EXECUTIVE SUMMARY
FINAL GUIDANCE

Integrating Effective Transportation Performance,
Risk, and Asset Management Practices

National Cooperative Highway Research Program 08-113

ApproachtoIntegration

DataandSoftwareNeeds

PersonnelandSkills

Policy and
Agency Structure

ResourceRequirements

EXECUTIVE SUMMARY

Transportation agencies have matured significantly over the past decade through advancement of practices in transportation asset management, transportation performance management, and the use of risk management and assessments. The ongoing development of these management systems contributes to an evolving and growing understanding that agencies must engage in an intentional and continual effort of identifying synergies among these three management disciplines to maximize value added to the system. The evolving process in the collection and use of data, tools and resources, and the resulting necessary agency structure, personnel, and skills development to facilitate these changes are emerging, complex considerations with no pre-existing standards. Transportation agencies are beginning to understand the importance and value that integration of performance, asset and risk management can provide, but there remains a lack of experience within the industry to achieve this. Across the board, agencies are maturing their Transportation Asset Management Plans (TAMP) according to the requirements of the Fixing America's Surface Transportation (FAST) Act while still trying to refine and define performance measures to help guide decision making. Risk management is complex, and states are just beginning to grapple with how to use risk management as part of every function within their agency.

To achieve that end, a study of national and international efforts in integrating performance, risk and asset management was conducted to develop guidance for a process framework any agency, regardless of current maturity level, can continuously apply to identify how the evolving management practices intersect, and how effective integration can be incorporated. This guidance identifies the investments needed to drive these changes as well as the benefits and value-add that a department of transportation (DOT) can expect. The report offers a framework for an agency looking to accomplish the following:

1. Develop or refine a process of management practice integration and innovation;

2. Assess organizational maturity in five key areas for management integration (see Figure E-1) and lay out a critical path for progression;

3. Identify, evaluate, and develop management practices to facilitate, drive, and monitor integration; and

4. Recruit, train, and retain human capital to support integrated management practices and related functions.

Defining Terms

$ **Asset Management**

The application of asset data and management strategies to manage the condition of infrastructure assets that are needed to provide safe and secure mobility on the transportation system.

Performance Management

A strategic approach to achieve desired performance goals using system information to make investment and policy decisions.

Risk Management

Identifying and responding to the inherent uncertainties of managing a complex organization through a process of analytical and management activities related to finances, asset condition, and climate change.
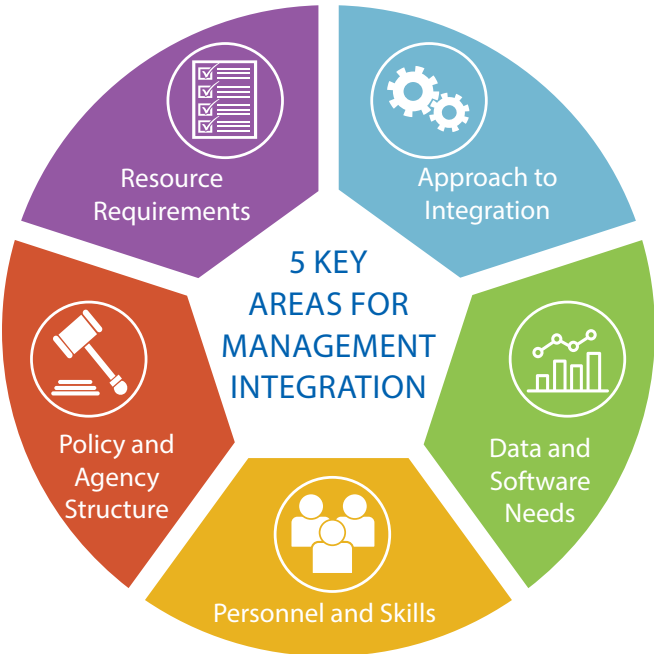

Figure E-1. Key Areas for Integration

How Can an Agency Benefit from Integrated Management

The need to integrate performance, risk, and asset management presents itself to agencies responsible for managing growing transportation systems in a resource-constrained environment. The FAST Act formalized requirements for DOTs to use data-driven investment strategies and life-cycle planning approaches. Agencies are in the midst of identifying the metrics or indicators to meet this requirement effectively and facilitate more qualitative and quantitative decision making, as well as understanding what data, tools, and skills are needed. This process is still in the early stages of development, particularly with regard to risk management. Enhancing this process provides DOTs an opportunity to operationalize existing and developing data collection and management programs, tools, skills and resources in other management practices, all with the objective of building an integrated management process to increase agency resource efficiency while improving overall system management.

The study team observed transportation agencies across the country and recognized in their individual efforts at management development that the lack of access and integration across the system was a consistent roadblock to progress. In response, these agencies were beginning to see how integrating management practices could achieve an improved level of integration. Although agencies are at varying stages of initial development of the culture and framework needed to integrate performance, risk, and asset management, the study team consistently observed that agencies recognized the effort as a modern requirement to outfitting an increasingly complex and sophisticated transportation system

with the tools and framework to maintain existing operations while growing to meet future demand.

The development of the guidance in this report used a range of direct engagement events with transportation agencies to ensure the framework of integrated management could be used by any agency, regardless of its level of experience with regard to integrating these three management disciplines. In all these engagement events, it was clear that each agency specifically identified how it could benefit from integration. Agencies repeatedly observed that a more integrated framework that required management and staff to look across division lines and make more meaningful decisions to further agency goals and objectives. This broader strategy was seen to improve workflow while also providing valuable insight for identifying and managing the risks incorporated into the overall agency portfolio, the use and development of asset data, and the projected system performance. Each agency that participated in the testing of the guidance also indicated this was a new language and an emerging process within DOTs that is just beginning to be understood.

The primary value provided by integrated management is a more comprehensive and trustworthy decision-making process in which policy makers, system strategists and designers, operational managers, and agency executives have a more complete

> *"Enterprise-level implementation of performance, asset and risk management will allow us to more efficiently utilize the public funds we have stewardship over.* **Better information = better decisions***."*
>
> UDOT Regional Director

What are Some Skills Needed to Integrate Management?

For **POLICY AND MANAGEMENT**

- **Risk Management** | This is a skill for which standards, thought leadership, and training exist, primarily from the private sector. Every day, which risks are worth taking, and how confident are you in the predictions you make?

- **Influence** | Can your champions send important people home with "homework" and expect it to be completed?

- **Facilitation** | People should feel heard and leave excited.

- **Policy Changes** | Which levers have the most impact? Can you make policy a tool for coordination?

For **DATA AND TECHNOLOGY**

- Management and exploration of large/new datasets

- Data visualization

- Tool development in spreadsheets or software

For **OUTREACH**

- **Comprehension of analysis products** | An integrated system uses complex technical models. Communicators will need to make the products understandable to lay people.

- **Report production** | Effective communication may require high-quality technical writing, effective presentation slides, attractive and clearly laid-out documents, and web materials.

understanding of the benefits, risks, costs and requirements in making a decision. Other value adds for transportation agencies include the following:

- Advance capital improvement planning by using more robust data to improve project selection and development.

- Improve system performance by identifying and incorporating risks and improving system resiliency.

- Enhance agency structure and management by considering agency assets holistically and enabling managers to access the right data and staff resources to reduce duplicative effort and make decisions that optimize the position of the broader agency.

Integration of performance, asset and risk management has proven to be fruitful for those trying to drive their agencies to modify and improve their management practices to foster more efficient investment and operations decisions.

> *"A proven way to raise morale,* **reduce costs of maintaining the transportation network***, and improve customer service"*
>
> VTrans Asset Manager

> *"We need to clearly stretch and* **maximize taxpayer dollars***"*
>
> MnDOT Systems Planner

> *"We own $6B worth of assets and spend $100M per year on replacement. If we can't* **maximize performance** *under uncertainty for the whole lifecycle, we'll be wasting a lot of money."*
>
> TriMet Director

How to Use this Guidance

Following are fundamental questions each agency should be considering and that can be addressed with more integrated management.

- How is project and operational risk being incorporated into your agency's investment strategy?

- Is your agency able to access data across the enterprise and are data and process owners identified and understood?

- How are agency staff trained in understanding and supporting overarching agency goals and objectives?

- How can your agency develop a less siloed, more collaborative environment?

In using the framework this guidance provides, transportation agencies will come to understand the five key areas for management integration. By following the steps in performing an integration maturity assessment, agencies will adequately evaluate how mature integration management is deployed and will be able to develop their own agency-specific roadmap. This process will assist the agency in highlighting specific objectives and strategies to close the gaps in integrated management and create champions of change within the agency to drive implementation. These champions must be supported by leadership and have the authority and respect to generate the motivation and buy-in for integration.

The guidance in this report is a framework for a process that must be applied continuously to be effective. Testing of this guidance with transportation agencies of varying sizes and levels of maturity in their individual development of performance, risk and asset management revealed a lack of experience in integration. Therefore, at this juncture, the primary need for agencies is a framework adaptable to the structure of an individual agency and to the maturity level of its management practices. This report presents examples of attributes, skills, systems, policies, structures, and initiatives that agencies have been observed employing in this effort. However, there are two core components that are required for effective integrated management and that make this effort a unique journey for each agency:

1. The synergistic value in integrated performance, risk and asset management is limited by the individual development of each management practice. Although many agencies are reaching an appropriate level of maturity in asset management as a result of the development of the federally mandated TAMP, for many, operative performance indicators are still under development. Enterprise-level consideration and management of risk are the least developed, although ongoing research and initial considerations are recognized to be developing the practice.

2. The agency structure, culture and individual staff—particularly the integration champions and agency executives supporting them who work together to set the tone for cross-divisional workflow—are as critical to the success of integrated management as the data and policy frameworks that are operationalized to accomplish it.

A comprehensive, robust management strategy for performance, risk, and asset management individually is both required for and enabled by integrating the three management practices. The guidance in this report and the integration process strategy therein is therefore structured not as a national standard or checklist to be completed, but as an agency-specific iterative, continuously applied method of maturity evaluation and identification of roadblocks and progress opportunities. These efforts inform the development of an action plan and integration roadmap.

Key Areas for Management Integration

This adaptable framework for integrating performance, risk, and asset management is structured around the identification and consideration of five key areas observed to be appropriate and essential to integration in any agency regardless of size, structure, location, or maturity level. If embraced as a framing device early in an agency's maturity assessment, and continuously reconsidered as integrated management matures, these key areas can provide a

resilient framework to drive an evolving process for a balanced and comprehensive integration process.

These core integration components were observed to be an integral piece in the integration journey, and the guidance in this report illustrates, through observed industry case studies and examples, maturity levels for each key area. The discussion of each area also includes integration needs, common roadblocks observed in initial agency efforts, and practical examples of how agencies are approaching some of these needs and challenges. In addition to the case study and agency engagement observations, the supporting resources for each of these key areas draw on literature from across multiple industry sectors and countries. This literature review was also tested with transportation practitioners through a national webinar during which feedback was collected on initial findings.

What Practitioners Already Think!

"I've heard about a pooled fund research study we could join to pilot vulnerability assessments on a cross-border highway corridor. Sign us up!"

"If we had a cross-silo task force for integrated asset, performance, and risk management, we could share data and collaborate more."

"Our annual capital planning process is what gets everyone's attention around here. To make a difference, let's call out projects that address climate resilience."

"Singular assets that are shared across divisions allow for actual life-cycle costing, analysis and staffing requirements"

5 KEY AREAS FOR MANAGEMENT INTEGRATION

- Resource Requirements
- Approach to Integration
- Data and Software Needs
- Personnel and Skills
- Policy and Agency Structure

"We'd look so much better to our legislature if we had people who know how to build visualizations in Tableau."

Integration Maturity Assessment

Regardless of the level of integrated management taking place, a transportation agency can benefit from a maturity self-assessment. The guidance details maturity levels for each focus area. For example, within the area of data and software needs, a Level 1 integrated agency will have decision-makers who are actively considering the investment case for any needed system infrastructure enhancement, although no significant changes in system, software, or process have taken place yet. A Level 4 agency will be following a defined roadmap with tools and processes that enable systematic data and workload sharing. Figure E-2 provides a general explanation for each maturity level.

These assessments work best when they are appropriately relevant and when empowered leaders and agency staff are transparent both horizontally and vertically, when they are engaged, and when they see a way to benefit and contribute, regardless of their level of familiarity with the concepts. Participants assessing maturity should also be engaged in integration efforts and see a way to contribute to the discussion, regardless of their level of familiarity with the concepts.

This will provide the necessary insight into the maturity level as it stands within the organization (management, process leads and champions) as well as the maturity level at which it is perceived or being used (initial, defined, optimizing). Agencies with a structure that is tiered or geographically spread, or both (i.e., field offices, divisional offices, and headquarters) should seek the broadest possible input. The more comprehensive the assessment is, the better it will be for

- Establishing an honest baseline to inform the roadmap development process and track progress against;

- Detecting gaps, corners or roadblocks in agency or process structure and resource needs;

- Identifying training and mentorship opportunities and staff development;

- Identifying misalignment in development of key areas of integrated management; and

- Pointing toward concrete actions and a critical path for addressing gaps and improving maturity.

Integrated management cannot be developed in a non-integrated way. Some agencies that have completed the maturity assessment have reported that a siloed, inconsistent, uncoordinated process has handicapped their ability to achieve more integrated management. This is the cause for a focus on agency culture requirements to enable integration, mainly, the development of a culture that exhibits cross-agency cooperation, collaboration, and communication abilities so as to mature the key areas for integration across the enterprise as holistically as possible.
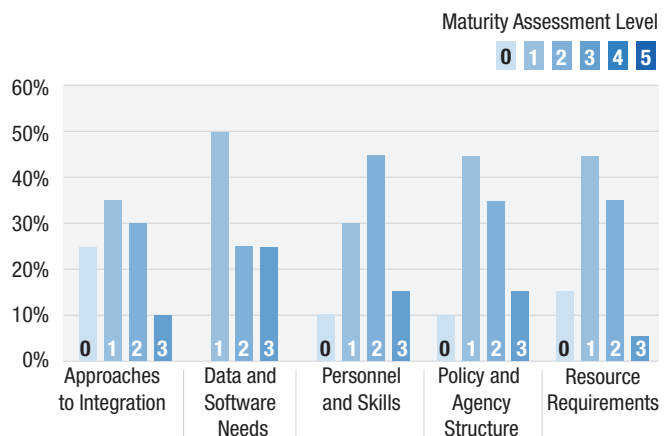
Level 0 — Pre-Integration
Integration not yet begun

Level 1 — Initial
Identified needs for integration; determining structure and approach

Level 2 — Defined
Established metrics, initial documentation, and monitoring; developing a roadmap and initiating small-scale integrated practices

Level 3 — Expandable, Repeatable
Processes are becoming systematic and repeatable, producing consistent results; not fully integrated across agency departments

Level 4 — Managed
Integration is being performed across all appropriate asset classes and agency departments; processes are well-documented and effective

Level 5 — Optimizing
Processes are fully deployed throughout the agency and are highly effective; commitment to continuous improvement

Figure E-2. Integration Maturity Levels

Figure E-3. Maturity Assessment Results Example

For example, in a survey of management staff at one state DOT, the area of personnel and skills was viewed mostly at a Level 2 maturity level, meaning that metrics had been established and small-scale integration had taken place (Figure E-3). Most staff felt that the area of approaches to integration was at a level 0 or Level 1. This misalignment will cap the development progress of personnel and skills as the underdevelopment of integration approaches continues and can also be a reason why no area was observed to have progressed further into the higher, more systematic and optimizing levels of integration.

Developing a Roadmap

A roadmap makes an agency's opportunities actionable and clearly defines the steps, personnel, and timetable for integrating performance, risk, and asset management practices. The roadmap begins with a vision that identifies the needs and purpose of integrating management processes, along with a set of agency-specific objectives or pillars for making that vision real. Each objective has metrics and time-bound milestones that are used to track progress regularly for managers and executives. The roadmap sets forth a process for evaluation and revision so that the innovative nature behind integrated management can be utilized and efforts can be refined or repositioned as needed (Figure E-4).

When the guidance in this report was being tested with different agencies, the research team observed that specific needs within each key area were contingent on agency maturity in that area. The research team developed a roadmap for each agency that described a unique journey forward from that agency's individual status quo or recent accomplishments.

Some inhibitors to integration were observed in several or all of the agencies.

- The necessity of executive-level buy-in and a supportive organizational structure when pursuing integration management, how it can be done and what that can look like;

- The need to modify or change agency culture to drive a more cooperative, team-oriented working process across departments or functions and enable integrated management efforts

- The value of comprehensive data governance. See *NCHRP Research Report 952* for comprehensive guidance on managing modern data "with the goal of organization-wide change" (Pecheux et al. 2020);

- The important role of enterprise standards such as International Organization for Standardization (ISO) 55000 or ISO 31000 or data glossaries to lay the foundation for integrated processes, communications, data and resource sharing and other central tenants to help create a successfully integrated management program;

- The value of sharing policy frameworks for integrating management that have worked in states or regions;

- The value of long-term investment planning and how to support it through milestone development, agency policy, standards, progress tracking and partnerships; and

- The need to motivate agencies to integrate performance, risk and asset management while recognizing the need to model asset deterioration in view of funding uncertainty and both natural and human-made hazards.

Buy-in and an inclusive agency culture are foundational principles with critical impact on the success of an integration effort. Different agencies addressed these in different ways. In a notable example, a transportation agency included integrated management in their agency-wide 5-year business plan and restructured the organizational chart to drive more cross-divisional engagement. This top-down approach signaled executive-level support while putting organizational actors in the best possible position to mobilize for integrated management. The structural and procedural changes illuminated inconsistencies within standards and datasets for staff, who raised them with management.
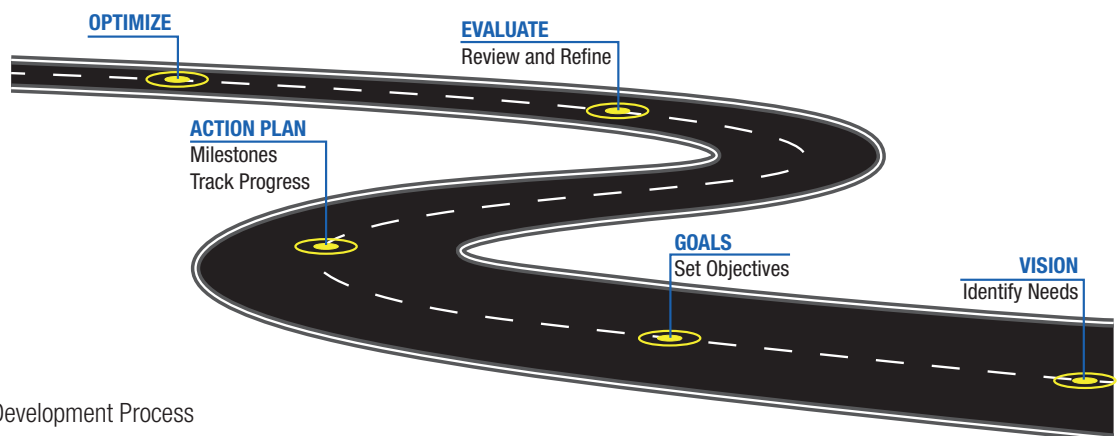

Figure E-4. Roadmap Development Process

Successful Integration

At the time of this research, most of the successful integration observed was only between performance and asset management (i.e., risk management was not included) and had occurred at a pilot scale. With further development of risk management techniques, agencies can find effective ways to incorporate risk into the decision-making process. One initial technique observed included federally required risk-based state agency TAMPs with a prioritized risk register; however, further development in this critical consideration should be considered for every agency.

Among the most critical of integration-enabling attributes discussed in this guidance, the development of an agency structure that enables and entices cooperation and communication and an agency culture that celebrates and rewards integration and innovation are core elements to the success of integration. These developments (and thereby the development of their structural supports in the leaders, policies, and tools, that develop that structure and culture) will either unlock integration opportunities or be the chief inhibitors of integration success. As defined in the maturity assessment, a fully deployed, understood, and successful integration of performance, risk, and asset management requires a commitment to continuous improvement. As systems, staff, and assets change and capabilities in evaluating and tracking performance and risk are enhanced, champions should always be willing to raise the bar even higher on the maturity scale. The work completed for this project, NCHRP 08-113, demonstrates the value of building and maintaining a fully integrated management program.

There is no single formula that an agency can pick up and easily apply. Each agency has to find its own unique path toward integrated management through continuous application of this guidance—assessing maturity in the five key areas and developing and revising a roadmap that details the integration vision and tasks assigned to accountable staff and managers, and being supported by a strong collaboration within leadership to improve the organization are critical steps. The buy-product of this process is more robust qualitative and quantitative decision making. By doing so, agencies will progress the integrated management framework and develop a more efficient, productive, and resilient transportation planning and management system.

How can I help to integrate management at my agency?

- Obtain executive-level buy-in.
- Foster an agency culture that celebrates change and innovation.
- Pursue comprehensive data governance.
- Set enterprise-level standard operating procedures.
- Share policy frameworks with stakeholders and partners.
- Incorporate performance, risk, and asset management in long-term investment planning.
- Look for ways to incorporate uncertainty into your thinking.

Who can an agency count on as champions for change?

- ✓ Champions are the voice of "why" and the force for "how"!
- ✓ Champions have walk-in privileges with the people who control bridge and pavement inventories, GIS systems, IT infrastructure, and dashboards.
- ✓ Champions facilitate the documentation of current practices and the development of a critical path.
- ✓ Champions secure financial resources and executive-level endorsement for change to business practices and standard operating procedures.
- ✓ Champions ensure that if they leave the organization, others can continue their work.

What Approaches Can an Agency Use to Integrate its Practice? It's All About Change Management!

- Identify key decision-makers aware of the day-to-day of performance, asset, and risk management.
- It is important to bring them together in unison and to secure their buy-in.
- Document current practices for key processes: data collection, modeling and data processing, project development and delivery, mapping, and so forth.
- Develop a road map or critical path for modifications or enhancements to these practices that can be reflected in cultural change or formal standard operating procedures.
- Implement and monitor change to ensure it takes root. Plan, do, check, act, and repeat!