Best Practices for Highway Project Scoping

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

in cooperation with
Kentucky Transportation Cabinet
Commonwealth of Kentucky

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16. Abstract

One of the Kentucky Transportation Cabinet's (KYTC) foremost priorities in fulfilling its mission is to deliver successful projects — quality solutions that meet the defined scope and are delivered on time and within the budget specified in the Highway Plan. When a project scope is not clearly defined or uncertain, revisions may take place after the project is already underway, leading to delays or overpromising what can be delivered. Ideally, a reliable, decisive project scope is defined in the early phases of the highway project development process. The scope should include a project definition that clearly communicates the project scope's framework and specifies what the project will and will not deliver. Recognizing the effectiveness of systematic approaches for managing preconstruction engineering activities and resources, KYTC initiated a study to identify effective methods for defining highway projects. The findings presented in this report will help KYTC strengthen scoping processes so it can clearly and accurately identify project needs, better control project development activities, optimize resource use, keep activities on schedule, and improve project outcomes. The guidance in this report is targeted for the phase of project development that begins will the purpose and need statement and progresses to letting. Each recommended best practice defines a goal and implementation strategies, and is ranked by implementation effort and value to the agency.

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Executive Summary

One of the Kentucky Transportation Cabinet's (KYTC) foremost priorities in fulfilling its mission is to deliver successful projects — quality solutions that meet the defined scope and are delivered on time and within the budget specified in the Highway Plan. KYTC develops and delivers projects listed in the Six-Year Highway Plan (a construction program) and a maintenance program. These programs are legislatively authorized and enacted through the biennial budget process and address needs throughout the highway system. One of the Cabinet's foremost priorities is delivering successful projects. Improving their project delivery success rate helps the Cabinet fulfill its mission and enrich the lives of all Kentuckians.

A 2002 AASHTO Standing Committee on Quality (SCOQ) study found that a focus on pre-construction activities is one of four indicators that can be used to measure agency effectiveness and efficiency (AASHTO 2003). However, many DOTs lack formalized scoping processes, and guidance varies significantly in terms of quality and content. Recognizing the effectiveness of systematic approaches for managing preconstruction engineering activities and resources, KYTC initiated a study to identify effective methods for defining highway projects. KYTC relies on program and project managers to develop and deliver high-quality projects within the schedule and budget. Throughout project development, program and project managers should be mindful of the following principles:

- Every project is a promise
- Every project has a constituency
- Every project cost must be realistic
- Every project schedule must be reasonable

The findings presented in this report will help KYTC program and project managers strengthen scoping processes and clearly and accurately identify project needs, better control project development activities, optimize resource use, keep activities on schedule, and improve project outcomes.

Once a transportation need is identified, project development begins with planning and scoping. Scoping entails investigating a situation and developing a project description that will address the purpose and need. When a project scope is not clearly defined or uncertain, revisions may take place after the project is already underway, leading to delays or overpromising what can be delivered. Ideally, a reliable, decisive project scope is defined in the early phases of the highway project development process. The scope should include a project definition that clearly communicates the project scope's framework and specifies what the project will and will not deliver. Good project scoping defines project boundaries, identifies project components, develops key design parameters, and estimates a detailed budget and schedule. Dedicating resources to robust scoping work is a proactive approach to project development and helps avoid unexpected problems that can jeopardize an entire transportation program.

This research defines principles to 1) help KYTC programmatically improve its project scoping, 2) identify tools and processes to facilitate programming, and 3) help program and project managers narrow and hone a project's scope before it is established in the Highway Plan. Researchers performed a literature review, analyzed peer state scoping processes, and held several KYTC brainstorming workshops which unveiled valuable insights into current scoping practices. Since complex highway programs generate multiple project scoping processes within the same DOT, researchers investigated scoping processes for different project scales (minor, intermediate, major) and for several project types: (1) Capital Improvement Projects (i.e., Mobility & Economic Development), (2) Safety, (3) Asset Management (i.e., Bridges/ Pavement), and (4) Maintenance & Operations. This study also considered the point in the project timeline that scoping occurs. Some DOTs define highway project scoping to be the first 0-3% of project development, and others continue project scoping to 30% of project development, or when the environmental phase is complete. For this research study, both scoping paradigms were considered.

Throughout the study researchers documented several project scoping practices. Each recommended best practice includes a title, background information, goal, implementation strategies that KYTC can use, and a ranked score for implementation effort and value to the agency. Many of the best practices fell into the project types of Safety/HSIP,

Asset Management, and Maintenance. Because the best practices for Capital Improvement projects had universal application across project types, the research team created a General Best Practices category. The qualitative ranking methodology for each best practice is described in the table below.

Table E1 Qualitative Methodology Used to Evaluate Best Practices

Metric	Definition
Implementation Value Ranking: 5 – High Value 4 – Moderately High Value 3 – Medium Value 2 – Moderately Low Value 1 – Low Value	A multi-dimensional parameter evaluated based on each practice's ability to accomplish the following: • Keep projects on schedule and on budget • Promote greater statewide collaboration among Districts, the Central Office, and SMEs on planning and scoping • Improve the consistency and accuracy of scopes • Enhance scoping knowledge and capabilities • Improve the overall highway system
Implementation Effort Ranking: 5 – High Effort 4 – Moderately High Effort 3 – Medium Effort 2 – Moderately Low Effort 1 – Low Effort	For each best practice an implementation ranking is assigned based on the following factors: • Development time (production hours) and availability of staffing needed to implement change • Financial cost • Impact on staff (e.g., learning curve temporarily reduces productivity) • Magnitude of process changes and resistance to change • Political factors

The ranking system was used to create a list of highway project scoping best practices and recommendations. In addition to cataloging best practices by project type, they were grouped into the following categories: 1) Human Resource-Focused Practices, 2) Programmatic Changes, 3) Project-Level Improvements, and 4) Secondary Best Practices. Chapter 4 of this report fully describes all the general best practices, including eight selected as a top practice:

- Strengthen Commitment to Robust Scoping and Lengthen Early Project Stages
- Ramp Up Project Development Activities During Scoping
- Increase the Number of Project Managers
- Multidisciplinary Coordination and Risk Based Scoping
- Cross Program Coordination and Collaboration
- Scoping and Project Delivery Performance Measures
- Scoring of Project Alternatives
- Increase Human Resources for Project Scoping

Chapter 1 Best Practices for Highway Project Scoping

1.1 Overview

The Kentucky Transportation Cabinet's (KYTC) mission is to provide a safe, efficient, environmentally sound, and fiscally responsible transportation system that opens economic opportunities and enhances the quality of life in Kentucky. This guides the Cabinet's efforts to serve the citizens of the state. KYTC's Department of Highways helps fulfill this mission by constructing, maintaining, and improving roads and bridges statewide. The Six-Year Highway Plan (a construction program) and a maintenance program provide the foundation for KYTC's activities. These programs are legislatively authorized and enacted through the biennial budget process and address needs throughout the highway system. KYTC develops and delivers projects listed in the *Six-Year Highway Plan* and those which are part of the maintenance program.

One of the Cabinet's foremost priorities is delivering *successful projects* — quality solutions that meet the defined scope, and are delivered on time and within the budget specified in the Highway Plan. Improving the project delivery success rate helps the Cabinet fulfill its mission and enrich the lives of all Kentuckians. Recognizing the effectiveness of systematic approaches for managing preconstruction engineering activities and resources (e.g., time, money, personnel), KYTC commissioned *Best Practices for Highway Project Scoping* to identify effective methods for defining highway projects. The findings presented in this report will help KYTC strengthen scoping processes so the agency can more clearly and accurately identify project needs, better control project development activities, optimize resource use, keep activities on schedule, and improve project outcomes.

1.2 Problem Statement

The *Project Management Body of Knowledge* defines a project as a temporary endeavor undertaken to create a unique product, service, or result. All projects are executed under several constraints — scope, time, cost, and quality. Scoping entails investigating a situation and developing a project description that will address the purpose and need. KYTC confronts many challenges when a project's scope is uncertain. As such, it is imperative for KYTC to establish a reliable, decisive project scope in the early phases of the highway project development process. A project definition should be established to clearly communicate basic project scope's framework. The definition should specify what the project *will* deliver and what it *will not* deliver. An unclear or inaccurate scope may require significant revisions once the project has been programmed. A poorly defined scope may delay the project or lead to KYTC overpromising what it can deliver. This report lays out principles to 1) help KYTC programmatically improve its project scoping, 2) identify tools and processes to facilitate programming, and 3) help program and project managers narrow and hone a project's scope before it is established in the *Highway Plan*.

1.3 Background

Managing preconstruction engineering processes on the thousands of projects in KYTC's annual portfolio is very complex due to political polarization, engineering challenges, environmental issues and laws, budget constraints, reduced staffing, and increasing system needs. KYTC relies on program and project managers to develop and deliver high-quality projects to construction within the schedule and budget.

Once a transportation need is identified, project development begins with planning and scoping. State departments of transportation (DOTs) have adopted a wide variety of approaches to planning and scoping. Regardless of the form planning and scoping take, the success of these activities is closely bound up with the success of DOT programs. Most agencies incorporate projects into their programs in a manner that ensures available funds are spent on the most urgent needs. Once DOT programs are adopted and funded, agencies commit to delivering documented projects in accordance with the scope description, funding, and schedule. In some cases, projects are programmed without adequate scoping. This impedes project development by not allowing the agency to develop a realistic and accountable cost estimate and schedule. If projects are not successfully completed on time and within budget, the program is not delivered successfully, jeopardizing the agency's mission.

KYTC project budgets are taken from the *Six-Year Highway Plan*, a document issued every two years that lists major highway improvements the agency wants to pursue over the next six-year period. The plan released in 2022 covers

FYs 2023 – 2028 and has total funding estimates of nearly $8.5 billion — $2.3 billion in anticipated state revenues and $6.2 billion in Federal-aid highway program funding. KYTC consults with Area Development Districts (ADDs), metropolitan planning organizations (MPOs), District Offices, and elected officials to determine which projects are included in the Highway Plan.

At KYTC, a critical issue of concern is how a transportation need becomes a promise. Proposed projects usually speak to a precise, data-defined need and compete for inclusion in the *Highway Plan*. After a project is added to the plan, it attains a constituency, one that expects schedules will be met. Once a project schedule is established, it effectively becomes a promise to deliver. Delivering projects on time is essential because elected officials and project sponsors make promises to their constituents about completion dates. These constituents hold officials accountable. As such, KYTC must establish reasonable project schedules to minimize the possibility for conflict and confusion, and project managers must stick to that schedule.

The Cabinet is similarly responsible for finishing projects within budget. The *Highway Plan* is fiscally balanced by the Authorization Review Team, and when a project experience cost overruns, it directly impacts *Highway Plan* schedules. Basically, KYTC cannot start project construction until there is enough money coming in to pay for the project. Thus, the Cabinet must select which promises to keep and deal with changes that threaten to undermine project delivery schedules.

Throughout project development, program and project managers should be mindful of the following principles:

- Every project is a promise
- Every project has a constituency
- Every project cost must be realistic
- Every project schedule must be reasonable

Adhering to these principles increases the likelihood of successful project completion that meets the public's and Cabinet's expectations. Because the public demands accountability for highway projects, when project delivery goes amiss, KYTC shoulders the responsibility. The Cabinet's credibility suffers damage when promises are not kept.

1.4 The Importance of Highway Project Scoping
Attending closely to scoping during early project stages helps keep projects on time and on budget. Project scoping involves taking a general transportation-improvement idea and transforming it into a well-developed solution ready for detailed design work. Successful project scoping accomplishes the following:

- Defines project boundaries
- Identifies project components
- Develops key design parameters
- Estimates the required budget and schedule to an adequate level of detail for planning purposes

A well-defined scope helps project managers develop broadly accurate estimates of the project budget and timeline.

Project scoping faces three constraints — the scope itself, the project budget, and time allowed for project completion. From a project's initiation, knowledge of these factors needs to be reasonably accurate. Each factor should balance one another to create the basis for successful project delivery. During a project's early stages, project teams focus on accurately defining the scope of the work and developing cost and schedule estimates based on the scope.

The scope, cost estimate, and schedule establish the framework for a project's design and implementation phases. If this underlying framework is not well-conceived, thorough, and accurate, unexpected difficulties and complications are likely to arise during later project phases. Inadequate scoping can and often does result in significant cost increases, completion delays, and the constructed project exhibiting poor performance or quality

due to development constraints imposed by inaccurate estimates. Furthermore, changes in budgeting and scheduling resulting from inadequate project scoping can spill over to affect other planned projects, requiring adjustments in an agency's entire transportation planning program. The potential domino effect caused by budgeting and scheduling inaccuracies makes project scoping a critical component of the overall transportation program's success.

Thus it is advantageous to initiate a thorough scoping analysis very early in highway project development. Scoping should begin early in the initial planning phase of project development; the scope should be continually refined throughout the preliminary design phase. This helps ensure the conceptualized project is feasible and that no unexpected risks impact the budget and schedule. During the last stage of scoping the project scope, budget, and schedule are finalized. At this point in project development, enough information is available to firmly establish the project parameters, including final design, right-of-way needs, existing utilities, environmental impacts, broadly accurate cost estimates, schedules, and staffing demands. The final scoping work is passed along to road and structure designers to guide their efforts.

To a large degree, the success of project development and the ability to control a project's scope, schedule, and cost depend on the accuracy of and effort put forth during scoping. Although successful scoping is often invisible on successful transportation projects, flaws in the underlying scope – cost – schedule framework can become very apparent when budget overruns and project delays result from inadequate attention to scoping. Investing sufficient resources in robust scoping work at appropriate points throughout project development is therefore a proactive approach that aids tremendously in avoiding unexpected problems that can jeopardize an entire transportation program.

Chapter 2 Overview of the KYTC Highway Project Scoping Processes

2.1 KYTC Initial Highway Project Scoping Process

At the beginning of this study, the research team recognized that complex highway programs generate multiple project scoping processes within the same DOT. They investigated scoping processes for different project scales (minor, intermediate, major) and project types: (1) Capital Improvement Projects (i.e., Mobility & Economic Development), (2) Safety, (3) Asset Management (i.e., Bridges/ Pavement), and (4) Maintenance & Operations. The scoping processes of these project types are discussed later in this chapter.

Further complicating the issue, different programs carry scoping processes to different points along the project timeline. Project maturity is defined as the percentage of project definition completed. The project definition is ultimately captured in the final contract plans and documents used for highway construction. When construction documents are complete and ready to let to construction, the project maturity is one hundred percent, and the project development phase (i.e., pre-construction) has been completed. Some DOT professionals consider highway project scoping to be the first 0-3% of project development. For others, project scoping continues to 30% of project development, or when the environmental phase is complete. For this research study, both scoping paradigms were considered.

Scoping processes and timelines vary based on highway project type. KYTC's Highway Plan lists both projects and programs. Project and programmatic oversight are assigned to subject-matter leaders who are responsible for getting projects to letting. For KYTC project managers, the SYP project description, budget, and schedule identify and frame up the project they are managing. Project managers play a key role in interpreting the project scopes in the Highway Plan which defines the spending and general time frame for each project. KYTC program managers do not have projects defined in SYP. Programs are described in SYP and appropriated funds are allocated to use on the transportation need specified. Program managers, through their own planning and scoping processes, identify projects to fulfill their program's intended focus and mission. Figure 2.1 shows a timeline of project development by highway project types. In general, the shorter-duration project types are programmatically listed and funded in KYTC's SYP.

For projects listed in SYP, their initial documentation was likely held in KYTC's Continuous Highways Analysis Framework (CHAF). CHAF is an application enabling users to collect, track, and analyze identified transportation needs. CHAF also provides a means to sponsor, score, and rank projects as part of the Strategic Highway Investment Formula for Tomorrow (SHIFT). SHIFT is the Cabinet's data-driven, objective approach to compare capital improvement projects and prioritize limited transportation funds. SHIFT helps schedule projects in SYP and plan the highway construction funding in the upcoming years. Several strategic planning studies, including the Long-Range Statewide Transportation Plan, Corridor Studies, and Data Needs Analysis (DNA), are completed to help define the project scope.

KYTC has several process maps used to describe their project scoping. Included in Appendix A are 1) *SYP Manage Project Status – Day to Day Process Flow*, 2) *Complete Preliminary Engineering*, and 3) *Planning Prioritization Process (Draft)*. Additionally, the Highway Design Manual has a generalized write up on project administrative procedures. Project scoping excerpts from the Highway Design Manual are included here:

Figure 2.1 Timeline by Project Type

HD-202.1 PROJECT ORGANIZATION

Projects may be proposed by various entities including area development districts (ADDs), metropolitan planning organizations (MPOs), highway district offices, and local officials to address safety, operational, or other transportation system needs. When potential capital projects are identified, the district planning engineer, ADD or MP planner enters the proposed project into the Continuous Highway Analysis Framework (CHAF). The CHAF is used to:

- Collect, track and analyze transportation needs. Provide characteristics of the existing conditions
- Identify an initial project description
- Provide a planning level estimate of environmental, design, right-of-way, utility, and construction costs for use in future project scoping and prioritization

Once the CHAF entry is completed, the project can be sponsored for consideration in the Strategic Highway Investment Formula for Tomorrow (SHIFT) maintained by the Division of Planning. SHIFT is a data-driven, objective approach to compare capital improvement projects and prioritize transportation spending. Each project is reviewed and scored on a scale of 0 to 100 with a formula that uses objective measures for five key attributes-safety, congestion, asset management, economic growth and benefit/cost. Projects of statewide significance-interstates, parkways and other major connecting routes – are scored first. The remaining projects, known as regional projects, are scored using a similar formula. More information about SHIFT can be found at: https://transportation.ky.gov/SHIFT/Pages/default.aspx.

KYTC combines the statewide and regional priorities to help develop the Governor's Recommended State Highway Plan, which is presented to the General Assembly, in even numbered years. During the legislative session, lawmakers fine-tune the plan based on additional information and funding availability. The result is the Enacted State Highway Plan, which includes two years of funded projects in the biennium and spending priorities for the following four years.

HD-202.6 PRE-DESIGN COORDINATION

After project authorization, the PDM should coordinate with other project team members to review the issues faced by the project. The primary focus of this coordination is to address the following:

- Performance Measures
- Purpose and Need
- Project Scope
- Schedule and Milestones
- Additional Resources
- Additional Mapping
- Environmental Overview
- Traffic Forecasting
- Public Involvement

HD-202.6.1 through HD-202.6.9 details these discussion points.

HD-202.6.3 PROJECT SCOPE
Properly scoping a project is essential to its successful development. All projects regardless of size, location, complexity, or funding require scoping in order to discuss the needs and challenges associated with the project, develop the tasks and schedule for preliminary engineering, assess the level of environmental studies required to obtain clearances, and to estimate preliminary costs for comparison to programmed costs. The project should be clearly defined and should address the following:

- Type of project (New Route, Reconstruction, Construction of Existing Roads)
- Project description and limits (project location, study area including context, magnitude and length, classification, current AADT, etc.)
- Performance Based Flexible Design (aspects of roadway performance identified and need of improvement/s determined
- Draft purpose and need statement including clear description of objectives
- Roadway characteristics
- Potential options to consider (without preference to meet purpose and need and to fit context)
- Design criteria
- Proposed access control
- Current project estimate, programmed budget and possible funding types
- Potential environmental impacts and constraints
- Right-of-way requirements
- Utility impacts
- Constructability and MOT
- Number and types of structures anticipated

For quantitative performance measures, it is imperative in determining a project's scope to gather existing data (safety, traffic, etc.) to assess current performance and identify issues affecting the project. Future performance with improvements and without improvements should be forecasted to compare the impacts of the proposed improvements. For analyzing safety and capacity performance, please refer to methodologies in the Highway Safety Manual and the Highway Capacity Manual. Ultimately, the project manager should rely on the data and the resources available, and the engineering judgement of the project team and subject matter experts. Some projects may benefit from taking the time to scope different project types, i.e., reconstruction and spot improvements. This would allow the project team to compare the effectiveness of each project type and determine the appropriate value to address the identified needs.

2.2 KYTC Capital Improvements Projects
KYTC Capital Improvement Projects are challenging to define. Historically, KYTC staff called them *highway plan projects* or *design projects*. These projects have larger budgets than others in KYTC's portfolio and generally involve new road or bridge construction or major improvements on higher-traffic routes. Capital Improvement projects are also defined by the funding source and compete for KYTC's Highway Plan funds. They are typically not maintenance related unless they entail a larger effort for which the Division of Maintenance lacks funding.

Capital improvement project needs and the conceptual scopes of work to address those needs most often come about through KYTC's Statewide Transportation Planning Process. Federal regulations require each state to carry out a continuing, cooperative, and comprehensive statewide multimodal transportation planning process to identify its most important transportation needs. Kentucky's process is described in Chapters 7 and 8 of the KYTC Division of Planning's *Annual Work Program*. Through this process, KYTC coordinates with entities across the state, including Area Development Districts (ADDs), Metropolitan Planning Organizations (MPOs), and Highway District Offices (DOs), to continually identify and prioritize Kentucky's most important needs. Through coordination and data-driven tools such as the Continuous Highway Analysis Framework (CHAF) project database and the Strategic Highway Investment Formula for Tomorrow (SHIFT) project selection methodology, the process provides meaningful input used to develop Kentucky's biennial highway spending plan.

Projects may first be introduced by highway officials, the public, legislators, or local governments (e.g., Long-Range Plans, Regional MPO Plans, ADD plans). Since implementation of the SHIFT process, the CHAF database has been used to house project data for both unscheduled and scheduled project needs. Unfunded and funded projects are prioritized separately by planning staff, who examine projects in coordination with state highway officials, ADDs, MPOs, elected officials, and others to establish project priorities.

A project usually starts with a problem or roadway need. Project ideas are submitted to either an ADD, an MPO, or DO for inclusion in the CHAF project database. Data establishing the project origin, need, description, and limits are entered into the database. Data may be entered by the ADD, MPO, or DO. DO personnel later verify all project data. Cost estimates are developed exclusively by DO personnel. Once data are entered and verified, projects can be scored through the SHIFT process.

There are nine urban MPOs areas across Kentucky. An MPO is a transportation policymaking body made up of local government and transportation agencies that assume some authority and responsibility in the MPO area. They are centered around large cities and were created by federal legislation to ensure that transportation project expenditures are based on continuing, cooperative, and comprehensive planning. Federal transportation funding is channeled through MPOs. MPOs often introduce visionary or non-traditional, streetscape-type projects into the CHAF database and SHIFT process. MPOs have more planning personnel than ADDs, which often devote fewer resources to planning.

Some projects — referred to as *legislatively-added projects* — receive SYP funding without going through the CHAF/SHIFT selection process. They are added during the late stages of the SYP approval process during the biennial budget legislative session. Initially, they bypass the SHIFT prioritization process altogether. The DO typically provides scopes and cost estimates for these projects and works to make their characteristics consistent with traditional projects housed in the CHAF database. Often, these projects are later added to the CHAF database to compete for future SYP funding.

Although every District should have, at minimum, a planning supervisor and traffic counting personnel, some Districts have difficulty filling those roles. Most Districts do not prefer using consultants to provide scoping estimates. Often, planning jobs go unfilled, or a person who takes a planning job does not stay very long. As part of KYTC's 2008 reorganization, district planning branches began to operate as sections under Project Development Branch Managers. This move seemed to diminish the importance of planning in Districts' overall project development and delivery programs and may contribute to the challenge of maintaining planning staff at the district level.

KYTC has a user manual that explains how to enter projects into the CHAF database, and there is an old guide to creating the Project Identification Form (PIF), which was previously used to document initial project information. No available guidance describes the reason for scoping and the process of project scoping.

2.3 KYTC Safety Projects
The Highway Safety Improvement Program (HSIP) is achieved through a data-driven approach to reduce traffic fatalities and serious injuries on public roads. This strategic approach focuses on performance and is consistent with the Strategic Highway Safety Plan (SHSP). There is a range of project types included in the HSIP investments, which

can be arranged into three general levels of scoping effort (low, medium, and medium-high). Amount of scoping work (man-hours) and level of coordination among team members were considered when assigning project types to each level. The levels of scoping effort are as follows:

- Low Scoping Projects (1-2 months)
- Medium Scoping Projects (3-6 months)
- Medium-High Scoping Projects (6-12 months)

There are also two project types categorized as Not Project Seeking/Supplemental Investments that do not require scoping; these include Localized Risk Mitigation and Other Initiatives (CMV, Non-motorized, Safety Circuit Rider, KTC Technical Assistance, and Preconstruction KYTC).

Based on the three general levels of scoping effort, typical scoping processes are defined for each level. In general, *administrative scoping* (project evaluation, coordination, and refinement) increases with project difficulty. Some medium-high level scoping projects also involve *engineering scoping*, which may include investigating potential treatments to determine impacts, benefits, costs, etc... Higher level scoping may also involve field visits or using PhotoLog to review conditions.

Low Scoping Projects

Low Scoping projects are generally handled through Central Office, with matching funds by the Division of Maintenance. Project types include:

- Systemic Intersection Improvements – this program uses Highway Safety Manual (HSM) methods to identify intersection characteristics that correlate with severe crashes. Low-cost improvements are identified and primarily include sign and signal changes.
- High Friction Surface – HSM methodologies are used to identify wet-pavement crash locations for application of a high friction surface. In this process, high-quality aggregate is applied to the pavement using a polymer binder.
- New Guardrail (FE06) Matching Funds – this program provides matching funds to the New Guardrail Program (FE06). The Maintenance Rating Program (MRP) determines guardrail improvement locations, based on severity of conditions.
- Cable Barrier – delivered by the Central Office Division of Design, this program evaluates the interstate system for locations without longitudinal barrier. Project locations are prioritized using a data-driven approach.

The scoping process map for Low Scoping Projects is shown in Figure 2.2.

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┌─────────────────────────────────────┐
│  1. Data Collection, Analysis, &    │
│      Priortization by Others         │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│  2. HSIP review of Network Screening │
│   (Guardrail is limited to Warranted │
│        [identified] Locations)       │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│  3. Cordination with Districts/Divisions │
│   based on Project Type. Iterative as │
│               needed                  │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│  4. Virtual/Field Review of Locations as │
│     Needed (Note: Step 4 is Fluid in │
│      Timeline for All Scoping)        │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│  5. Evaluate Data; Coordinate Feedback │
│  to Determine Project Locations Based │
│     on Available Budget. Regulation   │
│     Review Based on Funding Rules     │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│                                       │
│       END ADMINISTRATIVE SCOPING      │
│                                       │
└─────────────────────────────────────┘
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Figure 2.2 Low Scoping Project Process Map

Medium Scoping Projects (3-6 Months)

Intersection Emphasis projects are considered Medium Scoping level and rely on District knowledge of the local system; often, the traffic, design, and planning sections may all get involved. Intersections and Roadway Departure Corridors are the largest areas of focus within HSIP, garnering more than 80% of the annual budget.

HSM methodologies are used to evaluate safety performance of intersections within all highway Districts. Generally, five to ten intersections are selected in each District for further evaluation, to include field reviews, existing conditions, crash analysis, and identification of potential improvements. The scoping process map for Medium Scoping Projects is shown in Figure 2.3.
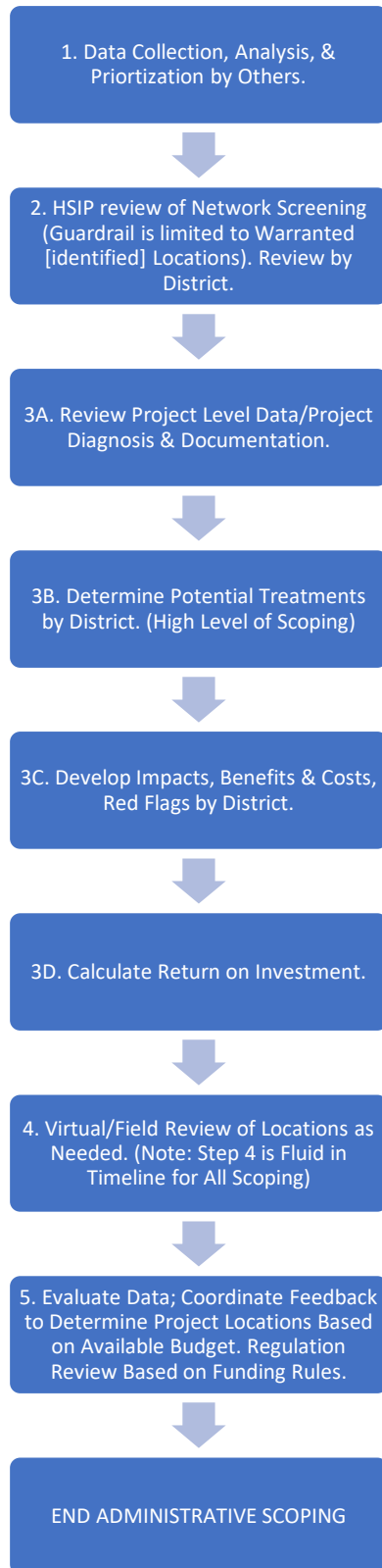
Figure 2.3 Medium Scoping Project Process Map

Medium-High Scoping Projects

Medium-High Scoping projects are considered under the Roadway Departure Emphasis program, which includes Roadway Departure Corridors, Shoulder Widening, Horizontal Alignment Signing, and National Highway System End Treatments. Roadway Departure Emphasis improvements are studied within each KYTC District, including priorities and preliminary costs. The Emphasis area studies include crash data review, GIS analysis, and virtual review (i.e., Photolog, StreetView) to identify locations where crashes may be reduced by improvement projects.

The Roadway Departure Emphasis studies generally take about 6-12 months currently; improvements are planned to reduce this to 6-8 months in the future. The studies will be repeated biannually. The HSIP project types included in the Roadway Departure Emphasis Studies include the following:

- Roadway Departure – this program focuses on rural, two-lane, roads with speeds over 50 m.p.h. HSM methods are used to identify and prioritize locations for safety improvements, such as shoulders, rumble strips, slope, superelevation, culverts, ditching, signage and delineation.
- Shoulder Widening – potential projects are identified using the Highway Information System (HIS), along with resurfacing priorities or the Roadway Departure Emphasis project list. Improvements include establishing or widening shoulders, and evaluating projects for centerline and edgeline rumble strips.
- Horizontal Alignment Signing – this program identifies curves that would benefit from enhanced horizontal alignment signage, including fluorescent yellow sheeting. Project locations may be submitted by District staff for recently resurfaced corridors or for local routes with complete engineering studies.
- National Highway System End Treatments – replacement of outdated guardrail (turn-down style) on National Highway System (NHS) routes is included in this initiative; new barrier installations are not permitted. Project locations are researched and documented by the highway Districts.

The scoping process map for Medium-High Scoping Projects is shown in Figure 2.4.

Not Project Seeking/ Supplemental Investments

HSIP also supports some supplemental investments. Localized Risk Mitigation has not been done for several years; those funds were converted to Systemic Intersection Improvement projects. Other Initiatives are not projects but rather receive supportive investments.
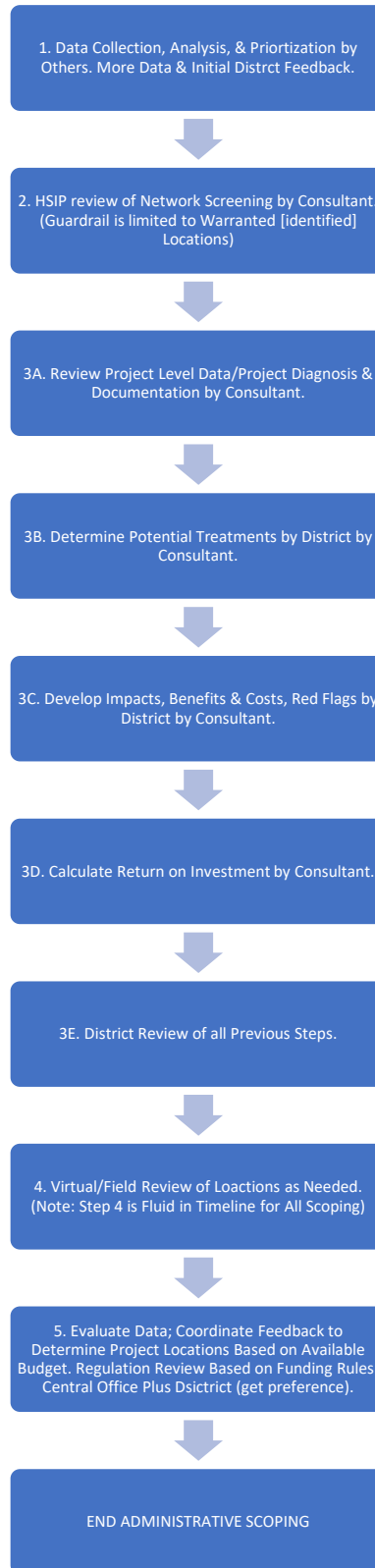
Figure 2.4 Medium-High Scoping Project Process Map

The flowchart contains the following steps from top to bottom:

1. Data Collection, Analysis, & Priortization by Others. More Data & Initial Distrct Feedback.

2. HSIP review of Network Screening by Consultant. (Guardrail is limited to Warranted [identified] Locations)

3A. Review Project Level Data/Project Diagnosis & Documentation by Consultant.

3B. Determine Potential Treatments by District by Consultant.

3C. Develop Impacts, Benefits & Costs, Red Flags by District by Consultant.

3D. Calculate Return on Investment by Consultant.

3E. District Review of all Previous Steps.

4. Virtual/Field Review of Loactions as Needed. (Note: Step 4 is Fluid in Timeline for All Scoping)

5. Evaluate Data; Coordinate Feedback to Determine Project Locations Based on Available Budget. Regulation Review Based on Funding Rules. Central Office Plus Dsictrict (get preference).

END ADMINISTRATIVE SCOPING

2.4 Asset Management Projects

Asset Management Projects are those that have the primary purpose of addressing the condition of existing highway assets through replacement or repair. They do not typically involve the addition of new capacity or roadway functionality, although minor improvements may sometimes be included. The most common asset management projects include those meant to address pavements or bridges that have deteriorated due to age and traffic impacts.

Each year, KYTC awards more asset management projects through the Division of Construction Procurement than any other project type. Of 630 total projects awarded in 2021, 510 were to address asset management needs. Major categories of asset management projects are identified in Table 2.1 along with the number of projects awarded in 2021.

Table 2.1 2021 Asset Management Projects

Asset Management Category	# Awarded
Pavement Resurfacing	385
Pavement Preventive Maintenance	54
Pavement Rehabilitation	34
Bridge Repairs or Rehabilitation	21
Bridge Replacement	14
Bridge Preventive Maintenance	2

Pavement resurfacing projects make up the largest category of asset management projects awarded each year. These are funded through KYTC's FD05 and CB06 programs, which are administered by the Division of Maintenance and the Department of Rural and Municipal Roads respectively. Bridge repair, rehabilitation, and preventive maintenance projects are administered by the Division of Maintenance through the FE02 maintenance program. Major rehabilitation and bridge replacement projects are administered through a variety of funding mechanisms and programs within KYTC.

In addition to projects awarded to contract through the Division of Construction Procurement, KYTC also initiates smaller scale repair projects for bridges and pavements. These projects may be undertaken by state forces or contract labor administered through a master agreement.

Prioritizing Asset Management Projects

The identification of highway asset management needs is primarily accomplished through condition assessments performed by Central Office and District staff. Bridge needs are identified through the National Bridge Inspection System (NBIS), which includes inspections performed by KYTC and contract staff. The NBIS requires all public highway bridges to be inspected at least every two years, but many bridges are inspected more frequently based on condition and risk. Prioritization of projects for the FD05 pavement resurfacing program is accomplished through a two-step process that includes visual evaluations performed by pavement management engineers and automated distress capture using the KYTC's pavement data collection vehicles. The CB06 pavement resurfacing program relies primarily on visual assessments performed by district staff who then coordinate with local officials to prioritize projects for Rural Secondary routes.

Scope-Limited Funding Programs

Scoping for asset management projects is generally constrained based on the funding mechanism utilized. Projects which can be completed within the constraints of a given program are prioritized against other such projects, while those with greater needs are forced into a separate prioritization process. This allows KYTC to provide a streamlined process for those projects that can be addressed with a reduced scope.

Resurfacing projects funded through the FD05 or CB06 programs are typically limited to a single surface layer no more than 1.5" thick, with some allowance made for minor base failure repairs and leveling material to address

rutting or other cross-section deficiencies. Additional items included in resurfacing projects are limited to those required to reestablish functionality of the roadway or to comply with federal-state agreements. These items include striping, signal detection loops, pavement markings, and ADA-compliant sidewalk ramps.

The scope constraints for bridge projects funded through the FE02 bridge maintenance budget are less strict than those applied to the FD05 and CB06 pavement programs. There is no hard and fast rule that limits the type of work that can be performed using FE02 funding. However, it is generally understood that projects funded with FE02 will be limited to maintenance and minor rehabilitation. Typical projects include deck rehabilitation, scour mitigation, painting, and low-cost preventive maintenance work. Bridges requiring more significant rehabilitation or replacement are programmed through the Six-Year Highway Plan process.

Summary of Asset Management Projects
KYTC's asset management programs focus on maintaining and improving the condition of existing highway assets. In order to address the greatest number of assets with available funding, KYTC limits the scope which can be applied to individual projects. This strategy allows KYTC to award a much larger number of asset management projects each year than would otherwise be possible, thereby providing greater value to the overall highway network.

2.5 KYTC Maintenance Projects
Like asset management projects, maintenance projects primarily address the condition of existing highway assets, and do not involve the addition of new capacity or roadway functionality. In fact, maintenance is typically considered a subset of an agency's asset management program. The distinction between the two lies primarily in the scale and impact of projects. Whereas asset management projects will often restore bridges or pavements to a condition approaching that of a newly constructed facility, maintenance projects typically involve the restoration or repair of minor assets that contribute to the overall functionality of the roadway. Maintenance projects may serve to address the gradual deterioration of an asset over time or sudden damage caused by severe weather events or vehicular impacts. Common examples of maintenance projects include re-striping of pavements, ditch cleaning, pothole patching, guardrail replacement, and minor bridge deck repairs.

KYTC performs highway maintenance efforts utilizing both in-house and contract forces. Where possible, in-house labor is used to provide maximum flexibility in response to changing needs and emergency situations. However, challenges in maintaining sufficient personnel and the need for specialized equipment or skills has required the Cabinet to rely more on contract forces over time.

Contracts for KYTC maintenance work are established through one of two mechanisms – defined bid contracts and indefinite delivery/indefinite quantity (IDIQ) contracts. Defined bid contracts resemble most other highway contracts in that the amount and location for work to be performed is determined prior to the advertisement for bids. In such instances, the total cost of the contract is known at the time of award based on the winning contractor's bid tab prices. KYTC uses defined bid contracts for activities where the needs of the Cabinet are relatively predictable from one year to the next – such as mowing and striping.

Conversely, IDIQ contracts – also known as master agreements – do not specify how much work will be performed or precisely where the work will occur. Instead, an estimated range of quantities is provided for work to be performed within a specified geographic area (typically a county or district). KYTC uses master agreements for activities that are frequently needed, but which can vary significantly from one year to the next. Common master agreement contracts include tree trimming, snow and ice removal, and pavement patching.

Prioritizing Maintenance Projects
Central Office Division of Maintenance staff are involved in establishing both defined bid contracts and master agreements for maintenance work, but the primary responsibility of identifying and prioritizing daily maintenance needs is carried out by district personnel. District staff assign in-house labor to carry out day-to-day activities based on prevailing conditions. The scheduling of work for KYTC maintenance crews is a dynamic undertaking, requiring flexibility and an understanding of operational needs to respond to changing conditions.

The prioritization of work to be performed by contract is also administered by district staff but requires more advanced planning than work carried out by in-house labor. Work carried out using defined bid contracts must be identified at the time of advertisement, which can be several months before work is performed. Master agreements contracts have greater flexibility but usually include language allowing the contractor a minimum response time. These can range from a few hours for emergency work such as snow and ice removal to several weeks for activities requiring significant lead time such as interstate panel sign replacement.

Regardless of the mechanism used to perform the work, the prioritization of maintenance activities is based on the temporal impact to the operation of the highway network. Issues causing an immediate closure – such as a crash or roadway collapse – must take priority over those that may cause a closure in the near future. Similarly, potential future problems must be assessed based on their level of impact and likelihood of occurrence in order to determine their priority in relation to other needs. Resource limitations often result in a deferral of routine maintenance needs that may improve future operational performance, but which do not yield immediate improvements.

Determining Scope of Maintenance Projects

Whereas the capital program takes a more forward-looking view that emphasizes distinct projects to improve mobility and economic development, the maintenance function is focused on the immediate operational needs of the entire highway network. Consequently, the do-nothing option is rarely available in cases where mobility has been compromised due to roadway damage or deterioration. When combined with the budgetary limitations of maintenance programs, this emphasis on network level response naturally encourages maintenance practitioners to constrain the scope of individual projects in order to maximize the impact of work performed.

The mechanisms that KYTC uses to address maintenance needs – in-house staff, master agreements, and defined bid contracting – provide the Cabinet with a framework that encourages project constraint by simplifying implementation of those activities which have narrower scope. As stated previously, district maintenance staff can be deployed quickly to address urgent needs when they arise. However, the range of projects that can be performed by in-house staff is limited to the availability of skilled personnel and equipment suitable to carry out the necessary tasks. At the other end of the spectrum, defined bid contracts can be used to perform an almost unlimited range of projects but require more time, effort, and funding to carry out. Master agreements provide a middle ground between these two extremes, with a predefined set of activities at a known cost that can be deployed relatively quickly but with some limits on both speed and scope.

When faced with any operational challenge, district maintenance engineers have the authority to initiate a response using in-house staff or a master agreement if an applicable agreement exists within the geographic area of concern. The primary limitation in such cases is the availability of sufficient maintenance funding at the district level. If the necessary work exceeds the ability of the district to perform using their staff or a master agreement contractor, a defined bid contract may be pursued. Such cases require the involvement of Central Office staff to facilitate development of a project proposal and identification of necessary funding. In this way, project scopes are expanded only when a less complex method is insufficient for the task at hand.

Summary of Maintenance Projects

KYTC Maintenance projects serve primarily to address immediate operational issues and to repair minor highway assets. In order to maintain mobility across the entire roadway network, maintenance staff must address emergency issues as soon as possible. To accomplish this, KYTC utilizes a tiered approach which encourages districts to use the least complex scope which can meet the needs of a given project.

Chapter 3 Investigation of Highway Project Scoping Practices

3.1 National Level Literature Review

Highway project scoping is "a systematic means of defining the purpose, need, and characteristics of proposed improvement projects" (Kyte et al. 2004), which can entail developing an idea for improvement into a solution ready for design (e.g., Hessami et. al. 2017). The scope can also be thought of as a performance specification that defines a project's output (Ainger and Fenner 2014). Scoping addresses these key tasks (Anderson et. al. 2016):

- Defining project goals and requirements
- Identifying safety shortcomings
- Establishing design criteria
- Pinpointing challenges associated with environment, utility, and right-of-way (ROW) processes
- Specifying alternatives
- Estimating the preliminary budget and schedule

A high-quality scope minimizes the likelihood of changes or cost overruns during detailed design (Kermanshachi et al. 2017). Scope creep is the most common reason for costs increasing or projects falling behind schedule (Anderson 2016). While robust scoping practices can prevent major setbacks such as omitting a traffic mitigation plan or not providing enough funding to acquire needed ROW, many DOTs lack formalized scoping processes, and guidance varies significantly in terms of quality and content.

A 2002 AASHTO Standing Committee on Quality (SCOQ) benchmarking study found that the traveling public was unhappy with the amount of time DOTs take to design and construct highway projects. It recommended strategies to reduce project cost and delivery times. For example, a focus on preconstruction activities — which stretch from project concept to bid advertisement, including the environmental process — is one of four indicators that can be used to measure agency effectiveness and efficiency (AASHTO 2003). AASHTO's study found that the time needed to complete preconstruction activities, including Environmental Impact Statements (EIS), ranged from 3 to 11 years with an average of 7 years (AASHTO 2003). Kentucky ranked in top 10, with average project delivery cost and time to completion less than the national average.

Industry experts are united in their view that spending more time and effort on planning upfront improves project delivery, reduces the need for changes later on, and lowers overall costs (Chowdhury et al. 2020). Consulting with stakeholders early in project development also minimizes the potential for complications later in the project timeline. But accelerating project delivery schedules can reduce planning time, increase risk, and negatively impact cost and quality. Figure 3.1 illustrates the consequences of compressed project timelines and not putting enough effort into preconstruction activities.

Figure 3.1 Challenges for the Delivery of Transport Infrastructure Projects are Interconnected
Source: Chowdhury et. al. (2020, p. i).

DOTs have explored the potential benefits of building stronger connections between scoping and other project planning processes (Miller and Lantz 2010). Involving planners in risk analysis is critical for identifying potential issues

and establishing appropriate contingencies (Hessami et. al. 2017). This step is particularly valuable for the environmental assessment phase, often a hurdle that lengthens project timelines. Miller and Lantz (2010) described challenges inherent to the scoping process and recommended possible solutions (Table 3.1).

Table 3.1 Scoping Process Challenges and Corresponding Recommendations

Common Issue	Potential Solution
Purpose and Need Statement not confirmed before scoping begins	• Distinguish between the pre-scoping meeting, where questions are raised, and the scoping meeting, where questions are answered • Make more project decisions at the scoping meeting
Little coordination between planning and scoping	• Use in-house staff to create conceptual plans
Deliverables from the scoping process are not defined	• Do not rely on checklists — track commitments or describe challenges
Project requires a higher-level cost estimate	• Use risk assessment to engage all disciplines, identifying all issues that could impact project scope
Decisions and commitments made during scoping are not documented or inconsistently documented	• Consider streamlined agreements or memorandums of understanding, instead of charters
Outside agencies and stakeholders do not participate effectively in the scoping process	• A facilitator other than the project manager should run the scoping meeting • Increase the scoping meeting's effectiveness by including all interested parties
Full funding for the project is underestimated, or the project is under-scoped	• Perform some preliminary scoping before the project is programmed

Project budgets and timelines are influenced by unknown factors and conditions that vary across and within project sites. These issues also complicate scoping. When inadequate scoping is directly responsible for changes in the project's budget and schedule, possible outcomes include a finished product that is poorly constructed or knock-on effects that impact other planned projects, creating a domino effect throughout an agency's program (Hessami et. al. 2017). Depending on the level of stakeholder interest in design alternatives, tradeoffs in design, cost, and scope may not be apparent until after scoping. Miller and Lantz (2010) highlighted expenses incurred when decision makers request an alignment at different points in project development. Prior to scoping, brief site visits by designers to walk several proposed alignments may cost as little as several hundred dollars. Later in project development (e.g., after scoping, following selection of a final alignment), the cost to survey additional alignments increases by several orders of magnitude. The design lives of products and materials also influence the quality of deliverables. Scoping offers the opportunity to analyze and specify design-life requirements as part of a project's performance specification (Ainger and Fenner 2014). Many issues can derail scoping, such as inadequate support from agency leadership. Table 3 lists key scoping challenges and possible solutions (Anderson et. al. 2016).

Table 3.2 Resolutions to Key Scoping Challenges

Category	Critical Challenges	Action Required
Process	Lack of comprehensive and flexible scoping	• Use a scalable process tailored to meet the requirements of every project • Use necessary framework and tools to facilitate effective scoping
Definition	Scoping outreach and consistency in definition	• Offer guidance to ensure consistent implementation of scoping across DOTs • Scope every project • Use a consistent definition across DOTs

Category	Critical Challenges	Action Required
Timeframe	Inadequate and inappropriate scoping timeframe	• Use a flexible timeframe, but complete scoping before detailed design begins
Activities Covered	Lack of scoping activities covering critical areas of project development	• Perform activities related to project requirements for ROW, utilities, environmental, traffic management plan (TMP), cost, and schedule
Techniques	Lack of performance measurement techniques	• Identify technique(s) to identify the effectiveness of scoping before setting the project's baseline
Tools	Lack of tools to support scoping	• Develop tools to support scoping
Expert Involvement	Absence of construction experts in the scoping	• Involve construction experts in scoping
Detailed Design Complete	Advanced detailed engineering/ design earlier	• Target to complete 20% – 30% of the design by the end of the scoping phase
Public Engagement	Lack of public engagement during scoping	• Consider requirements of the public and other stakeholders

Source: Anderson et al. (2016)

Another frequent challenge is that engineers lean on previous training, experiences, or standard designs to scope projects and identify solutions (Ainger and Fenner 2014). Two strategies for avoiding this situation are keeping the scope as expansive as possible and questioning the logic of constrained scopes as design alternatives are outlined. Broadening a project scope may require coordination among designers, planners, stakeholders, and the public, and it will often entail modifying existing practices.

3.1.1 Formal Guidance to Improve the Scoping Process
Most state DOTs scope projects during the preliminary design phase as scoping is critical for preparing a budget and specifying a letting date before a project is entered into a state transportation improvement plan (Anderson et al. 2016). Typical scoping activities include the environmental assessment, identification of ROW issues, creation of budget and schedule estimates, and specification of the preferred alternative. However, scoping timelines and the type of work completed during scoping varies between agencies. Applying sound project management principles, building a dependable team, and informing residents, business owners, and the public about projects can improve scoping and project outcomes (Ainger et al. 2014)

Anderson et. al. (2016) divides scoping into four hierarchical levels of activities (Figure 3.2):

• Level 1 — Perform Project Scoping — is the umbrella under which all work falls.
• Level 2 is made up of major scoping functions — project development, evaluating alternatives, and developing a recommended alternative.
• Level 3 includes activities that support major functions (in Figure 6 these activities are located at the bottom of the diagram).
• Level 4 encompasses subprocesses required to accomplish Level 3 activities and is not depicted in Figure 6.
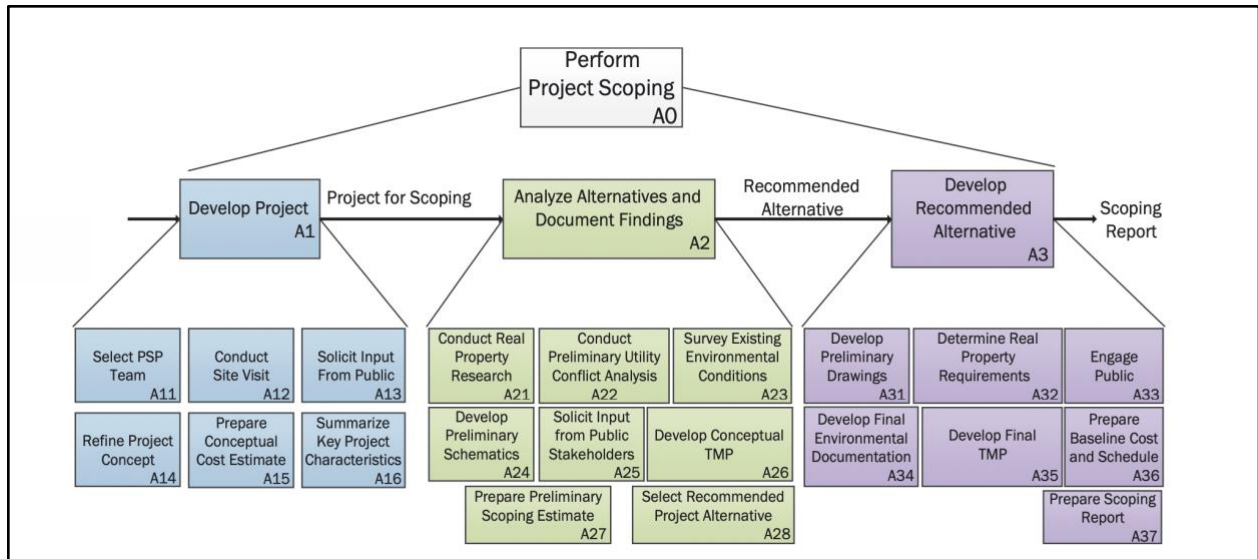
Figure 3.2 Project Scoping Framework

The Texas DOT's *Project Scoping Guidebook for Metropolitan Planning Organizations (MPO) Transportation Projects* adopts a three-stage approach to scoping (Hessami et. al. 2017) — Stage A: Identification of Project Needs; Stage B: Preliminary Project Scoping Study, and Stage C: Finalized Project Scoping Study. The agency completes scoping alongside initiation planning and preliminary design. Table 3.3 lists activities pursued during each stage.

At the end of each stage, the project team completes a *gateway review* to confirm the project scope, schedule, and cost estimate are defined clearly enough to continue to the detailed design phase. Summary sheets for Stages A and B of the scoping process can be found in Hessami et. al. (2017).

Table 3.3 Texas DOT Project Scoping Process for MPO Projects

Stage	Activities
A — Transportation Need Identified by Local Government	• Define the current situation • Develop a project needs description and an initial scoping statement • Prepare the initial cost estimate and timeline • Submit the project proposal to the MPO
B — Local Government Submits Project MPO Reviews Project for Inclusion in the MTP	• Develop specific alternative solutions for the project's needs • Perform ROW, utilities, and environmental studies • Develop schematic drawings and typical sections • Update the cost estimate and project timeline • Solicit public input • Submit a more detailed proposal to the MPO
C — Local Government Submits Project MPO Reviews Project for Inclusion in the TIP	• Review and update all relevant scoping information • Prepare the final project scoping report, cost estimate, and timeline • Submit the final report to the MPO

3.1.2 Performance Measures for the Scoping Process

Agencies benefit from using performance measures to evaluate scoping. Miller and Lantz (2010) cited several useful metrics: performance per dollar spent, whether the project sponsor's goals were achieved, number of changes (and magnitude) in budget from conception through construction, and results of the scoping process used during project development. Some assessment strategies, however, can be counterproductive. Examples include project charters, long checklists, and applying too many performance measures during scoping and too few during project delivery (Miller and Lantz 2010). During scoping AASHTO recommends only performing required activities at the level of analysis needed for a project. For example, the content and length of a traffic impact report for a resurfacing project will differ greatly from one prepared for an interstate construction project. Addressing the issue of scalability and complexity, Anderson et al. (2016) observed that project type is a driving force when selecting activities and measures to integrate into scoping.

3.1.3 Data and Documentation

Many agencies find it beneficial to revisit activities several times throughout scoping. This lets engineers collect new information and iteratively update key conclusions and findings, and is particularly useful for scoping activities that involve gathering documents (Hessami et. al. 2017). Although many agencies publish documents (e.g., a preliminary design report) in a standard format, this may not be effective for smaller projects. Tailoring documents to project type and size during the early stages of project development can accelerate scoping (ASSHTO 2003). Anderson et al. (2016) listed documents and data requirements for initiating each scoping activity. Table 3.4 summarizes activities and data requirements for refining project concepts.

Table 3.4 Activities and Data for Refining Project Concepts

Activity Required to Refine Project Concept	Data Requirements and Information Needed to Initiate the Activity
Identify and Document Future Expansion and Alternatives Consideration	• Project definition — project parameters, narrative descriptions • Updated physical parameters • Purpose and need statement • Documented major alternatives • Stakeholder input
Refine Project Purpose and Need Document	• Future expansion and alternatives consideration • Capacity improvement needs — existing levels of traffic service and estimates of future traffic demands

Activity Required to Refine Project Concept	Data Requirements and Information Needed to Initiate the Activity
	• Social, environmental, and economic factors; existing infrastructure conditions; and suggestions from operations and maintenance, planners, local elected officials, and the public • Updated physical parameters • Project definition • Purpose and need statement — why the project is being pursued. • Stakeholder input — administrative record of key stakeholders, partners, agencies, and impacted populations
Refine Project Characteristics	• Future expansion and alternatives consideration • Capacity improvement needs • Social, environmental, and economic factors • Physical parameters • Project definition — project parameters, narrative descriptions of the key project work • Updated purpose and need statement • Stakeholder input

3.1.4 Use of Data and Technology to Improve Scoping Practices

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) mandated that DOTs comprehensively assess transportation data needs. In response, the Transportation Research Board (TRB) invited all standing committees to discuss transportation data needs. During a 2007 TRB-sponsored peer exchange, participants discussed how data can support transportation decision making. Examples from two states illustrate how data can be used before project implementation to support scoping and inform the public. Planners and project engineers at the Minnesota DOT leveraged a database of project information to improve awareness of potential challenges and facilitate a well-informed scoping process. DOT staff in New Mexico relied on a roadway information database to provide real-time information on traffic and the roadway's physical conditions, which supported efforts to prepare early cost estimates (Schofer 2007).

Many agencies depend on software solutions and historical data to guide decision making during scoping. An early example comes from the South Carolina DOT, which in 1987 implemented a Preconstruction Project Management System (PPMS) to mitigate complexities associated with handling projects, activities, personnel, and funding (ASSHTO 2003). The agency adopted a Primavera-based scheduling system in 2002, which helped with scheduling preconstruction activities statewide. Similarly, the New Jersey DOT implemented Primavera to track the schedule and budget of every design and construction project.

Nationwide, DOTs are making it a priority to shorten project timelines and deliver projects on budget. Spending more time on preconstruction activities like scoping leads to better outcomes. Agencies can strengthen scoping by establishing multidisciplinary scoping teams that include planners, involving the public and stakeholders early on, and implementing scoping guidance.

3.2 Interviews with State Departments of Transportation

The research team reviewed scoping processes at five peer DOTs (Minnesota, North Carolina, Ohio, Utah, and Virginia). KYTC also offered valuable insights into current best practices. The review began with guidance and resources available online. Appendix B includes a table that summarizes information gathered during our review. This includes:

• An initial summary of who in the organization identifies projects

- System(s) used to collect project requests
- Data included in the project request system(s)
- Types of system(s) used to rate/rank projects
- Types of data developed or considered in the rating/ranking system(s)

To better understand scoping processes, a list of follow-up questions were submitted to agency representatives prior to holding online meetings in July and August 2021. Twenty representatives participated in the meetings, providing important details on current scoping efforts, recent improvements, and future goals. Peer states generally agreed that a well-scoped highway project is more likely to meet expectations and remain on time and on budget, which remain key concerns for KYTC. Appendix B contains interview meeting minutes and the initial questions submitted to agency representatives. Meeting minutes are organized according to the initial list of follow-up questions, based on two general categories:

1. Cabinet or DOT, including:
   - Cabinet/DOT Organization Breakdown
   - Preconstruction Organization
   - Project Management Manual Availability
   - Scoping Guidance Documentation
2. Initial Scoping for Highway Project Initiation, including:
   - Decision Makers
   - Timeline and Extent of Preliminary Investigation
   - Level of Design Development
   - Scoping Report Documentation
   - Accuracy of the Initial Scoping Process
   - Tracking of Scoping through Project Development

3.3 KYTC Brainstorming Workshop
The team organized and led a brainstorming workshop for KYTC staff in November 2020. During this session, they examined current scoping processes and potential improvements for different project scales (minor, intermediate, major) and project types: 1) Safety, 2) Maintenance & Operations, 3) Asset Management (Bridges/ Pavement), and 4) Capital Projects. Invitees included key leaders from KYTC Divisions and Districts and FHWA. Appendix C includes preliminary materials gathered for discussion during the session (e.g., existing process maps for scoping).

Some project types (e.g., Capital Projects) have been long established within KYTC. Others are more recent initiatives (e.g., Highway Safety Improvement Program [HSIP]). This resulted in individual brainstorming sessions varying in their range of activities and accomplishments. For well-established project types (e.g., Capital Projects), participants did not spend much time documenting the process and could transition quickly into developing improvement ideas and strategies. For newer programs, a lot of time was spent developing process maps. In the case of HSIP, participants dedicated considerable effort to creating process maps for the different project categories (from low scoping effort to medium-high scoping effort). Ideas and strategies developed during the session spurred development of best practices and recommendations included in Chapter 4. Appendix D includes meeting summaries or notes for brainstorming sessions by project type.

Chapter 4 Highway Project Scoping Best Practices and Recommendations

4.1 Method for Ranking the Utility of Scoping Practices

Through our investigation, the research team documented and organized highway project scoping practices. They gave a title to each practice and summarized background information, the goal(s), KYTC implementation strategies, and references to source material. Many of the best practices naturally fell into the project types (i.e., (1) Safety/HSIP, (2) Asset Management, and (3) Maintenance). However, practices for Capital Improvement Projects seemed to have a more universal application across project types. As such, the Capital Improvement group was eliminated and in its place was created a *General* project type. Ideas listed under *General Best Practices* can be applied to most project types.

Based on conversations with KYTC staff, the literature review, and conversations with DOTs, a qualitative ranking methodology was devised to evaluate the value of each practice and effort required for implementation. Table 4.1 defines our approach to each metric.

Table 4.1 Qualitative Ranking Methodology

Metric	Definition
Implementation Value Ranking: 5 – High Value 4 – Moderately High Value 3 – Medium Value 2 – Moderately Low Value 1 – Low Value	A multi-dimensional parameter evaluated based on each practice's ability to accomplish the following: • Keep projects on schedule and on budget • Promote greater statewide collaboration among Districts, the Central Office, and SMEs on planning and scoping • Improve the consistency and accuracy of scopes • Enhance scoping knowledge and capabilities • Improve the overall highway system
Implementation Effort Ranking: 5 – High Effort 4 – Moderately High Effort 3 – Medium Effort 2 – Moderately Low Effort 1 – Low Effort	For each best practice an implementation ranking is assigned based on the following factors: • Development time (production hours) and availability of staffing needed to implement change • Financial cost • Impact on staff (e.g., learning curve temporarily reduces productivity) • Magnitude of process changes and resistance to change • Political factors

The ranking was used to create a list of highway project scoping best practices and recommendations. In addition to cataloging best practices by project type, they were grouped into the following categories: 1) Human Resource-Focused Practices, 2) Programmatic Changes, 3) Project-Level Improvements, and 4) Secondary Best Practices. The first three describe the focus area of the recommendations. Secondary Best Practices are supportive actions which will help administer the other best practices. The next four sections provide an overview of KYTC Scoping Best Practices and Recommendations.

4.1 General Best Practices

4.1.1 Strengthen Commitment to Robust Scoping and Lengthen Early Project Stages*

Background
Often project estimates and schedules in the *Six-Year Highway Plan* (*SYP*) are created early in project development, when projects are not well defined and further study is needed to refine initial scopes. Without continual planning and scoping refinement, projects can go over budget or off schedule. This situation can be avoided by waiting until a project has advanced through Preliminary Engineering and Environmental to program its costs and schedules in the *SYP*. At this point, an alternative can be selected and environmental approvals obtained.

Goal
Increasing KYTC's focus on accurate planning and scoping helps prevent projects from going over budget or being delayed. Extending the duration of early project stages will facilitate the development of more accurate scopes and better-defined projects, help PDTs determine the purpose and need, enable preparation of realistic costs and schedules for *SYP* projects, and improve fiscal and program management. Scoping timeframes should remain flexible and tailored to project needs, but scoping should be completed prior to the start of detailed design. Project costs should not be programmed until Preliminary Engineering and Environmental are complete.

Implementation Strategies
- Create distinct chapters in the *SYP* for (a) projects in the Planning and Scoping phases and (b) projects in the Final Design and ROW phases.
- To distinguish projects in the Planning or Scoping phases in the *SYP*, list projects with only Planning phase information shown. Omit information on DRUC phases until an alternative is selected and environmental approvals are received. This strategy can be adopted with or without distinct *SYP* chapters.
- Create a project delivery schedule (Gantt chart) for programmed projects in the Final Design stage. Use the schedule to coordinate with Cabinet SMEs and consultants and schedule human resources.

References
Minnesota DOT Interview
Utah DOT Interview
KYTC Brainstorming Session
KYTC Project Scoping Task Force Report
Chowdhury, et al.
Haidary et al.
Miller and Lantz
Anderson et al.

*Selected as a Top Practice
Category: Programmatic Changes

4.1.2 Ramp Up Project Development Activities During Scoping*
(Alternative to Strengthen Commitment to Robust Scoping and Lengthen Early Project Stages)

Background
Initial scoping studies are often done quickly, at a point when the project definition remains uncertain (i.e., project maturity of 0 to 5%). Despite uncertainties associated with these studies, they are often used to program projects in the *SYP*. As project development moves forward, projects are routinely scoped with inadequate estimates for schedules and construction funding. KYTC wants to implement a more comprehensive scope, schedule, and

estimation process from the outset of projects that can better handle unknowns that emerge during project development.

Goal

Completing more project development activities during scoping helps to clarify the purpose and need and progress toward a more mature project definition. Advancing project development and scoping in tandem will increase the accuracy of programmed costs. Scoping timeframes should remain flexible and tailored to project needs, but scoping should be completed prior to the start of detailed design.

Implementation Strategies

- Carry initial scoping efforts through to a project maturity of 10 – 15% or greater.
- Conduct early planning and scoping before projects are programmed in the *SYP*.
- Set aside funding that District Offices and the Central Office can use for pre-scoping and initial scoping activities.
- Establish a statewide consultant on-call contract for pre-scoping and initial scoping activities.
- Create discipline-specific scoping worksheets for risk identification. Require SMEs to fill out these worksheets. North Carolina performs Express Design Evaluations before projects are prioritized. Goals of the Express Design phase include (a) confirming the intended purpose and need, (b) pinpointing previously unidentified risks, and (c) identifying opportunities to integrate Transportation Systems Management and Operations (TSMO) or complete street elements (where desired).

References
Utah DOT Interview
KYTC Project Scoping Task Force Report
Chowdhury, et al.
Haidary et al.
Miller and Lantz
Anderson et al.
Ohio DOT Interview
Virginia DOT interview

*Selected as a Top Practice
Category: Programmatic Changes

4.1.3 Increase the Number of Project Managers*

Background

KYTC does not have enough project managers (PM) to oversee active projects. As a result, PMs have too many projects to manage. Rather than managing project details, including scoping, they function as portfolio managers who supervise projects at a high level. The Cabinet has no job series for PMs. Employees are given project management responsibilities as one of their many work assignments. Often, these staff are classified as engineers. Currently, Cabinet PMs are responsible for the project from the end of planning to the construction letting.

Goal

PMs can deepen their focus on individual projects when they have responsibility for fewer projects. Giving PMs responsibility for the entire project — from planning through construction — helps ensure compliance with the approved scope.

Implementation Strategies

- Establish a job classification series for PMs.

- Have PMs oversee projects from planning through construction. Construction Managers will remain necessary for contract management and QA /QC.
- Establish an Office or Division of Project Management. Assign PMs to the Central Office but place them in Districts.
- Retain project management consultants for projects that are large or which have aggressive timelines.

References
Utah DOT interview
Chowdhury et.al.
Virginia DOT interview

*Selected as a Top Practice
Category: Human Resource-Focused Practices

4.1.4 Multidisciplinary Coordination and Risk-Based Scoping*

Background
Often, initial scoping is completed without the input of a multidisciplinary team. When a multidisciplinary group of SMEs does not help develop the scope, critical project items are missed or not addressed properly. This may delay or increase the cost of project development.

Goal
Using multidisciplinary teams for scoping enables better risk identification and improved estimates of the amount of time and expense required to address risks. Adopting a multidisciplinary approach to scoping and dedicating more resources to projects during their early stages also strengthens the ties between scoping and other facets of project development. More clearly defining project attributes, risks, schedules, and cost estimates improves project delivery and program predictability.

Implementation Strategies
- Hold a pre-planning conference to help define the project, identify needed experts, and begin developing the purpose and need.
- Ask SMEs to identify issues that could impact the scope. Use their findings when estimating project costs and schedules.
- Have the PM or PDT create or help prepare the scope and related documentation. The PDT should have SMEs knowledgeable on topics relevant to the project. *When preparing scoping documentation, clearly state what the purpose and need covers and what it does not cover*.
- Retain consultants where necessary for planning and scoping. Involve construction experts in scoping to address constructability issues.
- Develop risk analyses for more complex projects. Identify potential challenges and determine appropriate time and money contingencies.
- Attend to the requests/requirements of the public and other stakeholders.
- Include roadway and structure designers on the planning team for planning and scoping studies. Incorporate design-focused comments into planning documents and project records.

References
Minnesota DOT Interview
Utah DOT Interview
KYTC Brainstorming Session
Haidary et al.
Miller and Lantz
Anderson et al.

Ohio DOT Interview

*Selected as a Top Practice
Category: Project-Level Improvements

4.1.5 Cross-Program Coordination and Collaboration*

Background
A program includes all projects of a given type. This study examined four KYTC project types:

- Asset Management
- Capital Improvements
- Highway Safety
- Maintenance & Operations

A Program Manager plans and leads program implementation. Projects within a given program have different sources of funding and portfolios (e.g., regional areas like the KYTC Districts), foci (e.g., bridge replacements), and delivery methods (e.g., design-bid-build).

When multiple projects are planned for the same locations, Program Managers should coordinate to combine them into a single project to take advantage of efficiencies in engineering and construction contracting. For instance, if a major structure is being replaced, nearby bridges on the planned detour route(s) may require rehabilitation. Similarly, if a capital project will preclude asset management for several years, assets may have to undergo preservation or minor rehabilitation earlier than recommended. This avoids having to perform expensive asset management projects immediately after the capital project.

Goal
High-level programmatic coordination lets KYTC leverage economies of scale and use the same engineering resources on combined projects. Program Managers can work together to identify opportunities across project types, or expedite completion of one type of project when other projects may interfere with recommended scheduling.

Implementation Strategies
- Develop a scalable scoping process that can be tailored to different project contexts and types.
- Set aside time at quarterly District Project Development Status Meetings for Program Manager updates. Identify opportunities for collaboration. Hold regular meetings that bring together different Central Office program areas to coordinate project timelines.
    - Improve the agencywide visibility of asset management needs through GIS or a similar platform.
- Alternative to setting aside time for Program Manager updates at District Project Development Status Meetings:
    - Increase programmatic oversight by establishing a committee that reviews connections between all project types. The committee could function like a commission (similar to how some DOTs are governed) and help coordinate activities of various programs.
- Bolster programmatic oversight by adding a milestone at the end of scoping that requires signature authority on scoping documents (like the Design Executive Summary Process).
- Review capital and safety programs for upcoming *SYP* projects that could incorporate asset management needs.

References
Minnesota DOT Interview
Utah DOT Interview

KYTC Brainstorming Session
KYTC Project Scoping Task Force Report
Anderson et al.
Ohio DOT Interview
North Carolina DOT Interview
KYTC Transportation Asset Management Plan

*Selected as a Top Practice
Category: Human Resource-Focused Practices

4.1.6 Formalize Scalable Scoping Processes**

Background
Different KYTC project areas use different scoping processes, and the content of scoping guidance varies between project types. Decisions and commitments made during scoping are not documented or inconsistently documented.

Goal
A scalable, consistent scoping process applicable to all project types improves scope quality and accuracy and results in better schedules, estimates, and other work products.

Implementation Strategies
- Formalize and document scalable scoping processes. For the early stages of project development, customize standard-format documents based on project type and size.
- Develop project initiation packets which contain standardized forms that walk multidisciplinary teams through the scoping process and required documentation.

References
Minnesota DOT Interview
Utah DOT Interview
Miller and Lantz
Anderson et al.
Ohio DOT Interview
Virginia DOT Interview
North Carolina DOT interview

**Selected as a Secondary Best Practice

4.1.7 Document and Catalogue Initial Scoping Concepts**

Background
Initial scoping occurs at the request of different stakeholders (e.g., KYTC employees, legislators, Area Development Districts, MPOs). Documentation of initial scoping is often limited, incomplete, or unavailable.

Goal
Documenting initial concepts and storing materials in a centralized repository provides open, permanent access to scoping information. Documentation should describe in precise language project characteristics and activities as well as record estimates and their underlying assumptions. Readers should be able to understand what was and was not included in a project.

Implementation Strategies

- Scope all projects.
- Establish a process that lets PMs nominate a project and locks in the scope, cost, and schedule. Nominations can be submitted upon receiving the environmental approval or after initial scoping.
- Document information for all projects in CHAF reports, the PD&P-PreCon Database, and AASHTOWare Estimation. Planning and scoping efforts should explicitly define what problems a project is solving.
    - The level of scoping should be commensurate with the proposed work. Develop alternate standard forms and documentation to address projects with different levels of complexity.
- On capital improvement projects, hold a cross-functional project team review in the scoping phase.
- For complex projects that demand a more thorough preliminary investigation, initial concept documentation should record major decisions and salient project information. Perform a risk analysis when scoping more complex projects.
    - Use the Scoping Report process during early stages of project development to simplify coordination with resource agencies. Classify projects as: (a) unlikely to impact the human / natural environment; (b) likely to impact the human / natural environment; or (c) having unclear environmental impacts.
- For non-traditional projects, add fields to CHAF reports for data capture and develop guidance on minimum requirements.

References
Minnesota DOT interview
Utah DOT interview
KYTC Project Scoping Task Force Report
Chowdhury et al.
Haidary et al.
Miller and Lantz
Anderson et al.
Ohio DOT Interview
Virginia DOT Interview
North Carolina DOT Interview

**Selected as a Secondary Best Practice

4.1.8 Develop Scoping Tools, Training, and Guidance**

Background
KYTC lacks comprehensive scoping guidance. Most staff learn how to scope projects through on-the-job training, or complete scoping as best they can. Scoping processes vary between areas within KYTC.

Goal
Creating scoping tools, developing formal trainings, and publishing scoping guidance can give PMs the knowledge and skills needed to prepare scopes that are higher quality, more consistent, and more accurate.

Implementation Strategies

- Implement AASHTOWare statewide for project estimates and documentation. Link AASHTOWare Estimation to PDP-PreCon to capture and transmit scoping information throughout project development.
- Prepare guidance to facilitate consistent scoping methods across KYTC. This guidance can be included in KYTC's *Project Management Guidebook* (under development).
- Add a module to KYTC's Project Manager's Boot Camp that reviews the goals and expectations of scoping.

References
Minnesota DOT Interview
Utah DOT Interview
Miller and Lantz
Anderson et al.
Ohio DOT Interview
Virginia DOT Interview
North Carolina DOT Interview

**Selected as a Secondary Best Practice

4.1.9 Early Confirmation of Purpose and Need**

Background
Scope creep is the most common reason for costs increasing or projects falling behind schedule. Often scope creep occurs because the Purpose and Need evolves or expands beyond the project's original intent.

Goal
Approving the purpose and need early in project development will focus project development activities, tighten coordination between planning and scoping, and promote solutions that align with the original intent (including schedule and budget).

Implementation Strategies
- Clearly distinguish between problem-identification activities and scoping. Scoping answers questions raised during planning.
- Require that the purpose and need remain unchanged unless KYTC leadership approves a modification.

References
Utah DOT Interview
Miller and Lantz
Anderson et al.
Virginia DOT Interview

**Selected as a Secondary Best Practice

4.1.10 Scoping and Project Delivery Performance Measures*

Background
KYTC must deliver successful projects to fulfill its mission. A successful project addresses the defined scope with quality solutions and deliverables on schedule and within the budget specified in the *SYP*. KYTC wants to use a strong project management business model, assigning PMs responsibility for project performance. ODOT uses a similar model that tracks performance measures for each District, including lettings, roadway safety performance, and project scope schedule and budget.

Goal
Developing performance measures for scoping and project delivery will confer greater importance to the scope and to delivering projects on schedule and within budget. Giving PMs information on performance measures can help them identify best practices, areas that can be improved, and underfunded project elements. However, care

should be taken to ensure performance measures increase the exactitude of scoping on the front end, rather than restrict project development staff to a poorly defined scope on the back end.

Implementation Strategies
- Develop and apply performance measures based on project type and complexity. Potential metrics: performance per dollar spent, whether the project achieved its goals, number/magnitude of budget changes from conception through construction, and results of the scoping process used in project development. Publish performance measures on a publicly accessible dashboard.
- Begin measuring project schedules and costs when projects enter the Final Design and ROW Phases.

References
Utah DOT Interview
Anderson et al.
Ohio DOT Interview
Virginia DOT Interview

*Selected as a Top Practice
Category: Project-Level Improvements

4.1.11 Scoring of Project Alternatives*

Background
As projects advance through Preliminary Engineering and Environmental, different alternatives are studied. Alternatives are evaluated based on environmental, economic, and engineering factors as well as public input. An alternative is then selected, and environmental approvals obtained. While economic factors are considered, there is no programmatic comparison between projects to determine if expenditures of a single project help KYTC meet its systemic goals. For some projects, KYTC may be justified in selecting a lower-cost option and applying the savings to a different project.

Goal
Implementing an objective scoring process for evaluating alternatives can improve fiscal and program management. Any scoring process should account for a project's cost and anticipated performance within the context of the larger highway system.

Implementation Strategies
- Establish a scoring process the PM and PDT can use to recommend alternatives for the *SYP* (e.g., the Virginia DOT's Smart Scale system).

References
Virginia DOT Interview

*Selected as a Top Practice
Category: Project-Level Improvements

4.1.12 Increase Human Resources for Project Scoping*

Goal
Allocate more human resources to planning and scoping.

Implementation Strategies
- Hire additional in-house staff and/or reallocate current staff to carry out planning and scoping.

- Outsource planning and scoping. Ensure adequate funding is set aside to hire consultants.
- Assign responsibility for project scoping quality control to Location Engineers.

*Selected as a Top Practice
Category: Human Resource-Focused Practices

4.2 HSIP Projects

4.2.1 Coordinate HSIP and Maintenance Project Timelines

Background
HSIP personnel joined Resurfacing meetings for the first time in 2020. Previously, coordination had been informal. The groups were able to coordinate project timelines for at least one project in every District, reducing costs for maintenance of traffic and other items. With the HSIP staff attending the meetings, the team could adjust priorities to align project timelines.

Goal
Increasing coordination among project types for programmatic timelines will reduce costs for maintenance of traffic and possibly delays to the public.

Implementation Strategies
- Develop a schedule for key coordination points (e.g., one meeting per quarter) so that project personnel can discuss and adjust project timelines.
- Identify opportunities to implement HSIP safety improvements on resurfacing projects (e.g., shoulders, ditching, signing, culvert clean out).
- Explore using GIS location resources to coordinate projects.
- Supplement resurfacing funds with HSIP dollars to carry out these extra improvements.

References
KYTC Transportation Asset Management Plan

4.2.2 Develop a Ranking System for Prioritizing HSIP Intersection Emphasis Projects

Background
HSIP Intersection Emphasis projects have typically been programmed and prioritized based on District-level knowledge of the local system. In some cases, the Traffic, Design, and Planning sections participate. Ranking Intersection Emphasis projects will bolster communication between the Districts and Central Office on problematic intersections. The ranking system could adopt a hybrid format, coupling the worst-first concept and a District balance to have the most positive impact on the public.

Goal
Increased coordination between the Districts and Central Office will identify priority intersection projects and improve traveler safety.

Implementation Strategies
- Coordinate discussions with the project development team, as well as integration with CHAF projects, where issues may already be identified.
- Evaluate the costs and safety benefits of using Crash Modification Factors.
- Consider other impacts, like utilities, that can require expensive relocations (e.g., gas lines, water).

References
KYTC Brainstorming Session

4.2.3 Expand HSIP Project Management Practices to Other KYTC Programs

Background

HSIP personnel typically manage projects and scopes while adhering to performance measures and working within budgeted funds. This model is used to some extent by Pavement Design and Maintenance. ODOT uses a similar model that tracks performance measures for each District, including lettings, roadway safety performance, and project scope schedule and budget.

Goal

Giving PMs information on performance measures can help them identify best practices, areas that can be improved, and underfunded project elements.

Implementation Strategies

- Survey or interview key project implementation personnel to collect insights and ideas on how performance measures can be used for different project types.
- Develop a standard set of performance measures for each project type.

References

KYTC Brainstorming Session
Ohio DOT Interview

4.2.4 Identify Additional Funding Source for Scoping HSIP Projects

Background

KYTC typically uses State Planning and Research (SPR) funds to scope HSIP projects. Another way to fund scoping is with HSIP dollars, which is a practice UDOT adopts. At UDOT, projects start with a Concept Report when a project is 0-2% complete. Concept Reports include a cost estimate based on 10-20% of the pay items. While environmental work may or may not be complete, there is enough information to ask the Commission to fund it. Project scoping begins after a project is funded.

Goal

Allocate HSIP dollars for scoping HSIP projects. This will enable more complete scoping at the project outset and reduce future changes.

Implementation Strategies

- Establish annual goals for HSIP project implementation and set aside scoping funds to cover project goals.
- Develop a standard set of scoping documents for each type of HSIP improvement.

References

Utah DOT Interview

4.2.5 Develop Consistent Strategies for the HSIP Roadway Departure Emphasis Program

Background

Roadway Departure Corridors, Shoulder Widening, Horizontal Alignment Signing, and National Highway System End Treatments are all being considered under a Roadway Departure Emphasis program. Roadway Departure Emphasis improvements, including their priorities and preliminary costs, are being studied by nine (9) consultants in all 12 KYTC Districts. Emphasis area studies focus on crash data review, GIS analysis, and virtual review (i.e., Photolog, StreetView) to identify locations where crashes may be reduced by improvement projects. Once the studies are complete, the Central Office will work with Districts to implement projects.

Goal

Develop standards, methodologies, and long-term funding strategies for Roadway Departure Emphasis Program assessments so that studies generate results in each District that are complete and consistent.

Implementation Strategies
- Develop standard methodologies for Districtwide studies to ensure consultants follow consistent processes.
- Pair field review with virtual evaluation for more comprehensive assessment in each District.
- Identify long-term funding sources for Districtwide studies, including Statewide Planning Contract funds and other sources.

References
KYTC Brainstorming Session

4.3 Asset Management Projects

4.3.1 Improve Preliminary Scoping for Pavement Rehabilitation Projects

Background
KYTC's Pavement Management staff collect pavement surface data and conduct visual surveys to determine recommended treatments. Interstate and parkway data are collected annually, while data are collected every three years on state primary and state secondary routes. This data collection strategy helps KYTC prioritize resurfacing and preventive maintenance projects. But it is inadequate to detect underlying substructure issues that may require significant rehabilitation. Consequently, some pavement projects do not adequately address these underlying conditions. Failing to accurately identify project needs can lead to rapidly escalating project costs.

Forensic analysis of the pavement substructure is carried out during the pavement design phase. This lets KYTC detect unforeseen pavement needs that require more substantial remediation and identify opportunities to use a more economical but sufficient treatment. Since these data are not collected until a project is prepared for contract, significant changes in the programmed budget are sometimes required. To avoid exceeding limitations on the asset management program's budget, projects with escalating costs are often delayed until sufficient funding is available.

Goal
Improve substructure pavement analysis to identify rehabilitation needs when a project is programmed in the *SYP*.

Implementation Strategies
- Identify pavement conditions and project types most likely to result in underestimated costs.
- Determine analytical methods to preliminarily categorize pavement needs.
- Complete a preliminary forensic analysis of pavements prior to programming.
- Perform in-depth analysis as needed during the pavement design phase.

References
KYTC Brainstorming Session

4.3.2 Reassess Prioritization of Asset Management Projects Requiring Significant Scope Changes

Background
Sometimes the original project scopes for delayed asset management projects need to be updated because assets deteriorate over time. Deterioration can render the original scope obsolete. Updating a project scope can increase costs, as can inflation experienced during the delay. If a minor rehabilitation project is delayed, the asset may deteriorate to the point that a major rehabilitation is required, potentially doubling or tripling project costs.

Higher individual project costs adversely impact the asset management program by reducing the number of projects that can be tackled within the program's budget. Efficient use of asset management funding requires that each project's scope be constrained so it precisely addresses the project purpose defined as by asset management staff. If the project purpose is modified in response to delays or unforeseen deterioration, the project must be reprioritized by asset management staff based on how it will impact the asset management program.

Goal
Ensure asset management project scopes align precisely with the original project purpose. This will facilitate delivery of the overall asset management program.

Implementation Strategies
- Use KYTC's Enhanced Bridge Prioritization and Enhanced Pavement Prioritization processes to assess the criticality of individual projects based on current asset condition.
- If the original scope is no longer viable, asset management staff must reassess and reprioritize the project based on current program needs.

References
KYTC Brainstorming Session
KYTC Transportation Asset Management Plan

4.3.3 Strengthen Cross-Project Coordination

Background
When scoping an asset management project, a recommended practice is identifying opportunities for coordination with upcoming projects of all types (e.g., mobility, safety, maintenance). As noted in the section on general scoping practices, this approach to scoping benefits all project types — not just asset management projects. Often, cross-program needs can be met by carrying out activities unrelated to the primary project type and should be considered whenever possible.

It is sometimes important evaluate asset management needs that will arise in response to an upcoming project. For instance, if a major structure is being replaced, nearby bridges on the planned detour route(s) may need to be rehabilitated. Similarly, if a capital project will preclude asset management for several years, assets may have to undergo preservation or minor rehabilitation earlier than recommended. This avoids having to perform expensive asset management projects immediately after the capital project.

Goal
Expedite completion of asset management projects when other projects may interfere with recommended scheduling.

Implementation Strategies
- Improve the agencywide visibility of asset management needs through GIS or a similar platform.
- Identify asset management project types best suited to cross-project coordination. Generate lists each year that all program areas can review.
- Review capital and safety programs for upcoming *SYP* projects that could incorporate asset management needs.

References
KYTC Brainstorming Session
KYTC Transportation Asset Management Plan

4.3.4 District-Level Reviews for Planned Bridge and Pavement Projects

Background
KYTC's Bridge Management and Pavement Management software programs process bridge inspection and pavement evaluation data to identify corrective treatments for deficiencies in asset condition and prioritize rehabilitation projects. But discerning local contingencies from these systems is challenging. Project planning must account for conflicts with nearby infrastructure projects — both KYTC and non-KYTC — and local impacts due to a project's advancement or delay. These impacts should be addressed if doing so will not significantly hinder programmatic asset management goals.

Goal
Document how local impacts will influence asset management projects. Address impacts that will not significantly limit program goals.

Implementation Strategies
- Submit asset management needs to District personnel well in advance of project programming.
- Solicit feedback related to needs and impacts beyond asset management.
- Assess program-level budgetary constraints and incorporate additional work where feasible.
- If additional work is critical but not feasible with existing asset management funding, consider other funding sources.

References
KYTC Brainstorming Session
KYTC Transportation Asset Management Plan

4.4 Maintenance Projects

4.4.1 Solicit District Input on Resurfacing and Preventive Maintenance Projects

Background

Projects slated for inclusion in KYTC's annual FD05 resurfacing and preventive maintenance program are identified from visual inspection and automated distress evaluations conducted by the Pavement Management Branch in the Central Office Division of Maintenance. Pavements are prioritized based on a composite score — the Pavement Distress Index (PDI). Each year, Pavement Management staff prepare a prioritized list for each District based on anticipated funding levels. This list is shared with District PD&P staff to obtain input on local concerns such as conflicting highway plan projects, anticipated changes in traffic generators, safety considerations, or any issue that may be impacted by an upcoming project. Projects may be delayed, advanced, or modified based on this feedback.

Local input is also critical to identify potential issues that exceed the scope of a standard resurfacing project. Additional needs such as improved drainage, shoulder improvements, or other work require a different approach than can be accomplished through resurfacing alone. If these needs cannot be incorporated into the resurfacing project, a separate rehabilitation project may be necessary.

Goal

Incorporate District input on resurfacing and preventive maintenance projects to ensure they align with and address localized needs and contexts.

Implementation Strategies
- Continue annual District meetings to review the upcoming resurfacing program.
- Explore opportunities to expand District-level participation using hybrid or virtual meetings.
- Exclude projects from resurfacing and preventive maintenance whose needs go beyond the scope of those programs.

References
KYTC Brainstorming Session
SAC Member Interviews

4.4.2 Use Master Agreements to Define Scope and Expedite Repairs

Background

The loss of maintenance staff has increased KYTC's reliance on master agreements for highway maintenance activities. Master agreements are contracts which specify a type of work to be performed at a unit price established through a competitive bidding process. They do not explicitly state the exact location or quantity of work. Master agreements may be awarded for commodities (e.g., salt, aggregate) or for a specific work type (e.g., mowing, guardrail repair). These agreements include a defined scope based on the type of work covered and let the Cabinet quickly respond to urgent needs. Recently, KYTC has added several Districtwide master agreements for bridge repairs to address unforeseen needs.

Goal

Establish a mechanism to quickly address unforeseen needs through use of master agreements with a well-defined scope of work.

Implementation Strategies
- Identify opportunities for applying the master agreement concept to other maintenance activities.

- Review usage rates of existing master agreements to identify potential opportunities for improved scope definition. This may help increase their use.

References
KYTC Brainstorming Session
SAC Member Interviews

4.4.3 Consider TSMO Solutions Before Examining Other Options*

Background
Transportation Systems Management and Operations (TSMO) projects focus on operational improvements that maximize a highway network's efficiency without increasing its capacity. Examples of TSMO solutions include traffic signal coordination, improved access management, and reversible lanes. These solutions can sometimes address highway corridor capacity demands more quickly, economically, and with less impact to the environment than alternative methods. In cases where a TSMO solution cannot meet all capacity needs, it may be combined with increased capacity in a way that reduces the level of effort and expense.

Goal
Reduce costs, time, and impacts of major capacity improvement projects by first considering TSMO solutions that can meet or mitigate the identified need.

Implementation Strategies
- Place consultant requirements for TSMO solutions in RFPs.
- Develop TSMO training opportunities for KYTC staff and consultants.
- Proactively identify TSMO options before congestion issues reach critical levels.
- Create a standalone TSMO program tasked with evaluating projects and identifying potential solutions.

References
KYTC Brainstorming Session
SAC Member Interviews

*Selected as a Top Practice
Category: Project-Level Improvements

Chapter 5 Conclusions

This project sought to (1) examine and document highway project scoping processes among peer states and (2) develop project scoping guidance for KYTC. A well-scoped highway project is more likely to meet expectations, timeline, and budget, which remain key concerns for the Cabinet.

The literature review, analysis of peer state scoping processes, and KYTC brainstorming workshop unveiled valuable insights to scoping. A consistent theme was that insufficient effort during the initial stages of project development is one of the main causes of projects not being adequately scoped. Not spending enough time on planning and scoping and having insufficient access to technical expertise adversely affect scope development. Problems arise when error-prone and inadequate scopes are used to set schedules and budgets. Unclear and inadequate scoping often leads to frequent scope changes, cost increases, and negatively impacts the quality of work. Therefore, our number one recommendation is that KYTC strengthen its commitment to robust scoping and lengthening early project stages.

Several other best practices and recommendations are documented in this report. Implementing these will require significant effort. KYTC's Office of Project Development is preparing to conduct a focus group that will evaluate the scoping recommendations presented in this report and the steps needed for their adoption. Members of this project's Study Advisory Committee and the research team will assist with implementing recommended scoping process improvements, including delivery of potential training, technical assistance, monitoring performance after launch, and troubleshooting implementation.

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Appendix A SYP Manage Project Status Day to Day Process Flow, Complete Preliminary Engineering Flowchart, and Planning Prioritization Process (Draft)

Appendix B Summary of Initial Scoping Activities by State

Questions for State Transportation Officials on Highway Project Scoping

Cabinet/DOT Organization
- Overview of how the Cabinet/DOT is organized (centralized, decentralized, hybrid)
    - How much of road system is managed by DOT versus local municipalities?
- How is Preconstruction organized (centralized, decentralized, hybrid)?
    - By discipline, project type, geographical area, or other?
    - Multiple preconstruction groups?
- Project Management Manual
    - Level of development? Last update?
    - Where in the project timeline does the Manual begin? Scoping guidelines included?
- Scoping Guidance Documentation
    - Level of development? Last update?
    - What phase(s) of the project timeline does the Scoping Guidance cover?

Initial Scoping for Highway Project Initiation
- Who is involved, who are the decision makers?
    - Is there a regular scoping team, how often do they meet?
- When developed, how developed, and the extent of preliminary investigation (utilities, survey, environmental, etc…)?
- What is the level of design development for the initial project scoping effort?
    - Does it vary based upon project type, size, funding source, etc.?
    - Does project type include design, safety, preservation, maintenance, other project categories?
- Scoping report/documentation
    - Is a formal detailed scoping report generated? What details are documented?
    - Is a scoping report produced for all projects or a select group?
    - Who endorses/approves the scoping document?
    - How is the scoping documentation filed and archived?
- What is the accuracy of the initial scoping process (cost and timing)?
    - Is training provided for scoping activities?
    - How often does the agency need to revise STIPs as projects move through the project timeline?
- Is project scoping revisited as the project proceeds through development?
    - Do you track how well projects meet the original scope, particularly budget?
    - What happens when a project scope changes significantly and what do you consider significant (i.e. >15% increase in cost)??

Summary of State Practices

System Used to Collect Project Requests	Data Included in Project Request System	System Used to Rate/Rank Projects	Rate/Rank Details
Utah's Unified Transportation Plan	Assumptions made based on Rate/Rank Details on Website: -Location and Milepoints -Functional Class -Current and Projected Future Traffic Volumes -Volume/Capacity Ratio -Truck Traffic -Benefit/Cost for Intersection/Interchange Projects -Crash/Safety Information	Decision Support System (DSS) - adds a project to the Statewide Transportation Improvement Program (STIP)	Projects are scored based on category: -Widening: AADT, Truck AADT, Functional Class, Existing V/C, Safety Index, Transportation Growth -New Facilities: AADT, Truck AADT, V/C Score, Improvement V/C Score -New Interchanges on Existing Facilities: Daily Ramp Traffic, Daily Vehicle Hours Saved, Benefit/Cost, Improved V/C, Distance to Adjacent Interchanges -Upgrade Existing Interchanges: Daily Ramp Traffic, Daily Vehicle Hours Saved, Benefit/Cost, Safety Index -Upgrade Existing At-Grade Intersections: Daily Traffic, Daily Vehicle Hours Saved, Benefit/Cost, Safety Index -Passing Lanes: AADT, Truck AADT, Safety Index, Primary Freight Network
Smart Scale Dashboard (System Management and Allocation of Resources for Transportation: Safety, Congestion, Accessibility, Land Use, Economic Development and Environment)	SMART SCALE project applications must include the following information: -Scope (define the limits of the project, its physical and operational characteristics, and physical and/or operational footprint) -Schedule (clearly define the expected process for further project development including key milestones, work activities, related activities, and approvals/approval timelines, phases, availability of funding) -Cost (the cost estimate should be as realistic as possible and should account for applicable risk and contingencies based on the size and complexity of the project. Projects should not be divided/segmented to the extent that they no longer have logical termini or independent utility. Cost estimates must be escalated to the anticipated start date for future phases). Pre-application coordination form includes the following information: Applicant Info and Contact, Project Title and Description, SmartScale Need Category, VTrans 2040 Need Addressed, VDOT District, Project Sketch, Project Features (New Lanes, Widening, Access Management, Intersection Improvement,	Smart Scale Prioritization System - adds a project to the Six-Year Improvement Program (SYIP)	Projects are scored on the degree to which they address the following: -Improvements to Safety -Congestion Reduction -Accessibility -Land Use -Economic Development -Environment After specialized programs, funding is distributed as follows: -45% for the State of Good Repair Program (SGR); -27.5% for the District Grant Program (DGP); and -27.5% for the High-Priority Projects Program (HPPP). Both the HPPP and the DGP are subject to SMART SCALE.

System Used to Collect Project Requests	Data Included in Project Request System	System Used to Rate/Rank Projects	Rate/Rank Details
	New Alignment, etc...), Bike/Ped Facilities, Transit/Rail Features, ROW, Economic Development, Planning Status, Design Method and Delivery, Cost Estimate and Schedule by Phase, Funding, Traffic Volumes by Segment, Other Supporting Documents.		
Comprehensive Transportation Plan (CTP) - information entered through NCDOT Connect Scoping Team Site	Project Scoping Process takes a CTP project, determines whether it moves on to SPOT, through 2 steps: 1) Express Design Evaluation - Data Collection, Environmental Features Map, Coordination with Key Agency Stakeholders, Conceptual Design Options and Quantities, Mapping Limits, Cost Estimates by Phase.	Strategic Transportation Initiative Prioritization Process (SPOT) - using the Strategic Mobility Formula	Projects are scored in 3 broad categories: -Division Needs (30% of funding): Project scores are based 50 percent on data and 50 percent on rankings by local planning organizations and the NCDOT transportation divisions. -Regional Impact (30% of funding): Projects on this level compete within 7 regions, made up of two NCDOT transportation divisions per region, with funding divided among the regions based on population. Data makes up 70 percent of the project scores in this category. Local rankings account for the remaining 30 percent. -Statewide Mobility (40% of funding): The project selection process is based 100 percent on data. Criteria are weighted differently for the 3 broad categories, including: Congestion (AADT, V/C), Benefit/Cost, Safety (Critical Crash Rate, Density, Severity, Safety Benefits, Frequency), Economic Competitiveness (Jobs, County Economy), Accessibility/Connectivity (County Economic Indicators, Mobility Improvements), Freight (Truck AADT, Truck Percentage, Future Interstate Completion), Multimodal, Lane Width (Existing vs. Standard), Paved Shoulder Width, Pavement Condition Rating
Highway Project Development Process (HPDP)	Did not find a general project idea form - here are two others: Early Notification Memorandum (this one seems earlier, but more like coordination with DNR), to include: Project Description, expected Environmental Documentation, Location Map, Photographs, List of Water Resources. One-page Project Summary (this one seems later, toward plan listing): Route, Location, MPs, Funding Information, Project Maps, Schedule, Project History, Benefits and Risks, Description, Cost Estimate, Design Completion, District Information, Project Manager.	MnDOT Project Selection Policy - adds a project to the CHIP (10 year) or STIP (4 year) plan	Projects are scored in 3 broad categories: -Asset Management, including pavements, bridges, culverts, non-motorized paths: scored based on wide-range of criteria -Targeted Safety Improvements: mostly selected through other plans, such as Highway Safety Improvement Program, Rail-Crossing, ITS, and other programs. Remaining projects are scored on Crash history, Benefit/Cost, AADT, Benefit to EJ populations. -Mobility and Capacity Expansion: mostly selected through other plans, such as Corridors of Commerce, MN Highway Freight Program, Transportation Economic Development Program. This is for any project that adds 1 lane-mile, adds new or improved interchange, requires an EA or EIS, or includes $10M or more in capacity. Remaining projects are scored on: Priority in Regional Plans and Studies, Asset Management, Benefit/Cost (for Twin Cities), or Travel Time Reliability, Safety/Crash Data, and System Role and Route Characteristics (Greater Minnesota).

System Used to Collect Project Requests	Data Included in Project Request System	System Used to Rate/Rank Projects	Rate/Rank Details
Scope and Fee (SAFe) System - used to document the Project Development Process (PDP)	There are five project paths, number 1 through 5, where 1 is a simple project and 4/5 is one of the most complicated projects. Each path advances through all five PDP phases: Planning, Preliminary Engineering, Environmental Engineering, Rinal Engineering ROW, and Construction. Based on PDP path designated for a project, standard task lists are generated for scoping. Project Initiation Package (PIP) is a template used to identify critical issues during project scoping. This helps define the path of the PDP and includes discipline-specific focus areas such as design, traffic/safety, geotechnical, environmental, right-of-way and utilities.	Transportation Review Advisory Council (TRAC) Scoring System	New capacity projects are scored in 3 categories: - Transportation Factors (55%), such as benefit/cost, air quality, intermodal connectivity, and balance between modes - Community Economic Growth and Development Factors (25%), such as local poverty and unemployment rates, land development and brownfield reclamation, business development, and investment and employment opportunities - Local and Private Investment Factors (20%), such as local and private investment, and the use of Federal earmarks. Need additional information for other funding categories (online resources limited).
Continuous Highway Analysis Framework (CHAF)	-Location (County, Route, Milepoints) -Map (tool in CHAF, cardinal direction selection, break points at county line, order of routes impacted) -Bridges (identified by CHAF) -Purpose and Need (complete and well-informed) -Cost Estimates by PDRUC (estimate source and improvement type selections available) -Project Characteristics (existing studies, access control, lane width, added lanes, median type, shoulder type, shoulder width, ROW, relocation) -Points of Interest the Project Supports (National Parks, State Parks, shopping centers, schools, historic sites, industries, monuments, public lands, military) -Amenities Included (shared use paths, park/ride lots, sidewalks, bicycle paths) -Socioeconomic Impacts (neighborhood/community cohesion, travel patterns, household relocations, elderly, disabled, non-drivers, minorities, low-income persons) -Environmental Concerns (historic properties, churches, blue line streams, wetlands, floodplain, cemeteries, wildlife management areas, public lands, endangered species, noise impacts, architectural sites, NR properties, parks) -Utilities (gas, sewer, telephone, power, cable, water, ITS)	Strategic Highway Investment Formula for Tomorrow (SHIFT) - adds a project to the Six-Year Highway Plan (6YP)	Projects are scored based on the following: -Safety -Asset Management -Congestion -Economic Growth -Benefit/Cost

System Used to Collect Project Requests	Data Included in Project Request System	System Used to Rate/Rank Projects	Rate/Rank Details
	-Attachments (example given is meeting summary) -Sponsorship (entered by ADDs, MPOs and KYTC District, planning determines how many projects each can sponsor)		

Best Practices for Highway Project Scoping
Minnesota DOT
August 12, 2020

Attendees
- Amber Dallman, Minnesota Department of Transportation, MnDOT
- Peter Harff, MnDOT
- Jennie Read, MnDOT
- Tom Styrbicki, MnDOT
- Stephen DeWitte, Kentucky Transportation Cabinet, KYTC
- Kevin Rust, KYTC
- Kevin Sandefur, KYTC
- Ken Sperry, KYTC
- Jeff Jasper, Kentucky Transportation Center, KTC
- Samantha Wright, KTC

Discussion Items
A peer state interview for the research titled, "Best Practices for Highway Project Scoping," was held with MnDOT on August 12, 2020, via Microsoft Teams. The KYTC attendees listed above are considered to be the study advisory committee (SAC) for the research project, providing guidance on the scoping definition, work plan, and outcomes of the study.

Jeff Jasper welcomed the attendees and asked for introductions. Jeff provided a brief overview of KYTC's scoping process, starting with the Six-Year Highway Plan (SYP) and the biennium budget, which often leads to more emphasis on the development of projects in the first two years of the SYP. Emphasis has been put more recently on attempting to distribute project dollars more widely, using practical solutions as a guide. Funding can be impacted by starts, stops, and phase dollars allocated in the legislature, even though KYTC provides original numbers on project costs.

The discussion portion of the meeting is summarized below, organized by the list of preliminary interview questions (underlined), which were shared with the MnDOT peers prior to the meeting.

Initial Scoping for Highway Project Initiation
- Who is involved, who are the decision makers?
  - Is there a regular scoping team, how often do they meet?

MnDOT starts with a 20-year plan, which is reduced to a 10-year plan (the Capital Highway Investment Plan or CHIP), and then to a 5-year plan, where projects get further developed.

At the District level, there are 3 types of projects at the 10-year horizon: public driven, expansion types, and core needs of pavement or bridges. As far as selecting projects, there are two approaches: 1) maintenance and materials people making lists and 2) a legislative scoring process. For the scoring process, different weights are put on different aspects, which may not give the full picture. For example, the scoring process does not consider anything else along the roadway or in the project area.
Once a project is in the CHIP with an assumed fix, data is collected until scoping starts in earnest. There is a cost estimated when it is identified in the CHIP, but we try to emphasize this is not a true cost until it is scoped.

Jeff asked how much central office is involved in decision making. MnDOT Districts have a fair amount of autonomy; however, if it is environmentally complex, the office of Public Engagement can get involved. There is a defined group called the Major Project Leadership Team (MPLT), who would hear from scoping teams and give approvals.

In the past, money was distributed to the Districts based on lane-miles and the Districts managed the projects as they saw fit. About 10 years ago, a portion of that was centralized to take care of bridges and also pavement and could be distributed by need. The recent effort for higher profile and larger projects is to have the MPLT balance priorities.

- When developed, how developed, and the extent of preliminary investigation (utilities, survey, environmental, etc…)?

The State Transportation Improvement Program (STIP) is a 4-year document; projects are scoped before entering into the STIP. Planners put together a Charter for projects within the 10-year CHIP window, including what the needs are that have driven the project so far. This is set up before scoping starts. If Year 0 is letting to construction, then scoping starts around Year 7 for larger projects, Year 6/5 for smaller projects. The budget is revised annually.

Jeff asked how in depth the alternatives might be evaluated before the project goes into the STIP. For something like pavement, the effort to consider alternatives is smaller, but at the appropriate level (i.e., taking cores, etc…). For something like a roundabout, a signal, or an interchange, there will be a lot more engineering that goes into it, as well as public engagement and environmental work.

MnDOT has a larger state budget than KYTC, so the federal portion is not as critical. The local FHWA has voiced concerns that the NEPA process is clouded by having an assumed fix and wants to be sure that NEPA is integrated into scoping.

Scoping takes a lot of resources, so knowing what budget is available allows MnDOT to not waste scoping efforts for projects that cannot be funded. Peter Harff has been working to update the scoping process; he shared his screen to show the new Scoping Process Overview:

1. Create Scoping Plan
2. Determine Purpose and Needs
3. Develop Evaluation Criteria and Alternatives
4. Analyze Alternatives
5. Make Decisions
6. Document Decisions and Plan Next Steps

Peter's new document is replacing an old 17-page guidance; the idea is to heavily train the District folks and lead Project Managers on the new process.

- What is the level of design development for the initial project scoping effort?
    - Does it vary based upon project type, size, funding source, etc.?
    - Does project type include design, safety, preservation, maintenance, other project categories?

For Step 6 in the newly developed scoping process, scoping responsibilities may be in-house or contracted to a consultant. If the project is large or complex, a consultant is hired to do the scoping. Within MnDOT, the Project Manager consults with the functional units (materials, hydraulics, maintenance, bridge, environmental, right-of-way, and construction), along with public engagement, when needed. The functional area folks do field visits to say what they think is involved, what should be included in the project, etc… The sponsor and the Project Manager then make the decision on what to include. This takes place on all projects; it just takes more time and people for the larger projects.

Peter shared his screen to show a number of activities under Step 6, which is intended to document the scope, the rationale for decisions, and the plan for next steps. Peter also shared a worksheet for preservation projects, which is used to keep track of activities during scoping.

- Scoping report/documentation
  - Is a formal detailed scoping report generated? What details are documented?
  - Is a scoping report produced for all projects or a select group?
  - Who endorses/approves the scoping document?
  - How is the scoping documentation filed and archived?

The new scoping process will be used, scaled to each project, including preservation projects, for anything we anticipate 4 years in advance. The new process will be used on any STIP set-asides, even a year in advance, and will include a very simple scope. Peter provided a full copy of the Scoping Process V-3.1 following the meeting for reference; following is a list of items to be resolved, in order for scoping to be considered complete, from page 13 of the guidance:

- *Construction Scope Items – specified in enough detail in order to prepare a cost estimate and schedule and to guide subsequent design efforts:*
  - *Geometric changes – alignment, profile, turn lanes, inslopes, etc.*
  - *Intersection Control modifications – signal, roundabout, RCUT*
  - *Roadway Structure – milling, reclaiming, recycling, grading, paving, aggregates, edge drains including mainline, shoulders, turn lanes, ramps, side roads, entrances*
  - *Bridge – for each bridge in limits: Work/No Work, Bridge Work Type, Accelerated Bridge Construction*
  - *Pedestrian Facilities – upgrade pedestrian ramps, driveway cross slopes, replace sidewalks, new sidewalks, widen shoulders, countdown timers, APS*
  - *Bicycle Facilities – sidepath/trails, bike lanes, wide shoulders*
  - *Transit Facilities – pullouts, shelters, pedestrian access to stops*
  - *Roadside Infrastructure*
    - *Access changes*
    - *Guardrail*
    - *Signing*
    - *Lighting*
    - *Fencing*
    - *Retaining walls*
    - *Noise walls*

- - ▪ *Blowing snow mitigation*
  - o *Drainage Improvements*
    - ▪ *Culvert repairs*
    - ▪ *Storm sewer repairs*
    - ▪ *Stormwater ponds*
  - o *Local infrastructure improvements (city utilities, other streets)*
  - o *Railroad work – approaches, bridges, shoo-fly*
- *Traffic Control and Detour*
- *Major utility moves*
- *Right of Way Acquisition – likely or not, approximate acres, major sites*
- *Work items considered, but not included in construction scope – explain why*
- *Cost effectiveness analyses*

- What is the accuracy of the initial scoping process (cost and timing)?
  - – Is training provided for scoping activities?
  - – How often does the agency need to revise STIPs as projects move through the project timeline?

Jeff asked if at Year 3 or 2, it is discovered that the proposed solution is inadequate, what do you do about this and funding as a Project Manager. The new guidance has a section for this, you want to be just as formal in your scope change process, as you are in the scoping process. Make sure to go back and do the initial steps of scoping.

- Is project scoping revisited as the project proceeds through development?
  - – Do you track how well projects meet the original scope, particularly budget?
  - – What happens when a project scope changes significantly and what do you consider significant (i.e. >15% increase in cost)?

Some discussion of this is included in the previous question.

Tom followed up with the following information for MnDOT:

- – 376 construction projects let during calendar years 2016-17
- – $1.8 billion in construction projects were developed for calendar years 2016-17 lettings
- – $21 billion in planned investments for state highways over the next 20 years
- – $195 million in contracts awarded to small businesses in FY2016-17
- – The 20-year Minnesota State Highway Investment Plan (MnSHIP) is updated every five years with the new release in January 2022
- – The 10-year Capital Highway Investment Plan and four year State Transportation Improvement Program (STIP) are updated every year
- – The program can be up to a billion dollars in the construction program, plus other legislative additions.

MEETING SUMMARY
Best Practices for Preliminary Project Scoping
North Carolina DOT
September 16, 2020

Attendees
- Terry Arellano, NCDOT (Long-Range Planning, Corridor Development Team)
- Teresa Bruton, NCDOT (Manager of the Design-Build Unit)
- Derrick Lewis, NCDOT (Head of Feasibility Studies Unit)
- Brenda Moore, NCDOT (State Roadway Design Engineer)
- Jason Schronce, NCDOT (Manager of Prioritization Office for Capital and Modernization Projects)
- Laura Sutton, NCDOT (Project Management)
- David Wasserman, NCDOT (Division of Planning and Programming, Western STIP Region)
- Derrick Weaver, NCDOT (Head of Environmental Policy Unit)
- Christopher Werner, NCDOT (Director of Technical Services for Programming Delivery)
- Stephen DeWitte, Kentucky Transportation Cabinet (KYTC)
- Kevin Rust, KYTC
- Kevin Sandefur, KYTC
- Ken Sperry, KYTC
- Samantha Wright, Kentucky Transportation Center (KTC)

Discussion Items
A peer state interview for the research titled, "Best Practices for Preliminary Project Scoping," was held with NCDOT on September 16, 2020, via Microsoft Teams. The KYTC attendees listed above are considered to be the study advisory committee (SAC) for the research project, providing guidance on the scoping definition, work plan, and outcomes of the study.

Kevin Sandefur welcomed the attendees and asked for introductions. Kevin provided a brief overview of the ongoing research project and the purpose of our meeting with the ODOT peers, including the preliminary questions shared with ODOT before the meeting. The discussion portion of the meeting is summarized below, organized by the list of preliminary interview questions (underlined).

Cabinet/DOT Organization
- Overview of how the Cabinet/DOT is organized (centralized, decentralized, hybrid)
  - How much of road system is managed by DOT versus local municipalities?

NCDOT operates and maintains 80,000 lane-miles of local, state and NHS roadways across the state. There are 14 Divisions across the state, including multiple counties, and districts within the Divisions. There are central technical units also located in Raleigh. Ten (10) years ago, there were about 13,000 employees, but this has been reduced to about 9,500.

- How is Preconstruction organized (centralized, decentralized, hybrid)?
  - By discipline, project type, geographical area, or other?
  - Multiple preconstruction groups?

NCDOT became partially decentralized for preconstruction a few years ago. The intent was to allow the Divisions to handle the smaller, less complex projects, and to be able to apply their local knowledge. In 2018, the formal Project Manager (PM) role was established; there are more project managers in the urban areas, with a total of about 100. The Divisions are managing about 70% of the projects and about 30% of the dollars; the rest are managed centrally, where the more complex projects are managed. A project manager at the lowest level would manage about 8-10 projects that are more straightforward. In the Project Management Unit (PMU), there is a senior PM that serves as

a mentor to the project managers, while managing 4-6 projects of their own. There is also a Team Lead, that is the next level up, and they might manage 1 or 2 major projects, with the assistance of the senior PMs.

The expectation for consultant usage has gone up over the past several decades, with about 70% of the work being outsourced to consultants now. Most NCDOT folks are managing the project, rather than doing the work. Project management focuses on communication and collaboration with the technical team, starting at STIP development.

The downsizing of staff levels was not the driving factor in launching the PM role in NCDOT. There could have been a program delivery issue in the past, with about 50% of projects requiring Environmental Assessments (EA) or Environmental Impact Statements (EIS). Since the Strategic Transportation Investment (STI) system was legislated, which helps prioritize projects through a data driven process, about 90-95% of projects are Categorical Exclusions (CE). This is because the STI system would be more likely to elevate a widening project over a new route for increased capacity, which would only require the lower level environmental study. STI was the primary source that KYTC built upon for the SHIFT, which also provides a boosting mechanism for local input.

NCDOT is working on continuing to improve the process, going all the way back to project inception, to consider the flow of information. This is to confirm and document why the DOT is doing the project and how the process would be built if time was not a variable. This falls under an Integrated Project Delivery culture change that is underway. The Process Delivery Framework will be the outcome of these efforts and the first version should be finished soon. There is an Integrated Project Delivery website for reference:
https://connect.ncdot.gov/projects/Integrated-Project-Delivery/Pages/default.aspx.

The PM is assigned at the STIP level, and prior to that, the Scoping Guidance Documentation is considered.

- Project Management Manual
  - Level of development? Last update?
  - Where in the project timeline does the Manual begin? Scoping guidelines included?

NCDOT is planning to roll out the Project Delivery Network (PDN) around the beginning of 2021. The goal is to keep PMs out of production and allow them to focus on managing the project from start to finish; steps for this will be documented in the PDN. The PM Guide will be a companion document for this and will include training modules for PM development.

- Scoping Guidance Documentation
  - Level of development? Last update?
  - What phase(s) of the project timeline does the Scoping Guidance cover?

NCDOT has redeveloped their project scoping process with what is called Express Design Evaluation and Project Scoping; Derrick Lewis shared the guidance document on his screen with the group. Before the NCDOT Planning and STIP Units, MPOs and RPOs, and the divisions submit projects for prioritization, the Express Design Evaluation should be completed. This is guidance for developing the project before it goes into prioritization, including scope, express design, environmental screening, stakeholder outreach, and cost estimating. If a project emerges from the prioritization process, as it enters the STIP, then a Project Scoping Report package is put together. The goal is to pass along all the information learned to date on the project to the project development team. The Express Design phase is also meant to confirm the purpose and need as intended by the project originator, along with identifying any risks that may not have been identified before, and opportunities to include complete street elements, where desired. Derrick shared a list of output items from the Express Design Evaluation and Project Scoping Report:

There is also an effort to use the Scoping Report process to simplify coordination with resource agencies, but identifying projects as one of three groups: 1) projects that are not likely to have impacts on the human and natural environment, 2) projects are likely to have impacts, and 3) projects that may or may not have impacts.

Most of the Express Design studies are contracted out to consultants, mostly through on-call task orders, based on the concept of effort related to an interchange design (i.e., a small roadway project might be a 0.5 effort). Consultants are then tasked with tracking effort and only spending what they need, with any remainder being returned to NCDOT. Some of these are funded with SPR funds, where the MPO or RPO might also contribute to the work, which keeps the scope under control. The bulk of the studies are funded by working with the STIP managers to get a slice of the Preliminary Engineering (PE) budget assigned to Scoping.

Initial Scoping for Highway Project Initiation
- Who is involved, who are the decision makers?
    - Is there a regular scoping team, how often do they meet?

The project scoping process involves the MPO, RPO, NCDOT Division staff, Central Planning staff and Central Specialized Units, including hydraulics, traffic, structures and rail, as needed. The Environmental Policy Unit will be coordinating with the team under the new process, but logical termini are confirmed prior to the prioritization process.

- When developed, how developed, and the extent of preliminary investigation (utilities, survey, environmental, etc…)?

- What is the level of design development for the initial project scoping effort?
  – Does it vary based upon project type, size, funding source, etc.?
  – Does project type include design, safety, preservation, maintenance, other project categories?
- Scoping report/documentation
  – Is a formal detailed scoping report generated? What details are documented?
  – Is a scoping report produced for all projects or a select group?
  – Who endorses/approves the scoping document?
  – How is the scoping documentation filed and archived?

Much of the discussion for these three bullet items is included under the Scoping Guidance documentation above.

- What is the accuracy of the initial scoping process (cost and timing)?
  – Is training provided for scoping activities?
  – How often does the agency need to revise STIPs as projects move through the project timeline?

NCDOT scoping processes are currently being updated and developed through the Project Scoping Report and Integrated Project Development initiatives. Training for NCDOT staff and Private Engineering Firm (PEF) partners will be developed and implemented as changes emerge.

If scope creep can be kept out of a project, the cost estimates have been pretty accurate; NCDOT considers within 10% to be reasonable for a large capital improvement project. Updated right-of-way and utility estimates seem to change the most.

Overall, cost estimates have increased over $3B dollars in the last year, which has caused a major reshuffle in the STIP. There are 14 central corridor development engineers assigned to the Divisions, who report to the central STIP Unit, and are currently looking at all the costs in the STIP to see if they are reasonable. If updates or increases are needed, this will be reported to the central STIP Unit by September 25th, 2020. A cost estimation tool was used for the 2016-2025 STIP; 85% of the projects in that STIP were new, with no previous work completed. Many of the costs generated through this process have increased exponentially, some due to scope creep and some due to the nuances in the cost estimation tool. For example, one project that used a 1993 right-of-way cost of $7.2M is now a $112M estimated cost.

For KYTC, a lot of the early estimates set the budget, while a lot of money has dried up. Funding resources have also shrunk, but inflation may not be as high as seen for NCDOT. NCDOT observes that some of the cost increases are due to scope definition or project vision that changes over the course of the project. NCDOT's new process is intended to circumvent this from happening in the future. If a project cost increases over $25M or 35% above the cost that was used to score the project, the project is flagged and will be reviewed by the STICKER (full name not defined) Committee. This committee will decide if such projects should be down-scoped or reprioritized in the next round.

NCDOT revises the STIP every two years, along with updating the costs. 25% of NCDOT's program is federally funded. There are about 20,000 miles managed by local municipalities.

The Virginia DOT activates their prioritization process later in the project development process, with the scope significantly nailed down at that point. NCDOT would like to have the goal of completing an Express Design on every project before prioritization, but it would take a change of mindset about reducing the number of projects that go into the prioritization process.

- Is project scoping revisited as the project proceeds through development?
  – Do you track how well projects meet the original scope, particularly budget?
  – What happens when a project scope changes significantly and what do you consider significant (i.e. >15% increase in cost)?

This item is discussed under the previous section.

Other discussion items included the following:
In Kentucky, there are maintenance and safety projects that use HSIP and pavement funds; does NCDOT go through the scoping process for these types of projects? This work would be localized at the Division level and do not go through the prioritization process, but can also experience cost estimate increases.

Through the Express Design process, NCDOT can help the local municipalities develop the vision for their projects, along with what the impacts and estimated cost may be. This is a service that many of the local agencies would not have the funds to do and has served to improve the relationships with NCDOT.

The Express Design process does not include public involvement, beyond coordination with the local agencies, who represent the needs of the public. It is assumed that projects submitted for prioritization have had public consideration through the Long-Range Planning process. For Feasibility Studies, it seems the public involvement process does not draw much attention early in the project, but can have a big impact if there is public dissent later in the project. NCDOT tries to let the MPOs and RPOs, who originate the project ideas, handle the management of public expectations for projects.

NCDOT likes for PMs to take a project all the way through construction, in order to maintain the intent and spirit of the project, and to share information with the construction team. This also allows the PM to take construction knowledge back to the project development process and to inform decisions on future projects.

NCDOT will follow up with a few report examples and notes after the meeting.

MEETING SUMMARY
Best Practices for Preliminary Project Scoping
Ohio DOT
September 11, 2020

Attendees
- David Holstein, Ohio Department of Transportation (ODOT)
- Susan Stehle, ODOT
- Stephen DeWitte, Kentucky Transportation Cabinet (KYTC)
- Kevin Rust, KYTC
- Kevin Sandefur, KYTC
- Jeff Jasper, Kentucky Transportation Center (KTC)
- Samantha Wright, KTC

Discussion Items
A peer state interview for the research titled, "Best Practices for Preliminary Project Scoping," was held with ODOT on September 11, 2020, via Microsoft Teams. The KYTC attendees listed above are considered to be the study advisory committee (SAC) for the research project, providing guidance on the scoping definition, work plan, and outcomes of the study.

Jeff Jasper welcomed the attendees and asked for introductions. Jeff provided a brief overview of KYTC's scoping process, starting with the Six-Year Highway Plan (SYP) and the biennium budget, which often leads to more emphasis on the development of projects in the first two years of the SYP. The SYP process was based on the premise of a gas tax increase about 20 years ago, but the tax did not pass, so the SYP was overprogrammed. About 4-5 years ago, a new process called the Strategic Highway Investment Formula for Tomorrow (SHIFT), was developed as a way to prioritize projects; SHIFT mostly looks at capital construction. The SYP does have programmatic money included as well.

KYTC Highway Districts come up with their priorities through the SHIFT process, assigning points for each project, which is one input to the decision making. Planning and design are both often scoping projects and these do not always match up. The Kentucky legislature actually approves the KYTC Highway Plan.
ODOT funds are allocated differently, as the legislature does not have input on projects, rather they only approve the top-level dollar amounts. ODOT planning and finance people come up with those top dollar numbers and then decide how to distribute it among the programs. ODOT has 2-year and 6-year work plans, where the 2-year work plan is pretty locked in and is based on system conditions and meeting set goals for pavements and bridges. There are statewide goals and money is allocated to the Districts to meet those goals. There are also centrally controlled pots of money to fund rehabilitation projects statewide. It is distributed based on system conditions, for both preservation and for bigger projects that are controlled by central managers. ODOT would call this process statewide planning.

For ODOT, scoping is undertaken for 2-year work plan projects for each District, where 90% of design and preliminary engineering work is done by consultants. For KYTC, planning/scoping is considered to be the first 0-3% of a project, with preliminary engineering & environmental phases moving the project up to 30%, followed by final design. Other states think of the first 30% of a project is scoping, and through this research, KYTC is trying to figure out how to better define its projects.

ODOT has a Project Initiation Packet (PIP) that is used to begin a project. Districts take a multidiscipline team to go to the field and fill out this form. This rolls up into the scope and then to a Scope of Services for a consultant. The PIP does not have to be approved by Central Office, but often subject matter experts from Central Office go on the site visit and contribute to the PIP.

Following this introductory discussion, Susan Stehle shared her written responses (*in italics*) and the team continued discussion. This portion of the meeting is summarized below, organized by the list of preliminary interview questions (underlined), which were shared with the ODOT peers prior to the meeting.

Cabinet/DOT Organization
- Overview of how the Cabinet/DOT is organized (centralized, decentralized, hybrid)
  Hybrid:
  Centralized at the policy level (scoping/design standards, some funding programs e.g. Major Bridge, Major Rehab, Safety program)
  Decentralized at the project planning, scoping, design level (within District budget)

  With ODOT's centralized functions, does this include the Long Range Plan, with projects already identified in the plan? ODOT's 20-year plan is managed centrally, but it is more strategic than specific projects. KYTC does identify corridors in long range planning. ODOT's projects fall into several buckets: 1) preservation, which is the majority of the projects; 2) the safety program, where these locations are picked centrally, but the studies and projects are through the Districts; and 3) big capacity projects, like the Brent Spence Bridge. These big capacity projects are led by a separate group, called the Transportation Review Advisory Council (TRAC), which is run by ODOT.

  What systems or data are used to make decisions? Bridges become eligible based on a 10-point scale when they reach a four (4). There is also a pavement management system that develops a list of locations, then the Districts decide 75% of what projects will be undertaken.

  - How much of road system is managed by DOT versus local municipalities?

  Centerline miles in Ohio: ~ 120,000 CL miles
  Centerline miles maintained by ODOT:
  ~ 20,000 CL miles (Interstates, US Routes, State Routes outside the cities)
  Centerline miles maintained by Locals:
  ~ 100,000 CL miles (County Routes, Township Routes, Municipal Routes)

  All of ODOT's mileage is outside the cities. David shared a comparison of mileage between Ohio, Kentucky and several other states:

		Ohio	Kentucky	Maryland	New York	Pennsylvania	West Virginia	Wisconsin
	Total Mileage	39,730	27,671	5,164	15,079	19,249	34,408	11,743
	Total Lane Miles	88,265	62,216	14,827	38,152	49,636	71,010	29,739

- How is Preconstruction organized (centralized, decentralized, hybrid)?
  – By discipline, project type, geographical area, or other?
  – Multiple preconstruction groups?
  Decentralized by Districts (geographical area)
  "Preconstruction" is comprised of two sections, Planning & Engineering
  – Planning – project programming, environmental, traffic/safety, maintenance of traffic, hydraulics, structures, pavements, local projects
  – Engineering – in-house design, consultant contract administration, real estate

ODOT has a Capital Programs Manager in each District, who manages planning, design and construction, which provides flexibility in continuity to each project. This reduces the "silo-ing" of each topic.

- Project Management Manual
  – Level of development? Last update?
  – Where in the project timeline does the Manual begin? Scoping guidelines included?

Central Office offered formal PM training program ~5 years ago? Time intensive, program spanned ~1.5 years from start to finish and included training classes in several different disciplines for all prospective PM's. Some Districts offer their own training programs to staff within their Districts.

Project Development Process (PDP) Manual
- Drafted by ODOT Division of Planning, Office of Environmental Services
- Last updated July 2018
- Begins with identifying potential projects
  o Assess and prioritize by need
  o Available funding
- Determine PDP Path (paths 1 thru 5)…generates tasks needed to complete the project
- Determine cost estimate (revised over life of the project)
- Scoping (flexibility based on needs of each project)
- Overview of the various PDP phases
  o Planning
  o Preliminary Engineering
  o Environmental Engineering
  o Final Engineering/Right-of-Way
  o Construction

ODOT does have a very well-defined PDP process, which is well documented, and training is provided for this, along with access for the consultants as well. Susan can provide the PDP Manual as a follow-up to the meeting.

- Scoping Guidance Documentation
  – Level of development? Last update?

Different technical areas have different levels of guidance in their design manuals (some more robust than others). For example, the ODOT Bridge Design Manual has good examples of scoping needs for bridge rehab work.

Scopes are created in ODOT's web-based portal called SAFe (Scope and Fee) System
- Likely tasks are shown based on the project's PDP Path (1 thru 5)
- Subject Matter Experts within the District will work with District Scoping Engineer to create the scope and task list (with concurrence from other SMEs)
- SAFe Manual available for users

Susan shared her screen to show the SAFe program for a recently advertised project. When a project is set up in SAFe, the District picks which path the project will take, and therefore how the project proceeds through the PDP, based on a 1-5 scale. The Brent Spence Bridge would be a five (5) in this system, and a striping project would be a one (1), for example. Setting the project up in SAFe is where the scoping is done, along with who will be responsible (ODOT, consultant, local, etc...). Each SAFe line item includes a Task Help description to make sure all bases are covered. The PIP and other supporting documents are also attached here, such as consultant agreements and submittals.

If there is a change in the schedule, is it recorded in the SAFe? 90% of ODOT projects are filed on time, although individual tasks may shift within the timeline. The State Controlling Board is a legislative body that approves the total dollars and number of contracts for ODOT; the total dollars include a margin of error, in case the consultant agreement is too low. The Controlling Board limit is very rarely exceeded.

For the PIP, the scope writer, or Scoping Engineer, takes a team to the field to define the project. Susan shared a sample PIP on screen and will provide a copy of it following the meeting. The PIP form has detailed questions on every subject area and is about 15 pages long. The Scope Engineer then uses the PIP to write the scope, in consensus with the subject matter experts, and the funds manager for the project. There is no formal approval of the PIP. ODOT makes scopes available to consultants 10 weeks prior to posting, so they can consider appropriate teaming arrangements and sub-consultants.

A scope document can be printed from the SAFe system, which shows all of the expected tasks, who will do them, some legal information, and unit/rate estimate information. There is guidance for how many hours each task in the scope should take. This document can then be used in the consultant agreements. For construction cost estimating, the Districts program a project in the Ellis system.

– What phase(s) of the project timeline does the Scoping Guidance cover?

General project timeline:
- District monitors their multi-year workplan, budget allocation
- Project programmed (rough cost estimate based on type of work, size of project)
- Project Initiation Package aka PIP completed (field mtg of SMEs, identify risks)
- Project Scoped (by Scoping Engineer based on findings of PIP)
- If design is to be performed by consultant:
  o Project Posted, Consultant Selected, Fee Negotiations, Agreement Executed, Consultant Authorized
- Design/PDP Process
  o Scope revised as needed (add additional phases of work after a decision point or add scope items not originally anticipated)
  o Update cost estimates and project schedule
  o Construction phase – on-going services during construction

Initial Scoping for Highway Project Initiation
- Who is involved, who are the decision makers?

– Is there a regular scoping team, how often do they meet?

Scope team meets as necessary to draft scopes for in-house design projects. For projects that will be designed by consultants, ODOT posts programmatic groups 3x/yr. Scopes for each programmatic group are drafted/reviewed with a scope team comprised of relevant SMEs for each particular project.

- When developed, how developed, and the extent of preliminary investigation (utilities, survey, environmental, etc…)?

Scoping Engineer does an initial desktop review (pulls plans from previous projects, reviews inspection reports, maintenance requests, letters/complaints, reviews crash/safety info, requests certified traffic ADT numbers). A PIP is created during a field visit with SMEs. Lastly, the scope and task list are generated in SAFe based in findings from the desktop review and PIP.

Preliminary Investigations are project dependent… utility work and survey typically scoped for consultant to perform, environmental by either ODOT or consultant.

- What is the level of design development for the initial project scoping effort?
  – Does it vary based upon project type, size, funding source, etc.?

Smaller projects are typically scoped all the way through Final Engineering tasks. Larger projects or projects without a known alternative/outcome are initially scoped through a Feasibility Study, Alternatives Evaluation Report, or Structure Type Study. Then after a decision is made, the remainder of the scope and tasks will be scoped.

As far as the level of design development for ODOT's scoping, the simple projects are scoped start to finish. For the more complicated projects, a feasibility study is typically completed first, which is basically an alternatives study; this is similar to KYTC's process.

When practical design was started by Federal Highways, ODOT looked at it as right-sizing projects. They started performance-based design at the purpose and need level, considering a primary need (system conditions) and a secondary need, or other opportunities that can be considered during the feasibility study. These are documented in the purpose and need in the PIP, where the purpose and need is right-sizing the scope of the project, and the design exception is right-sizing the impacts of the project.

– Does project type include design, safety, preservation, maintenance, other project categories?

Projects are initiated to meet one or several of the above-mentioned categories. At the District level, Districts monitor and budget for various types of projects to address pavement conditions, bridge conditions, high crash locations, maintenance needs, etc. Districts maintain a multi-year workplan based the identified needs within their geographical area.

- Scoping report/documentation
  – Is a formal detailed scoping report generated? What details are documented?

Documentation of scoping needs are compiled in PIP and SAFe scope/task list. Simpler projects such as maintenance or resurfacing might be abbreviated, with less investigation/reports. Level of complexity drives investigation/documentation of project needs.

– Is a scoping report produced for all projects or a select group?

All projects, but with varying level of detail based on project complexity.

- Who endorses/approves the scoping document?

Scope approval by consensus of the SMEs relevant to the project, Funds Manager, and Planning & Engineering Managers.

- How is the scoping documentation filed and archived?

Electronic version in web-based SAFe portal. Paper version of the scope document is incorporated into consultant's design agreement. Districts also typically maintain their own electronic project files.

- What is the accuracy of the initial scoping process (cost and timing)?
  - Is training provided for scoping activities?

Not formally, learned on the job.
  - How often does the agency need to revise STIPs as projects move through the project timeline?

STIP revised as information becomes available. ODOT typically uses grouped projects (aka line items, e.g. $500M annually for resurfacing), to minimize the volume of changes for routine work. Districts estimate ~25% of projects need to have the STIP revised at some point.

- Is project scoping revisited as the project proceeds through development?

Project scope may be revised based on the results of Preliminary Engineering investigations or studies.

- Do you track how well projects meet the original scope, particularly budget?

No. Districts are bound by their budget constraints to implement the needs of the project within the dollars approved by the Funds Manager. Scoping Engineers use lessons learned from previous scopes when generating new scope documents.

- What happens when a project scope changes significantly and what do you consider significant (i.e. >15% increase in cost)?

Significant scope changes are typically evaluated by District leadership and the Funds Manager, then either approved or denied. 10% or some dollar amount threshold ($100k) is typically used to trigger the need to obtain approval from the Funds Manager.

If the construction estimate starts to go above what was programmed, projects can get moved out, for something like pavement rehabilitation, so the budget is balanced. If it is a major project, like a bridge, then there is a discussion about how to proceed with increasing the budget or not.

Other discussion items included the following:
District 8 (Cincinnati) has about 17-20 project managers, which is one of the bigger districts. ODOT has about 4,800 total employees, with a legislative cap just under 5,000, and one-half to two-thirds in county offices. KYTC has around 4,400 total employees, with about 10% in central office. David can provide a profile of their workforce, if that would be helpful.

KYTC is interested in balancing effort across the Cabinet and would be interested in knowing how many projects each project manager handles. KYTC does about 20% in-house design, primarily to train project managers. A Capital Program Administrator position would really help break down the silos in the current KYTC structure.

KYTC has Division of Maintenance in Central Office and maintenance personnel. Does ODOT specify maintenance projects beyond system preservation? For ODOT, the decision to do something internally, like guardrail repair, would be managed within the District, while also meeting all of the goals. ODOT Central Office does not have maintenance people, just policy on this.

KYTC's program is almost all federalized, because most of the state dollars are used for federal match, so most projects go through NEPA. ODOT is similar, although state funding is typically higher than federal. The last few programmatics have been done with federal funds, however, because it is seen as more stable during COVID. Ohio is a NEPA assignment state.

Ohio has the Chief Engineer, with three Deputy Directors directly underneath, including Planning, Design (David) and Construction. These three deputies work together as a team to bring projects along.

Following the meeting, the ODOT team provided a sample copy of a PIP and a scope document.

Susan also provided a link to a number of ODOT resources here:
https://www.transportation.ohio.gov/wps/portal/gov/odot/working/pdp

Best Practices for Highway Project Scoping
Utah DOT
August 6, 2020

Attendees
- Fred Doehring, Utah Department of Transportation (UDOT)
- George Lukes, UDOT
- Kris Peterson, UDOT
- David Schwartz, UDOT
- Stephen DeWitte, Kentucky Transportation Cabinet (KYTC)
- Kevin Rust, KYTC
- Kevin Sandefur, KYTC
- Ken Sperry, KYTC
- Jeff Jasper, Kentucky Transportation Center (KTC)
- Samantha Wright, KTC

Discussion Items
A peer state interview for the research titled, "Best Practices for Highway Project Scoping," was held with UDOT on August 6, 2020, via Microsoft Teams. The KYTC attendees listed above are considered to be the study advisory committee (SAC) for the research project, providing guidance on the scoping definition, work plan, and outcomes of the study.

Jeff Jasper welcomed the attendees and asked for introductions. Jeff explained that this project is a continuation of the project we met with UDOT about last, focused more on the scoping activities for a project.

Jeff provided a brief overview of KYTC's scoping process, starting with the Six-Year Highway Plan (SYP) and the biennium budget, which often leads to more emphasis on the development of projects in the first two years of the SYP. Emphasis has been put more recently on attempting to distribute project dollars more widely, using practical solutions as a guide. Funding can be impacted by starts, stops, and phase dollars allocated in the legislature, even though KYTC provides original numbers on project costs.

The discussion portion of the meeting is summarized below, organized by the list of preliminary interview questions (underlined), which were shared with the UDOT peers prior to the meeting.

Initial Scoping for Highway Project Initiation
- Who is involved, who are the decision makers?
    - Is there a regular scoping team, how often do they meet?

Concept Reports are triggered by UDOT employees, legislators, and safety numbers. Planning is also involved, including work with the MPOs and other partners, and long-range plans on 10-yr horizons that are fiscally constrained. This is for large capacity projects that are cost-estimated, and ready to go to the Commission to ask for money; project limits and purpose would be included here.

Resurfacing projects get Concept Reports too, for the most part, and one reason is to keep these projects from increasing in size/content (like limiting to paving, not adding signs, etc...).
Who completes a Concept Report depends on the program within UDOT, it could completed internally or by a consultant, like a traffic project, for example. Groups of Concept Reports then go to portfolio managers, who do a sifting of the projects to decide which reports go to the Commission. Portfolio managers are regional (like pavement) and centralized (like safety, or structures). They work in concert with others to make recommendations to senior leadership; for safety, they may consider crashes or fatalities, or benefit/cost ratios to make decisions.

Senior leadership reviews the recommended projects before they go to the commission and decides what the fiscal constraint is for the recommended projects.

Concept Reports are funded by Highway Safety Improvement Program (HSIP) funds or overhead dollars for UDOT employees to do the reports. State Planning and Research (SPR) funds are used for these types of reports for KYTC.

For UDOT assets, the pavement management system collects distressed pavement inventory, and then produces a list of projects by level of service, that is fiscally constrained. Managers then field review those sections and make decisions about priorities. UDOT is moving toward an asset management basis for guardrail, signs and striping.

- When developed, how developed, and the extent of preliminary investigation (utilities, survey, environmental, etc…)?

For UDOT, projects start with a Concept Report when a project is 0-2% complete. Concept Reports include a cost estimate based on 10-20% of the pay items, and environmental work may or may not be complete, but there is enough information to ask the Commission to fund it. Project scoping begins after a project is funded.

David Schwartz offered to provide a link to completed Concept Reports for review. Generally, Concept Reports are built in Excel, with tabs and short write-ups for various items including:

- Executive Summary, with signatures, total cost, inflation factor, contingency of 20-30%, and expected design year;
- Information on right-of-way, structures, utilities, drainage, roadway, etc…; and
- Cost Estimate.

Some of the concept teams use the GIS system to see assets, and put down project limits, but the best tool is to visit the project.

- What is the level of design development for the initial project scoping effort?
    - Does it vary based upon project type, size, funding source, etc.?
    - Does project type include design, safety, preservation, maintenance, other project categories?

For UDOT's larger projects, the environmental document will be the Concept Report, where alternatives have already been considered. Much of this work is done using Google Earth and GIS parcel records. For a big project, at the end of a Corridor Study or Environmental Impact Statement (EIS), Concept Reports can then be broken out for each segment. Fred Doehring shared the I-15 Concept Report on his desktop with the meeting attendees, and will follow up with links to other Concept Reports and cost estimating resources.

KYTC's Phase 1 Design for larger projects overlaps with UDOT's concept report process here.
- Scoping report/documentation
    - Is a formal detailed scoping report generated? What details are documented?
    - Is a scoping report produced for all projects or a select group?
    - Who endorses/approves the scoping document?
    - How is the scoping documentation filed and archived?

Another tool in UDOT's scoping process is the Project Delivery Diagram, which should start once a project is funded and gives steps from design to delivery at letting. This helps a project manager coordinate with all parts of the DOT that need to be involved.

In the Scoping phase of the diagram is the Project Definition Document (PDD), which includes what the project will do and will not do. This is about a 30-40% plan at this point. This also commits to a final date to advertise the project. This document is written by the project manager and the team, signed by the project manager and the regional

leader, and reviewed by regional leadership team. They may reject it if they feel like it doesn't meet the original intent of the project.

- What is the accuracy of the initial scoping process (cost and timing)?
  - Is training provided for scoping activities?
  - How often does the agency need to revise STIPs as projects move through the project timeline?

Concept Report training is mostly on the job; the process is moving more toward an asset management process.

Concept Reports do break cost out into phases, including design, utilities, row, and construction, including an inflation factor; but, the lump cost is what is submitted to the Commission. Once the project is funded, the project manager is responsible for breaking the funding back into phases.

- Is project scoping revisited as the project proceeds through development?
  - Do you track how well projects meet the original scope, particularly budget?
  - What happens when a project scope changes significantly and what do you consider significant (i.e. >15% increase in cost)?

UDOT project managers are measured on delivering projects on time and in budget, even through construction the construction phase. There are amendment procedures to go back to the Commission for more money, but it is more common to sweep extra funds from projects that have remainders. UDOT has a strong project management business model, with personal responsibility for project managers to meet budget.

There are four program managers with UDOT, one in each of the four regions, with 5-7 project managers in each region. The number of projects per project manager depends on the size of the projects. UDOT also has consultants manage projects, who could even manage in-house UDOT employees.

David showed UDOT's budget management system dashboard on his desktop to the meeting participants. The system tracks projects that are on budget and over budget, statewide or by region. Excess funds get swept back to the concept plan phase, so new projects or amendments can be funded.

A program manager can help keep this process straight, as they are more removed than the project manager. UDOT estimates that 80-90% of projects are done by consultants, although UDOT does have a couple hundred engineers that do some design work, mostly managed out in the regions.

UDOT has 1,600 centerline miles of state routes, including interstate routes, compared to KYTC's 27,000 centerline miles.

UDOT's QC/QA program is set up more for design plan details, not so much for the scoping process. Keeping track of the project scope is up to the project manager.

The group discussed UDOT's comprehensive risk assessment program. Fred developed the risk tools and process, with three different levels, and Monte Carlo simulations for larger projects. The process is probably more closely followed on larger projects.

Best Practices for Preliminary Project Scoping
Virginia VDOT
September 18, 2020

Attendees
- Vernon (Butch) Heishman, Virginia Department of Transportation (VDOT) (Assistant Location and Design Engineer)
- Robert Tieman, VDOT (Director of Project Management Office
- Stephen DeWitte, Kentucky Transportation Cabinet (KYTC)
- Kevin Rust, KYTC
- Kevin Sandefur, KYTC
- Ken Sperry, KYTC
- Jeff Jasper, Kentucky Transportation Center (KTC)
- Samantha Wright, KTC

Discussion Items
A peer state interview for the research titled, "Best Practices for Preliminary Project Scoping," was held with VDOT on September 18, 2020, via Microsoft Teams. The KYTC attendees listed above are considered to be the study advisory committee (SAC) for the research project, providing guidance on the scoping definition, work plan, and outcomes of the study.

Jeff Jasper welcomed the attendees and asked for introductions. Jeff provided a brief overview of the ongoing research project, the purpose of our meeting with the VDOT peers, and the KYTC process for developing and scoping projects. Robert asked if the KYTC study is addressing two different questions: 1) how the projects are selected and 2) how the projects are scoped. Project selection is involved in this discussion, because funding is so limited, and it is important to avoid scope creep.

The discussion portion of the meeting is summarized below, organized by the list of preliminary interview questions (underlined).

Cabinet/DOT Organization
- Overview of how the Cabinet/DOT is organized (centralized, decentralized, hybrid)
    - How much of road system is managed by DOT versus local municipalities?

VDOT has nine geographic Districts, where projects are administered both by VDOT (50%) and locally (50%). VDOT Project Management Office (PMO) supports both of these efforts with guidance, training and advocacy. The 50/50 split is by number of projects, rather than dollars.

VDOT maintains almost all of the roads in the Commonwealth, with the exception of some jurisdictions, so there is unique interest in many of the local projects as well. VDOT's project development process and performance measures should remain the same for local projects. There are about 128,500 lane-miles maintained by VDOT.

- How is Preconstruction organized (centralized, decentralized, hybrid)?
    - By discipline, project type, geographical area, or other?
    - Multiple preconstruction groups?

Each VDOT District is responsible for their own projects, and Central Office plays an advising and guiding role. There are Tier 1 projects, which are $10 million or less, and are approved by the Districts. Tier 2 projects, which are more than $10 million or particularly unique projects, come through Central Office for review and approval. Central Office also establishes and maintains all the guidance and rules for the whole DOT.

VDOT has about 1,000 people in the PMO, including project managers for VDOT projects, and project coordinators for local projects. About 600-800 of these folks do some form of project management; project loads may vary widely from 6-10 to more than 50, depending on project size and responsibility. The PMO staff are dispersed throughout the state and their chain of command is at the District level. Overall, VDOT has about 7,200 employees.

VDOT project managers handle both internal work (Design Management) and outside consultants (Project Management). The balance of these two roles varies in the Districts, where the more urban project managers work more with consultants, while the more rural project managers work more with internal design teams.

VDOT tries to hire project managers in various ways. For bridges and roadway, most project managers come up through the VDOT program, or they are hired from consultants. Project coordinator positions are more difficult to fill and maintain; some are long term employees, but others tend to be rotating positions. Coordinators must build trust with the localities and get projects implemented, without the same authority as a project manager. Most project managers hand a project over to construction at the point of a letting.

- Project Management Manual
    - Level of development? Last update?
    - Where in the project timeline does the Manual begin? Scoping guidelines included?

There is project management training (PM 101) for on-boarding new employees; in-person training has been put on hold during COVID -19, but there is a library of videos that can be used, along with online training. There is also the Transportation Project Management Institute (TPMI) led by VDOT and the University of Virginia, with is the pinnacle of project management training the Commonwealth. TPMI is a two-week, residential, intense training program for about 35 people per year; these are the rising stars in the Districts, localities, and consultants.

- Scoping Guidance Documentation
    - Level of development? Last update?
    - What phase(s) of the project timeline does the Scoping Guidance cover?

With regard to project selection, VDOT is moving toward an application-based approach. There is a Six-year Improvement Plan, with every project in the plan fully funded, which makes development and delivery substantially improved. There are three phases of project development: 1) PE, which is planning and design, 2) Right-of-Way, which is right-of-way and utilities, and 3) Construction. Projects are delineated by phase and anticipated year using a scheduling software called Project Web Application (PWA); there are about 7,000 projects in the system now. Dates from the scheduling software are cascaded through the VDOT systems, so that each project has one schedule. VDOT's success in project delivery can be largely attributed to the fully funded plan and the PWA scheduling, which both started about five years ago.

Initial Scoping for Highway Project Initiation
- Who is involved, who are the decision makers?
    - Is there a regular scoping team, how often do they meet?

VDOT uses the Smart Scale system for project funding applications from each locality or MPO. Smart Scale uses a scoring process to identify projects to be funded in the Six-Year Improvement Plan. Other processes also identify projects, such as State of Good Repair (bridges), HSIP (safety) and maintenance projects. Once project applications come into Smart Scale, Central Office and the Districts evaluate them for risk and funding level; cost estimates are locked in at this point, with a 10% flexibility in cost. Once projects are funded, the official scoping does not close out until the first major milestone, which is preliminary field inspection (15-20% plans). At this point, responsibility for a project is determined to be Tier 1 or Tier 2, based on the cost or unique features of a project. The schedule for the project is also locked in at this point.

More than 90% of VDOT projects are selected based on the Smart Scale ranking, which is data driven and analytical, and undertaken by a scoring team. The Smart Scale rankings go for approval to the Commonwealth Transportation Board, where some adjustments may be made.

The projects that go through Smart Scale are safety and operational improvement projects, but not HSIP, bridge replacement or maintenance projects. Tier 1 and Tier 2 projects are included in the Smart Scale process. Smart Scale is the largest pot of money VDOT has at its disposal but does not include the majority of projects undertaken by VDOT.

- When developed, how developed, and the extent of preliminary investigation (utilities, survey, environmental, etc.…)?

KYTC would like to have a more comprehensive scope and estimate at the beginning of a project, but the funding is not set up that way. VDOT has funding set aside for pre-scoping activities, for each District and Central Office, along with funding set aside for the Smart Scale process, which can be used for the development of the applications. This is beneficial in getting better project definitions and cost estimates. Some localities also fund scoping activities, or hire consultants to do scoping, in the interest of a better project definition.

- What is the level of design development for the initial project scoping effort?
  - Does it vary based upon project type, size, funding source, etc.?
  - Does project type include design, safety, preservation, maintenance, other project categories?

While Smart Scale projects are not fully scoped, many of them are pretty far along, primarily in bigger localities or areas with more funding. Other projects are not as well-scoped and do require some District help; further scoping happens more once the project is funded and underway.

The Smart Scale application has discipline-specific scoping worksheets (materials, traffic, roadway, etc.…), which allow for early identification of risks. The required subject-matter experts are identified by the project manager (or District engineer) as part of the scoping team, which triggers the completion of the appropriate worksheets. Environmental documentation is in a very preliminary stage when a project is entered into Smart Scale and may include only basic impacts.

- Scoping report/documentation
  - Is a formal detailed scoping report generated? What details are documented?
  - Is a scoping report produced for all projects or a select group?
  - Who endorses/approves the scoping document?
  - How is the scoping documentation filed and archived?

The PM 100 form locks in the budget, scope and schedule for each project. VDOT uses a dashboard to track project schedules; project management changes are made if needed.

- What is the accuracy of the initial scoping process (cost and timing)?
  - Is training provided for scoping activities?
  - How often does the agency need to revise STIPs as projects move through the project timeline?

Once a project is at the 15-20% development stage, it is now less likely that a project cost is inaccurate, due to the evolution of the Smart Scale process. Funding applications have gotten more complete and refined since the first round of project applications.

- Is project scoping revisited as the project proceeds through development?
  - Do you track how well projects meet the original scope, particularly budget?

      –   What happens when a project scope changes significantly and what do you consider significant (i.e. >15% increase in cost)?

This item is discussed under the previous section.

During and following the meeting, the VDOT folks provided the following documents and links:
- Smart Scale Website, which includes how-to guides and a description of the scoring process: http://vasmartscale.org/
- PM 100 Scoping Form: http://vdotforms.vdot.virginia.gov/SearchResults.aspx?strFormNumber=PM-100
- Project Scope Procedure: http://www.virginiadot.org/business/resources/LocDes/ProjectScopingPMO.pdf
- Project Change Management: http://www.virginiadot.org/business/resources/LocDes/Change_Management_PMO-22-0_FINAL_4-7-20.pdf
- Project Management Office: http://www.virginiadot.org/business/locdes/project_management_office.asp
- VDOT Project Dashboard: http://www.virginiadot.org/dashboard/projects.asp

Appendix C Process Maps

SYP Manage Project Status - Day to Day Process Flow

Key:
Items in Blue = Internal steps
Items in Purple = Consultant Steps
Item in Grey = Both Complete

Enacted SYP

Hold meeting with CDE, Program Manager and State Highway Engineer's Management Staff → Prioritization → Assign Project Manager → Complete data gathering & purpose and need → Evaluate tasks/ required steps (Scope, Schedule, Budget) → Update Cost Estimate w justification → Determine Resources (internal or external)

Consultants Needed? — No → Hold PreDesign Meeting → Required Phases, Estimate(s) & Environmental Involvement → Request Funding

Consultants Needed? — Yes → Complete RFQ for consultants → Required Phases, Estimate(s), & Environmental Involvement → Request Funding

Project in 1.SYP Cost? 2. STIP? 3.MPO/TIP? — Yes → Make Design Funds Available

Project in 1.SYP Cost? 2. STIP? 3.MPO/TIP? — No →
1. If the project is not in the SYP works stops

2. If the Project is not STIP then make a modification and approve.

3.If the project does not have a MPO TIP then wait and make a modification in TIP

Advertise for Consultant? — No → Stop
Advertise for Consultant? — Yes → Select and Award Consultant → Hold Pre Design Conference → Negotiate Man Hours for Cost

Project in 1.SYP Cost? 2. STIP? 3.MPO/TIP? — Yes
Project in 1.SYP Cost? 2. STIP? 3.MPO/TIP? — No →
1. If the project is not in the SYP work stops

2. If the Project is not STIP then make a modification and approve.

3.If the project does not have a MPO TIP then wait and make a modification in TIP

Make Design Funds Available → Send Notice to Proceed → Initiate Scope of Work* → Complete Monthly Status (*Iterative*)* → Project Status → Complete Status Report/Quarterly Meeting (*Iterative*)* → Rollup for SYP Book drafting upon notice from Div. of Program Management → Reevaluate work per New SYP & Update

Project still in 1.SYP Cost? 2. STIP? 3.MPO/TIP? — Yes → Send Notice to Proceed
Project still in 1.SYP Cost? 2. STIP? 3.MPO/TIP? — No

*Note: These steps indicate activities that may result in changes to the project. Not all changes can be updated in PreCon without management approval via Div. of Program Management.

The following fields cannot be changed without PGM approval:
- Letting Date
- Project Description
- Type of Funds
- Scheduled Fiscal Year
- Status of Funds
- Location of Project
- Beginning or Ending mile points of work

Complete Preliminary Engineering

Administer Maintenance agreements with Border State

Existing agreements W border state that define Maintenance agreement for every bridge

Central Office decides who will do the inspection

Central Office conducts inspection internal or external

Inspection is completed internally or externally

- NBIS (every 4 yrs.
- Fracture critical inspection report
- Depth inspection reports

Infomration is put into BRM by inspector and is shared w neighboring state elxctronically

Central office determines work to be done and develops cost estimates

Central Office notified neighboring state of scope of work and cost estimates

Hold yearly meeting to discuss schedules of needs, finding, etc.

MOA is reviewed and executed by enighboring state

Is there technical design?

Yes

Day to Day Process ⊞

No

Normal Bridge Repairs ⊞

Prioritization Process
Draft

Fall Even Years → Select Shortlist of universe of needs → ADD s/HDD s Prioritize local officials → ADD s Record Priority in PIF Local Year and Rank → ADD s/MPO s Conduct Regional Prioritization → ADD s/MPO s Record Year and Regulate Priority in PIF → District Conducts District Prioritization → HDO Records Year and Reviews in PIF

Jan Odd Year

Mar

June 30th Odd Year

Dec Even Year PIF Tech Review

New PIFS may be generated

Life of a PIF (+)

Jan Odd Years

District Prepares Goals and Objectives and Custom Summary

Prioritizes Feed DHP (+) DTP

HDO s Prepare DTP Summaries → Revisions are made as necessary → DTP is Finalized → End Process

Feedback from EOC Meetings DHP Process

Bridge Replacement and Major Rehabilitation

Emergency Response Process (FEMA & FHWA)

Identify Maintenance Bridge Needs (bridges, pavement, guardrail, rockfalls and landslides)
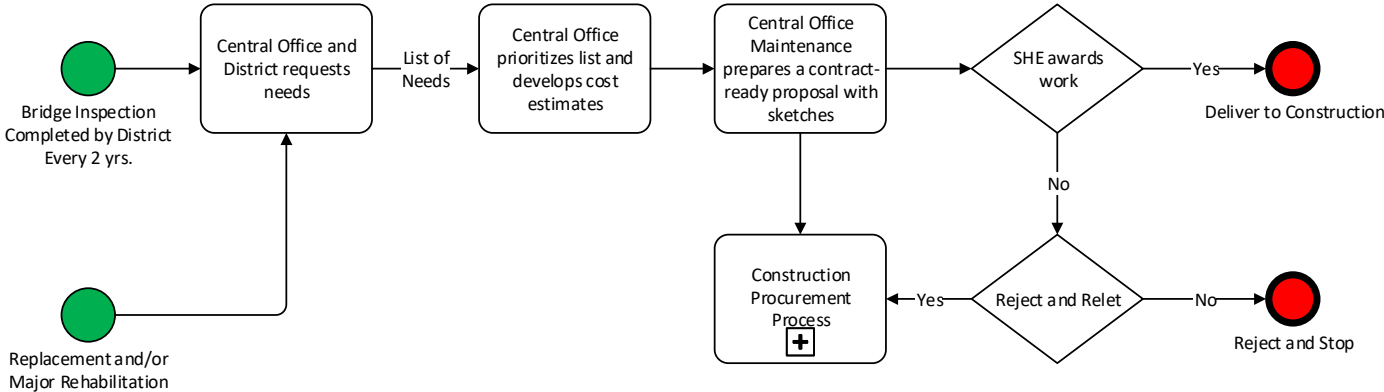
Identify Six Year Plan Pavement Needs
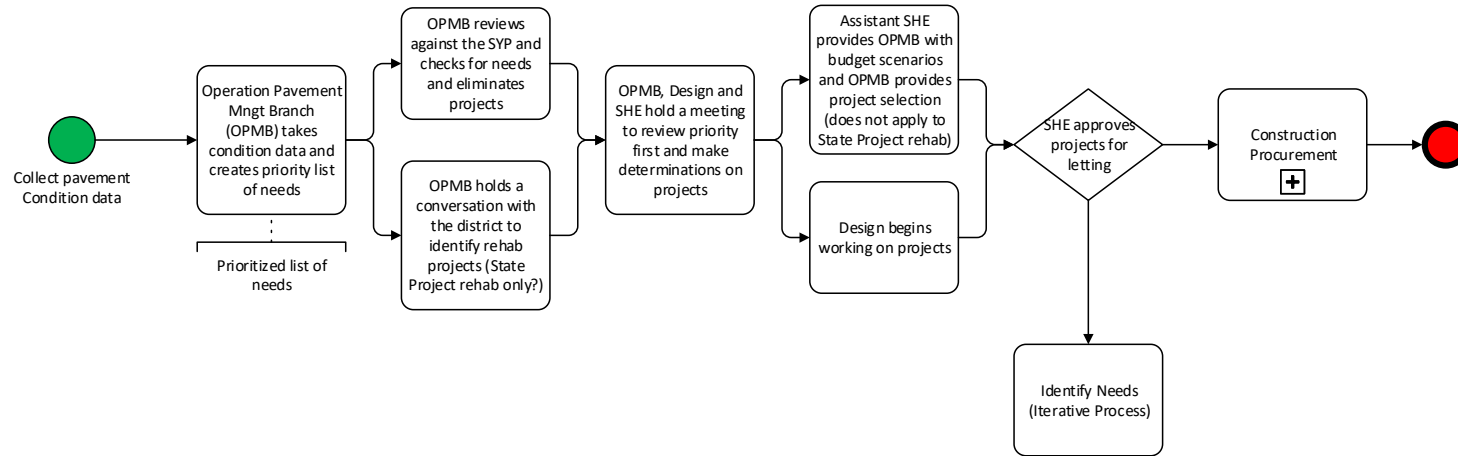
Landslide Correction Process
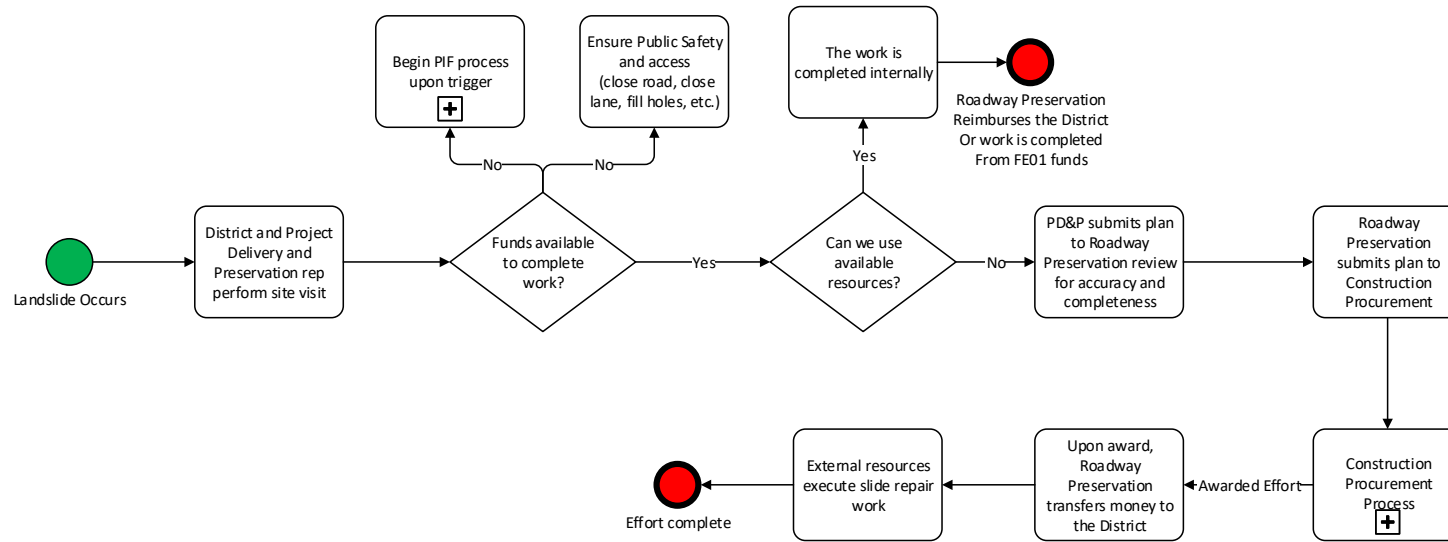
Traffic High-Level Process

Key:
Items in Blue: Steps in the SYP project process steps
Items in Green: Indicate non-SYP project process steps
Items in grey indicate steps for both SYP and non-SYP
projects

Hold scoping meeting with PM And all applicable phases/resources

Notify District the request is not approved

District Traffic Engineer/PM submits request for devices and /or plans

Traffic Engineering reviews the request

Request is approved? — No / Yes

Traffic Engineering notifies District/PM and Design Services

Design Services completes

State Wide Consultant completes

Project Consultant completes

Design Services does work

Design Services coordinates work

Design Services reviews work

Design Services and/or Consultant works with Utilities, Traffic Engineers and Right of Way (if applicable)

Traffic Plans are developed

Design Services sends final traffic plans

District installs with an electrical contractor

Appendix D Asset Management Notes, Safety Scoping Brainstorming, Scoping Maintenance and Operations Scoping Process Improvements

Scoping Process for Bridge Projects

1. Collect inspection data

2. To identify candidate projects, analyze and synthesize inspection data based on:
    - BrM Optimizer
    - District reconnaissance
    - Priority Index

3. Identify the appropriate action for each project
    - Rehabilitation
    - Replacement
    - Preservation

4. Add project to the Six-Year Plan

5. Perform a district-level review that:
    - Identifies conflicts
    - Analyzes crash data
    - Prioritizes candidate projects based on districtwide needs

6. Identify and resolve challenges
    - Limiting termini
    - Typical sections
    - Right-size the structure
    - Maintenance of traffic
    - Environmental process (if necessary)
    - Right of Way
    - Utilities

7. Assign design work
    - Bridge
    - Roadway

8. Post-Design Reassessment
    - District-level review
    - Elevate major issues (e.g., major budget overrun) to the State Highway Engineer's Office for resolution/reprioritization

Scoping Process for Pavement Projects

1. **Collect data on pavement condition**
   - Visual assessments
   - LCMS vehicles (e.g., measure cracks)

2. **Use condition data to identify project needs**
   - Identification usually comes from Division of Maintenance (Central Office or district offices)

3. **Define project type**
   - Mill and fill
   - Intermediate
   - Major Rehabilitation

4. **Add project to the Six-Year Plan**

5. **Following project assignment, perform reconnaissance (KTC function)**
   - GPR, cores, perform other assessments
   - KTC is now doing assessments not included in the Six-Year Plan to get ahead of the curve
   - If originally proposed project type is not feasible, redefine project type and coordinate with Pavement Management/SHE Office on possible reprioritization of project

6. **Identify and resolve challenges**
   - Drainage
   - Slides
   - Clearance issues
   - NEPA

7. **Assign design work**

Process Improvement in Highway Project Scoping Meeting Notes

Date: November 18, 2021
Location: KYTC Central Office Conference Room
Attendees: Jill Asher, Federal Highway Administration
                    Chris James, KYTC District 12
                    Mike Vaughn, KYTC Central Office
                    Gayle Marks, Kentucky Transportation Center
                    Samantha Wright, Kentucky Transportation Center

The purpose of this meeting was to review and discuss the scoping process for Safety projects in the Cabinet, particularly those included in the Highway Safety Improvement Program (HSIP). The goals of the meeting were to 1) define the project type, 2) define the scoping process for the project type, 3) identify areas for improvement to the scoping process, and 4) rate the ease of implementation for identified improvements.

Project Type
With the range of project types included in the HSIP investments, the group first worked to identify general levels of scoping effort among the project types, as summarized here:

Low Scoping projects (1-2 months)
Systemic Intersection Improvements
High Friction Surface
New Guardrail (FE06) Matching Funds
Cable Barrier

Medium Scoping projects (3-6 months)
Intersection Emphasis

Medium-High Scoping Projects (6-12 months currently; 6-8 months in the future. Consultant studies will repeat biannually.)
Roadway Departure Emphasis by District, to include:
Roadway Departure
Shoulder Widening
Horizontal Alignment Signing
National Highway System End Treatments

Not Project Seeking/ Supplemental Investments
Localized Risk Mitigation
Other Initiatives (CMV, Non-motorized, Safety Circuit Rider, KTC Technical Assistance, Preconstruction KYTC)

Discussion items related to these levels of scoping included the following:

- The HSIP Investments pie chart shows the magnitude of project types. Roadway Departure Corridors and Intersections are the largest areas of focus.
- Other Initiatives are not projects but rather receive supportive investments.
- Localized Risk Mitigation has not been done for several years, after not meeting federal requirements. Those funds were converted to Systemic Intersection Improvement projects. For example, KYTC is now doing corridor-based signal improvements (i.e., reflected signal backplates, flashing yellow arrow and supplemental signal heads) for higher crash risks or higher crash rates.
- For Intersection Emphasis, scoping would more at a medium level because Central Office would not need a lot of information to make an investment in a solution. Intersection Emphasis relies a lot on District knowledge of the local system and the Traffic, Design, and Planning sections may all get involved.
- High Friction Surface, New Guardrail Matching, and Cable Barrier are all handled out of Central Office and there is low coordination. Matching funds are handled primarily by the Division of Maintenance. They have a new guardrail rating program within the Maintenance Rating Program (MRP), which determines improvement locations by severity of conditions. Cable Barrier may involve a little higher coordination with the Pavement Management Branch as friction data is collected and shared.
- Roadway Departure Corridors, Shoulder Widening, Horizontal Alignment Signing, and National Highway System End Treatments are all being considered under a Roadway Departure Emphasis program. Roadway Departure Emphasis improvements are currently undergoing study by nine (9) consultants in all twelve (12) KYTC Districts, including priorities and preliminary costs. The Emphasis area studies include crash data review, GIS analysis, and virtual review (i.e., Photolog, StreetView) to identify locations where crashes may be reduced by improvement projects. Once the studies are complete, Central Office will work with the Districts to implement projects.

Project Scoping Process

Once the group had sorted the various HSIP investment types into the three (3) general levels of scoping, discussion continued about the typical scoping process for each level. The group agreed that project evaluation, coordination, and refinement increase with project difficulty. This was referred to as administrative scoping in the group's discussion and included items such as project location, limits, basic data, budget, red flags, etc.…

Some medium-high level scoping projects also involve engineering scoping, which may include investigating potential treatments to determine impacts, benefits, costs, etc... Higher level scoping may also involve field visits or using PhotoLog to review conditions.

Using the three (3) general levels of scoping identified for HSIP investments, the group next worked to develop scoping process maps for each:

Low-Level Scoping for HSIP Projects

1. Data Collection, Analysis, & Priortization by Others

↓

2. HSIP review of Network Screening (Guardrail is limited to Warranted [identified] Locations)

↓

3. Cordination with Districts/Divisions based on Project Type. Iterative as needed

↓

4. Virtual/Field Review of Locations as Needed (Note: Step 4 is Fluid in Timeline for All Scoping)

↓

5. Evaluate Data; Coordinate Feedback to Determine Project Locations Based on Available Budget. Regulation Review Based on Funding Rules

↓

END ADMINISTRATIVE SCOPING

Medium-Level Scoping for HSIP Projects

1. Data Collection, Analysis, & Priortization by Others.

↓

2. HSIP review of Network Screening (Guardrail is limited to Warranted [identified] Locations). Review by District.

↓

3A. Review Project Level Data/Project Diagnosis & Documentation.

↓

3B. Determine Potential Treatments by District. (High Level of Scoping)

↓

3C. Develop Impacts, Benefits & Costs, Red Flags by District.

↓

3D. Calculate Return on Investment.

↓

4. Virtual/Field Review of Locations as Needed. (Note: Step 4 is Fluid in Timeline for All Scoping)

↓

5. Evaluate Data; Coordinate Feedback to Determine Project Locations Based on Available Budget. Regulation Review Based on Funding Rules.

↓

END ADMINISTRATIVE SCOPING

Medium-High Level Scoping for HSIP Projects

1. Data Collection, Analysis, & Priortization by Others. More Data & Initial Distrct Feedback.

↓

2. HSIP review of Network Screening by Consultant. (Guardrail is limited to Warranted [identified] Locations)

↓

3A. Review Project Level Data/Project Diagnosis & Documentation by Consultant.

↓

3B. Determine Potential Treatments by District by Consultant.

↓

3C. Develop Impacts, Benefits & Costs, Red Flags by District by Consultant.

↓

3D. Calculate Return on Investment by Consultant.

↓

3E. District Review of all Previous Steps.

↓

4. Virtual/Field Review of Loactions as Needed. (Note: Step 4 is Fluid in Timeline for All Scoping)

↓

5. Evaluate Data; Coordinate Feedback to Determine Project Locations Based on Available Budget. Regulation Review Based on Funding Rules. Central Office Plus Dsictrict (get preference).

↓

END ADMINISTRATIVE SCOPING

Areas for Improvement in the Scoping Process
Due to the lengthy work undertaken by the group to define levels of scoping under HSIP and to develop multiple process maps, a full discussion of potential areas of improvement was not completed during the session. It should be noted that several more recent improvements have already been planned or implemented by HSIP, many of which are documented in the process maps defined by the group.

Some ideas for potential improvements to the various scoping processes were discussed throughout the group's work session; these are summarized below by project type.

Intersection Emphasis Projects
- A competitive solution may be to change Intersection Emphasis to Competitive Intersections. It would generate more communication about specific problematic intersections between Districts and Central Office. This could include coordinated discussions with the project development team and integration with CHAF projects where issues may already be identified. From a planning perspective, costs and safety benefits could be considered using Crash Modification Factors. Other considerations could include utility impacts (gas lines, water, etc. that can be very expensive to relocate).

New Guardrail (FE06) Matching Funds
- A checkpoint to coordinate with Planning could be added to this process, so that new guardrail is not installed where corridor improvements are planned (using Highway Plan GIS, perhaps).

Roadway Departure Emphasis
- For the ongoing studies in each District, it will be important to consider the consultants' methodologies, so that similar processes are used.
- Another improvement may include pairing field review with the virtual assessment in future District-wide studies.
- For the guardrail end treatments, all the potential improvement locations are not in the system. The consultants are only able to screen projects/locations identified by KYTC, rather than every location that warrants an improvement. Potential solutions may be considered for this.

Ease of Implementation
This meeting goal will be handled through follow-up communication with the group.

Process Improvement In Highway Project Scoping
Determination of Process Improvements
November 18, 2021

Maintenance and Operations Group
Group Members:
Stephen De Witte
Brain Schroeder
Jarrod Stanley
Facilitator: Bryan Gibson
Note Taker: Pam Clay-Young

Identify Project Types

FE01 Projects
- Pipe Replacement
  - Pipe estimate (type and amount)
  - Backfill type
- Guardrail Repair
  - Can include shouldering which might require scoping
- Catch-all for projects that FD04 has no funds for or projects that don't fall within any other category.

FE02 Projects
- Bridge Maintenance

FE06 and HSIP
- New Guardrail
  - Guardrail Rating Project

FD04 Projects
- Slides
- Can include guardrail via FEMA
- Drainage -- a question of "How are we going to repair?" rather than, "How much are we going to repair?"
  - Culvert Replacement
    - Close Road?
    - Box Culvert type
Aluminum or Concrete
    - Repave
- JPC Intersections
- Signal Rebuilds
  - Allow traffic maintenance to confirm finds of small area study. See note in Resurfacing.
  - Striping
  - Crosswalks
  - New Sign or Sign Replacement
- Signal Rebuilds – not considered a major project
  - Wire, parts, conduit, traffic controller,
  - Flashers, etc.
  - Conflict Monitor
  - Configuration: does it need to change?
  - Accommodation for pedestrians?
  - Location of right of way

o Placement and heads
o Can include roadway lighting if there is any change to geometry

FD05 Projects
- Resurfacing -- Maintenance could provide a list of everything to be resurfaced to traffic so traffic could determine improvements since traffic looks at other modes of transportation such as bike lanes. There is no program in place to connect traffic suggestion to the next resurfacing project. The traffic suggestions get lost over time.
  o Estimate Cost
    ⊢ Asphalt amount
    ⊢ Walkways
    ⊢ Shouldering

TSMO Projects
Should be a stand-alone project type, but it is not presently. Project is scoped by having a wish list. Project is data driven, and KYTC is just now finalizing what these projects mean. Requires stakeholder buy-in for bigger projects. Future maintenance should be part of the scoping, which is what other DOTs are doing. Rather than being used as a stop gap measure (e.g. a warning system which provides immediate benefit for a lesser cost), there could be scoping for a TSMO project's long-term benefits as it is considered alongside bigger projects.
- Implementation of TSMO
- Maintenance of TSMO
  o Cameras
  o Adaptive Lamp metering

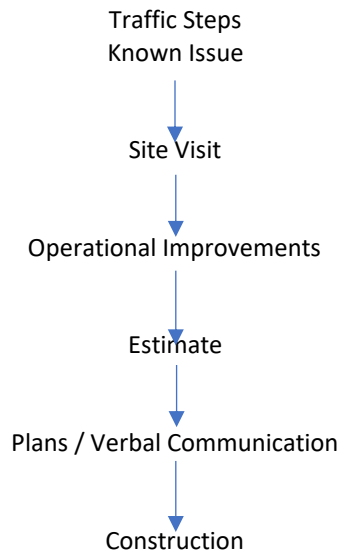**Define the Scoping Process for the Project Type:**

Guardrail
1. GRP ranking
2. Funding Provided
3. Project picked based on GRP ranking
4. District produces estimates and submits to CO Maintenance
5. Estimates are reviewed
   - Ensure estimates stay within scope
   - Ensure compliance with standard notes / procedures
   - Discussion with District
6. Proposal is finalized
7. Proposal sent to Procurement for bidding/award
8. Construction begins

Other Projects (Slides, Drainage, etc.)
1. District shows a need
2. Funding becomes available
3. Project approved District produces estimates and submits to CO Maintenance
4. Estimates are reviewed
   - Ensure estimates stay within scope
   - Ensure compliance with standard notes / procedures
   - Discussion with District
5. Proposal is finalized
6. Proposal sent to Procurement for bidding/award
7. Construction begins

Resurfacing/ Preventive Maintenance

1. Pavement Management evaluates roadways and ranks
2. Discussion at District about list and priorities
   - Any adjustments for ranking are made based on discussions
3. Funding allotments determined
4. Final List complied
5. District produces estimates and submits to CO Maintenance
6. Estimates are reviewed
   - Ensure estimates stay within scope
   - Ensure compliance with standard notes / procedures
   - Discussion with District
7. Proposal is finalized
8. Proposal sent to Procurement for bidding/award
9. Construction begins.

Traffic Steps
Known Issue

↓

Site Visit

↓

Operational Improvements

↓

Estimate

↓

Plans / Verbal Communication

↓

Construction

Bridge Maintenance

| Preservation: Deck overlay, sealing, washing, etc.	Repairs and Rehabilitation: Emergency BS incident, beam impact, plate retrofit
1. District makes a request • Bridge Inspection Engineer	1. Internal or statewide maintenance contract
2. Proposal prepared	2. Site Visit
3. Letting	3. Design
	4. Proposal and letting

GO TO NEXT PAGE

TSMO – Assume Designated Funding

1. ID needs/Data, Network Screening
2. Get everyone (PD PDSP Traffic) a maintenance plan
3. ID potential Deployment – maintenance
   Demonstration/Expansion? Limits of TSMO Implementation
4. If project is big, solicit stakeholder involvement
5. Construct
6. Feedback/Maintenance

Resources: Rob Frazier
               Chris Barrow
               Les Jacobson

It's Infrastructure

SYSTEMS ENGINEERING
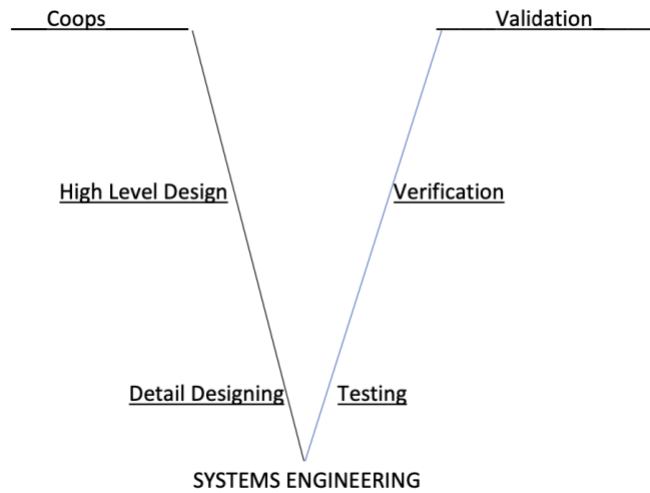
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Issues and Challenges
1. Lack of Experience
   - Inexperience leads to scope creep
2. Lack of consistent safety analysis among districts
3. Smaller projects could be done with FD04 or FE01 funding with experience and good communication
4. Data availability / Systems

Process Improvement Suggestions
1. Establish regular communication between Planning and Maintenance in order to share information on a regular basis.
   - Planning should proactively share what they have already looked at
2. Establish comprehensive data analysis
3. Commit to TSMO plan to make it a stand-alone program
4. Utilize Master Agreements

At final session
5. Have all districts and CO marry resurfacing and sign replacement so these activities can be done simultaneously

Capital Improvement Projects

Capital Improvement projects are challenging to define. Historically, Kentucky Transportation Cabinet (KYTC) staff called them highway plan projects or design projects. These projects have larger budgets than others in KYTC's portfolio and generally involve new road or bridge construction or major improvements on higher-traffic routes. Capital Improvement projects are also defined by the funding source and compete for Six-Year Highway Plan (SYP) funds. They are typically not maintenance related unless they entail a larger effort for which the Division of Maintenance lacks funding.

Capital improvement project needs and the conceptual scopes of work to address those needs most often come about through KYTC's Statewide Transportation Planning Process. Federal regulations require each state to carry out a continuing, cooperative, and comprehensive statewide multimodal transportation planning process to identify its most important transportation needs. Kentucky's process is described Chapters 7 and 8 of the KYTC Division of Planning's Annual Work Program. Through this process, KYTC coordinates with entities across the state, including Area Development Districts (ADDs), Metropolitan Planning Organizations (MPOs), and Highway District Offices (DOs), to continually identify and prioritize Kentucky's most important needs. Through coordination and data-driven tools such as the Continuous Highway Analysis Framework (CHAF) project database and the Strategic Highway Investment Formula for Tomorrow (SHIFT) project selection methodology, the process provides meaningful input used to develop Kentucky's biennial highway spending plan.

Projects may first be introduced by highway officials, the public, legislators, or local governments (e.g., Long-Range Plans, Regional MPO Plans, ADD plans). Since implementation of the SHIFT process, the CHAF database has been used to house project data for both unscheduled and scheduled project needs. Unfunded and funded projects are prioritized separately by planning staff, who examine projects in coordination with state highway officials, ADDs, MPOs, elected officials, and others to establish project priorities.

A project usually starts with a problem or roadway need. Project ideas are submitted to either an ADD, an MPO, or DO for inclusion in the CHAF project database. Data establishing the project origin, need, description, and limits are entered into the database. Data may be entered by the ADD, MPO, or DO. DO personnel later verify all project data. Cost estimates are developed exclusively by DO personnel. Once data are entered and verified, projects can be scored through the SHIFT process.

There are nine urban MPOs areas across Kentucky. An MPO is a transportation policymaking body made up of local government and transportation agencies that assume some authority and responsibility in the MPO area. They are

centered around large cities and were created by federal legislation to ensure that transportation project expenditures are based on continuing, cooperative, and comprehensive planning. Federal transportation funding is channeled through MPOs. MPOs often introduce visionary or non-traditional, streetscape-type projects into the CHAF database and SHIFT process. MPOs have more planning personnel than ADDs, which often devote fewer resource to planning.

Some projects — referred to as legislatively-added projects — receive SYP funding without going through the CHAF/SHIFT selection process. They are added during the late stages of the SYP approval process during the biennial budget legislative session. Initially, they bypass the SHIFT prioritization process altogether. The DO typically provides scopes and cost estimates for these projects and works to make their characteristics consistent with traditional projects housed in the CHAF database. Often, these projects are later added to the CHAF database to compete for future SYP funding.

Although every District should have, at minimum, a planning supervisor and traffic counting personnel, some Districts have difficulty filling those roles. Often, planning jobs go unfilled, or a person who takes a planning job does not stay very long. As part of KYTC's 2008 reorganization, district planning branches began to operate as sections under Project Development Branch Managers. This move seemed to diminish the importance of planning in Districts' overall project development and delivery programs and may contribute to the challenge of maintaining planning staff at the district level.

Most Districts do not prefer using consultants to provide scoping estimates.
KYTC has a user manual that explains how to enter projects into the CHAF database, and there is an old guide to creating the Project Identification Form (PIF), which was previously used to document initial project information. No available guidance describes the reason for scoping and how to do it.

Work Session
What are some of the bottlenecks or growth areas you have encountered during the scoping process in a Capital Improvement project?

1. Scoping non-traditional highway projects is challenging (e.g., streetscape).
2. Cost estimates and legislatively-added projects often end up in the CHAF. Estimates are performed quickly and with limited information and study. MPO areas require alignments to be included in the estimate; other projects do not.
3. A KRS requires a cost estimate for projects, but early estimates are often not accurate due to underdeveloped project scope.
4. During the project design phase, designers and members of the design team often alter project details, which increases (at times significantly) the estimate and scope developed during the project planning phase. Sometimes changes are needed, sometimes they are not. Per the *Highway Design Manual*, at least one alternative should be within the cost constraints of the SYP.
5. Every District requires the resources and expertise to properly scope and estimate projects. But low salaries often prevent Districts from hiring good personnel.
6. Planning studies and Data Needs Analysis (DNA) studies vary in detail, often affecting the cost estimate or how the project is defined.
7. Some projects are selected that lack planning studies, which leads to poorly scoped projects.
8. Consultant-led projects are often scoped more thoroughly (RFPs, proposals, pre-design meeting); however, in-house projects do not have the same resources to put equal effort into scoping.
9. KYTC's manuals lack formal guidance on project scoping.
10. Project descriptions and ideas need updating.
11. Project Development TEBM or Planning Supervisor directs projects to the correct programs (e.g., pavement preservation).
12. Even though SHIFT has reduced this problem, rushed scope/estimates are frequently put together at the request of the legislature during the early months of the even biennium.
13. Legislative projects tend to lack supportive data justifying the scope they are prescribing.

14. KYTC lacks a useable historical database to assist with development of reasonable cost estimates for both construction costs and design hours. Many Districts maintain such a document and use it as the basis for planning/design projects.
    a. Often the Districts spreadsheet tabulates full mileage of a project (mainline + approaches). It also tabulates design production costs but using the D funds authorized, subtracting the consultant fee to arrive at KYTC-D cost. With these calculations, there are various dollar per mile scenarios. There is also a distinction between urban and rural.
15. Depending on when a scope is estimated and how much solid data is available, a strongly recommended level of contingency should be calculated. For example, a legislatively-added project should have a 25% contingency; coming out of a consultant-prepared traffic study, the contingency should be in the range of 15%. Most DNAs could have a 20% contingency. Providing a recommended level of contingency in the *Planning Manual* and *Highway Design Manual* would be very beneficial to less experienced engineers.

Workshop Question: What are the process improvements needed to improve the highway scoping process in capital improvement projects?

Process Improvement Ideas

Issue or Challenge	Process Improvement Ideas

1. KYTC lacks up-to-date guidance on scoping projects.	• Develop updated guidance on:
	  o Scoping
	  o Developing a Purpose & Need statement
	  o Developing a Project Description

2. In-house versus consultant design projects — The RFP process has multiple scoping discussions and efforts.	• Develop better guidance for in-house projects. o Place more emphasis on capturing and preserving what the initial need or intent of a new project is and where it came from. • Create DNA reports when needed. • Design in-house less complex projects that require less intensive scoping. • Hold predesign meetings when needed.
3. Scoping process for non-traditional projects is difficult through the CHAF system and reporting.	• Guidance should explain the minimum requirements for completing a CHAF on non-traditional projects (and all projects). • Look at CHAF reports and determine if additional fields are needed to capture data on non-traditional projects.
4. Estimates of legislative project add-ons	• When a new project idea is submitted, ensure the scope and estimate are done properly. (This point should be discussed in the scoping guidance.)
5. KYTC can only devote limited human resources/personnel to scoping	• If scoping is to be a priority, additional resources are needed. Possibilities include: 1) hiring staff, 2) setting aside funding and hiring consultants, 3) reallocating current staff, or 4) having Location Engineers vet the scope.
6. Tools are needed for estimating and scoping	• Update estimation software/spreadsheet. • Begin to implement AASHTOWare across Districts.

Issue or Challenge	Process Improvement Ideas
7. The project's planning team and design team often do not share the same vision for the project scope.	• Include a designer in the planning phase and get design input for scoping and planning studies. • Place more emphasis on the importance of where the project comes from and what the original need is — throughout the planning and design phases. • Seek to incorporate the design-focused comments in the planning documents and project records.
8. Planning studies vary greatly in detail and quality.	• Develop guidance and a training course on scoping and planning processes. ○ Specifically, the training should discuss how the scoping process works and the philosophy of project scoping (why it is important). • Hold a pre-planning conference to help define the project and to begin to form the purpose and need. • Have different levels of planning studies in order to scale these studies based on project complexity. • KYTC does not have in-house planning/design staff who can do Synchro/Vissim at the District level. This would be very beneficial to better define project scope.
9. Not all projects have planning studies.	• Strengthen the link between planning and design. • Define the CHAF process. • Provide training on the philosophy of the process. • Clarify in guidance which projects should require a planning phase/planning study. • Clarify in guidance which projects require a DNA study.
10. As project ideas are submitted, they need to be directed to the right program	• KYTC programs for maintenance and asset management are well-established and work well most of the time. • Guidance is needed on when projects are designated for *Safety* or are eligible for HSIP.
11. Projects that include in the proposed footprint existing signals or problematic intersections, especially those in an urban areas, and projects with pedestrian issues may need to collaborate with Engineering Support.	• During the scoping, estimating, planning and design phases, Engineering Support and other subject-matter experts should be consulted to improve concept ideas that might help address the original need. Many times, the purpose/need evolves to include other identified needs, but the project development process should be utilized to right-size the project and not jump to solutions through scope creep.

Issue or Challenge	Process Improvement Ideas
	• While a potential project might be initiated from another source, coordination with Engineering Support helps to identify issues that the project might need to address. Therefore, a potential cost item is identified at inception rather than at PL&G or Joint Inspection, which results in higher costs.