



Project Management Research Support

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Kentucky Transportation Center
College of Engineering, University of Kentucky, Lexington, Kentucky

in cooperation with
Kentucky Transportation Cabinet
Commonwealth of Kentucky

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Research Report
KTC-21-12/SPR18-562-1F

Project Management Research Support

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16. Abstract Like many state transportation agencies, the Kentucky Transportation Cabinet (KYTC) faces unprecedented challenges related to project development and management. Staff losses due to attrition and retirements have resulted in the loss of institutional knowledge. Early- to mid-career project managers (PMs) shoulder more responsibilities than ever while being expected to deliver over 600 successful projects each year. To improve the efficiency of project management, PMs must be able to access effective project management concepts, tools, and strategies which are field validated. Recognizing the importance of strengthening its project management capabilities, the Cabinet asked the Kentucky Transportation Center (KTC) to provide ongoing support in this area. This report presents a high-level summary of the support delivered over a three-year period, including a review of project management practices at 11 state transportation agencies, a peer exchange convened with key stakeholders at the Utah Department of Transportation, the development and delivery of multiple Project Manager's Boot Camp (PMBC) trainings, creating articles on project time management, assistance with software implementation (PDP-Precon and AASHTOWare Estimation), the selection and implementation of division-specific performance measures, and building a database which describes and links to administrative regulations and statutes with a transportation focus. Recommendations are advanced to help KYTC deepen its commitment to effective project management.			
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Executive Summary

If Kentucky Transportation Cabinet (KYTC) project managers (PMs) are to deliver successful projects, they must have recourse to dependable project management practices, tools, and resources. PMs also benefit from understanding the interplay of engineering, environmental, legal, and funding issues and its influence on project development. With KYTC suffering the loss of institutional knowledge through attrition and retirements, maintaining the continuity of project management operations is becoming increasingly difficult. Even though PMs are saddled with more responsibilities than ever, tools and resources for moving a project from development through completion are scarce. With an eye toward improving agencywide project management practices, the Cabinet commissioned a multiyear study from researchers at the Kentucky Transportation Center (KTC). This report summarizes activities undertaken and deliverables submitted by KTC researchers during this project.

Research kicked off with a survey of project development and management practices at 11 state transportation agencies (STAs) (Appendix A). This review documented the roles of PMs in each organization as well as institutional resources and published materials PMs can leverage. After identifying the Utah Department of Transportation as an agency which excels in project management, KTC researchers and KYTC leadership visited Utah to speak with the organization's staff and brainstorm best practices to strengthen the Cabinet's project management. Key ideas included establishing job classifications for PMs, program managers, and portfolio managers as well as creating a project definition document early in the planning process. Following this peer exchange, KYTC devised a list of action items for bolstering its project management capabilities (Table 2.1). Additionally, the Center's researchers assisted KYTC on a number of tasks, which included:

- Developing and delivering Project Manager's Boot Camp, a training for new KYTC and consultant PMs
- Helping convene project development webinars to update Cabinet PMs and leadership on policy and guidance
- Developing an Excel database of Kentucky Administrative Regulations (KAR) and Kentucky Revised Statutes (KRS) related to transportation policy
- Facilitating approximately 30 sessions with KYTC leadership to craft a *Vision for Project Development in 2020*, focused on improving project development and introducing a project selection process that equally considers all proposed projects
- Generating project time management articles for the Highway Knowledge Portal (HKP) that summarize project management tasks on the critical path
- Assisting with software implementation, including PDP-PreCon and AASHTOWare Estimation
- Helping coordinate efforts to identify, develop, and implement division-specific performance measures.

In the coming years KYTC will benefit from using the resources produced during this study. The agency can pursue the following actions to further strengthen project management:

- Continuing to prioritize work on project management guidance, particularly HKP articles on core competencies and job responsibilities
- Continuing to monitor and update the KRS/KAR Excel database as legislative changes are made
- Exploring strategies for integrating software (e.g., Microsoft Project, PDP-PreCon, AASHTOWare Estimation) into current project management systems
- Creating (1) a project definition document and (2) a document that captures the planning and scoping process
- Using HKP project time management articles and work performed for PDP-PreCon to develop Gantt charts and milestones for all projects that go through the letting process
- Focusing on strategies to accelerate environmental clearance and the right-of-way process
- Prioritizing performance measures within each division to increase efficiency
- Fine tuning a project development process able to program long-term projects and forecast beyond what is covered in the *Highway Plan*

Chapter 1 Introduction

The Kentucky Transportation Cabinet’s (KYTC) project development process encompasses all work activities needed to move a transportation project from concept and project initiation to construction letting. Through the adoption of sound project management practices, KYTC project managers (PMs) are able to assume responsibility for the entire project and execute the tasks needed for successful project delivery (i.e., on time and within budget). Without knowledge of how engineering, environmental, and economic issues interact and affect different stages and facets of project development, PMs risk privileging one area over another and retreating into subject-matter-specific silos. The Cabinet has an impressive track record of executing complex transportation projects, but doing so is becoming more difficult due to staff attrition and the loss of institutional knowledge. Today, entry- and mid-level PMs assume more project development responsibilities than ever but lack the tools and guidance to get projects from development to completion. Another complicating factor is that the biennial budget’s purchasing power has fallen over the past decade.

The multi-year study documented in this report sought to help KYTC establish and enact a comprehensive vision for project development. Our Kentucky Transportation Center (KTC) research team undertook many activities to help the Cabinet achieve its goal of improving the project development process; these included facilitating work sessions, documenting research products as directed by KYTC’s Project Development Team, and providing counsel for implementing new initiatives. Deliverables submitted over the course of the project included research briefs, project management tools, and other documentation. Cabinet officials have used the materials provided by KTC to reimagine the project development process. This report does not reproduce every deliverable or the contents of every conversation between the Center’s researchers and KYTC’s Project Development Team. Rather, it provides a high-level overview of work completed during the four-year study. Table 1.1 summarizes the report’s structure and contents.

Table 1.1 Report Structure

Chapter 2	<ul style="list-style-type: none">• Reviews approaches to project management used by other state transportation agencies• Discusses a peer exchange with the Utah Department of Transportation• Presents action items KYTC is prioritizing to enhance project management capabilities
Chapter 3	<ul style="list-style-type: none">• Describes project management resources available to Cabinet staff• Discusses a 2020 webinar series, articles generated by KTC on the critical path method and time management articles, creation of a KAR/KRS database, and implementation of PDP-Precon
Chapter 4	<ul style="list-style-type: none">• Reviews the approximately 30 sessions KTC facilitated with the KYTC Project Development Team and efforts to brainstorm a <i>Vision for Project Development in 2020</i>• Explores the importance of instituting division-specific performance measures
Chapter 5	<ul style="list-style-type: none">• Advances recommendations to help KYTC improve project management in the coming years

Chapter 2 State Approaches to Project Management

During the project’s first year we completed a review of project management practices at 11 state transportation agencies (STAs). We summarized our findings in a technical research report issued in 2017. This is reproduced in its entirety in Appendix A. This chapter discusses the results of a peer exchange KYTC and KTC held with the Utah DOT (UDOT), presents high-level findings from our review of STA, practices, and looks at project management software used by several agencies.

2.1 Utah Peer Exchange

UDOT is a nationally recognized leader in preconstruction project management. Having embraced a culture of project development, the agency relies on performance metrics to track project delivery. For example, in 2018 UDOT set a goal of keeping 85% of projects on schedule. The agency does not establish project schedules until the project is defined and environmental process complete. Projects are organized into phases, and UDOT’s planning division works with a commission to define projects. Hoping to learn from its experiences and identify project management strategies that could be applied in Kentucky, we held a peer exchange in December 2018. Six Cabinet officials, two KTC researchers, and nine staff from UDOT participated. Discussions focused on milestones which can impede project delivery (e.g., scoping, environmental clearance, right-of-way acquisition). Based on the peer exchange, the Cabinet identified 19 action items for strengthening project delivery. Table 2.1 summarizes these and specifies for each its priority and difficulty of implementation. Four of the highest priority actions require significant effort from the Office of Human Resource Management (OHRM).

Table 2.1 KYTC Action Items to Strengthen Project Management

Name	Description	Priority	Implementation Difficulty
Strong PM Matrix Org Structure for KYTC	Create a strong PM matrix organization. Matrix organizations blend functional and project characteristics. Strong matrix organizations employ full-time project managers who have considerable authority and full-time project administrative staff. While the balanced matrix organization recognizes the need for a project manager, the project manager lacks full authority over the project and project funding. Authority is given to deliver the project within defined scope, time, budget, and quality.	High	High
Project Manager Designations	Create a KYTC job classification for PMs and Program Managers. The PM is accountable for planning, executing, monitoring, and closing a project. Explore making Project Management Professional (PMP) certification a requirement for this job series, or having to obtain it within one year of hire (similar to the federal government).	High	High (work with OHRM to create)
Regional Program Manger Designations	Create a KYTC job classification for Program Managers who oversee regions of highway districts. Establish four regions, with three districts in each. Each region would have a Program Manager who plans and develops methods and procedures to implement their region’s program. The program would consist of all projects associated with the region that stretch across all types of funding and portfolios.	High	High (work with OHRM to create)

Portfolio Manager Designations	Create a KYTC job classification for Portfolio Managers. Portfolio Managers manage funding sources for specific project types (i.e., HSIP).	High	High (work with OHRM to create)
Consultant Project Managers	Use consultant PMs to manage projects when KYTC staff are not available or when special expertise is needed. Have early-career KYTC PMs shadow consultant PMs.		
Independent Contractor as Project Managers	Use contractors for services to hire PMs, similar to how Office of IT (OIT) hires computer programmers or the Office of Legal Service (OLS) hires attorneys.		
Concept Report	Create a project concept report which helps with the planning/scoping effort.		
Project Definition Document (PDD)	A Definition Team creates a draft PDD. This document defines the project for the Project Delivery Team. The PDD establishes the project scope, schedule, and budget.		
PM Authority on Construction Revisions	For acceptance of a Construction Revision/Change Order, the PM must approve.		
KYTC NEPA Assignment	UDOT and several other STAs have worked with FHWA to become NEPA Assignment states; these STAs have authority over environmental approval. Investigate this model for KYTC, the risks, and whether it would help project development and delivery.		
Innovative Contracting for Roadway Projects	Use design-build for project development and delivery. Explore Construction Manager General Contractor (CMGC) and other innovative constructing methodologies.		
KY Highway Plan New Chapter(s)	Expand the <i>Highway Plan</i> to include a <i>Final Design</i> chapter of locked-in projects that will be delivered within scope, on time, and within budget. Include a <i>Preliminary Engineering</i> chapter that covers projects that are being planned and considered. Measure project development performance on the <i>Final Design</i> projects. <i>Final Design</i> projects could be locked-in for 4-6 years. <i>Preliminary Engineering</i> projects could be a 10-15-year window.		
Local Public Agency (LPA) State Fund Allowance	Give LPAs 85¢ in state funds in exchange for a \$1 federal allotment. LPAs would be completely responsible for the projects funded through this allowance. If the goal is for KYTC to be uninvolved in these LPA projects, find a way to pass funding to the LPA by mechanism other than an memorandum of agreement (MOA). State-funded projects require an MOA, which requires some level of oversight.		
Project Development Performance Measures	Create a culture of accountability by using performance metrics (e.g., time, budget) to evaluate PMs.		
PM Tools	Develop a suite of tools for project management. Particular emphasis should be placed on performance measurement.		
Project Time Management	Require Gantt Charts on all KYTC projects that go through the letting process. PMs would be responsible for tracking projects via Gantt charts. Risk analysis should be		

	used for time needed to complete work and a <i>Project Manager Float</i> or <i>Management Reserve</i> should be added for margin. (Float would not be added to each work unit.)		
Project Cost Management	Track project estimates and use professional estimators to create estimates or perform QA/QC on project costs.		
Corridor Preservation Fund	Set aside Corridor Preservation Funding to buy right of way for future projects. Refund money from project costs when Final Design begins.		
ROW Cleared with Limitations	Similar to KYTC's Utility Impact Notes allow projects to be let when right of way is cleared with limitations.		

Following the peer exchange, KYTC implemented several action items, some with the assistance of KTC staff: (1) issued guidance for design-build projects and alternative technical concepts (ATCs), and (2) developed sample Gantt charts for three project types (see Section 4.2). Modeling KYTC's project development on the Utah approach will require buy-in from KYTC leadership and policy changes. For example, the Cabinet schedules projects during a two-year window. UDOT issues a six-year plan and prepares 10-30-year forecasts. Chapter 5 further describes how possible changes could influence KYTC's culture.

2.2 State DOT Review of Project Management Guidance

Here we briefly summarize key findings of the technical assistance report on STA project management practices found in Appendix A.¹ Funding constraints have motivated STAs to embrace flatter organizational structures that rely on fewer workers and focus on efficient project delivery. Some agencies have established sections dedicated to project management, but it remains common for highway or planning divisions to assume responsibility for this task. Generally, project managers oversee a project from its inception to closeout. However, exceptions to this rule exist. The Florida DOT assigns project managers for each phase of project (e.g., planning, right of way). At the Oregon DOT, project leaders spearhead development on in-house projects; once a project moves into construction, project managers assume charge. Several agencies have made improvements in their environmental processes. Many agencies have published guidebooks that offer a step-by-step narrative of the project management process, specifying activities project managers need to complete during each project phase, documents and forms that need to be submitted, agency procedures, software resources, and helpful tips. Some guidebooks are comprehensive, while others embrace a more intuitive approach that leverages checklists, graphics, and references to other documents. Table 2 provides a high-level comparison of project management practices across the 11 STAs we looked at.

¹ Van Dyke, Chris, Bryan Gibson, Jeff Jasper, and Doug Kreis. 2017. Review of Project Development Practices and Project Management Resources at State Transportation Agencies. *Kentucky Transportation Center Technical Assistance Report*, KTC-TA-17-06/SPR18-562-1F.

Table 2.2 Summary of STA Project Management Practices

State	Centralized Organization	District/Regional Organization	PM's Role within Organization	Guidance Documents	PM Major Tasks	Unique Strategies
Florida	Office of Design's Project Management Section	n/a	Project Management section hires consultant PM and a PM for each project phase	<i>Project Management Handbook</i> ; PM guidebooks; online resources and contacts	Develop and understand the scope; modify the scope throughout each phase; accountable for project's success	Six project phases
Nebraska	Divisions of Project Development and Program Management	n/a	Responsibilities divided between Divisions of Project Development and Program Management	Website houses <i>Project Management Reference Guide</i> , checklists, and best practices	Maintain records of work performed; monitor work progress; ensure contractors follow plans; preserve documentation that justifies payment	Annual PM Conference
California	n/a	Deputy Director of Program/Project Management in each office	Assigned at district level	Project Management Handbook and the Project Development Procedures Manual	Coordinate and facilitate all work; monitor project performance; and control changes to project scope, cost, and schedule	PMs lead the project team to develop a project management plan

Georgia	Office of Program Delivery under the Division of Program Delivery	District Program Managers supervise Project Managers	Assigned at District level	Project Management Handbook	Establish schedules, identify critical paths and risks; conduct meetings with team, planning, and stakeholders; plan, monitor, evaluate, mitigate, and resolve issues; deliver the project	New PMs assigned a mentor; use of project charter
Ohio	n/a	n/a	Planning and Engineering department, dedicated PM for more complex projects	Project Development Process Manual	Manage deliverables; oversee critical tasks and milestones; coordinate internal reviews; hold progress meetings; oversee and provide technical guidance to consultants; monitor funding	Five-phase project development process; classification of projects based on complexity
Massachusetts	DOT Design & Engineering oversee projects designed by consultants	District office and community stakeholders approve project	PM assigned by MassDOT	Project Development & Design Guide; website	Oversee all work during each project phase	Follow an eight-step project development workflow; Project Review Committee
Utah	n/a	Project Management Division in each region	Assigned within the region	<i>Project Manager Guide</i> ; website with guidance on finances, team building, Microsoft Project, templates of project stages	Project coach, mentor, risk manager, and primary decision maker; plans, executes, monitors, and closes a project	Monitor, Investigate, Take Action, Report (MITAR)
Oregon	Resources provided by Planning and Highway Divisions	n/a	Project leaders (PLs) — in-house projects; project	Web-based <i>Project Delivery Guide</i> ; links to environmental	PLs or PMs oversee lifecycle milestones: project initiation,	Outsourced projects leverage

			managers — outsourced projects	procedures; and task lists for each stage	design acceptance, advanced plans, final plans, PS&E submittal, and project closeout	private sector resources
North Carolina	n/a	n/a	Multidisciplinary teams handle more complex projects; Highway Division manages less complex projects	n/a	Team Lead oversees tasks that are assigned within the team	Screening process determines project delivery
Indiana	Office of Project Management, Production Management Division – Central Office	n/a	PMs for major projects chosen from districts	Project Development Process (PDP) Manual; Templates for each project type	PMs have specific tasks, based on project type	Project Development Process (PDP) classifies projects into major, minor, and maintenance
Minnesota	Office of Project Management and Technical Support	n/a		Website has guidance and resources for PMs; <i>Instant Project Management</i> summarizes PM tasks	Prepare management plans, direct/manage project team, monitor project performance, and report status	Primavera P6; PM Scoping Worksheet and other Word and Excel templates

2.3 Project Management Software

Cabinet officials expressed interest what project management software STAs use. To answer this question, we reviewed a 2016 roundtable held by the Southern Association of State Highway and Transportation Officials (SASHTO) Subcommittee on Design (SCOD). The most commonly used platforms include Microsoft SharePoint, Oracle, and Microsoft Project. Several agencies either do not rely on project management software or have adopted proprietary systems. For scheduling, Primavera, Microsoft Project and SharePoint are the most common packages, while ProjectWise is often the choice for storing project information. Most of the participating agencies track project milestones, although not all have a detailed process for doing so. Table 2.3 summarizes information gathered from the roundtable, including data on software(s), its purposes, and user permissions.

Table 2.3 State DOT Milestones and Project Management Software (SCOD 2016 Roundtable)

State	Scheduling Software	Project Information Storage	Milestone Tracking	Permission to Access
Alabama (ALDOT)	Proprietary Comprehensive Project Management System (CPMS)	Proprietary CPMS	Proprietary CPMS	ALDOT only
Arkansas	None dedicated; Contractors choose Primavera or Microsoft Project; Connecting Arkansas Program (CAP) uses Primavera	e-builder		CAP personnel only may access Primavera
Florida (FDOT)	Project Suite Enterprise Edition (PSEE)	PSEE	(PSEE)	FDOT and consultant project managers
Georgia	Primavera P6	ProjectWise		n/a
Kentucky	Microsoft Project being implemented	ProjectWise	Microsoft Project being implemented	n/a
Louisiana	Microsoft Project	SharePoint, ProjectWise, SiteManager, AASHTOWare	LAGOV (mandated SAP system)	Allows non-DOT access; consultants upload design deliverables, quantities, and estimates
Mississippi	Oracle; Microsoft Project for in-house work	Oracle	Oracle	DOT access only
North Carolina	Plans to tie project schedule information into the file collaboration system	Cloud-based STaRS system that uses SharePoint and ProjectWise technology	Cloud-based STaRS system that uses SharePoint and ProjectWise technology	Permission granted to non-DOT based on role assignments
South Carolina	Primavera P6 for construction; tsaAdvet Falcon for as-built and as-let	ProjectWise — plans to integrate with custom P2S project programming system;	P2S project programming system	Contract Inspectors may access ProjectWise; In-house may access SharePoint for ROW documents

		Encroachment permits on SharePoint		
Tennessee (TDOT)	Site Manager (PPRM & Primavera Project Portfolio Management)	Site Manager (PPRM & Primavera Project Portfolio Management)	Site Manager (PPRM & Primavera Project Portfolio Management)	TDOT only
Virginia (VDOT)	Project POOL	Microsoft Project in SharePoint Environment	Microsoft Project in SharePoint Environment	VDOT only
West Virginia	No division-wide system	No division-wide system	No division-wide system	

Chapter 3 Project Management Resources at KYTC

3.1 Project Manager's Boot Camp

Cabinet PMs deliver approximately 650 new highway construction projects awarded each year. Given the complexity of shepherding a project from initiation to letting, early-career PMs often lack the requisite knowledge to successfully deliver projects on schedule and within the established scope and budget. In 2016, KYTC asked KTC researchers to develop a project management training that would:

- Accelerate project delivery by teaching PMs methods for keeping project schedules intact
- Sharpen PMs' knowledge and challenge them to take ownership of the whole project
- Equip PMs with the tools to build effective teams, acquire necessary resources, and manage critical path activities

The eight-day intensive training created and delivered by KTC — Project Manager's Boot Camp (PMBC) — delves into the following topics:

- Project Management Strategies
- Monitoring Budgets
- Building Harmonious Project Teams
- Managing Consultants
- Environmental Permitting and Documentation
- Utility and Rail Coordination
- Structural Design
- Right-of-Way Acquisition
- Professional Ethics

Concepts presented in PMBC are reinforced through structured group activities focused on translating knowledge into practice. At the end of each day, participants complete surveys and questionnaires. These provide instructors with immediate feedback so they can tailor course material to the needs of each PMBC cohort. Cabinet PMs have responded enthusiastically to PMBC. In post-course surveys they have observed that PMBC deepened their understanding of project management practices and improved their ability to deliver successful projects. KTC continues to update and refine the curricula based on new policy and guidance. PMBC 2021 revised its training objectives and included a presentation of KYTC's Mission and the importance of delivering the *Highway Plan* on schedule. New modules were added which review software tools for tracking project milestones — Program Delivery Platform for Preconstruction Activities (PDP-PreCon), Microsoft Project, and AASHTOWare Estimation. The 2021 iteration also incorporated training modules on PM Core Competencies — critical skills all effective PMs possess. In response to PMBC's reception, KTC developed PMBC Xpress, a condensed two-day version of the course that KYTC now requires all consultant project managers to attend. This project helped fund delivery of PMBC Xpress in December 2020 as well as PMBC 2021.

3.2 Webinar Series — KYTC Project Management Updates

To prepare project managers and project team members for upcoming project work and provide updated information, KYTC's Office of Project Development hosted a webinar series, *Implementing the 2020 Highway Plan*. Webinars covered several project management topics, including:

- Federal Stimulus Rumors
- Lessons Learned from American Recovery and Reinvestment Act of 2009 (ARRA)
- Highway Design Process Updates
- Update on Professional Services
- Update on Environmental Requirements for Projects
- Project Time Management
- Alternative Project Delivery

Guest speakers from KTC and KYTC educated project managers during for one-hour webinars over two weeks. More details about each module are provided below.

3.2.1 Implementing the 2020 Highway Plan

KYTC leadership discussed the agency's vision for implementing the 2020 *Highway Plan* and using federal stimulus (triggered by the COVID-19 pandemic). Presenters reviewed lessons learned from the 2009 American Recovery and Reinvestment Act and announced the opportunity to participate in the increased Federal Share program. Updates were also given on different Cabinet divisions.

3.2.2 Project Time Management and Alternative Project Delivery

PMs typically estimate critical milestone dates and project hours when a project begins, but detailed schedules are not usually forthcoming until a design consultant is selected. The Cabinet is looking at whether consultants should be required to develop critical path method (CPM) schedules for all projects. KTC researchers developed a method to generate CPMs and produced high-level templates for three bridge replacement project types. A review of 200 KYTC bridge replacement projects found that the average duration was 38 months — a project designated normal priority and of medium complexity took an average of 36 months to complete; a normal priority, high complexity project averaged seven years. Microsoft Project Gantt charts were used to visually organize project schedules and capture work activities and their durations, the interdependency of tasks, and project timeline. Some of the tools introduced by KTC for project time management were process maps of each project type and a corresponding article for each work item in the flowchart. Articles are available in print form, although they will eventually be published online for faster access while working onsite.

Under the design-bid procurement model, teams consisting of a contractor and design consultant bid on highway projects. Two advantages of design-build are early contractor involvement (which can reduce delivery times) and the integration of alternative technical concepts (ATCs) proposed by design-build teams. To establish standard design-build practices, KTC researchers and the Cabinet's subject-matter experts prepared a guidance document that walks PMs through the design-build process. It covers topics such as developing project selection criteria, pre-advertisement and advertisement activities, the process for evaluating proposals and awarding projects, and post-award work. The document also includes a full RFP template.

3.2.3 Consultant Contracts and Environmental Clearance

Due to their complexity, consultant contract administration and the environmental process may impact the critical path. KYTC speakers addressed several topics during the webinars on both topics. On the consultant administration side, they talked about Consultant Portal, Statewide Contracts, eMARS Closeouts, and selection meetings. Cabinet experts also provided a refresher on environmental requirements and reviewed strategies for holding virtual public meetings.

3.2.4 Highway Design Updates

KYTC's *Highway Design Manual* was updated to accommodate new guidance in the American Association of State Highway and Transportation Officials (AASHTO) *Green Book*. Updates focused on geometric design criteria, flexible and performance-based design, and revised context classifications for urban and rural areas. The Cabinet's projects now fall into three categories: (1) new construction, (2) reconstruction, and (3) construction on existing roadways. Reconstruction projects are done along an existing roadway but modify the basic roadway type. Presenters also announced new resources and events, including a standard drawing reprint, Data Driven Safety Analysis (DDSA) implementation, and ORD and AASHTOWare implementation.

3.2.5 Conclusion

KYTC leadership and staff endorsed the project management webinar series. In a post-webinar survey, 60% of participants rated it as very good, 69% of thought the information was very useful, and 94% felt webinar durations were appropriately tailored to the subjects. Ninety-five percent of respondents expressed interest in participating in future project management update webinars.

3.3 KAR/KRS Databases

In response to a request from KYTC leadership, KTC researchers developed searchable Microsoft Excel tool that lists all Kentucky Administrative Regulations (KAR) and Kentucky Revised Statutes (KRS) related to transportation topics. The tool is searchable by the KYTC policy manual where the regulation or statute is found. Entries are organized according to KRS and KAR number and contain a descriptive title and a brief summary, both of which can be searched by keyword. Clicking on a KRS/KAR number brings users to a new window, where the entire policy opens from the Kentucky General Assembly web page.

3.4 Program Delivery Platform — PDP-Precon

Introduced in 2019, PDP-Precon is an umbrella data system that serves program and project management needs. The first release replaced Oracle and Clearview and provided faster web interface and better functionality. Prior to this release, project milestones and phases were revised and redefined, with specific tasks defined for each preconstruction planning phase. Actions were converted into milestone inputs into the PDP-Precon database. To ensure no sources of project data were overlooked, a crosswalk was created for each new PreCon milestone with data from the milestone’s corresponding existing database. Table 3.1 defines milestones and tasks which fall under the remit of each. Appendix B provides the milestones and definitions for PDP-Precon.

Table 3.1 PDP Precon Phases and Tasks

Planning	Preliminary Engineering	Final Design	Right of Way Acquisition	Utility Engineering and Relocation	Railroad Clearance	Letting
Planning Funding	Preliminary engineering Funding	Additional Design Funding	Right of Way Plans	Utility Agreement	RR Engineering Agreement	Check Prints
Planning study & reports	Notice to Proceed	Notice to Proceed	ROW Consultant Notice to Proceed		RR Real Estate	Final Plans Submittal
	FHWA Scope Verification Meeting	Geotechnical – Roadway Design Investigation	ROW Inspection			Plans, Specifications, and Estimates
	Alternative Selection	Pavement Design	ROW Clearance			Advertisement
	Design Executive Summary	Highway Drainage Design				
	Environmental Approval	Drainage Inspection				
		Joint Inspection Meeting				
		Traffic Management Plan				
		Structure Plans				
		Signing Plans				
		Traffic Lighting Plans				

		Traffic Control Electrical Device Plans				
		Traffic Signals Plans				
		Roadway Plans				

Chapter 4 Facilitated Sessions with KYTC Leadership

Over two years, KTC researchers and KYTC leadership across several divisions met regularly to brainstorm the *Vision for Project Development in 2020*. Approximately 30 facilitated sessions were held, along with informal meetings and calls.

4.1 Defining a Vision for KYTC Project Development

Sessions focused on helping the Cabinet sharpen its project delivery strategies. Early on, the team developed a list of actions for the *Vision for Project Development in 2020*:

- Develop innovative delivery methods
- Putting people in the right place
- Revise project development responsibilities
- Measure what you care about — accountability
- Improved project development tools
- Improved planning and programming

During sessions, team members identified specific tasks for each item. KTC captured ideas during brainstorming, including steps required to realize the vision and set priorities. The following sections briefly review the discussions on each action item.

4.2 Develop Innovative Delivery Methods

PMs need access to adequate tools and resources throughout the project development process. New strategies resources are being made available to Cabinet PMs. Given the critical role of consultants in on-time project delivery, two beneficial strategies are making statewide contracts available and developing on-the-job training for consultants. PMs can now access new software solutions to handle project data and track important project milestones. KTC is helping the Cabinet implement PDP-Precon, a system that tracks major project milestones using checklists and consolidates required sources of data into one platform. The Center has also developed training for AASHTOWare Estimation, which is project estimation software. The team discussed a new approach to Microsoft Project, where PMs adapt milestones — and corresponding Gantt charts — outlined in Highway Knowledge Portal (HKP) project time management articles.

4.2.1 Putting People in the Right Place

KYTC has lost skilled personnel and institutional knowledge through retirements and attrition. In response, the Cabinet and KTC are defining for various positions job roles and the core competencies so that knowledge and skills remain in-house and transferred to new employees. Job roles critical to project delivery will be summarized in articles that appear in the HKP. A key concern moving forward is recruiting and retaining employees with the right skills, particularly those with project management experience.

4.2.2 Revise Project Development Responsibilities

Cabinet PMs and consultant PMs have built new skills through PMBC trainings. To further revise the project development process the team discussed designating Program Managers for the Kentucky Department of Highways (KDOH) programs in Asset Management, Capital Projects, and Safety Improvement. Some STAs adopt a programmatic approach to larger, more complex projects. Their successes and best practices could guide KYTC's effort to update its project management strategies.

4.2.3 Measure What You Care About

Agencies that develop and publicize performance metrics are able to better track project delivery success rates. Monitoring performance measures throughout project development fosters a culture of accountability. KYTC division leaders discussed the deliverables and data points most critical to their divisions. Section 4.3 reviews high-priority, division-specific performance measures.

4.2.4 Improved Project Development Tools

KYTC leadership now prioritizes equipping PMs with the tools they need to lead successful project development processes. Most of these tools have been mentioned in previous sections — HKP project time management articles, Gantt Charts/CPM schedules, PDP-Precon, and AASHTOWare Estimation, statewide contracts, and project management services and training as needed.

4.2.5 Improved Planning and Programming

Programming projects with a high degree of complexity requires input from planning, design, public, and other stakeholders. Many agencies improve project delivery by fine-tuning preconstruction activities (i.e., the scoping process). Seeking early public involvement and knowing how to build a good team are prerequisites for executing well-defined projects and help establish a plan for critical, time-consuming tasks, (e.g., environmental clearance, right-of-way acquisition). Following a consistent approach when defining and scoping projects leads to better project outcomes and is an indicator of an agency's efficiency and effectiveness. At KYTC, corridor improvements often require long-range planning, and multi-year projects transcend conventional project management by requiring programming beyond *Highway Plan*. KTC is researching scoping practices used by STAs with the goal of identifying best practices for implementation at KYTC.

4.3 Performance Measures

Agencies can use performance measures to monitor and forecast trends in transportation system performance. Because these metrics foster a culture of accountability, they are a critical component of KYTC's *Vision for Project Development in 2020*. This vision directs each division to establish and publish performance measures. Knowing that what gets measured gets managed and what gets measured gets done, KYTC leadership identified priorities for each division using SMART performance metrics. SMART metrics and goals are:

- Specific — Applicable to the subject matter and target a specific area for improvement
- Measurable — Choose quantifiable measures to evaluate performance and track progress toward goals
- Attainable — Goals should be challenging yet attainable and contribute to an organization's growth
- Relevant — The focus must help reach the goal of on-time, within-budget project delivery
- Time-Bound — Specify when result(s) can be achieved

KYTC division leaders worked with district and Central Office staff to propose performance measures. Although the focus was on tangible actions, so-called intangibles (e.g., staff expertise, training) were mentioned as being equally important. Staff training, for example, can be further developed and broken into more specific, measurable tasks. Despite subject-matter expertise and institutional knowledge being difficult to measure, the Cabinet must have these assets if it is to maintain control in the face of unpredictable situations or to complete tasks on the critical path that could affect project delivery. Proposed performance measures were formulated as lists of action items. These items are to be completed at the appropriate time so that projects are delivered on time. Some divisions identified goals which are easier to measure using quantitative benchmarks. Moving forward, any consideration of performance measures must include a discussion of targets that carry the most risk compared to the most value. Some performance measures should aim at improving tracking dates. Rather than focusing on the project letting date, a better approach is to know when a PM requires a deliverable on the critical path.

4.4 Proposed Project Selection Process

Taking the *Highway Plan* as its baseline, KYTC generally forecasts project and funding needs for two-year intervals. Wanting to develop an updated approach to planning, scoping, and programming projects, the Cabinet explored a solutions-based project selection process that would afford all proposed projects equal consideration and identify long-term needs, which demands forecasting beyond the current *Highway Plan*. KTC researchers documented the conversations held by KYTC leadership and generated a flowchart of KYTC's project development process. The graphic begins with entities that participate in the project screening process. Based on the project classification, it may follow one of several funding trajectories: (1) Highway Safety Improvement, (2) Traffic Improvement, (3) Pavement/Bridge/Structure Repair, or (4) Economic Development. Projects are then categorized as needs-based or

performance-based before they are programmed into the *Highway Plan*. The proposed process continues to be revised.

Chapter 5 Conclusion and Future Actions

The Cabinet's PMs encounter many challenges throughout project development, including funding constraints, staff turnover, and loss of institutional knowledge. These challenges hamper successful project delivery. Hoping to mitigate difficulties PMs confront, the multi-year study documented in this report helped KYTC formulate a vision for project development. Among the key activities undertaken as part of this project were a review of the project management practices instituted at other STAs; a peer exchange which brought together stakeholders from KTC, the Cabinet, and UDOT; developing a catalogue of project management resources; updating PMBC trainings and offering them to Cabinet and consultant project managers; and facilitating 30 brainstorming sessions to help KYTC leadership give shape to their vision for project development. Meetings and deliverables produced during this study will shore up project management capabilities at the Cabinet and give staff the resources they need to preserve and communicate valuable institutional knowledge. Another valuable outcome of this project was establishing performance measures to evaluate how well divisions carry out their project management and development responsibilities. Once fully implemented, performance metrics will bolster transparency at KYTC and foster a culture of accountability. Moving forward, the Cabinet will benefit from the following:

- Continuing to prioritize work on project management guidance, particularly HKP articles on core competencies and job responsibilities
- Continuing to monitor and update the KRS/KAR Excel database as legislative changes are made
- Exploring strategies for integrating software (e.g., Microsoft Project, PDP PreCon, AASHTOWare Estimation) into current project management systems
- Creating (1) a project definition document and (2) a document that captures the planning and scoping process
- Using HKP project time management articles and work performed for PDP-PreCon to develop Gantt charts and milestones for all projects that go through the letting process
- Focusing on strategies to accelerate environmental clearance and the right-of-way process
- Prioritizing performance measures within each division to increase efficiency
- Fine tuning a project development process able to program long-term projects and forecast beyond what is covered in the *Highway Plan*

Appendix A Review of Project Development Practices and Project Management Resources at State Transportation Agencies



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Review of Project Development Practices and Project Management Resources at State Transportation Agencies

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KTC's Mission

We provide services to the transportation community through research, technology transfer, and education. We create and participate in partnerships to promote safe and effective transportation systems.

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Introduction

At the Kentucky Transportation Cabinet's (KYTC) Department of Highways, project development encompasses all the work activities needed to move a transportation project from concept and project initiation to construction letting. Developing projects efficiently requires the adoption of sound project management practices. And having recourse to validated project development practices is critical for helping KYTC project managers negotiate the variety of tasks and processes leading up to project implementation and delivery. For a project manager to be successful, they must possess a holistic understanding of how the complex interplay of engineering, environmental, and economic issues affect different stages and facets of project development. Without an expansive knowledge of these variables, project managers risk privileging one area over another, which leads to the development of subject-matter silos that impede efforts to develop a big-picture understanding of a project. Although KYTC has a long track record of executing complex transportation projects, doing so is becoming increasingly challenging due to staff attrition and the attendant loss of institutional knowledge. Today, entry- and mid-level project managers have more project development responsibilities than ever but lack a dependable source of guidance they can turn to that will help them champion projects from the development stage and through to completion. Given staffing and budget constraints, it is more important than ever that KYTC project managers be equipped with all the tools necessary to successfully develop and deliver the construction program. As part of this project to develop *A Guidebook for Project Development*, the research team has reviewed literature on project management organizational structure and state transportation agency (STA) organizational structures, particularly those that have explicit project development and management components.

Literature Review

KTC first reviewed approaches to project management and development at state transportation agencies (STAs) to identify recent and emerging trends. In the coming years, changes at STAs will be driven by adjustments in funding priorities and a shift toward flatter organization structures (Lindquist et al. 2009). They will need to consider making organizational changes as necessary to fit particular needs, involve their employees in the decision-making process, and assess performance results and needed changes. At the same time, agencies should refrain from making changes too often (Cameron et al. 2009).

Secrest et al. (2012) classified STA organizational structures into three dimensions, although they noted that STAs often share characteristics across each dimension. The first dimension is a silo-based versus workflow-based structure, where functions are either grouped into silos or into team-based workflows with various skill sets being grouped together to deliver projects. The second dimension is a centralized versus decentralized organization; in the former, efforts are concentrated in a central office while for the latter they are dispersed among regional or district offices. Many agencies have adopted a hybrid organizational structure, combining a central office with offices located around their states. The final dimension is performing common STA functions in-house versus a more outsourced approach.

Secrest et al. (2012) also examined the changes being made and why STAs have begun to explore and undertake organizational changes. Drivers of organizational change include the pressure to increase efficiencies, enhance performance accountability, improve project delivery, insufficient revenues, and bolstering DOT credibility. Trends in organizational change center around the use of hybrid silo/workflow-based designs, the recentralization of key functions (command functions accompanied by the continued decentralization of delivery), and increased outsourcing. The first two are driven by a focus on innovation, efficiency, and consistency, while outsourcing is generally motivated by budgetary constraints. As STAs continue to evolve in response to various pressures, reorganized agencies are characterized by reduced size, a refined mission, the diversification of project delivery strategies, and a focus on performance and risk management (Secrest et al., 2012). Table 4 and Table 5 in the Appendix replicate Figures 6 and 7 (p. A-7,

A-9) and summarize how STA survey respondents answered questions about what areas have or will require change and overall organizational change strategies.

Brown et al. (2007) developed a guide for STA executives to improve organizational performance. The authors identified nine success factors related to organizational improvement and effectiveness:

1. Legacy Leadership
2. Champions
3. Measures of Success
4. Desire to Look in the Mirror
5. Alignment
6. Dialogue
7. Taking Care of Business
8. A Culture of Kaizen (Continuous Improvement)
9. Empowerment with Accountability¹

While not specific to project management or highways, organizational structures across transportation modes can be useful for comparing STAs.

Fazzalero (2007) grouped STAs into four categories based on the organization structures adopted by their divisions of highway and public transit: by functional activity, transportation mode, multi-agency, and no identifiable component unit. This list is shown in Table 1. Kentucky is listed in the group organized by functional activity.

Table 1: State Department of Transportation Organizational Models (Public Transit)

Functional Activity
<i>Alabama, Arkansas, California, Colorado, Florida, Iowa, Kansas, Kentucky, Louisiana, Maine, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Mexico, New York, South Carolina, South Dakota, Tennessee, Vermont, and Wisconsin</i>
Transportation Mode
<i>Arizona, Connecticut, Hawaii, Idaho, Illinois, Maryland, Michigan, Montana, New Hampshire, North Carolina, Oklahoma, Oregon, Pennsylvania, Texas, Washington, and West Virginia</i>
Multi-Agency
<i>Delaware, Georgia, Massachusetts, New Jersey, Ohio, Rhode Island, and Virginia</i>
No Readily Identifiable Public Transit Component Unit
<i>Alaska, Indiana, North Dakota, Utah, and Wyoming</i>

STAs have increasingly turned their focused toward improving their project development and management to more efficiently and expeditiously deliver projects. Often, lengthy project phases (e.g., the environmental process) can produce significant delays. Burbank et al. (2009) reviewed organizational structures that can help streamline environmental processes.² After interviewing personnel at 11 STAs, they identified 12 features of an effective and efficient environmental process:

1. *Provide two levels of leadership:* executives and career environmental managers and staff.
2. *Organize for environmental awareness and accountability throughout the STA and assure effective communications:* ensuring appropriate staffing levels throughout the organization.

¹ For tools and tips on implementing these best practices see p. 12-40.

² As part of this project, 27 additional literature sources related to environmental issues and streamlining are cited. If more information on the environmental process is desired, these sources provide a good starting point.

3. *Provide expert staffing*: given the complexity of environmental issues, ensure that staff has expertise and resources needed.
4. *Build an environmental culture*: focusing on environmental issues throughout the organization emphasizes their importance.
5. *Support improved land use*: cultivate responsible land use practices that benefit transportation and the environment.
6. *Invest in environment*: view environmental features as essential to projects, like safety features.
7. *Nurture relationships with resource agencies*: build and maintain relationships with federal and state resource agencies.
8. *Invest in GIS*: helpful for early resource coordination, planning, and mitigation.
9. *Develop programmatic agreements*.
10. *Shift from projects to ecosystems*: less focus on project-by-project planning and mitigation in favor of ecosystem planning and mitigation.
11. *Be judicious with environmental management systems (EMS) and environmental performance measures (EPMs)*: implementing performance measures were seen as adding value.
12. *Continually streamline environmental processes*: vary based on state experiences and number of projects.

The authors highlighted several state efforts that streamlined project development processes, including: Florida's Efficient Transportation Decision Making³ (more on Florida's efforts below and in the next section), Oregon's Collaborative Environmental and Transportation Agreement on Streamlining⁴, and North Carolina's Ecosystem Enhancement Program⁵.

Florida DOT (FDOT) established a project management office in 2001 and conducted a project benchmarking study shortly thereafter (Florida Department of Transportation, 2006). The results of the study offer insight into best practices, lessons learned, and trends and next steps/recommendations concerning project management at STAs. Best practices covered project management structures, online information databases, scope and budget creep, scheduling, consultant contracts, project management training, and program assessments. The report discussed various project management structures, including projectized structures, cradle-to-grave project manager, cross-functional project delivery teams, and phased project manager/team approach. The study concluded that existing organizational structures may be problematic when trying to implement different project management approaches; cross-functional project delivery teams and phased project manager are least likely to impact existing structures. For more efficiency, the cradle-to-grave and projectized structures are preferable; however, agency personnel may resist their use. Project management training focused on formal courses, training with real scenarios, and handbooks/guidelines. All approaches can help improve and make uniform project management practices in an STA.⁶

FDOT identified the following trends in project management (p.16):

- Increasing frequency of studies of best practices or benchmarks where organizations examine their practices and seek to adapt as needed to improve project management
- Major organizational changes requiring leadership buy-in
- Development of lessons-learned/knowledge databases
- Project management of in-house projects
- Online project management information sources
- Training

³ <http://www.fdot.gov/environment/etdm.shtm>

⁴ <https://www.environment.fhwa.dot.gov/strmlng/newsletters/oct01nl.asp>

⁵ <https://deq.nc.gov/about/divisions/mitigation-services>

⁶ If information about the other best practices is desired see p. 11-14.

- Project management guidebooks

Next steps for project management were focused on defined project management roles and using them across all levels of an agency, communicating with other states about project management practices, selecting approaches to project management, and training project managers. Recommendations arising from the study reflect many of the best practices previously listed and are noted below (p. 18-19):

- Evaluate different project management structures
- Develop an online project management database or web portal
- Provide formal software training
- Examine more effective scheduling methodologies like critical path or critical chain
- Potentially reduce the number of projects undertaken
- Reevaluate entire project phase schedule
- Explore the use of incentive programs for various contracts
- Use a Project Management Handbook as basis for project management training
- Take lessons learned/case studies from actual projects and use them in training

Organizational change at STAs is ongoing due to many factors, such as tighter budgets and the need to improve performance and efficiency. With organizational change being pursued at many agencies, the FDOT study and others reviewed in this section provide STAs with valuable information on organizational structures and current best practices in project management. The next section looks at state-level approaches to project development and management and discusses numerous examples of materials KYTC should consider when assembling its project development and management guidebook (e.g., policy manuals and guidance).

State Approaches to Project Development and Management

The research team looked at how different STA's approach project development and project management. To understand STAs' varied strategies, the team examined policy manuals, guidance, best practices, and other resources made available to project managers. Three questions guided the inquiry:

- What activities are project managers responsible for?
- Where are project managers located within an agency's organizational hierarchy?
- What resources are available to project managers?

Although this section does not review the policies and practices of every STAs, it provides a representative sample. Some agencies (e.g., Caltrans) have published extensive guidebooks that describe practically every facet of project development and reference laws, agency-specific practices, and permits, among other items. Additional efforts such as *NCHRP's Web Document 137: Guidance for Transportation Project Management*⁷ also provide project management basics in a guidebook format for practitioners to utilize. We do not exhaustively document the contents of these guidebooks. Rather, our goal was to capture and highlight resources and strategies that could be applied at KYTC or elsewhere.

Nebraska

Project managers at the Nebraska Department of Transportation (Nebraska DOT) are employed in one of eight district-level offices located around the state. Each district has a District Engineer and District Construction Engineer; project managers are located below these positions within the organization's hierarchy. The agency also has Divisions of Project Development and Program Management, but no Division of Project Management. The Division of Project Development was created in 1971, principally to

⁷<http://www.trb.org/Publications/Blurbs/161950.aspx>

deal with the increased federal requirements that were imposed by the 1969 Environmental Policy Act (e.g., writing environmental impact statements). While there is no Division of Project Management, the agency hosts a webpage for Project Manager Resources (<http://dot.nebraska.gov/business-center/pm/>). Along with links to agency-specific resources (e.g., approved products list, construction manual, spec book, electronic contract documents), it also contains a best practice manual and a Project Management Best Practice Checklist, which offer project managers step-by-step guidance on what tasks they are responsible for during each phase of a project. Nebraska DOT also holds an annual Project Manager's Conference.

Nebraska DOT project managers have many responsibilities, including 1) maintaining records of work performed, 2) monitoring the performance and progress of work, 3) making sure that contractors perform work as specified in plans and that sufficient documentation is preserved to justify payment. Their efforts stretch from pre-construction and construction through the post-construction phase. Project managers serve as the primary point of contact for project communications involving Nebraska DOT and external project stakeholders. They are not responsible, however, for directing the daily activities of the prime contractor or subcontractors.

To streamline the project management process and establish a stable source of knowledge accessible to all Nebraska DOT project managers, the agency developed the *Project Management Reference Guide*. Written with the input of current and former project managers, the reference guide adopts a checklist format that documents best practices for the activities project managers are responsible for during each phase of a project (i.e., pre-construction, construction, post-construction). Callout boxes located throughout the text contain examples and best practice tips that pertain to specific activities. A sample page (Figure 1) from the guide illustrates the guide's structure and concise presentation used. Chapters include guidance on what steps are necessary to keep a project running smoothly. Topics are wide-ranging; for example, field survey operations, locating potential maintenance issues, verification of existing signage, materials management, contract management, and final review. Generally, the main text lacks detailed instructions on how to perform or coordinate a specific activity. Rather, the checklist format is designed to help project managers optimize their workflow and offer reminders of when a task should be performed. Appendices, however, include worked examples and templates to facilitate the development of memoranda or project-related documents (e.g., pre-construction agenda request letter, project materials required document list, status of environmental commitments, pre-construction meeting minutes, project information forms, work orders).

C. Materials Management

1C-1

- P.M. distributes copies to inspection personnel for the project specific Materials Required Document List (M-RDL), sent by M&R (See the *Materials Sampling Guide*, *Quick Reference Guide*, and [Materials Standard Operating Procedures for Project Managers](#) for more detailed information about how to use the M-RDL, the *SiteManager Sampling Checklist*, and documenting material requirement compliance.)
(See [Example 1A-23](#) in the appendix)

Best Practice Tip

Use the MRDL contacts list to determine who to send records to. Also, there are the names of the M&R representatives who will review the documentation during the final materials review.

Remember that the M-RDL is based on contract items and quantities. Should you add items or deviate from plan quantities, addition samples will be required.

A detailed review of the project material sampling will be done during the finals process and may require additional information at that time.

1C-2

- Verify that technicians, vendors, suppliers and manufacturers qualifications and certifications are current.

BACK to 1A-3

BACK to 1A-11

Best Practice Tip

Use the NDOR web-site to see if concrete plants, asphalt plants, etc. certifications are current. See Section 28 of the *Materials Sampling Guide* to see the technician material and sampling certification requirements, temporary certification requirements, etc. If a sampler/tester is not certified, but needs to be, contact the QA manager for assistance.

If concrete plant or temporary plant is not certified, contact the NDOR PCC Engineer immediately.

RUG can be used to check on inspectors certifications.
(See [Example 1C-2](#) in the appendix)

Flagger Certification and Assistant Traffic Control Manager Certifications are now available on the NDOR web site – Contractors Corner – Highway, Bridge & Local Projects Lettings – scroll down to the bottom of the page.

Figure 1: Sample Page from Nebraska DOT's *Project Management Reference Guide*

California

Caltrans project managers work in one of 12 district-level offices located around the state of California. The Division of Project Management is responsible for the management and delivery of transportation improvement projects throughout the state⁸. Districts are staffed by a District Director, under whom there is a Deputy District Director of Program/Project Management. Project managers are situated beneath the Deputy District Director on the organizational hierarchy. Some districts have also delineated project manager boundaries. Figure 2, which is a map of Districts 1, 2, and 3, indicates the territorial assignments

⁸ <http://www.dot.ca.gov/projmgmt/>

for individual project managers in the region. The Division of Project Management has produced several resources to facilitate project managers' activities, including two guidance manuals that define the purview of the agency's project managers and lays out the procedures they must follow during a construction project.

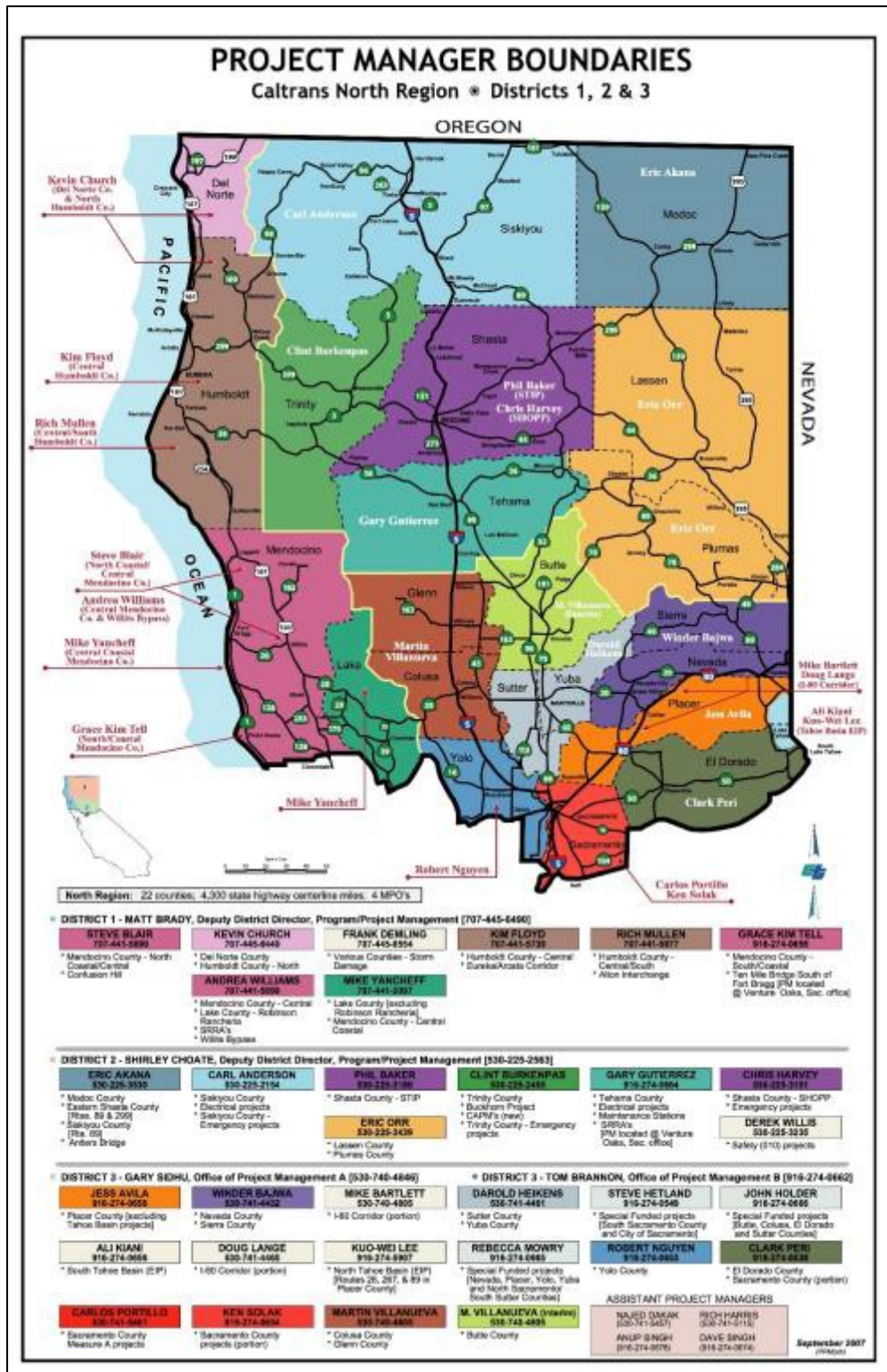


Figure 2: Territorial Assignments of Caltrans Project Managers, Districts 1–3

Project managers are involved with projects for their entire duration and have the authority to control resources designated for the project and their schedules. They oversee all steps in the project development process, starting with project initiation and extending through closeout of the construction contract. In most cases, project managers receive their assignment before project initiation occurs. The agency's *Project Management Handbook* specifies the activities project managers are responsible for during each project component — these components are Project Initiation Document; Permits and Environmental Studies; Plans, Specifications, and Estimates, Right of Way, and Construction. At the beginning of a project, project managers are expected to identify the needs and expectations of project sponsors. They also lead the project team in development of a project management plan, which should define scope, schedule, cost, resource needs, risk, and communication strategies. As a project moves forward, project managers coordinate and facilitate all work; monitor project performance; inform district management of problems encountered by district-level management, sponsors, and other members of the project team; and work to control changes to project scope, cost, and schedule. Project managers are responsible for ensuring on-time completion and once work concludes, they prepare a final report and document lessons learned. Leading up to project approval, an interdisciplinary project development team composed of internal and external stakeholders is assembled to advise and assist project managers, carry out the work plan, participate in meetings and public outreach activities, and oversee early tasks of project activities.

Two published resources can assist project managers with their daily activities. First, is the *Project Development Procedures Manual*, which is a compendium of all information project managers need to know to carry out specific tasks. Divided into three parts, the manual presents general information (e.g., roles and responsibilities; project cost, scope, and schedule changes), a thorough description of the project development process (covering topics ranging from project initiation and formal project studies to public hearings and permits, licenses, agreements, certifications, and approvals), and details of specific project development procedures (e.g., encroachments and utilities, value analysis, community involvement). Patterned after the *Project Management Body of Knowledge*, Caltrans' *Project Management Handbook* offers guidance on best practices. It discusses each project component (listed above) and instructs project managers on what is expected of them during various phases; individual sections dedicated to each project component also specify what deliverables are required of each. Additionally, the handbook reviews processes associated with each project component. Taking a cue from the *Project Management Body of Knowledge*, the handbook divides project activities into five process groups (Initiating, Planning, Executing, Monitoring and Controlling, and Closing). The handbook also reviews tools and techniques project managers rely on during each stage of a project. Tools and techniques are described for different knowledge areas: managing project integration (e.g., forming the project development team at the beginning of a project's lifecycle, developing a purpose and need statement) and scope, time, cost, quality, human resources, risk, communication, and procurement management. The roles played by project stakeholders are covered as well, with the responsibilities of each project team member carefully itemized. Figure 3 is a table from the handbook that provides an overview of the project manager's core responsibilities within each process group. The second resource available to Caltrans project managers is the *Project Development Procedures Manual*. This manual painstakingly documents the project development process, from project initiation through the preparation of plans. It also contains numerous chapters that explain specific project development procedures (e.g., encroachment and utilities, value analysis, preparation of cost estimates, community involvement, noise abatement, landscape architecture).

Role	Process Group	Action
Project Manager <i>Has full authority, delegated from the DDDPPM, to produce the intended results, on schedule and within budget, and to keep the project sponsors and customers satisfied</i>	Initiate	Identifies the needs and expectations of the project sponsors
	Plan	Leads the project team in the development of a project management plan that defines the project scope, schedule, cost, resource needs, risk, and communication needs Ensures that the project management plan includes all the work required, and only the work required, to produce the product Assigns resources in the following order: <ul style="list-style-type: none"> ▶ First, assigns WBS elements to functional managers in his/her own district or region ▶ Second, brokers WBS elements to functional managers in other districts, regions or divisions, if functional managers in his/her own district or region are unable to meet the delivery requirements ▶ Third, uses consultants to produce work elements, if neither local district or region staff nor brokering will meet the delivery requirements Modifies workplans to account for the use of project-specific consultant contracts
	Monitor & Control	Coordinates and facilitates the work performed throughout the project lifecycle Monitors project performance and takes corrective action if necessary Communicates sensitive issues and project progress to district management, the sponsors, and the project team Provides input into the performance evaluation of project team members, and recommends changes to the project team membership when necessary Serves as the single point of contact on matters involving overall project scope, cost, or schedule Resolves problems that affect project scope, cost, or schedule Controls change to the project scope, cost, or schedule throughout the project lifecycle Coordinates communication between task managers and internal customers of project deliverables to verify and document customer expectations Coordinates the efforts of the overall team, including the Division of Engineering Services Chairs project team meetings Controls the project budget (both support and capital)
Close	Provides timely project completion Ensures that the final product meets the needs of the project customers Discusses the final product with sponsors to gauge their level of satisfaction Prepares a final report on the project, with recommendations for improvement Provides feedback to the team on lessons learned	

Figure 3: Responsibilities of Caltrans Project Managers by Project Phase

Georgia

The Georgia Department of Transportation (GDOT) established an Office of Program Delivery in 2009 to facilitate the delivery of projects — from inception to completion. The office coordinates project development and delivery with other Georgia DOT offices and divisions, local governments, staff from metropolitan planning organizations (MPOs), business and community stakeholders, and other state and federal agencies. It prioritizes and encourages the use of codified and proven project management practices, such as those found in the *Project Management Body of Knowledge*. Within the agency’s organizational hierarchy, the Office of Program Delivery and Program Control Office fall under the purview of the Division of Program Delivery. The Program Control Office monitors, controls, and reports on project status. It also offers training courses on the plan development process and local administered projects, encourages GDOT employees to build a collaborative environment throughout the project development process,

recommends lettings to executive management, helps project managers use the agency’s scheduling tool, and is responsible for maintaining a balanced work program and reviewing project concept reports. Each district office is staffed by a program manager who supervises the activities of a team of project managers.

Georgia DOT project managers oversee projects from initiation through construction. More specifically, they are “the person in responsible of a project who makes the day-to-day scope, schedule, and budget decisions and is responsible for steering, coordinating, and managing a project through the Project Development Process and through the construction phase” (Georgia DOT, 2012). The agency has published a list of the tasks assigned to project managers:

- Meet with Planning, stakeholders, and MPO as required
- Review project justification statement with an assessment of commitments and agreements
- Meet with Program Control to establish schedules, identify critical path and risks
- Identify and monitor resources — team members, stakeholders, and subject-matter experts
- Project Manager’s project acceptance into Program Delivery with risk assessment
- Initiate and assign projects with a project charter
- Implement and execute the project management plan with team members
- Conduct meetings, plan, monitor, evaluate, mitigate, resolve, and report
- Deliver the project

Less experienced project managers are assigned a Senior Project Manager mentor. When they confront procedural issues or other problems they feel unequipped to handle, they are instructed to consult with their mentor to achieve a resolution. If this does not solve the problem, they should escalate the issue to upper management.

Georgia DOT has published a project management handbook that presents a view of project management which aligns closely with principles laid out in the *Project Management Body of Knowledge* and gives users practical guidance on different aspects of the project development and delivery process. After reviewing the mission of the Office of Program Delivery, the handbook quickly gestures toward salient policies and procedures project managers should familiarize themselves with, discusses methods and software for documenting progress on the project, and describes how to generate project status reports. The handbook’s chapter on project management serves as a concise introduction to project management strategies and their application to effective and efficient project delivery. Later chapters run through a series of topics relevant to project management, including work breakdown structures, the administration and organization of GDOT programs, working with consultants and processing invoices, and legal matters. The handbook also discusses and establishes a roadmap for the Project Team Initiation Process, the goal of which is to standardize the roles played by project managers and subject-matter experts when GDOT projects are initiated and reduces the amount of time needed to move from the preliminary engineering funding authorization to the beginning of preliminary design activities. The remaining chapters touch on the project manager’s roles during different phases, including preliminary design, final design, and construction — including construction oversight, handling change orders, final inspection, and project closeout. Once a project ends, project managers are expected to hold a meeting with the project team to identify lessons learned and discuss ways to improve future projects.

Florida

Compared to most other state agencies, the Florida Department of Transportation (FDOT) has adopted a somewhat unique approach to project management. At the state level, FDOT has a Production Support Office, which is located under the Office of Design. The mission of the Office of Design is to support and manage the delivery of the design phase of projects. Within the Production Support Office is the Project Management Section, whose purpose is to supply the tools needed to deliver projects on schedule and within

budget and to develop and consistently implement project management practices to facilitate transportation project delivery. Additionally, the Project Management Section hires — when needed — consultant project managers to assist with delivery of the transportation work program. Consultant engineers provide design, construction engineering, and inspection services. What separates FDOT from most other agencies is that project managers generally oversee project phases rather than projects from inception to completion. The Production Support Office has published a comprehensive *Project Management Handbook* that contains guidelines and recommended practices for Florida DOT project managers and consultant project managers. The handbook lists and describes the various types of project management: 1) Planning Project Management, 2) Project Development and Environmental Project (PD&E) Management, 3) Design Project Management, 4) Right of Way Project Management, 5) Construction Project Management, 6) Design-Build Project Management, 7) Maintenance Project Management, and 8) Local Agency Program (LAP) Project Management. Project managers are assigned to oversee work in of these areas/phases. For example, a Right of Way Project Manager is responsible for managing the right or way phase of a project. After the Right of Way phase concludes, they communicate commitments and transfer purchase agreements and other materials to the Construction Project Manager. The agency maintains online resources for its project managers. The central website for Project Management (<http://www.fdot.gov/designsupport/PM/>) contains points of contact, lists project management areas, and links to the agency’s *Project Management Handbook* and other agency-specific policies and resources, lets users access district-level project management websites. Only three of Florida DOT’s seven districts have a web presence. The most detailed webpages (linked to below) contain links to manuals, files, documents, and other guidance that can facilitate project management activities.

- District 4 (<http://www.fdot.gov/designsupport/Districts/D4/HomeKB.shtm>)
- District 5 (<http://www.fdot.gov/designsupport/Districts/D5/default.shtm>)

At FDOT a project manager is the person responsible for executing and completing a project. As noted, project managers often come from outside consultants, and they preside over a single project phase (e.g., design, right of way). Project managers are also responsible for ensuring that work adheres to the project scope, managing contracts to verify all contractual requirements are satisfied, overseeing budgets, making sure that work is completed on schedule, eliminating or mitigating risks, communicating effectively with stakeholders, overseeing the work of project staff, and confirming that quality standards are met. The agency treats project managers as the “hub of concern and accountability.” If a project has project managers from both FDOT and an external consultant, each assumes equal responsibility for the project’s success. FDOT project managers are accountable to the management of the department in which their work takes place. Less experienced project managers are also encouraged to identify and work with informal mentors. Table 2 summarizes the responsibilities of agency and consultant project managers.

Table 2: Responsibilities of Internal and Consultant Project Managers (FDOT)

Area	Florida DOT Project Manager Responsibilities	Consultant Project Manager Responsibilities
Scope	<ul style="list-style-type: none"> • Develop the scope of services. Coordinate input from support services and the project team. • Know and understand the scope. • Be accountable to management for the success of the project. • Approve modifications to the scope and update the document. 	<ul style="list-style-type: none"> • Completely understand and fulfill the scope of services. • Not work beyond the scope of services. • Be accountable to both Florida DOT and firm management for the success of the project.

Contracts	<ul style="list-style-type: none"> • Thoroughly know and understand the contract and fulfill all contractual obligations. • Understand fiduciary responsibilities to ensure proper expenditure of public funds and to ensure that contracted services are delivered. • Review deliverables, progress reports, and other project monitoring tools to identify problems early. • Take decisive action if monitoring indicates a problem: work products are deficient, the consultant is not responsive, or the project is significantly behind schedule. 	<ul style="list-style-type: none"> • Thoroughly know and understand the contract and fulfill all contractual obligations. • Fulfill all contractual requirements on time, within budget, and of an acceptable quality. • Ensure that all progress reports and deliverables are submitted on time. • Advise Florida DOT of contractual problems on a time basis and propose reasonable solutions.
Cost	<ul style="list-style-type: none"> • Stay within the budget; be concerned about total costs, including design, right of way, construction, and inspection services. • Process appropriate charges in the contract amount. 	<ul style="list-style-type: none"> • Complete the project within the established budget. • Meet the profit objective set by firm management.
Time	<ul style="list-style-type: none"> • Approve any change in project schedule. • Be concerned with schedule linkages to other projects in the work program. • Identify actions required by Florida DOT management and ensure timely completion. • Ensure that Department review commitments, as defined in the contract, are met. 	<ul style="list-style-type: none"> • Meet all schedule requirements. • Know which activities are on the critical path and manage these activities aggressively. • Update schedule as needed.
Human Resources	<ul style="list-style-type: none"> • Ensure that staff is available to perform the project and to review the project team. 	<ul style="list-style-type: none"> • Ensure that the necessary human resources are available to perform the project. • Ensure that the key staff members work on the project as proposed to the Florida DOT. • Delegate effectively. Coach and train others to become Project Managers

FDOT's *Project Management Handbook* presents high-level guidance on many topics salient to project managers. It is divided into two parts. The first part examines generalized project management strategies that all project managers should adopt irrespective of what project phase they have responsibility for. The second part gives overviews of all the project management sub-disciplines (e.g., planning, design,

construction). After defining the attributes of successful project managers and discussing ethical principles, the first part of the handbook outlines procedures to monitor and control projects, explores the role of consultants, and maps the planning process FDOT uses to identify transportation needs. A brief primer on context sensitive solutions (CSS) follows, as it is the agency's policy to plan, design, construct, and maintain projects in a manner sensitive to the surrounding community and environmental contexts. The integration of CSS into the Planning and PD&E phases is covered, as is working with communities to develop workable transportation solutions and design strategies to implement CSS. Because most FDOT projects will have several agency and consultant project managers during their lifecycle, one chapter is set aside to discuss transitions between project managers, specifically the procedures for handing off materials and coordinating with project managers responsible for subsequent phases. Figure 4(a) depicts the workflow of a typical transportation project. Notice, there are six phases; each phase has a separate project manager. The handbook also instructs project managers on what deliverables they should provide to project managers who are responsible for the ensuing phase. As an example, Figure 4(b) illustrates what materials and knowledge the Design Project Manager hands off to the Construction Project Manager as the project transitions into construction. Additional chapters in the first portion of the handbook deal with other standard items such as procuring consultants, negotiating contracts, scheduling work, quality assurance and quality control, right of way, and risk management. The second half of the handbook provides fine-grained descriptions of the activities and responsibilities of project managers assigned to different phases. Most of the content relates to agency procedures and standard practices, laying out all the steps project managers should follow to successfully negotiate their project phase. Throughout, the handbook links to Florida DOT webpages, manuals, specifications, guides, and bulletins project managers will require access to.

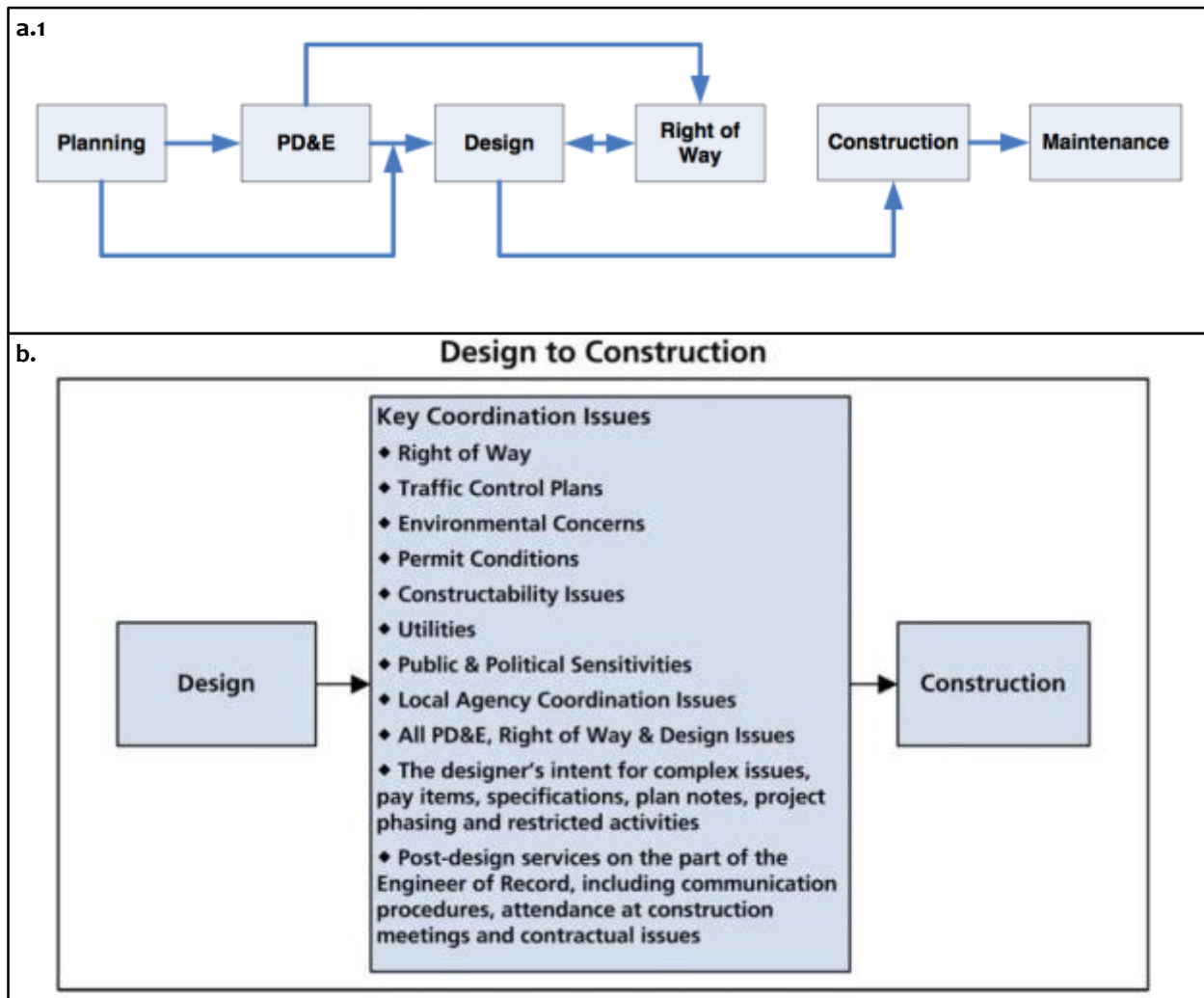


Figure 4: (a) Transportation Project Workflow at FDOT; (b) Design to Construction Handoff

Ohio

The Ohio Department of Transportation (Ohio DOT) lacks a dedicated office or division focused on either project development or project management at the state level, although it does offer resources to facilitate project management. In each district, the Planning and Engineering Department oversees the development and design of all highway construction projects. Located within this department are project managers who work on consultant projects and Local Project Administration (LPA) Projects — LPA Projects are those which move through the Local Let Process. Ohio DOT adheres to a five-phase Project Development Process (PDP): planning, preliminary engineering, environmental engineering, final engineering/right of way, and construction. Project managers oversee work during these phases. Preliminary Engineering and Environmental Engineering are done in tandem. The agency also has a classification system that is used to categorize projects based on project complexity. Path 1 and 2 projects are minor transportation improvement projects (e.g., maintenance and efforts that require minor structural or roadway work). Path 3, 4, and 5 projects are more complex, ranging from projects focused on existing alignments and significant relocations that do not significantly impact the environment (Path 3) to urban transportation improvements that entail acquiring significant right-of-way, relocating numerous utilities, and demand considerable public input (Path 5). To ensure continuity on more complex projects (Path 3, 4, and 5), Ohio DOT recommends assigning a dedicated project manager to oversee development across the project lifecycle. The agency has

a website focused on its PDP⁹ that includes links to its *Project Development Process Manual*, a discussion of project paths and their respective milestones, training materials, and worked examples of PDP documents.

After a project manager has been chosen by the project sponsor, the project manager establishes a project identification number, enters information into the agency's project management system, works with the sponsor to select an appropriate project team, and begins documentation of all project activities and products. To facilitate selection of the project pathway, project managers define project conditions, potential impacts, constraints, and solutions (i.e., alternatives) and report on them to help the Planning and Engineer Administrator make an initial project classification selection. It is also the project manager's responsibility to communicate and coordinate with Ohio DOT's Central Office specialty staff throughout the project. At the outset of a project, project managers organize a kickoff meeting, the aim of which is to identify project stakeholders, define work requirements, develop a preliminary scope and schedule, and determine whether the agency will hire an outside consultant. Project managers are expected to organize project meetings at each PDP phase and at other critical times; they must ensure the project remains on schedule, is not exceeding the scope, and is within budget. If a consultant becomes involved in a project, the agency suggests the project manager participate in development of the pre-Scope of Services, conducts the scope of services meetings with the consultant, evaluates the consultant proposal, and negotiates the fee. Throughout the project, the project manager is responsible for monitoring and controlling costs and providing routine updates on its status to internal and stakeholders (e.g. Ohio DOT personnel, FHWA, Federal Transit Administration, MPOs). Project managers are expected perform the following tasks:

- Verify that contract deliverables meet the scope of services requirements and that deliverables are received
- Coordinate and schedule internal reviews — plan submissions are tendered to the project manager
- Establish and monitor project funding
- Coordinate and schedule plan reviews
- Directly provide technical guidance to consultants (or coordinate its provision)
- Manage and balance project risks
- Regularly hold progress meetings
- Coordinate processing of any needed design exceptions
- On design contracts, manage activities required to certify plans to Ohio DOT's central office (e.g., right of way clearance, utility clearance, acquisition of necessary permits, railroad agreements, cost estimates, environmental clearance)

Project managers have the ability to customize a project's scope by modifying required tasks to address project needs. When a consultant is involved in a project, the project manager also monitors the consultant's work to ensure it complies with Ohio DOT's plan format requirement and the scope of services. After project has been completed, project managers are required to evaluate a consultant's performance.

Ohio DOT's *Project Development Process Manual* offers detailed guidance for each phase of the agency's PDP. The manual links to references, documents, and other resources located on the agency's website and elsewhere that project managers should consult if they need additional information. The introductory chapter has a high-level review of the PDP, articulates the project manager's responsibilities, and briefly touches on issues such as estimating project costs, scoping, alternative delivery methods, and transitioning a project from one path to another if the need arises. Next, individual chapters offer detailed treatments of each project phase. Each of these chapters, in addition to outlining key processes, includes a section that specifies what activities project managers are responsible for during each phase. The planning chapter walks

⁹<http://www.dot.state.oh.us/projects/pdp/Pages/default.aspx>

through issues such as identifying and researching traffic problems that need to be addressed; developing purpose and need statements; and developing a project's scope, budget, and schedule. Following this, the manual goes over the preliminary engineering, during which project managers spearhead detailed investigations to identify appropriate transportation solutions. Topics such as feasibility studies, conducting environmental field assessments, developing an alternatives report, initial (Stage 1) design, and public involvement are reviewed. The environmental engineering phase occurs alongside preliminary engineering. In discussing this process, the handbook reviews environmental field studies in greater detail and discusses value engineering, detailed (Stage 2) design, and preliminary right-of-way plans. For items such as preliminary-right-of-way plans, the manual provides instructions on key items to consider and what to include with deliverables; this information is presented in callout boxes. National Environmental Policy Act documentation and environmental mitigation are covered in this chapter as well. Once preliminary/environmental engineering wrap up, projects transition to final engineering/right of way. The chapter dedicated to this phase examines right-of-way acquisition, completing detailed (Stage 3) design plans, preparing cost estimates, and the advertising and award process. The final chapter delves into construction, including preconstruction meetings, value engineering change proposals, acceptance of materials, construction activities (with an emphasis on which should be monitored and documented), and final acceptance. A post-construction meeting is held to revisit the project and document lessons learned.

Massachusetts

The Massachusetts Department of Transportation (MassDOT) has a Project Management Section that is housed within its Design and Engineering Department. The mission of this section is to oversee roadway and bridge projects designed by consultant engineering firms. Agency employees are divided among five district offices and a central office in Boston. Project managers have access to many resources, including the *Project Development and Design Guide*, which contains a dedicated chapter on project development and management (see below). The developmental framework MassDOT is meant to facilitate successful project execution; encourage the use of sound planning, design, and implementation practices; and promote the long-term success of the agency's projects. It also counsels the use of a collaborative approach to address transportation problems and prioritizes the use of context sensitive solutions. Figure 5 presents the agency's project development workflow. Along with the *Project Development and Design Guide*, the Project Management Section website also houses a variety of tools that facilitate the project development process. It includes links to project development tools (e.g., highway design review checklist, project need form, project initiation form, and construction project estimator), contract and invoicing tools (e.g., payment invoice processing procedures, consultant contract closeout procedures), and design manuals and guides. Information on public hearings, PRC activities, and scoping and estimating project costs are available too.

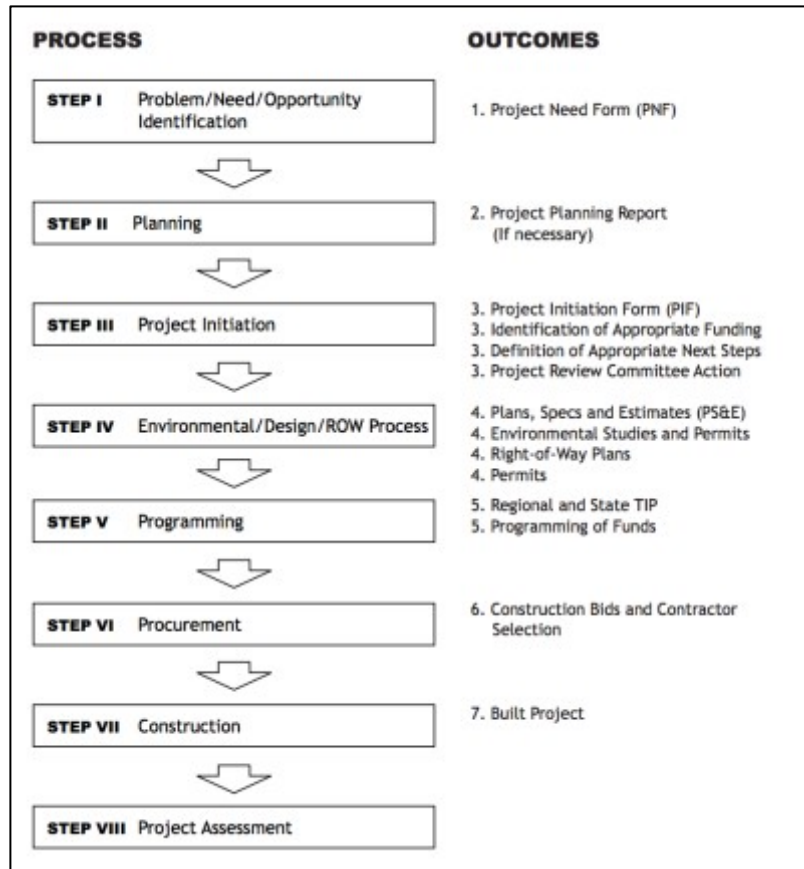


Figure 5 MassDOT Project Development Process

Project managers oversee work during each phase of a project, from initiation through construction. Project proponents are responsible for completing Steps I and II of project development (i.e., problem identification and planning). After a project need has been identified and goes through planning and the MassDOT district office and local community agree the project is warranted, the district office submits a project initiation form to the agency’s Project Review Committee (PRC). The PRC evaluates proposed projects and decides whether they are both eligible for funding and feasible to undertake. Only after the PRC approves a project is a project manager assigned by the agency. On many roadway projects, cities or towns provide funding, supervise design, and acquire the right of-way. Project managers also coordinate with municipalities during the design phase, when they control the right-of-way and have selected a consultant engineering firm.

As noted, the *Project Development and Design Guide* includes a chapter on project development; the following discussion is restricted to this chapter. The first three chapter sections discuss project phases in which the project manager has little or no involvement. Needs identification and planning, which the first two sections explore, occur before a project manager is assigned. However, these would be of use to project proponents needing guidance on the process. The third section examines project initiation, from screening to approval by the PRC. The fourth section outlines the environmental, design, and right-of-way processes, which are concurrent. This section provides instruction on public involvement and specifies when various hearings occur. It also provides guidance for coordinating different facets of the environmental process (e.g., federal and local environmental laws, mitigation, documentation). The next two sections briefly review programming and procurement. Before construction gets underway, the project proponent and contractor must develop a construction management plan; MassDOT recommends closely monitoring and managing construction activities to verify quality standards are met and project expectations satisfied. Building on previous material, a section offers an in-depth review of public outreach, including a discussion

of stakeholder identification, deciding on appropriate public involvement strategies, and tools that are available to communicate with the public about new projects. It includes a matrix that identifies what public outreach approaches are necessary for different project types (Figure 6). Two final sections delve into scheduling (including a sample template) and design exceptions.

Source: MassHighway

	Necessary and Recommended Public Outreach Approaches						
	Notify abutters and utilities of construction impacts*	Community notification and involve abutters	Early involvement of Local Boards/ Commissions	Early Local Issues Meeting	Public forums at several stages of Planning and Design	Active communication about project progress	Form an Advisory Task Force
System Preservation**							
Roadways, Sidewalks, and Shared Use Paths							
Maintenance	<input type="checkbox"/>		<input type="checkbox"/>				
Resurfacing	●	<input type="checkbox"/>	<input type="checkbox"/>				
Reconstruction/Reconfiguration within Existing Layout	▲	▲	▲	●	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bridges							
Maintenance	<input type="checkbox"/>		<input type="checkbox"/>				
Rehabilitation	●	<input type="checkbox"/>	<input type="checkbox"/>				
System Improvement or Expansion							
New Roadway or Shared Use Path	▲	▲	▲	▲	▲	●	●
Widened Roadway or Shared Use Path Widening	▲	▲	▲	▲	●	●	<input type="checkbox"/>
Intersection or Roundabout Improvements	▲	▲	▲	▲	●	●	<input type="checkbox"/>
New Interchange or Interchange Reconfiguration	▲	▲	▲	▲	▲	●	●
Roadside Safety, Sidewalk or Signage Improvements	▲	●	●	●	●	●	
Traffic Calming, Streetscape, Lighting, or Transit Enhancements	▲	▲	▲	▲	▲	●	<input type="checkbox"/>
New or Widened Bridge	▲	▲	▲	●	●	●	
New or Expanded TDM/Park & Ride Lot	▲	▲	▲	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
New or Expanded Traffic Management System	▲	▲	●	<input type="checkbox"/>			

▲ Usually necessary/recommended.
● Suggested for project types indicated and usually necessary for more complex projects within each type.
 May be helpful for more complex projects for the types indicated.
* The Public Works Department and other utilities should also be consulted to determine if there are any planned improvements to subsurface utilities and infrastructure.
** Public outreach may not be needed for system preservation activities such as routine maintenance and resurfacing; however, these projects may offer opportunities to enhance the accommodation of bicyclists or pedestrians and it may be useful to reach out to specific constituencies as projects are being planned. Examples of these types of projects include restriping, new crosswalks, ADA enhancements, or drainage improvements.

Figure 6 MassDOT Matrix to Select Appropriate Public Outreach Approaches

Utah

Within the Utah Department of Transportation’s (UDOT) Project Development Group there is a Project Management Division whose mission is to provide resources to support the efforts of program managers, project managers, and project teams. Each of the agency’s four regions houses a Project Management Division, which is headed by a Region Program Manager who oversees and manages all the projects that are taking place within the region. The program manager is tasked with monitoring the region’s performance management system, coordinating all project assignments in design and construction, and working with UDOT Central Planning and Programming Division to prepare and submit budget requests to advance the region’s program. Individual project managers work in regional offices and are supervised by Region Program Managers. Program Managers assign project managers to specific projects. The agency maintains a website for the Project Management Division¹⁰, which contains documents and other resources project managers can draw from to facilitate the project management process. Along with UDOT’s *Project Manager Guide*, which is comprehensive resource for project managers, the website also links to guidance on financial management, a handbook devoted to team building, project delivery networks (which are templates that map out the project stages — and the activities associated with each one — of successful project delivery), information on Microsoft Project, risk assessment and management, and other assorted tools.

¹⁰<https://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:649>,

Utah DOT likens the project manager to an orchestra conductor — someone who manages the project at a high level, who although they lack detailed knowledge of every technical area (e.g., construction, quality assurance and quality control) can successfully coordinate, harmonize, and direct the activities of workers with multiple responsibilities to deliver a high-quality transportation product. More specifically, project managers are responsible for delivering every project within a region from concept development through construction and closeout. They oversee delivery of all project types: safety improvements, enhancements, preservation, and reconstruction. Project managers are responsible for keeping the project within scope, on schedule, and within budget, as well as ensuring data quality is sufficient. As project team leader, the project manager is accountable for planning, executing, monitoring, and closing a project. The agency views project managers as occupying several roles: project coach, mentor, risk manager, and primary decision maker. Project managers are responsible for ensuring that projects support UDOT’s goals, improve nearby communities and the environment, bolster the safety and efficiency of travel, and they verify that the project benefits the agency’s entire program. They also collect data on project metrics to determine whether a project is meeting its performance goals.

UDOT developed its *Project Manager Guide* to outline critical project management skills and document resources that are useful for both new and experienced project managers. The guide is divided into chapters. Each chapter — along with the main narrative — includes callout boxes that contain a variety of information, such as noting where different types of information can be found, defining key terms, delineating the roles of stakeholders, and succinctly outlining the steps needed to complete activities (Figure 7). The end of each chapter includes a chapter summary, links to guidance and manuals, tools germane for processes discussed in the chapter, key agency contracts, and business systems that are necessary to complete specific tasks. The first substantive chapter in the guide is focused on project creation and the role various agency stakeholders play in bringing a project into being. The next chapter on planning talks about the collaboration between the project manager and Definition Team, which involves defining and documenting the purpose, scope, and goals for a project. It includes guidelines for selecting members of the Definition Team, high-level instructions for determining risks, and the steps required to initiate a project. Following this, the guide addresses project execution. UDOT directs its project managers to adhere to the MITAR management principle. MITAR stands for *Monitor, Investigate, Take Action, Report*. For each phase of project execution, the guide instructs project managers on how to operationalize the MITAR principle. Thus, it describes how to apply the principle to scope management, schedule management, and project team management. Next, the guide addresses project construction and closeout, outlining the responsibilities of the project manager and resident engineer. The resident engineer is responsible for directly supervising construction activities, while the project manager works to ensure the scope, schedule, and budget are upheld, and that right-of-way acquisitions and other commitments are fulfilled. This chapter provides guidance on meeting attendance, processing change orders, strategies for partnering with contractors, and final inspection and acceptance. The guide then examines contract administration, including the various contract types used, procedures for identifying and selecting consultants, and alternative delivery methods (e.g., design build, contract manager/general contractor). A final chapter discusses UDOT’s approach to risk management.

PROJECT DEFINITION DOCUMENT

- Create Objective Statement
- Develop Goals and Metrics for success
- Develop Project Scope Statements
- Project Delivery Method
- Identify Major Potential Risks
- Preliminary Project Estimate
- Project Schedule

Project Objective Statement
Reconstruct and widen (to 12 lanes) I-15 from 11400 South Interchange to Bangerter Highway by December 31st 2014 for \$160 Million.

Teams throughout the development and execution of the project.

3.1.4.2 PROJECT GOALS
The Project Goals and associated metrics are developed by the Definition Team. Project Goals are high level statements that declare what the project is trying to achieve. Project Goals should be measurable in the before and after conditions. A metric is a quantifiable measurement of a project's performance. Metrics are to be project specific. If the project is supporting programmatic goals, metrics are not required. The PM is responsible to collect, store, and document the Project Goals and metrics.

Project Goals and Metrics
Capacity Project
Goal: Improve Level of Service on corridor from E to D
Metric: Use traffic data prior to and after project completion
Safety Spot Improvement Project
Goal: Reduce crashes at intersection by 50%.
Metric: Use Central Traffic and Safety data to compare crashes before and after the project completion

3.1.4.3 PROJECT SCOPE STATEMENTS
Project Scope Statements define the work that needs to be accomplished to satisfy the Project Goals. These statements document the major components of the project. The team should also document what "is not" included in the project. The "is not" statements are important because they help to reduce scope creep during delivery of the project. The Project Delivery Team will use these statements to better understand their role and effort on the project.
UDOT's Practical Design initiative eliminates "over designing" improvements by aiming to achieve, but not exceed, the project objectives. The documented project scope

Project Scope Statements
Overlay Project

- Overlay road with 2 to 3 inches of HMA in travel lanes and shoulders
- Replace all safety signs on project limits
- Mill and fill existing asphalt in Provo River bridge
- Do not install, replace, or improve guardrail
- Do not replace drainage pipes

completing the draft PDD. This may require additional time, resources, and field investigations as needed.

3.1.4 ESTABLISH THE PROJECT FRAMEWORK
The Definition Team's purpose is to create the draft PDD. This document defines the project for the Project Delivery Team.
The PDD is created and stored in the Project Management folder in ProjectWise, UDOT's document management system. The PDD consists of several parts, as detailed below.

Figure 7 Sample Page from UDOT's *Project Manager Guide*

Oregon

The Oregon Department of Transportation (ODOT) lacks a dedicated project development or project management office, however, there are helpful resources available to guide project management activities. Two divisions participate in project development and delivery. The Transportation Planning Section manages the transportation planning component of program development, which includes activities leading up to project initiation (e.g., identifying potential projects, drafting the statewide transportation improvement program, project scoping). The Highway Division is responsible for the design, construction, operation, and maintenance of roadways. It also performs activities such as right-of-way acquisition, the award of highway construction contracts, supervision of contractors, studying the environmental impacts of proposed projects, and executing other research functions. ODOT has two designations for staff who oversee and manage projects — project leaders and project managers. *Project leaders* are assigned to in-source projects while *project managers* administer outsourced projects. In-source projects are those which follow the design-bid-build process: the agency uses its own resources to design projects and provide construction management. Projects that are outsourced leverage private sector resources for delivery. This

method of delivery is common on projects that use design-build and the program management (i.e., a program management firm offers day-to-day direction, organization, implementation, and operational management for a group of related projects) delivery strategies; it is occasionally used for design-bid-build projects as well. The project development phase begins once a project leader or manager has been assigned to a project. However, the agency’s *Project Delivery Guide* (explored in greater detail below) states that *project leaders* may contribute to several activities during program development, including collecting data on their regions during the management systems analysis phase, identifying potential projects, and scoping projects for the statewide transportation improvement program. There is a website devoted to the agency’s *Project Delivery Guide* that links to numerous resources and tools (e.g., manuals, environmental procedures, design manual) used throughout a project¹¹.

Area managers manage and lead regional development and construction programs; they also supervise and mentor project managers, project leaders, and in some cases local agency liaisons. Table 3 compares the responsibilities of project managers and project leaders. Note, the roles of project managers and leaders are different. Project leaders manage project development activities on in-house projects but do not play a role in outsourced projects. Conversely, project managers are responsible for managing outsourced projects and function as the ODOT representative once an in-house projects transitions to delivery (i.e., construction).

Table 3: Roles and Responsibilities of Project Managers and Project Leaders at ODOT

Project Manager	Project Leader
Represents ODOT in delivering multi-million-dollar in-house transportation projects	Supplies project management leadership for in-house projects during project development
Leads and oversees activities required to develop and administer outsourced consultant contracts for project development and/or construction	Oversees all activities required to ensure all projects move through the project development process successfully
Main point of contact at the regional level for the development and implementation of design-build solicitations and contracts	Coordinates and leads all project management processes for all assigned projects, including risk, quality, public involvement, scope, schedule, and budget management
Responsible for contract administration on construction contracts	Spearheads multiple interdisciplinary teams working on project development
Represents the engineer on a project and has authority to enforce contractual provisions	Offers direction to project team members and coordinates the successful completion of the project development phase
Manages engineers, technicians, surveyors, and clerical personnel who facilitate the project manager’s efforts	Prepares and manages project work plans
Plans, analyzes, documents, and manages budgets and cash flow for the construction workforce, facilities, vehicles, equipment, training, travel and other resources	Leads scoping teams
Represents the Highway Division’s deputy director, chief engineer, and region manager as an ODOT expert on outsourcing highway construction contracts to consultants, contractors, and local communities	
Reviews, approves, and accepts work produces from ODOT’s suppliers	

¹¹ <http://www.oregon.gov/ODOT/ProjectDel/Pages/Project-Delivery-Guide.aspx>

ODOT characterizes its *Project Delivery Guide* as a living web-based document that grew out of presentations originally given in 2008 that were focused on the project delivery process. It is broken into four sections, with each covering a different phase of project development: program development, project development, awarding the construction contract, and construction management. Several appendices contain information related to project types and project delivery methods; procurement; general project management principles; and tools, resources, and systems that facilitate project delivery. The section on program development covers transportation planning as well as activities required to prepare the statewide transportation improvement plan. As noted, project leaders may occupy a limited role during this phase. Project development begins after a project has been identified and been assigned a project leader, project manager, or regional local agency liaison. This phase encompasses everything from project initiation to letting. The guidebook's project development chapter is split into two sections. The first section of the chapter includes ordered task lists that specify activities and deliverables required to complete a milestone (e.g., project initiation, design acceptance, right-of-way acquisition). Task lists present high-level descriptions of work activities and help project leaders organize their work to ensure all tasks are completed and documents correctly submitted. Following the task lists, the second portion of the chapter describes the steps needed to execute each task. These descriptions outline the purpose of a task, personnel who are involved at each stage, succinct directions for carrying the task out, ODOT resources and offices that can provide support, and activity codes. The lifecycle milestones include project initiation, design acceptance, advanced plans, final plans, PS&E submittal, and project development closeout. From project development, the guidebook moves into the awarding of the construction contract, and discusses how to move a project from PS&E submittal to bid opening, and then from bid opening to contract award. The final chapter addresses construction management; as such it is most relevant to the project manager, who serves as ODOT's representative during this phase on most design-bid-build projects. It summarizes tasks that must be completed before onsite work begins, construction activities, completion of construction, and project closeout. After a project concludes, project managers must ensure that comments and concerns pertaining to constructability, problems, solutions, and design changes are incorporated into the project narrative. Project managers also organize a post-project critique with project team members and interested stakeholders to document lessons learned and ways to improve processes that were part of the project.

North Carolina

The North Carolina Department of Transportation (NCDOT) first audited its organizational structure in 2007 with the goal of developing suggestions for areas to improve. The audit found that NCDOT should be more strategic in managing the transportation network, set performance goals and accountability, prioritize projects, and strengthen leadership and talent management (Lindquist et al., 2009). Responding to the audit, NCDOT focused on changing functional alignments to address challenges such as department silos, lack of accountability, and inconsistent coordination in project delivery and management. Functional alignments are:

- Monitoring, Communication, and Control
- Strategy and Investment Analysis
- Business Administration
- Process Management
- Program and Asset Management

NCDOT undertook a study several years later on the agency's current state, how the organization's goals were aligned with current structure, and pay structures (North Carolina Department of Transportation, 2015). The study objectives were to enhance decision making at the division level, practice more individual accountability for project delivery, and right-size staffing levels. Reviewing project delivery goals indicated that focusing on planning document completion, letting dates, and construction completion dates was

needed. Of note was the implementation of a new screening process to determine the delivery of projects, where simpler projects are sent to the Highway Divisions for development while more complex projects are assigned to project delivery teams, or multidisciplinary teams. “Multidisciplinary Teams will eliminate the current silo approach to project delivery, and transition the Department to an integrated organizational structure that increases accountability for project delivery” (p.6). A project delivery committee oversees the screening process before proceeding to executive review. Table 6 in the Appendix (reproduced from Figure 2.2, p.4) shows considerations NCDOT accounts for during the screening process.

Figure 8 (Figure 2.4, p.6) illustrates how division engineers work with project delivery teams and central office staff during the project development process. Figure 9 (Figure 2.5, p.7) provides an overview of the multidisciplinary team that assigns project responsibilities to the team lead and design questions to the roadway design team.

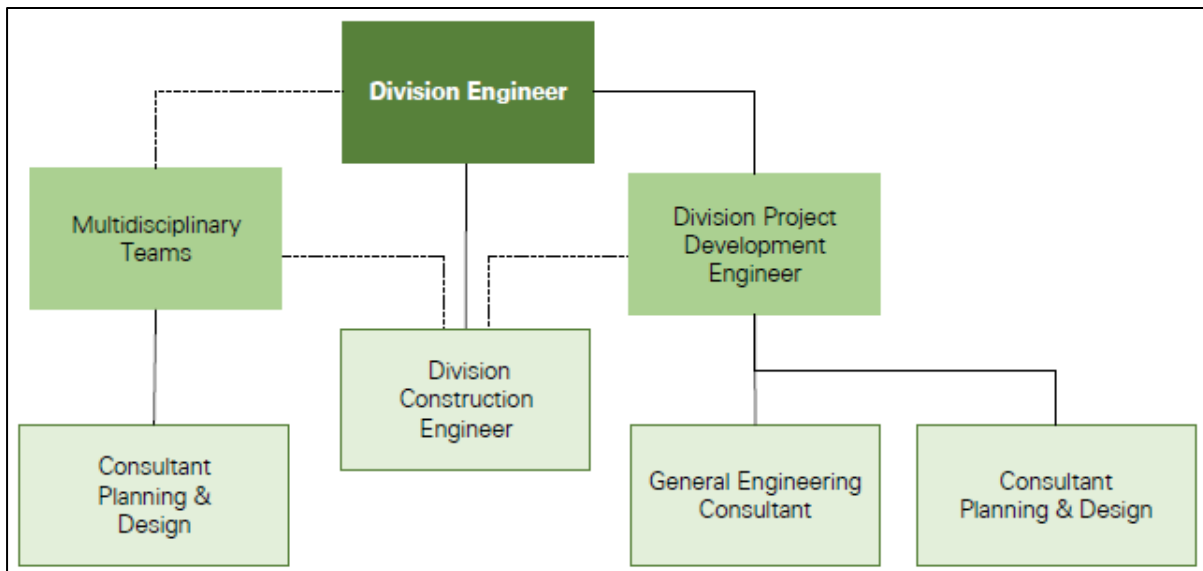


Figure 8 Division Engineer Project Development Resources

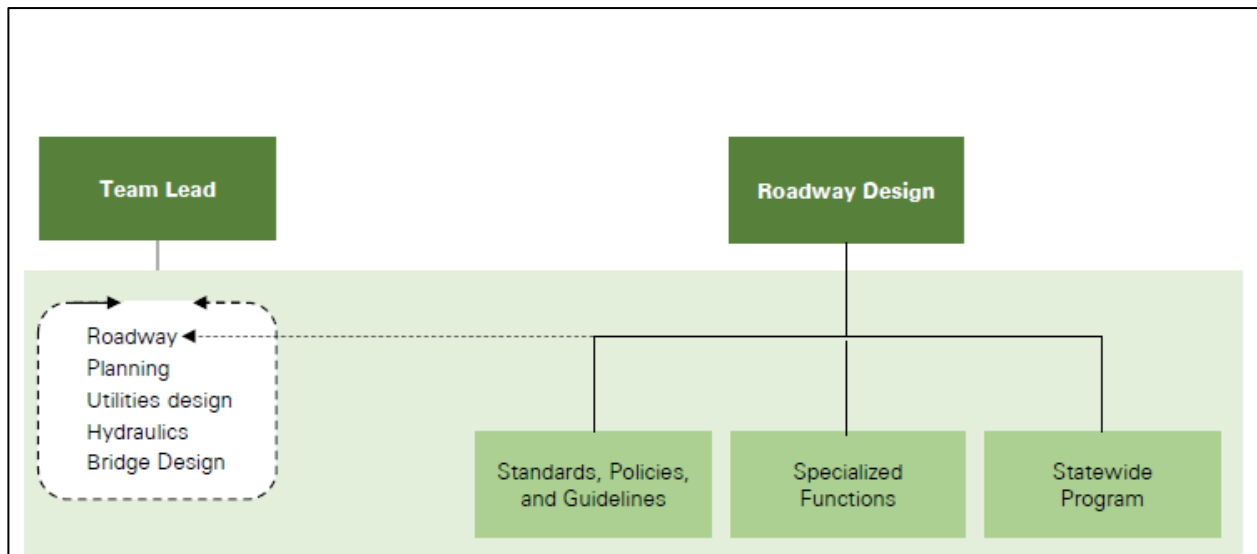


Figure 9 Multidisciplinary Team Example

Indiana

The Indiana Department of Transportation (INDOT) has an Office of Project Management in the Production Management Division (located in the agency's central office). Most project managers reside within one of the agency's six district offices. The Office of Project Management will designate a project manager from its office on major projects, whereas for minor or maintenance projects the project manager is assigned at the district-level office. INDOT has created and adopted the Project Development Process (PDP), a project management and decision-making process for transportation projects. The primary goal of the PDP is to encourage communication among disciplines, ensure there is documentation that describes the reasons underpinning project-related decisions, eliminate duplicated effort among disciplines, identify early in the project development process potential red flag issues (INDOT defines red flag issues as areas of concern that might require additional study coordination, creative management or design approaches, or increased right-of-way or construction costs), and facilitates the completion of work products as early in the process as possible. In doing so, the PDP improves communication among technical disciplines, results in quality plans, and minimizes cost overruns during right-of-way acquisition and construction. INDOT classifies projects based on their size, complexity, and potential impact on the environment. There are three categories — major, minor, and maintenance. Each project type has its own PDP template; Figure 10 lists the processes required for different project types. The agency maintains a small website¹² focused on project management, which contains a brief narrative on INDOT's approach to constructability reviews and several resources, including Gantt chart templates for major and minor projects, the PDP manual, documents pertaining to value engineering, and a link to the cost estimating and cost management program.

¹² <https://www.in.gov/indot/2697.htm>

Maintenance	Project Classification	
	Minor	Major
<i>Step 1:</i> Project Compilation (Data Management and Inspections)	<i>Step 1:</i> Professional Services (Contracts and Agreements)	<i>Step 1:</i> Professional Services (Contracts and Agreements)
<i>Step 2:</i> Project Identification (Cost Benefit Analysis)	<i>Step 2:</i> Conduct Research and Technical Studies	<i>Step 2:</i> Conduct Research and Technical Studies
	<i>Step 3:</i> Identify and Evaluate Conceptual Solutions	<i>Step 3:</i> Identify and Evaluate Conceptual Solutions
<i>Step 3:</i> Prioritization of Selected Projects	<i>Step 4:</i> Develop Reasonable Alternatives	<i>Step 4:</i> Develop Reasonable Alternatives
	<i>Step 5:</i> Identify Preferred Alternatives	<i>Step 5:</i> Identify Preferred Alternatives
	<i>Step 6:</i> Stage 1 – Develop Preferred Alternative	<i>Step 6:</i> Stage 1 – Develop Preferred Alternative
<i>Step 4:</i> Separate Projects into Project Categories for Submittal	<i>Step 7:</i> Stage 2 – Advance Preferred Alternative	<i>Step 7:</i> Stage 2 – Advance Preferred Alternative
	<i>Step 8:</i> Environmental Approval	<i>Step 8:</i> Environmental Approval
	<i>Step 9:</i> Prepare Final Right-of-Way Plans	<i>Step 9:</i> Prepare Final Right-of-Way Plans
	<i>Step 10:</i> Begin Land Acquisition	<i>Step 10:</i> Begin Land Acquisition
	<i>Step 11:</i> Stage 3 – Complete Preferred Alternative	<i>Step 11:</i> Stage 3 – Complete Preferred Alternative
	<i>Step 12:</i> Prepare Final Tracings Package	<i>Step 12:</i> Prepare Final Tracings Package

Figure 10 Steps Required to Complete Different Project Types (INDOT)

At INDOT, once project managers are assigned to a project, they generally stay with the project as it moves through the entire PDP. The agency has published a high-level description of project managers’ key responsibilities; these include:

- Verifying the project has been entered into INDOT’s scheduling and project management system
- Confirming that a project’s development funding has been approved in the Transportation Improvement and the Indiana State Transportation Improvement Plan
- Producing a business case for the project if the agency anticipates that consultants will be needed for development
- Working with the project sponsor to identify a project design team, which is responsible for completing work specified by the PDP
- Maintaining a project file that documents all project activities and products and communicating and coordinating with designated INDOT staff throughout the project
- Determining the extent of federal involvement in the project

Project managers are responsible for classifying projects, sometimes receiving input from the INDOT’s central office. At the outset of each project, project managers organize and lead a kickoff meeting, the aim of which is to convene all affected stakeholders to discuss specifics about the project, identify the project

goals, determine the level of public involvement required, define general work requirements, develop an initial scope of work for planning studies (if necessary), generate an RFP to hire a study consultant, and ensure a consensus has been reached on how a project will move through the PDP. Furthermore, project managers develop and implement public involvement plans (on complex projects INDOT will sometimes assign a dedicated person to oversee this), generate a project-specific Gantt chart from the templates available to them, and establish a project commitments summary. This identifies all commitments that will be made during the PDP. It is a roadmap that provides guidance on information in the project file and documents what stakeholders are responsible for executing commitments made during the process. Project manager responsibilities vary slightly according to project type (i.e., expectations and level of involvement in various tasks differ for major and minor projects), however, project managers do oversee the entire PDP. The *Project Development Process Manual* includes task breakdowns and assignments for different project types. It also contains matrices for major and minor projects that outline the reviewing responsibilities INDOT (i.e., internal) stakeholders and external stakeholders that contribute to projects.

INDOT's *Project Development Process Manual* is a comprehensive guide to the agency's PDP. The manual's brief introduction offers an overview of the PDP as it applies to each project type (i.e., major, minor, and maintenance). It then discusses how project managers contribute to the development and delivery of projects by coordinating multidisciplinary project teams. The introduction also reviews how projects are classified (and transitioning a project from one classification to another if needed), federal oversight determinations, public involvement, roles and responsibilities, and links to manuals that are used to inform project development. The manual then includes separate chapters for each project type, with each defining what steps are needed to completed tasks, individual activities, and sub-activities. For each activity, the manual highlights what work is performed, who the responsible parties are, materials needed to complete the work, activities that must precede work before it can begin, and what deliverables an activity results in. Individual sections within each chapter describe how to execute the processes listed in Figure 10. As noted, INDOT has also developed Gantt chart templates for major and minor projects. These templates can serve as a baseline, which project managers can alter to meet their specific needs. The Gantt charts include spaces in which to enter activity IDs, activity names, activity duration, start and finish dates, and predecessor and successor activities, and a graphical timeline.

Minnesota

The Minnesota Department of Transportation's (MnDOT) Office of Project Management and Technical Support facilitates project development and delivery. Three additional offices are situated under this office on the agency's organizational hierarchy — Office of Design Support, Office of Project Management, and the Office of Project Delivery. Within each of these offices are specialized groups and offices focused on different aspects of project development. Under the Office of Design Support are Design Standards; Geometric Design Support; Design Flexibility and Site Development; Value Engineering; and Major Project Committee, HPDP (Highway Project Development Process), and Spec Book. Within the Office of Project Management are Cost Management, Design Build, the Construction Manager General Contractor, and P6 Project Controls and Shared Service Center (dedicated to scheduling project activities). Lastly, the Office of Project Delivery contains the following groups: Special Provisions, Cooperative Agreements, Project Design Services, Engineering Cost Data and Estimating, Consultant Services, and the Technology Support Group. Project managers work in district offices throughout the state. MnDOT publishes numerous resources for its project managers, and its website houses extensive websites with guidance pertaining to HPDP and project management¹³. Currently, the agency is revising some aspects of its project development and management process. For example, it is reworking its scoping guidance to achieve consistency with the *Project Management Body of Knowledge* and within the past few years has switched over to Primavera P6 for its scheduling needs. While all scoped projects must have a P6 Scoping Schedule, project managers

¹³ For HPDP, see <http://www.dot.state.mn.us/planning/hpdp/index.html>. For the Office of Project Management, see <http://www.dot.state.mn.us/pm/>.

are not responsible for developing schedules — they work with personnel in the Shared Services Center, who in turn construct project schedules.

MnDOT project managers work on projects from their initiation through construction. They develop project charters, which include details on project location, purpose and need, a preliminary scope, potential risks, and initial costs estimates. Once an assistant district engineer has approved the charter, project managers use MnDOT resources to develop a scope and plan for project delivery. Project managers have the following responsibilities: 1) serve as the primary contact on projects and working with stakeholders; 2) prepare management plans (e.g., scope, schedule, budget) and obtain management's approval of those plans; 3) direct and manage the project team to ensure the delivered project is within scope, on time, within budget, and is high quality; 4) monitor project performance and take corrective actions; and 5) periodically report on project status to stakeholders and management. Furthermore, MnDOT authorizes project managers to make scope, schedule and budget decisions within the approved baselines. If necessary, they can elevate issues that demand resolution from individuals with greater authority and specify reasonable deadlines for decision making.

Currently, MnDOT does not have a guidebook that consolidates all relevant information on project development and management into a single document. However, websites for the Office of Project Management and HPDP contain guidance, tools, and templates that walk project managers through the project development process. The agency has published a short document, *Instant Project Management*, that briefly summarizes the tasks project managers are responsible for during project development, from project planning to closing out. Patterned after the *Project Management Body of Knowledge*, and borrowing some of its terminology, the guide divides the project into phases and specifies what is accomplished during each. The Office of Project Management website also houses several tools explicitly classified as project management tools, including a project charter template, instructions on developing a public information plan, and Microsoft Excel templates for stakeholder and contact lists, a stakeholder management workbook, and schedule initiation form. It also provides extensive guidance on scoping and many templates and instruction sheets for conducting scoping. Microsoft Word templates are available for scoping worksheets, project planning and scoping reports, and project change request forms, among others. Additional resources obtainable through the Office of Project Management include information on Primavera P6 (scheduling software) and a master work breakdown structure; cost guidance, which encompasses forms and templates for preparing cost estimates and directions for estimating project costs; material on cost management; risk guidance and tools, including references for analyzing and managing risk, risk checklists, and a risk register and issue log Microsoft Excel template; project team and communications tools; project management tools; and tools for monitoring and controlling the project. Readers should consult MnDOT's website to examine the content and layout of individual templates. The HPDP website stores abundant resources that can assist project managers in navigating the project development process. Notably it offers step-by-step outlines that summarize the precise steps needed to complete different activities, such as drafting purpose and need statements, preparing environmental impact statements, and developing scoping documents. It includes charts and guidance that specify the offices and personnel various documents must be submitted to for review. Along with these items, the HPDP website links to subject-matter guidance documents on a range of topics, from air quality and complete streets to erosion control and layouts. Each guidance document includes high-level information on a topic; threshold criteria; how the issue relates to HPDP; applicable guidelines and regulations, a glossary of key terms, and contact information. The documents also link to offsite (i.e., non-MnDOT) guidance, manuals, best practice manuals, and other materials project managers should examine to develop a topical understanding of different subject areas.

Other States

This review sought to provide a representative survey of what responsibilities state DOTs assign to their project managers, where project managers are located within their agency's organizational hierarchies, and

what resources have been made available to them to facilitate project management. While not an exhaustive review, the discussion of the eight states' practices captures the major contours of how state DOTs conduct develop and manage projects throughout the United States. That said, other states not discussed in the above sections have released tools and guidance that warrant brief mention, as they could potentially serve as a model for KYTC's project development guidebook.

Some DOTs have developed highly technical project development manuals that provide fine-grained information on software packages and systems they use to manage projects — principally, their documentation. The Connecticut Department of Transportation (ConnDOT) has published its *Digital Project Development Manual*, which offers precise guidance on using ProjectWise and preparing key project documents (e.g., plan sheets, contracts, change orders, as-built revisions). For various processes, the manual has step-by-step procedures that guide users in the correct execution of tasks. Because it is software-oriented, the manual includes little on the specifics of project development and management at the programmatic level.

Several of the guidebooks referenced previously adopt a checklist or bulleted format, enabling them to quickly communicate what is to be done during each step of the project management process. The Virginia Department of Transportation (VDOT) has a slightly different, more high-level take on this form (Figure 11). For each of the agency's project categories, a table specifies whether an activity is required or should be considered. Eight of the procedures are non-optional irrespective of project category. The table also links to brief guidance documents for 14 of the 17 tasks (indicated in blue). Guidance documents are succinct (averaging between four and six pages) and contain a description of the task, its purpose, steps for completing it, tools and resources that can facilitate work, and sample deliverables. While most of the guidebooks we discussed link to other resources, VDOT's approach is somewhat unique in that the agency pairs a high-level guidance document that outlines and describes the complete project development process with dynamically linked materials that scrutinize individual processes. Uncoupling the high-level description from narratives of individual processes perhaps makes for a less intimidating manual, one project managers would be more likely to take advantage of routinely.

Project Management Procedures and Checklists	Project Category				
	I	II	III	IV	V
Initiate Project Scope	R	R	R	R	R
Final Project Scope					
Project Development Schedules	R	R	R	R	R
Project Development Budget/Estimates	R	R	R	R	R
Public Hearing Team Meeting	C	C	R	R	R
Public Hearing	C	C	R	R	R
Field Inspection Team Meeting	C	C	R	R	R
Pre-Advertisement Conference	C	R	R	R	R
Prepare for Advertisement and Contract Execution	R	R	R	R	R
Construction Budget Development & Mgmt	R	R	R	R	R
Pre-Ad Construction Schedule Development	R	R	R	R	R
Post Award Construction Schedule Mgmt	R	R	R	R	R
Pre Construction Conference	R	R	R	R	R
Progress Meetings	C	C	R	R	R
Financial Management Plan	C	C	C	R	R
Risk Management Plan	C	C	C	R	R
Project Communication Plan	C	C	C	C	R
Project Management Plan	C	C	C	C	R

R = Required C = Consider

Figure 11: Virginia DOT Project Development Requirements Matrix

Several agencies (e.g. ConnDOT, Washington DOT) have developed process maps that illustrate workflows for different project phases. These vary in size and complexity. Washington DOT, for example, adopted a high-level approach; its maps depict the relationship between and among processes, but omit discussion of specific tasks or documents associated with each. ConnDOT’s process maps are highly detailed. Their stated purpose is to expedite the completion of each project task by delineating standardized processes and communicating them clearly and effectively. A second goal of the agency’s process maps is that young engineers or consultants should be able to complete tasks accurately and efficiently. They can also be revised to reflect changes to internal processes. Figure 11 is a Design-Phase Utility Coordination Process Map. Note that the map includes processes, documents, key decision points, register the beginning and end of processes, and indicates where data are needed or produced.

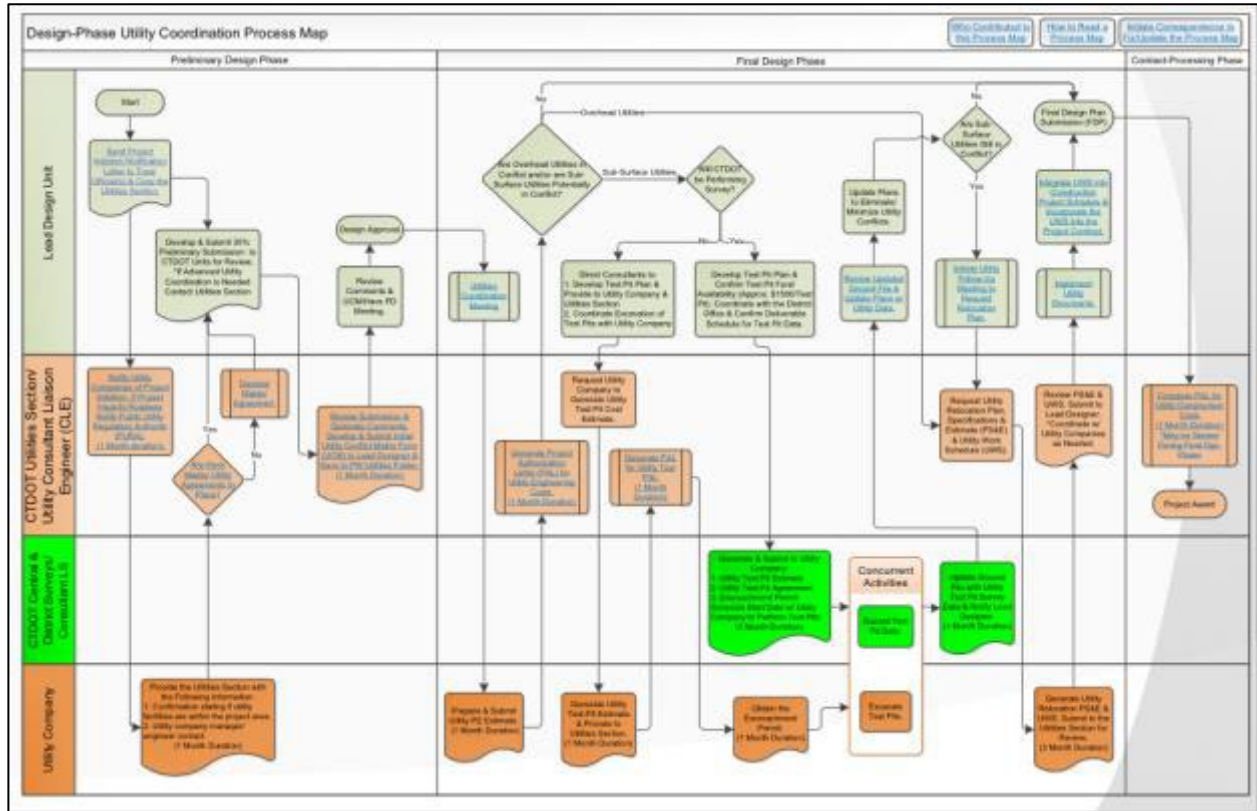


Figure 12 Connecticut DOT Design-Phase Utility Coordination Process Map

Conclusions

- STAs undergoing organizational change are being driven by factors such as smaller budgets, changing priorities, a focus on efficiency, and improving project delivery. One area where research has shown process improvements can be made is the environmental process. As far as project management, Florida's DOT conducted a benchmarking study that explored project management structures and potential training options, which are grounded in traditional project management orthodoxy. Such best practices in these areas can be used as a template when considering organizational change to emphasize project development and management.
- While several state DOTs have created sections or departments focused entirely on project management, not all have. Some delegate project development and management responsibilities to their highway or planning divisions. Typically, project managers work in regional or district offices and are responsible for overseeing a project from its inception to closeout. There are some exceptions, however. Florida's DOT assigns project managers for each phase of project (e.g., planning, right of way); Oregon's DOT has both project leaders and project managers, with project leaders spearheading the development of in-house projects and project managers taking over once a project reaches the construction phase.
- Project managers have a wealth of resources to draw upon when managing projects. Many states have published guidebooks that offer a step-by-step narrative of the project management process, specifying what activities their project managers need to complete during each project phase, documents and forms that need to be submitted, agency procedures, software resources, and helpful tips. Guidebooks vary in terms of their length and complexity. Some guidebooks are very text-heavy, differentiating them little from other policy manuals that agencies issue. Others embrace a more intuitive approach, relying more heavily on checklists and graphics while directing project managers to other documents if they require more detailed information. These guidebooks tend to be much briefer than their denser counterparts.

Some agencies maintain up-to-date websites that link to key resources, manuals, and other materials that project managers can turn to for instruction.

References

- Brown, T.J., Ruth Hallenback, Malcolm Baird, and Caryl Rice. 2007. A Transportation Executive's Guide to Organizational Improvement. *American Association of State Highway and Transportation Officials*.
- Burbank, Cynthia, Hal Kassoff, Amy Zwas, and Alan Lubliner. 2009. Organizational Structures and Management Practices for Achieving Environmental Stewardship and Streamlining. National Cooperative Highway Research Program, Project 25-25, Task 37.
- Caltrans Division of Design. 2009. *Project Development Procedures Manual*. Retrieved from: <http://www.dot.ca.gov/design/manuals/pdpm.html>.
- Caltrans Office of Project Management Process Improvement. 2007. *Caltrans Project Management Handbook*. Retrieved from: <http://www.dot.ca.gov/hq/projmgmt/guidance.htm>.
- Cameron, John, Henry Canipe, Craig Secrest, Theodore Poister, and Richard Daft. 2009. Alternative Organizational Processes in State Departments of Transportation. *American Association of State Highway and Transportation Officials*.
- Fazzalano, James. 2007. Transportation Agency Organization in Other States. Connecticut General Assembly Office of Legislative Research, 2007-R-0028.
- Florida Department of Transportation. 2006. *Project Management: A Benchmarking Study*. Retrieved from: <http://www.fdot.gov/designsupport/publications/benchmarkstudyreportfinal.pdf>.
- Florida Department of Transportation Production Support Office. 2016. *Project Management Handbook*.
- Georgia Department of Transportation Office of Program Delivery. 2012. *Project Management Handbook*. Retrieved from: <http://www.dot.ga.gov/PartnerSmart/Business/Documents/ProjectMgmt/PMHandbook.pdf>.
- Indiana Department of Transportation. 2007. *Project Development Process Manual*. Retrieved from: <http://www.in.gov/indot/files/ProjectDevelopmentProcessManual.pdf>.
- Lindquist, Kathy, Michel Wendt, and Leni Oman. 2009. State DOT and Related Industry Organizational Structures and Best Practices: Synthesis. *Washington State Department of Transportation Report*. Retrieved from: http://www.wsdot.wa.gov/NR/rdonlyres/0C42871A-23BC-4EE4-A7B5-B21BCD1D93EB/0/State_DOT_Organizations_Synthesis_Jerry_Lenzi9213.pdf.
- Massachusetts Department of Transportation. 2006. *Project Development and Design Guide*. Retrieved from: <http://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/ProjectDevelopmentDesignGuide.aspx>.
- Nebraska Department of Transportation. 2017. *Project Management Reference Guide*. Retrieved from: <http://dot.nebraska.gov/business-center/pm/>.
- North Carolina Department of Transportation. 2015. *NCDOT Restructure Study and Plan*. Retrieved from: https://www.ncdot.gov/download/about/structure/DOT_REPORT_Restructure_Plan.pdf.

Ohio Department of Transportation. 2016. *Project Development Process Manual*. Retrieved from: <https://www.dot.state.oh.us/projects/pdp/Pages/default.aspx>.

Oregon Department of Transportation. 2010. *Project Delivery Guide*. Retrieved from: <http://www.oregon.gov/ODOT/ProjectDel/Pages/Project-Delivery-Guide.aspx>.

Secret, Craig, Joe Crossett, and Jessie Huang. 2012. Alternative DOT Organizational Models for Delivering Service. National Cooperative Highway Research Program, Project 20-24 (83).

Utah Department of Transportation. 2013. *UDOT Project Manager Guide*. Retrieved from: <https://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:49>.

Appendix

Table 4: Areas of Organizational Change

	Total States	Alaska	Arizona	Arkansas	Colorado	Delaware	District of	Florida	Hawaii	Idaho	Maine	Massachusetts	Michigan	Mississippi	Missouri	Hampshire	New York	North	Oregon	Rhode	South	South	Utah	Vermont	Wisconsin	
All Business Units (Do Not Check Other Boxes)	7	X							X	X	X	X			X	X										
Performance measures	10		X		X	X							X	X				X		X				X	X	X
Planning	10		X			X		X					X				X	X	X	X	X				X	
Construction	9		X			X		X					X	X			X	X		X				X		
Maintenance & operations	9		X		X	X		X					X					X	X	X				X		
Multimodal transportation	9		X				X	X					X	X				X	X		X				X	
Traffic operations & ITS	8		X	X	X								X				X		X	X				X		
Design	7					X	X	X					X				X	X		X						
Public affairs	7		X	X									X	X			X	X			X					
Policy	7		X	X									X	X					X	X					X	
Programming & budget	7		X	X	X	X							X						X	X						
Environment	6		X			X	X						X											X	X	
Districts/regions	6				X	X		X					X				X	X								
Finance	6				X	X							X					X		X	X					
Administration/HR	6		X		X			X										X		X	X					
ROW	5					X	X	X					X				X									
Freight	5		X					X					X					X			X					
Safety	4												X				X		X		X					
Legal	3			X		X	X																			
IT & other support services	3		X				X															X				
Government affairs	2		X											X												
Materials & research	2												X							X						
Motor vehicle, state police, or other non-	1		X																							
Other: Local Government Assistance	1																						X			

Development Status	Projects with substantially advanced planning and environmental efforts may not be included in the screening process in order to avoid delays.
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Appendix B Milestones and Definitions

Basic Milestones	
Phase	Required/Not Required
Planning	
Preliminary Engineering	
	Alternative Selection
	Environmental Approval
Final Design	
	Geotechnical - Roadway Design Investigation
	Structure Plans
	Roadway Plans
Right of Way Acquisition	
	Right of Way Plans
	ROW Clearance
Utility Engineering and Relocation	
	Utility Agreement
Railroad Clearance	
Letting	
	Final Plans Submittal

Detailed Milestones	
Phase	Required/Not Required
Planning	<u>Planning Funding</u> Planning Study and Reports
Preliminary Engineering	<u>Funding for Preliminary Engineering</u> <u>Additional Design Funding</u> <u>Preliminary Engineering Notice to Proceed</u> <u>FHWA Scope Verification Meeting</u> <u>Alternative Selection</u> <u>Design Executive Summary</u> Environmental Approval
Final Design	<u>Additional Design Funding</u> <u>Final Design Notice to Proceed</u> <u>Geotechnical - Roadway Design Investigation</u> <u>Pavement Design</u> <u>Highway Drainage Design</u> <u>Drainage Inspection</u> <u>Joint Inspection Meeting</u> <u>Traffic Management Plan</u> <u>Structure Plans</u> <u>Signing Plans</u> <u>Traffic Lighting Plans</u> <u>Traffic Control Electrical Device Plans</u> <u>Traffic Signals Plans</u> Roadway Plans
Right of Way Acquisition	<u>Right of Way Plans</u> <u>Right of Way Inspection</u> <u>Right of Way Consultant Notice to Proceed</u> ROW Clearance
Utility Engineering and Relocation	<u>Utility Agreement</u>
Railroad Clearance	<u>RR Engineering Agreement</u> RR Real Estate
Letting	

Check Prints
Final Plans Submittal
PS&E
Advertisement

PLANNING

Like any engineering activity, careful planning is a prerequisite for highway development. During the highway planning phase, individual projects are analyzed to: 1) define the problem being addressed, 2) characterize existing conditions, 3) generate an initial project description, and 4) prepare a planning-level estimates for environmental, design, right of way (ROW), utility, and construction costs. Planning-level estimates can be used in future project scoping and prioritization. Decisions regarding program management, project scope, funding, and project delivery are all made during the planning phase.

PLANNING FUNDING

For highway projects with a Planning Phase, KYTC authorizes Planning Funding to pay for scoping and planning work. Generally, the Cabinet only designates a separate Planning Phase on larger and/or complex highway projects. Funding requests are submitted to the Division of Program Management. This Division prepares a TC 10-1 (*Project Authorization*). Program Management distributes a weekly email (on Friday) which lists all authorizations by District.

TASK DELIVERABLE: An approved TC-10-1 (*Project Authorization*) authorizing funds for Planning Phase activities. Federal-aid projects also require an approved PR-1.

PLANNING STUDY AND REPORTS

A Planning Phase study culminates in a Planning Report. Detailed Planning Phase studies include the following: preliminary purpose and need, public input, project alternatives, socioeconomic and environmental impacts, cost-effectiveness, preliminary cost estimates, and scheduling.

TASK DELIVERABLES: Planning Studies and Reports (e.g., Programming, Scoping, Alternatives, Small Urban Area, Justification, Feasibility Studies, and Data Needs Analysis Studies (DNAs))

Preliminary Engineering

Once the Highway Plan allocates Design Funding to a project, preliminary engineering and design begins. The critical products of preliminary engineering are 1) the transportation decision, and 2) the environmental document, which justifies the decision and is reflected in the preliminary line and grade plans.

FUNDING FOR PRELIMINARY ENGINEERING

On projects with a Design Phase, Design Funding is authorized to pay for preliminary engineering work. Funding requests are made through Program Management, which prepares the TC 10-1 (*Project Authorization*). Program Management distributes a weekly email (on Friday) which lists all authorizations by District.

TASK DELIVERABLE: An approved TC 10-1 (*Project Authorization*) authorizing funds for preliminary engineering activities. Federal-aid projects also require an approved PR-1.

ADDITIONAL DESIGN FUNDING

The Highway Plan specifies the preliminary design budget. This budget should be sufficient to pay for the project's design. However, in some cases the funds are not adequate, and more money is requested. Submit requests for additional funds to Program Management as early as possible.

TASK DELIVERABLE: An approved TC 10-1, *Project Authorization* authorizing additional funds for design phase activities. Federal-aid projects also require an approved PR-1.

PRELIMINARY ENGINEERING NOTICE TO PROCEED

If consultant services will be used for preliminary engineering, the Division of Professional Services helps the PM advertise for services and secure contracts. For the duration of contracts, the PM and Professional Services process consultant pay estimates for payment and monitors consultants. After negotiations are complete, Professional Services finalizes the contract and transmits to the consultant the notice to proceed. After receiving approval from the Legislative Research Commission Contract Review Committee, Professional Services informs the consultant they can bill the project.

TASK DELIVERABLE: When Professional Services receives eMARS approval, it electronically sends a notice to proceed and approval for payment to the PM and firm, authorizing it to begin work and bill for services.

FHWA SCOPE VERIFICATION MEETING

As soon as possible following project authorization, the PM and Environmental Coordinator are to identify potential environmental impacts in areas affected by project construction. On Federal-aid projects with an anticipated NEPA document of CE Level 3 or above, a scope verification meeting should be held to discuss the project scope and probable environmental impacts. The purpose of a scope verification meeting is to bring together key members of the Project Development Team (PDT) (e.g., PM, FHWA, Environmental SMEs, and other team members) before the Pre-Design Conference to discuss work that needs to be initiated and what level of NEPA document to pursue.

TASK DELIVERABLE: Decisions on 1) project work to initiate, and 2) the level of NEPA document to pursue. The PM should ensure FHWA concurrence with these decisions is documented in meeting minutes.

ALTERNATIVE SELECTION

When identifying a preferred alternative, the PDT must work through the decision-making process for highway projects. During this process, PDT members study each alternative to determine strategies for avoiding, minimizing, mitigating, or enhancing project impacts. Identifying potential constraints, issues, and solutions as early in the process as practical is critical for ensuring the best solution is developed. Integral to the progression of alternatives analysis and the shared transportation decision-making process is understanding the magnitude of environmental, ROW, utilities, budgetary impacts, and scheduled associated with each alternative. Assessing the environmental, economic, and engineering implications of a proposed action or project informs the PDT's deliberations and helps its members identify their preferred alternative.

TASK DELIVERABLE: An alternative selected based on an analysis of environmental, economic, and engineering issues as well as public input.

DESIGN EXECUTIVE SUMMARY

At the end of the Preliminary Engineering and Environmental Phase — typically after the Preliminary Line and Grade Meeting and identification of the selected alternative — a Design Executive Summary (DES) is drafted and submitted to the Division of Highway Design. The DES serves as the record of engineering decisions for a project.

The DES justifies the preferred alternative and contains requested design exceptions and design variances. Projects administered by Highway Design require a DES unless the Division Director provides an exemption. Highway Design uses this information as a record of the project and when making decisions about design exceptions. The Division of Environmental Analysis uses this report to identify required environmental actions. Since the DES outlines the justifications for design decisions, it is important that the DES contain all pertinent information used in the decision process.

TASK DELIVERABLE: An approved DES. On projects with FHWA oversight, KYTC submits the DES to FHWA. FHWA approval of design exceptions is solicited under separate cover.

ENVIRONMENTAL APPROVAL

Obtaining environmental clearance is a critical step on Federal-aid projects (i.e., completing the environmental document and receiving federal approval). An environmental document records the project decision-making process and the evaluation and selection of project alternatives. It describes the engineering, environmental, and economic

factors considered during analysis. Normally, the environmental document is developed and approved in the Preliminary Engineering and Environmental Phase. NEPA documents and alternatives analysis should clearly indicate why and how the range of project alternatives was developed, including the public and agency input used. In addition, alternatives analysis must describe criteria used to eliminate alternatives, when alternatives were removed during the process, the personnel who helped establish criteria for evaluating alternatives, and measures used to assess alternative effectiveness.

TASK DELIVERABLE: The final (and approved) environmental document.

FINAL DESIGN

Detailed plans and documents needed for ROW acquisition, utility relocation, permitting, and construction of the selected alternative are produced during final design (i.e., Phase 2 design). As part of this task, updated and more detailed estimates are prepared for ROW, utilities, and construction costs. The final design must reflect resolutions to project-specific issues or special circumstances identified in the preliminary design phase.

Additional Design Funding

On larger projects, it may be useful to break project development into two phases. Larger projects require greater project definition through the Preliminary Engineering Phase to understand the type and amount of work needed in the Final Design Phase. For these projects, the District Project Development Branch Manager (PDM) initially requests sufficient funding to complete preliminary engineering and environmental work. After a transportation decision is made, the PDM requests additional funding for Final Design. Phase 2 requests are dealt with in the same manner as initial Design Funding Authorizations.

TASK DELIVERABLE: An approved TC 10-1 (*Project Authorization*) authorizing additional funds for design phase activities. Federal-aid projects also require an approved PR-1.

Final Design Notice to Proceed

If consultant services will be used for final design, Professional Services helps the PM advertise for services and secure contracts. Throughout a contract, the PM and Professional Services processes consultant pay estimates for payment and monitors consultants. After negotiations are complete, Professional Services finalizes the contract and transmits to the consultant the notice to proceed. After receiving approval from the Legislative Research Commission Contract Review Committee, Professional Services informs the consultant they can bill the project.

TASK DELIVERABLE: When the Professional Services receives eMARS approval, it electronically sends a notice to proceed and approval for payment to the PM and consulting firm, authorizing them to begin work and bill for services.

Geotechnical - Roadway Design Investigation

Recommendations in the geotechnical report play a significant role in developing final plans. Through consultation with the Geotechnical Branch, the PDM determines what level of geotechnical investigation is required for the project. The level of effort ranges from advisory to a full-scale geotechnical analysis, with fieldwork, lab work, and reports for the roadway, structures, or both.

TASK DELIVERABLE: The Geotechnical Branch summarizes its recommendations in a report submitted to the PM. When applicable, the Geotechnical Branch provides the following sheets for inclusion in the roadway plan set: geotechnical notes sheets, geotechnical symbols sheets, and soil profile sheets.

Pavement Design

To design a pavement structure that will support the traffic load and distribute it to the roadbed, the PDT must draw on resources from the Division of Planning, the Geotechnical Branch, and the Pavement Branch. With support from staff in these areas, the PDT documents the project-specific conditions and decisions made during the pavement design process. The Pavement Branch develops pavement designs and engineering analyses for all projects on the National Highway System (NHS) and projects having at least 20 million equivalent single axle loads (ESALs). For other projects, the PDT performs all project-related design activities including pavement design, engineering analysis, and documentation. See the *Highway Design Guidance Manual (HD-204.2)* for more details.

TASK DELIVERABLE: An approved pavement design that includes typical sections, pavement details, and special notes and provisions. When applicable, the following are also delivered: 1) a Life Cycle Cost Analysis of alternatives, and 2) a justification for the pavement type selection.

Highway Drainage Design

The selected alternative's proposed drainage plan includes culverts and headwalls, inlets and storm sewers, bridges, temporary drainage, and project-specific drainage needs. Proposed drainage plans must contain economical and hydraulically feasible solutions that comply with KYTC's policies, specifications, and standards. Once the drainage design aligns with the PDT's expectations, all relevant information is placed in a drainage folder.

TASK DELIVERABLE: The project drainage plan (i.e., analysis, design, findings, and final recommendations) documented in Preliminary and Final Drainage Folders.

Drainage Inspection

On each project, the PM is responsible for scheduling a drainage inspection meeting. This meeting is often combined with the final joint inspection meeting. Comments on drainage design are incorporated into the meeting minutes. If a project or the drainage design are complex, a separate drainage inspection meeting may be held. Irrespective of whether the drainage inspection meeting is combined with the final joint inspection meeting or held independently, its purpose is to review material submitted in the preliminary folder and let subject-matter experts (SMEs) ask questions about elements of the submittal they are unclear on.

TASK DELIVERABLE: The final inspection report with drainage comments. If the drainage inspection is held at a different time, a separate drainage inspection report is submitted. Meeting minutes may suffice.

Joint Inspection Meeting

During the final joint inspection meeting the PDT and project-specific SMEs review the project design and the proposed contract plans, updated estimates, and other project documents. Construction, maintenance, traffic, structures, and drainage staff, as well as any other staff needed for the PDT, may be invited to attend and offer input. The proposed plans are distributed in either electronic or paper (i.e., hard copy) format to attendees prior to the meeting so they can perform a detailed technical review of the project's design and prepare feedback. This technical review provides reasonable assurance that the project design is complete, accurate, and of high quality.

TASK DELIVERABLE: A final inspection report that includes relevant project details such as maintenance-of-traffic methodology, list of all box culverts and bridges, project cost estimate, meeting minutes, and any concerns.

Traffic Management Plan

Traffic Management Plans (TMPs) outline specific requirements for maintaining and controlling traffic during highway construction activities. TMPs are required for significant projects and must be approved by the PDM, the Project Delivery and Preservation Branch Manager, and the Engineering Support Branch Manager (and FHWA on interstate or oversight projects). See the *Highway Design Guidance Manual (HD-206.3)* for more information.

TASK DELIVERABLE: An approved TMP, including a traffic control plan and public information plan.

Structure Plans

Structural plans contain the design and associated documentation for highway structures (e.g., bridge, large culvert, retaining wall) being constructed on a highway project.

The *Structural Design Guidance Manual (SD-201 through SD-210)* describes the process and procedure for structural design.

TASK DELIVERABLE: Final structure plans that include the design, details, special notes, quantities for all structures, and a construction estimate for the final plans.

Signing Plans

Plans are prepared for new sign installations for interstates, parkways, and other high-volume, limited-access roads that include interchanges.

The *Highway Design Guidance Manual (HD-1201.2)* describes the process for requesting signing design and plans.

TASK DELIVERABLE: Final signing plans that include designs, details, special notes, quantities for all signing and structures, and a construction estimate for the final plans.

Traffic Lighting Plans

Traffic lighting plans contain the design and associated documentation for traffic lighting (e.g., conventional light poles, high-mast lighting) being constructed on a highway project.

The *Highway Design Guidance Manual (HD-902)* and *Traffic Operations Guidance Manual (TO-701 through TO-716)* describe the process for requesting lighting designs and plans.

TASK DELIVERABLE: Final traffic lighting plans that include designs, details, special notes, quantities for all lighting and structures, and a construction estimate for the final plans.

Traffic

Control Electrical Device Plans

Traffic control electrical device plans contain the design and associated documentation for traffic control electrical devices (e.g., advance warning flashers, railroad-warning system, flashing beacons, school flashers) being constructed on a highway project.

The *Traffic Operations Guidance Manual (TO-600)* lists additional traffic control electrical devices and describes the process for requesting their design and plans.

TASK DELIVERABLE: Final traffic control electrical device plans that include designs, details, special notes, quantities for all traffic control electrical devices and structures, and a construction estimate for the final plans.

Traffic

Signals Plans

Traffic signal plans contain the design and associated documentation for traffic signals being constructed on a highway project.

The *Highway Design Guidance Manual (HD-902)* and *Traffic Operations Guidance Manual (TO-602)* describe the process for requesting designs and plans for traffic signals.

TASK DELIVERABLE: Final traffic signal plans that include designs, details, special notes, quantities for all traffic signals and structures, and a construction estimate for the final plans.

Roadway Plans

Roadway plans contain designs and associated documentation for roadway items that will be constructed on a highway project (e.g., roadway plan view, profile, and cross sections; pavement design, pipe sheets, maintenance of traffic, striping plans, and erosion control plans)

The *Highway Design Guidance Manual* (HD-208.2 through HD-208.19) discuss policies and procedures for preparing contract roadway plans.

TASK DELIVERABLE: Final roadway plans that include designs, details, special notes, quantities for all roadway elements, and a construction estimate for the final plans.

Right of Way Acquisition

Procuring sufficient ROW to accommodate the construction, adequate drainage, and maintenance of a highway is an integral part of a highway project. During the ROW acquisition phase, ROW professionals work on behalf of the PDT to acquire the necessary property.

Right of Way Plans

The PM and the Division of Highway Design supervise preparation of ROW plans for the chosen alternative so that ROW needed for project delivery can be acquired. Final ROW plans are normally submitted after the final inspection meeting(s).

TASK DELIVERABLE: Final ROW plans that include ROW details, ROW summaries, strip maps, source deeds, and ROW Deed Descriptions.

Right of Way Consultant Notice to Proceed

Upon receiving the notice to proceed, the District Right of Way Supervisor sends a notice of the proposed acquisition letter to consultants or subagents instructing them to begin ROW purchasing activities.

TASK DELIVERABLE: When Professional Services receives eMARS approval, it electronically sends a notice to proceed and approval for payment to the firm authorizing it to begin work and bill for services.

Right of Way Inspection

The District Right Of Way Supervisor (or a qualified representative) participates in the plan-in-hand inspection and joint field inspection to ensure the effects of ROW are considered in establishing the project location and design. Due to time constraints in acquiring ROW parcels, the PM may elect to conduct a ROW inspection before the joint inspection. This inspection should be used at the discretion of the PM to expedite the ROW process (e.g., to aid project authorization, initialize total takes, or to accomplish advance acquisition of properties).

TASK DELIVERABLE: A ROW inspection report that includes pertinent ROW details, current ROW cost estimates, and any project concerns.

ROW Clearance

KYTC cannot advertise projects for construction until clearance or a right of entry has been secured for all ROW parcels. Central Office and District ROW personnel advise the PM and KYTC leaders when a project is clear for construction. PMs and Right of Way supervisors should establish a clearance date 30—45 days prior to the proposed letting date. On federal *Projects of Division Interest*, a ROW certification must be submitted for approval to the FHWA prior to authorizing construction.

TASK DELIVERABLE: An approved Right of Way Certification (TC 62-226).

Utility Engineering and Relocation

Relocating existing utility facilities is a primary concern during project development. Utility engineering and coordination are used to identify and then relocate facilities that conflict with highway construction.

Utility Agreement

The Cabinet executes utility agreements with utility companies to establish in writing a clear description of the costs and responsibilities assigned to the utility company and the Cabinet. When all parties approve and execute agreement, authorized utility relocation work can commence.

TASK DELIVERABLE: Executed utility agreements between the Cabinet and all impacted utility companies. Agreements define the costs, roles, and responsibilities of each party. When applicable, utility impact notes are delivered.

Railroad Clearance

If a highway project may potentially impact a railroad, KYTC must coordinate with the affected railroad company. Once coordination is complete, Railroad Clearance is given and highway construction may proceed.

RR Engineering Agreement

The railroad engineering agreement contains the terms negotiated between KYTC and the railroad company for highway construction. It includes an estimate of compensation the railroad is due.

TASK DELIVERABLE: An executed Rail Coordination Project Agreement Addendum (i.e., Railroad Engineering Agreement). This serves as a formal agreement between the Cabinet and railroad company.

RR Real Estate

When a highway project adjoins or encompasses a railroad facility (e.g., a railroad track or railroad ROW), the facility owner becomes an active partner in the project's development. Depending on the terms of the project's design and its impacts to the railroad, KYTC may need to negotiate with and compensate a railroad for additional easement (i.e., real estate).

TASK DELIVERABLE: An approved RR easement deed for the needed easement defining costs, roles, and responsibilities of each party.

Letting

During letting, the Division of Construction Procurement 1) advertises the highway projects, 2) receives bids to complete the work, and 3) awards projects to the low bidder. Projects are assigned target letting dates; KYTC's intention is to deliver all projects to letting on time. Submitting final contract plans on time is essential for preventing scheduling problems and delayed lettings.

Check Prints

Approximately 3 months before the scheduled letting date the PM submits 1) check prints, 2) a cost estimate, and 3) an estimated completion date to the Plan Processing Branch of the Division of Highway Design.

TASK DELIVERABLE: Check plans returned with corrections and comments to the PM for any editing needed in the plan set.

Final Plans Submittal

The Plan Processing Branch returns to the PM plans amended plans with corrections and comments for inclusion of appropriate items in the plan set. After the plans have been edited, final contract plans are created and submitted for letting.

TASK DELIVERABLE: The final contract plan set to be awarded through the letting process.

PS&E

The Division of Construction Procurement's Plans, Specifications, and Estimates Branch (PS&E) helps prepare highway projects for letting. Final contract plans must be submitted a minimum of 7 weeks before those lettings that PS&E help prepare.

TASK DELIVERABLE: The final contract plan set and all contract documents finalized for the letting process.

Advertisement

The Division of Construction Procurement advertises the letting. These advertisements solicit for bids on construction projects. They are distributed: 1) not less than 21 days prior to opening of bids for Federal-aid projects, or 2) not less than 7 days prior to opening of bids for 100 percent state-funded projects.

TASK DELIVERABLE: The posted NOTICE TO CONTRACTORS of letting through Construction Procurement.
