who will also be an important audience in helping to define critical concerns to transportation agencies.

Implementing a New NCHRP 20-126 Research Series

The research project identified 18 potential research problem statements (RPS) across six research areas: Equity; System Impacts and Externalities; System Performance and Condition; System Use; Organizational Capacity and Governance; and Transformational Technologies. As noted above, these RPS could serve as the foundation for a new research series (NCHRP 20-126) for state DOTs and other transportation agencies. The creation of such a research series would require the approval of the American Association of State Highway and Transportation Officials (AASHTO) Special Committee on Research and Innovation (R&I), which oversees NCHRP; the TRB Executive Committee; and the AASHTO Board of Directors. The Committee on R&I consists of representatives of state DOTs and FHWA.

In addition, if the decision is not to create a new research series, the RPS could be forwarded to AASHTO committees for their consideration as part of the normal research initiation process. The committees that would be more relevant include:

- Transportation Policy Forum
- Highways and Streets Council
- Committee on Design
- Committee on Environment and Sustainability
- Committee on Materials and Pavements
- Committee on Transportation System Operations
- Committee on Performance-Based Management
- Committee on Safety
- Committee on Civil Rights (with respect to equity topics)
- Committee on System Security and Resilience

The annual research program for NCHRP is developed based on research needs identified by chief administrators and other staff of state DOTs, committees of AASHTO, and FHWA. The implementation steps for the research series to be created and for the initial round of RPS to be submitted for consideration follow two separate paths. The first path establishes a research program area within the NCHRP program, which can be established administratively within NCHRP by the Deputy Director, Cooperative Research Programs (CRP) who also holds the title of Manager, NCHRP. The second path establishes a funding source for the RPS in this new program area. This path will be more involved given the groups that provide funding for the NCHRP program. Implementation steps include the following:

1. The NCHRP Project 20-126(01) panel would submit a recommendation through the NCHRP program office to the AASHTO Committee on R&I to fund an NCHRP 20-126

research series. The justification for creating this research series could be summarized from the final products of Project 20-126(01).

2. The Committee on R&I would recommend the funding for such a research series to the AASHTO Board of Directors, the TRB Executive Committee, and FHWA.
3. Once the research series is approved and possible funds made available, the RPS for the new series could be solicited as part of the normal NCHRP solicitation process. Given the development of RPS as part of this research project, the project panel could identify potential submitters of RPS from state DOTs, AASHTO committees, or FHWA.
4. For those RPS selected by the Committee on R&I, project panels would be created to manage the research problem statement process, select a contractor, and oversee the research and production of final products.

The NCHRP Project 20-126(01) panel should play a lead role in catalyzing this process by laying the groundwork within the AASHTO research structure and with individual state DOTs or AASHTO committees.

The initial concept for the research series was that it would occur via the NCHRP program structure, either as a new research focus or as individual RSP supported by AASHTO committees as part of the existing research programs. However, other organizations may have compelling interest in the RPS and the results of this research. Such organizations include the Association of Metropolitan Planning Organizations (AMPO), National Association of Regional Councils (NARC), American Public Transportation Association (APTA), Council of University Transportation Centers (CUTC), as well as FHWA and FTA. Outside of transportation agency structure, the Joint Office of Energy and Transportation between the USDOT and the US Department of Energy could be another important supporter of research, especially that related to electric vehicles.

The UTCs could play a particularly important role in conducting research on the topics identified in this research project. The USDOT often provides guidance on the types of research or research areas that are considered to be worthwhile. Such guidance could be provided to the UTC researchers. In addition, UTCs could act as forums (e.g., workshops, peer exchanges, conferences, and the like) for further exploring innovative and cutting edge research applications.

The project panel could ensure that the RPS are sent to the appropriate organizations for consideration and dissemination among their members.

Implementation Challenges for Procedures and Tools

It is useful to describe some of the barriers or challenges associated with implementing new procedures or tools in an organization to provide a rationale for the subsequent recommendations on implementing the results of this research. The recommended strategies in the following section reflect possible actions for overcoming some of these challenges.

Studies on organizational change have consistently pointed to organizational inertia, that is, a propensity for organizations not to embrace change, as one of the key barriers to innovation and

changing behavior. Such inertia can come from many sources—a natural tendency to be more comfortable with the status quo; a long-standing and engrained culture in an organization that relies on proven methods and approaches; encoded standard operating procedures that have directed acceptable practice (but which might not be supportive of new program goals); lack of understanding of what is exactly needed to implement a new program (especially challenging if there are few examples of where the program has been implemented elsewhere); and a lack of funding and staff capabilities to undertake the efforts needed to achieve new program goals.

Table 1 identifies some of the challenges to implementing organizational change actions. This table was originally created in TCRP Report 106/NCHRP Report 536, *From Handshake to Compact: Guidance to Foster Collaborative, Multimodal Decision Making*, that focused on strategies to foster effective collaboration among transportation agencies and a diverse set of partners (Campbell et al. 2005). The table has been modified to focus instead on the implementation of the self-assessment tool.

Table 1: Challenges to Implementation.

Organizational Characteristics	
Organizational	Narrowly defined roles can be major impediments to working with other organizations that do not share the same mission. For major transportation functions—transit operations, traffic operations, infrastructure planning, design and construction—agencies have different perceived missions, priorities, and legal requirements. Often these missions reflect different jurisdictional responsibilities and roles that can hinder collaborative implementation.
Organizational motivation	Although a mission can often explain why an organization acts the way it does, organizational behavior can be motivated by a variety of factors. Often, and especially when both public agencies and private firms are involved with a collaborative undertaking, a lack of understanding of what motivates the behavior of others can hinder joint action.
Standardized practice or standard operating procedures	Organizations often establish standard practices when facing situations that occur repeatedly. Thus, for example, most design manuals or transit operating guidelines provide standard responses to the types of decisions facing agency personnel. However, in many cases, the public today demands more tailored responses targeted at very specific needs, thus requiring a more flexible and creative response from the organizations involved.
Organizational culture	Organizational culture includes the concepts of mission, motivation, and standard practices, in addition to the history of interaction and the type of personnel (and their education and training) that are found within an organization. For example, an agency might be very hierarchically oriented with respect to decision making, where this decision making is driven by data and technical information.

Organizational Characteristics	
Professional mindset of dominant organizational groups	The professional mindset of dominant groups in an organization can strongly influence the way an organization behaves and responds to challenges. Transportation is a complex field that fosters technical specialization, resulting in organizational fragmentation and the development of standardized approaches to solving problems.
Language barriers	The reliance on technical specialties in transportation often lends itself to the use of different vocabulary, acronyms, and terminology among the many different disciplines involved. For example, planners, traffic engineers, urban designers, developers, elected officials, and enforcement personnel often use different terms. This lack of a common language often creates great challenges in communicating key concepts.
Uneven playing fields in the institutional environment	In many cases, not all potential members of a collaborative implementation team have equal power or influence. Those having control of financial resources or legitimacy due to legal mandate can often have a greater say.
Interpersonal Relationships	
Personal dynamics	Collaborative implementation depends primarily on establishing trust among the participants involved in the effort. Organizational barriers might stand in the way, but on a personal basis, success can still occur within these boundaries as long as everyone trusts the other actors. In some cases, due to personalities or personal history, establishing such trust can be difficult.
Established behavior	Some individuals have difficulty thinking beyond the “way it has been done for the past 40 years.” Through many years of experience, promotion guidelines, or training, they have come to believe that there is only one right way to do something and that any deviation is unacceptable.
Resources	
Insufficient dollars	Many collaborative undertakings require the sharing of costs and thus the need for participants to support financial efforts that are often at the fringe of their main mission. This is often one of the most difficult challenges and is especially critical in the initial start-up phase of an implementation where, in the short term, financial resources are needed that can usually only come from limited budgets that are mostly allocated to other programs.
Inadequate information or communication sharing	Information and communication systems are an important resource in support of collaborative efforts. Not having the ability to communicate and exchange information because of incompatible information systems or inadequate organizational support of such systems can seriously degrade efforts to establish effective implementation strategies.

Organizational Characteristics	
Insufficient staff capabilities	Many examples of collaborative implementation require staff support to establish joint ownership of a particular initiative. This support might be nothing more than organizing and staffing meetings, or could be as significant as conducting detailed assessments of the technical and/or institutional feasibility of actions that are being considered. In either case, the assignment of adequate and capable staff time is critical for overall success.
Changing staff	For collaborative implementation that lasts, it is likely that new staff members will join the effort while others will retire or leave the organization. Staff turnover, which represents a loss of institutional memory, leads to the need to educate new participants in the goals of the effort, what has been done to date, and what has yet to be done.
Inadequate analysis tools	Many collaborative implementation efforts focus on transportation issues that include different modes of transportation and different professional perspectives. This research found that few analysis capabilities exist to understand and assess multijurisdictional and multimodal strategies. Thus, for those implementation collaborations that require a good analysis foundation for understanding the problem and needs, inadequate analysis capability could be a significant challenge.

Source: As modified from Campbell et al. 2005

With respect to the self-assessment tool, one could imagine that the challenges to using the tool would most relate to the following factors: organizational motivation, standardized practice or standard operating procedures, organizational culture, and professional mindset of dominant organizational groups. A successful implementation strategy would address as many of these challenges as possible, recognizing that there will be different roles for those participating in the strategy.

For implementing the research program or supporting individual research statements, at the national level, the Federal Government has historically been involved in implementing national programs in a variety of ways, from outright legislative and regulatory requirements, to providing funding incentives to encourage actions to meet program objectives, to providing technical guidance and funding pilot studies to establish best practices. The Federal Government has had in the past, and conceivably will continue to have, a strong influence in setting the agenda and providing support for the challenges that state DOTs and other transportation agencies face.

At the individual agency level, which in this project is defined mainly at the state DOT level, bringing about change can include a wide range of strategies. Depending on how the agency is structured and how standard operating procedures and information channels have been established, the leader (Chief Executive Officer [CEO]) of the agency can mandate, encourage, reward, establish expectations, and/or monitor agency efforts at addressing the policy issues deemed to be important to the success of the agency. Meaningful implementation strategies also

include engaging “next-tier” leadership in institutionalizing new procedures and approaches in state DOTs and other transportation agencies.

The final area where long-term implementation success needs attention is in fostering the knowledge base, skills, and talents of the transportation staff who will be involved in analyzing and assessing the policy issues facing their agencies. This includes existing staff through training and professional development opportunities to introduce new concepts into staff expertise, and new and future staff by encouraging universities and other educational programs that produce the next generation of DOT staff members to expose students to key concepts and tools (discussed in the final section).

Lead Adopters and Disseminators

The self-assessment tool is designed to provide transportation officials with the ability to identify and implement actions and strategies to enhance their agency’s capabilities with respect to the issues identified in this research. Efforts need to be made to discuss the availability of the tool, provide exposure to how it can be used, and overview the types of strategies that could be considered by transportation officials with respect to specific types of issues. Such efforts could include other groups, such as AMPO.

The initial challenge is getting top agency leadership interested and committed, especially with many competing demands on their time. Therefore, a key to successful implementation is cultivating the active engagement of a core group of state DOT CEOs and career agency leaders who can become advocates for analyzing policy issues and in identifying actions for best positioning their agency in meeting the challenges. This core group of leaders can then convey the benefits of such an approach to their counterparts.

Second, many state DOTs tend to look toward the leading edge of practice before deciding whether to move in the same direction and at the same pace. There is a natural tendency of wanting others to “take the first step,” particularly in areas that are still relatively new to an organization. Highlighting leading states via peer exchanges, newsletter articles, and even national recognition awards (from AASHTO and FHWA) can identify which states are leading examples of applying the tool. Identifying these leaders requires the commitment of agencies and organizations that support peer exchanges and a presence at the national level (AASHTO, FHWA, and TRB).

Third, as with most topics in transportation, the concepts examined in this research will change quite often, as new agencies contribute to the dialogue, and as new interest groups and stakeholders enter into policy discussions. A system should be in place for providing updates on the latest information on the policy issues, some of which would occur via the proposed research series. A good example of an institutional mechanism for sharing information is AASHTO’s Center for Environmental Excellence, which provides updated information on a range of issues and topics of interest to state DOTs (AASHTO 2021).

This component of an implementation strategy could include:

- Peer exchanges among transportation agencies interested in finding out about best practices.

- Pilot studies on use of the tool.
- Working with AASHTO and the regional organizations of state DOTs at the AASHTO spring meeting and regional meetings to present the results of the research and demonstrate the tool.
- Webinars.
- Working with TRB to set aside a session at the 2023 annual TRB meeting relating to the research results.
- Preparation and dissemination of information aimed at target audiences; for example, interacting with relevant TRB committees to make sure committee members are aware of the research. This could also include preparing abbreviated versions of the research results and the tool for use in newsletters, websites, and other information media.

Education and Training

In many cases, agency actions resulting from the use of the self-assessment tool depend on a broader knowledge and information base from the core state DOT business areas. This can be accomplished for current staff with training and professional development opportunities and for new staff with course material in academic programs.

Training and Professional Development: State DOT officials often emphasize the need for staff training and professional development when specialized knowledge is needed or when staff need to be introduced to the broad dimensions of the challenges facing their agency. Training programs provide an opportunity to expose existing transportation staff to such knowledge and skills (e.g., in new transformational technologies or equity analysis tools). This training and professional development could be provided by the agency itself, by a local university or college, or at a national level through the National Highway Institute (NHI). In the latter case, it is more likely that material relating to the self-assessment tool could be added to existing training courses (e.g., the transportation planning course).

Education: Most transportation staff have either an undergraduate or graduate degree in a field related to transportation, including engineering (e.g., civil and environmental), planning, public administration, business, or other specialty areas (e.g., history and archaeology). In some functional areas, such as maintenance, many staff members have a high school degree or a degree from a community college. The capabilities of educational programs to incorporate new material into academic offerings will vary by program. For example, because some academic programs only offer undergraduate courses, transportation courses are usually “survey” courses designed to provide an overview of the key concepts in a particular field. Other, larger academic programs have the possibility of providing more in-depth course electives, which is usually the case for graduate programs. Implementation strategies for both kinds of degrees are as follows.

Undergraduate Courses

- Develop lecture modules illustrating the challenges facing transportation agencies and the types of data and tools transportation professionals can use to address them. These modules could include lecture notes, PowerPoint presentations, and example problems.

- Develop course guidelines/modules for including the challenges in an undergraduate capstone experience. Most undergraduate programs have a capstone course that exposes students to an integrated design experience. These capstone courses could ask the students to contemplate how the design might change given possibly new transportation technologies or a concern for equitable distribution of benefits and costs.

Graduate Courses

- Similar to undergraduate courses, develop lecture modules illustrating the challenge to be included in a graduate transportation course. These modules could include lecture notes, PowerPoint presentations, and example problems. Given the graduate level of education, the example problems would be more detailed and require more thought as compared to the undergraduate course material. The emphasis would also include broader linkages to societal concerns.
- Some larger graduate programs have developed courses on specific topics that are of concern to the transportation profession. Examples include automated and connected vehicle technologies, and equity. Such efforts could include developing a course outline and associated materials for a course on transportation system performance and impacts for example.

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