Integration of Utility Engineering, Coordination, and Highway Design

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

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Research Report
KTC-21-17/SPR20-581-1F

Integration of Utility Engineering, Coordination, and Highway Design

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State transportation agencies (STAs) strive to deliver highway projects on time and on budget. Utility relocations are frequently cited as a primary reason for delays. This report describes a new approach for enhancing the alignment of utility coordination and design. Researchers crafted this new approach based on the findings of a literature review, an evaluation of how utility coordination milestones and project development milestones are currently aligned at the Kentucky Transportation Cabinet (KYTC), and the experiences of other STAs. KYTC should use this guidance to facilitate implementation of the new approach and an associated Utility Coordination Training and Certification Program. All personnel engaged in project design and delivery can benefit from the proposed guidance (e.g., district utility coordinators, consultant utility coordinators, project designers, project managers, surveyors, right-of-way staff, construction staff, central office utility coordinators, etc.). This guidance document also includes suggestions for identifying, managing, and mitigating, utility-related risks using Utility Conflict Management (UCM), provides information on the use of Subsurface Utility Engineering (SUE), and offers recommendations for managing consultant-led utility coordination.</td></tr>
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Executive Summary

State transportation agencies (STAs) strive to deliver highway projects on time and on budget though there are many sources of project delays. Project delays are increasingly common and frustrate motorists. Utility relocations are frequently cited as a primary reason for delays. Over the last 10 years, many agencies have developed strategies to improve utility coordination and reduce the causes of utility-related delays. Key strategies for improving utility coordination include forming partnerships with utility companies (UCs), strengthening communication with UCs, and more thoroughly integrating utility coordination and project design processes. Better integration of the utility coordination and design processes helps to identify and resolve utility conflicts earlier in project development and eliminate delay sources.

Like other STAs, the Kentucky Transportation Cabinet (KYTC) has faced many challenges related to utility work. Data on utility facilities has not always been readily available, which negatively impacts project outcomes. This report describes a new approach for enhancing the alignment of utility coordination and design. Researchers crafted this new approach based on the findings of a literature review, an evaluation of how utility coordination milestones and project development milestones are currently aligned at the Cabinet, and the experiences of other STAs. The new approach takes as its point of departure the Indiana Department of Transportation's (INDOT) utility coordination framework. INDOT's framework has proven immensely effective. The new approach was developed iteratively in consultation with the project's Study Advisory Committee (SAC).

The new utility coordination approach is described in Chapter 5, the *Integrated Project Development Guidance Document*. KYTC should use this guidance to facilitate implementation of the new approach and an associated Utility Coordination Training and Certification Program. All personnel engaged project design and delivery can benefit from the proposed guidance (e.g., district utility coordinators, consultant utility coordinators, project designers, project managers, surveyors, right-of-way staff, construction staff, central office utility coordinators, etc.). The guidance document also includes suggestions for identifying, managing, and mitigating, utility-related risks using Utility Conflict Management (UCM), provides information on the use of Subsurface Utility Engineering (SUE), and offers recommendations for managing consultant-led utility coordination.

Chapter 1 Introduction

1.1 Background and Problem Statement

Delays in highway construction projects are increasingly common and frustrate the traveling public. Utility relocations are frequently cited as a primary cause of delays. Unfortunately, it has become common practice to require that utility companies relocate their facilities late in the project development process, which can exacerbate delays. Delays resulting from utility relocations, however, can be reduced through better integrating utility coordination and project design, with early involvement being most critical (Sturgill et al., 2017). As in other states, utility work on highway projects presents many challenges to the Kentucky Transportation Cabinet (KYTC). Research and practice have demonstrated that many utility conflicts can be identified and resolved earlier in the design process. However, KYTC's past projects have shown that information on the location and characteristics of utility facilities is not always available in a timely manner. Consequently, even though efforts are made to avoid utility relocations, they often become necessary (Sturgill et al., 2014). Time and funds spent identifying and dealing with utility conflicts during a project's final design stage creates problems and worsens project outcomes.

Several state transportation agencies (STAs) have developed strategies to improve the efficiency of utility coordination. For example, the Indiana Department of Transportation (INDOT) has developed the *New Paradigm* model that has proven immensely effective. INDOT serves as a benchmark for illustrating how careful integration of project partners can move projects forward faster and lower risk. These efforts have changed national perceptions about how STAs should work with utility companies (UCs), which historically have been viewed as obstructions. Acknowledging the benefits of work in other states, Cabinet staff identified the need to (1) recast utility companies as partners — not obstacles — in project development and (2) improve the integration of utility coordination and highway design.

This project evaluated KYTC's current alignment of utility coordination process milestones with project development milestones to identify opportunities for improvement. The study presents guidance for modifying KYTC's utility coordination process; implementing utility conflict management to identify, manage and mitigate utility-related risks; strategic adoption of Subsurface Utility Engineering (SUE); and strategies related to consultant utility coordination. Project findings are being used to develop a Utility Coordination Training and Certification Program.

1.2 Research Objectives

This project sought to develop an *Integrated Project Development Guidance Document* (see Chapter 5). This guidance advocates early identification of potential utility conflicts and minimizing utility-related project risks during project development by identifying, avoiding, minimizing, and then mitigating all utility conflicts. KYTC will benefit from viewing design projects and utility coordination as opportunities to partner with UCs. The guidance document can be used by all personnel engaged in the design and delivery of KYTC projects (e.g., district utility coordinators, consultant utility coordinators, project designers, project managers, surveyors, right of way [ROW] staff, construction staff, and Central Office utility coordinators.

1.3 Organization of Report

This report is divided into five additional chapters. Table 1.1 summarizes their contents.

Table 1.1 Report Structure

Chapter	Content
2	• Reviews best practices for utility coordination.
3	• Reviews KYTC's current practices for highway design and utility coordination
4	• Describes the integration of recommended utility coordination practices into KYTC's current process
5	• Guidance document that walks through implementation of the proposed framework for tightening integration of utility coordination and highway design
6	• Conclusions and recommendations

Chapter 2 Literature Review

This chapter summarizes information on different practices and strategies that can be used to improve utility coordination. Information was gathered from a review of local- and national-level studies. To determine the most adequate sources of information, the research team considered relevant utility-related synthesis, research, and implementation projects presented by Quiroga et. al (2019) in the TRB Centennial Paper, *Strategic Research Needs in the Area of Utilities*.

2.1 Local Level Review

As Sturgill et al. (2017) indicate, KYTC has made significant changes to its utility coordination process over the past several years. It established a task force to review and procure tools for improved utility coordination and relocation, pursued research projects in collaboration with the Kentucky Transportation Center (KTC) to streamline the utility process, and participated in a pilot project for one of the products of Strategic Highway Research Program (SHRP) 2 R15B — the utility conflict matrix (UCM). The key findings of these research efforts are presented in this section.

Methods to Expedite and Streamline Utility Relocations for Road Projects

Managing utilities located within or near road ROWs way often challenges STAs. During design, KYTC attempts to inform project teams of potential utility conflicts, but often minimal data are available at this stage. Personnel try to avoid utility relocations, but they often prove necessary. KYTC recognizes the right of the owner/operators and therefore must engage them and implement strategies to support more collaborative utility relocations. Thus, the Cabinet needs better methods to estimate time and risks associated with relocations (Sturgill et al., 2014)

To identify the practices the Cabinet can adopt to streamline its utility coordination process, the research team administered surveys to and conducted interviews with KYTC engineers and UCs. Their feedback was critical because they are familiar with current processes and issues related to utility relocations. Table 2.1 summarizes interview findings.

Table 2.1 Recommended State Utility Practices for Utility Coordination Process

Aspect	Recommended Practices
Training	• Provide training to project managers and other design team personnel on utility issues • Provide training to UCs on highway plan reading • Train consultants and UCs on utility coordination processes and issues
Coordination and Communication	• Frequent meetings with UCs as the design progresses to get their input on utility conflicts and coordinate their relocation designs • Host meetings (monthly, quarterly, or annually) with UCs and other stakeholders to discuss future highway projects • Recognize the importance of long-range coordination • Conduct onsite meetings for utility coordination to determine utility conflicts and potential resolutions • Invite UCs to preconstruction meetings and encourage project participants to hold regular meetings throughout the project life cycle (as necessary) • Contact UCs to inform them of the proposed project and send preliminary plans early in the project development process
Right-of-Way (ROW)	• Use utility corridors for utilities that cross major highways • Acquire sufficient right of way properties for utility purposes • Define utility corridors during the project design
Subsurface Utility Engineering	• Develop a rigorous pre-qualification for SUE consultants that address their technical qualifications

	• Develop a screening tool to assist and formalize the process of selecting the most appropriate quality levels for SUE • Use existing cost-benefit studies to evaluate the cost-effectiveness of SUE • On projects where it is known in advance that utilities may represent significant time and cost factors, get QL B information as early as possible, preferably along with the topo development
Financing and Reimbursement	• Pay costs of utility relocation design — regardless of prior rights — to maintain coordination between available space and project timing • Develop an early utility cost estimate considering worst-case scenario assumptions. • Develop a database of historical utility relocation costs to generate the best possible cost estimate
Technical Tools	• **Geographic information systems (GIS):** Using this tool will require sufficient budgets to implement a completely functional electronic document system and funding to purchase software licenses and provide employees training • **Marker technology and field marking**: The main problem of using this tool is including inaccurate and incomplete field markings in the project information • **Utility impacts matrices:** The main drawback of using conflict matrices is the additional time required and the funding needed to hire a SUE consultant to identify potential conflicts and find useful solutions

Sturgill et al. (2014) identified 15 factors responsible for utility relocation delays in KYTC projects:

1. Inadequate financial budget and personnel resources
2. Utility companies would not be notified early when KYTC makes plan changes
3. Project design changes required changes to utility relocation
4. Poor control on big projects, especially coordination, is time-consuming
5. Long process of ROW acquisition
6. Relocations that could have been avoided during the design phase
7. Involving utilities late in the design phase
8. Contract controversy
9. Material acquisition and equipment procurement
10. Damages to existing facilities delay other relocation
11. Lack of communication between KYTC and UCs
12. Limitations on utility design consultant capacity
13. Short timeframe for STA to plan and design the projects
14. Utility companies give low priority to utility relocation
15. Rework required/change orders

Utility Relocation Task Force

During this study, KYTC commissioned a Utility Relocation Task Force to review utility relocation procedures and define and implement practices that will streamline utility relocation . Two key takeaways of this task force were: **1)** KYTC and UCs must coordinate early in the design phase, and **2)** KYTC and UC staff must be in communication throughout project development. The task force mapped and review processes for utility planning and relocation, which was depicted in three flowcharts (see Appendix A). Another important outcome of this task force was a list of potential best practices for utility coordination (Table 2.2).

Table 2.2 Best Practices to Improve KYTC Utility Coordination Process – Utility Relocation Task Force

Best Practices	Description & Benefits
Earlier and Enhanced Utility Coordination and Involvement	KYTC's previous approach to project development considered few interactions with UCs until later in the design process when funding is authorized for utility relocations. By this point, decisions regarding design and main alignments have been made, making possible design changes quite costly and potentially leading to project delays. Inputs and feedback from UCs are received during the middle of the project, so they are typically left out of the decision-making process. Involving UCs earlier in the process may require enhanced coordination and communication. **Benefits:** Allow designers to make reasonable efforts to minimize utility impacts since they will be able to make informed decisions about project siting. It can also help to improve workflows and streamline utility relocation processes.
Emphasize Strategic Avoidance in Project Design	By emphasizing strategic avoidance in project design, designers could use a more context-sensitive design approach. They should be more mindful of current utility placement. **Benefits**: Lets the design team modify the project design to avoid or minimize effects on existing utilities without sacrificing safety or project functionality.
Strategic and Routine Communication between KYTC and UCs	Frequent communication among KYTC and UCs is a vital piece for successful project completion. Maintaining strategic communication refers to keeping communication based on project needs. Communication must be routine and conducted on a district-by-district basis. **Benefits**: Frequent communication between KYTC and UCs will benefit both. It will keep everyone informed on project activities.
Develop and Offer training to the Use SUE, Utility Specific Plan Reading, and the Coordination of Project Design, Utilities, and Right-of-Way	The three main areas in which training concepts could be implemented to improve project outcomes are: 1) Use of SUE, 2) Reading utility plans, and 3) Coordination of project design, utility relocation, and ROW acquisition. **Benefits:** Help project designers improve how they visualize utility locations that may be affected by different implementation scenarios and eliminate potentially costly errors. If all project stakeholders understand their responsibilities, the odds of successful project completion increase.
Coordinated Statewide Electronic Management System for Utilities and Relocations	One practice to improve the utility coordination process is data tracking and availability. **Benefits**: Having a database system can help track utility relocations, store updates from UCs, enable electronic submission, and exchange necessary documentation.
Use of Master Agreements	Master agreements can help streamline the establishment of agreements between KYTC and UCs. **Benefit**: Reduce the amount of time needed to execute design and relocation agreements.

Significant conclusions of the task force were:

- Training STAs designers and UCs could produce a comprehensive knowledge of utility relocation.
- Improving interaction early in the utility relocation process can boost collaboration on potential design solutions and open communication lines between KYTC and UCs.
- Holding meetings during the preconstruction and construction phases will let KYTC and UCs negotiate resolutions to problems that arise during utility relocations.
- There is a lack of communication, coordination, credibility, and trust among KYTC, UCs, and contractors, especially on larger projects.
- UCs will benefit if KYTC shares with long-term budget plans and schedules.
- KYTC has not developed a utility impact matrix to facilitate utility relocation.

- SUE has not been adopted by KYTC or UCs.
- Additional sources should be developed to improve the acquisition of as-built plans.

Managing Utilities Conflicts in Kentucky through the SHRP2 Solution: Identifying and Managing Utility Conflicts (R15B) – Case Study

KYTC has invested tens of millions of dollars annually looking for ways to streamline and create standard procedures for its designers and utility experts while minimizing utility conflicts. Under KYTC's prior utility program, no clear standards or policies for utility conflict identification existed to help designers communicate and mitigate utility conflicts during design (FHWA, 2020). With 12 Cabinet districts, the process of identifying and managing utility locations was inconsistent. As a result, KYTC began developing a new vision for its utility program, which culminated in the development of the Kentucky Utilities and Rails Tracking System (KURTS). KURTS is a data management system that lets utility and design subject-matter experts access project information remotely and securely with an internet connection (Sturgill et al., 2014). This data management software retains utility pertinent project records of all documents and provides different options (e.g., approval of relocation plans, agreements, invoices, change orders, and project status changes). KURTS allows users to interact with the UCM in more helpful ways.

As part of the FHWA/AASHTO Implementation Assistance Program, seven STAs, including KYTC, implemented R15B products (utility conflict data model and database and UCM training course). This resulted in the development of KURTS Release 2, which includes cost comparisons and schedule impacts, providing KYTC decision makers a better perspective of the potential project impacts. Potential users of R15B2 products are utility experts, design experts, project consultants, and UCs. During implementation of R15B products, the research team noticed that developing a standardized system in an industry with few standards protocols is challenging. However, as more users engage the system and the UCM, the value of this tool will become more evident.

Effective Utility Coordination: Application of Research and Current Practices

This report documented current practices in utility coordination, their effectiveness, and how recent utility coordination research has been implemented. Sturgill et al. (2017) highlighted several practices for effective utility coordination, including better coordination, timely involvement, and making utility alignment more integral to the design process. Figure 2.1 presents additional practices identified in this report .

Element	Percent of STA Respondents Selected ($n = 42$)	Number of Non-STA Respondents Selected ($n = 29$)	Number of Utility Owners Selected ($n = 16$)
Early Utility Involvement in Design (30% or earlier)	88% ✦	26 ✦	15 ✦
Utility Preconstruction Meetings	67% ☆	20 ✦	12 ✦
Defined Procedures (i.e., Utility Coordination Guidance Manual)	67% ✦	17 ✦	8 ☆
Consideration of Utilities Relocation Schedules in Relation to Project Schedules	74% ✦	15 ☆	10 ✦
Use of SUE (Subsurface Utility Engineering)	57% ☆	13 ☆	2
Regularly Scheduled Meetings with Utility Owners	57% ☆	12 ☆	5
Communication of Short-Range Transportation Plan	21%	12 ☆	9 ☆
Use of Utility Corridors	14%	12 ☆	8 ☆
Use of Standardized Utility Agreements	60% ☆	8	6
Identification of and Plan for Long-Lead Items	50% ☆	4	0
Utility Mapping System (utility location information entered into a GIS-based system)	26%	10	7 ☆
Communication of Long-Range Transportation Plan	24%	10	7 ☆

✦ Top three elements selected by respondents.
☆ Top eight elements selected by respondents.
Respondents were limited to choosing their top eight.

Figure 2.1 STA Effective Utility Coordination Practices

2.1 National Level Review

<u>Optimizing Utility Owner Participation in the Project Development and Delivery Process</u>

Quiroga et al. (2013) suggest that effective communication, cooperation, and coordination among utility stakeholders are critical to keeping projects on schedule . Unfortunately, these are frequently lacking during project development, precluding the adoption of potentially more collaborative and cost-effective solutions. This usually happens because project managers lack familiarity with utility issues, project uncertainties lead to UCs not participating in the process earlier, and lack of adequate utility facility data. This research developed strategies to improve UC participation and responsiveness.

The research team compiled 64 potential strategies to improve UC participation during project development and delivery at the Texas Department of Transportation (TxDOT) (24 strategies for communication and coordination, 17 strategies for contracts and agreements, 19 strategies for utility data collection and management, and four strategies for training). Researchers also met with stakeholders to consolidate and rank potential strategies. Some strategies were selected for further development:

- **Modernize the utility process:** The research team developed three flowcharts with different levels of detail that depict the project development and utility coordination processes at TxDOT.
- **Utility Conflict Matrix Approach:** The research team implemented and adapted the SHRP2 Research Project R15B, "Identification of Utility Conflicts and Solutions," to develop three products (compact standalone UCM spreadsheet, utility conflict data model and database, and a training course on the materials).
- **Streamline and standardize utility cost data submission:** The research team prepared a prototype Microsoft Excel template with integrated worksheets. This tool helps UCs prepare and submit standardized utility cost estimates.
- **Core skills training on utility topics:** The research team developed a list of potential training needs on utility issues. They also identified core skills that can be used as a reference for training courses.

Chapter 104: Utility Coordination Guidance Manual - Indiana DOT

Recently, STAs have made efforts to change how they work with UCs. Work done by the Indiana Department of Transportation (INDOT) offers a benchmark for demonstrating how collaboration between project partners can reduce project risks and streamline delivery. The agency has encouraged a change in mindset, using the mantra *everyone knows where everyone goes* to promote collaborative work between the project team and UCs.

The research team reviewed INDOT's current guidance for utility coordination, specifically Chapter 104: Utility Coordination, as it describes and the roles and responsibilities of project participants. This review process helped the research team identify the practices that INDOT applies to utility coordination. Figure 2.2 portrays the main stages of INDOT's utility coordination process. See Appendix B for a detailed illustration of each stage.

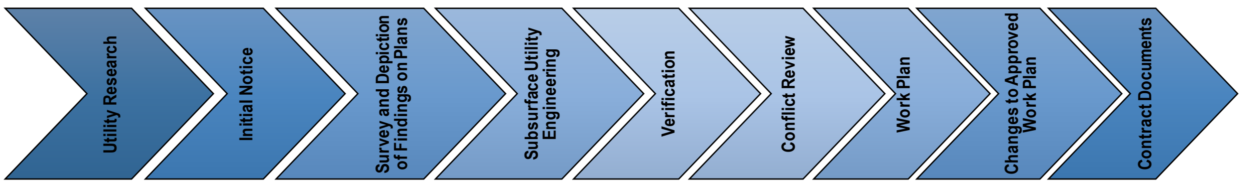


Figure 2.2 Utility Coordination Process – Indiana DOT

The research team noticed some positive aspects in how INDOT's utility coordination process is integrated into project development, which allows designers to make informed design decisions. Figure 2.3 depicts the interaction between the designer and UCs throughout utility coordination.

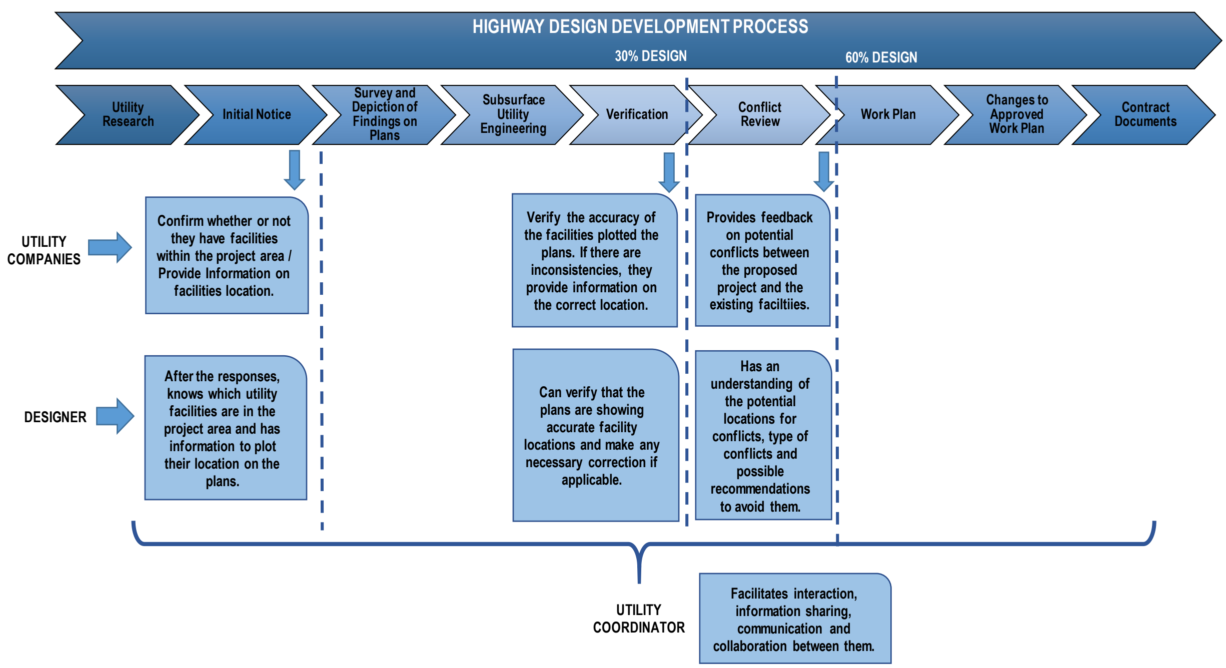


Figure 2.3 Interaction between Designer and Utility Companies through the Utility Coordination Process

Other important takeaways regarding utility coordination identified from the revision of this guidance are:

- Coordination with UCs should begin as soon as a project scope has been developed and must continue throughout construction until utility work is complete.
- The design process should occur in tandem with utility coordination and integration of utility accommodation.

- The designer should be familiar with all aspects of utility coordination. Active involvement of the designer with the UCs and utility coordinator throughout project design can avoid later utility relocation issues and make a difference in whether a project is successfully completed.
- Throughout utility coordination, the designer's goal must be to minimize the number of utility conflicts while considering the project's design goals (safety, project budget, and project schedule).

<u>The Root Causes of Delays in Highway Construction</u>

In this paper, Ellis and Thomas (2022) summarizes findings from NCHRP 20-24(12), *Avoiding Delays During the Construction Phase of Highway Projects*. The report identified apparent and root causes of delays during construction and gave recommended practices, procedures, methods STAs and contractors can use to avoid delays and mitigate their impacts and costs. Researchers developed 40 recommendations for dealing with root causes that are organized into five broader categories:

a) Recommendations related to STA business practices and procedures
b) Recommendations related to contractor procurement and contract administration
c) Recommendations related to incorporating construction input into the design
d) Recommendations related to utility locations and relocations
e) Recommendations related to contractor management

Categories c) and d) contain recommendations related to utility coordination. These are:

c) Recommendations for integrating construction input into the design:
    - Make more effective use of formal constructability reviews
    - Employ a construction manager (CM) who is responsible for coordinating the design and construction schedules
    - Include contractors on the constructability review team
    - SHAs should maintain a lessons learned database that should be shared among STAs

d) Recommendations related to utility locations and relocations:
    - Use SUE on all time-sensitive projects. Quality Level A should be used at key locations where there is a concentration of utilities or where critical utilities are located
    - Use 3D and 4D CAD models at critical intersections and locations
    - Develop guidelines citing specific criteria defining when utilities should be relocated
    - Develop standards of practice for how utility information is conveyed. These standards should include details on items such as quality levels, information, and symbols.
    - Relocate utilities using specialty subcontractors
    - STAs loan funds to the municipality until their funding request is approved

<u>Best Management Practices and Incentives to Expedite Utility Relocation</u>

This project investigated, identified, and recommended best management practices (BMPs) and incentives to expedite utility relocations and minimize delays affecting their completion. El-Rayes et al. (2017) generated 45 BMPs and incentives (Table 2.3).

Table 2.3 Utility Relocation Best Management Practices (BMPs) and Incentives

Best Management Practices and Incentives (45)	
Coordination Practices (5)	• Coordination, cooperation, and communication • Utility coordination councils • Designated utility coordinator • Multi-level memorandum of understanding • Utility coordination during construction
Financial Incentives (6)	• Cash Bonuses • Incentives / Disincentives • Cost sharing • No-excuse incentives • Contractor – provided financial incentives • Gain share – pain share
Practices Requiring Funding (10)	**IT Solutions:** • Utility cost database • Electronic utility permits • Utility coordination websites • Electronic document delivery
	Field Solutions: • SUE • Clearing, grubbing, staking, grading • Utility-relocation safety program • Removal of abandoned utilities • Trenchless technology • Utility tunnels
No-Cost Practices (24)	**Contract Type:** • Utility work by Highway Contractor • A+B bidding • Lane rental • Design-build • Unit cost • Combined utility segments • Highway contract facilitating language • Lump-sum agreements
	Right-of-way Management: • Right-of-way acquisition • Utility corridors • Locate next to ROW line • Use existing tunnels for utilities

	Administrative: • One-call system • UCM • Advance relocation of utility work • Utility training classes • Standardized estimate/bid forms • Standardized invoice submissions • Value engineering for utilities • Avoidance for utility relocation • Modernize utility processes • Utility manuals • Context-sensitive design • Simplified permit approvals for utilities

Utility Location and Highway Design

This report describes current practices used by STAs for managing utilities during project development. It includes information on when during project development utility impacts should be assessed, when relocation decisions should be made, and how design decisions are influenced by utilities (Anspach, 2010). The research team developed a list of best practices that have an application, even if minor, for the relocation versus design-to accommodate decision process:

- Train project managers and design team personnel on utility issues
- Train consultant and UC staff in topics related to coordination processes and issues
- Consider paying the utility relocation design costs regardless of prior rights to maintain coordination between available space and project timing
- Consider task-order contracts, including experts on utility and highway design, as an additional resource for alternative design recommendations
- Develop early utility cost estimates based on worst-case assumptions and frequently review them if anything changes
- Use tools such as Google Earth, roadway video logging, and GIS systems to access early visualization of utilities during planning
- Include a utility expert on the design team early in the process and keep them involved and informed as the design progresses
- Develop a standardized format for identifying and resolving utility conflicts as the design progresses
- Develop a mechanism to record changes to existing utility facilities performed by utility companies as the design progresses.
- Develop or encourage use of a GIS system for collecting, storing, and managing utility-related data
- Require utilities to install radio frequency identification markers or nonmetallic utilities
- Develop a database of historical utility relocation costs to improve the accuracy of cost estimates. Update it periodically.
- Develop visualization aids for utility pole and structure relocation costs
- Develop and encourage the use of visualization techniques to assist designers with design alternatives
- Develop a screening tool to assist with identifying the proper quality level for utility mapping. This should be a dynamic process that is reviewed as additional detail is developed in the design.
- Use existing cost-benefit studies to evaluate the cost-effectiveness of SUE
- Have frequent joint meetings with utility owners to input relocation issues and do necessary coordination
- Provide training in highway plan reading to UC personnel
- Review and ensure that all guidance documents do not conflict with each other

Appendix C contains survey results and case studies from the report.

Highway/Utility Guide

The Federal Highway Administration (FHWA) published this guidance in 1993. The report is a collection of good practices that can provide insight into current utility practices for highway agencies, UCs, and their employees. A successful highway project requires the participation of all entities whose assets lie within the project's ROW. All parties with facilities within the ROW way should be able to examine and consider the impact of proposals affecting that ROW (Thorne, 1993). Recommendations for **highway agencies** include:

- Share the highway improvement program with all relevant stakeholders
- Include all construction and maintenance work in the highway improvement program. Plans should be at least for the next two years with longer timeframes (5-6 years).
- Hold meetings (at least once per year) with UCs and highway personnel to discuss upcoming project development and construction activities.
- Notify UCs of projects before the design phase (as early as possible)
- Send route plans of highway projects to UCs for comment during the design phase
- Determine the impact of all projects on other facilities in or adjoining the ROW
- Set meetings between highway project team and utility owners prior to each major project phase, including planning, design, and construction
- Identify and resolve conflicts prior to construction
- Share construction schedules with UCs
- Provide one point of contact in the agency to work with UC representatives from project inception through completion
- Publish maps each year showing municipality, county, STA, and utility projects
- Publish detailed descriptions of projects, including project schedules, managers, and contact information.

Similarly, the recommendations developed for **UCs** are:

- Develop a utility master plan in conjunction with other public planning efforts
- Provide capital improvement programs to highway agencies
- Review and update utility system plans continually every 2 to 5 years and provide them to public works and highway agencies
- Meet with local or state agencies to discuss projects, determine impacts, and explore alternatives to avoid potential conflicts
- Establish one point of contact and inform the highway agency of future work on utility conflict resolutions
- Minimize the impact of utility facilities on highways with high traffic volumes, few alternative routes, or limited ROW

SHRP2 Report S2-R15-RW "Integrating the Priorities of Transportation Agencies and Utility Companies"

This report documented current practices, opportunities for improvement, and anticipated barriers for integrating UC and transportation agency priorities on highway renewal projects. Utility issues are a major cause of delays. Some factors contributing to construction delays are lack of accurate information on the location of underground or overhead utility facilities, inadequate estimation of the time and budget for utility relocations, and insufficient coordination and cooperation between transportation agencies and UCs (Ellis et al. 2009). There are universal core deficiencies in DOT – UC coordination. The most common difficulties that usually affect timely relocations are insufficient communication, scheduling, and coordination in planning, ROW acquisition, design, and construction phases. Appendix D provides a summary of the findings. To improve their performance, STAs and UCs need to resolve the fundamental issues by applying the following best practices:

1. Utility relocations in advance of construction work
2. Early involvement of utilities in planning and design phase
3. Train STA designers on the utility relocation process
4. Develop a GIS database
5. Preconstruction and progress meetings

6. Incentives for early relocation
7. Develop utility and right of way management systems
8. Include utility relocation work in construction contracts
9. SUE
10. Hold utility coordination meetings during the design phase
11. SUE rating procedures
12. Hire a work site utility coordination supervisor

Best practices can be applied in different phases of the project life cycle (Figure 2.4).

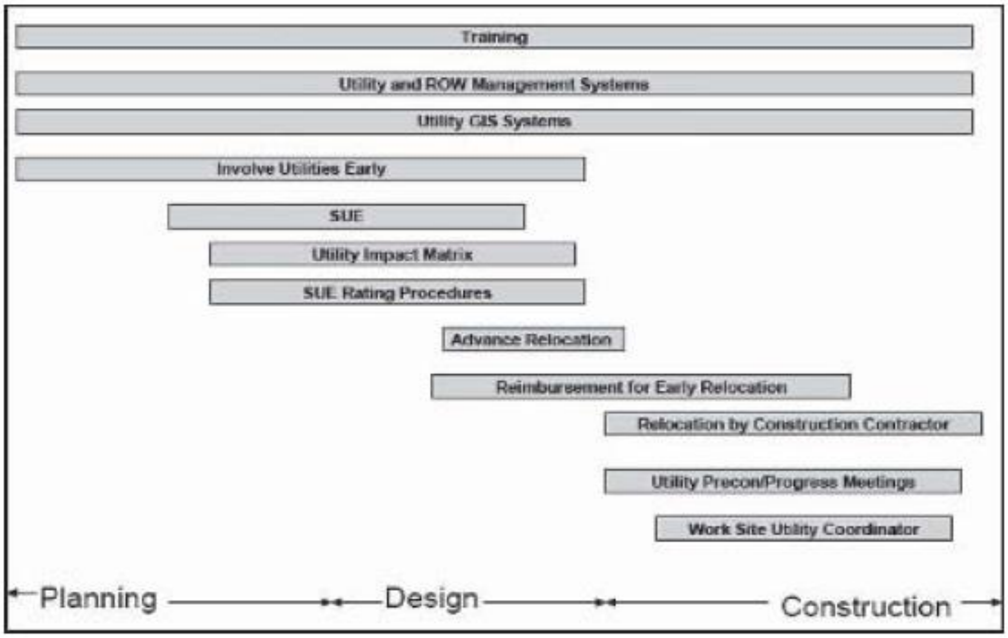


Figure 2.4 Recommended Best Practices by Project Phase

Successful implementation of these strategies requires four important initiatives:

- STAs and UCs must operate as partners
- View utility in highway ROW as a STA responsibility
- STAs and UCs must understand one another's technology and business processes *and* be able to speak one another's language
- Improve location methods and mapping technologies

SHRP 2 Report S2-R15B-RW-1 "Identification of Utility Conflicts and Solutions"

This project continued the research on resolving utility conflicts developed in SHRP2 Report S2-R15-RW *Integrating the Priorities of Transportation Agencies and Utility Companies*. This report provided comprehensive, optimized concepts and procedures for identifying and resolving utility conflicts. It found that procedures for using UCMs vary widely across the country (Quiroga et al. 2012). The research team documented these procedures and then developed optimized UCM concepts and techniques that are presented in a one-day training course. The main products of this research project were:

- **Product 01: Contact standalone UCM spreadsheet.**
  A standalone product developed for Microsoft Excel. The UCM spreadsheet includes a main utility conflict table and a supporting worksheet for analyzing alternative utility conflict resolution strategies by tracking utility conflict data and associated information. Recommendations for managing utility conflicts include:

- Identify utility conflicts at the individual utility facility involved
    - Include control dates in UCMs
    - Keep in mind potential environmental implications related to utility relocations
    - Use utility engineering groups at STAs and utility coordinating councils
    - Develop utility conflict sheets for individual utility owners
    - Keep UCMs simple
    - Update the UCM regularly
    - Start assembling utility conflict tables during preliminary design
    - Include data from the UCM in the PS&E assembly
    - Use document management systems to support the utility conflict management process
    - Involve stakeholders in the review of utility conflicts and solutions
    - Conduct a plan-in-hand field trip with utility owners
    - Use and document radio frequency ID tags for damage prevention during construction
    - Work with one-call providers to identify utility owners and facilities
    - Develop effective communication with utility owners regardless of reimbursement eligibility
    - Provide training to utility coordination stakeholders

- **Product 02: Utility conflict data model and database**
  A scalable representation of the UCM that can be used to manage utility conflicts in a comprehensive database environment. The research team used industry-standard protocols to develop the model, including a logical model, a physical model, and a data dictionary.

- **Product 03: UCM training course and course materials**
  This product helps end-users to adopt tools and strategies developed through the first two products. The training course includes a lesson plan and presentation materials.

- **Product 04: Implementation Guidelines**
  These guidelines include steps for implementing the products, including identifying the implementation team, training courses on the UCM, and detailed activities to implement Products 01 and 02.

<u>Avoiding Utility Relocations</u>

This FHWA manual encourages highway designers to avoid unnecessary utility relocations. It discusses the value of avoiding relocations and the technologies and techniques that can be used to accomplish this goal. Historically, information on utility facilities has been taken into account in highway plans development at the 60% design stage with the goal of identifying utility conflicts that require relocation. Unfortunately, at this point, not much can be done to avoid or alleviate the conflict (FHWA, 2020).

Identifying potential conflicts as early as possible — at the 30% design stage or sooner — can let stakeholders adopt more creative solutions to remedy utility conflicts. To enable the design team to design around utilities, having information on utilities location is necessary. This project lists practices that support collecting accurate and comprehensive subsurface utility information and promote effective communication and coordination among highway agencies and UCs throughout the project life cycle. A list of strategies for different stages of the highway project is presented (e.g., meetings, utility coordination councils, one-call notifications, SUE, utility agreements, cost-sharing, joint project agreements, context-sensitive design, locating next to the ROW, trenchless technology, use of utility tunnels, use of subways for dry lines, removal of abandoned facilities). Key takeaways were:

- Conflicts between utility facilities and the alignment, geometry, grade, and drainage of an improvement highway project occur too frequently.
- Utility conflicts are one of the most common causes of delays for highway contractors. Not having access to accurate and comprehensive information on utility locations and the lack of communication and coordination between project participants contribute to problems on highway projects.

- Identifying potential utility conflicts early in the development of highway projects to find the most efficient and cost-effective alternative during the design stage is fundamental for project success.
- Designers should use SUE to obtain accurate subsurface utility information for highway plans and manage that information during project development. Efficient use of this information will let designers design around as many utilities as possible and avoid relocations without affecting project safety and functionality.
- Good communication and coordination between STAs and UCs is necessary throughout project development and construction. The practice of designing projects without involving UCs and then relocating utility facilities in conflict must be done away with. Considering UC input early in the design process may result in minor design changes to avoid relocations. Otherwise, significant plan changes that result in costly, time-consuming, and unnecessary relocations will be needed.

CI/ASCE 38-02 ASCE's Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data

This report provides a system for classifying the quality of data associated with existing subsurface utilities (ASCE, 2002). This guideline was produced to help end users (project owner, engineer, constructor, and utility owner) develop different strategies to reduce risk by improving the reliability of the information on subsurface utilities. Important takeaways include:

- The engineer should advise the project owner of potential risks the project may present to subsurface utilities and analyze project needs to recommend a scope for utility investigations. The engineer should also discuss deliverable formatting and the sequence of data acquisition during the planning and design stage. They should participate in reviewing plans as design progresses and design changes are made. When necessary, the engineer should recommend any upgrades in quality level.
- The project owner should specify and discuss the work scope and deliverable formatting with the engineer. The project owner should also discuss the adequate quality levels with the designer, constructor, and other users.
- Differentiating quality levels:
  - **Quality Level D:** The engineer researches utility records to help UCs identify facilities the project may impact. Sources that can be used for this quality level are previous construction plans in close proximity, conduit maps, distribution maps, as-built drawings, and record drawings.
  - **Quality Level C:** The engineer must perform the task for Quality Level D and identify surface features on the topographic plan and surface appurtenances of existing subsurface utilities. The engineer should also determine if there are discrepancies between records and features and resolve them. If necessary, they can consult with UCs.
  - **Quality Level B:** The engineer must perform the task for Quality Level C and define the appropriate surface geophysical methods to search for existing utilities in the project area. Then, the engineer has to interpret the surface geophysics and mark any indication of utilities for a subsequent survey. The engineer must survey all markings that indicate the presence of a subsurface utility and depict all designated utilities correlating the results with existing utility records.
  - **Quality Level A:** The engineer must perform the task for Quality Level B and select the level-appropriate method for gathering data based on the project requirements for accuracy and precision. It is also the engineer's responsibility to resolve any difference between Quality Level A data and information derived from other quality levels. The engineer must determine horizontal and vertical location of the top/or bottom of the utility, elevation of the existing grade over the utility, outside diameter of the utility, material composition of the utility structure, benchmarks and/or project datum used to determine elevations, paving thickness and type, general soil type and site conditions, and other pertinent information.

AASHTO Strategic Plan "Right of Way and Utilities Guidelines and Best Practices"

This report summarized best practices for handling utilities, classifying them into four groups:

1) Use currently available technology to the greatest extent possible
   - Use SUE on projects where underground utilities are present and high-quality information is necessary for design. Utility facilities should be depicted at appropriate quality levels.
   - Require UC certification of record drawings and encourage development of a CAD database system

- Expand the use of GIS for utility mapping purposes

2) Encourage frequent coordination and communication with **local government agencies** to reduce delivery time and costs and improve quality in the utility process.
   - Work with local government jurisdictions to establish pavement criteria and backfill requirements

3) Encourage frequent coordination and communication with **UCs** to reduce delivery time and costs and improve quality in the utility process.
   - Provide UCs with long-range highway construction schedules
   - Host meetings with UCs to discuss future highway projects
   - Recognize the importance of long-range highway/utility coordination. Consider using long range-planning meetings to discuss other highway/utility issues.
   - Organize periodic meetings with UCs within the highway planning region
   - Request information on UC capital construction programs (potential expansions or reconstructions) and look for opportunities to coordinate overlapping projects. There could be opportunities to minimize costs and public impacts.
   - Provide UCs with a notice of proposed highway improvements and preliminary plans early in the project development process
   - Involve UCs in the design phase, especially when major relocations are anticipated
   - Conduct onsite utility meetings to determine utility conflicts and resolutions
   - Participate in local One-Call notification programs
   - Conduct monthly utility coordination meetings. If possible, meet individually with all UCs. Involve them in determining potential needs for ROW acquisition.
   - Invite UCs to participate in pre-construction meetings. Encourage them, contractors, and project staff to hold regular meetings during the construction phase.

4) Expedite utility relocations through improved contracts, internal project development, and training processes
   - Use standardized utility agreements
   - Use separate agreements for advance roadway work prior to utility relocation
   - Set responsibilities for appropriate actions to avoid delays for contractors
   - Provide special provision language in the construction contract
   - Avoid changes late in the process
   - Use highway contractors to relocate utility and municipal facilities when possible
   - Acquire enough ROW for utility purposes
   - Offer training sessions to STA utility specialists and UC staff

Chapter 3 Overview of the KYTC Highway Design and Utility Coordination Processes

This chapter reviews KYTC's highway design and utility coordination processes. The research team began with a detailed review of the *Highway Design Guidance Manual* and *Utilities & Rails Guidance Manual*..

3.1 KYTC Highway Design Process

Chapter 2 of the Highway Design Guidance Manual describes administrative procedures related to highway design (see Sections 202 – 204). Another source of information for this review was KTC's report, Critical Path for Project Development, which includes a work activities glossary that describes each activity KYTC's completes during project development (Kreis et al., 2019). Based on that information, the research team developed for the highway design process a Work Breakdown Structure (WBS) (Figure 3.2) and Gantt Chart (Figure 3.3). The WBS identifies all activities that are part of the design process. The WBS is arranged hierarchically:

- **Level One:** Illustrates the KYTC Highway Design Process
- **Level Two:** Illustrates the summary levels (pre-design, preliminary design, and final design stages)
- **Level Three:** Illustrates the work package level, including all the design activities

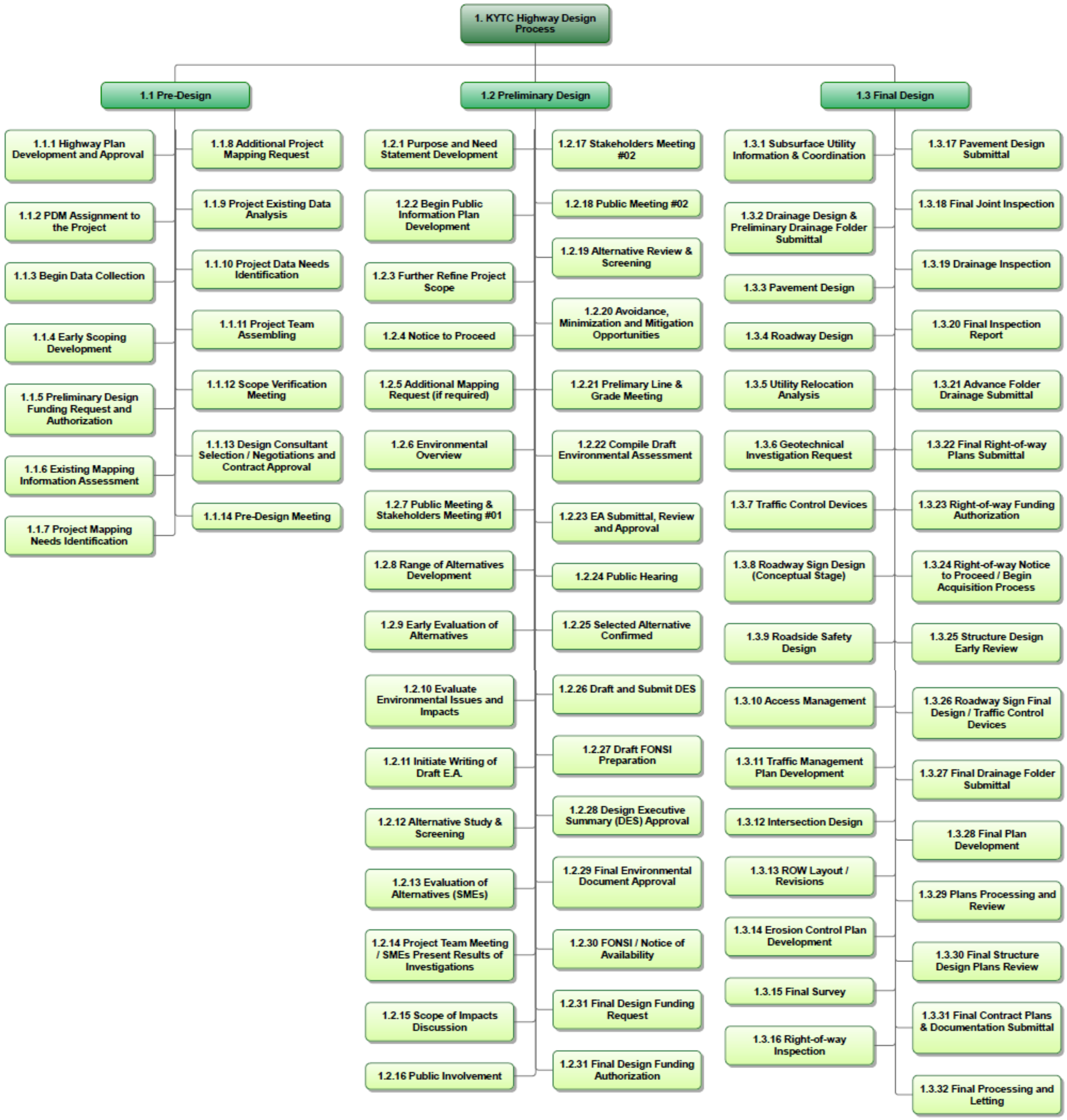


Figure 3.1 Work Breakdown Structure – KYTC Highway Design Process

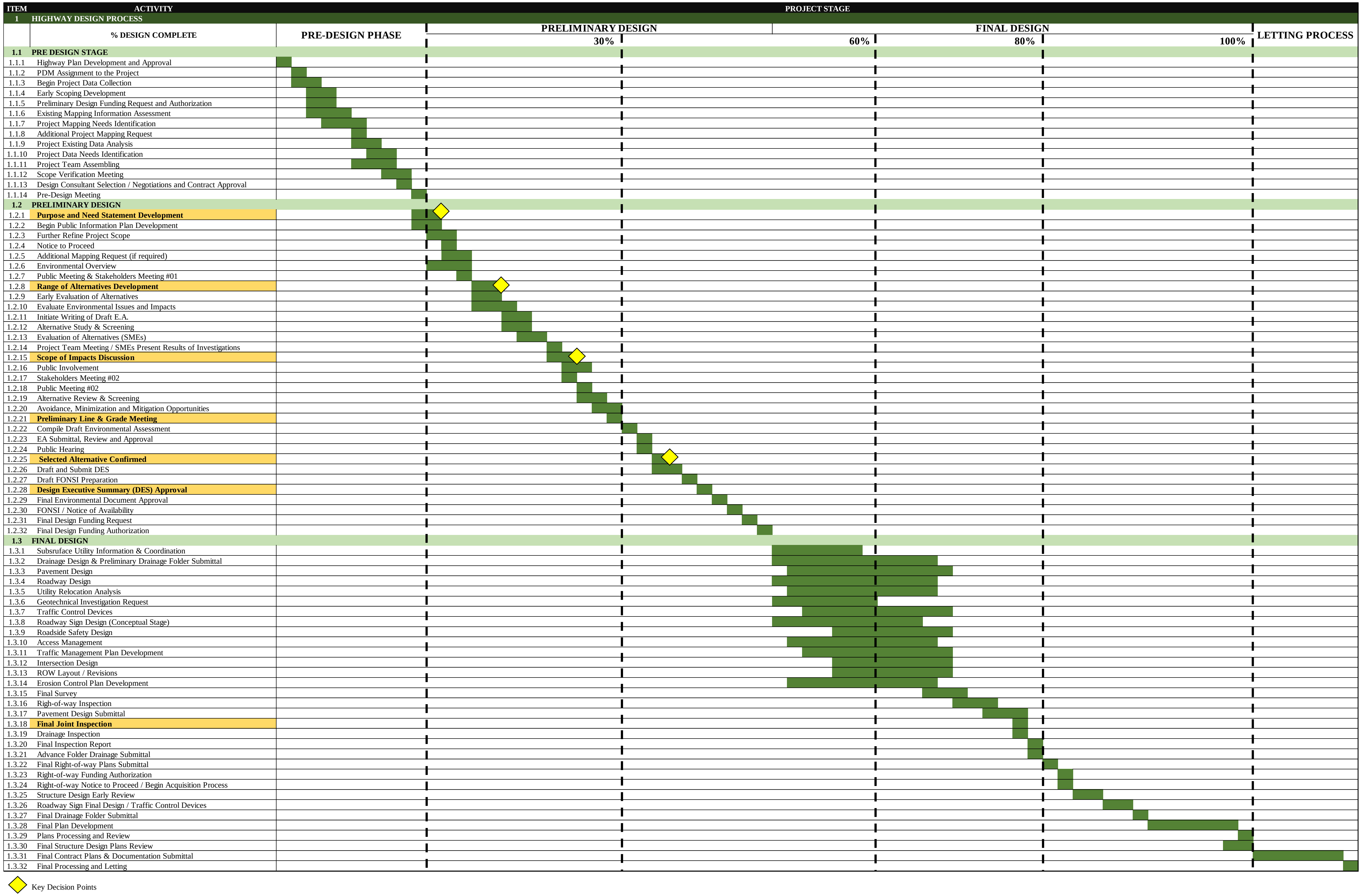


Figure 3.2 Gantt Chart - KYTC Highway Design Process

After completing the WBS, the research team sequenced project development activities using a Gantt Chart (Figure 3.3). Although the *Highway Design Guidance Manual* indicates when activities are expected to take place, descriptions are not always clear, making it difficult to understand the sequence of activities. However, the manual provides two flowcharts that shed light on the process (see Appendix E). The Gantt Chart captures the sequence of design activities relative to their alignment with the percentage intervals the research team established. The preliminary design stage and final design stage are divided into percentage intervals using three milestones — 30%, 60%, and 80% design complete. The *Highway Design Guidance Manual* does not describe the design process in terms of percentage complete. It describes the process based on the preliminary and final design stages. The only percentage data in the manual is the Final Joint Inspection, which occurs when design is approximately 80% complete. Some data on percentage complete also came from a report, *Tools for Applying Constructability Concepts to Project Development (Design)* (Stamatiadis et al., 2013*)*. This report indicates that the Preliminary Line and Grade Meeting occurs when 30 to 40% of the design is complete. At this point, alternative alignments are selected, the preliminary plans show a general layout for the proposed alignment, and environmental documents have been approved. The Final Joint Inspection Meeting is generally held when between 75 and 90% of the design is complete, matching with the percentage (80%) from the *Highway Design Guidance Manual*. Other sources of information on KYTC's design process works are:

a) Flow Chart number 2 in the research project *Methods to Expedite and Streamline Utility Relocation for Road Projects* (see Appendix A)
b) Flow Chart in *Critical Path for Project Development* (see http://ktc.uky.edu/ismyprojectonschedule/)

Seven design activities listed on the Gantt chart are highlighted yellow:

- Purpose and Need Statement Development (i)
- Range of Alternatives Development (ii)
- Scope of Impacts Discussion (iii)
- Preliminary Line and Grade Meeting
- Selected Alternative Confirmed (iiii)
- Design Executive Summary (DES) Approval
- Final Joint Inspection

Four of these activities (i, ii, iii, iiii) are highlighted because they are the four key decision points during preliminary design at which many early and critical design decisions are made. The others are significant milestones in the design process.

3.2 KYTC Utility Coordination Process

To document the utility coordination process, the research team reviewed the *Utilities & Rails Guidance Manual* (Chapters 5 – 18). Taking INDOT's utility coordination process as a benchmark, this review employed a method of analysis similar to that used by that agency (Appendix B; see Appendix F for an analysis of how KYTC's utility coordination process can be improved). Other sources of information included flowcharts from *Critical Path for Project Development* and flowcharts in the report, *Methods to Expedite and Streamline Utility Relocation for Road Projects*. Figures 3.4 and 3.5 are the WBS and the Gantt Chart for KYTC's Utility Coordination Process, respectively. The WBS is arranged hierarchically:

- **Level One:** Illustrates KYTC's Utility Coordination Process
- **Level Two:** Illustrates the summary levels or sub-processes
- **Level Three:** Illustrates all the activities of the KYTC utility coordination process.

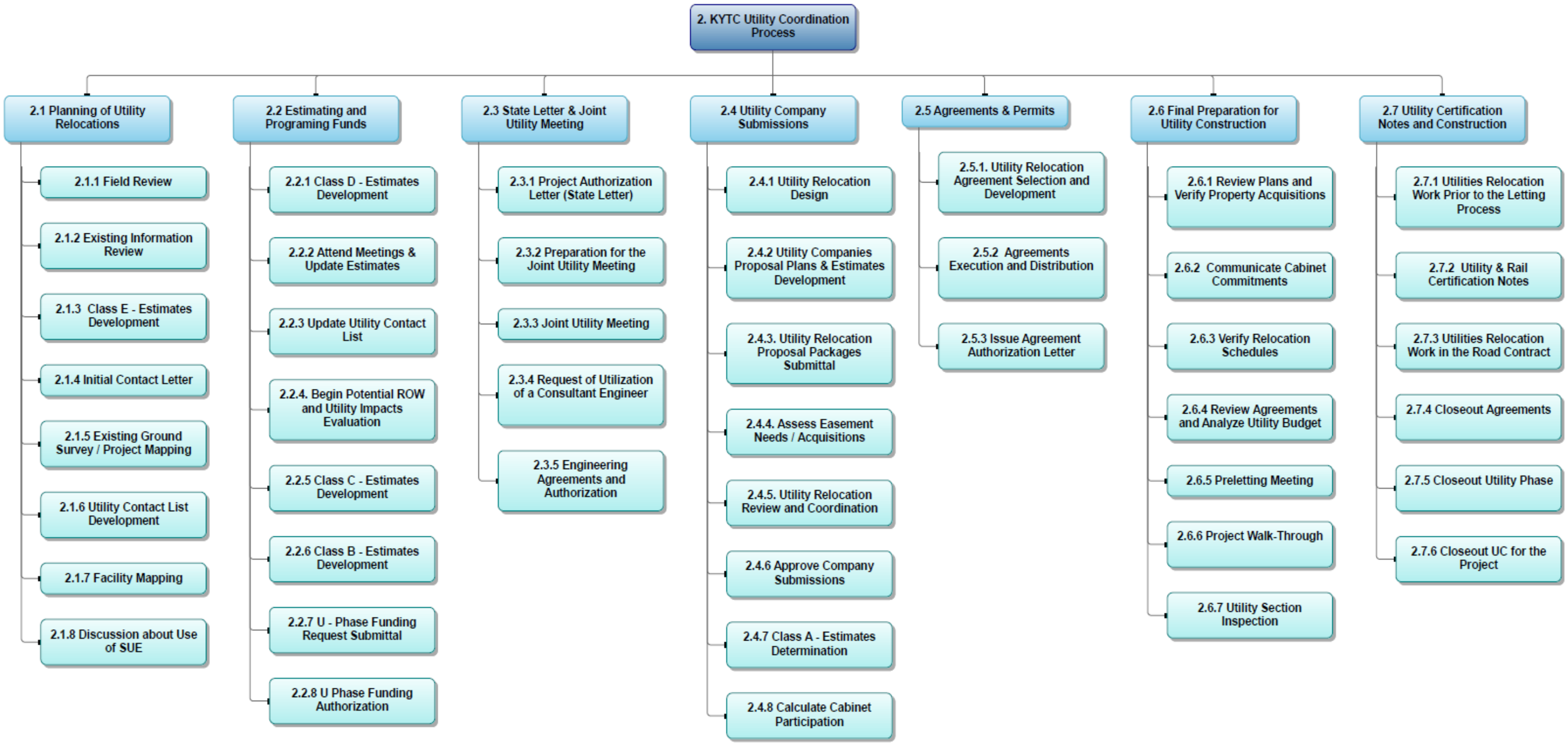


Figure 3.3 Work Breakdown Structure – KYTC Utility Coordination Process

UTILITY COORDINATION PROCESS

2.1	**PLANNING OF UTILITY RELOCATIONS**
2.1.1	Field Review
2.1.2	Existing Information Review
2.1.3	Class E - Estimates Development
2.1.4	**Initial Contact Letter**
2.1.5	Existing Ground Survey / Project Mapping
2.1.6	**Utility Contact List Development**
2.1.7	Facility Mapping
2.1.8	Discussion about Use of SUE
2.2	**ESTIMATING & PROGRAMING FUNDS**
2.2.1	Class D - Estimates Development
2.2.2	Attent Meetings & Update Estimates
2.2.3	Update Utility Contact List
2.2.4	Begin Potential ROW and Utility Impacts Evaluation
2.2.5	Class C - Estimates Development
2.2.6	Attent Meetings & Update Estimates
2.2.7	Class B - Estimates Development
2.2.8	U-Phase Funding Request Submittal (minimum Class C)
2.2.9	**U-Phase Funding Authorization**
2.3	**STATE LETTER & JOINT UTILITY MEETING**
2.3.1	**Project Authorization Letter (State Letter)**
2.3.2	Preparation for the Joint Utility Meeting
2.3.3	Request of Utilization of a Consultant Engineer
2.3.4	Engineering Agreements and Authorization
2.3.5	**Joint Utility Meeting**
2.3.6	Assess Replacement Easement Needs / Acquisitions
2.4	**UTILITY COMPANY SUBMISSIONS**
2.4.1	Utility Relocation Design
2.4.2	Utility Companies Proposal Plans & Estimates Development
2.4.3	**Utility Relocation Proposal Packages Submittal**
2.4.4	Utility Relocation Review and Coordination
2.4.5	Approve Company Submissions
2.4.6	**Class A - Estimates Determination**
2.4.7	Review Cabinet Participation
2.5	**AGREEMENTS & PERMITS**
2.5.1	Utility Relocation Agreement Selection and Development
2.5.2	Agreements Execution and Distribution
2.5.3	Issue Agreement Authorization Letter
2.6	**FINAL PREPARATION FOR UTILITY CONSTRUCTION**
2.6.1	Review Plans and Verify Property Acquisitions
2.6.2	Communicate Cabinet Commitments
2.6.3	Verify Relocation Schedules
2.6.4	Review Agreements and Analyze Utility Budget
2.6.5	Preletting Meeting
2.6.6	Project Walk-Through
2.6.7	Utility Section Inspection
2.7	**UTILITY CERTIFICATION NOTES AND CONSTRUCTION**
2.7.1	Utilities Relocation Work Prior to the Letting Process
2.7.2	Utility & Rail Certification Notes
2.7.3	Utilities Relocation Work in the Road Contract
2.7.4	Closeout Agreements
2.7.5	Closeout Utility Phase
2.7.6	Closeout UC for the Project

Figure 3.4 Gantt Chart - KYTC Utility Coordination Process

The WBS for the utility coordination process identifies all relevant activities, while the Gantt chart illustrates process sequencing. In addition to narratives from the *Utilities & Rails Guidance Manual*, materials were drawn from other reports, including *Methods to Expedite and Streamline Utility Relocation for Road Projects* (Appendix A). The Gantt Chart highlights the following utility coordination activities (important milestones):

- Initial contact letter
- Utility contact list development
- U-phase funding authorization
- Project authorization letter
- Joint utility meeting (JUM)
- Utility relocation proposal package submittal

3.4 Current Alignment between both Processes

The next step was to understand how the design and utility coordination processes work together. Reviewing manuals turned up little information on aligning these processes. Figure 3.6 is one of the few figures that gets at this relationship.

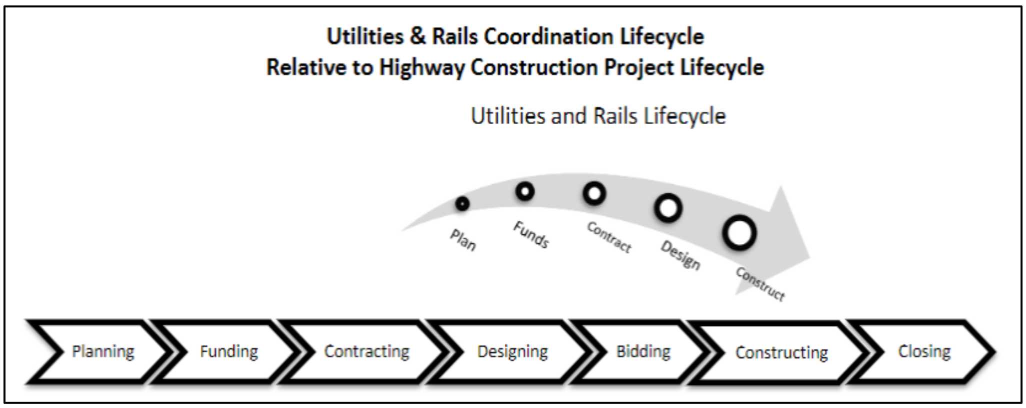


Figure 3.5 Utilities & Rails Coordination Lifecycle relative to Highway Construction Project Lifecycle

The *Utilities & Rails Guidance Manual* states that the Request of Funding for utility relocations occurs around the same time or right after the final ROW plans are submitted and ROW funds are approved. It also states that the estimates for utility relocations are periodically reviewed and updated at different milestones:

- **Class E – Estimates (Project Planning Stage):** Occurs when the project is conceptual in nature, being scoped, or in a preliminary study
- **Class D – Estimates (Preliminary Design Stage):** Occurs when the project is in preliminary design or is a study
- **Class C – Estimates (Early Final Design Stage):** Occurs when the project is at the preliminary line and grade milestone
- **Class B – Estimates (Final Design Stage):** Occurs when the project is at the final joint inspection milestone
- **Class A – Estimates (Final Design Completion Stage):** Occurs when the company forwards their relocation

This information was combined with Flow Chart Number 2 (Appendix A) to understand how utility coordination activities align with design. This information was summarized in a new Gantt chart (Figure 3.7) that depicts the current alignment of design and utility coordination processes. It locates utility coordination activities within the preliminary and final design stages and uses percentage intervals (30%, 60%, and 80%). Activities highlighted in orange are those for which the guidance manuals provide information that clarified this alignment. However, project development can deviate from the general process portrayed in Figure 3.7. Once the WBSs and the Gantt Charts were complete, the research team met with the study advisory committee (SAC) to evaluate their accuracy. Feedback from the SAC informed the final deliverables presented in this report.

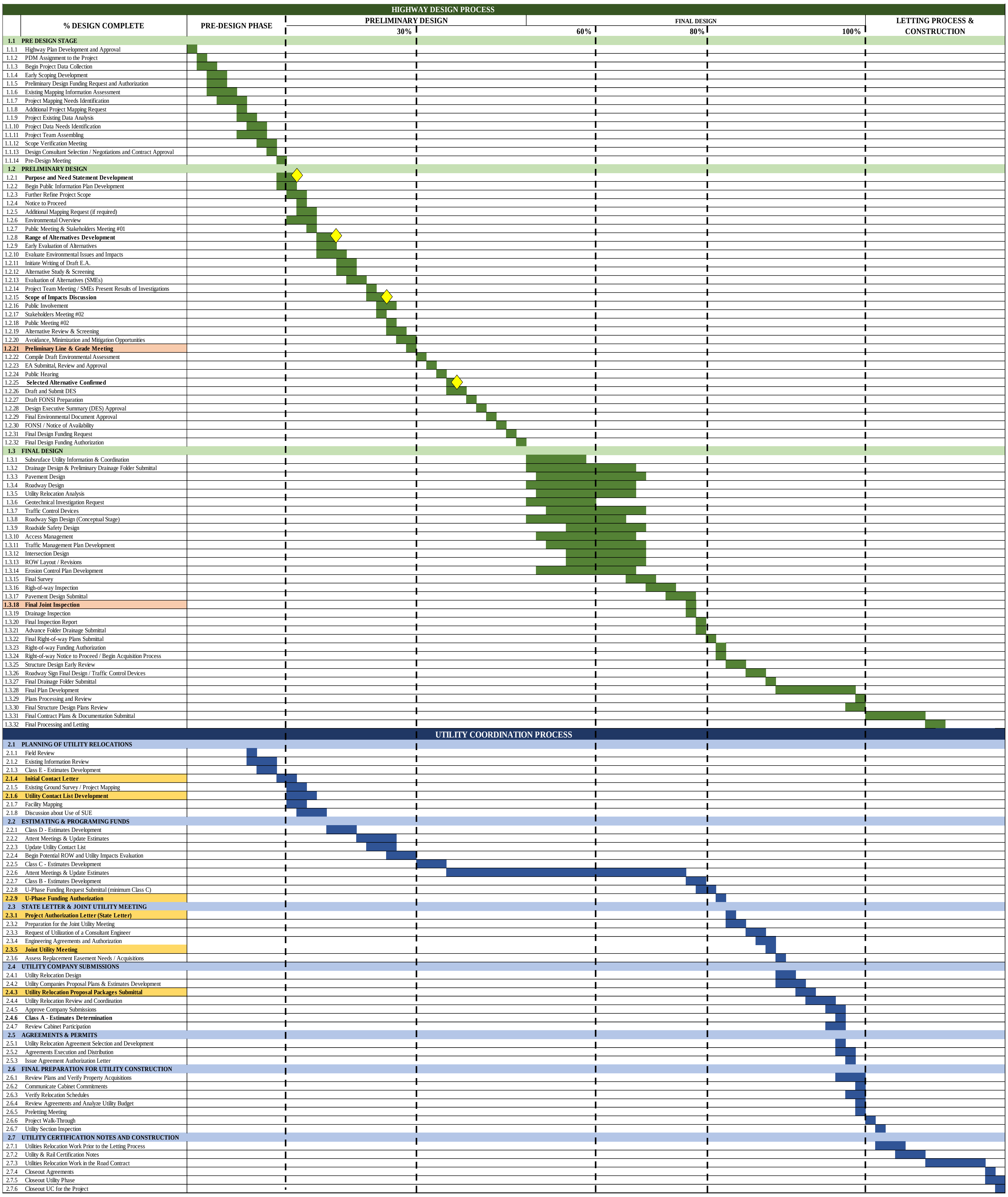


Figure 3.6 Gantt Chart of the Current Alignment between the Highway Design Process and the Utility Coordination Process at KYTC

Chapter 4 Development of the Proposed Coordination Approach

This chapter describes strategies to better integrate design and utility coordination processes based on concepts and practices for utility coordination identified by the literature review.

4.1 Assessment of the Current KYTC Utility Coordination Approach

Tasks highlighted yellow in the Gantt chart delineating KYTC's current utility coordination process (Figure 3.5) are critical documents and/or milestones. The research team paid special attention to these items during its assessment. Each of these tasks is described below based on the KYTC Utilities and Rails Guidance Manual.

- **Initial Contact Letter:** Once project is identified, the utility agent (UA) or project engineer (PE) prepares and mails or emails an initial contact letter to each UC that may have facilities within the project area. This letter notifies UCs of the proposed project construction and its potential impact on their facilities.
- **Utility Contact List Development**: There are two contact lists. The General Contact List includes all UCs identified within the district and the Project-Specific Contact List includes all UCs in the project area.
- **U-Phase Funding Authorization:** Funding request packages are submitted through the Kentucky Utilities and Rails Tracking System (KURTS) and must include, at minimum, Class A, B, or C estimates. The package is then reviewed, approved, and processed in KURTS. Once funding is secured, a notification of the available funding is posted in KURTS.
- **Project Authorization Letter:** Also known as a State Letter. This letter is issued by the Utility Supervisor (US) once the appropriate funding is secured and sent to UCs whose facilities may be affected by the project. This letter authorizes utility or rail companies to proceed with preliminary and planning services.
- **Joint Utility Meeting (JUM):** The JUM is the first official meeting of potentially affected UCs with district staff. This meeting provides an opportunity to:

    a) Determine the accuracy of the existing facilities shown on the plans
    b) Identify facility conflicts with the highway design
    c) Define possible relocations to address the conflicts
    d) Examine resolutions with all involved UCs to identify and resolve conflicts with their relocation plans
    e) Identify reimbursable and non-reimbursable utility work
    f) Consider the highway project schedule and plan utility design and relocation schedules
    g) Look for minor highway redesign measures that could minimize utility relocations
    h) Look for any utility data needs that can be addressed with SUE or surveying

- **Utility Relocation Proposal Package Submittal**: Utility relocation plans are required for compensable **and** non-compensable utility relocations. Prompt submission of these packages is critical for the Cabinet to ensure that all relocated facilities avoid physical conflicts with the project and other relocated facilities and that they comply with KYTC's utility accommodation policy. Only reimbursable UCs are responsible for submitting detailed relocation plans and cost estimates.

Based on these descriptions, the research team identified key takeaways:

- After sending the Initial Contact Letter, the next official contact with UCs is the JUM. This meeting is scheduled through the Project Authorization Letter. The utility funding authorization is issued simultaneously or shortly after the ROW authorization, which is issued after the Final Joint Inspection when the design is 80% complete. Thus, the first official meeting of district staff with potentially affected UCs is held when the design is around 80% complete.
- A successful JUM addresses all the meeting objectives described above, conveys pertinent project data and material, develops project utility contact lists in KURTS, identifies needs to facilitate utility relocations, and schedules future meetings. Cabinet staff wait until holding the JUM (design is 80% complete) to officially work with UCs to identify facility conflicts with the design, examine potential resolutions or define relocations to address conflicts, look for minor highway redesign options to minimize utility relocations, and identify utility

data needs that can be addressed with SUE or surveying. However, by this point, decisions regarding the design and main alignments have been made, making possible design changes quite costly and potentially leading to project delays. Previous research indicates that identifying potential conflicts as early as possible (at the 30% design stage or sooner) enables more creative solutions to utility conflicts. KYTC should consider engaging UCs and working collaboratively with them much earlier than the JUM (see Figure 4.1)

- Section UR-803 of the *Utilities & Rail Guidance Manual* states that during the JUM, "*…utility companies must first determine the accuracy of the plans as they pertain to their facilities in location, type, or size. If the company determines that discrepancies do exist, the corrections shall be noted on the plans, so the project engineer (or consultant) can make the appropriate correction*." (Kentucky Transportation Cabinet, 2019). Inputs and feedback from UCs on the accuracy of the facilities plotted on plans are received later in the design process. Getting feedback on plan accuracy late in the process can result in the designer lacking information to make informed design decisions.
- Section UR-803 of the *Utilities & Rail Guidance Manual* states that "*Identifying utility facilities conflicts at the JUM may be completed to some degree, but such analysis takes time. A JUM is more suitable to the collaborative development of relocation design concepts rather than conflict identification*." Efforts during this meeting focus on planning relocation design and not looking for opportunities to avoid, minimize, or mitigate utility conflicts. This could make sense because avoiding utility conflicts at this stage may require major design changes and result in delays. According to previous research, designers usually prepare the design, and when utility conflicts arise, they ask UCs to relocate.

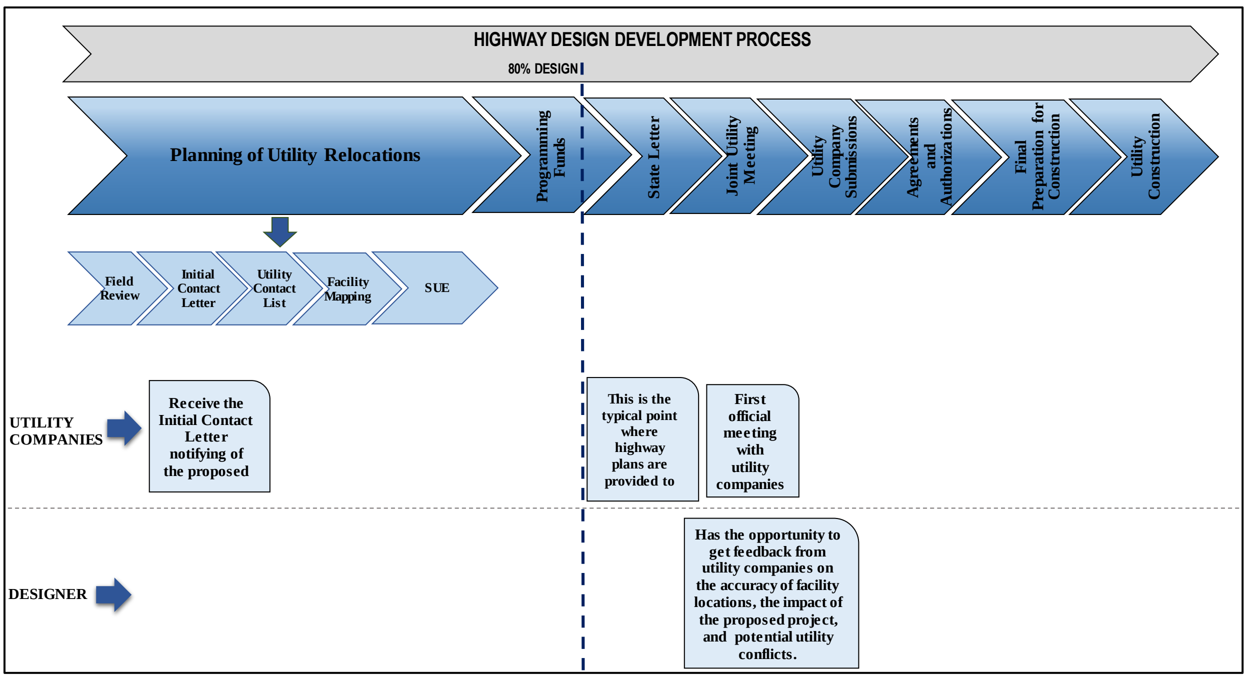


Figure 4.1 Interaction between Designer and Utility Companies through the Utility Coordination Process – KYTC

The research team accounted for the findings of Sturgill et al. (2014) to assess KYTC's utility coordination approach. Sturgill et al. (2014) catalogued major utility relocation delays and the responsible parties (Table 4.1).

Table 4.1 Primary Reasons and Responsible Party for Major Delays at KYTC

	Major Delays	Responsible Party	Cited by KYTC or utilities	Number of interviewees agreed on
1	Inadequate financial budget and personnel resources.	Both	Both	5
2	Utility companies would not be notified early when plan changes are made by KYTC.	KYTC	Utilities	2
3	Project design changes required changes to utility relocation.	KYTC Both	Both Utilities	4 3
4	Poor control on big projects, especially coordination, is time consuming.	Both	Utilities	1
4	Long process of ROW acquisition.	KYTC	Utilities	4
5	Relocations that could have been avoided during the design phase.	KYTC	Both	3
6	Involving utilities late in the design phase.	KYTC	Utilities	3
7	Contract controversy.	Both	Utilities	2
8	Material acquisition and equipment procurement.	Utilities	Utilities	3
9	Damages to existing facilities delay other relocation.	Utilities	Utilities	1
10	Lack of communication between KYTC and Utilities.	Both	Both	2
11	Limitations on utility design consultant capacity.	KYTC	Utilities	1
12	Short time frame for state transportations to plan and design the projects.	KYTC	KYTC	1
13	Utility companies giving low priority to utility relocation.	Utilities	KYTC	1
14	Rework required/change orders.	Both	Utilities	1
15	Severe weather events.	N/A	N/A	1
16	Some services are not clearly clarified in the contract. Or sometimes some information is missed and leads to utilities are misallocated.	Both	Utilities	1

Source: Sturgill et al. (2014)

Sturgill et al. (2014) also included the findings of KYTC Right-of-Way and Utility Relocation Task Force. Chapter 2 summarized the task force's findings (Table 2.2). Important takeaways regarding how KYTC currently approaches utility coordination follow:

- KYTC's model for project development involves few interactions with UCs until the design advances to the point that funding could be authorized for utility relocations. This authorization is usually issued after the Cabinet verifies the project complies with NEPA regulations. However, many design decisions have been made by this point, so introducing changes at this juncture that could potentially affect ROW acquisition or design orders can increase expenses or cause delays. Thus, the influence of UCs on design decision making is limited.
- KYTC needs to emphasize strategic utility conflict avoidance in project design. Yet designers must not adopt changes that would sacrifice safety or project functionality.
- KYTC and UCs need to engage in strategic and routine communication. Project communication should be frequent and conducted based on each party's needs. Seventy-five percent of KYTC design employees felt the level of communication is inadequate.
- Interviewees and stakeholders identified areas that may require the implementation of new training concepts to improve project outcomes: 1) the use of SUE, 2) conducting training or workshops on reading utility plans, and 3) training to coordinate project design, utility relocation, and ROW acquisition.
- Training Cabinet designers and utility owners can help them develop a comprehensive knowledge of utility relocation.
- Strengthening interactions early in the utility relocation process, when analyzing potential design solutions for utility conflicts, improves collaboration and opens communication lines between KYTC and UCs.

- There is a lack of communication, coordination, credibility, and trust between KYTC, UCs, and contractors, especially on larger projects.
- KYTC has not developed a utility impact matrix to facilitate utility relocation.
- SUE has not been adopted by KYTC and UCs.

4.2 Evaluation of Potential Utility Coordination Practices and Strategies

Based on the assessment presented in Section 4.1 and the literature review, the research team evaluated strategies and practices that can improve the integration of KYTC's utility coordination and highway design processes. These are listed below.

- Involve utility coordination staff in the planning phase
- Include utility experts on the design team early in the process. Keep them involved and informed as design progresses.
- Involve UCs early in design, especially when major relocations are anticipated. Provide them with a notice of proposed highway improvements and preliminary plans early in project development.
- Involve UCs in determining ROW needs to ensure enough ROW is acquired for utility purposes
- Let all parties with facilities within the ROW examine and consider the impact of proposals affecting that ROW.
- Locate potential utility conflicts early in project development to identify the most efficient and cost-effective alternative during the design
- Send preliminary plans to utility owners asking for feedback during the early design phase (on the accuracy of plans, identification of conflicts, and potential resolutions)
- Meet with UCs to discuss projects, determine impacts, and explore alternatives to avoid potential conflicts. Work collaboratively to minimize utility impacts.
- Avoid utility relocations rather than ignoring the impact of utilities on construction costs and timing
- Conduct detailed monthly utility coordination meetings with UCs to (1) receive their input on relocation issues and (2) do necessary coordination. Meet with all UCs individually if necessary. Utility coordination meetings held during the design phase are highly recommended, but another option is holding a meeting prior to each major project phase, including planning, design, and construction.
- Conduct plan-in-hand onsite meetings with utility owners to identify potential conflicts and identify appropriate resolutions.
- Use SUE on all time-sensitive projects, on projects where underground utilities are presented, or when high-quality information is necessary for design purposes. Capture utility facilities appropriate quality levels.
- Collect SUE Quality Level B and Quality Level A data for all projects that might involve utility adjustments. Collect Quality Level B data during the preliminary design phase. Collect Quality Level A data at locations where utilities are concentrated or where critical utilities are located.
- Encourage designers to use SUE information to design around existing utilities and avoid relocation without compromising project safety and functionality.
- Use a UCM to manage utility conflicts at every project. Consider potential use of UCM through KURTS.
- Make more effective use of formal constructability reviews to address utility issues during preliminary design.
- Encourage effective communication, cooperation, and coordination between KYTC and UCs
- Maintain a lessons learned database that is shared with all districts
- Develop standards of practice on how utility information is conveyed, including details on quality levels, information, and symbols
- Provide one point of contact in the agency to work with UC representatives from inception to completion of the project
- Ask UCs to establish and provide information of one point of contact for future work on utility conflict resolutions
- Encourage KYTC and UCs to operate as partners
- Provide training to project managers and design team personnel on utility issues and to consultant and UC personnel on topics related to coordination processes/issues and highway plan reading. Be able to speak each other's language(s).

- Develop a standardized format for identifying and resolving utility conflicts as design progresses
- Conduct utility impact analysis at critical project development milestones

The evaluation also considered strategies identified in *Methods to Expedite and Streamline Utility Relocations for Road Projects* (Sturgill et al., 2014), the findings of the Utility Relocation Task Force described in Table 2.2 of this report, and the INDOT utility coordination process. Because of INDOT's success working with UCs to streamline project delivery, the research teams examined the feasibility of incorporating some of INDOT utility coordination practices into KYTC procedures.

4.3 Incorporation of the Utility Coordination Practices and Strategies

Strategies listed in Section 4.2 were grouped into seven categories that established a foundation for the research team to develop an approach to better integrate utility coordination and design processes. (Figure 4.4).

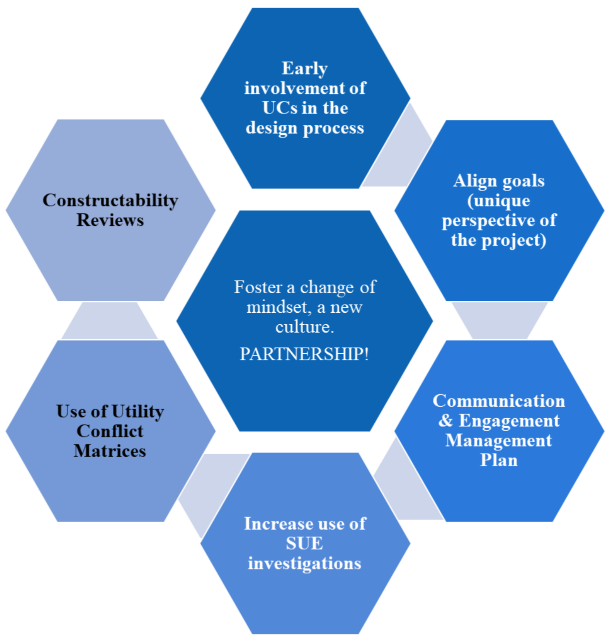
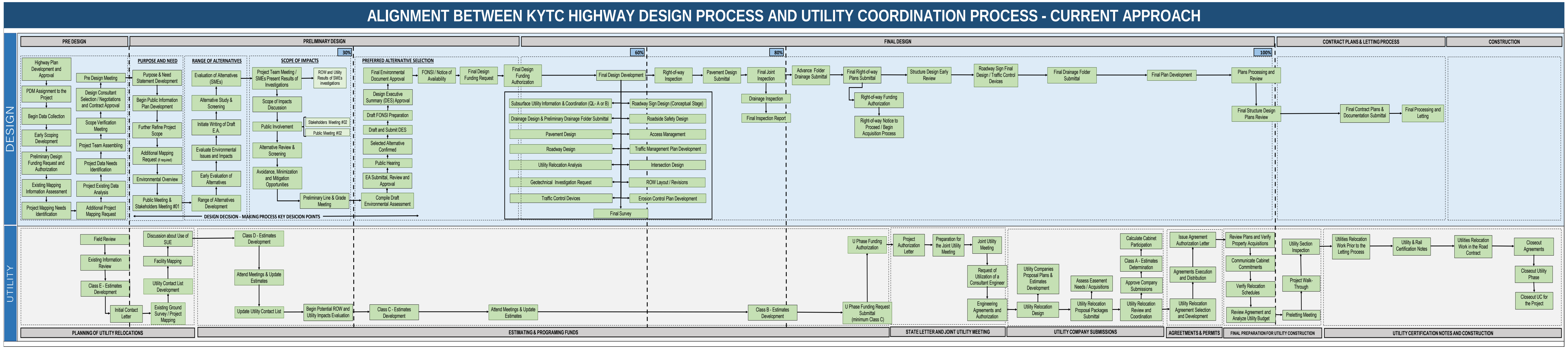


Figure 4.2 Categories of Recommended Strategies to be Incorporated into KYTC Procedures

This proposed approach (Figure 4.4) incorporates tailored strategies into utility coordination while modifying the alignment of utility coordination and highway design. Figure 4.3 represents alignments in the current process while Figure 4.4 captures the proposed approach and alignments based on the seven categories in Figure 4.2. Figure 4.4 contains several yellow boxes that represent proposed changes to better integrate utility coordination and design. Chapter 5 includes descriptions of these boxes as part of the Integrated Project Development Guidance Document developed by the research team. Although the modifications proposed by the research team are best characterized as recommended practices their adoption by KYTC is highly encouraged. Timeframes delineated serve as general guidelines. Project contexts vary significantly, so it is not possible to suggest timeframes for every situation.

Once the flowcharts were developed, the research team conducted several meetings with the SAC to gather feedback and validate the new approach. Figures 4.3 and 4.4 were developed iteratively based on this feedback. The Gantt chart in Figure 4.5 indicates at what stages of design different activities are completed.



(*) This flowchart is a written procedures' interpretation of the official manuals - Highway Design Guidance Manual and Utility and Rail Coordination Manual - from the Kentucky Transportation Cabinet.

Figure 4.3 Flow Chart of the Alignment between the Highway Design Process and the Utility Coordination Process at KYTC – Current Approach

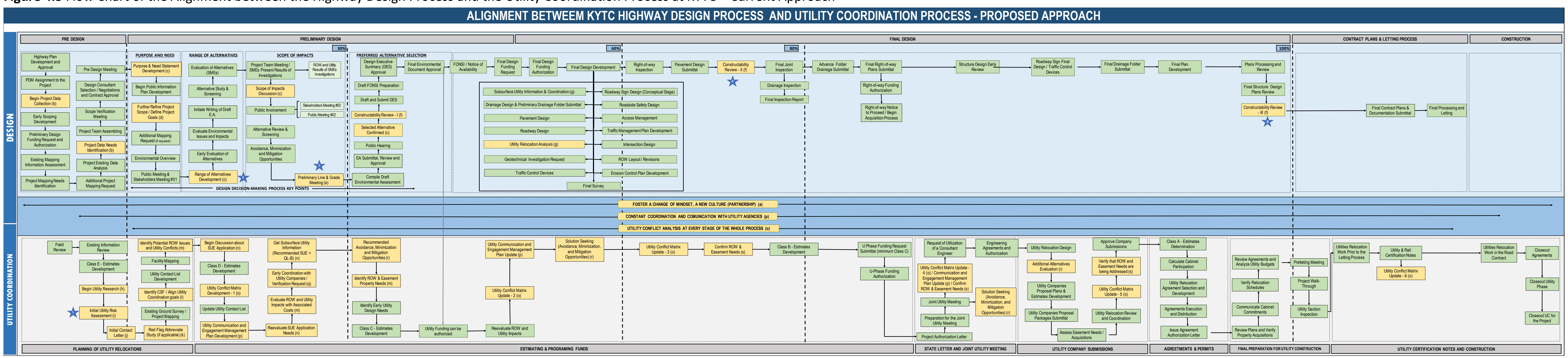


Figure 4.4 Flow Chart of the Alignment between the Highway Design Process and the Utility Coordination Process at KYTC – Proposed Approach

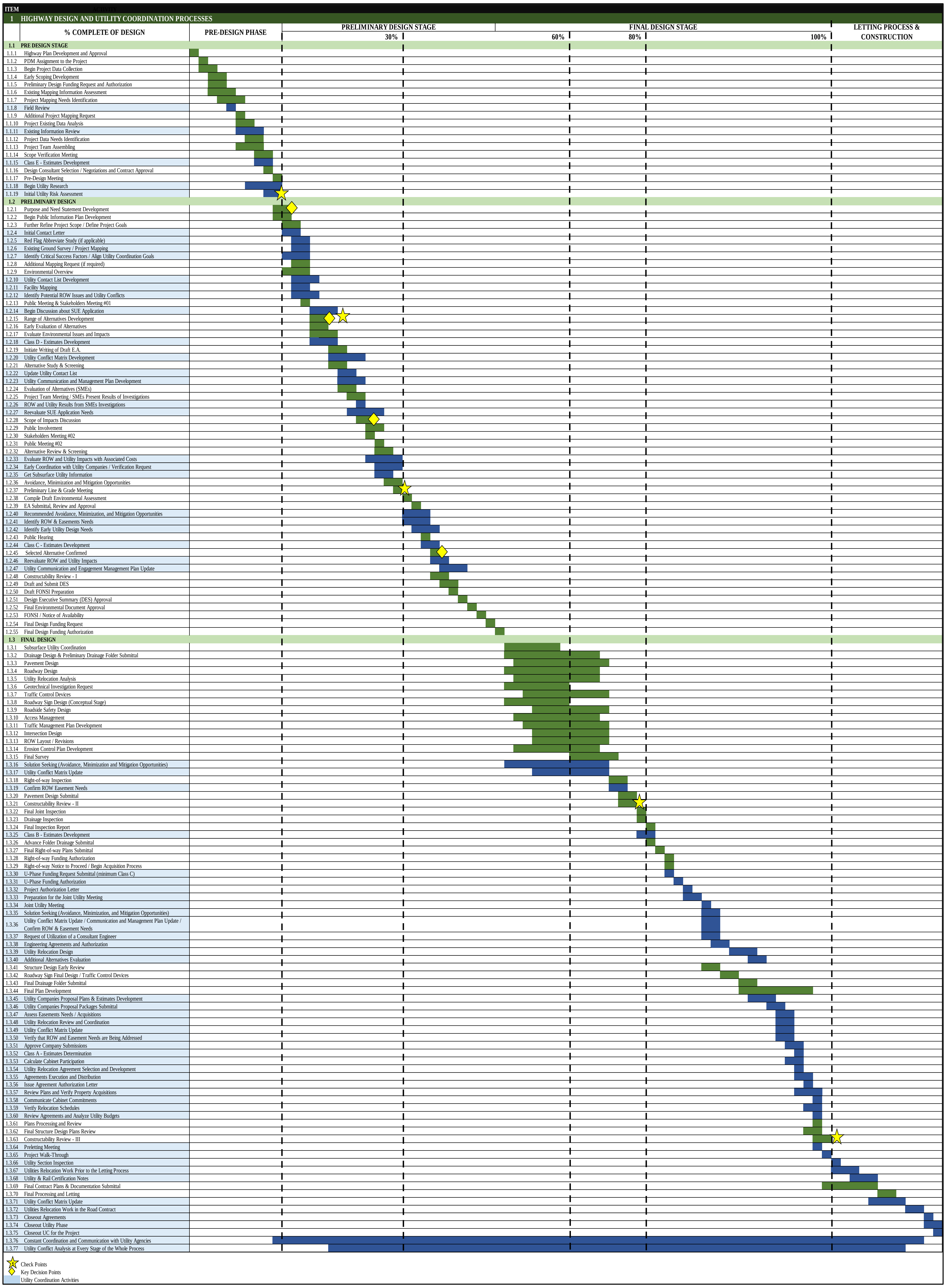


Figure 4.5 Gantt Chart of the Proposed Approach for the Integration of the Utility Coordination and Highway Design KYTC Processes

Chapter 5 Integrated Project Development Guidance Document

This guidance document can be used by KYTC personnel to improve the integration of utility coordination and design. Target users are design and utility coordination staff, ROW staff, UCs, subject-matter experts, consultants, and contractors. The document is organized into six sections:

- Recommended Utility Coordination Strategies and Practices for KYTC Procedures
- Roles and Responsibilities to Promote Implementation of the Proposed Approach
- KYTC Utility Companies' Engagement and Communication Management Plan
- Utility Conflict Matrix Guidance and Use for KYTC
- Integrating Appropriate Utility Investigations into Project Delivery
- Strategies For Preparing Scopes of Work for Utility Coordination and SUE Services

5.1 Recommended Utility Coordination Strategies and Practices for KYTC Procedures

Users should read this section alongside Figure 4.4. It focuses on proposed modifications to the alignment of design and utility coordination processes. Alphabetical reference labels (e.g., (a), (b)) help readers link material in Figure 4.4 to information in this section.

a) Foster a Change of Mindset, Embrace a New Culture: Work in Partnership

All project stakeholders (e.g., KYTC, UCs) must embrace a culture of partnership as this will confer enormous benefits. This represents a significant change and is best viewed as a long-term goal for KYTC as establishing a new culture within an organization takes time and adjustment. Strong partnerships bolster project efficiency and stakeholder responsiveness. The following criteria can guide this proposed change:

- **Partnership:** Each project member is instrumental to completing the portion(s) of the project for which they are responsible. Some portions require collaboration. Utility coordination will be improved by conceptualizing the process as a series of collaborative steps during project development and delivery. Accounting for what each stakeholder regards as important — including UCs — facilitates strong partnerships. Work to build and foster relationships with UCs that preserve open communication and build trust.

- **Coordination, Cooperation, and Collaboration:** Where projects require teamwork, it is important to understand how different functional groups operate. Sometimes project team members coordinate and cooperate but do not achieve true collaboration. Coordination entails the exchange of information and resources between team members to support one another's goals. With cooperation, team members make coordinated efforts to perform their assigned portions of a shared process. They have a shared objective and their efforts depend on one another. When a project team collaborates, team members reciprocally engage in a co-creative effort to achieve a shared goal. Each member makes a unique contribution to the project while respecting other contributions. KYTC and UCs must develop ***collaborative*** relationships to achieve successful utility coordination and successful project outcomes.

- **Early and proactive engagement of utility companies:** Engaging UC partners earlier in project development will improve utility coordination outcomes. Throughout project development, information and feedback from UCs are critical and must be valued in the same way as geometric data. It is most beneficial if this engagement occurs from the beginning of the project.

- **Create a sense of shared purpose**: Projects succeed when all stakeholders have a shared sense of purpose, especially on projects demanding significant collaboration. Project delivery requires that different functional groups collaborate (e.g., design team, utility staff, consultants, utility companies). Each functional group must clearly understand (1) the project goals, (2) the goals of each group and how they align with the overall project goals, and (3) their respective functions. This information must be shared with all project participants.

- **Develop a sense of trust:** Project outcomes suffer when stakeholders distrust one another. KYTC staff and UCs must construct trust-based relationships to forge durable partnerships. Dialogue between stakeholders about priorities and other salient information must be open and consistent.

- **Strategic, timely, and frequent communication:** Stakeholder communication needs vary by project and across project phases. KYTC utility coordination staff must prioritize open communication to ensure utility- and project-related information is shared in a frequently and timely manner. Communication management strategies on each project must meet the needs of all team members.

- **Consider Lessons Learned:** Along with implementing the proposed approach, KYTC will benefit from documenting lessons learned from enacting changes. Doing so will verify which changes directly improve utility coordination and project development. Documenting lessons learned will also increase agency buy-in and is an important first step to shift the agency's mindset and embrace a new culture.

The proposed approach must be communicated to all KYTC personnel and project stakeholders. Marketing this change is critical to establish a new culture and organizational mindset.

<u>Highway Design Process</u>

b) Begin Project Data Collection / Project Data Needs Identification

Data collection occurs during the pre-design stage. During this stage, as much information as possible should be obtained on existing infrastructure (e.g., record plans, management system reports, traffic data, crash data, project mapping, ROW way, preliminary budget, existing geotechnical information, existing utility locations, and attributes). This helps the project team begin to understand project needs and limitations, even before the beginning preliminary design.

Integrating Utility Coordination: By collecting existing project data, the project team can identify project data needs and choose strategies to meet those needs. For mapping and surveying needs, care should be taken to ensure sufficient coverage and avoid the need for subsequent mapping. An early understanding of utility infrastructure is imperative to successfully meet needs with minimal impacts. A live conversation with each UC can also clarify the nature of facilities in the project area. This knowledge is especially important for underground facilities. For example, does a communication company have a large underground vault with only a small cabinet above ground? While exact utility location information may not be necessary at this stage, understanding facility types, and their potential impacts if there are conflicts, will help plan future survey and utility mapping needs.

c) Key Decision Points:

Purpose & Need Statement Development / Range of Alternatives Development / Scope of Impacts Discussion / Selected Alternative Confirmed

During preliminary design, four milestones — purpose and need, range of alternatives, the scope of impacts discussion, and selected alternative — are the key points at which significant decisions related to the project design are made. At these points, the project scope is defined to develop a range of alternatives. The impacts of each alternative are then evaluated to narrow the alternatives and select the preferred project alignment. The project's utility coordinator project must be involved in these discussions and decisions.

Integrating Utility Coordination: The project team needs sufficient and accurate enough utility information (location and facility characteristics) to design the alignment around existing utility facilities when feasible. Avoidance should be a priority, followed by minimizing impacts and then working collaboratively to mitigate remaining impacts. If the utility is in KYTC's ROW, they are likely permitted to be there, and the location is considered to be in the public (rate-payer/taxpayer) interest. As shown in the flow chart (Figure 4.5), the key decision points occur during preliminary design when the design plans are 30 - 40% complete. Identifying potential conflicts with utilities and contacting the involved UCs should occur earlier in the process — if possible, as soon as the project scope is defined.

Given the importance of these points in the conceptual design stage, accurate and sufficient information on utility facility locations should be available in time to make informed decisions. As preliminary alternatives are developed and evaluated (30% design completed), the project team should have the horizontal locations (SUE QL-C minimally, SUE QL-B recommended where engineering requires it) for existing utilities, data on facility attributes (e.g., size, material), and knowledge of existing utility property interests and/or future facility construction. This includes all known location information provided by the district utility staff, KY811 design tickets, project surveys, SUE investigations, and UC feedback. This information will assist significantly in the roadway alternative decision-making process. As the project moves through these four key points, the project team should consider the time and cost of utility impacts for each alternative to be able to identify high cost and time relocations when selecting the preferred alignment.

Another recommendation is to consider *identification of utility conflicts avoidance alternatives* as a key decision point. Avoidance, minimization, or mitigation options for each alternative must be evaluated early in design by the Project Development Team (PDT) and project utility staff. This will enable development of the best alternative that eliminates or minimizes utility impacts while meeting all project goals.

d) Further Refine Project Scope / Define Project Goals

When project development involves different functional groups, stakeholders will express hold attitudes, opinions, and priorities. Group procedures and philosophies may be inconsistent. Both issues can impact project outcomes. For instance, designers tend to ignore utilities during design and compel their relocation if they conflict with the project footprint. Utility coordination staff, on the other hand, encourage the avoidance of utility relocations when feasible. To avoid difficulties, project goals must be clearly defined, aligned, and communicated to everyone on the project team and external stakeholders.

Integrating Utility Coordination: As the project scope is refined, the PDT will have a better understanding of project characteristics, constraints, potential risks, and conflicts. Based on this, the team can identify project goals that will lead project development. Stakeholders must inform themselves about project objectives, internalize and buy into them, and work collaboratively to achieve project goals. Setting the project goals and communicating them clearly will establish a common vision for all functional groups and help stakeholders fulfill every aspect of their roles and duties and make target-driven decisions to achieve better outcomes. If project goals include considerations of overall time and budget, utility avoidance is also a project goal until it conflicts with higher priority goals (e.g., improved safety).

e) Preliminary Line & Grade Meeting

At the Preliminary Line and Grade (PL&G) Meeting the PDT uses all available information and professional judgment to select the preferred alternative.

Integrating Utility Coordination: When selecting an alternative, the PDT should have good knowledge of of utility facility features and locations, utility relocation costs, responsibilities, schedules, and potential easement needs. Data on these elements should be collected before the PL&G Meeting so the design team can design around existing facilities, avoid relocations when possible, and make informed project decisions. The best way to ensure the accuracy of facility location data is to work closely with UCs from a project's outset. The PL&G Meeting occurs when the design plans are 30 – 40% complete, so communication and coordination with UCs must begin earlier. Early interactions between the design team and UCs is a best practice.

f) Constructability Review I – II – III

Although the *Highway Design Guidance Manual* states that requests for constructability reviews should be submitted as early as possible, it does not precisely specify when they need to occur. The PDT should not wait until the final design stages to perform a constructability review as it could delay the project if a correction or redesign is necessary. Ideally, a constructability review should be done as soon as a preferred alternative has been selected — mainly so that right of way and utility concerns can be addressed. Leaving constructability reviews until the end of design is usually too late to prevent problems and sometimes too late to correct minor issues. Delaying constructability reviews lessens project efficiency and effectiveness.

Integrating Utility Coordination: Constructability reviews help minimize project utility risks by identifying, minimizing, and mitigating utility conflicts and avoiding unnecessary relocations. They are particularly useful for identifying utility-related issues and conflicts given that construction phasing, equipment, and temporary project elements may impact utilities in ways not readily apparent on the design. They are opportunities to evaluate how utility conflict resolution impact feasibility, in terms of both cost and schedule, of the selected alternative and account for constructability issues.

Since constructability reviews provide important inputs for utility coordination and development of the utility relocation plan, the design team and UCs should be consulted during reviews. The research team recommends three constructability reviews — at PL&G, near final joint inspection, and near plan completion. However, the number of reviews will be dictated by the PDT's assessment of the project context and needs. Constructability reviews save time and money by pinpointing design errors or omissions and potentially identifying methods to to avoid utility relocations. Descriptions of the three constructability reviews follow:

- **Constructability Review I:** Plans are more than 30% complete. The environmental document is underdeveloped, and critical utility conflicts are identified and addressed. Performing a constructability review once the preferred alternative is confirmed helps identify omissions or design errors or potential areas in which utility impacts should be avoided before moving forward with a detailed design. Making geometric changes increases in difficulty after this point, so this review provides the optimal opportunity to avoid relocations.

- **Constructability Review II:** Design plans are approximately 75% complete. A constructability review at this point identifies necessary minor design changes. If utilities were not avoided, design changes might not be reasonable at this point for convenience alone. But input on constructability at this juncture is very important. This review can highlight utility impacts that may involve major cost or schedule impacts so they can be discussed and mitigated. This review is a good opportunity to ensure that sufficient ROW exists for utility relocations, thus validating potential ROW and replacement easement needs.

- **Constructability Review III:** Design plans are around 95 % complete. This review verifies that the design is ready to proceed to letting and that known relocation needs can be communicated through plans and contract documents. This is also a good opportunity to review utility relocation packages, verify their plans are well coordinated, determine if any relocations depend on one another, and assess if relocations can be executed simultaneously, or if concurrent efforts or assistance (i.e. clearing) from the highway construction process may be needed. These considerations will help avoid problems during the construction phase.

Constructability Review I is the most impactful and will potentially result in the most cost savings.

g) Utility Relocation Analysis

Instead of reserving utility relocation analysis for the final design stage, strategic avoidance of utility conflicts must be emphasized throughout design as long as the avoidance does not compromise technical feasibility. This will reduce the impact of utility relocations and therefore budget and scheduling pressures caused by utility relocations. The design team must not adopt changes to avoid utilities that would sacrifice project functionality or safety. But earlier consideration of utility avoidance offers ample opportunities to achieve these collective project goals.

The proposed approach encourages collaborative work with UCs to identify the most challenging utility conflicts early in the project. This lets the design team prepare a design that circumvents utilities (as feasible). Collaborating with UCs early in project development may eliminate or minimize the need for design changes at later stages. KYTC should not wait until the final design stage to engage UCs. By then it is often too late to adopt changes, especially geometric changes. The Cabinet should make every effort to improve collaboration and communication with UCs from the project outset as this will streamline utility coordination.

Utility Coordination Process

h) Begin Utility Research

When preliminary design begins, identifying existing utilities provides an opportunity to successfully integrate utilities with design. The project team should research utility facilities in the project limits by reviewing Cabinet survey maps, existing utility facility maps, as-built plans, and hold discussions with area residents and known UCs. A field review to investigate conditions and to visually identify utility facilities is also extremely important. During the field review, the UA must look for identifying markers of UCs and visually identifiable physical features (e.g., poles, vents, pedestals, fire hydrants, other appurtenances).

Integrating Utility Coordination: Early identification of existing utilities is recommended once the project scope is determined. Utility research should begin as soon as the project scope is defined. The UA and US should review the proposed scope to plan the collection of utility information and discuss the appropriate level of accuracy for utility information — this should be commensurate with the potential level of risk a facility presents to the project. Giving the project team detailed information on potential infrastructure – utility conflicts lets team members make informed decisions to achieve optimal project outcomes.

i) Initial Utility Risk Assessment

The initial utility risk assessment should occur during initial project scoping. After beginning utility research, the PE or UA must assess the project scope and all the information available to identify potential risks related to utilities on the project. Since information will likely be limited at this stage, the initial assessment should look for potential risks that may impact the project schedule and cost. As the project moves forward, more information on existing utility facilities will be available, and the PE or UA will be able to refine the previous risk assessment and determine the actions necessary to handle identified risks. The earlier accurate data are obtained, the better. Thus, efforts should focus on doing enough investigation, as early as possible, to support good planning and decision making.

Integrating Utility Coordination: Although information obtained at this point may not be sufficient for later design stages, the PE can have a general idea of the impacts expected from the proposed project and existing utility infrastructure. A list of the potential impacts should be developed. This list should catalogue how each impact can affect project schedules and costs. With this information, stakeholders can evaluate mitigation strategies. Project team members must be solution-oriented and identify best way to handle potential project risks. The recommended list also serves as a prelude to the project's UCM.

j) Initial Contact Letter

The initial contact letter is the first official contact with UCs. It is also the starting point for coordination and must be sent early in the project development as it notifies companies of the proposed project. The UA or PE should send the letter to all UCs in the project area identified during utility research.

Integrating Utility Coordination: At this stage of project development, information collected about existing utilities may not be comprehensive. The initial contact letter lets KYTC ask UCs to confirm the presence of their facilities within the project area. After sending the letter, the UA or PE should verify that the companies have received it and track their responses. A project tracking sheet should be developed to record these responses. This helps the UA follow up with non-responsive companies and lets the project team start engaging the UCs as partners on the project. The initial contact letter should ask companies to provide existing facility data and the contact information of a designated contact person who will work with the project team. All information provided by the UCs should be shared with the PDT as soon as it is received.

k) Red Flag Abbreviated Study (if applicable)

Access to high-quality information at the beginning of project development helps the PDT evaluate proposed alignments and make informed design decisions. Many sources of information can be used during data collection, including a Red Flag Abbreviated Planning Study (Red Flag Study). A Red Flag Study makes early identifications of significant existing features on a project. As part of the study, subject-matter experts provide professional input. For example, ROW agents evaluate property needs and utility coordinators catalogue complex utility facilities. Knowledge of these features influences project design decisions as preliminary alternatives are developed. It may facilitate discussions about the scope of impacts of these features so they may be considered or avoided completely. The PE and PDT should jointly plan the study's focus. For example, a Red Flag Study could focus solely on potential utility and ROW conflict red flags. This study could address utility identification, estimated cost of relocation per distance, potential areas to relocate, possible disruptions of the utility service during relocation, estimated time needed for relocation, and expected lead time to order and deliver any utility facilities required for a relocation. The PE should decide if a Red Flag Abbreviated Study fits the project information needs.

l) Identify Critical Success Factors (CSF) / Communicate Utility Coordination Goals

Critical project success factors must be identified. These factors include project elements critical to the project succeeding. They can be related to any aspect of a project (schedule, cost, technical characteristics, context, or financing).

Integrating Utility Coordination: When a project involves different functional groups, project participants harbor diverse attitudes, opinions, and priorities. Stakeholders may interpret project success differently and have different perceptions of what factors are critical. The PE and UA must work collaboratively to find tools to facilitate the identification of these factors and achieve critical project outcomes. Doing so will allow a clear understanding of utility coordination goals to emerge. Goals for this process must be aligned with general project goals and communicated to each team member and UC to ensure that all stakeholders have the same understanding of the project objective and will work collaboratively to achieve it.

m) Discuss Potential ROW Issues and Utility Conflicts / Evaluate ROW and Utility Impacts with Associated Costs / Identify ROW & Replacement Utility Easement Property Needs

The project team usually does not analyze ROW needs for utility impacts until final design. Late acquisition of ROW and easement property is a principal cause of project delays.

Integrating Utility Coordination: Assessing and identifying ROW and replacement utility easements needed to accommodate utility conflicts that cannot be avoided, i.e. relocations, should occur earlier than currently planned. Even though ROW funding is approved at the final design stage, obtaining enough accurate information and engaging UCs early in the process may help the PDT begin assessing ROW needs during the conceptual design stage. Identifying ROW needs may be difficult without preliminary relocation plans, but the PDT should bring them into the discussion from the beginning of the project and not ignore them until its final stages. All information collected and presented on the plans to identify utility conflicts and UC input can help identify potential ROW issues. If possible, cost evaluations for ROW involved in utility relocation should be assembled. This will strengthen the PDT’s ability to make informed decisions. Additionally, ROW staff need to be involved in the planning stages so they can inform the design team about factors that will significantly affect ROW (Van Dyke et al., 2020). A preliminary layout for ROW and proposed utility placements can be developed to underwrite the acquisition process and ensure that all property needs are met once funding is approved. A list of priority parcels to be acquired first should be developed when funding is approved. This list could include parcels with critical utility impacts or those which are crucial to UCs that need to relocate first. Constructability reviews also help spot areas of risk related to ROW needs. Following Constructability Review I is a good opportunity to identify ROW and replacement utility easement property needs.

n) Begin Discussion about SUE Application / Reevaluate SUE Application Needs / Get Subsurface Utility Information

Locating existing utility facilities should occur as early as possible, especially when large concentrations of facilities or a major utility facility could significantly impact the project. When more is known about utility locations, more creative solutions can be developed during preliminary design. More opportunities exist to design around existing utility facilities in earlier project stages. However, to do that the design team needs to know where the facilities are located. Implementing SUE can deliver this information to planners and designers to help them more accurately locate utility facilities. Having this information will let the design team make informed decisions, minimize uncertainty over the whereabouts of utilities, and avoid unreliable information.

Integrating Utility Coordination: Sufficiently detailed utility information should be given to the design team no later than the 30% design stage — earlier if possible. It is important to begin planning SUE implementation as soon as the project team identifies data needs and the existence of potential utility conflicts in the project area. As the range of alternatives is developed and existing utility information is collected, the PE, US, and UA should identify potential areas that may need SUE investigations and the quality level of information required throughout the project. The project surveyor may also be involved in making recommendations to the project team regarding SUE investigations. A general discussion on the quality level required for the SUE application is recommended to determine what SUE quality levels are appropriate in different areas and at different stages of the project. Decisions on SUE implementation (e.g., potential areas for investigations and required quality levels) can be used to develop a SUE application plan. This plan should be updated as design progresses and SUE application needs are reevaluated. Once the results of the SUE investigations are available, they should be forwarded to the PDT so they can include the information in the plans and verify the location of the existing facilities. Representations on plans should be carefully revised, updated, and noted to indicate the quality level of the information portrayed.

The SUE quality level should be commensurate with the potential impact of a conflict. The importance of locating a particular utility increases according to the potential for impacts (i.e., higher quality levels needed where conflicts are likely to be more costly or impactful) and for the given stage of project development. Localized areas in the project footprint may require a higher or lower SUE quality level than the project as a whole to address varying potential for conflict. Getting QL-A or QL-B data early in the design process may help the design team make adjustments through design alternatives that avoid or minimize utility relocations. However, because QL-A data are sometimes expensive, a better practice may be to opt for QL-B along with the project's topographic survey. QL-B information should provide approximate depths to 6" accuracy at an interval that matches the project needs. This information should be provided in 3D when possible and shown in cross sections on the plans. When a design feature falls within a utility’s tolerance zone, obtaining QL-A data is recommended. A good reference for developing a SUE application plan is ASCE guidelines, *The Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.*

o) Utility Conflict Matrix Development / Utility Conflict Matrix Update / Utility Conflict Analysis at Every Stage of the whole Process

Leveraging UCMs is a best practice for improving utility coordination. The UCM can be used to identify potential utility conflicts and track them to resolution. It offers a way to organize information related to utility facilities in the project area. It forces the designers to make decisions about each conflict by working collaboratively to analyze where conflicts are located, discuss their impacts, evaluate different resolutions, select a preferred resolution, document its justification, and track the status of the corresponding conflict along with responsible parties. Use of this matrix helps ensure that utility conflicts are addressed and planned for from early project stages into construction.

Integrating Utility Coordination: Using a UCM allows for input from utility staff, the design team, and UCs. It strengthens partnerships between the Cabinet and UCs. Team members collaborate to identify, document, and find the most efficient and cost-effective resolution to utility conflicts. The UCM should be updated after each utility coordination meeting or when any design decision is made until all conflicts have been mitigated.

The Joint Utility Meeting (JUM) is the first official meeting with UCs. At this meeting, stakeholders assess how accurately existing facilities are depicted on plans, identify conflicts, define possible relocations to address conflicts, and plan relocation designs and schedules. Completing all these activities can be a challenge in just one meeting can be challenging. As originally conceived, the JUM is more suitable for collaborative development of relocation designs than for conflict identification. Ideally, the PDT would identify utility conflicts as soon as the design team has reliable information (early in the process) and then make reasonable efforts to address conflicts throughout project development. Then, the JUM can be used as an opportunity to synchronize utility conflict resolutions in coordination with the PDT and impacted UCs. The UCM should be updated with all the decisions and solutions discussed in this meeting.

p) Utility Communication and Engagement Management Plan Development and Update / Constant Coordination and Communication with Utility Agencies

Coordination and communication are factors that impact whether utility conflicts can be avoided or resolved through timely relocation. As conflicts are identified and addressed, the UA should use a structured approach to manage the communication and engagement with each UC. Information on utility facilities, utility conflicts, previous interactions with UCs, and lessons learned from previous projects can inform the approach used to manage project communication. Development of a Utility Communication and Engagement Management Plan can facilitate these efforts.

Integrating Utility Coordination: Developing the utility communication management plan consists of identifying and classifying companies that own utility facilities in the project area based on the desired level of communication required to meet project information needs. Classification consists of identifying companies that represent a potential risk to the project, companies with facilities in the project area but do not represent a significant impact, and companies that own facilities in the project area but which are not necessarily impacted. Once companies have been classified, the UA must analyze each UC's concerns and expectations for the project as well as the project team's information needs. This will help the UA understand each UC's circumstances and what is important to each partner. This communication-level assessment is used to develop strategies to prioritize communication with each UC. Some companies will require closer coordination and communication than other companies, and needs will change as utility conflicts are addressed. A company that owns facilities which represent a high risk to the project may require frequent communication at the beginning of the design process when the design team is working to avoid, minimize, or mitigate the conflict. However, once the conflict has been resolved, the required communication between the Cabinet and the UC will be reduced. The UA and designer can then focus on engaging UCs that still require close coordination. The utility communication management plan should be dynamic and updated throughout the project. By having efficient communication with each UC, the UA can establish partnerships with each agency and other infrastructure owners. They can work as a team and focus their attention on improving conflict resolution.

q) Early Coordination with Utility Companies / Verification Request

As design progresses and utility conflicts are addressed, coordination with UCs becomes a foremost project need. In addition to partnering with UCs, early coordination is a must. This coordination allows designers to avoid, minimize, or mitigate conflicts with existing utility facilities throughout design.

Integrating Utility Coordination: At this point, the design team has developed a range of project alternatives and is discussing the impacts of each. To discuss utility-related impacts, sufficient and accurate information on the utility facilities involved must be available. The accuracy of facility depictions on plans should be verified by working collaboratively with the corresponding UCs. The UA can send a set of preliminary plans to UCs and ask them for feedback on the accuracy of the utility features plotted *or* meet with the companies and work through that information together. UCs employ staff who find it difficult to read highway design plans, so an in-person meeting could help ensure accuracy. When UCs participate on the project by providing feedback on the accuracy of facility locations and contribute to the design decision-making process, project outcomes benefit. Early coordination between district utility staff, the design team, and all known utilities in the project footprint help the designer can make reasonable efforts to avoid or minimize utility conflicts while meeting project needs.

r) Solutions Seeking – Recommended Avoidance, Minimization and Mitigation Opportunities / Additional Alternatives Evaluation

The design team should use information provided by UCs to make reasonable efforts to avoid, minimize, or mitigate impacts to utility facilities, even for utilities that are required to move at their own expense. This does not mean designers should attempt to avoid utility facilities at all costs. Designers should make reasonable efforts to minimize overall project costs to the general public. The earlier in project development that mitigation options are addressed, the more likely it is they will have a more significant impact on reducing the number and cost of utility facility relocations. For example, changing horizontal and vertical alignments, changing drainage features, changing ROW property needs, or any other feasible changes to eliminate or minimize utility impacts will generate more savings the earlier they occur and should at least happen before the project goes to letting. This requires a collaborative effort among design and utility staff as well as UCs.

Integrating Utility Coordination: An excellent option for evaluating possible utility conflict resolutions from different approaches is engaging UCs in the process. The UA and design team should send a set of preliminary plans to UCs so they may consider where the impacted utility facilities will need to relocate. UC staff may suggest new alternatives or the most beneficial alternatives for the project to avoid or minimize utility impacts. For example, they can highlight specialized or critical utility infrastructure that would be very costly to relocate. The PDT should be receptive and listen to UC suggestions and concerns. Subject-matter experts can recommend solutions. Cabinet staff and UCs must work together to develop the recommended avoidance opportunities until all utility conflicts are resolved. Remember the process is not about asking utilities to merely get out of the way, it is about working with them to avoid, minimize, or accommodate the conflict. If relocations are needed, the PDT and UCs should discuss suggested alignments for relocations so "everyone knows where everyone goes." This allows for consideration of ROW needs for relocations as well. The new approach proposes a shift to partnered work by all parties, so everyone buys into and is part of the same team working toward the same goal.

s) **Confirm ROW & Replacement Easement Needs / Verify that ROW and Replacement Easement Needs are being Addressed**
Final ROW plans are submitted after the Final Joint Inspection, when the design plans are around 80% complete. A preliminary layout for ROW and replacement easement needs for utilities should be prepared during the conceptual design stage. Developing this preliminary layout or evaluating and identifying potential property needs early in design will streamline the ROW and replacement easement property acquisition process. This will let ROW staff validate the amount of property needed to accommodate all utility relocations and ensure proper property acquisition. This also provides the opportunity to acknowledge utility relocation ROW needs for the environmental process. If UCs must navigate their own ROW and environmental process for relocation, delays are likely unavoidable. It may be too late if the project team waits until the final design stage to evaluate ROW and replacement easement needs for utility relocations. This can lead to design modifications and project delays that could have been avoided. ROW acquisition staff should attend the JUM to learn about utility relocation requirements so they can consider what portions of the ROW are required to accommodate them effectively. As design and acquisition progress, utility staff should track acquisitions to ensure necessary property is acquired to allow for relocation schedules. The UCM be used for this tracking.

Utility Coordination Checklist
Figure 4.3 includes five checkpoints (marked with a star) throughout project development. The Utility Coordination Checklist was developed based on these checkpoints (Table 5.1). The checklist can help verify needed actions at each checkpoint. Checkpoints help with design decision assessment and provide opportunities to justify and document resolutions adopted for each utility conflict. The five checkpoints are:

- Initial Utility Conflict Assessment
- Identification of Range of Alternatives
- Preliminary Line and Grade Meeting
- Constructability Review – II
- Constructability Review – III

Activities listed on the Utility Coordination Checklist are based on the strategies incorporated into KYTC's current processes to integrate design and utility coordination processes. The checklist supports early engagement and frequent communication with UCs. The activities included are those most likely to improve outcomes for utility coordination. This tool may be used as a reference by staff who work on utility coordination.

Table 5.1 KYTC Utility Coordination Checklist

UTILITY COORDINATION CHECKLIST				
1.0		**CHECKPOINT #01 : INITIAL UTILITY CONFLICT ASSESSMENT**		
ITEM	**PROCESS**	**DESCRIPTION**	**RESPONSIBLE**	**STATUS**
1.1	D	Collect as much existing data as possible (project mapping, existing right-of-way limits, utility information, record plans, existing utility locations, etc.)	PDM / PM	☐
1.2	D	Evaluate project needs and assemble the project team. Ensure that the appropriate personnel for utility coordination purposes is considered in the team.	PDM / PM	☐
1.3	D	Asses the quality of existing information in order to determine potential project needs (type and extend for coverage for additional project mapping)	PDM / PM / Survey Coord.	☐
1.4	D/UC	Based on the assessments, request additional project information and mapping (begin utility research).	PDM / US / UA / UC	☐
1.5	UC	Perform a field review to familiarize with the project area and visually identify existing utility facilities within the project limits. If possible, identify the names of utilities and types of facilities throughout the visual inspection.	UA / PM	☐
1.6	UC	Determine facilities in the area by discussing with area residents to determine probable utility locations.	UA / PM / PDT	☐
1.7	UC	Determine facilities in the area by reviewing existing facility maps, as-built plans, Transportation Cabinet survey maps, permit files, Kentucky 811, etc.	UA	☐
1.8	UC	Analyze project existing data and begin identifying potential project risks.	US	☐
1.9	UC	Perform an initial assessment of potential problems or conflicts between existing utilities, easements, or other physical features. Identify areas of significant concern.	US	☐
2.0		**CHECKPOINT #02 : RANGE OF ALTERNATIVES DEVELOPMENT**		
ITEM	**PROCESS**	**DESCRIPTION**	**RESPONSIBLE**	**STATUS**
2.1	D	Develop project purpose and need statement and define how public involvement will be conducted on the project. (Pre Design Meeting)	PM / PDT	☐
2.2	D	Refine project scope and gain input from the whole project team to define the project's general goals.	PM / PDT	☐
2.3	UC	Prepare and mail or email the initial contact letter to the utility companies identified during utility research. Through the letter, send utility companies the general project information, ask them to confirm the presence of their facilities within the project limits and to provide facilities location information. Also, request the contact information of a designated contact person. If possible, include the desired date to get the responses.	UA / UC / PE / PM	☐
2.4	UC	Verify that the companies have received the initial contact letter and track their answers. It would be recommended to develop a project tracking sheet for utility responses. Begin keeping constant communication and building a collaborative work relationship. Follow up non-responsive utilities.	UA / UO	☐
2.5	UC	Ensure that all answers and information provided by the utility companies and any other kind of information collected to this point are conveyed between the utility and design staff. Use companies' answers to plot the information on the plans and confirm that all utility facilities are appropriately shown.	US / UA / UC / D / UO	☐
2.6	D	Perform a Red Flag Abbreviate Study (if applicable) to identify the project's existing features related to ROW property needs or potential complex utility facilities.	SMEs	☐
2.7	UC	Based on the general project goals, identify the Critical Success Factors (CSF) for the utility coordination process. Evaluate CSF and determine utility coordination goals. Ensure they are aligned with the project's general goals, then share and internalize them with all project team members.	US / UA / UC	☐
2.8	UC	Develop the General Contact List (utility owners identified within the district).	US	☐
2.9	D	Invite and encourage utility companies to participate in all Public Meetings and Stakeholders meetings. Determine if any additional utility coordination meeting would be necessary prior to the JUM.	US / UO	☐
2.10	UC	Develop the Project-Specific Contact List (utility owners information, company name, utility type, etc.) Identify and indicate in the contact list if the utility facilities will be potentially impacted by the road work or are only within the project boundaries.	US	☐
2.11	UC	Review existing facility maps, physical surveys of visible facilities with the project limits, as-built drawings, GIS Data, and all available information. Identify and physically locate potential conflicts between the project and utility facilities. Begin drafting the Utility Conflict Matrix.	UA / UC / US / PE / PM	☐
2.12	UC	Identify and discuss potential project areas and accuracy levels for SUE investigations. Gather this information and plan how SUE will be applied in the project; if possible, develop a SUE Application Plan.	US / PE / D / PM	☐
2.13	D	Identify a reasonable range of competitive alternatives that meet the project's purpose and need.	PDM / PM / PDT / UO	☐
3.0		**CHECKPOINT #03 : PRELIMINARY LINE & GRADE MEETING**		
ITEM	**PROCESS**	**DESCRIPTION**	**RESPONSIBLE**	**STATUS**
3.1	UC	Finalize the first version of the Utility Conflict Matrix and convey information between design and utility staff.	US / UC	☐
3.2	D	Perform an early evaluation of the alternatives developed at this point (considering a corridor approach instead of an alignment approach).	PM / PDT / UO	☐
3.3	D	Present to the PDT the results of their investigation, including the corresponding impacts of each of the alternatives in the project area. Offer suggestions on the risk associated with moving forward with each alternative and the time frame required to resolve identified impact issues.	SMEs	☐
3.4	D	Discuss the scope of impacts of the alternatives developed. Assure that the scope of impacts discussion is considering avoidance, minimization, and mitigation opportunities.	PM / PDT / UO	☐
3.5	D	Determine if additional information is required to further investigate alternatives.	PM / PDT	☐
3.6	UC	As the design progresses, update the SUE Application Plan for the project. (new potential areas, quality level requirements, etc.)	US / PE / D / PDM / PM	☐
3.7	UC	Identify, classify, and group those companies representing a potential risk for the project and those that might not have a significant impact (Use Utility Contact List, the Utility Conflict Matrix, and all the assessment that was already done).	UA / UC	☐
3.8	UC	Evaluate and identify the concerns and expectations for the project of each utility company impacted by the project. Determine the level of interaction, communication, and engagement that best fit utility companies' concerns and expectations, and project needs.	UA / UC / UO	☐
3.9	UC	Determine the best strategies to achieve the desired level of engagement and communication with utility companies. Develop the Utility Communication and Engagement Management Plan.	UA / UC	☐
3.10	UC	Evaluate potential project's ROW needs or permanent easement necessary (If possible, analyze a rough associated cost or develop cost-benefit scenarios).	US / PE / D / PDM / PM / ROW Supervisor / UO	☐
3.11	UC	Share the most updated plans with the utility companies and ask them to verify the utility features' accuracy plotted on the plans. Verify that the companies have received the project plans and track their answers. Convey information and keep constant communication with companies.	UA / UC / D / PM / UO	☐
3.12	UC	Get required Subsurface Utility Information and analyze findings (Recommended QL-B)	US / D	☐
3.13	D	Use available data, analysis, and professional judgment to narrow down the alternatives to a preferred alternative.	PM / PDT	☐

UTILITY COORDINATION CHECKLIST - CONTINUED				
4.0	**CHECKPOINT #04 : CONSTRUCTABILITY REVIEW II**			
ITEM	**PROCESS**	**DESCRIPTION**	**RESPONSIBLE**	**STATUS**
4.1	D	Use input from the Preliminary Line and Grade Meeting and professional judgment to seek avoidance, minimization, and mitigation opportunities for utility relocations. If possible, send the most updated plans to the utility agencies and SMEs to ask them for input on alternatives to avoid or minimize utility impacts.	PM / PDT / UO	☐
4.2	D	Review and assure that appropriate and enough information has been conveyed and considered in the design decision-making process. Verify that identified utility conflicts are being addressed to avoid, minimize or mitigate relocation processes as long as safety, economic, engineering, and environmental factors have been considered first.	PM / PDT / UO	☐
4.3	UC	Use the most updated design plans to evaluate changes in the project ROW & Easement needs to identify and confirm future property needs for utility accommodation.	D / US / PM / UO	☐
4.4	UC	Evaluate design decisions made and changes in SUE information needs to update SUE Application Plan. If required, request new SUE studies.	US / PE / PM	☐
4.5	UC	Evaluate the effectiveness of the Communication and Engagement Management Plan. Determine if the level of engagement and communication is the desired one or if any change in the strategies is necessary.	UA / UC / UO	☐
4.6	UC	As the utility conflicts are resolved, update the Communication and Engagement Management Plans to satisfy utility companies and the design team's current needs.	UA / UC / UO	☐
4.7	UC	Coordinate and conduct additional individual utility coordination meetings with utilities as needed. These meetings can be used to start discussing design alternatives, relocations in advance of project, relocations concurrently with construction, reimbursable and non-reimbursable relocations.	UA / UC / US / UO	☐
4.8	UC	Convey data obtained to this point between the design and the utility staff for its consideration during the final design stage.	UA / UC / US	☐
4.9	UC	Keep constant communication between the design and utility staff during the final design development (especially for the utility relocation analysis). Assure that the design team applies the avoidance, minimization, and mitigation approach to resolve utility conflicts when feasible.	D / PE / US / UA / UC / PM	☐
4.10	UC	Update the Utility Conflict Matrix considering the current status of the utility conflicts. Document alternative proposals to resolve conflicts, analysis of the alternative resolutions, selection of the desired resolution, and the status of the solution.	US / D / PM / UO	☐
5.0	**CHECKPOINT #05 : CONSTRUCTABILITY REVIEW III**			
ITEM	**PROCESS**	**DESCRIPTION**	**RESPONSIBLE**	**STATUS**
5.1	UC	Send the Project Authorization Letter and the most updated plans of the highway project to involved utility companies. Ensure that all impacted utility companies are invited to the joint utility information meeting.	US	☐
5.2	UC	Prepare the materials for the meeting. (Set of the most updated design plans, all general project information that may be necessary for the meeting, proposed letting date and the date to submit relocation packages, the latest version of the UCM, etc.)	US	☐
5.3	UC	Hold the Joint Utility Meeting (determine the accuracy of the latest version of the design plans, identify and assess utility facility conflicts, update utility contact list if necessary, identify any needs to foster utility facility relocations, define possible relocations that could not be avoided, schedule future meetings, determine reimbursable and no reimbursable utility work, consider project schedules and important dates such as the letting date)	US / UA / UC / UO	☐
5.4	UC	Use the Joint Utility Meeting to work collaboratively with all impacted utility companies to seek avoidance, minimization, or mitigation opportunities for the benefit of all the parties involved in the project (The Cabinet and the Utility Companies)	US / UA / / UC / UO	☐
5.5	UC	Identify any utility company absent from the JUM and send them all materials provided at the meeting and the meeting minutes package. (attach all the relevant information from the meeting and information that may be necessary for the relocation packages development).	US / UA	☐
5.6	UC	After the JUM, update the Utility Conflict Matrix as the utility conflicts have been resolved in the meeting. Update the Communication and Engagement Management Plan as necessary.	US / UA / UC	☐
5.7	UC	Keep constant communication and provide support while the Utility Companies are developing the utility relocation design. Assure that the utility companies have enough and appropriate information on the project's current design to develop the utility relocation packages.	UA / UC / UO	☐
5.8	UC	If applicable, evaluate additional alternatives to avoid relocations.	US / D / PM / UO	☐
5.9	UC	Evaluate Utility Companies Proposal Packages (plans and estimates) to verify there are no remaining conflicts with the proposed design or schedule or other utility work to take place. Review that the plan sets and cost estimates comply with Cabinet policy. Address any questions, errors, or omissions and recommend and coordinate any corrective action as necessary.	US	☐
5.10	UC	Evaluate ROW and Easements needs based on the utility companies' proposals. Update the Utility Conflict Matrix documenting the status of the utility conflicts, evaluation of the alternatives, and solution determined for each conflict.	US / UO	☐
5.11	UC	Verify that ROW and Easements needs are being adequately addressed (property acquisitions).	US	☐

UA	=	District Utility Agent
PE	=	Project Engineer
UC	=	Utility Coordinator
US	=	District Utility Supervisor
AC	=	Area Coordinator
PDM	=	Project Development Branch Manager / Assigned Project Manager
SMEs	=	Subject Matter Experts
D	=	Designer
PDT	=	Project Development Team
ROW Supervisor	=	Right-of-way Supervisor
UO	=	Utility Owner

5.2 Roles and Responsibilities of KYTC's Projects Participants

The roles and responsibilities described in this section were developed to further the integration of design and utility coordination processes and improve project outcomes. These descriptions are in complement to the roles and responsibilities stated in the KYTC Utilities and Rail Guidance Manual and the proposed flowchart and guidance of the proposed integrated approach previously described. Successful utility coordination requires engaged participants from multiple functional groups. Members of each group should have a clear understanding of their responsibilities and be committed to fulfilling them. The *Utilities & Rail Guidance Manual* lists the following participants in the utility coordination process:

- The Utility Area Coordinator (AC) and the Utilities and Rail Branch Manager (UBM) are Central Office personnel. They control the programmatic functions of statewide utility coordination and are responsible for coordinating fiscal aspects of projects and assisting district staff by providing technical support, reviews, and policy interpretation.
- The Utility Supervisor (US), Utility Agent (UA), Project Engineer (PE)/Project Manager (PM), and Project Development Branch Manager (PDM) are district office personnel. They are primarily responsible for coordinating and managing the project development and utility coordination processes. District and consultant staff will have primary responsibility for applying the strategies necessary to integrate the utility coordination process and the highway design and development process.
- The expected roles and responsibilities of other project stakeholders, including the design consultant team, survey team, and utility companies, are described below.

<u>**Central Office Personnel**</u>

a) Utility Area Coordinator (AC)

The AC works with Cabinet staff, state and federal agencies, and UCs to facilitate timely, economical, and appropriate utility coordination practices and relocations when necessary. The AC is the first point of contact in the Central Office for district-level utility staff and has the following responsibilities:

- Facilitate the utility coordination process by promoting regular and early communication between all KYTC project team members and UCs
- Develop, update, and communicate KYTC's utility-related policies and procedures in partnership with district utility staff, utility owners, and consultant utility coordinators
- Develop and oversee the development and delivery of regular training, including utility-related policies, procedures, and deliverables of utility coordination efforts, including a Utility Coordinator Certification program
- Promote and encourage project team members to partner with UCs by engaging utility owners in all facets of project delivery, from planning to maintenance.
- Provide guidance and advice on compliance with Cabinet policy and procedures on utility-related matters as requested by district utility staff
- Help district staff review utility funding and reimbursement agreements (utility proposals, funding requests, agreements, relocation packages)

b) Utilities and Rail Branch Manager (UBM)

The UBM is provides overall management and programmatic decisions for all branch sections and units to ensure operations are proper, efficient, and economical. The UBM verifies adherence to KYTC policy and procedures in utility programs. The UBM has the following responsibilities:

- Assist in the establishment and implementation of utility and rail programs
- Provide technical assistance and prepare reports on the development and interpretation of policy, specifications, and processes
- Visit district offices to resolve utility-related issues and discuss future utility project development

<u>District Office Personnel</u>

a) Project Development Branch Manager (PDM) / Project Manager (PM)

The PDM oversees the district project development program as a whole and each stage of the individual project development. There are cases when the PDM acts as a PM and assumes all PM's responsibilities. If a project is managed by a PM, the PDM is involved programmatically and the PM directly oversees the project. In projects requiring the participation of the PDM and PM, their corresponding responsibilities are described below.

Recommended PDM responsibilities:

- Oversee activities to ensure proper coordination of all functional groups (e.g., survey, design, geotechnical, environmental, utilities) at the district office level
- Coordinate and manage the movement of all projects, and the program, through the development process. The PDM must work with other disciplines, especially during preliminary design.
- Participate in project pre-design activities, be responsible for the concept and final design phases, and serve as an advisor during the construction stage of district projects
- Work collaboratively with the UA to obtain appropriate data for utility locations as early as possible in the development process

The PM (sometimes referred to as the PE) manages individual projects and sets priorities and budgets for those projects. They oversee the project and support those involved in project development, including the utility coordination process. The PM/PE should work closely with the designer and UA (or UC when applicable) to maintain awareness of the project's current status, options for addressing utility conflicts, and possible action plans so they can make decisions that result in successful project delivery. All the recommended responsibilities are important, but compliance with the primary responsibilities below could be a decisive factor in improving utility coordination. Some **primary** PM/PE responsibilities are:

- Gather as much information as possible as early as possible during project development, even before the preliminary design stage. Evaluate and communicate information to applicable stakeholders, especially the UA and/or US. If applicable, determine additional project information needs.
- Work with the PDT to make decisions at the preliminary design stage's four key points. Consider avoidance, minimization, and mitigation opportunities when addressing utility conflicts.
- Work with the survey team to evaluate needed and collected information. Study the project area to select the type and extent of coverage to limit the need for subsequent mapping.
- Systematically track all promises made on the project. The PDM is responsible for ensuring all promises (related to ROW or utility concerns) are ultimately recorded in the CAP (communicating all promises) notes and that the Cabinet fulfills these promises.
- Coordinate regular team meetings with all team members, including utility section staff, to communicate project progress and information. The PM/PE should involve the Utilities Section at each milestone in the development process.
- Work collaboratively with the designer, the US, and UA to identify and document utility conflicts. Discuss avoidance, minimization, mitigation, or accommodation opportunities for utility facilities.
- Evaluate use of Design Phase Funding to start utility-related work (preliminary utility engineering) prior to completing NEPA documentation, so utility coordination activities begins earlier in the process
- Work collaboratively with project team members to evaluate the application of SUE. If possible, perform cost-benefit evaluations to decide when and how to apply SUE.
- Provide advice and comments regarding potential ROW and easement needs for utility accommodations
- Coordinate and ensure completion of Constructability Reviews throughout the development process

Some **complementary** responsibilities are:

- Ensure that sufficient high-quality quality information is gathered to develop accurate facility maps

- Work collaboratively with the UA to identify all UCs with facilities in the project footprint. Determine and evaluate potential utility impacts and develop strategies to engage companies on the project.
- Coordinate significant project decisions and design changes. Consider avoidance opportunities for utility conflicts when feasible.
- Manage the project and ensure that all utility conflicts are addressed on time and will not affect project delivery
- Facilitate communication and collaboration between all project participants. Provide guidance, support, and advice when needed.

b) District Utility Supervisor (US)

On utility-related matters, the US is the main point of contact between the district office and Central Office. The US oversees and manages utility agent and consultant utility coordinator activities, issues decisions on utility problems, and manages the resolution of outstanding utility issues. The US evaluates staffing needs and partners with PMs to include utility coordination duties in the consultant scope of work. US responsibilities are divided into two groups. Fulfilling primary responsibilities could make a positive difference in the utility coordination process. Recommended **primary** US responsibilities are:

- Host meetings with UCs in the district, or in cooperation with neighboring districts, to share long-range plans, share project specifics, and hold collaborative discussions on utility design and construction considerations
- Meet with PDM, PMs, and designers to regularly communicate utility issues
- Collaborate with Central Office utility staff to provide updates, challenges, policy concerns, best practices, and lessons learned on utility issues
- In collaboration with peers, develop utility coordination metrics from cradle to grave to gauge improvements and needs. Provide utility reports on these metrics to the district office and Central Office.
- With assistance from the UA, consult with UCs on facility locations and consider needs for SUE investigations. As the design progresses and utility conflicts are addressed, reevaluate SUE needs (e.g., new potential areas, quality level requirements)
- In coordination with the UA, as design progresses continuously evaluate potential project ROW needs or necessary easements to provide recommendations on ROW acquisition for utility accommodations
- Coordinate with the UA to hold JUMs. Use this opportunity to work collaboratively with impacted UCs and evaluate avoidance, minimization, and mitigation opportunities for utility conflicts. Help the UA update the UCM with decisions made in this meeting.
- Support successful and effective utility coordination and relocations by frequently communicating about utility matters with project participants
- Ensure that project information and project design decisions are documented and communicated
- If applicable, establish consultant utility coordinator needs and assignments for the district

Recommended **complementary** responsibilities are:

- Develop, update, store, and convey relevant project and UC documentation, such as the General Utility Contact List and Project Specific Contact Lists
- Work with the UA to send the Project Authorization Letters inviting all affected utility companies to the JUM. Assist the UA in preparing all required documentation (e.g., project information, updated plans, UCM) to conduct a successful JUM meeting.
- Review UC relocation packages (relocations plans, estimates). Ensure that all utility-related issues are resolved with the proposals and that they are reasonable and accommodate the project design.
- Help the UA prepare for utility construction (e.g., identify potential conflicts of workspace, ROW needs, completion dates for relocations).
- Monitor the relocation work status of all compensable and non-compensable utility relocations before the letting process and update the UCM. Identify potential risks that may cause project delays related to relocations. As needed, review and convey information on relocation schedules in the construction contract documents and to highway construction contractors/bidders (Utility Certification Notes).

c) District Utility Agent (UA)

The Utility Agent (UA) delivers utility coordination on a specific project. They serve as the liaison between the district and utility owners on project-related matters. The UA deals directly with UCs and the PDT, providing information on the project's utility needs. The US's responsibilities support UA responsibilities, but sometimes the US serves as the UA. In some cases, the UA role can be performed by an external consultant utility coordinator, so the responsibilities defined in this section are also applicable to a utility coordinator role (either externally or internally performed). UA responsibilities are divided into two groups. Recommended **primary** UA responsibilities follow:

- Work collaboratively with the PDM or PM to determine the critical success factors (CSF) for utility coordination on a project. Once defined, ensure that utility coordination goals align with the project's general goals and that all project team members are aware of them and working toward the same objective.
- Mail or email initial contact letters to UCs regarding the proposed project. In this letter, ask UCs to confirm the presence of facilities within the project limits and request information on facility characteristics and locations.
- Request that UCs to provide a designated contact person for future coordination . Keep a record of each UC's contact information and make that information available to all team members (including other utilities).
- Verify that UCs received the initial contact letter and track their responses. If possible, develop a project tracking sheet for these responses. Any time that official notices, requests, or critical project information are sent to UCs, verify they have received it and track their responses.
- Collect and report all responses and information obtained from UCs to the US and PM/PE. Ensure that all information provided by UCs is communicated to the project design team to confirm that all utility facilities are adequately depicted on the plans.
- Document and follow up with non-responsive UCs to maintain contact with them and attempt feedback for information. A non-response does not always indicate a lack of impacts.
- Identify and classify UCs that may represent a potential risk for the project and those that may not have a significant impact
- Communicate with UCs to identify their concerns and expectations with respect to the proposed project. Consider and communicate their concerns, needs, and expectations to work in partnership with all project stakeholders.
- Evaluate the project needs of each UC (e.g., information, feedback) and determine the level of interaction, communication, and engagement required to satisfy the utility and project team's needs.
- Based on the previous evaluation, determine best strategies to achieve the desired level of engagement and communication with UCs. Develop the Utility Communication and Engagement Management Plan.
- Maintain constant and effective communication (via letters, emails, phone calls, meetings) with all project stakeholders, considering the strategies developed in the Utility Communication Management Plan.
- Periodically evaluate the effectiveness of the Communication and Engagement Management Plan.
- Evaluate the status of utility conflicts and the project design. Determine and implement necessary changes to satisfy the UC and project team's needs.
- As design progresses, coordinate with UCs to verify the accuracy of facility depictions in plans. In cases of inconsistencies, notify the design team, provide recommendations to the US, and work closely with project stakeholders to make corrections.
- Work collaboratively with the US to identify potential conflicts between the proposed project and the utility facilities to develop the UCM. As design progresses and utility conflicts are addressed, update the UCM and share the information with pertinent team members. The UCM must be updated throughout the project until all utility conflicts have planned resolutions.
- Work collaboratively with affected UCs to develop utility conflict identification strategies, evaluate the potential impacts of utility conflicts, and discuss reasonable alternatives to avoid, minimize, or mitigate these conflicts
- Coordinate and conduct additional utility coordination meetings with UCs as needed. If applicable, these meetings can be held individually.
- Communicate and provide information to UCs about conflict resolutions or when design changes are made
- Use sound management skills to ensure utility facilities are successfully avoided when feasible, or relocated. Use soft skills to encourage team members to partner with UCs and ensure successful utility coordination

- Engage UCs from the beginning of the project and through construction to facilitate utility coordination and relocation efforts.
- Work with the PM and the PDM to evaluate and identify critical project areas, expected timelines, and quality levels required for SUE investigations. Develop a SUE Application Plan.

Complementary responsibilities are:

- Once the project is established, the UA must perform a field review of existing utility facilities within the project limits. This includes reviewing existing facility maps, as-built plans, KYTC survey maps, and permit files.
- Solicit information on the possible locations of utility facilities through discussions with area residents
- Meet with project partners (e.g., project development team, utility companies, consultants) to identify alternatives that avoid, minimize, and mitigate or accommodate utility conflicts.
- Once utility research begins, perform an initial assessment of potential risks or conflicts between existing utilities, easements, or other physical features. Determine areas of significant concern that may require further evaluation.
- Work collaboratively with the PM/PE and UCs to gather all information required to produce accurate facility maps. This includes, but is not limited to, existing facility maps, information on the type and size of facilities, drawings provided by UCs, survey results, SUE findings, and as-built plans.
- Invite UCs to public or stakeholder meetings. Work with the US to determine if additional utility coordination meetings are needed prior to the JUM.
- Work with the US to conduct the JUM. Use this meeting to work with all impacted UCs to seek avoidance, minimization, or mitigation opportunities that benefit all parties. Forward meeting materials and information to UCs absent from the meeting.
- Give the PDT all utility-related information necessary for design. Provide data required by UCs during the development of their relocation packages. Verify that UCs have enough and appropriate information on the current status of the project’s design.
- Provide inspections during the utility relocation process for conformance. Cross-reference all utility work plans to ensure that there are no conflicts at proposed facility locations or in relocation schedules.
- Coordinate with the PDM or PM to obtain and share information gathered during the project's early development stages. Evaluate existing data to make recommendations on additional project mapping and information needs and identify potential project risks.

Other Participants

a) Design Consultant Team

The Design Consultant Team develops the design. Designers must be involved with UCs and utility coordination throughout project development. Some of the Design Consultant Team's primary responsibilities related to utility coordination are:

- Identify critical project areas where if utility conflicts exist the project may be significantly impacted. Provide feedback to the UA to further evaluate those areas, which may include advanced utility investigations.
- Use data collected (e.g., survey information, as-built plans, SUE) to depict existing utility facility locations and attributes on plans. Update and make necessary corrections and modifications as more precise information is obtained.
- As design progresses and facility location information is plotted on the plans, identify potential utility conflicts.
- Design with utility layers visible
- In collaboration with the UA, evaluate the project's CSFs, budget, schedule, impacts to the traveling public. Develop a utility conflict management plan, including a UCM. As design progresses and utility conflicts are addressed, communicate design changes and the status of the conflicts to update the UCM.
- Avoid, minimize, or mitigate utility facility conflicts while achieving project goals. The designer must determine if cost-effective changes can be made as long as the design considers safety, environmental, economic, and engineering factors.

- Document and provide the rationale behind design decisions with respect to utility conflicts. For cases where utility relocations cannot be avoided, document and communicate reasons for the designer's decisions.
- Identify potential areas for advanced utility investigations. Make recommendations regarding the location and quality levels needed for utility investigations.
- Record and efficiently use results of subsurface utility investigations to produce more accurate utility locations in the project design plans.
- Provide adequate project plans, exhibits, and reports to the UA as needed to communicate with UCs.
- Coordinate and work collaboratively with the UA to determine the appropriate level of engagement and communication required with UCs.
- Identify ROW needs to accommodate utility relocations. Provide recommendations to the ROW acquisition staff so they can acquire property that accounts for utility relocations, maintenance of traffic, and construction phasing.

Complementary responsibilities include:

- Assess existing utility information and make recommendations to request additional utility data
- Ensure that appropriate personnel are involved in the key decision points during preliminary design
- Consider recommendations from SMEs and UCs to avoid or minimize utility conflicts. Convey information and maintain regular communication.
- Coordinate with the UA to attend utility coordination meetings, especially those held to work with UCs to resolve utility conflict.
- Provide all information required by UCs to develop their utility relocation work packages.
- Work collaboratively with the US to review utility relocation packages submitted by UCs. Ensure that relocation proposals were developed in accordance with the project design.
- Prepare and provide all required information for utility coordination meetings and constructability reviews

b) Surveyor

The surveyor provides data required by the project team. They collect initial topographic data, identify features the project design must accommodate, and do construction staking to assist in the construction phase of the project. Responsibilities pertaining to utility coordination include:

- In partnership with the project team, determine if advanced utility investigations such as SUE QL-B are needed with the initial project survey. This includes approximate depths collected from electronic readings by the SUE provider.
- Meet with UCs, the utility coordinator (or UA), and other project team members as needed to ensure adequate collection of utility information is done before submitting the survey deliverables
- Measure and document the location of existing utility facilities in the project area
- Measure and document the location of the field marking made by UCs to identify their facilities in the field. This may include 811 markings, but this information should be noted as such.
- Provide all information collected (e.g., utility facilities measurements, locations, utility type, utility size) to the design team and other pertinent team members.
- When advanced utility investigations/SUE QL-B are not collected with the topographic survey, evaluate the data collected and make recommendations to the PDM or PM/PE for application of subsurface utility investigations.
- Provide subsurface utility information in a three-dimensional layer in the survey deliverable, including the z coordinate.

c) Utility Company

Proactive participation by UCs from the beginning of the project is essential for successful utility coordination. The proposed approach requires that UCs be committed to the project and are willing to work in partnership with KYTC or consultant staff. Expected responsibilities for utility companies are:

- Partner with the statewide team to develop a usable and updated database and identify a person to serve as the first point of contact between the UC and the Cabinet or representative personnel
- Provide a contact person to the project team to facilitate communication and coordination
- Respond to initial contact letter requests with the following:
  - Record drawings of facility locations with as much specificity as possible
  - Note whether a facility is buried or aerial
  - If aerial, note who owns the pole(s) where the facilities are located
  - If the company owns the pole(s), identify owners of attachments on the pole(s)
  - Size and type of material, pressure, or voltage, or other characteristics
  - Unique structures — especially buried structures — or complexity in the project area
  - Future plans for replacement or maintenance of facilities
  - Full contact information for continued coordination
  - Documentation of a property interest, such as an easements
- When initial project plans are provided, provide timely feedback and verify the accuracy of facility locations on design plans
- Make recommendations on different alternatives to avoid, minimize, or mitigate utility conflicts
- Communicate to the UA what is needed to perform relocation work successfully to meet project goals. The UA must be aware of UC concerns and expectations and share this information with the entire project team.
- Be responsive to requests from the UA and other project team members. Do not ignore information/feedback requests — answer them as soon as possible.
- Evaluate project data needs and make recommendations for the project's SUE application plan.
- Participate in project and utility coordination meetings. If required, request additional meetings with the UA or the US to discuss utility issues.
- Coordinate with other UCs and railroads that may be impacted to avoid conflicts or complications during relocation work
- Develop utility relocation proposal packages in accordance with the project design in the specified time requested
- Execute the KYTC-approved utility relocation work plan. Ensure that the relocation work will be finished on time and within budget.
- Obtain approvals from the Cabinet to use outside design or construction forces
- Prepare a utility design and relocation estimate that includes:
  - Direct labor and labor surcharges
  - Overhead and indirect construction charges
  - Materials, supplies, and equipment
  - Transportation and handling charges
  - ROW costs
  - Engineering costs — preliminary engineering and construction engineering
  - Credits — salvage credits, betterment credits, and accrued depreciation credits
  - Describe factors included in the utility's overhead and indirect construction charges
  - Itemize materials that represent major components or costs in the relocation
- Prepare a relocation schedule that includes preconstruction and construction activities:
  - Required design time
  - Permits or internal approvals
  - Time to obtain materials
  - Time to obtain a contractor when using outside forces
  - Time to mobilize after notice to proceed with construction
  - Time to complete relocation and complete site restoration as required
- Submit timely invoices for all reimbursable work

5.3 Utility Companies' Engagement and Communication Management Plan

It is imperative to gain the support of and build collaborative relationship with each UC impacted by the project. Strategic, efficient, and effective communication with each UC plays a critical role in keeping them on board. The proposed approach promotes early engagement and frequent communication with UCs.

Utility Companies' Engagement Management

Managing UC engagement involves many activities, ranging from the correct identification of UCs impacted by the project to analyzing their respective expectations and concerns for developing the most appropriate strategies to achieve the desired engagement. Adequate management of UC engagement throughout the project helps the project team gain the support needed to improve utility coordination and project outcomes. Managing this engagement may require different strategies and methods, and they can vary from project to project. The PM and UA's choose the strategies and methods that best suit the project's needs. The sixth edition of the *Project Management Body of Knowledge* (PMBOK) recommends four processes as part of the project stakeholder management area of knowledge. These processes could be used as a framework to manage UC engagement in KYTC projects. Figure 5.1 shows how these processes are related and can be aligned with the development stages of a project.

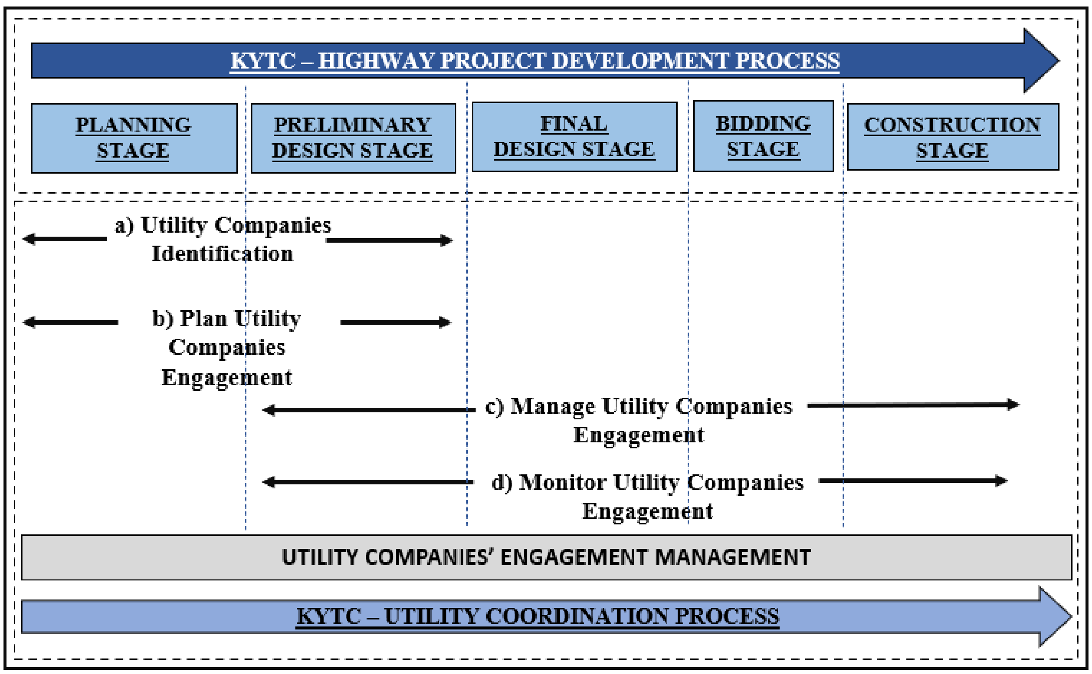


Figure 5.1 Framework for Utility Companies' Engagement Management

a) Utility Companies Identification

Identifying affected UCs should occur during planning and preliminary design. Doing this early in project development increases the chance of addressing utility impacts successfully. Identifying impacted companies and their facilities lets the project team analyze their main concerns, expectations, and needs related to project impacts and develop appropriate strategies for building partnerships with the UCs.

The *Utilities & Rails Guidance Manual* suggests developing the Utility Contact List as part of planning the utility relocations stage. There are two types of contact lists: (1) A **General Contact List**, which includes all UCs in a region, and (2) A **Project-Specific Contact List**, which includes all UCs identified within the project area and their assigned contact for the identified project. Both lists should be updated periodically and must include all necessary information (company name, utility type, contact name, title, mailing address, email address, telephone, and fax numbers) to contact the appropriate representatives. Developing the Project-Specific Contact List occurs during the planning and preliminary design stages as the project team collects data on existing utility facilities within the project limits. Once the project is initiated, the PDM, PM, and UA should start researching all the information sources available to identify the impacted UCs. Recommended tasks to gather these data and identify impacted UCs are:

- Review project scope definition
- Request and review any information from previous studies from the Division of Planning
- Secure a County/District Utility Contact list from KYTC's General Contact List
- Review Utility Contact Lists from previous projects in nearby areas
- Seek confirmation of facility presence from General Contact List
- Perform a field visit and discuss with area residents
- Secure and review existing facility maps and as-built plans
- Review visible features on KYTC survey maps
- Request KY811 Design Information Ticket
- Obtain QL-D SUE data

Given that information at the planning stage is not always comprehensive, when the project team is working to identify existing facilities in the project's footprint, they likely will not know which facilities will be impacted. Thus, the Project-Specific Contact List may include UCs which own facilities in the project area that the proposed project impacts and companies with facilities located in the project area but that may not be directly impacted. As more accurate data are collected, the project team can confirm and identify utilities that are significantly impacted by the project and companies that are not directly impacted. As design progresses, significant design decisions are made related to the proposed alignment, which might require the inclusion of new UCs on the Utility Contact List or modifications to the scope of impacts incurred by companies already on the list. Therefore, it is necessary to keep the contact list updated. The UC identification process is a critical step for the UC engagement management and for project communication management.

Once the Utility Contact List is developed, the PM/PE and UA must analyze the identified UCs. There may be some companies whose participation and engagement can impact utility conflict resolution. Some companies may be interested in participating in the project, while others may not care. The PM and the UA need to categorize them and determine which companies to prioritize. The PM and the UA bring different perspectives to this analysis. The PM/PE will look at this analysis from the perspective of the project, while the UA will look it from the perspective of the UCs. Aspects to consider when beginning analysis are:

- Potential conflicts between the proposed project and existing utility facilities
- Potential lack of information on utility facility locations
- Possible UC expectations and concerns about the project
- Required contributions (information and feedback) from UCs

The technique chosen to classify stakeholders should be based on project needs and complexity. Using an Impact/Interest Grid can help KYTC identify affected UCs. As shown in Figure 5.2, this diagram has two axes — the interest axis and the impact axis.

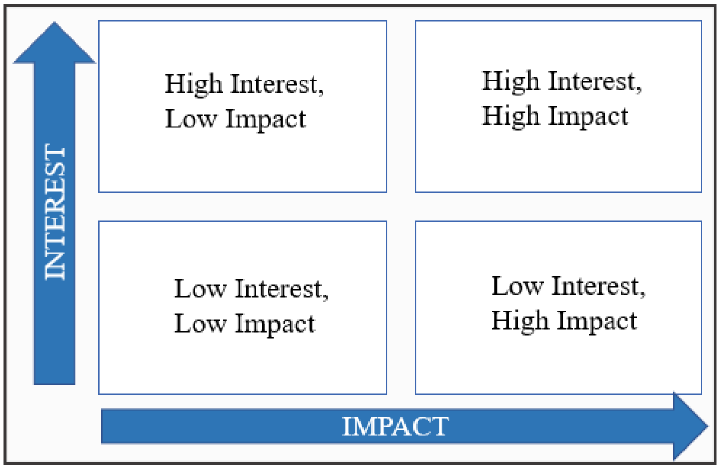


Figure 5.2 Impact / Interest Grid for Utility Companies' Engagement Prioritization

Use of the Impact/Interest Grid, requires that the PM and UA evaluate the following:

Impact Axis: This axis depicts the potential level of risk that a UC poses to the project; in other words, how significantly the project's impact is on their facilities and how serious the potential utility conflicts may be. Some considerations to categorize UCs either as high or low impact include but are not limited to:

- Potential level of complexity of relocation processes
- Utilities located at critical points in the project area (areas with many concurrent facilities)
- Utilities that may represent either a minor or major conflict for the project
- Utilities whose relocation may represent a significant impact on project cost
- Utilities whose relocation may require an unusually long period of time to accomplish
- Utilities located in areas with limited ROW access
- Utilities for which potential relocations may require high-quality, accurate information
- Utilities that historically have been complex to relocate

Interest Axis: This axis captures the level of interest that UCs have in the project; in other words, the level of their concerns about project outcomes. Considerations for categorizing UC interest levels are:

- Utilities that may have an interest in potential compensable relocations
- Utilities that may have an interest in future facilities expansion
- Utilities whose relocation may significantly impact on their service
- Utilities whose relocations may have special requirements
- Potential property acquisition needs and easement needs
- Utilities with difficulty scheduling outages

Following the UC identification process, the project team delivers the Utility Contact List and the Impact/Interest Grid .

b) Plan Utility Companies' Engagement Management

This process should occur during the planning and preliminary design stages. It identifies optimal strategies and approaches for engaging UCs. The PM and UA develop different approaches to manage UC engagement based on company level of interest, how they can contribute to the project (e.g., information, feedback), and where the interests lie. To assign a priority level to each UC, the PM and UA must first identify project needs and analyze UC concerns and expectations. Appropriate management of UC engagement can make the difference between utility coordination success and failure.

The PM and UA must determine how UCs feel about the project and work out how best to communicate and engage with them. The first step of this process is initiating contact with each UC. The Initial Contact Letter is the first official contact with UCs and informs them of the project. This letter should also ask UCs to confirm the presence of their facilities in the project area and provide all existing data on their facilities. The UA should verify that each UC receives the letter, track responses, and follow-up with non-responsive companies. This interaction lets the UA evaluate and identify the UC engagement level. A tracking sheet for UC responses is a valuable tool for this evaluation. Simultaneously, the PM needs to work with the design team to identify potential utility conflicts and UCs involved in those conflicts. The PM and design team must evaluate existing data to identify potential information/feedback needs and determine the required level of UC engagement to meet project needs. Information in the UCM can aid this evaluation. The UA and PM should put together the results of this assessment and develop the Utility Companies' Engagement Management Plan. This plan describes actions to achieve the required level of UC engagement. It need not be an elaborate plan as long as it clarifies which companies the project team should prioritize and what actions can be taken to accomplish this goal. Figure 5.3 illustrates this process.

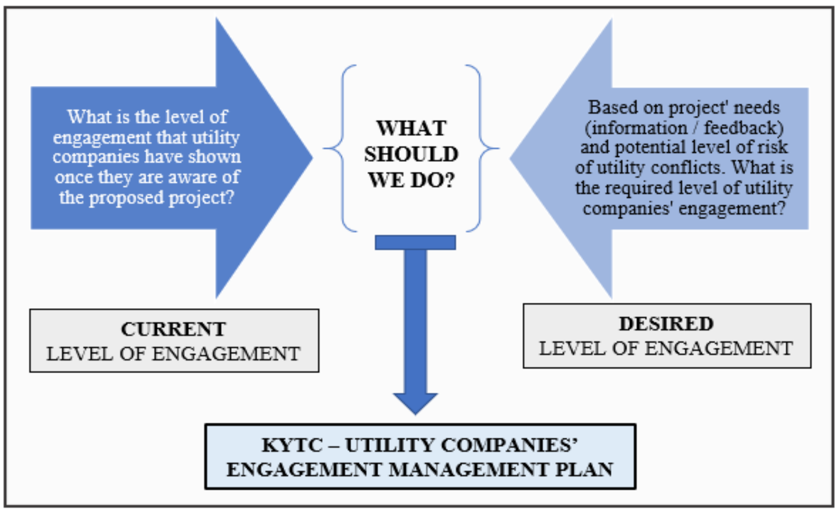


Figure 5.3 Utility Companies' Engagement Evaluation

Sources of information and considerations that can be taken into account when developing the UC engagement management plan are:

- CSFs related to utility coordination
- Utility Contact List and Impact/Interest categorization of UCs
- Tracking sheet for UC responses
- UCM information (KURTS)
- KYTC – Utility Companies' Communications Management Plan
- Lessons learned from previous projects (*)

(*) Utility coordination is learned through experience. Staff with knowledge of utility coordination problems from previous projects can identify potential problems earlier in future projects and reduce their impact. Similarly, knowledge of effective utility coordination practices from past projects can be used to improve utility coordination on future projects. Developing a Utility Coordination Lessons-Learned Repository can strengthen utility coordination. Many effective strategies are being applied on KYTC projects. However, these strategies are not commonly practiced in all districts because they have not been consistently recorded and shared. The repository will reinforce positive practices and help practitioners avoid mistakes. It should include recommended practices for UC identification, utility conflicts identification, Utility Contact List development, communication strategies, and engagement of UCs. This information can be shared with everyone involved in KYTC projects. Table 5.2 is a matrix that can be used to organize and manage this information. Given that each project is unique, the matrix may require modification, but Table 5.2 can serve as an initial reference. The second row of the matrix indicates suggested sources of information to fill out the matrix.

Table 5.2 Utility Companies' Engagement Management Matrix

Utility Company Name	**Category of Engagement Prioritization**	**Key Interest and Issues**	**Current Status (Responsive / Non-Responsive)**	**Desired Support (High/medium/low)**	**Action / Strategy to Be Taken**
Utility Contact List	Impact / Interest Grid for Utility Companies' Engagement Prioritization	Utility Conflict Matrix	Tracking Sheet for Utility Companies' Responses	Impact / Interest Grid for Utility Companies' Engagement Prioritization	Discussion between the PM and UA

The Utility Companies' Engagement Management Plan should be updated routinely. As design progresses and utility conflicts are resolved, project needs change as will the UC engagement needs.

c) Manage Utility Companies' Engagement

This process stretches from preliminary design stage through construction, until utility conflicts are resolved and relocations completed. The process consists of executing all strategies developed as part of the Utility Companies' Engagement Management Plan. During this process, the project team works with all the involved UCs to resolve utility conflicts or coordinate relocations. UCs must clearly understand the significance of their contributions to successful project completion. The strategies developed clarify that they are a critical part of the project team, and as a team, the project's goals, benefits, and risks are the same for everyone. The most significant benefit of this process is gaining UC support and commitment and involving each throughout project development. This lets the project team get all the required information about utility facilities and the necessary feedback to find the most cost-effective solutions for utility conflicts. Effective communication and interpersonal and team skills play a key role in this process.

As the project moves forward, the project team iteratively assesses utility conflicts and makes reasonable efforts to avoid, minimize, or mitigate utility relocations, resulting in changing project needs. As the PM and UA manage UC engagement, they must update the Utility Companies' Engagement Management Plan and accompanying matrix (if in use). The PM and UA must verify they are getting the desired level of UC engagement according to the project's needs.

d) Monitor Utility Companies' Engagement

Monitoring the engagement of UCs should be done from preliminary design through the construction, until utility conflicts are resolved and relocations completed. Goals of this process include monitoring UC relationships, evaluating the effectiveness of applied engagement strategies, and identifying adjustments. Because the design team and UCs need different things at different times, the project team must ensure that engagement strategies and approaches adapt as the project evolves.

The PM and UA may use the Utility Companies' Engagement Management Matrix to evaluate whether the strategies are achieving the desired level of engagement for each company. Updates to this matrix should show how UC engagement evolves and help identify companies that the project team requires more effort to engage. Feedback from the design team and UCs is necessary to evaluate the effectiveness of the Utility Companies' Engagement Management Plan,. Some options to monitor UC engagement are:

- Utility coordination meetings or other project meetings may present good opportunities to assess how engagement strategies are working. These meetings can let the PM and UA to collect feedback from UCs and other project participants and then update the Utility Companies' Engagement Management Plan. Face-to-face meetings are the best option to understand how project stakeholders feel about how engagement has been managed.
- The updated UCM is a good source of information. It can be used to evaluate whether engagement strategies have helped resolve utility conflicts and identify which UCs need to be more engaged.
- Satisfaction surveys can be a good tool to get necessary feedback for this process, especially for UCs that have no time for in-person meetings.

Positive and negative aspects of this process should be recorded in the Lessons Learned Repository for consideration on future projects.

Project' Communications Management
The aim of effective and efficient communication is to build lasting partnerships with UCs and to maintain their support to facilitate successful project outcomes. First, let's differentiate *effective communication* from *efficient* communication:

- **Effective Communication:** The right information reaches the right person at the right time and in a cost-effective manner.
- **Efficient Communication:** Only the information that is needed, nothing more, nothing less, is provided.

Effective and efficient communication helps KYTC understand and address UC needs and expectations, facilitate information sharing, handle issues, and make sure UCs participate in project decision making. Their active participation helps the design team make reasonable efforts to avoid or minimize utility relocations and mitigate unavoidable facilities.

The UA interacts directly with UCs and project management and is aware of all utility needs on a project. The UA must also build a bridge between KYTC and all UCs. Maintaining effective and efficient communication with UCs demands varying levels of effort based on the needs of each company. Understanding how needs differ between companies is fundamental for identifying strategies to manage communications with each one. These strategies are the starting point for developing Communications Management Plan. Management of communications must be strategic, meaning that each party is aware of the other's needs and that communication is based on project characteristics, constraints, and participant needs.

The PMBOK Guide – Sixth Edition recommends three processes for communication management. These can inform management of communication with UCs. Figure 5.4 illustrates how these processes are related and aligned stages of project development.

a) Plan Communications Management
This process occurs during planning and preliminary design and is focused on understanding and identifying the information UCs need from the Cabinet and the data they need to provide KYTC. The UA and PM must work collaboratively to develop approaches and strategies to communicate effectively and efficiently with each UC.

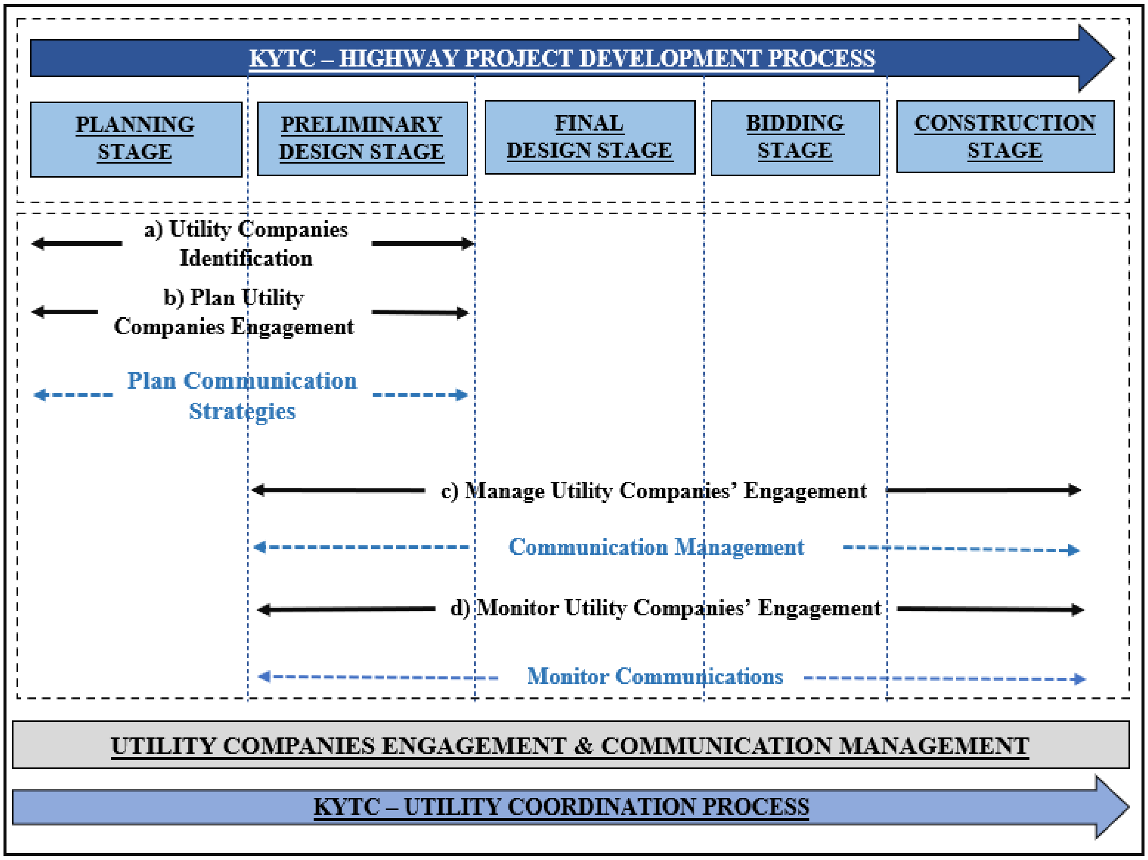


Figure 5.4 Framework for Utility Companies' Engagement and Communication Management

As existing project information is collected and the Utility Contact List is developed, the PM, UA, and design team must collaborate to identify potential communication needs related to utility issues. They must also analyze and understand what level of engagement with UCs is needed to achieve effective and efficient communication with those companies. Based on the Impact / Interest Grid for Utility Companies' Engagement Prioritization, the UA can develop an approach to manage communications with each company. Companies in each group of the matrix may have different communication needs, so it is more convenient to prioritize the efforts for achieving effective and efficient communication with each group according to their needs. Accordingly, the matrix has been modified to include recommended approaches for managing communication with each group (Figure 5.5)

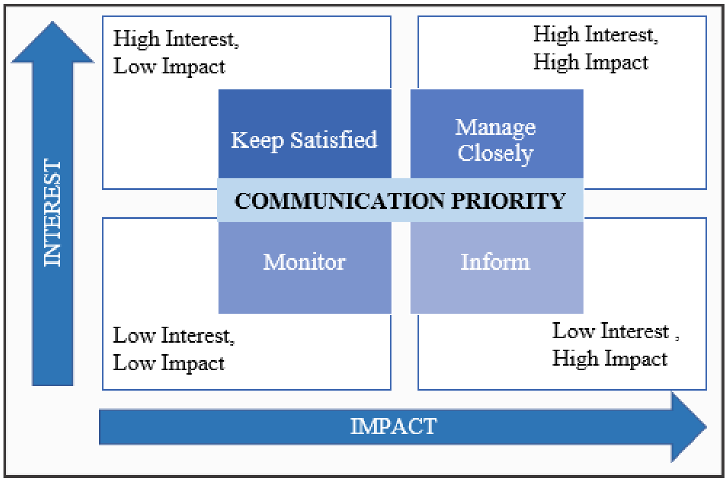


Figure 5.5 Communication Priority Grid for Utility Companies' Engagement

Communication with UCs whose facilities have a low impact on the proposed project and may have low interest in the project should only be monitored. Communication with UCs whose facilities highly impact the project and have a high interest in participating in the design should be managed closely. Based on this analysis, the UA can organize information using Table 5.3 and begin developing strategies to effectively communicate with each company.

Table 5.3 Utility Companies' Communication Management Matrix

Utility Company Name	Category of Engagement Prioritization	Key Interest and Issues (Potential Conflict)	Potential Communications Needs	Communication Priority	Recommended Action / Strategy

Sources of information that should be considered for this process are:

- **Utility Contact List —** to evaluate and address the communication needs of impacted UCs
- **Utility Companies' Engagement Management Plan —** to create consistency between the communication strategies and the strategies developed to engage UCs effectively
- **KYTC Guidance Manuals** — to consider standardized guidelines for exchanging project information and established communications channels, tools, and mechanisms. Any type of policy or procedure set by the official manuals must be followed.
- **Lessons Learned repository** — to take advantage of the information on effective communication strategies or practices applied in previous KYTC projects

During development of the communications management plan, other aspects that should be considered are:

- **Format and quality of information to be communicated**: Receiving information with formats and quality levels different from what is expected may lower the quality of information exchanged. For example, existing facility maps do not always have the same quality level and could exist in different formats, making it difficult to use the information to plot facility locations accurately on the plans.
- **Appropriate means and mechanisms to convey project information:** KYTC guidance lists some means and mechanisms (e.g., official letters, meetings, KURTS). The communication management plan must be elaborated considering compliance with the policy. However, projects and UC needs for coordination may require finding

other means and mechanisms for informal communication and coordination with UCs. These mechanisms may not be the same for all companies because their communications preferences will differ. For some companies, written documents, formal letters, or meetings are more effective than informal conversations, remote meetings, or emails. Addressing these preferences helps achieve effective and efficient communication. Do not to limit project communication to letters, reports, information packages, and other one-way modes of communication. Including interactive communication methods, such as face-to-face meetings, phone calls, online meetings, may help improve the effectiveness of information exchanges.

- **Frequency and urgency to exchange information:** Companies that require close engagement with the project may require more frequent interactions than other UCs. They also might prefer remote meetings, calls, or emails because of time availability constraints. The frequency of communication may also vary according to project stage and utility conflict status.

- **Correct interpretation of shared information (in both ways):** Because some UC representatives cannot interpret highway plans well, they may find it difficult to identify utility conflicts. Similarly, designers can have problems reading utility facility plans. Some communication strategies include face-to-face or remote meetings to discuss possible misunderstandings about data. If there is no problem interpreting the information, successful communication can be achieved and the feedback received will be more beneficial to the project.

The main deliverable of this process is a communication management plan that contains the following information:

- UC communication needs, requirements, and expectations
- Project team member communication needs, requirements, and expectations
- Information to be communicated (e.g., specifications, cost, plans). Specify the format, content, and level of detail expected by both parties (designer and UCs). Information needs may vary at different stages of project development.
- Reason for the exchange of information. Some companies might need to receive or share more information than others. Prioritizing communication with them must be justified after analyzing the project's impact on their facilities.
- The frequency of distributing the required information and receipt of responses. Communication for utility coordination purposes should be two-way communication and need not be limited to sending information to UCs. Responses are required and should be received on time to give stakeholders more opportunities to find creative solutions for utility conflicts.
- Responsibilities for communicating project information and receiving information from UCs
- Contact person information for each UC. Communications are more efficient if the person responsible for receiving and sending the information on utility facility locations is determined from the start.
- Methods or technology selected to convey project information. Standardized systems like KURTS should be considered when planning project communications.
- Constraints that could impact the effectiveness of project communications
- Glossary of common terminology to avoid miscommunications or misunderstandings between team members and UCs. Terms used in utility coordination may seem widely known, but different people could have different interpretations and definitions.
- Existing or new guidelines and templates for project status meetings, project letters, e-meetings, emails, and meeting minutes

KYTC will use the Communication Management Plan to share and obtain project information. The plan will describe what information has to be gathered and shared, information sources, what channels and tools are available, urgency, formality, and determination of methods (e.g., formal, informal, written, verbal).

b) Manage Communications

This process stretches from preliminary design through construction, until utility conflicts have been resolved or relocations are complete. It consists of preparing communications and distributing them to ensure the timely exchange of information between KYTC and UCs throughout project development.

During preliminary design, the UA notifies UCs about the proposed project and asks them to confirm the presence of their facilities within the project area and provide all existing information about their facilities. UCs must respond to as soon as possible with all available data. Later in the project, UCs must confirm the accuracy of the facilities plotted on plans and provide feedback about options to avoid, minimize, or mitigate utility conflicts. The interactions and exchanges of information between the Cabinet and UCs continues throughout project development. Using the communications management plan previously will make this easier, as the UA will know who needs to receive what information and when they need to receive it.

c) Monitor Communications

This process is ongoing from preliminary design through construction, until utility conflicts have been resolved or relocations are complete. It consists of monitoring application of the communication plan and ensuring that all the information needs are met *and* managing modification or updates to the communication management plan if any change in the project design represents a change to the project's impact on utility facilities and so in the project's communication needs. The UA should continuously review UC communication requirements, project information distribution, format and distribution methods, and other aspects to verify expectations are being met. This process is necessary to evaluate the impact of strategies on project communications and then make the required changes to achieve effective and efficient communication. All lessons learned from each project should be documented and kept for KYTC’s records. This information may be valuable for future projects. The following options can serve as indicators to monitor communications with UCs:

- Satisfaction surveys to document how the design team and the UC owners or representatives perceive communication effectiveness. These surveys have to be done throughout the project to make necessary modifications.
- Discussions to understand how the design team and UC owners or representatives perceive different types of project communications. Face-to-face meetings are always the best options to grasp how project stakeholders feel about the way communications have been managed.
- Lessons learned repository to evaluate if strategies have the expected effect or if there is any aspect that has been missing.
- UCM information to evaluate if project communication has helped resolve utility conflicts. The UCM can also help identify which utility conflicts requires better communication and engagement with the UC to settle on a resolution.

5.4 Utility Conflict Matrix Guidance and Use for KYTC

5.4.1 Introduction

Sometimes the use of a UCM is referred to as Utility Conflict Management. This practice involves a multistage process to systematically identify and resolve utility conflicts during project development and is considered a best practice in Utility Engineering. The UCM documents, tracks, and manages utility conflicts. It help KYTC utility staff, PMs, and designers collaboratively identify, organize, analyze, and track utility conflicts to resolution. The UCM should include data on utility location, type, and ownership; identification of potential utility conflicts; confirmation of conflict with some project feature; alternative proposals to resolve the conflict; analysis of alternative resolutions; selection of a resolution; and execution of the resolution. UCMs typically assume the form of a table or matrix, which allows for effective documentation and management of utility conflict data. KYTC has a UCM built into KURTS, which can be viewed in tabular format, as individual conflicts, or spatially. Appendix I includes guidance for using the UCM in KURTs. KYTC utility, design, and project management staff can contribute to the KURTS UCM.

5.4.2 KYTC Use of UCM

KYTC has an approach and guidance for implementing a UCM in KURTS (see Appendix I). UCMs improve project development and help project teams resolve complex utility challenges. A UCM should be used on every project with the potential for utility-related conflicts early in design. Conflicts should be documented based on available information; this information should be updated as more becomes known about the conflict. The UCM will clarify the scope and possible alternatives until a resolution is selected. The UCM should be used to collect data on all utility-related conflicts. Typical conflicts are:

- Between utility facilities and transportation design features
- Between utility facilities and transportation construction or phasing
- Between planned utility facilities and existing utility facilities
- Noncompliance of utility facilities with accommodation policies
- Noncompliance of utility facilities with safety or accessibility policies
- Noncompliance of utility facilities with utility related standards, policies, or guidelines

The earlier conflicts are identified, the more options and alternatives that can be considered for resolutions. This becomes clear when considering the possible resolutions. For example, a possible resolution may be changes to project alignments or grades. If these resolutions are not proposed early in design, they are typically not viable options. Using the mindset of **avoid—minimize—mitigate**, possible approaches for resolution include:

- Design modifications (e.g., changes to the horizontal or vertical alignments, drainage modifications, structure and foundation modifications, construction phasing limitations)
- Protect-in-place approaches to the utility
- Policy exceptions (e.g., accommodations through acceptable exceptions to the policy and as approved by federal partners)
- Relocations or modifications of the utility facilities

Project teams should think critically and creatively about conflict resolution strategies. Resolutions should be mindful of cost, schedule, and project impacts. While all projects benefit from UCMs, some projects benefit more than others. Projects in more urban settings with dense, complex, and costly utility facilities in the project footprint should implement UCM from their outset to maximize potential benefits.

5.5 Integrating Appropriate Utility Investigations into Project Delivery

- Getting what you pay for
- Getting the right information when you need it
- Project parameters define investigation needs

Information from utility investigations is critical for design and project development. Having accurate data on the location and attributes of utility infrastructure is fundamental to providing the most appropriate engineering solutions to serve the public's interest. Utility information complements other data the design team uses to make informed decisions (e.g., topographic survey, traffic volumes, environmental considerations, safety data). All utility relocations pose cost and schedule risks to the project itself and to the public either through the project or utility rate adjustments. As stewards of the public trust, unnecessary costs must be avoided. In **avoiding** utilities through design solutions, **minimizing** impacts when design cannot completely avoid them, and **mitigating** remaining impacts, project teams can control utility-related cost and schedule increases.

Utility investigations, as required by FHWA, identify utility locations and utility attributes to build reliability into project delivery. The investigation should be sufficient to understand how the construction of the proposed project might impact utility function and maintenance. SUE is the engineering practice, recommended by FHWA, for performing project utility investigations. SUE <u>is not</u> merely "potholing" in order to expose underground utility location, it is a programmatic approach inclusive of locating above ground features.

Subsurface Utility Engineering (SUE) is a standardized process defined by the American Society of Civil Engineers (ASCE) 38-02 “Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.” The cost of SUE services, as supported by in FHWA’s Program Guide for Utility Relocation and Accommodation on Federal-Aid Highway Projects, is an eligible expense for federal aid. The program guide also notes:

> “States should no longer be relocating underground utilities unnecessarily or encountering them unexpectedly on Federal-aid highway projects. The SUE technology is readily available to virtually eliminate these wasteful activities. Federal funds should not be used to participate in any unnecessary utility costs on projects where proven technologies, such as SUE, have not been used or have not been used properly (FHWA 2003).”

However, SUE has not yet found its way into programmatic practice. The FHWA (2018a) identified the following issues related to utility identification: lack of accuracy in utility location information; incomplete utility relocation plans; lack of justification in relocation estimates; no relocation schedules; limited utility information in bid packages; an inability to quantify cost and time increases to construction projects as a result of utilities; and limit oversight for relocation efforts (FHWA, 2018a). These deficiencies are often tied to underground utilities where SUE is not adequately performed, and few STAs methodically use SUE, with only 23% having a programmatic risk-based approach (FHWA, 2018a).

5.5.1 What is SUE?

SUE, as defined by the ASCE, is an engineering practice involving the management of risks associated with potential utility impacts through mapping utility locations at appropriate quality levels, utility coordination, utility relocation design and coordination, utility condition assessment, communication of utility data to concerned parties, utility relocation cost estimates, implementation of utility accommodation policies, and utility design. The process involves multiple stages, including scoping, designating, locating, data management, and conflict analysis. SUE couples traditional processes, such as records research and site surveys, with new technologies, such as geophysical methods and non-destructive vacuum excavation, to provide an investigation that leads to outputs of judged quality levels for each depicted utility segment (FHWA, 2017). These quality levels form the basis of SUE practices as they describe the relative accuracy, or definition, of the location of a utility through categorizing the methods in which it was investigated. A project team can determine what quality level is necessary to adequately design and construct their project and seek more accurate levels, which typically entails additional cost at specific locations as needed. This information and the following guidance should be presented in an executive briefing for KYTC leadership to establish the appropriate use of utility investigations on KYTC projects in all districts.
Subsurface Utility Engineering (SUE) is an engineering practice that is not just “potholing,” and is more than only the collection of geophysical information, but rather the overall encompassing effort of identifying, depicting, and interpreting utility information in such a manner that allows the project team to make engineering judgement pertinent to utilities to be made. SUE providers bring engineering judgement to the practice of collecting and depicting utility information.

5.5.2 SUE Quality Levels (ASCE 38-02)

When collecting utility information, it must be understood that various methods produce different confidence levels in the reliability of that information. For example, designers reviewing pothole information can see the specific vertical and horizontal position of a utility. However, utility records and marks provided by One Call locators are frequently inaccurate and unreliable for making design decisions. To let designers understand how to avoid impacts to utilities, SUE providers identify the quality or confidence level of subsurface utility information. These four quality levels are A, B, C, and D.

5.5.2.1 Quality Level D (QL-D)

Preliminary investigations such as record drawings or as-builts, verbal discussions with utility operators, and often the markings from the One Call System are referred to as QL-D. This information is the lowest quality. But it is very useful in preliminary project development. The information allows the project team to make high-level decisions based on the presence and general locations of utility infrastructure. The data should trigger discussions about utility system complexities, scheduling, and budget impacts. Utility coordinators can advise the project team about such information so the initial project scope and budget can be developed. Experienced utility coordinators can also advise the PDT on risks using this information and their experiences with a particular utility operator and local staff.

5.5.2.2 Quality Level C (QL-C)

QL-C includes a survey of visible aboveground features (e.g., manholes, poles, hydrants, valves, pedestals, other physical features). This information may be collected with field measurements, GPS accuracy, or survey-grade accuracy. Aboveground features are sometimes not in line with the facility but are perpendicular to the main. Sometimes the visible feature does not represent the magnitude of what is below the surface. For example, a buried communication vault may be 20’ in length and 8’ deep, but the aboveground presence may be just a 3’ box.

QL-D and QL-C are most useful and cost-effective for scoping and early planning because the horizontal accuracy of this data is not reliable and unconfirmed. These data may also be addressed in the project NEPA document with references to probable impacts and environmental impacts.

5.5.2.3 Quality Level B (QL-B) (Utility Designating)

QL-B involves the use of geophysical prospecting equipment to determine the horizontal position of underground utilities. As project design reaches alternative analysis and preliminary line and grade are determined, the horizontal position of utility infrastructure becomes important. Early decisions can make a significant difference in the project scope, schedule, and budget and support efforts to avoid or minimize utility relocations. These decisions can only be made with sufficient knowledge of environmental considerations, existing ROW, and accurate representations of utility infrastructure. Good horizontal accuracy up front can lower project risk significantly. Therefore, a best practice is to obtain QL-B data during preliminary design. Some states prefer to have this information prior to 15 – 30% design.

In some states, a request for QL-B data is made with the project’s initial topographic survey. This reduces project costs by not having a second set of utility locates to survey and gives the PDT team a high confidence level and a more complete picture of utility features in the project area at early decision points.

It is helpful to understand that the electromagnetic, ground-penetrating radar (GPR), and acoustic tools used to locate utilities provide an approximate depth of the signal the tool is receiving. The tool does not let the operator verify this information. Therefore, this depth should only be used for an initial reference point to understand where the utility may be located vertically in a general sense. This approximate depth should not be used for final design but only as a reference point. This information must be requested specifically in the scope of work and to what detail the depth should be provided. Collecting QL-B data is most cost-effective when the design team is making decisions about alignment, profile and grade, preliminary drainage design, and the placement of other horizontal features (e.g., bridge piers, traffic poles).

5.5.2.4 Quality Level A (QL-A) (Utility Locating)

QL-A involves the use of non-destructive digging equipment to determine the precise horizontal and vertical position of underground utilities at a specific point as well as their type, size, material, and other characteristics. Vacuum excavation is the most common tool for obtaining QL-A data (the use of high-pressure air or water with a separate hose to vacuum the disturbed soil). QL-A data can be obtained by hand digging as well.

QL-A/precise horizontal and vertical elevations should be obtained when a utility is near a proposed abutment, pier, footing, manhole, or pipe, or when the design features allows for flexibility and can be placed under or above a utility when precise location information is provided. Horizontal and vertical positions are critical when design flexibility allows a design feature to be adjusted to avoid impacting a utility. The designer may be able to move a foundation, pipe structure, or other feature but must know the exact position of the utility in that location.

A best practice is to model utilities in cross sections with an assumed approximate depth from QL-B until further data are obtained. If a design feature is within a tolerance zone around the utility, a QL-A investigation is needed to know the utility’s precise location.

Test holes are typically 12” in diameter and require the horizontal accuracy of QL-B for the vacuum excavation to be cost-effective. The deeper the, the greater risk of missing the utility by the angle of the hole.

5.5.3 What is One Call/811?

The state damage prevention law, or Dig Law, requires that all operators of public utilities disclose the location of their facilities to the One Call center. The One Call center receives requests from entities intending to dig in a particular area. When the request comes in, the One Call center notifies the utility owner/operator of the request for locates and generates a ticket. The utility operator then responds to the ticket request by performing a utility location or having a third-party contractor mark the location of the utility facility within the area of the request. Some One Call centers have requirements for the amount of area a ticket will cover. It is important to note that One Call does not mark utilities. Utilities are notified by One Call of a request and then often hire a third party to mark their facilities.

The utility normally only marks the location of a main and will not mark service lines in the area of the request. Public locators will usually not go beyond the service point or meter. This may leave large areas of the proposed project without utility location data as this is considered private and not included in public locating. A substantial industry exists for marking private utility lines.

Operators and their locators are usually only accountable for the performance of their location services when markings are incorrect by more than a margin of error (2’ either side of the marking) and there is damage. In many areas, utility owners/operators receive thousands of tickets per day across their service areas. Most UCs and utility locate companies have trouble keeping up with demand. Also, location service companies that experience high volumes of work operate under a risk-reward mindset when performing locates for design or survey, which may result in lower standards for marking utilities for design or survey requests compared to construction requests.

Third-party locators may receive minimal training before they are tasked as the main respondents to locate requests. When locating difficulties arise, they do not have the experience to provide a reliable marking solution for the utility. One Call is an excellent service for marketing damage prevention for excavation but is not often an adequate source for utility investigations during project design. Many state damage prevention laws preclude the use of One Call if digging is not imminent. In these cases, there are often design tickets that usually only result in the transfer of records without ground markings.

5.5.3.1 One Call is Not SUE QL-B

QL-B is given when the locator has certainty about the horizontal accuracy within a 1’ variance either side of the utility. The locator should have a 90% certainty of this horizontal accuracy. This certainty is obtained only by locating professionals who have the experience to understand the tools being used and validating responses. This does not happen in typical One Call locating response for survey or engineering. While electromagnetic tools used for One Call locating are often the same as those used by a provider of SUE QL-B, the time and effort to verify the signal are not the same. A typical One Call locator recognizing the locate ticket is for survey or design will often not properly connect the device to the utility for tracing and mark predominantly based on records or from the memory of previous marks. QL-B may use other geophysical tools to search for and verify horizontal positions. One Call providers will not take the time to verify their work. Also, the SUE quality level deliverables are professionally sealed. QL-B provides the project team a high degree of confidence to make design decisions; One Call marking does not.

Utility Investigations Approaches

Utility investigations should be conducted according to PDT assessment. Each project is unique and has its own set of utility-related changes. The PM and utility coordinator should discuss the appropriate approach for utility investigation during the pre-design stage and before the pre-design meeting. Initial records investigation should be completed internally during pre-design to facilitate an informed discussion of utility investigation needs. The three approaches are:

a) **Advanced Utility Investigations**

An advanced utility investigation entails the full application of SUE with an attempt to gather QL-B data (horizontal locations) of all utilities in the project footprint by the evaluation-of-alternatives stage. These services should be provided by a prequalified SUE provider. Utility locations and facility details should be captured and provided to the PDT with indications of impacts and potential lead times for relocation given if needed. SUE deliverables should also recommend resolutions to potential impacts and begin a UCM.

The PDT should use the UCM to track identified utility conflicts to resolution. Impacts that result in relocations should be noted with a justification explaining why they could not be avoided.

b) Moderate Utility Investigations

A moderate utility investigation approach involves the steps described in the alignment flowchart provided with this study. The discussion of SUE investigation needs should follow the study of alternatives and QL-B data for utilities in the project footprint should be collected by the Preliminary Line & Grade Meeting. SUE services may be limited for the project and could be obtained through use of the SUE statewide contracts.

The PDT should use the UCM to track the identified utility conflicts to resolution. Impacts that result in relocations should be noted with a justification explaining why they could not be avoided.

c) Minimal Utility Investigations

A minimal utility investigation may not require QL-B data unless there are potential impacts and the PM needs information for specified areas. SUE services would be obtainable through use of the SUE statewide contracts. The project team should use the UCM if impacts are encountered.

d) Guidance on Implementing the Investigations Approaches

Table 5.4 provides guidance for implementing the utility investigation approaches. This matrix should be considered a starting point. The approach can be modified through conversations between the PDT, utility coordinators, and UCs.

Table 5.4 Guidance Matrix for Implementing Investigations Approaches

Project Type	Urban	Suburban	Rural
New Route/Expansion	Advanced	Advanced	Advanced
Major Widening	Advanced	Advanced	Advanced
Minor Widening	Advanced	Moderate	Moderate
New Interchange	Advanced	Moderate	Moderate
Bridge Replacement	Moderate	Moderate	Moderate
Bridge Rehabilitation	Minimal	Minimal	Minimal
Resurfacing/Maintenance	Minimal	Minimal	Minimal

5.6 Strategies for Preparing Scopes of Work for Utility Coordination and SUE Services

The PDT must know how to develop and refine the scope of the work for consultants providing utility coordination and SUE services. As these services often interact, scoping documents may need to specify the contours of these interactions. Appendix H provides a sample scope of work for consultant-provided utility coordination. Another sample scope from the FHWA is provided. Most STAs have found success obtaining SUE services and utility coordination services from separate parties. In many cases, utility coordination services are provided by the prime design consultant if they have the expertise and prequalification.

5.6.1 Consultant Utility Coordination Scope of Work Strategies

The scope of work for utility coordination should clearly define the consultant utility coordinator's role and expected qualifications. Expectations should be defined for meetings, preparation and review of agreements, cost estimates, schedules, as-built information, and required deliverables. Services should include communication with UCs, the design team, location providers, and others. Location information should be tracked and monitored with a UCM, and data should be entered into KURTS. Expertise should be provided to the design team to avoid and minimize interactions with utilities, especially those with lengthy or costly impacts. If utility coordination services are provided, they should entail a complete set of services, with only over-the-shoulder review and signatory execution of agreements required of KYTC personnel. When serving as a utility coordinator, the consultant should comply with procedures outlined in the *Utilities & Rail Guidance Manual* and the roles and responsibilities recommended within this report.

5.6.2 Consultant SUE Services Strategies

The PDT and the SUE provider must discuss how to address the scope of work, field conditions — including the likelihood of incurring a high water table, maintenance of traffic, and required deliverables. Other scenarios where there are risks and unknowns related to locating the facility should be considered during scoping. It is a best practice to understand available tools for subsurface utility locating, the limitations of those tools, and the risks and time involved in performing subsurface investigations. KYTC staff should obtain this information from multiple industry sources as they build contracts for utility investigations. Understanding the proper use and limitations of the geophysical tools is helpful for these efforts. Items of note:

- GPR is very effective in sandy soils but not as effective in clay soils
- Plastic pipe that was not installed with a locating wire is very difficult to locate
- Not all fiber has a metallic conductor in the sheathing and is therefore not able to conduct a magnetic tone
- Because the equipment necessary for vacuum excavation requires a significant mobilization effort, often requiring maintenance of traffic, QL-A data collection must be strategic.
- Providers who use high-pressure air can be unable to locate a utility due to groundwater, where a hydrovac can deal with substantially more groundwater. However, air-knifing allows native soil to be returned to the hole and compacted. Hydrovac excavation requires disposal of the spoils in an approved location that may be some distance from the project area and is therefore more costly.

Further guidance can be found in many resources. One notable resource for implementing SUE and the development of SUE scopes of work is the *Subsurface Utility Engineering for Municipalities: Prequalification Criteria and Scope of Work Guide* (Anspach and Scott, 2019). Other considerations for SUE investigations are listed below.

- Can QL-B data collection be completed by foot or by hour? Often an hourly rate is significantly more cost-effective. Perhaps a two-stage approach to the fee would allow for initial research of the area; then, a more precise effort can be scoped for QL-B.
- How deep is the pothole likely to be? The cost of the pothole can vary depending on soil and surface, the anticipated hole depth, and the confidence of the horizontal location. Utility depth, as inferred from the approximate depth readings or utility records, can provide a starting point for anticipated pothole depth and help establish the scope and fee for QL-A data collection.
- The surface where a pothole is needed is another cost variable — pavement, concrete, or native soil.
- Backfill requirements may demand additional material to restore pavement.
- Maintenance of traffic requirements are a major cost consideration.
- Costs may vary by day or night work.
- Will the excavation require trenching to find a line that cannot be toned?
- How many utilities are known to be in the area?

Chapter 6 Project Recommendations and Conclusions

The proposed approach to better integrate utility coordination and highway design encourages KYTC stakeholders to embrace a culture of partnership through collaborative work; early and proactive engagement of UCs; and strategic, timely, and frequent communication. Figure 4.4 depicts optimal stages for implementing these changes. Considering that Figure 4.4 presents the information with a lot of detail, Figure 6.1. was developed as a summarized graphic representation of the same information. The guidance document in Chapter 5 includes a list of recommended roles and responsibilities for primary project participants. These complement the roles and responsibilities defined in the *Utilities & Rails Guidance Manual*. To achieve successful utility coordination, active engagement of all project participants is required; they must have a clear understanding of their responsibilities and be committed to working collaboratively to fulfill them. Adhering to these roles and responsibilities will be decisive for improving the utility coordination process.

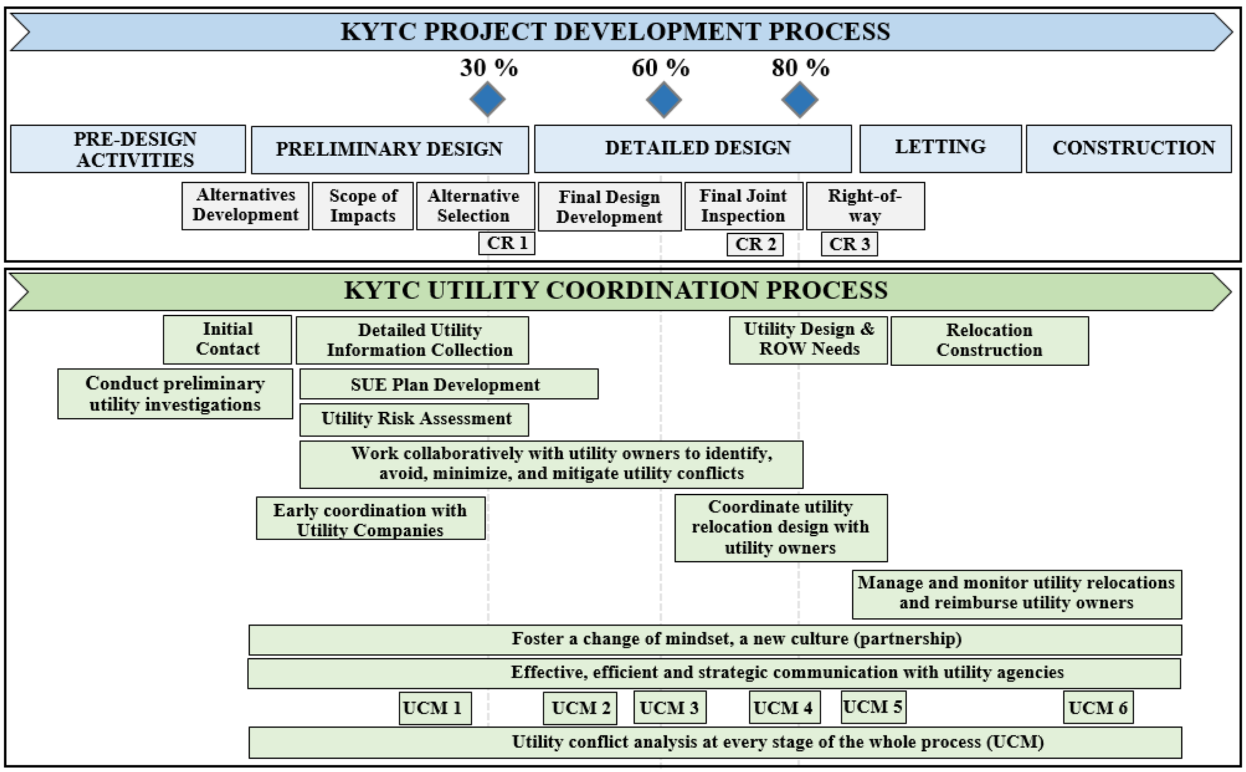


Figure 6.1. Proposed Approach for the highway design and utility coordination processes alignment

Gaining support and building collaborative relationships with UCs impacted by proposed projects is critical for establishing a new culture of partnership. It is equally critical is for KYTC to focus on strategic, efficient, and effective communication. A Communications Management Plan can facilitate the management of UC engagement. Future research should evaluate the benefits of applying and implementing this strategy. Guidance was offered on leveraging UCMs to identify, manage, and mitigate utility-related risks. KYTC has an approach and guidance for implementing UCM in KURTS. The appendices of this report include a section related to UCMs that can be added to *Utilities & Rails Guidance Manual*. All projects which may be affected by utility conflicts early in design should make use of a UCM. The guidance also provides insights into the strategic use of SUE, which has proven benefits and is now a widely recommended practice. The proposed approach recommends implementing SUE early in project development to help designers avoid, minimize, and mitigate utility conflicts. This guidance suggests three approaches for SUE based on a qualitative assessment of utility investigation needs. Finally, the guidance includes strategies for preparing scopes of work for utility coordination and SUE services. This guidance can be used to help

KYTC staff develop and refine the scope of work for a consultant that is providing these services. A sample scope of work in Appendix I can be used as a reference.

As this research concludes, the research team and the SAC are working to implement the proposed approach. In the next few months, the Integrated Project Development Guidance Document will be implemented through a Utility Coordination Training and Certification Program for KYTC. The research team looks forward to presenting this study's findings in the Training and Certification Program to help the Cabinet change its organizational mindset and redefine UCs as partners, a step which can improve collaboration and project outcomes.

References

[1] R. E. Sturgill, T. R. Taylor and L. Ying, "Effective Utility Coordination: Application of Research and Current Practices," National Cooperative Highway Research Program Synthesis 506, 2017.

[2] R. E. Sturgill, T. R. Taylor, S. Ghorashinezhad and J. Zhang, "Methods to Expedite and Streamline Utility Relocations for Road Projects," Kentucky Transportation Center, Kentucky, 2014.

[3] C. Quiroga, J. McCleve, R. Lee, E. Kraus, J. Anspach, R. Sturgill, N. Metje, J. Johnston and J. Cooper, "Strategic Research Needs in the Area of Utilities," Transportation Research Board, 2019.

[4] SHRP2, "SHRP2 Solutions," U.S. Department of Transportation. Federal Highway Administration, [Online]. Available: https://www.fhwa.dot.gov/goSHRP2/Content/Documents/SHRP2_R15B_KYTC.pdf. [Accessed March 2020].

[5] C. Quiroga, Y. Li, E. Kraus and L. Jerry, "Optimizing Utility Owner Participation in the Project Development and Delivery Process," Texas Department of Transportation, Austin, Texas, April 2013.

[6] C. Quiroga, L. Yingfeng, E. Kraus and J. Le, "Improving the Response and Participation by Utility Owners in the Project Development Process," Texas A&M Transportation Institute, Texas, 2013.

[7] Chapter 104 Utility Coordination Manual, Indiana: Indiana Department of Transportation, 2016.

[8] R. D. Ellis and R. H. Thomas, "The Root Causes of Delays in Highway Construction," *82th Annual Meeting of the Transportation Research Board,* 2003.

[9] R. H. Thomas and R. D. Ellis, "NCHRP 20-24(12) Avoiding Delays During the Construction Phase of Highway Projects," Transportation Research Board. National Research Council, Washington, D.C., 2001.

[10] K. El-Rayes, L. Liu, N. El-Gohary, M. Golparvar-Fard and E.-J. Ignacio, "ICT Project R27-153 Best Management Practices and Incentives to Expedite Utility Relocation," Illinois Center for Transportation, Illinois, July 2017.

[11] J. H. Anspach, "Utility Location and Highway Design. A synthesis of Highway Practice," Transportation Research Board. National Cooperative Highway Research Program, Washington D.C., 2010.

[12] J. Thorne, D. Turner, and J. Lindly."Highway / Utility Guide," Federal Highway Administration. Washington D.C., June 1993.

[13] R. Ellis, M. Venner, C. Paulsen, J. Anspach, J. Anspach, G. Adams and V. Kathleen, "Integrating the Priorities of Transportation Agencies and Utility Companies," Transportation Research Board, Washington D.C., 2009.

[14] C. Quiroga, E. Kraus, P. Scott, T. Swafford, P. Meis and G. Monday, "SHRP2 Report S2-R15B-RW-1 Identification of Utility Conflicts and Solutions," Transportation Research Board. Strategic Highway Research Program, Washington D.C., 2012.

[15] Federal Highway Administration (FHWA), "Avoiding Utility Relocations," U.S. Department of Transportation, July 2020.

[16] ASCE, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data," 2002.

[17] A. H. S. o. R. o. W. a. Utilities, "Utilities Guidelines and Best Practices," 2000.

[18] Kentucky Transportation Cabinet, "Highway Design Guidance Manual," Kentucky, 2017.

[19] Kentucky Transportation Cabinet, "Utilities & Rails Guidance Manual," Kentucky, 2019.

[20] D. Kreis, B. Gibson, J. Jasper, C. Van Dyke, C. Wallace and R. M. S. Catchings, "KTC - 19/22 Critical Path for Project Development," Kentucky Transportation Center, Kentucky, 2019.

[21] Stamatiadis, Nikiforos; Sturgill, Roy; Goodrun, Paul; Shocklee, Emily; Wang, Chen, "Tools for Applying Constructability Concepts to Project Development (Design)," Kentucky Transportation Center, Kentucky, 2013.

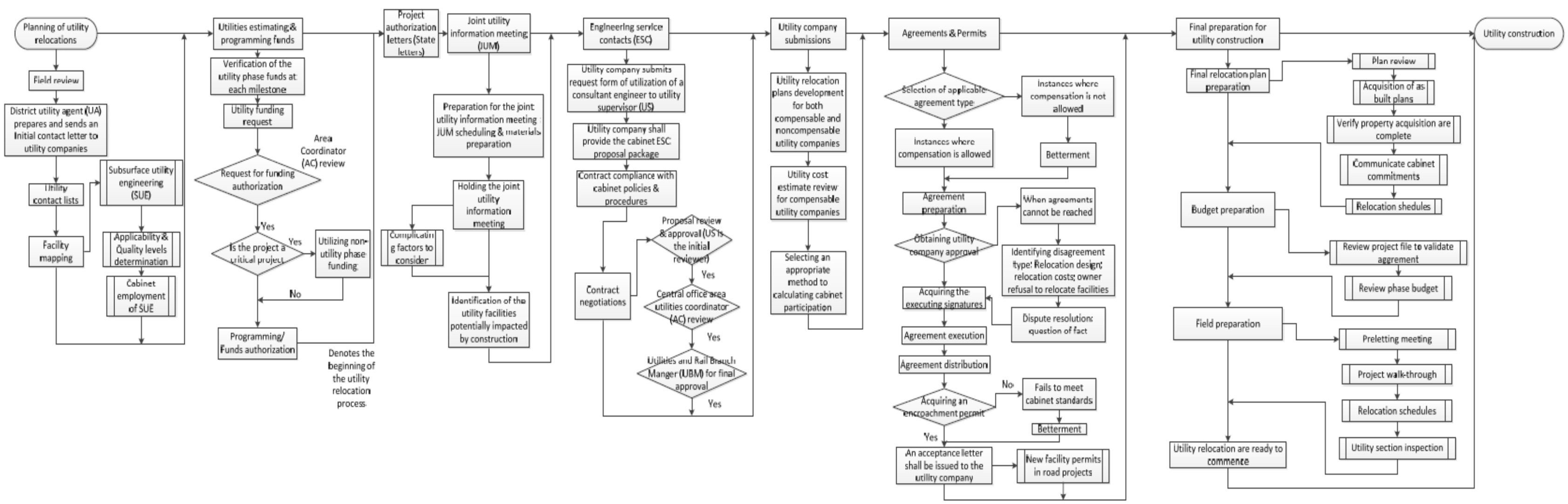
[22] C. Van Dyke, B. Gibson, R. Baskette, J. Jasper, C. Wallace and D. Kreis, "Kentucky Transportation Cabinet Right of Way Process Review (Phase I)," Kentucky Transportation Center, Kentucky, 2020.

[23] Project Management Institute, "A Guide to the Project Management Body of Knowledge PMBOK Guide Sixth Edition," Project Management Institute, Newtown Square, Pennsylvania, 2017.

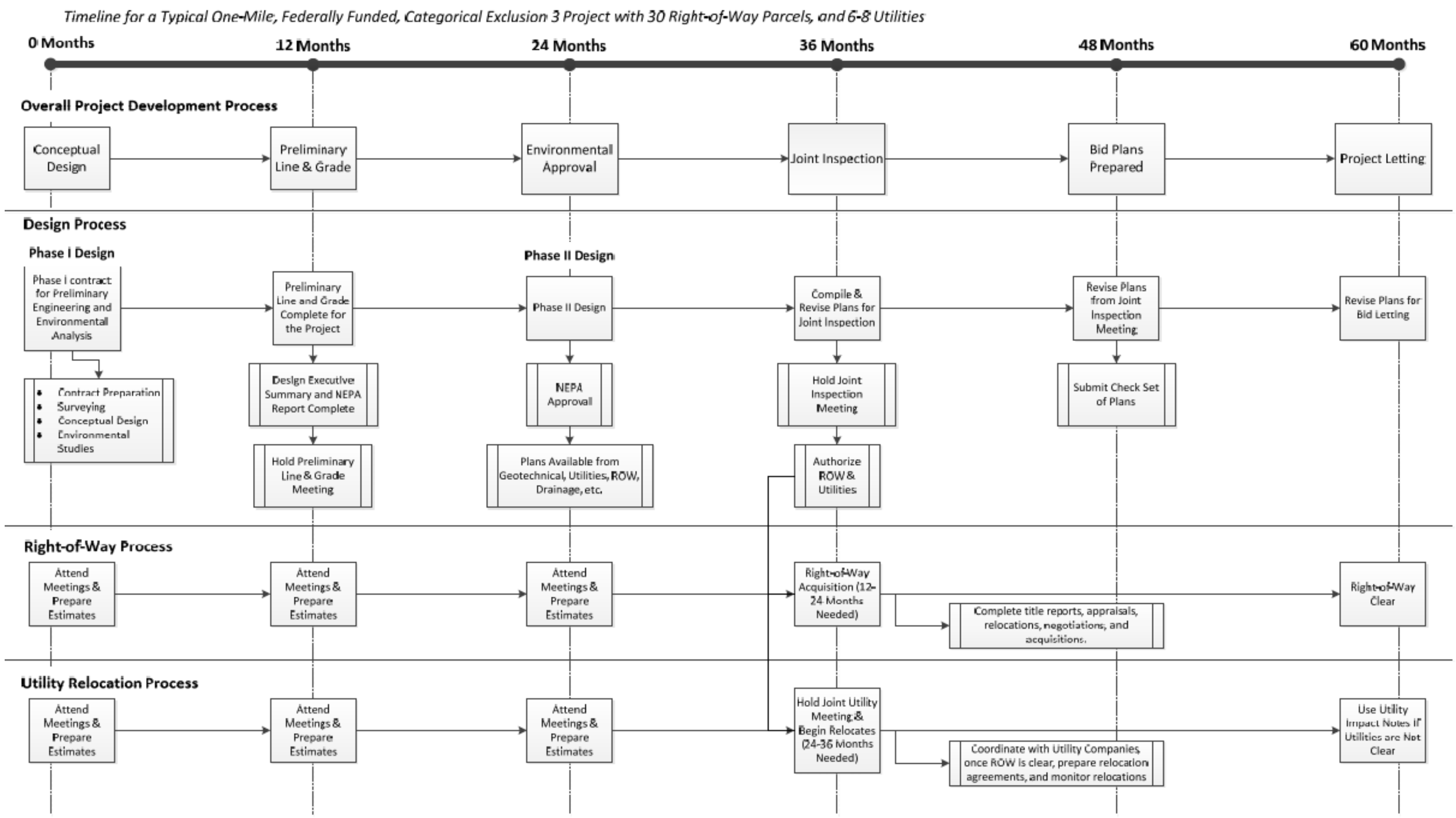
Appendix A KYTC Flowcharts

As part of the research project *Methods to Expedite and Streamline Utility Relocations for Road Projects* developed by the Kentucky Transportation Center, the following flowcharts were developed:

- **Flowchart 01 – Interpretation of KYTC Utility Planning and Relocation Process**: This flowchart depicts the utility planning and relocation process, which was interpreted from the written procedures.

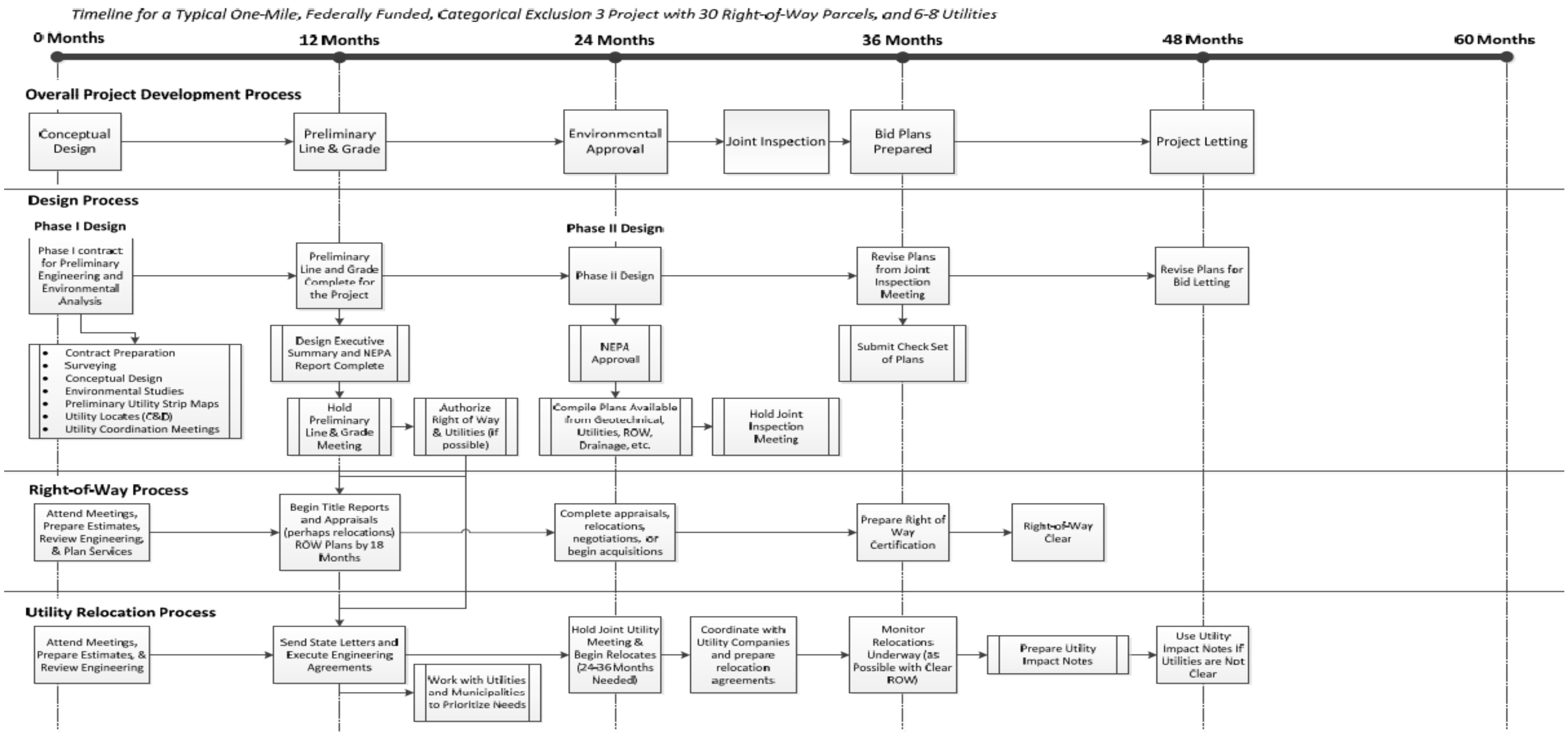


- **Flowchart 02 – Adaptation of the Original KYTC Project Development Process:** This flowchart depicts a KYTC project timeline that involves design, right-of-way acquisition, and utility coordination processes.



Source: Executive Director of the Office of Project Development

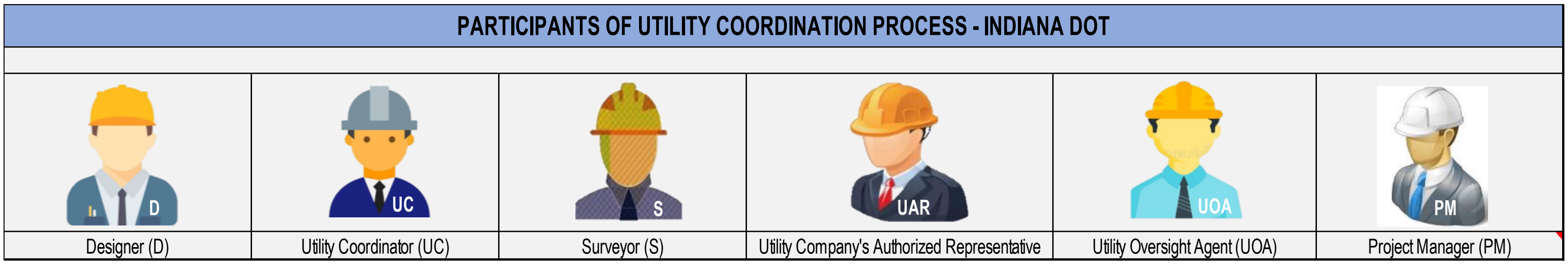
- **Flowchart 03 – Adaptation of the Revised KYTC Project Development Process**: This third flow chart was the result of the discussions held by the Utility Relocation Task Force. It shows how the project development process could be shortened by approximately a year if coordination and communication are improved.

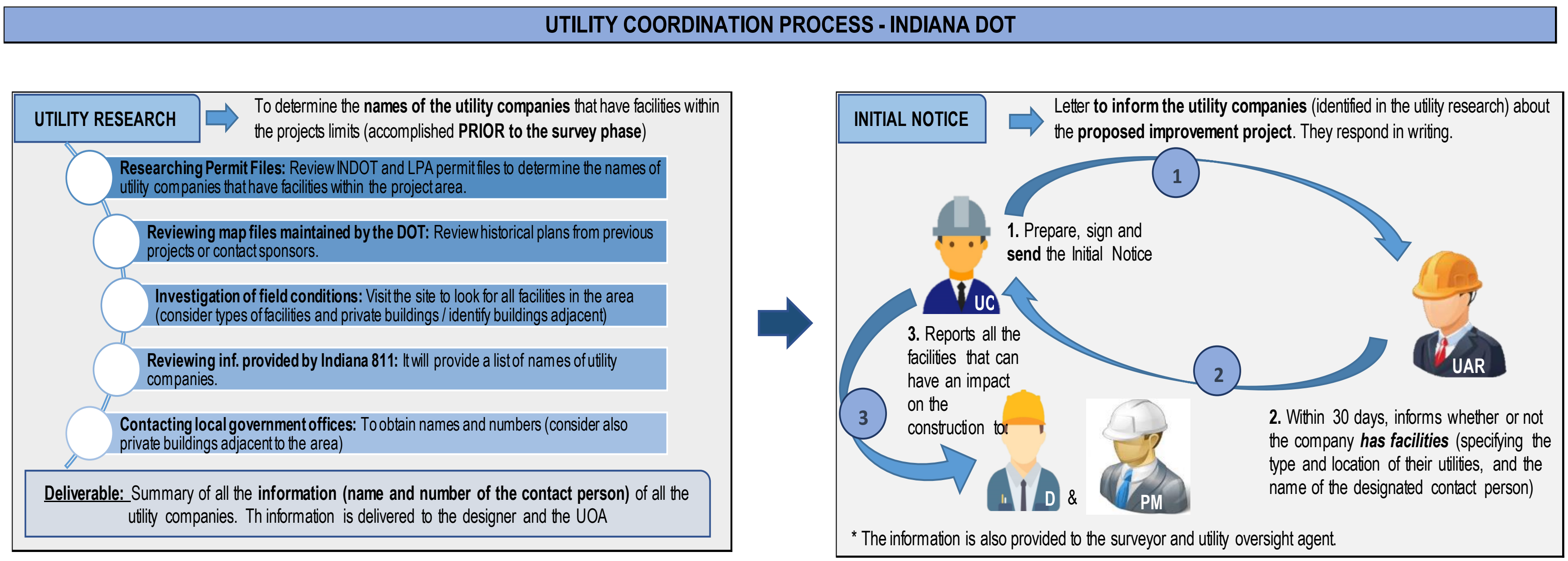


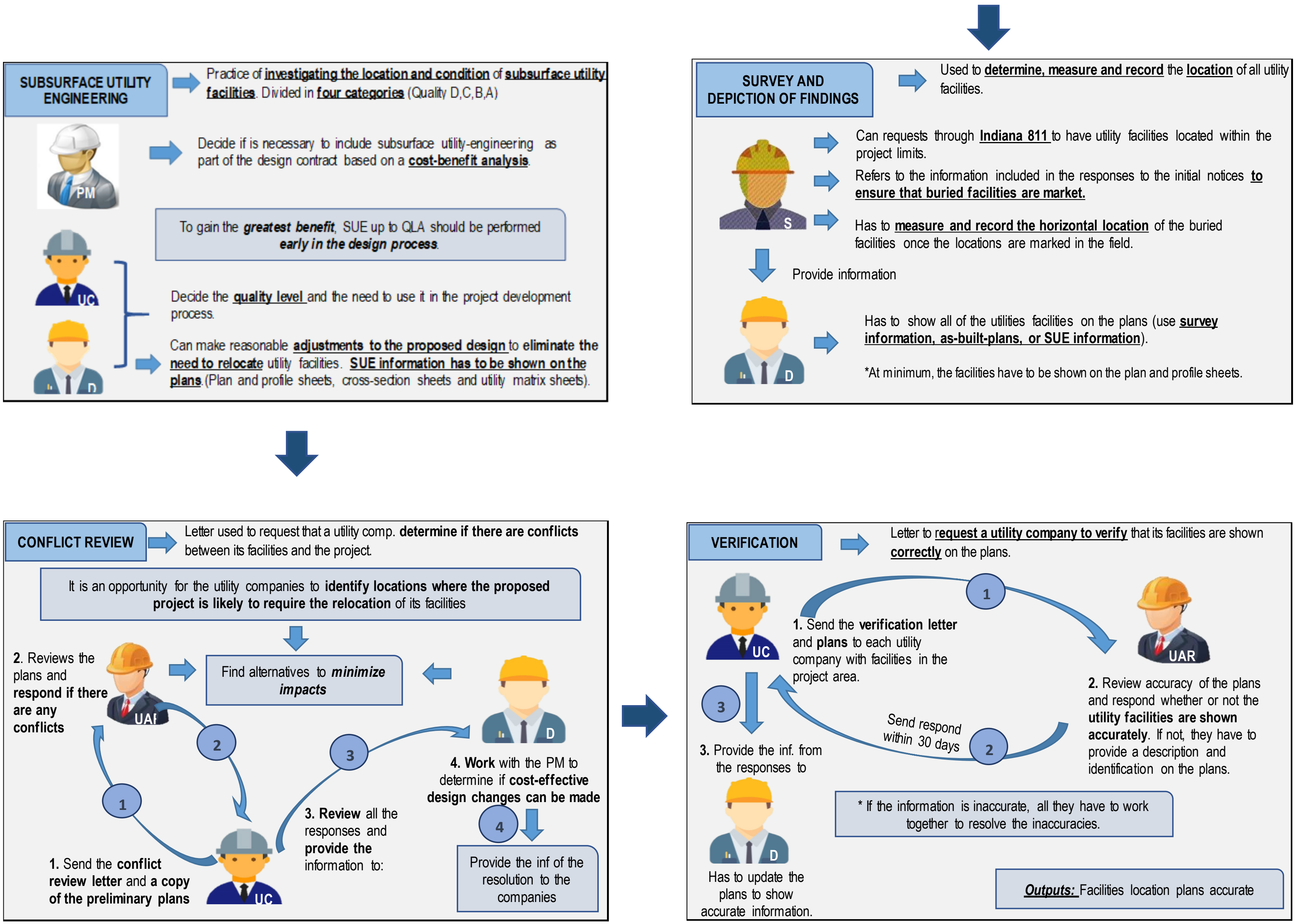
Source: Executive Director of the Office of Project Development

Appendix B Indiana DOT Utility Coordination Process

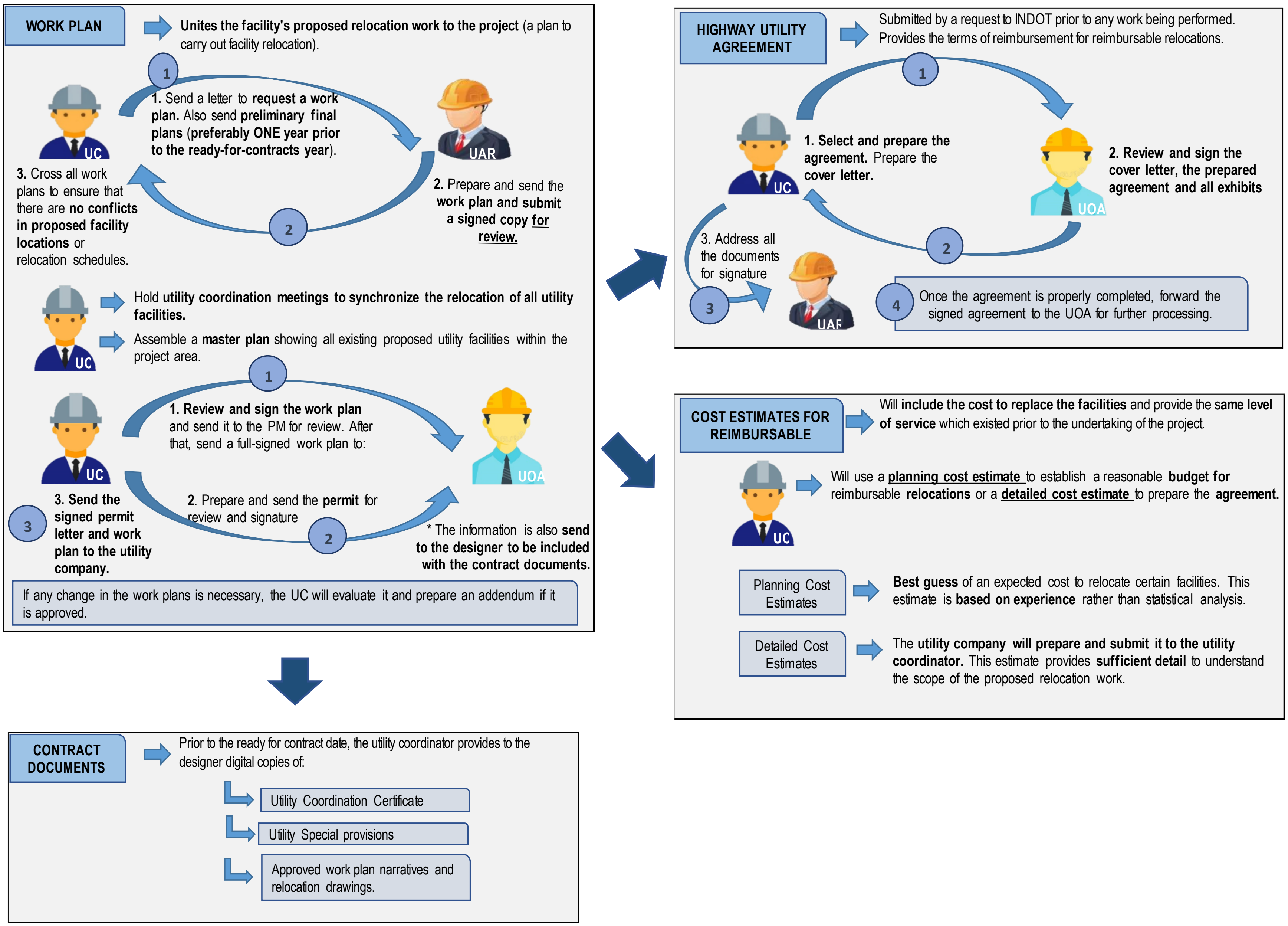
Through the literature review, the research team conducted a review of the Indiana DOT utility coordination process, depicted in the following figures:







SUBSURFACE UTILITY ENGINEERING
Practice of investigating the location and condition of subsurface utility facilities. Divided in four categories (Quality D,C,B,A)
PM
Decide if is necessary to include subsurface utility-engineering as part of the design contract based on a cost-benefit analysis.
To gain the greatest benefit, SUE up to QLA should be performed early in the design process.
UC
D
Decide the quality level and the need to use it in the project development process.
Can make reasonable adjustments to the proposed design to eliminate the need to relocate utility facilities. SUE information has to be shown on the plans.(Plan and profile sheets, cross-section sheets and utility matrix sheets).
SURVEY AND DEPICTION OF FINDINGS
Used to determine, measure and record the location of all utility facilities.
Can requests through Indiana 811 to have utility facilities located within the project limits.
Refers to the information included in the responses to the initial notices to ensure that buried facilities are market.
S
Has to measure and record the horizontal location of the buried facilities once the locations are marked in the field.
Provide information
D
Has to show all of the utilities facilities on the plans (use survey information, as-built-plans, or SUE information).
*At minimum, the facilities have to be shown on the plan and profile sheets.
CONFLICT REVIEW
Letter used to request that a utility comp. determine if there are conflicts between its facilities and the project.
It is an opportunity for the utility companies to identify locations where the proposed project is likely to require the relocation of its facilities
2. Reviews the plans and respond if there are any conflicts
UAR
Find alternatives to minimize impacts
D
2
3
4. Work with the PM to determine if cost-effective design changes can be made
1
3. Review all the responses and provide the information to:
4
1. Send the conflict review letter and a copy of the preliminary plans
UC
Provide the inf of the resolution to the companies
VERIFICATION
Letter to request a utility company to verify that its facilities are shown correctly on the plans.
UC
1
1. Send the verification letter and plans to each utility company with facilities in the project area.
UAR
3
Send respond within 30 days
2
2. Review accuracy of the plans and respond whether or not the utility facilities are shown accurately. If not, they have to provide a description and identification on the plans.
3. Provide the inf. from the responses to
D
Has to update the plans to show accurate information.
* If the information is inaccurate, all they have to work together to resolve the inaccuracies.
Outputs: Facilities location plans accurate


WORK PLAN
Unites the facility's proposed relocation work to the project (a plan to carry out facility relocation).
1. Send a letter to request a work plan. Also send preliminary final plans (preferably ONE year prior to the ready-for-contracts year).
2. Prepare and send the work plan and submit a signed copy for review.
3. Cross all work plans to ensure that there are no conflicts in proposed facility locations or relocation schedules.
UC
UAR
Hold utility coordination meetings to synchronize the relocation of all utility facilities.
Assemble a master plan showing all existing proposed utility facilities within the project area.
1. Review and sign the work plan and send it to the PM for review. After that, send a full-signed work plan to:
2. Prepare and send the permit for review and signature
3. Send the signed permit letter and work plan to the utility company.
* The information is also send to the designer to be included with the contract documents.
UOA
If any change in the work plans is necessary, the UC will evaluate it and prepare an addendum if it is approved.
HIGHWAY UTILITY AGREEMENT
Submitted by a request to INDOT prior to any work being performed. Provides the terms of reimbursement for reimbursable relocations.
1. Select and prepare the agreement. Prepare the cover letter.
2. Review and sign the cover letter, the prepared agreement and all exhibits
3. Address all the documents for signature
Once the agreement is properly completed, forward the signed agreement to the UOA for further processing.
UAF
COST ESTIMATES FOR REIMBURSABLE
Will include the cost to replace the facilities and provide the same level of service which existed prior to the undertaking of the project.
Will use a planning cost estimate to establish a reasonable budget for reimbursable relocations or a detailed cost estimate to prepare the agreement.
Planning Cost Estimates
Best guess of an expected cost to relocate certain facilities. This estimate is based on experience rather than statistical analysis.
Detailed Cost Estimates
The utility company will prepare and submit it to the utility coordinator. This estimate provides sufficient detail to understand the scope of the proposed relocation work.
CONTRACT DOCUMENTS
Prior to the ready for contract date, the utility coordinator provides to the designer digital copies of:
Utility Coordination Certificate
Utility Special provisions
Approved work plan narratives and relocation drawings.

Appendix C Utility Issues that Affect Highway Design Processes

Through the literature review of the report Utility Location and Highway Design, the research team was able to identify those utility issues that potentially affect highway design processes. Many of these issues are related to the coordination process and are highly interrelated to the decision on whether to relocate utility facilities or consider design changes to avoid relocations. These issues are presented below:

Information Source	Design Issues pertaining to relocation decisions for utilities
R-15 Integrating the Priorities of Transportation Agencies and Utility Companies	• Coordination process variations and involvement insufficiencies • Base information on new locations for utilities • Limited technical knowledge • Variability in transportation funding • Inability of DOT to purchase ROW in advance for utility relocations. Not knowing whether the ROW is available for utility relocations can influence design decisions. • Difficult getting Design Ticket locates from One-Call Centers and Locators. The service that Once-Call centers is usually limited, especially during the design stage. • Inaccurate or incomplete field markings, risk with multiple locators, and process inefficiencies. • Availability of Subsurface Utility Engineering (SUE) and State-Specific Cost-Benefit Information. Some states still resist applying SUE services to their projects. • Quality and Effectiveness of SUE Services. Many DOTs consider SUE services to be expensive. • Overly small mapping limits in early characterization because of efforts to minimize initial project cost.
FHWA's 2002 Avoiding Utility Relocations	• Property interest • Quality of records that are frequently inaccurate, incomplete, and many times unavailable. • Readability of plans sent to utilities, especially when DOTs send the plans to the utility companies asking to place their facilities on the plans. These plans may be challenging to interpret. • Reliance on institutional memory because of the constant change of personnel. • Technology to locate utilities. Even many SUE firms do not employ all the available tools. • Abandoned facilities because there are no available records.
DOT and Consultant Interviews	• Historical sequencing of solutions to problems because a solution to one problem may create new problems. • DOTs are unwilling to allow any changes in their existing utility relocation policies • Overlapping permit agencies • No comprehensive "Alternate Design" catalog with associated costs. • Prevailing attitude that there is not much that can be done to prevent utility issues and procedures in place to address them.

	• DOTs have a tendency to believe research findings or practices to be invalid for their states if they were developed outside of their jurisdiction. • There is a lack of a common system to arrange the activities that the manuals describe because states have different manuals and specifications for each department o division. • Ease of finger-pointing and blame the other entity for the problems. • Consistency of procedures and philosophies across departments

Similarly, the key findings of the three case studies conducted in this project to review practices regarding utilities in Pennsylvania, Virginia, and Georgia are described in the following table:

DOT	Utility Coordination Practices
Pennsylvania DOT	• Publishes a 12-year plan for the potential upcoming projects. • At least one representative of Maintenance, Traffic, Construction, Utilities, ROW, Environmental, Bridge, and Design is included in the project team. If applicable, a project manager of the consultant design team. • The project team conducts a field review along with a call to the One-Call center for a design ticket. One-Call design ticket is a notification to the utility companies of the proposed project and request for records. They create a QLD/QLC map using topo provided at the 0-5% design stage. • At the 30% design complete, the project team conducts a second field visit and provides advice about relocation costs, time issues, and other utility issues. At this point, they decide to upgrade the utility quality level to QLB. After this, the utility team sends preliminary maps to the companies asking for feedback (corrections, additions, and comments). Then, they hold the first face-to-face meeting with all utility companies. • As the design progresses, the utility staff keeps continuous coordination with design staff and utility companies. At 60%, they all begin reviewing those utilities that may be able to stay in place or the ones that may need minor adjustments. QLA information is used. Some other important takeaways of the PennDOT practices are: • Contractors are allowed to perform their own test holes at PennDOT's expense. • All projects in the state must use SUE or justify why not. • Every two years, each state-maintained roadway is video-logged, recording above-ground utilities. • PennDOT engineers rotate through the utility and other units for training.
Virginia DOT	• Works with a six-year work plan for upcoming projects. • Uses a Concurrent Engineering Process, that consist of representatives from Location & Design, Environmental, Right-of-way, Utility, and Construction • This DOT has the longest-running SUE program in the nation and uses QLB and QLA mapping on its transportation projects. • Develop its topo using a survey consultant at the 30% design stage, and QLB data is collected concurrently. After developing topo, they hold the first meeting with utility owners and use QLB data to coordinate and develop a worst-case scenario cost estimate. This estimate is updated quarterly as the design progresses to help to get attention paid to different resolution alternatives for utility conflicts. • VDOT vas a minimum of three additional meetings during the project development process (at 50%, 90%, and 100% design stages) • Before 30% of the design stage, a utility coordinator is assigned to the project, who is responsible for evaluating design versus relocation issues with the design team.

	• At the 50% design stage, the utility coordinator and design staff evaluate potential conflicts and determine QLA data locations. Some other important takeaways of the Virginia DOT practices are: • VDOT has been making different efforts for "relocation versus design-to accommodate" decisions, such as the federal pilot program that says that VDOT pays the utilities for their engineering and design costs regardless of prior rights. • VDOT has opened opportunities for utility companies to negotiate their easements as long as the companies already have a prior right.
Georgia DOT	• Works with a three-year work Statewide Transportation Improvement Program and a six-year Construction Work Program • GDOT has a state subsurface utility engineer (SSUE) position within the State Utilities Office (SUO). • GDOT develops a recommended project footprint during the concept stage (0-10% design stage) and holds an Initial Concept Team Meeting to understand better the project scope, information needs, and the required next steps for project development. The next meeting is the Concept Meeting, which intends to present the proposed concept and alternatives. • The SSUE is responsible for determining the levels of SUE to be performed. QLD is usually required during the Concept Phase, and QLC/QLB is typically performed during the 10%-30% design stage. • At the 30%-60% design stage (Preliminary Design Stage), the SUE consultant should perform a Utility Impact Analysis and make recommended solutions. This information is incorporated into a conflict matrix spreadsheet. • Approximately at the 70% design stage, the second request to the utility companies occurs. They are asked to provide markups for their proposed utility facilities/relocation plans. Some other important takeaways of the Georgia DOT practices are: • GDOT has been working on implementing an award-winning utility program. One of the big outcomes of this program was the development of the Utility Redline Software that facilitates the transmitting of utility plan markups electronically. • GDOT has developed a training program on topics that include avoiding unnecessary utility relocations, effectively applying SUE on GDOT projects, developing and using UIA/CM, and applying utility conflict avoidance methods.

Appendix D Reasons For Delays in Utility Relocations – SHRP2

The findings of the SHRP2 Report S2-R15-RW "Integrating the Priorities of Transportation Agencies and Utility Companies" showed that transportation agencies and utility companies that participated in the project agreed that the most common issues are:

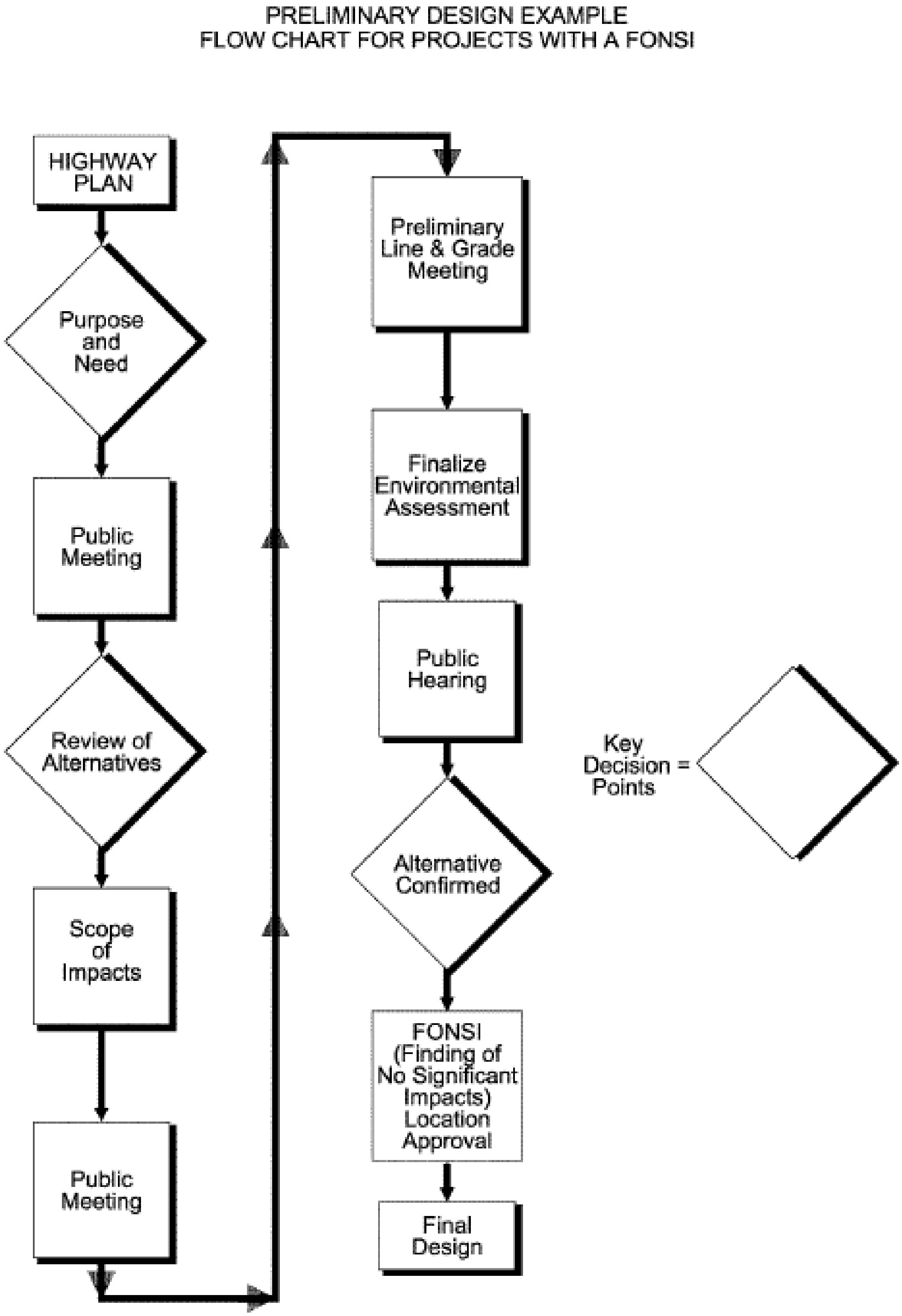
Phase	Issue Cited by UCs
Design	• Limited financial and personnel resources • Utility Relocation not an integral part of the design • Coordination with other agencies in the same proximity • Maintenance issues (internal) • Service upgrades (internal) • New customers demand (internal) • Changes to DOT design or schedule • Large turnover at DOT • Acquiring ROW reimbursement • Involving utilities late in the design phase • Ease of exchanging drawing files electronically • Lack of communication between DOT and UC • Development and predictability of overall project plan • UC given too many projects at once • DOT does not follow its own procedures
Construction	• Limited financial and personnel resources • Coordination with the contractor to establish a project plan to avoid relocating more than once for the same project • Coordination with other utility agencies in the same proximity • Maintenance issues (internal) • Service upgrades (internal) • New customers demand (internal) • System improvements (internal) • Contractor not following specified work plan • Lack of coordination between DOT and contractor • Utility relocation is not an integral part contractor's work plan • Material shortages • Insufficient notice is given to schedule the relocations • Unable to relocate before construction begins • Natural disasters such as hurricanes • Rework required

Phase	Issue Cited by DOTs
Planning / Design	• Short time frame for state agencies to plan and design project • Project design changes required changes to utility relocation • Delays in obtaining ROW for utilities • Inaccurate locating and marking of existing utility facilities

	• UCs give low priority to relocations • Obtaining accurate design plans early in the design phase • Obtaining environmental permits • Identifying utilities late in the design process • No utility coordination meeting held • Hazardous waste issues • Disagreements between DOT and UC on engineering solutions • High internal turnover at the DOT, personnel shortage • Miscommunication between the design and construction teams in the UC • Poor design of utility work plan • UCs merging, relocation, or downsizing • Utility relocation costs not given proper weight in selecting the preferred design
Construction	• Increased workload on utility relocation • Utility lacked financial and personnel resources for relocations • Inadequate coordination or sequencing among utilities using common poles and ducts • UCs give low priority to relocations • Phasing of construction and utility relocation work out of sequence • Delays in starting utility relocation work • Utilities are slow to respond to contractor's request • Material shortage • Natural disasters • Shortages of labor and equipment for contractor • UC did not follow its own work plan • UCs merging, relocation, or downsizing • Inexperienced people involved in the project • Union labor issues

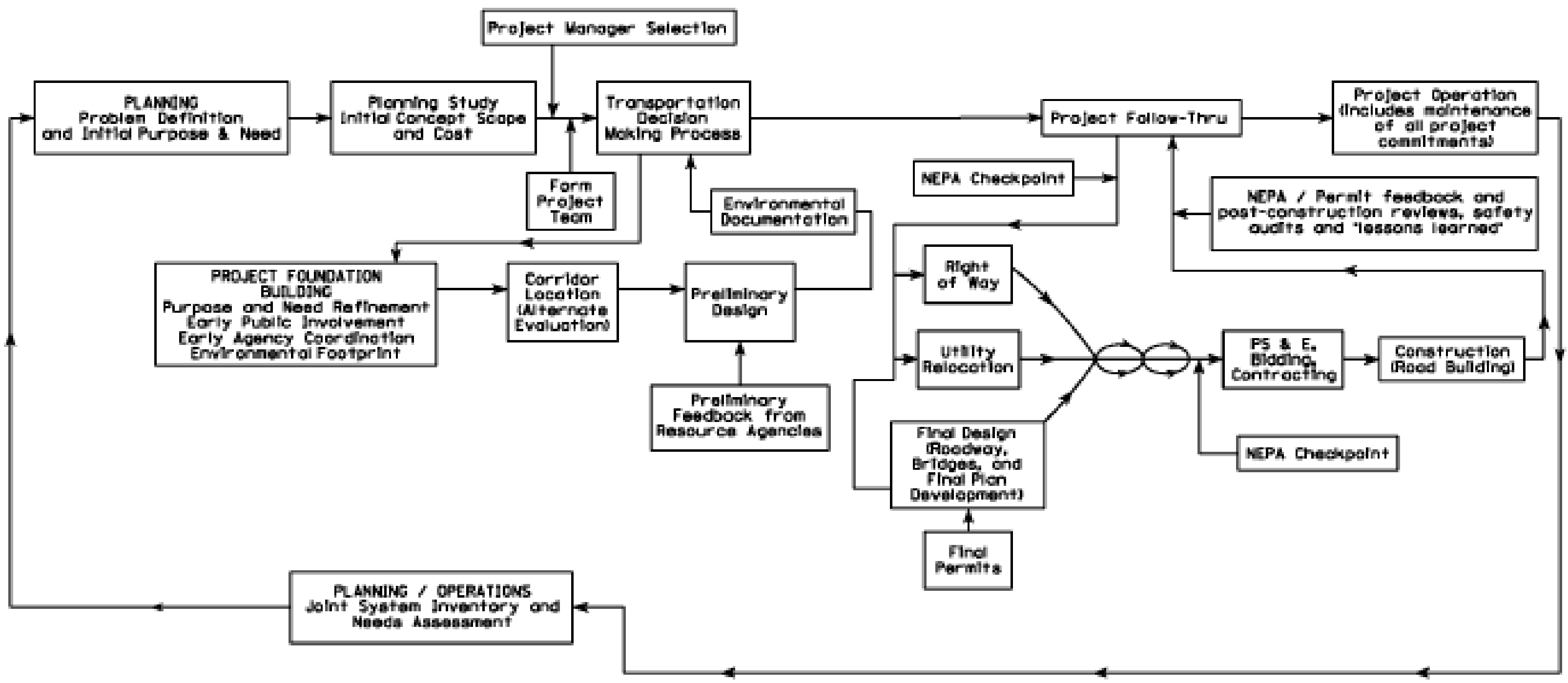
Source: (Ellis et al., 2009)

Appendix E KYTC Highway Design Guidance Manual Flowcharts



Project Delivery Core Processes

("Project ID + Scope" Thru "Road Building" and Maintenance)



Appendix F KYTC Utility Coordination Process

PARTICIPANTS OF THE KYTC UTILITY COORDINATION PROCESS

UA	PE	US	PDM	UBM	AC	
District Utility Agent	District Project Engineer	District Utility Supervisor	Project Development Branch Manager	Utility Branch Manager	Utility Area Coordinator	Utility Company
District Office Personnel				Central Office Personnel		

KYTC UTILITY COORDINATION PROCESS DESCRIPTION

FIELD REVIEW

U → Perform **a field review of existing utility facilities** within the project limits to do a **visual identification.**

- Review existing facility maps and as-built plans provided by the utility companies
- Review of Transportation Cabinet survey maps for physical survey information.
- Discussion with area residents to determine probable utility locations.
- Identify potential problems or conflicts between existing utilities, easements, etc.

INITIAL CONTACT LETTER

→ Letter to **notify the utility companies of the proposed construction and its potential impacts** upon their facilities

UA OR PE → Have to prepare and mail an initial contact letter **to each utility company** that may have facilities along the proposed route.

UTILITY CONTACT LIST

General Contact Lists → Shall be **updated as necessary** to include company name, utility type, contact information. KURTS facilitates tracking all this information.

Project - Specific Contact Lists → Shall **indicate** if each **utility is impacted by the roadwork** or **simply within the project bounds. (Specifically for each project)**

Shall be **maintained in KURTS** for the duration of the project's lifetime.

US → Shall maintain an **accurate, up-to-date list of utility companies** (including utility owners identified)

→ Should consul with the PE to gather any information received during the project's early development.

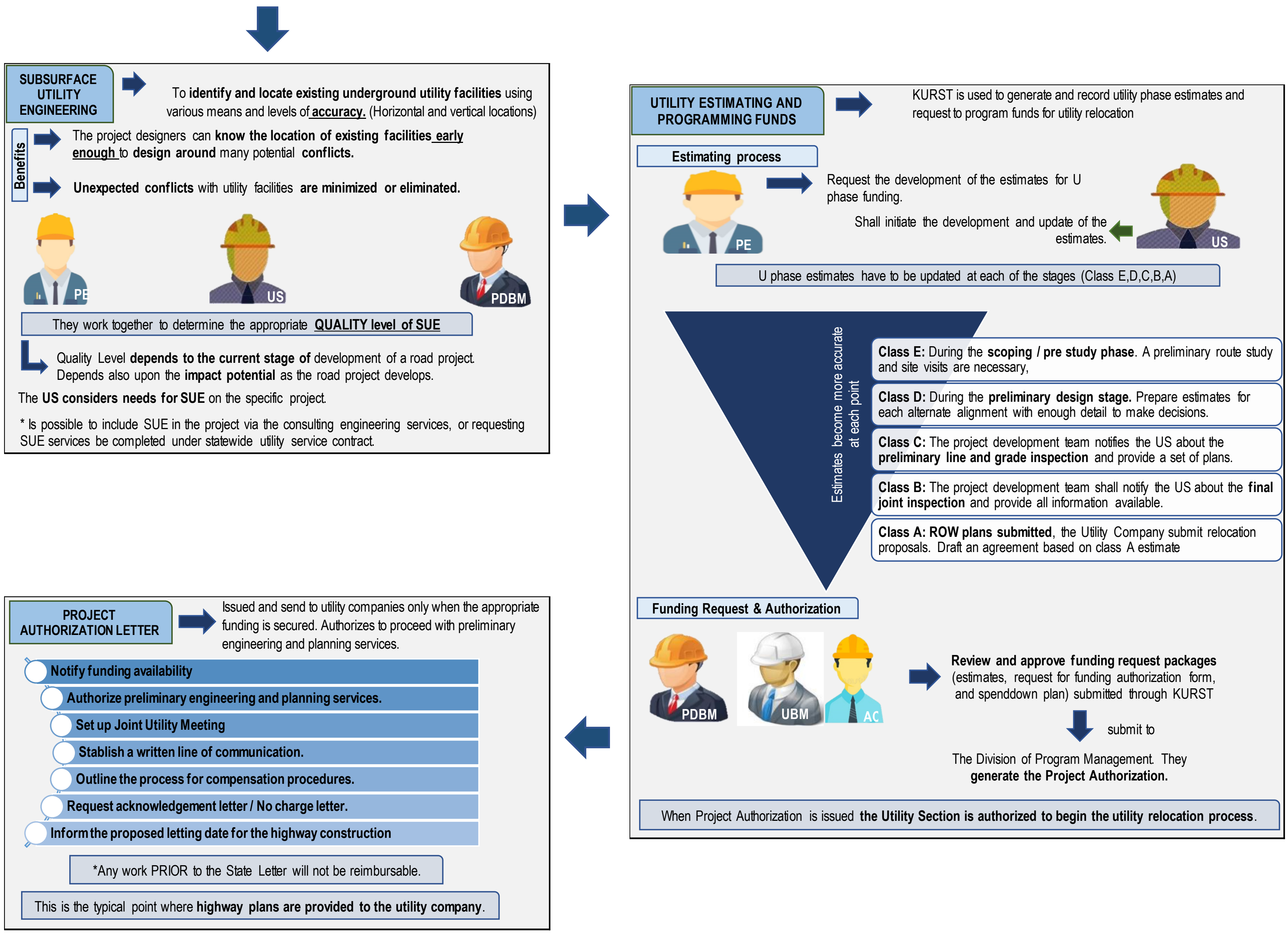
FACILITY MAPPING

→ **Identification** and **physical location** of all **utilities potentially affected by the proposed roadway** construction.

US PE

COLLABORATION between them is necessary to produce complete accurate

- Utilize project contact list to solicit facility maps from impacted utility companies.
- Visit sites to identify and quantify facilities in the area (KURTS Mobile Application).
- Review facility mapping, GIS Data, available plans.
- Consult with utility companies (No reimbursable)
- Identify locations that would benefit from SUE investigation
- Review SUE findings


SUBSURFACE UTILITY ENGINEERING
To identify and locate existing underground utility facilities using various means and levels of accuracy. (Horizontal and vertical locations)
Benefits
The project designers can know the location of existing facilities early enough to design around many potential conflicts.
Unexpected conflicts with utility facilities are minimized or eliminated.
PE
US
PDBM
They work together to determine the appropriate QUALITY level of SUE
Quality Level depends to the current stage of development of a road project. Depends also upon the impact potential as the road project develops.
The US considers needs for SUE on the specific project.
* Is possible to include SUE in the project via the consulting engineering services, or requesting SUE services be completed under statewide utility service contract.
UTILITY ESTIMATING AND PROGRAMMING FUNDS
KURST is used to generate and record utility phase estimates and request to program funds for utility relocation
Estimating process
PE
Request the development of the estimates for U phase funding.
Shall initiate the development and update of the estimates.
US
U phase estimates have to be updated at each of the stages (Class E,D,C,B,A)
Estimates become more accurate at each point
Class E: During the scoping / pre study phase. A preliminary route study and site visits are necessary,
Class D: During the preliminary design stage. Prepare estimates for each alternate alignment with enough detail to make decisions.
Class C: The project development team notifies the US about the preliminary line and grade inspection and provide a set of plans.
Class B: The project development team shall notify the US about the final joint inspection and provide all information available.
Class A: ROW plans submitted, the Utility Company submit relocation proposals. Draft an agreement based on class A estimate
Funding Request & Authorization
PDBM
UBM
AC
Review and approve funding request packages (estimates, request for funding authorization form, and spenddown plan) submitted through KURST
submit to
The Division of Program Management. They generate the Project Authorization.
When Project Authorization is issued the Utility Section is authorized to begin the utility relocation process.
PROJECT AUTHORIZATION LETTER
Issued and send to utility companies only when the appropriate funding is secured. Authorizes to proceed with preliminary engineering and planning services.
Notify funding availability
Authorize preliminary engineering and planning services.
Set up Joint Utility Meeting
Stablish a written line of communication.
Outline the process for compensation procedures.
Request acknowledgement letter / No charge letter.
Inform the proposed letting date for the highway construction
*Any work PRIOR to the State Letter will not be reimbursable.
This is the typical point where highway plans are provided to the utility company.

JOINT UTILITY MEETING

First official meeting of all potentially affect utility companies (identified in the contact list) with the district utility staff. At this point, **funds are secured and utility facilities potentially affected are identified**.

- Determine the accuracy of the existing facilities shown on the plans.
- Identify facility conflicts and define possible relocations.
- Examine resolutions with all involved utility companies.
- Plan utility design and relocation schedules considering the project schedule.
- Identify reimbursable and non reimbursable work
- Look for minor highway redesign
- Look for any utility data needs (possible use of SUE)

Scheduling of the JUM is based upon project complexity and schedule.

At this point ROW plans are fully developed, and companies shall use them to begin relocation designs.

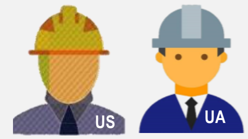
- Responsible for preparing JUM materials (sign-in sheet, agenda, general project information sheet)
- Conduct the meeting, distribute meeting minutes and send all the information to the absent companies with affected facilities.
- Ut. Companies must determine the accuracy of the plans and made corrections if necessary.
- Do collaborative development of relocation design concepts and review the project schedule to verify the relocation can be completed PRIOR to the construction or need to be included in the highway contract.

UTILITY COMPANY

Utility companies shall present relocation packages and the content depends upon the type of relocation (reimbursable or nonreimbursable).

REIMBURSABLE: Drawings, specifications, cost estimates, schedule, cabinet participation percentage analysis, engineering service contracts (if applicable)

NONREIMBURSABLE: No charge letter, relocations plans, specifications, any special request.



- Review all utility company submissions to validate their contents. Then, approve or reject submissions.
- If the **proposal is acceptable**, they shall communicate approval to the companies. If relocations are **reimbursable**, they may be **drafted as agreements. Nonreimbursable** relocations may then be **issued notice to proceed.**

At this point ROW plans are fully developed, and companies shall use them to begin relocation designs.

AGREEMENTS AND AUTHORIZATIONS

Written understanding of **responsibilities** of the Cabinet and the utility companies. Agreements may be to include the **relocation as part of the construction contract** or to **remove all the facilities PRIOR to the letting construction contract.**

AGREEMENT

1. Determine the **need of an agreement** or a delivery order.
2. Determine the correct **type of agreement**
3. Get all the **necessary information** for the agreement
4. **Write the agreement** (by US or UA), review and approve it through KURTS (by AC)
5. Get all the necessary **signatures** (district office, utility companies).
6. **Process the signed agreement,** prepare and distribute them the companies.
7. US provides the **agreement authorization number** to the utility company (formal authorization to relocate). US has to review all ROW acquisitions and all utility companies are properly scheduled.

NO CHARGE AUTHORIZATION

- A No Charge Letter and an approved relocation plan is the utility company's authorization application.
- After the proposal is submitted in KURTS, the district Utilities Section and AC shall review the authorization package and if it is approved, an acceptance letter and the authorization number shall be issued to the utility company.

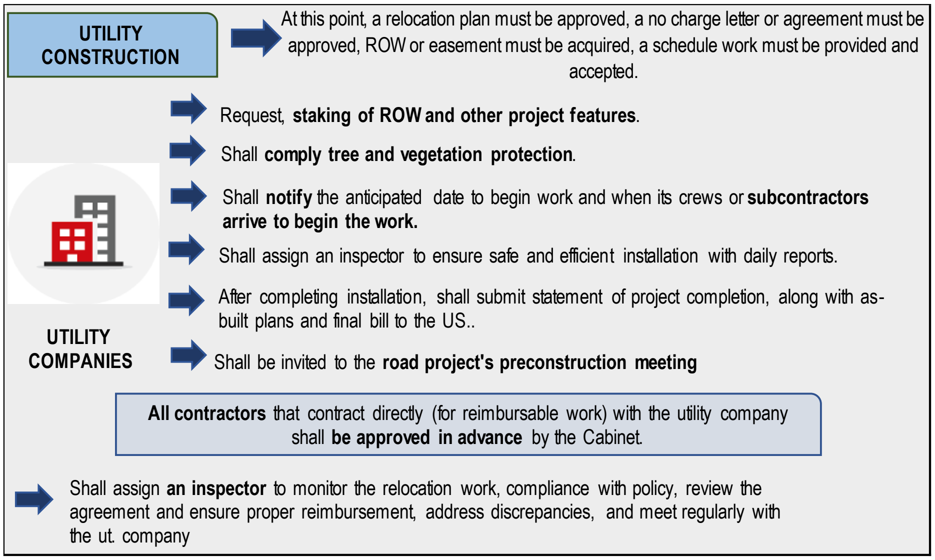
FINAL PREPARATION FOR

Process by which Utility Companies communicate with the Cabinet to **identify, design, organize & make ready any facility for relocation.**

- Review existing and proposed location plans for all Utility Companies to analyze for **potential conflict work space or method.**
- Verify that all **ROW and easements needed** have been **acquired.**
- (US) is responsible for **communicating all CAP issues** to companies.
- Consult Ut. Companies to determine their **anticipated completion date**
- Review the project file to ensure all **compensable work is included.**
- Analyze the Ut. Program budget to **ensure the funding is sufficient.**

A **preletting meeting** is highly recommended to communicate the project design and coordinate

A **project walk-through** is an option for the companies to explain their needs.


UTILITY CONSTRUCTION
At this point, a relocation plan must be approved, a no charge letter or agreement must be approved, ROW or easement must be acquired, a schedule work must be provided and accepted.
Request, staking of ROW and other project features.
Shall comply tree and vegetation protection.
Shall notify the anticipated date to begin work and when its crews or subcontractors arrive to begin the work.
Shall assign an inspector to ensure safe and efficient installation with daily reports.
After completing installation, shall submit statement of project completion, along with as-built plans and final bill to the US..
UTILITY COMPANIES
Shall be invited to the road project's preconstruction meeting
All contractors that contract directly (for reimbursable work) with the utility company shall be approved in advance by the Cabinet.
Shall assign an inspector to monitor the relocation work, compliance with policy, review the agreement and ensure proper reimbursement, address discrepancies, and meet regularly with the ut. company

Appendix G Consultant Scope of Work: Utility Coordination

Objectives
The Consultant will perform utility coordination according to the requirements and expectations as presented during Utility Coordinator Certification Training and KYTC Utility Manual. The consultant will engage the utility owners within the project limits with specific and targeted coordination efforts to identify and depict all existing utility locations and attributes. In partnership with the design team, the utility coordinator will coordinate to integrate this utility information into the project design and decision matrices to quantify cost and schedule impacts for KYTC due to the design impacts to utility facilities. The consultant will develop an appropriate accommodation and mitigation plan for the impacted utility facilities. The consultant will coordinate the timely relocation of utilities impacted by the project.

RESULTS / DELIVERABLES

The products of this section are as follows and will be provided to KYTC:

1. Complete turnkey Utility Coordination
2. Utility Certification and Utility Notes demonstrating that all existing utilities have been adequately identified and coordinated to allow for the construction and long-term maintenance of the transportation and utility infrastructures.
3. Provide necessary utility information for the KYTC Oversight agent to complete all funding and permitting required for the project.
4. Prepare necessary utility coordination reports, including a quarterly status report which will include an overall utility risk assessment.

GENERAL UTILITY COORDINATION ACTIVITY
In addition to or as part of the Deliverables, the Consultant will complete the following tasks:

1. Perform the requirements of utility coordination, including the identification and documentation of utility stakeholders within the Project Limits, and prepare and distribute all required utility correspondence.
2. Maintain and update the KURTS application as required.
3. Arrange and facilitate Project-specific utility meetings with utility stakeholders, designers, and KYTC oversight agent. (for most projects, this level of effort must be broken out into units)
4. Coordinate with adjacent projects as necessary and as directed by KYTC staff.
5. Create and maintain a master utility risk matrix, master utility schedule, master utility correspondence log,
6. Create a relocation report that identifies which utilities may require relocation and obtain the designer justification and KYTC PM approval to impact an existing relocation requiring any relocation.
7. Request utility relocation plans assist in coordinating the development of the relocation plans and review the relocation plans for the identified facilities within the project limits.
8. Develop utility special provisions and prepare utility coordination certificates for inclusion in the contract documents.
9. Initiate and facilitate the execution of utility relocation agreements for impacted facilities.
10. Issue construction NTP's for utility relocation work once utility relocation agreements are executed.
11. Develop and maintain a utility relocation schedule.
12. Facilitate the involvement of facility owners during utility construction by acting as a liaison between the utilities and KYTC, tracking utility construction progress, preparing regular status reports indicating the details of utility relocation work.
13. Coordinate the development of a master set of project plans to depict existing and proposed utility relocations.
14. Coordinate KYTC right of way acquisition with the utility operators.
    a. Engage utility right of way and legal teams.
    b. Identify and obtain all utility easement documents.

c. Coordinate and obtain sufficient legal title for KYTC parcel acquisitions for KYTC infrastructure and maintenance activities such as subordination agreements.
d. Coordinate right of way engineering with KYTC to facilitate appropriate utility relocation right of way needs.

UTILITY COORDINATION AND DESIGN INTEGRATION ACTIVITIES

15. Coordinate the integration of utility location and facility attributes into project plans
16. Create and maintain a master utility CAD file that shows existing and proposed utility facility locations
17. Develop a 3D CAD model of existing utilities located in the project limits.
18. Prepare current depiction of existing utilities on project plans for the preliminary field check.
19. Develop and maintain an accurate conflict matrix
20. Coordinate design alternatives to avoid or minimize impacts to utilities
21. Provide locations and quality levels where advanced utility investigations are required.
22. Perform constructability reviews on utility work plans with district construction as directed by KYTC oversight.
23. Prepare current depiction of existing and proposed utilities for the final field check meeting.

UTILITY AGREEMENTS AND FUNDING ACTIVITIES

24. Coordinate and submit all necessary documents for funding and agreements with KYTC Oversight Agent for execution.
25. Coordinate Buy America compliance for Federal Aid project as directed by KYTC.
26. Facilitate the execution of preliminary engineering agreements.
27. Distribute KYTC executed utility agreements and POs
28. Issue final closeout documents upon completion of the utility relocation.

Source: https://www.fhwa.dot.gov/programadmin/htmldoc4.cfm

Appendix H Sample SUE & Utility Coordination Scope of Work for Consultant Services

I. General

A. Definitions and Terms.

1. ***CI/ASCE 38-02:*** "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data," American Society of Civil Engineers, 2003.
2. ***DOT:*** State Department of Transportation and/or its authorized representative(s), as the context implies.
3. ***Consultant:*** The individual or firm directly, or indirectly through sub-consultants, providing engineering and design-related services as a party to the contract.
4. ***Contract Manager:*** The designated DOT representative responsible to coordinate, authorize, and monitor the status of task orders issued pursuant to the contract.
5. ***Project Manager:*** The designated DOT representative, typically from the involved DOT region, responsible on a specific project to evaluate and prescribe SUE needs, and to monitor the performance of approved tasks.
6. ***R.S.:*** Revised Statutes, as amended [Replace this reference with the name of applicable State statute].
7. ***MUTCD:*** "Manual on Uniform Traffic Control Devices," U.S. Department of Transportation, Millennium Edition, December 2000.
8. ***QL A:*** Utility Quality Level A as further described herein. Generally, QL A indicates the precise horizontal and vertical location of utilities obtained by the actual exposure (or verification of previously exposed and surveyed utilities) and subsequent measurement of subsurface utilities, usually at a specific point.
9. ***QL B:*** Utility Quality Level B as further described herein. Generally, QL B indicates information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities.
10. ***QL C:*** Utility Quality Level C as further described herein. Generally, QL C indicates information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating such information to QL D information.
11. ***QL D:*** Utility Quality Level D as further described herein. Generally, QL D indicates information derived from existing records and oral recollections.
12. ***Subsurface Utility Engineering, or SUE:*** A branch of engineering practice that involves managing certain risks associated with utility mapping at appropriate quality levels, utility coordination, utility relocation design and coordination, utility condition assessment, communication of utility data to concerned parties, utility relocation cost estimates, implementation of utility accommodation policies, and utility design.
13. ***UNC:*** Utility Notification Center.
14. ***Utility Quality Level:*** A professional opinion of the quality and reliability of utility information. Such reliability is determined by the means and methods of the professional.

B. Work Locations.

1. Potential projects on which SUE may be required are at undetermined locations statewide. The specific projects will be as determined by DOT.
2. Work under this contract will be authorized by means of task orders specific to the applicable project. The Consultant is reminded that this contract does not guarantee the amount of work, if any, available under the contract.

C. Range of Services.

1. The work to be performed will be only as specified in individual task orders, and may include any or all of the activities described herein.
2. The intent of this contract is twofold: (a) to achieve accuracy and economy in project-driven utility inventories, conflict assessment, and relocations, through the application of SUE techniques that are not otherwise readily available to DOT; and (b) to enable DOT to assign various tasks (such as utility

coordination, utility relocation design, cost estimating, agreement development, etc.) that DOT may otherwise perform in-house.
3. *However, the primary services anticipated to be rendered hereunder are QL A and QL B mapping.*

D. Work Inspections.

1. The Consultant shall make reasonable provision for DOT representatives to observe the Consultant's work in progress.

E. DOT Assistance.

DOT will furnish the following at no cost to the Consultant:

1. Copies of applicable manuals, policies, and procedures, forms, or other standard documentation.
2. Copies of applicable "as constructed" plans showing information pertinent to the work.
3. Information, if known, on involved utilities, such as owner name, contact person, permit records, or utility maps; provided, however, that DOT does not warrant the accuracy or completeness of such information.
4. Prints or electronic files of project plans, profiles, cross sections, details, or correspondence pertinent to the work.
5. Alignment, centerline, profile, and survey control data.
6. Liaison with utility owners and property owners as necessary to facilitate the Consultant's access to pertinent records or property.

F. Work Standards.

1. Except as may be modified or specified herein, or otherwise approved by DOT, the collection and depiction of information, and any required submittals, shall conform to the applicable provisions of CI/ASCE 38-02, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data." A copy of CI/ASCE 38-02 is available for inspection by contacting the DOT Contract Manager; or may be ordered from the American Society of Civil Engineers at http://www.asce.org/.
2. It is intended that this Scope of Work be construed harmoniously with CI/ASCE 38-02; however, in the event of a conflict, the provisions of this Scope of Work shall take precedence.

G. Submittals.

1. All required reports, documentation, studies, field notes, and sketches plan drawings, and electronic data shall be submitted for review and acceptance by the Project Manager.
2. When applicable, the Consultant shall submit an example of an original plan sheet and obtain approval from DOT prior to drafting plans.
3. Final submittals shall incorporate any corrections or revisions resulting from DOT's review.

H. Certification.

1. The Consultant's Professional Engineer or Professional Land Surveyor in responsible charge of the work shall perform a final review of, seal, and sign all applicable submittals, including but not limited to original field notes and sketches (or copies of same if approved by DOT), hard copies of electronic data, and plan drawings.

I. Plan Drawings.

1. Plan drawings shall conform to the requirements set forth in the DOT Drafting Manual or as otherwise directed or approved by DOT.
2. Drawings with colors shall be reproducible by all printing or duplication media in black-and-white.
3. Drafting and lettering shall be of proper density and legibility for a 50% reduction during reproduction.
4. The depiction of attributes such as line type, material type, age, condition, ownership, status (e.g., in-service, out-of-service, active, abandoned), number of conduits or direct buried cables, or other required information shall not be eliminated, obliterated, or obscured by the manner of reproduction or by 50% reduction in size.
5. Final drawings for reproduction shall have all drafting work and images on one side of the sheet.
6. The Consultant shall replace, at no cost to DOT, plan sheets that do not comply with the above criteria.

J. Electronic Data.

1. The Consultant's selected hardware and software, methodology, and format for deliverables, shall conform to the applicable requirements of the DOT Survey and/or Drafting Manuals or shall be as otherwise directed or approved by DOT.
2. The Consultant shall contact the Project Manager prior to creating any electronic data to verify the current collection and submission requirements.
3. The Consultant shall identify each unit of magnetic media submitted, with adhesive labels affixed to the media and containing identifying and archival information prescribed by the Project Manager.
4. A letter must accompany the magnetic media and shall contain the same information as required to be affixed to the media, and shall also contain a description of the software utilized.

II. Miscellaneous Tasks

A. Training and Orientation.

1. Assist DOT in conducting training and orientation sessions for interested parties. A training session will cover such items as available services, detection and excavation technology, project deliverables, and task order development.

B. Scoping Assistance for Task Orders.

1. Assist DOT in developing the scope of work for a subsequent task order by assessing project SUE needs, generating alternatives, and/or making recommendations.

C. Work Plan and Schedule.

1. Develop a detailed work plan and schedule of activities showing conformance to the work requirements and time constraints imposed by the task order; and obtain DOT's approval of said work plan prior to commencing work.

D. Mobilization.

1. Deploy necessary personnel, equipment, and supplies from the Consultant's central location to the work site in preparation for the work.
2. Unless otherwise approved by DOT, the Consultant shall not be compensated for more than one mobilization per task.

E. Traffic Control.

1. Whenever the work affects the movement of traffic or traffic safety, provide traffic control and utilize traffic control devices in conformance with the MUTCD, and [if applicable, the State supplement thereto adopted pursuant to State Statute].
2. Traffic Control shall be directed by a worksite traffic supervisor certified by the American Traffic Safety Services Association (ATSSA) or the [State] Contractors Association (CCA).
3. The Consultant's Traffic Control Plan (TCP) and Method(s) of Handling Traffic (MHT(s)) shall be subject to acceptance by DOT prior to commencing work.

F. Permits and Rights of Entry.

1. Obtain all necessary permits from DOT and/or local jurisdictions to allow the Consultant to work within public rights of way.
2. If work must be performed on private property, the Consultant shall obtain written permission from the property owner for the Consultant and DOT to enter the premises, including names and telephone numbers of contact persons should notification prior to entry be necessary.
3. Work on DOT rights of way may require a Special Use Permit or similar authorization, which will prescribe necessary conditions and controls. The DOT Project Manager will provide a liaison between the Consultant and the involved DOT permit office.

G. Condition Assessments.

1. Perform interior pipe wall inspections and/or thickness tests of existing buried utility lines, utilizing video, ultrasonic, and/or visual techniques as appropriate.

H. Aerial or Ground-Mounted Utility Facilities.

1. If specified by DOT, Quality Level D or C services as further described herein shall include records research, identification, surveying, correlation, and/or depiction of aerial or ground-mounted utilities, notwithstanding that such surface features may not be associated with an existing subsurface utility line or system.

I. Unknown Lines.

1. If, when performing an assigned task, the Consultant detects line(s) of unknown function, status, or ownership, the Consultant shall obtain, record, and depict information on such line(s) to a quality level that is commensurate with that of the original assigned task.

III. Project Utility Coordination/Design Tasks

A. Project Meetings, Site Reviews.

1. Attend project meetings and/or site reviews with DOT staff and/or other involved parties.
2. Record and report on proceedings.

B. Preconstruction Utility Coordination.

Coordination activities include but are not limited to:

1. Implement and comply with established DOT project utility coordination procedures.
2. Notify and furnish preliminary project data to involved utility owners.
3. Provide liaison among DOT, utility owners, and other involved parties.
4. Schedule and conduct coordination meetings and field reviews with utility owners.
5. Identify and coordinate the resolution or mitigation of utility conflicts.
6. Determine financial responsibility for utility relocation costs.
7. Negotiate and secure utility relocation agreements, owner commitments, or sign-offs.
8. Facilitate the incorporation of existing/proposed utility facility information into project plans.
9. Prepare project contract documents describing utility activities and utility/contractor coordination requirements.
10. Prepare project utility clearance documents certifying that all utility work has been completed, or that all necessary arrangements have been made for the work to be properly coordinated with the highway construction project.

C. Conflict Assessment, Development of Alternatives, Cost Estimates.

1. Work with DOT and utility owners to determine conflict points between planned construction and existing or planned utility facilities.
2. Develop and make recommendations on relocation alternatives, with emphasis on cost-effectiveness and on minimizing conflicts.
3. Develop or facilitate comparative cost estimates.

D. Utility Design.

1. Subject to owners' approval, design, and prepare plans and specifications for utility facilities to be relocated or installed on the DOT project.
2. Incorporate utility design information into project plans and furnish documentation to DOT and/or utility owners as needed.
3. Comply with applicable DOT and/or utility design standards and DOT utility accommodation policies.

E. Construction Coordination and Monitoring.

1. Provide liaison among DOT, construction contractors, and utility owners in the coordination, scheduling, and performance of utility work.
2. Monitor and report on utility relocation or installation work.
3. Determine and ensure compliance with construction plans, specifications, and schedules.
4. Negotiate field changes as conditions warrant.
5. Prepare as-built documentation and quantities.

IV. Quality Level D Tasks

Tasks leading to QL D include:

A. Records and Information Research.

1. Conduct appropriate investigations (e.g., owner records, DOT records, UNCL records, County records, personal interviews, visual inspections, etc.) to help identify utility owners that may have facilities within the project limits or that may be affected by the project.

B. Records Collection.

1. Collect applicable records (e.g., utility owner base maps, "as-built" or record drawings, permit records, field notes, geographic information system data, oral histories, etc.) on the existence and approximate location of existing involved utilities.

C. Records Review.

1. Review records for evidence or indication of additional available records; duplicate or conflicting information; need for clarification.

D. Aerial or Ground-Mounted Facilities.

1. Include records research, identification, and depiction of aerial or ground-mounted utility facilities in QL D tasks if specified (see "Miscellaneous Tasks").

E. Compilation and Presentation of Data.

1. Transfer information on all involved utilities to appropriate plan sheets, electronic files, and/or other documents as required or directed by DOT.
2. Exercise professional judgment to resolve conflicting information.
3. For information depicted, indicate utility type and ownership; date of depiction; quality level(s); endpoints of any utility data; line status (e.g., active, abandoned, out of service); line size and condition; number of jointly buried cables; and encasement.

V. Quality Level C Tasks

Tasks leading to QL C include:

A. Inclusive of QL D Tasks.

1. Perform tasks as described for QL D. There is no prescribed order in which QL D and C tasks must be performed.

B. Identification of Surface Utility Features.

1. Identify surface features, from project topographic data (if available) and from field observations, that are surface appurtenances of subsurface utilities.

C. Aerial or Ground-Mounted Facilities.

1. Include survey and correlation of aerial or ground-mounted utility facilities in QL C tasks if specified (see "Miscellaneous Tasks").

D. Surveys.

1. Survey surface features of subsurface utility facilities or systems if such features have not already been surveyed by a registered professional. If previously surveyed, check survey data for accuracy and completeness.
2. The survey shall also include (in addition to subsurface utility features visible at the ground surface): determination of invert elevations of any manholes and vaults; sketches showing interior dimensions and line connections of such manholes and vaults; any surface markings denoting subsurface utilities, furnished by utility owners for design purposes.

E. Confined Space Procedures.

1. Whenever the work requires the entry of personnel into confined spaces (including but not limited to manholes, vaults, and pipes), comply with applicable OSHA (Occupational Safety and Health Administration, U.S. Department of Labor) procedures and requirements.

F. Correlation, Interpretation, and Presentation of Data; Resolution of Discrepancies.

1. Exercise professional judgment to correlate data from different sources and to resolve conflicting information.
2. Update (or prepare) plan sheets, electronic files, and/or other documents to reflect the integration of QL D and QL C information.
3. Recommend follow-up investigations (e.g., additional surveys, consultation with utility owners, etc.) as may be needed to further resolve discrepancies.
4. As appropriate, amend the indicated quality level of depicted information.

VI. Quality Level B Tasks

Tasks leading to QL B include:

A. Inclusive of QL C Tasks.

1. Perform tasks as described for QL C. There is no prescribed order in which QL C and B tasks must be performed.

B. Line Detection and Marking.

1. Select and apply appropriate surface geophysical method(s) to search for and detect subsurface utilities within the project limits and/or to trace a particular utility line or system.
2. Based on an interpretation of data, mark the indications of utilities on the ground surface for a subsequent survey. Utilize paint or other methods acceptable to DOT for marking of lines.
3. Utilize the uniform color code of the American Public Works Association for marking of utilities.
4. Unless otherwise directed, mark the centerline of single-conduit lines and outside edges of multi-conduit systems.
5. Unless otherwise approved, maintain horizontal accuracy of +/- 1.5 feet (450 mm) in the marking of lines.
6. As an alternative to the physical marking of lines, the Consultant may, with DOT's approval, utilize other means of data collection, storage, retrieval, and reduction that enable the correlation of surface geophysical data to the project's survey control.

C. Surveys.

1. Survey all markings that indicate the presence of a subsurface utility.
2. Perform surveys to a horizontal accuracy consistent with applicable DOT survey standards. Reference surveys to the project's survey control.
3. If requested, record depth information as may be indicated by the particular detection method used.

D. Correlation, Interpretation, and Presentation of Data; Resolution of Discrepancies.

1. Exercise professional judgment to correlate data from different sources and to resolve conflicting information.
2. Update (or prepare) plan sheets, electronic files, and/or other documents to reflect the integration of QL D, QL C, and QL B information.
3. Recommend follow-up investigations (e.g., additional surveys, consultation with utility owners, etc.) as may be needed to further resolve discrepancies.
4. As appropriate, amend the indicated quality level of depicted information.

VII. Quality Level A Tasks

Tasks leading to QL A include:

A. Inclusive of QL B Tasks.

1. Perform tasks as described for QL B. There is no prescribed order in which QL B and A tasks must be performed.

B. Selection of Test Locations.

1. DOT may require QL A data where the precise horizontal and vertical location of utilities, obtained by exposure and survey of the utility at specific points, is needed for conflict assessment/resolution purposes.
2. The Consultant may recommend test locations based on the requirements of the project and on existing subsurface utility information.

C. Selection of Method.

1. When available, verifiable information on previously exposed and surveyed utilities (such as survey records during utility line construction) shall be furnished in lieu of new excavation, exposure, and survey at that same point or at a suitable nearby point.
2. Otherwise, when utility lines must be exposed and surveyed at specified locations, the Consultant shall use minimally intrusive excavation techniques, acceptable to DOT, that ensure the safety of the excavation, the integrity of the utility line to be measured, and that of other lines which may be encountered during excavation.
3. DOT intends that excavation shall be by means of air- or water-assisted vacuum excavation equipment manufactured specifically for the purpose. Provided, however, that approval of water-assisted vacuum excavation may be subject to additional findings by DOT that such method poses minimal risk of damage to the highway facility or utility lines.

D. Compliance with UNCL Requirements.

1. The Consultant shall comply with all applicable provisions of [State Law] when planning or performing excavations at utility test hole sites.
2. Compliance actions include, but are not limited to: notify owners or operators of underground utility facilities at least two (2) business days prior (not including the day of actual notice) to making or beginning excavations in the vicinity of such facilities; call the UNCL at ___________________ for the marking of member utilities; contact non-member utilities directly; coordinate with utility owner representatives as required for inspection or other on-site assistance; immediately cease excavation work and report any resultant utility line damage to the owner.

E. Excavation of Test Holes.

1. Clear the test hole area of surface debris.
2. In paved areas, neatly cut and remove existing pavement, which cut shall not exceed 225 square inches (0.15 square meters) unless otherwise approved.

3. Excavate the test hole by the method(s) acceptable to DOT and to the standards set forth herein (see also "Selection of Method" above). The nominal diameter of the test hole shall not exceed 15 inches (375 mm) unless otherwise approved.
4. Expose the utility only to the extent required for identification and data collection purposes.
5. Avoid damage to lines, wrappings, coatings, cathodic protection or other protective coverings and features.
6. Hand-dig as needed to supplement mechanical excavation and to ensure safety.
7. Revise the test hole location as necessary to positively expose the utility.
8. Store excavated material for re-use or disposal, as appropriate.

F. Collection, Recording, and Presentation of Data.

Measure and/or record the following information on an appropriately formatted test hole data sheet that has been sealed and dated by the Consultant:

1. Elevation of the top and/or bottom of the utility tied to the project datum to a vertical accuracy of +/- 0.05 feet (15 mm).
2. Elevation of existing grade over utility at test hole.
3. Horizontal location referenced to project coordinate datum, to a horizontal accuracy consistent with applicable DOT survey standards.
4. Field sketch showing horizontal location referenced to a minimum of three (3) swing ties to physical structures existing in the field and shown on the project plans.
5. Approximate centerline bearing of the utility line.
6. The outside diameter of the pipe, the width of duct banks, and the configuration of non-encased multi-conduit systems.
7. Utility structure material composition, when reasonably ascertainable.
8. Identity of benchmarks used to determine elevations.
9. Utility facility condition.
10. Pavement thickness and type when applicable.
11. Soil type and site conditions.
12. Identity of utility owner/operator.
13. Other pertinent information as is reasonably ascertainable from the test hole.

G. Site Restoration.

1. Replace bedding material around exposed utility lines in accordance with the owner's specifications or as otherwise directed or approved.
2. Backfill and compact the excavation in a manner acceptable to DOT. If approved, re-use excavated material with appropriate moisture/density control.
3. Install color-coded warning ribbon within the backfill area and directly above the utility line.
4. As applicable, provide permanent pavement restoration within the limits of the original cut using materials, compaction, and pavement thickness acceptable to DOT.
5. Repair or replace backfill or pavement that fails (i.e., subsidence and/or loss of pavement material) within two (2) years of the original restoration work.
6. For excavations in unpaved areas, restore the disturbed area as nearly as practicable to pre-existing conditions.
7. Furnish and install a permanent surface marker (e.g., P.K. nail, peg, steel pin, or hub) directly above the centerline of the structure and record the elevation of the marker.

H. Interpretation of Data and Resolution of Discrepancies.

1. Exercise professional judgment to correlate data from different sources and to resolve conflicting information.

2. Update plan/profile sheets, electronic files, and/or other documents to reflect the integration of QL D, QL C, QL B, and QL A information.
3. Recommend follow-up investigations (e.g., additional surveys, consultation with utility owners, etc.) as may be needed to further resolve discrepancies.
4. As appropriate, amend the indicated quality level of depicted information.

➢ UR-507-1

	Section UTILITY CONFLICT MATRIX
	Subject Overview

UTILITY CONFLICT MANAGEMENT

Utility conflict management is an element of utility engineering that utilizes a multistage process to systematically identify and resolve utility conflicts during the development and delivery of transportation projects.

UTILITY CONFLICT MATRIX

A utility conflict matrix (UCM) is a tool used in utility conflict management to document, track, and manage utility conflicts. It enables the Transportation Cabinet's (Cabinet) utility staff, project manager, and designer to collaboratively identify, organize, analyze, and track utility conflicts to resolution.

The UCM documents the following items in a multistep process throughout the lifetime of the project:

- Utility location, type, and ownership
- Identification of potential utility conflicts with the project
- Confirmation of conflict with an aspect of the road project
- Alternative proposals to resolve the conflict
- Analysis of alternative resolutions
- Selection of a resolution
- Execution of the resolution

UCMs are typically in the form of tables or matrices, which allow for effective documentation and management of utility conflict data. The Cabinet's UCM can be viewed in tabular format, as individual conflicts, or spatially.

PURPOSE OF UTILITY CONFLICT MATRIX

A UCM introduces efficiency into the project development process, allowing the entire project team to understand and address project complexities in regard to utilities.

The UCM allows the team to work together to identify utility conflicts early in the design stage, document needs, and determine the optimum means of conflict resolution. Identification of utility facilities and confirmation of conflicts establish a clear scope of potential project impacts, minimizing inefficiencies. Mitigating identified conflicts is necessary for a successful project. These are the critical factors that are known contributors to utility inefficiencies in transportation projects:

- Inadequate utility facility information
- Unidentified utility impacts to the project
- Ineffective management of potential conflicts

These inefficiencies can impact the project in a number of ways, including, but not limited to, the following:

- Unexpected disruptions during construction
- Damage to utility installations
- Delays that extend the project development and/or delivery
- Unnecessary utility relocations

These problems can negatively impact the project in varied means: higher bids, change orders, damage or delay claims, redesign, delayed schedules, and litigation. These issues also may result in frustration by the traveling public and a negative public perception about the project and agency.

To minimize these inefficiencies, the project team is charged to identify utility conflicts. Examples of scenarios that the team can encounter on a transportation project include the following conflict types:

- Utility facilities and transportation design features
- Utility facilities and transportation construction or phasing
- Planned utility facilities and existing utility facilities
- Noncompliance of utility facilities with accommodation policies
- Noncompliance of utility facilities with safety or accessibility policies

PURPOSE OF UTILITY CONFLICT MATRIX (CONT.)

Early detection of utility conflicts via the UCM optimizes opportunity to implement a variety of strategies to resolve conflicts. The resolution strategies should avoid conflicts first, minimize impacts second, and, if neither of these two strategies is feasible, then consider relocating the utility facility. In practice, utility conflict resolutions may include one or more of the following:

- Modify the proposed transportation facility, such as:
  - Changing the horizontal and/or vertical alignment
  - Altering the drainage design to avoid existing utility lines
  - Altering noise walls or traffic signal components
  - Optimizing construction phases
- Implement an engineering measure to protect-in-place a utility
- Remove, abandon, or relocate the utilities in conflict
- Accept an exception to policy

Note: The ultimate selection of a resolution strategy should always consider practical execution, cost, and schedule impacts.

USE OF UTILITY CONFLICT MATRIX

While the UCM can provide value to any project with utilities in the project footprint, there are certain project types for which the UCM can be leveraged for maximum benefit. Large, complex, or urban projects often benefit from using a UCM. Due to the living nature of the UCM, evolving with the project, a project that will span several years in development can benefit significantly from a UCM. Projects with limited right of way benefit from a UCM because of the need to minimize relocations and optimize the accommodation of relocated utility facilities.

The Cabinet also recommends the use of a UCM on projects with many utility companies in the footprint or particularly dense, complex, or costly utility facilities. **UR-507-2**, **"**UCM Evolution During Project Stages," details usage of a UCM at various stages of project development and delivery.

APPLICATION OF UTILITY CONFLICT MATRIX IN KENTUCKY

The Kentucky Utilities and Rail Tracking System (KURTS) provides a UCM tool for each initiated transportation project. This tool is available for contribution from Cabinet utility, design, and project management staff. The UCM allows for the documentation of all utility conflicts for coordination and resolution, allowing the proposal of multiple alternative conflict resolutions and documents decision making.

The Cabinet has a field collection tool, called KURTS mobile, which enables the collection of real-time and spatially connected utility conflicts. This data can be field collected and uploaded into the KURTS database.

UR-507-3, **"**Data Collection and Use," details these systems and functionality.

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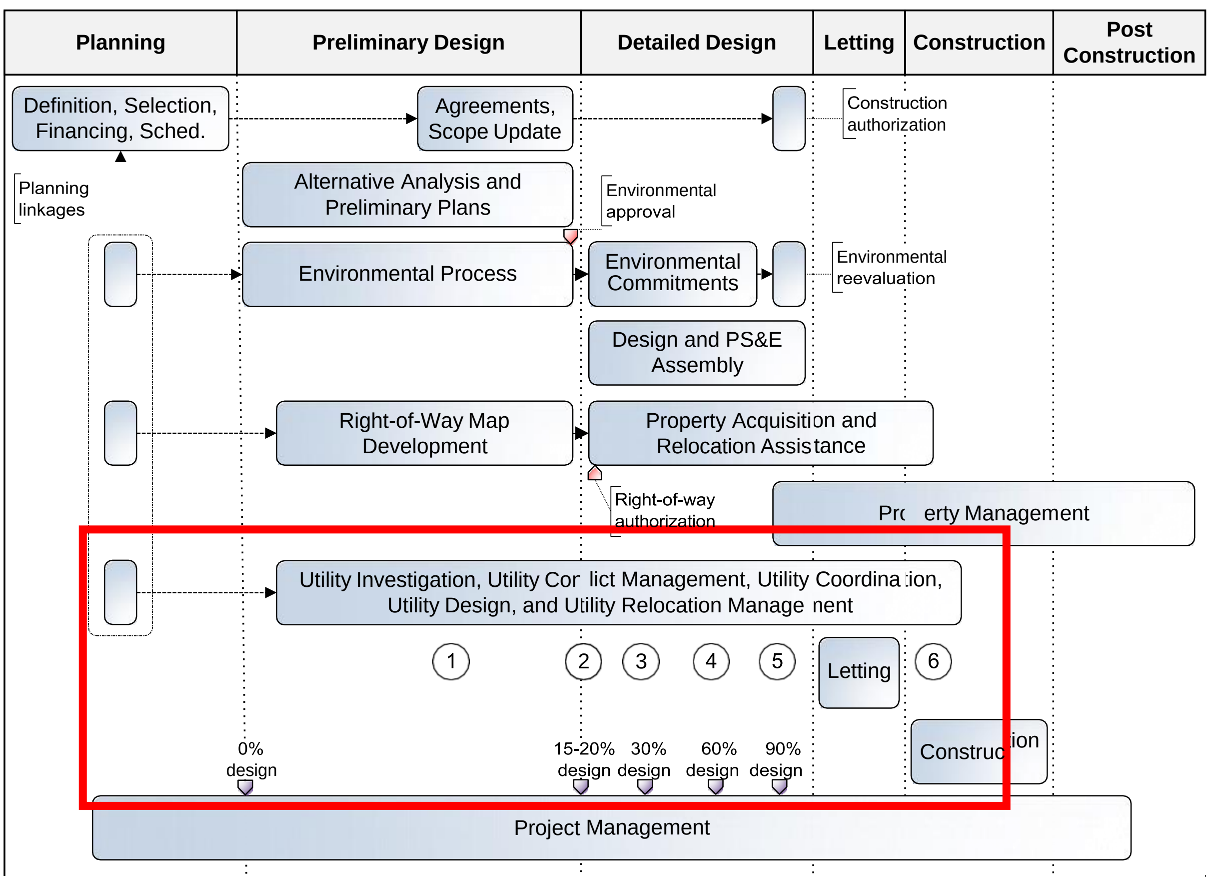
	Section UTILITY CONFLICT MATRIX
	Subject Evolution During Project Stages

OVERVIEW

There are advantages to using a utility conflict matrix (UCM) for all stages in the project development and delivery process. From planning to letting, including all stages in between, the UCM tracks critical utility activities. As an element of effective utility conflict management, a project benefits from a well-maintained UCM. The figure below provides a representation of a traditional design-bid-build project.

Utility Stages within the Project (Traditional Design-Bid-Build Project)



OVERVIEW (CONT.)

The utility activities span most phases of the project process, understanding that varying utility-related tasks are needed during each stage of the project. Utility conflict management is revisited during each stage identified, evolving and documenting utility conflicts in the UCM and performing other management activities throughout the project lifetime.

STAGES OF THE UCM

The six stages defined in the prior figure denote critical points in the development of the project. At these points, it is advantageous to use a UCM in addition to specific utility conflict management activities. The six stages of project development are outlined here:

STAGE 1 – This is generally the initial process when utility conflicts are first identified, which ideally takes place during the preliminary design phase.

STAGE 2 – This second stage typically follows preliminary design and is utilized early in the final design phase. One can expect to perform a detailed survey, including visible utility appurtenances.

STAGE 3 – The third stage typically consists of approximately 30% design, when horizontal and vertical design alignments are being finalized. More detailed information about subsurface utilities should be gathered and confirmed, and further conflict resolution strategies should be analyzedor reviewed.

STAGE 4 – This stage occurs at approximately 60% design, where horizontal and vertical design alignments are in place, possibly including drainage design. Higher levels of Subsurface Utility Engineering (SUE) may be needed at this point to determine utility facility depth and confirm conflicts. Utility agreements should be nearing completion and some relocations may be underway.

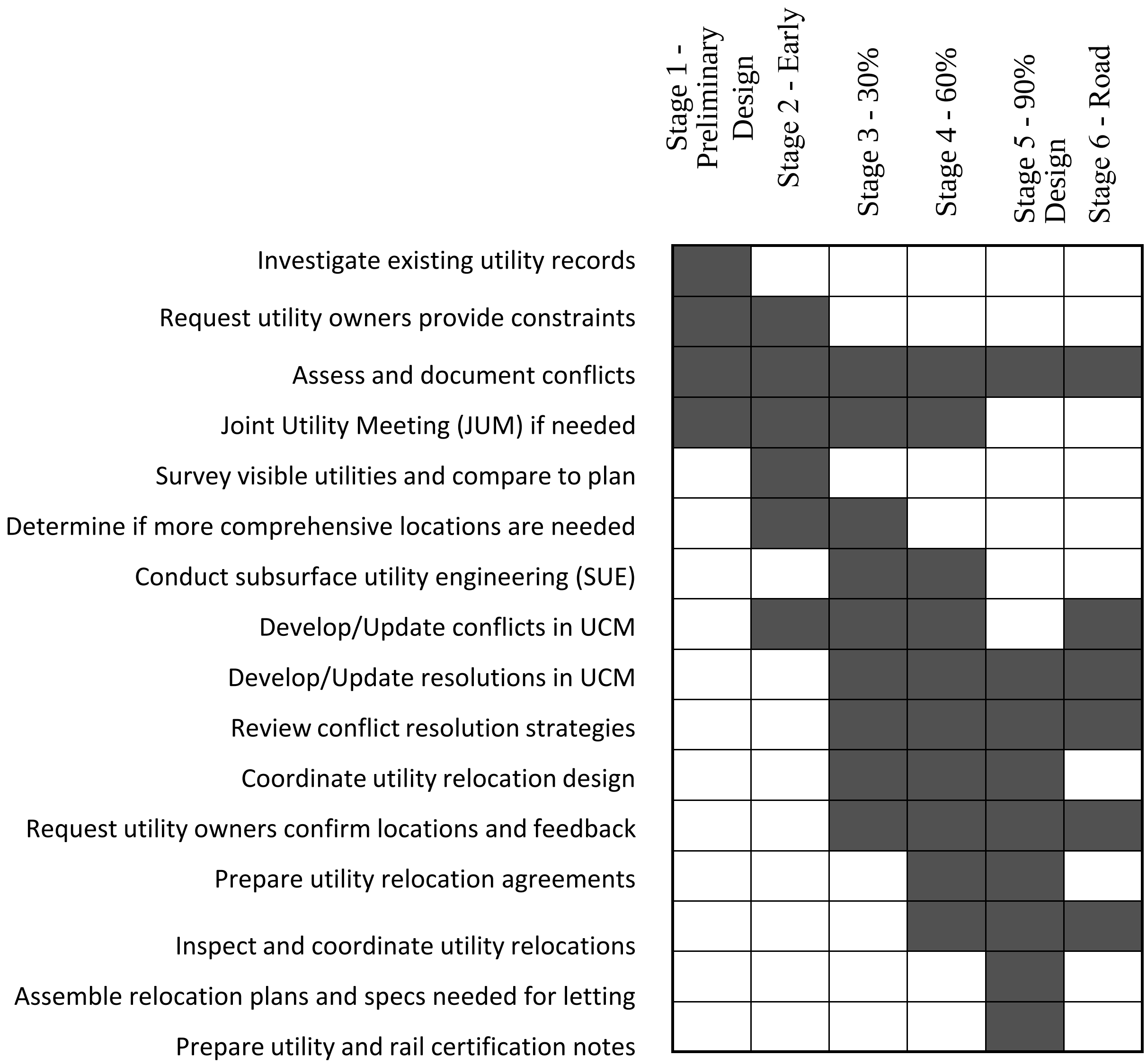
STAGE 5 – This stage typically corresponds to 90% design, when final roadway plans, specifications, and cost estimate are completed. Utility relocations may be underway, particularly those that are not to be incorporated into the road project.

STAGE 6 – The sixth stage is the beginning of the construction, where utility relocation construction may still require completion. Certain utilities may require relocation by the roadway contract. New utilityconflicts, which were missed before, may arise.

STAGES OF THE UCM (CONT.)

The graph below depicts some of the tasks typically executed during the varied stages described above. It should be noted that this graph is an estimate of a typical design-bid-build project of notable size. Tasks may be completed at various stages, or omitted altogether, as appropriate for the project at hand.

Tasks Typically Executed During a Design-Bid-Build Project of Notable Size



VARIATION DUE TO PROJECT TYPES

In practice, the number of utility conflict management stages and activities within each stage can vary widely, depending upon the specific characteristics and delivery method of the project. The following describes possible variations of these stages for three different project types:

- Large project with a traditional design-bid-build process
- Project with an accelerated project delivery
- Small project in which many elements of the project are fixed

Large project with a traditional design-bid-build process

This project type is effectively executed by leveraging the full plan as identified above. All of the identified six stages and associated activities are valuable elements of the project development and delivery process.

Project with an accelerated project delivery

Many agencies are pursuing strategies to shorten the time it takes to complete project development phases. In situations like this one, it may be possible to consolidate stages and activities. In general, opportunities for consolidation include the following:

- Consolidate utility investigation activities by conducting SUE, Quality Level B (QLB), and Quality Level A (QLA) investigations early.
- Assess utility conflicts and impacts earlier if critical elements of the design are fixed or known early.
- Improve utility coordination by identifying parcels to acquire and starting right of way acquisition early.

For an accelerated project delivery, the project team may consider incorporating the activities defined in stage 2 (early final design) into stage 1 (preliminary design). This strategy provides information to the project development team early, allowing opportunity for utility conflict identification and avoidance. Avoidance of conflicts is the preferred means to minimize delays to project letting, and promotes the accelerated project delivery.

VARIATION DUE TO PROJECT TYPES (CONT.)

Small project with many fixed project elements

Project development teams have little they can do to avoid utility conflicts if the project has known and fixed design elements. Utilityconflict management becomes focused on identifying, planning, and relocating any conflicts with existing utility installations. These activities become time compressed, especially for small projects that haveshortened development schedules. In situations like this, it is valuable to consolidate utility conflict management stages and activities.

For small projects, the project team must minimize the schedule for utility conflict management. This can be done by incorporating the activities defined in stage 2 (early final design) into stage 1 (preliminary design). This strategy provides information to the project development team early, allowing opportunity for utility conflict identification and avoidance. Avoidance of conflicts is the preferred means to minimize delays to project letting, and promotes the accelerated project delivery. Stages 3, 4, and 5 (30, 60, and 90 percent design) can also be merged since there is a notable decline in resolution options and minimal opportunity to avoid conflicts through design.

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UTILITIES & RAILS KENTUCKY TRANSPORTATION CABINET	*Section* UTILITY CONFLICT
	Subject Data Collection & Use

UTILITY CONFLICT MATRIX DATA

The Kentucky Utilities and Rail Tracking System (KURTS) provides utility conflict matrix (UCM) tool for each initiated transportation project. This tool is available for contribution from Cabinet utility, design, and project management staff. The UCM allows listing of all utility conflicts for coordination and resolution, provides alternative conflict resolution solutions, and documents decision making for avoiding or minimizing utility impacts altogether.

The UCM allows documentation and comparison of costs and time schedule variety for alternative utility conflict resolutions. In addition to the KURTS applications, the Cabinet has a field collection tool, called KURTS mobile, which enables the collection of real-time and spatially-connected potential conflicts. This data can be field collected and uploaded into the KURTS database.

Incorporation of the UCM tool utilizes early project planning and design to identify utility conflict resolutions that will be feasible, cost-effective, and beneficial.

A UCM collects the following data in a multi-step process throughout the lifetime of the project:

- Utility location, type, and ownership
- Identification of potential utility conflicts with the project
- Confirmation of conflict with an aspect of the road project
- Alternative proposals to resolve the conflict
- Analysis of alternative resolutions
- Selection of a resolution
- Execution of the resolution

UTILITY CONFLICT MATRIX DATA (CONT.)

This UCM data can be roughly broken down into two parts: utility conflict data and resolution data.

Utility conflict data includes the following:

- Utility location, type, and ownership
- Identification of potential utility conflicts with the project
- Confirmation of conflict with an aspect of the road project

Resolution data includes the following:

- Alternative proposals to resolve the conflict
- Analysis of alternative resolutions
- Selection of a resolution
- Execution of the resolution

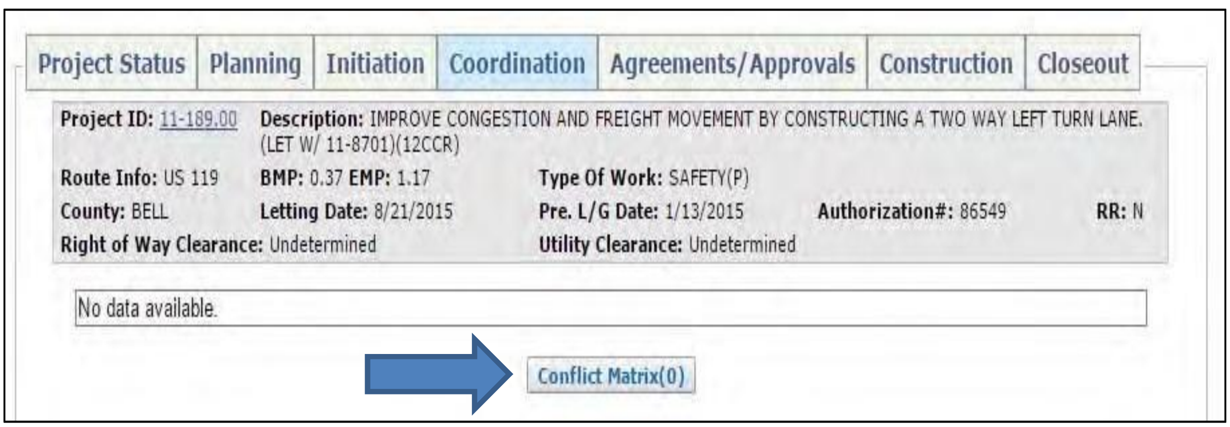
UTILITY CONFLICT DATA COLLECTION

Utility conflicts, as recorded in the Kentucky Transportation Cabinet (KYTC) UCM, are documented points in space where a project design is expectedto be in conflict with a utility facility. The collection of utility conflict datacan be completed in house, through the review of records and survey data,or it can be performed in the field, through the collection of GPS locationsof visible elements of the existing utility facilities.

IN-HOUSE CONFLICT DATA COLLECTION

The in-house collection of utility conflicts is recorded in the project housed within the KURTS project coordination pages, as shown here.

KURTS Project Coordination Page

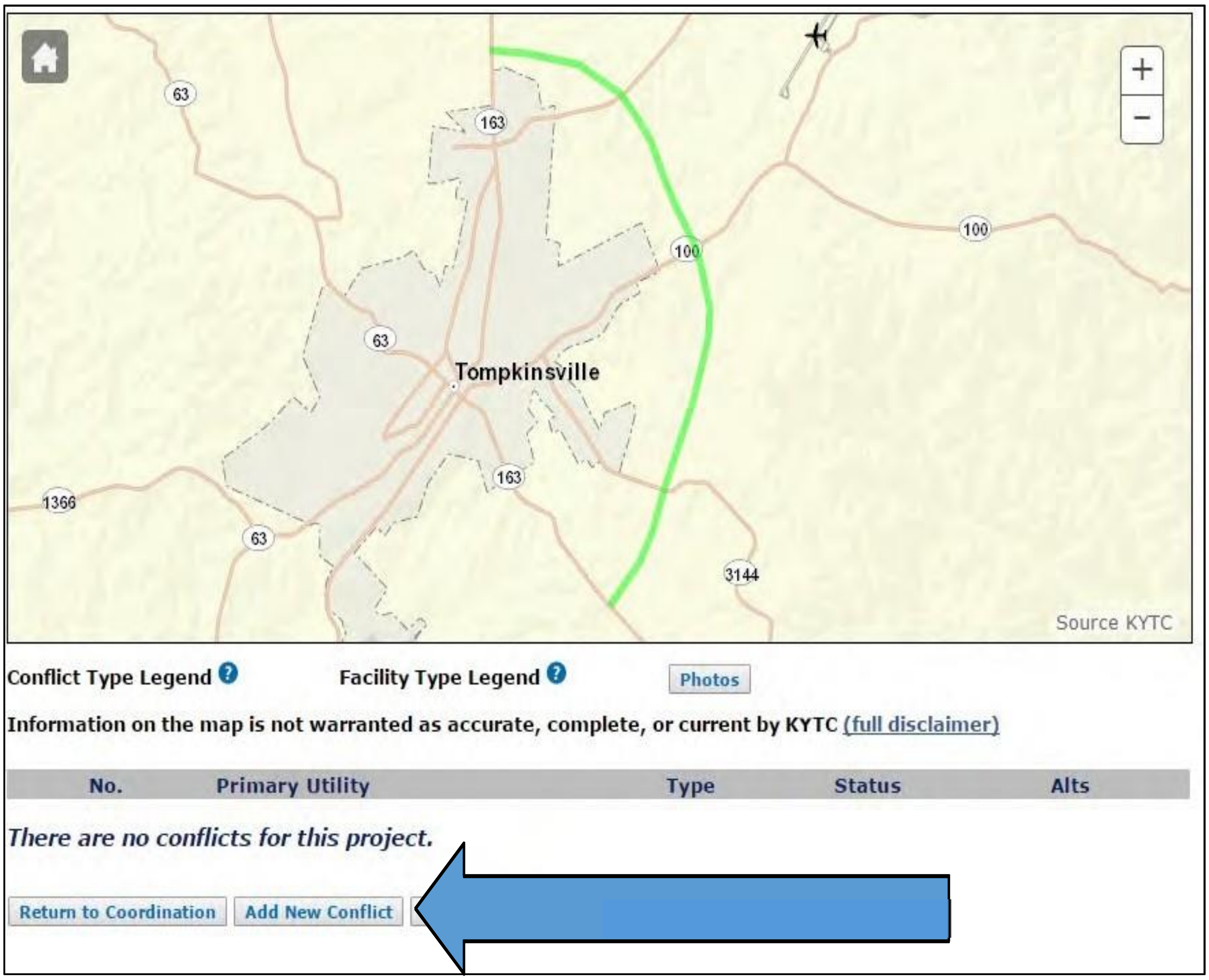


Utility, design, and project management staff can open the “ConflictMatrix” button to access the UCM.

IN-HOUSE CONFLICT DATA COLLECTION (CONT.)

Authorized users can utilize the “Add New Conflict” tab to record the collection of identified utility conflicts. Once authorized users have chosen the “Add New Conflict” tab, KURTS will open a map and fields which allow the user to select a map location of the conflict and enter data about the conflict identified. Some of the conflict data that can be collected includes:

Conflict Management



- **Latitude and Longitude -** Location selected on interactive mapping feature
- **Location -** A descriptive field to further explain the conflict location

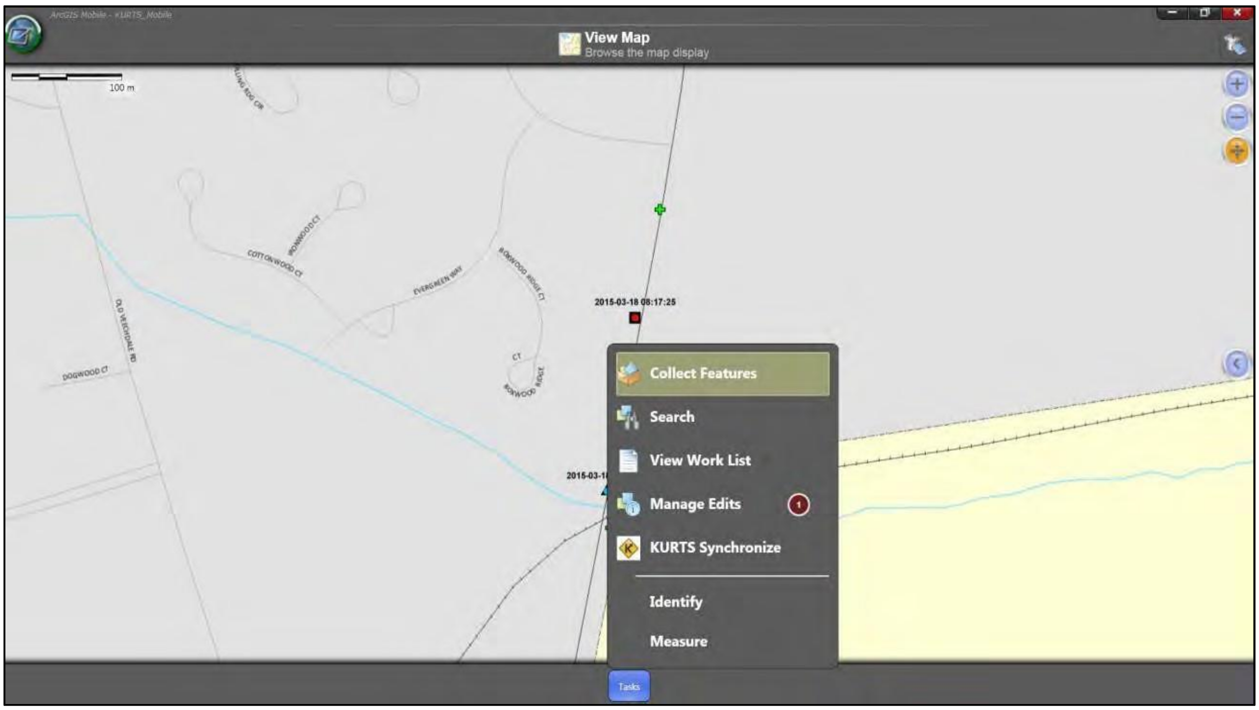
IN-HOUSE CONFLICT DATA COLLECTION (CONT.)

- **Type -** A drop down field identifying a generalized conflict type
  - Air clearance/air space impact
  - Structural Impact
  - Typical Impact
  - Work Around Facilities
  - Unknown Utility
- **Type Detail -** A drop down field providing the specific conflict at hand
- **Primary Utility -** The utility company primarily involved in the conflict
- **Additional Utilities -** Any additional utility companies involved in conflict
- **Accuracy of Utility Location -** The Subsurface Utility Engineering (SUE) quality level of the utility location on the project plans
  - QL-A: Locating
  - QL-B: Designating
  - QL-C: Surveying
  - QL-D: Existing Records
- **Utility Conflict Description -** A field used to describe or provide notes about the utility conflict
- **Status -** A drop down field providing a status of the conflict
  - Pending
  - Unconfirmed
  - Deferred
  - Resolved – Relocation
  - Resolved – No relocation

FIELD CONFLICT DATA COLLECTION

The field collection of utility conflicts is collected on site using KURTS mobile and then uploaded to the KURTS application. When uploaded, it is recorded in the KURTS project coordination pages using thesame process as for in-house collections. The field collection of utility conflict data is initiated by opening the application and selecting “Collect Features” as shown here:

Field Collection of Utility Data Using KURTS Application



FIELD CONFLICT DATA COLLECTION (CONT.)

The data collector must first select the "Conflict Type", choosing one of the following:

- Air Clearance/Air Space Impact
- Structural Impact
- Typical Impact
- Unknown Utility
- Work Around Facilities

Types of Field Conflict

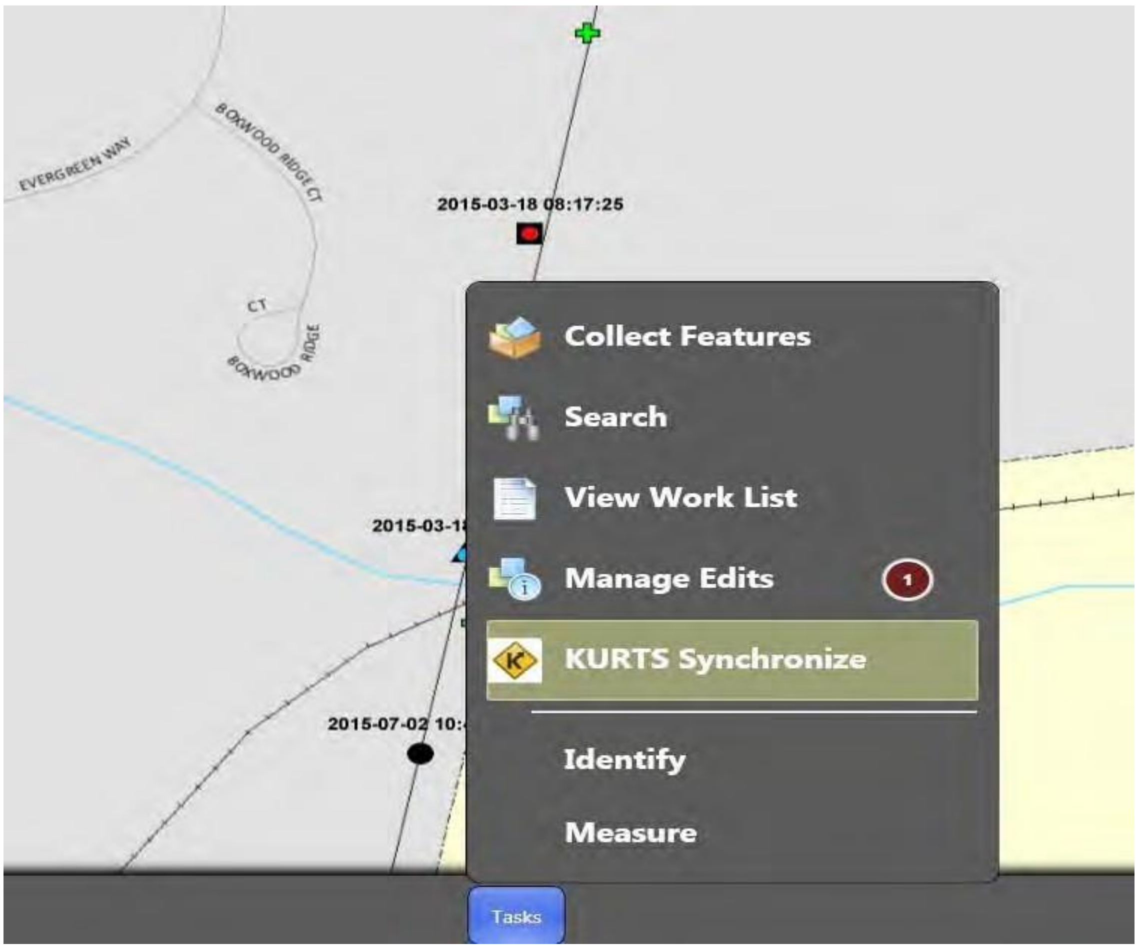
The data collector shall then perform the following actions:

- Enter the project item number for ultimately uploading it into KURTS.
- Collect the latitude and longitude, using a GPS receiver or tablet receiver.
- Collect imagery using the tablet camera.
- Enter the remaining utility conflict fields as they are denoted in the in-house collection section above.

FIELD CONFLICT DATA COLLECTION (CONT.)

The field-collected points of utility conflict are saved on the tablet and ultimately uploaded into KURTS and the respective project by selecting "KURTS Synchronize" as shown below.

KURTS Synchronize



UTILITY CONFLICT RESOLUTIONS

Conflicts are identified on utility relocation projects and are not limited to any specific aspect of the utility work. A conflict can be prevalent between utility companies or multiple other factors. Conflict resolution alternatives are proposed solutions to these conflicts. Each conflict may have multiple resolution alternatives but only one may be determined as the selected alternative.

All KYTC KURTS users can contribute to the UCM, providing a proposed resolution. The resolution alternatives are utility conflict specific and are posted to the bottom of an opened conflict as shown below.

Resolution Alternatives

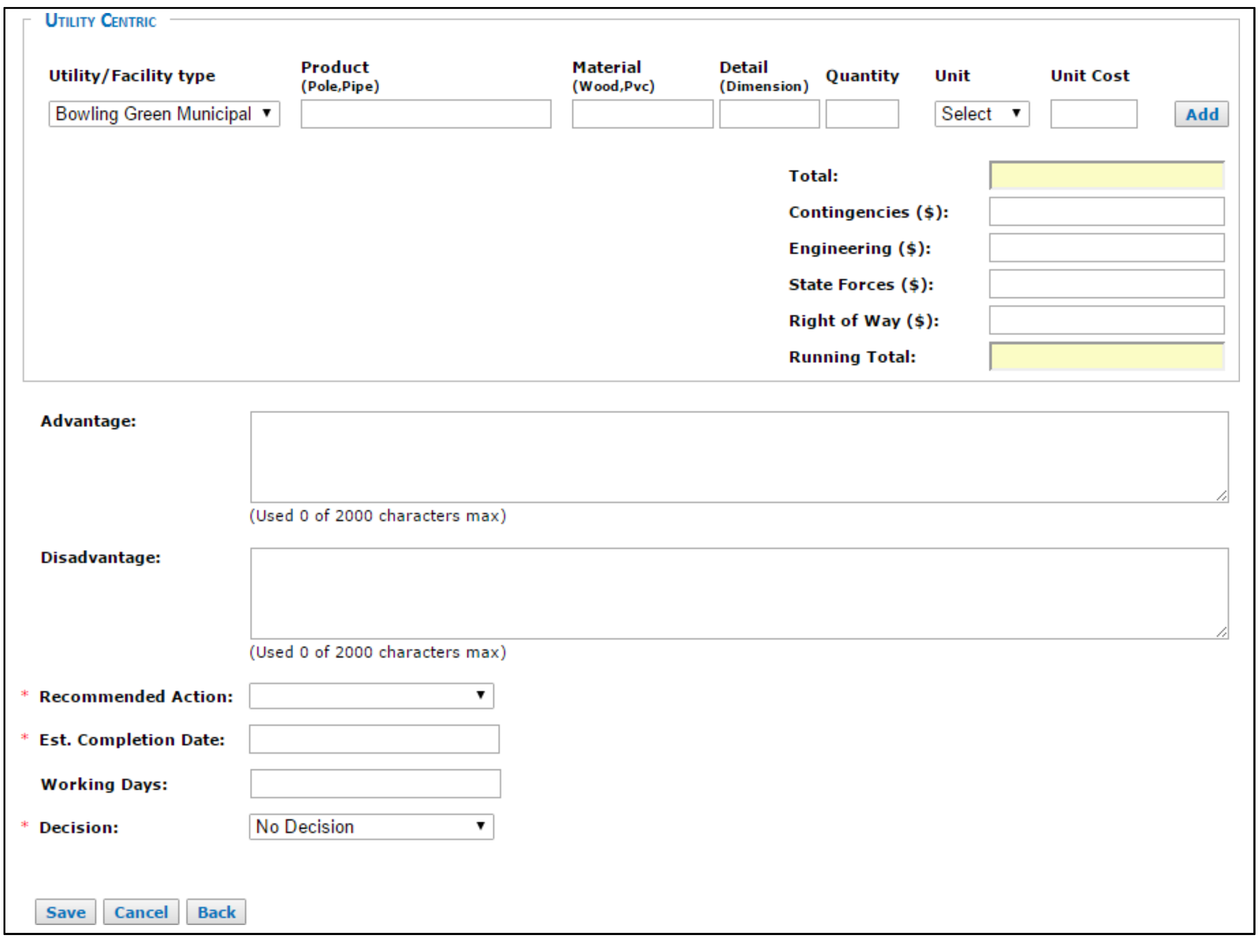
UTILITY CONFLICT RESOLUTIONS (CONT.)

Resolutions can be either **utility centric** (typically a relocation of the utility facility in conflict) or **KYTC centric** (typically a redesign or design modification that accommodated the existing utility facility).

For **utility centric resolutions**, the user is offered opportunity to provide aline item estimate of the relocation costs, advantages, disadvantages, schedule, and a recommended action. The cost estimating feature uses the KURTS unit price database to assist by offering line items and historicalpricing. The user may also enter costs for engineering, state forces, right of way, and a contingency factor when drafting a cost estimate. Finally, the resolution houses a field that records the ultimate decision of the project team:

- No decision
- Selected
- Rejected

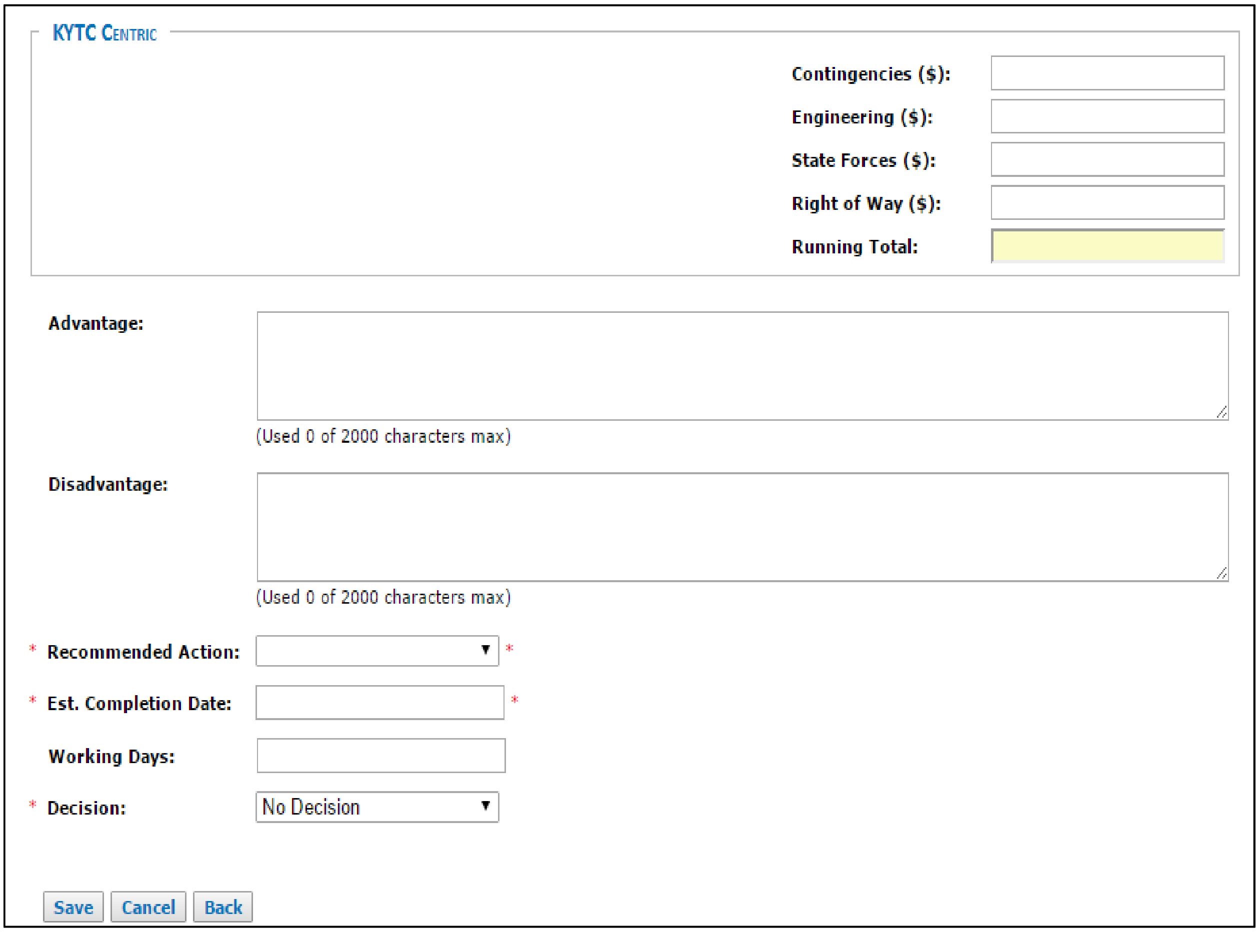
Utility Centric Resolution



UTILITY CONFLICT RESOLUTIONS (CONT.)

For **KYTC centric resolutions**, the user can provide an estimate of the cost, advantages, disadvantages, schedule, and a recommended action. However, the cost estimate for this resolution type does not offer relocation costs, only engineering, state forces, right of way, and a contingency factor. As with a utility centric resolution, the ultimate decision of the project team may be recorded.

KYTC Centric Resolutions



LEVERAGING THE UCM DATA

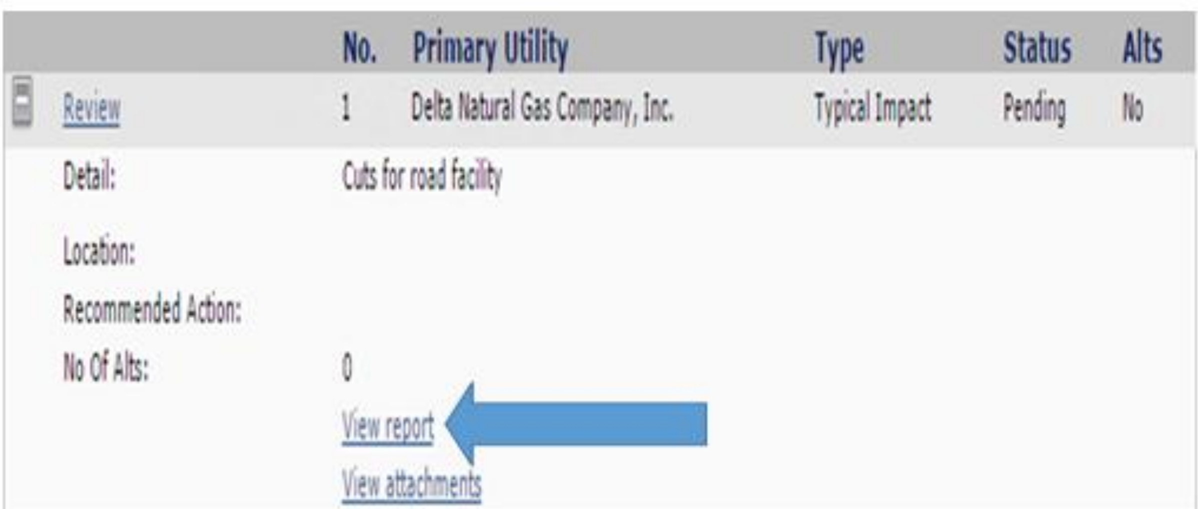
The UCM contains a list of conflicts and their resolution alternatives, which provides valuable data for the project team. As the project progresses in development, the project team may use this environment to:

- Log potential conflicts
- Denote conflicts that need additional field investigation (i.e.,subsurface utility engineering) to confirm
- Once confirmed, propose alternate resolutions
- Track resolutions to completion

This UCM data is accessible in multiple ways to best suit the user's role in the process. UCM data is accessible as follows:

Individual Conflict Analysis – Users can access utility conflict and resolution data by selecting the conflict matrix button on the coordinationpage of the KURTS project. Users may make contributions at any point in the project's development and execution, and may download the conflict report into a file which can be shared with others. To do so, users select the "View report" link on the expanded conflict as shown in the image below.

Expanded Conflict-View Report

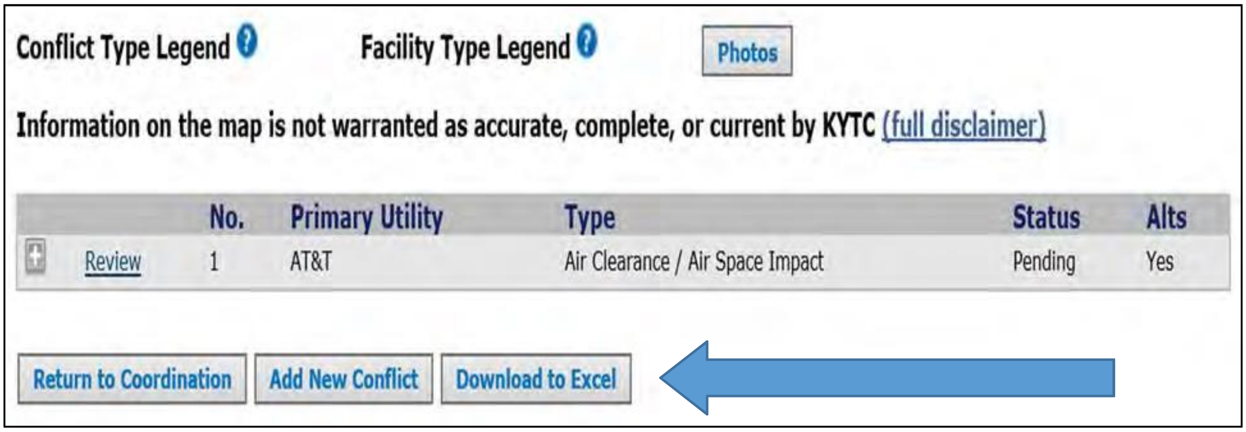


LEVERAGING THE UCM DATA (CONT.)

Project Conflict Report – The project's entire list of conflicts may be downloaded into an Excel report file which can then be shared with others.

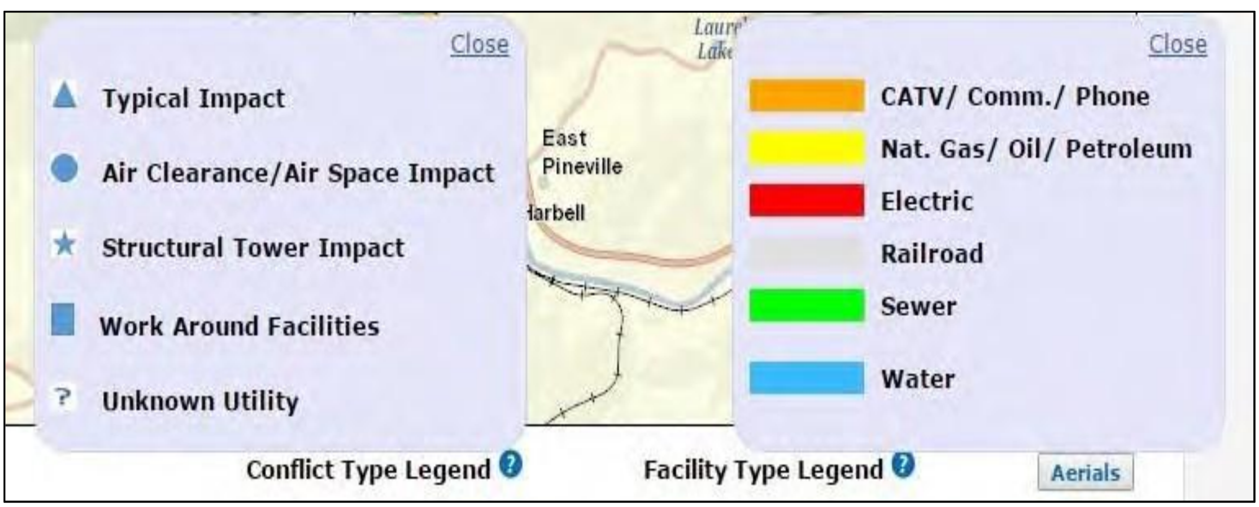
Note: This report does not provide the resolution alternatives in the download.

Conflict Report



Spatial Conflict Data – The project's entire list of conflicts is viewable in KURTS by selecting the conflict matrix button on the coordination page ofthe KURTS project and viewing the map. KURTS uses the utility conflict color coding as defined by the American Public Works Association. KURTSalso adds symbology to aid in identifying conflict types using the followinggraph.

Data Conflicts



LEVERAGING THE UCM DATA (CONT.)

The spatial conflicts may be imported from KYTC's enterprise database intothe project's MicroStation design files.

Note: The spatial locations of the conflicts are GPS-collected locations andare not survey quality.

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