Integration of Utility Coordination and Highway Design

Shani Montes Victorio

Follow this and additional works at: https://lib.dr.iastate.edu/creativecomponents

Part of the Construction Engineering and Management Commons

Recommended Citation
Montes Victorio, Shani, "Integration of Utility Coordination and Highway Design" (2021). Creative Components. 772.
https://lib.dr.iastate.edu/creativecomponents/772

This Creative Component is brought to you for free and open access by the Iowa State University Capstones, Theses and Dissertations at Iowa State University Digital Repository. It has been accepted for inclusion in Creative Components by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Integration of Utility Coordination and Highway Design

by

Shani Alexandra Montes Victorio

A Creative Component submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Civil Engineering (Construction Engineering and Management)

Program of Study Committee:
Roy E. Sturgill, Major Professor
Jennifer Shane, Committee Member
Omar G. Smadi, Committee Member

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this creative component. The Graduate College will ensure this creative component is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University
Ames, Iowa
2021

Copyright © Shani A. Montes Victorio, 2021. All rights reserved.
DEDICATION

I would like to dedicate this work to my beloved mom, Nancy Victorio Vasquez, whose unconditional love has always been my source of motivation to keep me moving forward. This work is also dedicated to my aunt Elizabeth Victorio Vasquez, who has provided me constant support throughout my life, sharing her words of advice and encouragement to keep me working for my personal and professional goals. Last but not least, I would like to dedicate this work to my best friend, Ana Lucia Allende Chucya, whose emotional support has been fundamental for me to not give up on this journey.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter/Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF FIGURES</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>NOMENCLATURE</td>
<td>viii</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>x</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>xi</td>
</tr>
<tr>
<td>CHAPTER 1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Problem Statement</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Research Objectives</td>
<td>2</td>
</tr>
<tr>
<td>1.3 Research Significance</td>
<td>3</td>
</tr>
<tr>
<td>1.4 Organization of Report</td>
<td>3</td>
</tr>
<tr>
<td>CHAPTER 2. LITERATURE REVIEW</td>
<td>5</td>
</tr>
<tr>
<td>2.1 Local Level Review – Kentucky Transportation Cabinet</td>
<td>5</td>
</tr>
<tr>
<td>2.2 National Level Review</td>
<td>14</td>
</tr>
<tr>
<td>CHAPTER 3. OVERVIEW OF THE KYTC HIGHWAY DESIGN AND UTILITY COORDINATION CURRENT PROCESSES</td>
<td>36</td>
</tr>
<tr>
<td>3.1 Review of the KYTC Highway Design Process</td>
<td>36</td>
</tr>
<tr>
<td>3.2 Review of the KYTC Utility Coordination Process</td>
<td>41</td>
</tr>
<tr>
<td>CHAPTER 4. DEVELOPMENT OF AN INTEGRATED APPROACH FOR THE UTILITY COORDINATION AND HIGHWAY DESIGN PROCESSES AT KYTC</td>
<td>48</td>
</tr>
<tr>
<td>4.1 Assessment of the Current Utility Coordination Approach in the Highway Design Process at KYTC</td>
<td>48</td>
</tr>
<tr>
<td>4.2 Potential Strategies to Improve Integration of Utility Coordination and Highway Design Processes at KYTC</td>
<td>55</td>
</tr>
<tr>
<td>4.3 Development of the Proposed Approach to better Integrate Utility Coordination and the Highway Design Processes at KYTC</td>
<td>59</td>
</tr>
<tr>
<td>CHAPTER 5. GUIDANCE DOCUMENT</td>
<td>63</td>
</tr>
<tr>
<td>5.1 Implementation of Recommended Strategies and Practices into KYTC Procedures</td>
<td>63</td>
</tr>
<tr>
<td>5.2 Utility Coordination Checklist</td>
<td>89</td>
</tr>
<tr>
<td>5.3 Roles and Responsibilities to Promote the Implementation of the Proposed Approach</td>
<td>92</td>
</tr>
<tr>
<td>5.4 KYTC Utility Companies’ Engagement Management and Communication Management Plan</td>
<td>112</td>
</tr>
<tr>
<td>CHAPTER 6. CONCLUSIONS</td>
<td>135</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.</td>
<td>STA Effective Utility Coordination Practices</td>
<td>13</td>
</tr>
<tr>
<td>Figure 2.</td>
<td>Utility Coordination Process – Indiana DOT</td>
<td>16</td>
</tr>
<tr>
<td>Figure 3.</td>
<td>Interaction between Designer and Utility Companies through the Utility Coordination Process</td>
<td>16</td>
</tr>
<tr>
<td>Figure 4.</td>
<td>Recommended Practices by Phase</td>
<td>27</td>
</tr>
<tr>
<td>Figure 5.</td>
<td>Work Breakdown Structure – KYTC Highway Design Process</td>
<td>37</td>
</tr>
<tr>
<td>Figure 6.</td>
<td>Gantt Chart - KYTC Highway Design Process</td>
<td>38</td>
</tr>
<tr>
<td>Figure 7.</td>
<td>Work Breakdown Structure – KYTC Utility Coordination Process</td>
<td>42</td>
</tr>
<tr>
<td>Figure 8.</td>
<td>Gantt Chart - KYTC Utility Coordination Process</td>
<td>43</td>
</tr>
<tr>
<td>Figure 9.</td>
<td>Utilities &amp; Rails Coordination Lifecycle relative to Highway Construction Project Lifecycle [19]</td>
<td>45</td>
</tr>
<tr>
<td>Figure 10.</td>
<td>Gantt Chart of the Current Alignment between the Highway Design Process and the Utility Coordination Process at KYTC</td>
<td>47</td>
</tr>
<tr>
<td>Figure 11.</td>
<td>Interaction between Designer and Utility Companies through the Utility Coordination Process – KYTC</td>
<td>51</td>
</tr>
<tr>
<td>Figure 12.</td>
<td>Categories of Recommended Strategies to be Incorporated into KYTC Procedures</td>
<td>59</td>
</tr>
<tr>
<td>Figure 13.</td>
<td>Flow Chart of the Alignment between the Highway Design Process and the Utility Coordination Process at KYTC – Current Approach</td>
<td>61</td>
</tr>
<tr>
<td>Figure 14.</td>
<td>Flow Chart of the Alignment between the Highway Design Process and the Utility Coordination Process at KYTC – Proposed Approach</td>
<td>61</td>
</tr>
<tr>
<td>Figure 15.</td>
<td>Gantt Chart of the Proposed Approach for the Integration of the Utility Coordination and Highway Design KYTC Processes</td>
<td>62</td>
</tr>
<tr>
<td>Figure 16.</td>
<td>Framework for Utility Companies' Engagement Management</td>
<td>113</td>
</tr>
<tr>
<td>Figure 17.</td>
<td>Impact / Interest Grid for Utility Companies' Engagement Prioritization</td>
<td>116</td>
</tr>
</tbody>
</table>
Figure 18. Utility Companies' Engagement Evaluation

Figure 19. Framework for Utility Companies' Engagement and Communication Management

Figure 20. Communication Priority Grid for Utility Companies' Engagement
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recommended State Utility Practices for Utility Coordination Process</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Best Practices to Improve KYTC Utility Coordination Process – Utility Relocation Task Force</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Utility Relocation Best Management Practices (BMPs) and Incentives</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>Primary Reasons and Responsible Party for Major Delays at KYTC</td>
<td>53</td>
</tr>
<tr>
<td>5</td>
<td>KYTC Utility Coordination Checklist</td>
<td>90</td>
</tr>
<tr>
<td>6</td>
<td>KYTC Utility Coordination Checklist - Continued</td>
<td>91</td>
</tr>
<tr>
<td>7</td>
<td>Utility Companies' Engagement Management Matrix</td>
<td>121</td>
</tr>
<tr>
<td>8</td>
<td>Utility Companies' Communication Management Matrix</td>
<td>128</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
<td></td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>Area Coordinator</td>
<td></td>
</tr>
<tr>
<td>BMPs</td>
<td>Best Management Practices</td>
<td></td>
</tr>
<tr>
<td>CAP</td>
<td>Communicate All Promises</td>
<td></td>
</tr>
<tr>
<td>CM</td>
<td>Construction Manager</td>
<td></td>
</tr>
<tr>
<td>CSF</td>
<td>Critical Success Factors</td>
<td></td>
</tr>
<tr>
<td>DES</td>
<td>Design Executive Summary</td>
<td></td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transportation</td>
<td></td>
</tr>
<tr>
<td>DRB</td>
<td>Dispute Review Board</td>
<td></td>
</tr>
<tr>
<td>FDOT</td>
<td>Florida Department of Transportation</td>
<td></td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
<td></td>
</tr>
<tr>
<td>FONSI</td>
<td>Finding of No Significant Impact</td>
<td></td>
</tr>
<tr>
<td>GDOT</td>
<td>Georgia Department of Transportation</td>
<td></td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
<td></td>
</tr>
<tr>
<td>ICT</td>
<td>Illinois Center for Transportation</td>
<td></td>
</tr>
<tr>
<td>InDOT</td>
<td>Indiana Department of Transportation</td>
<td></td>
</tr>
<tr>
<td>JUM</td>
<td>Joint Utility Meeting</td>
<td></td>
</tr>
<tr>
<td>KURTS</td>
<td>Kentucky Utilities and Rails Tracking System</td>
<td></td>
</tr>
<tr>
<td>KTC</td>
<td>Kentucky Transportation Center</td>
<td></td>
</tr>
<tr>
<td>KYTC</td>
<td>Kentucky Transportation Cabinet</td>
<td></td>
</tr>
<tr>
<td>NCHRP</td>
<td>National Cooperative Highway Research Program</td>
<td></td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
<td></td>
</tr>
<tr>
<td>PDM</td>
<td>Project Development Branch Manager</td>
<td></td>
</tr>
<tr>
<td>PDT</td>
<td>Project Development Team</td>
<td></td>
</tr>
<tr>
<td>PennDOT</td>
<td>Pennsylvania Department of Transportation</td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td>Project Engineer</td>
<td></td>
</tr>
<tr>
<td>PL&amp;G</td>
<td>Preliminary Line and Grade</td>
<td></td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>PM</td>
<td>Project Manager</td>
<td></td>
</tr>
<tr>
<td>PS&amp;E</td>
<td>Plans, Specifications, and Estimate</td>
<td></td>
</tr>
<tr>
<td>QLA</td>
<td>Quality Level A</td>
<td></td>
</tr>
<tr>
<td>QLB</td>
<td>Quality Level B</td>
<td></td>
</tr>
<tr>
<td>QLC</td>
<td>Quality Level C</td>
<td></td>
</tr>
<tr>
<td>QLD</td>
<td>Quality Level D</td>
<td></td>
</tr>
<tr>
<td>ROW</td>
<td>Right of Way</td>
<td></td>
</tr>
<tr>
<td>RRT</td>
<td>Rapid Response Team</td>
<td></td>
</tr>
<tr>
<td>SAC</td>
<td>Study Advisory Committee</td>
<td></td>
</tr>
<tr>
<td>SHRP</td>
<td>Strategic Highway Research Program</td>
<td></td>
</tr>
<tr>
<td>SHA</td>
<td>State Highway Agency</td>
<td></td>
</tr>
<tr>
<td>SMEs</td>
<td>Subject Matter Experts</td>
<td></td>
</tr>
<tr>
<td>STA</td>
<td>State Transportation Agency</td>
<td></td>
</tr>
<tr>
<td>SUE</td>
<td>Subsurface Utility Engineering</td>
<td></td>
</tr>
<tr>
<td>TRB</td>
<td>Transportation Research Board</td>
<td></td>
</tr>
<tr>
<td>TxDOT</td>
<td>Texas Department of Transportation</td>
<td></td>
</tr>
<tr>
<td>UA</td>
<td>Utility Agent</td>
<td></td>
</tr>
<tr>
<td>UBM</td>
<td>Utilities and Rails Branch Manager</td>
<td></td>
</tr>
<tr>
<td>UCM</td>
<td>Utility Conflict Matrix</td>
<td></td>
</tr>
<tr>
<td>UCS</td>
<td>Utility Companies</td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>Utility Supervisor</td>
<td></td>
</tr>
<tr>
<td>WBS</td>
<td>Work Breakdown Structure</td>
<td></td>
</tr>
</tbody>
</table>
ACKNOWLEDGMENTS

I would like to thank my Major Professor, Dr. Roy E. Sturgill, for being a wonderful and supportive adviser; without him, this research would not have been possible. I would also like to extend my sincere thanks to my committee members, Dr. Jennifer Shane and Dr. Omar Smadi, for their guidance and support throughout the course of this research.

In addition, I would like to thank Dr. Timothy Taylor (University of Kentucky), PE. Jennifer McCleve (Kentucky Transportation Center), PE. Jeff Jasper (University of Kentucky), PE. Kenny Franklin, and other members of the KYTC Study Advisory Committee (SAC) for their technical guidance, support, and direction throughout the development of this research.

Finally, but not less important, I would also like to take this opportunity to thank my friends (Linnel Ballesteros, Alanna Costas, Fabrice Basema, and Tarig Omer), colleagues, the department faculty, and staff for making my time at Iowa State University a wonderful and unforgettable experience. Their endless support in and outside of graduate research and willingness to participate in my observations is greatly appreciated.
Utility relocations have been cited as one of the main causes of highway project construction delays. Research and practice suggest that these delays can be alleviated with early coordination, partnership, and enhanced communication. As in other states, utility work associated with highway projects presents many challenges to the Kentucky Transportation Cabinet (KYTC), who has funded this project to investigate how to improve the integration between the utility coordination and highway design processes in KYTC projects. To achieve this objective, the research team (1) mapped and analyzed the KYTC current highway design and utility coordination processes, (2) conducted a comprehensive literature review to evaluate and determine utility coordination strategies to be incorporated into the KYTC’s current procedures, (3) developed a proposed approach to improve the alignment and the integration between the utility coordination and highway design processes, (4) defined specific roles and responsibilities for implementing the proposed integrated approach, and (5) developed a guidance document to assist in the implementation of the proposed approach. All this work has been conducted in a collaborative effort with the KYTC Study Advisory Committee, who has provided feedback to validate the applicability of the research findings in KYTC projects. The findings of this research effort include different utility coordination strategies and practices grouped into seven categories - (1) change of mindset – partnership, (2) early involvement of utility companies in the design process, (3) aligned project goals, (4) management of communication and utility companies’ engagement, (5) increased use of SUE, (6) use of Utility Conflict Matrices, and (7) constructability reviews – that are the base of the proposed approach to improve the integration between the utility coordination and highway design processes at KYTC.
CHAPTER 1. INTRODUCTION

1.1 Problem Statement

Time delays in highway construction projects have become a common issue that represents a significant annoyance to the public. Utility relocations are frequently cited as one of the main causes of delaying the construction of highway projects. Unfortunately, it has become common to require utility relocations of utility companies late in the highway design process, which is partly the cause for these delays. Better incorporation of the utility coordination process into the transportation design process is necessary, with early involvement being most critical [1]. As in other states, utility work associated with highway projects presents many challenges to the Kentucky Transportation Cabinet (KYTC). Research and practice have demonstrated that many potential utility conflicts can be identified and resolved earlier in the design process. KYTC's past projects have shown that information on the location of utility facilities is not adequately available at this stage, so while efforts are made to avoid utility relocations, they often become necessary due to a lack of information when it is needed [2]. The time and budget spent identifying, evaluating, and managing utility conflicts that appear in the final design stage of the project also is problematic because they were not previously considered and can significantly impact KYTC project's outcomes. In the last few years, several State Transportation Agencies (STA's) have been working successfully to develop strategies to improve the efficiency of their utility coordination processes. Based on these efforts and their results, national perceptions have been changing in how we should work with those facilities that have historically been viewed as obstructions to highway improvement projects. Therefore, the Cabinet has identified the need to redefine utility companies from obstacles to partners in the highway project development process and improve the integration of utility coordination.
activities within the highway development process in KYTC projects. This situation led to the problem statement for this study - How can the integration of utility coordination activities into the highway design process be improved in KYTC projects?

1.2 Research Objectives

The primary objective of this research project was to develop and propose a new approach to better integrate the utility coordination and highway design current procedures of the KYTC transportation projects. To accomplish this research goal, the research team established the following objectives:

1) Map and analyze the KYTC current highway design process and utility coordination process to identify the project's stages that can be improved through modifications in the procedures or implementation of recommended practices known by its effectiveness to enhance utility coordination in other State Transportation Agencies.

2) Determine and evaluate applicable strategies that can be tailored to the KYTC's current procedures for engaging utility companies in the early stages of the project development.

3) Develop a proposed alignment that better aligns utility coordination milestones with the project development process milestones to improve both processes' integration.

4) Define specific roles and responsibilities for implementing the proposed integrated approach to provide guidance for those who participate in the design and delivery of KYTC transportation projects.

5) Prepare and develop guidance that includes information on the implementation of the proposed approach for the integration of utility coordination and highway design in KYTC projects, roles and responsibilities of projects participants, effective identification and management of utility-related risks through Utility Conflict Management (UCM),
and the strategic use of Subsurface Utility Engineering (SUE) at the optimum stages of the project development process.

1.3 Research Significance

Development of guidance for the implementation of a new approach to better integrate the utility coordination and highway design procedures of the Kentucky Transportation Cabinet will allow KYTC personnel to incorporate recommended practices and strategies to improve utility coordination, and more importantly, the project delivery outcomes. The guidance intends to highlight the potential benefits of viewing utility coordination as an opportunity to work in partnership with utility companies during the highway project development. The guidance is geared to generate a change in the mindset of those who participate in the delivery process of transportation projects at KYTC; and it will be a useful tool for KYTC personnel, especially utility coordination staff, project designers, project managers, surveyors, ROW managers, and construction staff, who will be the primary users. The main deliverable of this creative component will be the development of a guidance document that will be part of the Integrated Project Development Guidance Document of the KYSPR 20-581 research project, which is expected to be implemented through a concurrent effort developing a Utility Coordination Training and Certification Program for the Cabinet. Besides, it might also serve as a reference to other STAs, many of whom are currently making efforts to improve the effectiveness of their utility coordination processes.

1.4 Organization of Report

This report is divided into six chapters that organize, illustrate, and describe the steps taken to meet the defined research objectives. Following Chapter 1: Introduction, Chapter 2: Literature Review provides an overview of recommended practices and strategies for utility
coordination based on different local and national research findings. Chapter 3: Overview of KYTC Highway Design and Utility Coordination Current Processes, describe and illustrate the process followed to map and analyze the current alignment between the highway design and utility coordination procedures in KYTC transportation projects. Chapter 4: Development of an Integrated Approach for the Utility Coordination and Highway Design Processes at KYTC details how the recommended practices and strategies were tailored and integrated into the KYTC current processes in order to develop a proposed approach to better align the highway design and utility coordination processes. Chapter 5: Guidance Document presents the developed guidance for the implementation of the proposed approach, which includes descriptions of the recommended practices of the integrated approach, specific roles and responsibilities for KYTC projects' participants, and guidance on management of utility companies engagement through a communication management plan. Chapter 6: Conclusions provides a summary of the tasks accomplished and the ongoing data development. Finally, supporting materials used in the development of this research are contained within the appendices.
CHAPTER 2. LITERATURE REVIEW

This chapter of the report describes different existing strategies and practices that can be used to improve utility coordination in transportation projects. These practices were gathered from a literature review that included local (Kentucky Transportation Cabinet-level) and national research findings. To determine the most adequate sources of information, the list of relevant utility-related synthesis, research, and implementation projects developed in the TRB Centennial Paper titled *Strategic Research Needs in the Area of Utilities* [3] has been considered. The following section will present the literature review findings organized in two sections: the local and national levels.

2.1 Local Level Review – Kentucky Transportation Cabinet

This review level has included the findings of some utility-related research projects conducted at the Kentucky state level and other national research projects where KYTC has participated along with other states. The Kentucky Transportation Cabinet has been making substantial changes to its utility coordination process over the past several years [1]. It initiated a task force to review and accumulate tools for improved utility coordination and relocation, developed some research projects in collaboration with the Kentucky Transportation Center (KTC) to streamline the utility process, and participate in a pilot project for one of the products of SHRP 2 R15B, the utility conflict matrix (UCM) [1]. The results of these research efforts are presented in this section. However, unlike the section for the national level review, this section has been described in more detail because it describes some strategies and practices already identified to improve utility coordination and the problems affecting this process in KYTC projects. It was necessary to collect this information to understand and identify the utility coordination improvement needs at the Cabinet.
Managing utilities located within or near road rights-of-ways usually presents challenges to State Transportation Agencies. The Kentucky Transportation Cabinet is not an exception since utility-related work in its highway projects has usually presented many challenges. During the design stage, KYTC makes the necessary efforts to inform project teams of potential utility conflicts, but often, minimal data is available at this stage. KYTC personnel work to avoid utility relocations, but they often become necessary. The Cabinet recognized the right of the owner/operators; therefore, they must engage them and implement strategies to support a more collaborative work for utility relocations. Thus, the KYTC needs better methods to estimate the time and risks associated with relocations [2].

The results of this investigation are several recommendations to improve the interaction between KYTC and utility companies (UCs) that will enhance better communication and, therefore, stronger coordination between them. To identify the practices that the Cabinet could adopt to streamline its utility coordination process, the research team conducted surveys and interviews with KYTC engineers and utility companies. Their feedback was critical because they are familiarized with the current KYTC processes and issues related to utility relocation. The findings of these interviews and surveys indicated that some options to improve relocations are related to the aspects discussed in Table 1.

Table 1. Recommended State Utility Practices for Utility Coordination Process

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Recommended Practices</th>
</tr>
</thead>
</table>
| Training | • Provide training to project managers and other design team personnel on utility issues.  
          • Provide training in highway plan reading to UCs.  
          • Train consultants and UCs in 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 on-site 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 and inform them about the proposed project and send preliminary plans early in the project development process.

### Right-of-Way (ROW)

- Use utility corridors for utility crossing major highways.
- Acquire sufficient ROW properties for utility purposes.
- Define utility corridors during the project design.

### Subsurface Utility Engineering (SUE)

- 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 QLB 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.

- DOTs share annual bills and monthly schedules with UCs and provide them incentives for early relocation.

| Technical Tools | • Use of 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.  
• Use of marker technology and field marking: The main problem of using this tool is including inaccurate and incomplete field markings in the project information.  
• Use of 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) also identified the major delays responsible for delaying utility relocations in KYTC projects. The fifteen major reasons for delays are listed as follow:

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 Utilities
12. Limitations on utility design consultant capacity
13. Short time frame for state transportation agency to plan and design the projects
14. Utility companies are giving low priority to utility relocation.
15. Rework required/change orders.

**Utility Relocation Task Force**

As this research project was developed, KYTC commissioned a Utility Relocation Task Force. This task force intended to review utility relocation procedures at KYTC and define and implement practices that will streamline utility relocation process in transportation projects. 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 maintain communication throughout the project development. Part of the objectives of this task force was mapping and reviewing KYTC’s processes for utility planning and relocation, which was depicted in three flowcharts, presented in Appendix A of this report. Similarly, another important outcome of this Task Force was a list of potential best practices for improved utility coordination process. These practices are described in Table 2.

Table 2. Best Practices to Improve KYTC Utility Coordination Process – Utility Relocation Task Force

<table>
<thead>
<tr>
<th>Best Practices</th>
<th>Description &amp; Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earlier and Enhanced Utility</td>
<td>KYTC's previous approach for project development considers few interactions with UCs until later in the design process when funding is authorized for utility relocations. By this point, decisions regarding</td>
</tr>
<tr>
<td>Coordination and Involvement</td>
<td></td>
</tr>
</tbody>
</table>
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. Involving UCs earlier in the process may require enhanced coordination and communication. UCs are typically left out of the decision-making process.

**Benefits:** Early UCs involvement will allow designers to make reasonable efforts to minimize utility impacts since it will let them make informed decisions about project siting. It can also help to improve workflows and streamline utility relocations processes.

<table>
<thead>
<tr>
<th>Emphasize Strategic Avoidance in Project Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designers would use a more context-sensitive design approach. They should be more mindful of current utility placement.</td>
</tr>
<tr>
<td><strong>Benefits:</strong> Let the design team modify the project design to avoid or minimize effects on existing utilities without sacrificing safety or project functionality.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strategic and Routine Communication between KYTC and UCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>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. The recommendation states that communication must be routine and conducted on a district-by-district basis.</td>
</tr>
<tr>
<td><strong>Benefits:</strong> Frequent communication among KYTC and UCs will be a mutual benefit for both. It will allow keeping them informed on the project activities.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Develop and Offer training to the Use SUE, Utility Specific Plan Reading, and the Coordination of Project Design, Utilities, and Right-of-Way</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>Benefits:</strong> Help project designers improve how they visualize utilities' location that may be affected by different implementation scenarios</td>
</tr>
</tbody>
</table>
and eliminate potentially costly errors. Besides, having a mutual understanding among all project participants regarding their responsibilities increases the odds for successful project completion.

| **Coordinated Statewide Electronic Management System for Utilities and Relocations** | A highlighted 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 to streamline the establishment of agreements between KYTC and UCs.

**Benefit:** Reduce the amount of time needed to execute design and relocation agreements. |

Some significant conclusions of the task force include the following:

- Training STA designers and utility owners could develop a comprehensive knowledge of utility relocation.

- Improving interaction early in the utility relocation process can boost collaboration on the analysis of potential design solutions for utility conflicts and open communication lines between KYTC and UCs.

- Holding meetings during the preconstruction and construction phases will allow KYTC and UCs to 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.

- It would be beneficial for UCs that KYTC shares with them long-term budget plans and schedules.

- KYTC has not developed a utility impact matrix to facilitate utility relocation.
• SUE has not been adopted by both KYTC and 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**

The Kentucky Transportation Cabinet has been investing tens of millions 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 the design stage of transportation projects [4]. Moreover, considering that there are 12 separate KYTC Districts, the process of identifying and managing utility locations was inconsistent. Thereby, KYTC began developing a new vision for its utility program, which ended up in the development of the Kentucky Utilities and Rails Tracking System, widely known as KURTS. KURTS is a database that allows utility and design subject matter experts to access project information remotely and securely with just an internet connection [2]. This database was designed to retain historical records of all documents and provides different options, such as approval of relocation plans, agreements, invoices, change orders, and project status changes. Moreover, KURTS allows its users to interact with the utility conflict matrix (UCM) in more helpful ways for all project participants.

As part of the FHWA/AASHTO Implementation Assistance Program, seven state DOTs, including KYTC, implemented R15B products (utility conflict data model and database and utility conflict matrix training course). As a result of this implementation, KURTS Release 2 was developed. This version of KURTS includes cost comparisons and schedule impacts, providing KYTC decision-makers a better perspective of the potential impacts to the project. The potential
users for implementing R15B2 products in KYTC are utility matter experts, design matter experts, project consultants, and utility companies. During the implementation of R15B products, the research team noticed that developing a standardized and technologically based system in an industry with few standards protocols is a challenge for the transportation agency. 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** [1]

This report aimed to capture the state of the practice regarding utility coordination, its effectiveness, and how recent utility coordination research has been implemented. The primary method to achieve this objective was a survey of STAs, which was complemented with a literature review on areas related to utility coordination, focusing on the SHRP 2 utility products, and some interviews with six states, including Kentucky. Through the survey results, 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. Some additional practices identified in this report are presented in Figure 1.

![Figure 1. STA Effective Utility Coordination Practices](image-url)
2.2 National Level Review

*Optimizing Utility Owner Participation in the Project Development and Delivery Process* [5]

Effective communication, cooperation, and coordination among utility stakeholders are critical to keeping transportation projects on schedule [5]. Unfortunately, these elements are frequently lacking during project delivery to adopt cost-effective solutions strategies. This usually happens because there is a lack of familiarity with project managers about utility issues, project uncertainties that lead to utility owners nonparticipating earlier in the process, and lack of adequate utility facility data [6]. This research aimed to develop strategies to improve the participation and response of utility owners in the project development and delivery process.

Based on the literature review, the research team developed 64 potential strategies (24 strategies for communication and coordination, 17 strategies for contracts and agreements, 19 strategies for utility data collection and management, and 4 strategies for training) to improve utility owner participation in the project development and delivery process at TxDOT. These strategies were organized into four groups as listed below:

- **Modernization of the utility process:** The research team developed three flowcharts with different detail levels 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 and respective materials).

- **Streamlining and standardization of utility cost data submission:** The research team prepared a prototype Microsoft excel-based template with integrated worksheets. This tool
intends to assist utility owners during the preparation and submission of standardized utility cost estimates.

- **Core skill training on utility topics**: The research team developed a list of potential training needs on utility matters at TxDOT. They also identified specific core skills that can be used as a reference for the training courses.


During the last years, due to the importance of utility facilities for the communities they serve, different Departments of Transportations (DOTs) have been making efforts to change how they should work with these facilities that have been considered for a long time obstructions in highway projects. Among all these DOTs, the work that the Indiana Department of Transportation (InDOT) has been performing can be considered a benchmark for demonstrating how careful the integration of these project partners can reduce the project's risks and streamline the delivery process. They have been encouraging a change in mindset, with the mantra "everyone knows where everyone goes," to promote collaborative work between the project team and utility companies during the project delivery process.

The research team has reviewed the current guidance for utility coordination in this Department of Transportation, specifically Chapter 104: Utility Coordination [7]. This guidance manual describes not only each stage of the utility coordination process but also the roles and responsibilities of the project participants. This review process has helped the research team identify the practices that InDOT applies for utility coordination. Figure 2 portrays the main
stages of the InDOT utility coordination process. A detailed depiction of each stage of this process is presented in Appendix B of this report.

The research team has noticed some positive aspects in how its utility coordination process is integrated into the project development process, which allows the designer to make informed design decisions. The following figure depicts the interaction between the designer and the utility companies through the utility coordination process.

Some other important takeaways regarding utility coordination identified from the revision of this guidance are listed as follow:
• Coordination with utility companies should begin as soon as a project scope has been developed and must continue throughout construction until utility work has been completed.

• The design process should occur simultaneously with the utility coordination process and integration of utility accommodation.

• The designer should be familiarized with all aspects of the utility coordination process. Active involvement of the designer with the utility companies and the utility coordinator throughout the design of the project can avoid later utility – relocation issues and make a difference in the successful completion of the project (on time and within budget).

• Throughout the utility coordination process, the designer's goal must be to minimize the number of utility conflicts while considering the design goals (safety, project budget, and project schedule) of the transportation project.

_The Root Causes of Delays in Highway Construction_ [8]

This paper summarizes some of the findings from NCHRP 20-24(12) "Avoiding Delays During the Construction Phase of Highway" [9]. The intent of NCHRP 20-24 was to find apparent and root causes of time delays during the construction phase of highway construction projects; and provide recommended practices, procedures, methods that can be used by State Highway Agencies (SHAs) and contractors to avoid these delays and to mitigate their impacts and the associated costs. The findings of this research were the result of a nationwide study that included on-site visits to six states (California, Florida, Georgia, New York, South Carolina, and Wisconsin); a survey of SHAs, highway contractors, and design consultants; and an analysis of project records to identify the most frequent reasons for construction delays.

The literature review results and the survey distributed to SHAs, highway contractors, design consultants, and other professional organizations allowed the research team to identify the
root causes of highway construction delays, which are described in Appendix C of this report. Besides, 40 recommendations were developed and classified into five broader categories, as listed below:

a) Recommendations related to SHA business practices and procedures:
   - Embrace the widely accepted costs-time influence that states that more effort in planning and design will lead to cost and time savings in construction.
   - Develop a time classification scheme that should be applied to each project based on the project's time sensitivity.
   - Develop an SHA employee evaluation procedure that includes time accountability.
   - Encourage the widespread use of innovative contracting practices to promote constructability and timely completion.
   - Take advantage of the Dispute Review Boards' (DRB) experience and expertise to obtain recommendations relative to specific problems.

b) Recommendations related to contractor procurement and contract administration:
   - Award a single, two-phase contract.
   - Require that contractors have key planning documents approved prior to commencing the work.
   - Allow flexible start dates to allow contractors to select the most convenient date to start a project (within a specific time window) to make more effective use of critical sources.
   - Make use of right-of-way or lane rentals.
   - Assign liquidated damages to intermediate project.
   - Develop designer and contractor responsibility procedures that include time accountability.
• Encourage and accept time-reduction proposals.
• Make an annual award for the best-designed and executed project.
• Assign a senior project manager to lead the team.
• Develop an overall project schedule and monitor the scheduling priority.
• Make effective use of pre-bid meetings and walk-downs (site visitations during the design phase).
• Organize a rapid response team (RRT).
• Develop a training course on contract interpretation and administration.
• Revise project closeout procedures to limit the number of punch lists.

c) Recommendations related to injecting construction input into the design:
• Make more effective use of formal constructability reviews.
• Use a construction manager (CM) 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 by various SHAs.

d) Recommendations related to utility locations and relocations:
• Use of 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 on how utility information is conveyed. These standards should include details on quality levels, information, symbols, etc.
• Relocated utilities using specialty subcontractors.
• SHAs loan monies to the municipality until their funding request is approved.

e) Recommendations related to contractor management:

• Use A+B bidding or establishing a fixed completion.
• Hire or retain a CM or use the DRB to review the project.
• Provide contract language requiring schedule updates at regular monthly intervals.
• Develop guidelines or standards of practice on how to critique a project schedule.
• Make use of alternate scheduling methods.
• NCHRP should develop guidelines on the use of linear schedules and promote their use.
• Contractors are required to develop their own maintenance of traffic plans.

**Best Management Practices and Incentives to Expedite Utility Relocation** [10]

This research project, funded by the Illinois Center for Transportation (ICT), intended to investigate, identify, and recommend best management practices (BMPs) and incentives that the ICT can use to expedite the utility relocation process and minimize any delays that can affect its completion. The results of this research effort were 45 Best Management Practices and Incentives identified. These BMPs and incentives were organized and grouped as shown in Table 3.

Table 3. Utility Relocation Best Management Practices (BMPs) and Incentives

<table>
<thead>
<tr>
<th>Best Management Practices and Incentives (45)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordination Practices (5)</td>
</tr>
<tr>
<td>• Coordination, cooperation, and communication</td>
</tr>
<tr>
<td>• Utility coordination councils</td>
</tr>
<tr>
<td>• Designated utility coordinator</td>
</tr>
<tr>
<td>• Multi-level Memorandum of Understanding</td>
</tr>
<tr>
<td>• Utility coordination during construction</td>
</tr>
</tbody>
</table>
### Financial Incentives (6)
- Cash Bonuses
- Incentives / Disincentives
- Cost-sharing
- No-Excuse Incentives
- Contractor – provided financial incentives
- Gainshare – Pain share

### Practices Requiring Cost (10)

#### IT Solutions:
- Utility Cost Database
- Electronic Utility Permits
- Utility Coordination Websites
- Electronic Document Delivery

#### Field Solutions:
- Subsurface Utility Engineering
- 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 of Existing Tunnels for Utilities
### Administrative:

- One-Call System
- Utility Conflict Matrix
- Advance Relocation of Utility Work
- Utility Training Classes
- Standardized Estimate/Bid Forms
- Standardized Invoice Submissions
- Value Engineering for Utilities
- Avoidance for Utility Relocation
- Modernization of Utility Processes
- Utility Manuals
- Context-Sensitive Design
- Simplified permit Approvals for Utilities

---

**Utility Location and Highway Design** [11]

This report, developed through the National Cooperative Highway Research Program (NCHRP), describes current practices in use by transportation agencies for management of utilities during the project development process. It included information on where in the process the utility impacts should be assessed and relocation decisions made, and how design decisions are influenced by utilities [11]. To achieve this objective, the research team conducted a comprehensive literature review, distributed surveys to the DOTs of the 50 states, Puerto Rico, District of Columbia, and 9 Canadian provincial transportation agencies, and conducted interviews and three case studies (Georgia, Virginia, and Pennsylvania DOTs). Regarding best practices for management of utilities, the research team developed a list of best practices that have an application, even if minor, to the "relocation versus design-to accommodate" decision process. These practices are listed as follow:

- Train project managers and design team personnel on utility issues.
- Train consultant and utility companies' staff in topics related to coordination processes and issues.
• Consider paying the utility relocation design cost regardless of prior rights to maintain coordination between available space and project timing.

• Consider task-order contracts, including experts on utility and highway design matters, 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 different tools such as Google Earth, roadway video logging, and GIS systems to access early visualization of utilities in the planning stage.

• Include a utility expert on the design team early in the process and keep him or her 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 on the project as the design progresses.

• Develop or encourage using a GIS system for storage, management, and gathered utility information purposes.

• Require utilities to install radio frequency identification markers or nonmetallic utilities.

• Develop a database of historical utility relocation costs to improve the accuracy of the 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 in alternate design alternatives.
• Develop a screening tool to assist the process of 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 any necessary coordination.

• Provide training in highway plan reading to utility companies personnel.

• Review and ensure that all guidance documents do not conflict with each other.

The results of the survey and the case studies are presented in Appendix D.

**FHWA's Highway/Utility Guide** [12]

The Federal Highway Administration published this guidance in 1993 to provide comprehensive useful information on highway/utility issues matters. This report is a collection of good practices that can provide insight into current utility practices for highway agencies, utility companies, and their employees. In this project, the research team pointed out that a successful highway project requires the participation of everyone present in the right-of-way of the project. All parties with facilities within the right-of-way should have the opportunity to examine and consider the impact of proposals affecting that ROW [12]. The recommendations developed by the research team for highway agencies are described below:

• Share the highway improvement program with all relevant stakeholders.

• Include all construction and maintenance work in the highway improvement program. The plans should be at least for the next two years with longer time frames (5-6 years).

• Hold meetings (at least once per year) with utility companies and highway personnel to discuss upcoming project development and construction activities.
• Notify utility owners of projects as early as possible before the design phase.
• Route plans of highway projects to utility owners for comment during the design phase.
• Determine the impact of all projects on other facilities in or adjoining the right of way.
• Set meetings between highway project team and utility owners prior to each major phase of a transportation project, including planning, design, and construction.
• Identify and resolve conflicts prior to construction.
• Share construction schedules with utility companies.
• Provide one point of contact in the agency to work with utility company representatives from inception to completion of the project.
• Publish maps each year showing municipality, county, state highway agency, and utility projects.
• Publish detailed descriptions of projects, including project schedules, managers, and contact information.

Similarly, the recommendations developed for utility companies are:

• Develop a utility master plan in conjunction with other public planning efforts.
• Provide capital improvement programs to highway agencies.
• Review and updated utility system plans continually; it would be recommended every two to five years and then 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 for future work on utility conflict resolutions.
• Seek to minimize the impact of utility facilities on highways with high traffic volumes, few alternative routes, or limited right of way.

**SHRP2 Report S2-R15-RW** "**Integrating the Priorities of Transportation Agencies and Utility Companies**" [13]

The purpose of this report was to document current practices, opportunities for improvement, and anticipated barriers for integrating utility and transportation agency priorities in highway renewal projects. Utility issues have been considered one of the major causes of delays. Some of the 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 utility companies [13]. The results showed that there are universal core deficiencies in DOT – UC coordination. They both agreed that the most common difficulties that usually affect timely relocations are insufficient communication, scheduling, and coordination in planning, ROW acquisition, design, and construction phases. A summary of the findings regarding these issues is presented in Appendix E. The results also showed that to improve their performance, both DOTs and UCs need to resolve the fundamental issues by applying the following best practices:

1. Advance relocation of utility work
2. Early involvement of utilities in planning and design phase
3. Training of DOT designers on utility relocation process
4. Development of a geographic information system database
5. Preconstruction and progress meetings
6. Incentives for early relocation
7. Development of Utility and ROW Management Systems

8. Inclusion of utility relocation work in construction contract

9. Subsurface Utility Engineering

10. Utility coordination meetings held during design phase

11. SUE rating procedures

12. Hire a work site utility coordination supervisor

These best practices can be applied in different phases of the whole project life cycle, as shown in the following figure:

![Recommended Practices by Phase](image)

Figure 4. Recommended Practices by Phase

Also, the researchers noticed that successful implementation of these strategies would require four important initiatives, listed below:

- DOTs and UCs must operate as a team (Partnership).
- View utility in highways ROW as a DOT responsibility.
• Mutual understanding of the technology and business process of the other half between DOTs and UCs. Be able to speak the other's language.
• Improve location methods and mapping technologies.

**SHRP 2 Report S2-R15B-RW-1 "Identification of Utility Conflicts and Solutions" [14]**

This project was created to continue the research effort of SHRP 2 in the project on resolutions of utility conflicts developed in SHRP2 Report S2-R15-RW [13]. This report intended to provide comprehensive, optimized concepts and procedures for identifying and resolving utility conflicts in the highway project development process. This study revealed that there are different procedures that involve the use of Utility Conflict Matrices (UCM) that vary widely across the country [14]. The research team documented these procedures and then developed optimized UCM concepts and techniques compiled in a 1-day training course. The main products of this research project were:

• **Product 01: Contact standalone UCM spreadsheet.**

  This is a stand-alone product developed in Microsoft Excel format. The UCM spreadsheet includes a main utility conflict table and a supporting worksheet that can be used to analyze different alternatives for utility conflict resolution strategies by tracking utility conflict data and associated information. To develop this product, the research team conducted a survey and follow-up interviews to gather positive and negative lessons learned and recommendations from the interviewed DOTs. Based on the information collected, the research team developed the following recommendations for the management of utility conflicts:
  
  o Identify utility conflicts at the individual utility facility involved.
  
  o Include control dates in UCMs.
  
  o Keep in mind potential environmental implications related to utility relocations.
- Use utility engineering groups at state DOTs and utility coordinating councils.
- Develop utility conflict sheets for individual utility owners.
- Keep UCMs simple
- Maintain the UCM updated 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**

  This product is a scalable representation of 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 intends to help end-users to adopt the tools and strategies developed through the first two products. This training course includes the lesson plan and presentation materials to help with the implementation of the products of the research project.
• **Product 04: Implementation Guidelines**

These guidelines include a series of specific steps for implementing the products, including identifying the implementation team, training courses of UCM, and detailed activities to implement products 01 and 02.

**Avoiding Utility Relocations** [15]

In 2002, the Federal Highway Administration (FHWA) developed this manual to encourage highway designers to avoid unnecessary utility relocations while working on the design process. The research team identified the value of avoiding relocations on highway transportation projects and the technologies and techniques that can be used to accomplish this goal. Historically, information on utility facilities is taken into account in the highway plans development at the 60% design stage with the intent to identify the utility conflicts that will require relocation. Unfortunately, at this point, there is not much that can be done to avoid or alleviate the conflict [15].

The alternatives found in this project indicate that identifying potential conflicts as early as possible – at the 30% design stage or sooner, can allow finding more creative solutions for utility conflicts. In order to enable the design team to design around utilities, having information on utilities location is necessary. This project lists practices that support the collection of accurate and comprehensive subsurface utility information and promote effective communication and coordination among highway agencies and utility companies through the project life cycle. Based on these practices, the report developed a list of strategies for different stages of the highway project, such as meetings, utility coordination councils, one-call notifications, Subsurface Utility Engineering (SUE), utility agreements, cost-sharing, joint project agreements, context-sensitive design, locate next to ROW, trenchless technology, use of utility tunnels, use of subways for dry
lines, and removal of abandoned facilities. Also, some of the most important takeaways of this research project are:

- Conflicts between utility facilities and the alignment, geometry, grade, and drainage of an improvement highway project are too frequent.
- Utility conflicts are considered one of the most common causes of delays to highway contractors. Not having access to accurate and comprehensive information on utility location and the lack of communication and coordination between project participants are contributors to problems in highway projects.
- Identifying potential utility conflicts early in the development of highway projects to find the most efficient and cost-effective resolution alternative during the design stage is fundamental for project success.
- Designers should use SUE to obtain accurate quality of subsurface utility information in highway plans and to manage that information during the development of the project. Efficient use of this information will allow designers to design around as many utilities as possible and so avoid relocations without affecting project safety and functionality.
- Having good communication and coordination between the highway agencies and utilities is necessary throughout the development and construction of the project. The idea of designing projects without involving utility companies and then relocating those utility facilities in conflict has to change. Considering utility companies' input early in the development of the design may result in minor design changes to avoid relocations; otherwise, significant plan changes that subsequently cause costly, time-consuming, and unnecessary relocations will be necessary.
In 2002, the American Society of Civil Engineers published *The Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data* [16] to provide a system of classifying the quality of data associated with existing subsurface utilities. This guideline was developed to help its 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. Some important takeaways of this document are:

- The engineer should advise the project owner regarding potential risks that the project may represent to existing subsurface utilities and analyze the project needs to recommend a scope for utility investigations. The engineer should also discuss deliverables' formatting and the sequence of acquiring the data during the planning and design stage. He or she should participate in reviewing plans as the design progresses and design changes are made. When necessary, the engineer should advise any upgrade in quality level.

- The project owner should specify and discuss the work scope and the deliverables' formatting for the engineer. The project owner should also discuss the adequate quality levels with the designer, constructor, and other users.

- Regarding quality levels:
  - **Quality Level D:** The engineer will research utility records to help utility owners identify facilities that the project may impact. Some sources that can be used for this quality level are previous construction plans in the proximity, conduit maps, distribution maps, as-builts, and record drawings, etc.
o **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, can consult with utility owners.

o **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 within the project area. Then, the engineer has to interpret the surface geophysics and mark any indication of utilities for a subsequent survey. It is also responsibility of the engineer to survey all markings that indicate the presence of a subsurface utility and depict all designated utilities correlating the results with existing utility records.

o **Quality Level A:** The engineer must perform the task for Quality Level B and select the appropriate level 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 and other quality levels information. For this quality level, the engineer must determine, horizontal and vertical location of the top/or bottom of the utility, elevation of the existing grade over the utility, the outside diameter of the utility, the material composition of the utility structure, the benchmarks and/or project datum used to determine elevations, paving thickness and type, general soil type and site conditions, and any other pertinent information.

**AASHTO Strategic Plan "Right of Way and Utilities Guidelines and Best Practices"** [17]

In 2000, the U.S. Department of Transportation and the Federal Highway Administration, through the subcommittee on Right of Way and Utilities of AASHTO, developed a report named
"Utilities Guidelines and Best Practices" with the intent to present different best practices for handling utilities. These best practices were grouped in four guidelines, as listed below:

1) Use current available technology to the greatest extent possible.
   - Use SUE for projects where underground utilities are presented, and high-quality information is necessary for design purposes. Ensure depiction of utility facilities at appropriate quality levels.
   - Require utility company certification of record drawings and encourage the development of CAD database system.
   - Expand use of GIS for utility mapping purposes.

2) Encourage frequent coordination and communication with local government agencies to reduce delivery time, 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 utility companies to reduce delivery time, costs and improve the utility process quality.
   - Provide utility owners with long-range highway construction schedules.
   - Host meetings with utility companies to discuss future highway projects.
   - Recognize how important is long-range highway/utility coordination. Consider using long range-planning meetings to discuss other highway/utility issues.
   - Organize periodic meetings with utility companies within the highway planning region.
   - Request information on utility companies' capital construction programs (potential expansions or reconstructions) and look for opportunities to coordinate overlapping projects. There could be opportunities to minimize costs and public impact.
• Provide utility companies with a notice of proposed highway improvements and preliminary plans early in the project development process.

• Involve utility companies in the design phase, especially when major relocations are anticipated.

• Conduct on-site 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 utility owners. Involve them in determining potential needs for right-of-way acquisition.

• Invite utility companies to participate in pre-construction meetings, encourage them, contractors, and project staff to regularly hold meetings during the construction phase.

4) Improve contract, internal project development, and training processes to expedite utility relocation.

• 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 change late in the process.

• Use highway contractors to relocate utility and municipal facilities when possible.

• Acquire enough right-of-way for utilities purposes.

• Provide training sessions to DOTs utility and utility companies staff.
CHAPTER 3. OVERVIEW OF THE KYTC HIGHWAY DESIGN AND UTILITY COORDINATION CURRENT PROCESSES

To accomplish objective number one of this research project, the research team conducted a search and review of different published information on the highway design and utility coordination processes at KYTC. The research team began with a detailed review of the official written procedures of both processes, the KYTC Highway Design Guidance Manual [18] and the KYTC Utilities & Rails Guidance Manual [19]. This information was complemented with other published research projects developed by the KYTC and KTC.

3.1 Review of the KYTC Highway Design Process

The primary source of information on the highway design process was the KYTC Highway Design Guidance Manual [18]. The second chapter of this guidance document describes the administrative procedures of the highway design process, primarily through its sections (202) Pre-design activities, (203) Preliminary Design, and (204) Final Design. A complementary source of information for this review was the report of the research project Critical Path for Project Development [20] developed by the Kentucky Transportation Center. In its Appendix A, this report presents a work – activities glossary that describes each activity of the KYTC project development process. Based on that information, the research team developed the first two deliverables of this research effort, the Work Breakdown Structure (WBS) and the Gantt Chart of the KYTC Highway Design Process, illustrated in Figures 5 and 6, respectively. The WBS intended to identify all the activities that are part of the design process. As shown in Figure 5, the WBS has been organized hierarchically with three levels of organization, as described below:

- **Level one**: Illustrates the KYTC Highway Design Process.
• **Level two:** Illustrates the summary levels (the pre-design, preliminary design, and final design stages).

• **Level three:** Illustrates the work package level, including all the activities of the highway design process.

Figure 5. Work Breakdown Structure – KYTC Highway Design Process
<table>
<thead>
<tr>
<th>ITEM</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>PRE DESIGN STAGE</td>
</tr>
<tr>
<td>1.1.1</td>
<td>Highway Plan Development and Approval</td>
</tr>
<tr>
<td>1.1.2</td>
<td>Field Research in the Project Footprint</td>
</tr>
<tr>
<td>1.1.3</td>
<td>Special Scoping Development</td>
</tr>
<tr>
<td>1.1.4</td>
<td>Preliminary Project Preliminary Design and Siting Information</td>
</tr>
<tr>
<td>1.1.5</td>
<td>Existing Planning Information Assessment</td>
</tr>
<tr>
<td>1.1.6</td>
<td>Project Planning Needs Identification</td>
</tr>
<tr>
<td>1.1.7</td>
<td>Additional Project Mapping Request</td>
</tr>
<tr>
<td>1.1.8</td>
<td>Project Existing Data Analysis</td>
</tr>
<tr>
<td>1.1.9</td>
<td>Project Existing Data Needs Identification</td>
</tr>
<tr>
<td>1.1.10</td>
<td>Project Team Assembling</td>
</tr>
<tr>
<td>1.1.11</td>
<td>Scope Verification Meeting</td>
</tr>
<tr>
<td>1.1.12</td>
<td>Design Consultant Selection / Negotiations and Contract Approval</td>
</tr>
<tr>
<td>1.1.13</td>
<td>Pre-Design Meeting</td>
</tr>
<tr>
<td>1.2</td>
<td>PRELIMINARY DESIGN</td>
</tr>
<tr>
<td>1.2.1</td>
<td>Purpose and Need Statement Development</td>
</tr>
<tr>
<td>1.2.2</td>
<td>Begin Public Information Plan Development</td>
</tr>
<tr>
<td>1.2.3</td>
<td>Further Refine Project Scope</td>
</tr>
<tr>
<td>1.2.4</td>
<td>Notice to Proceed</td>
</tr>
<tr>
<td>1.2.5</td>
<td>Additional Mapping Request (if required)</td>
</tr>
<tr>
<td>1.2.6</td>
<td>Environmental Overview</td>
</tr>
<tr>
<td>1.2.7</td>
<td>Public Meeting &amp; Stakeholders Meeting #01</td>
</tr>
<tr>
<td>1.2.8</td>
<td>Range of Alternatives Development</td>
</tr>
<tr>
<td>1.2.9</td>
<td>Early Evaluation of Alternatives</td>
</tr>
<tr>
<td>1.2.10</td>
<td>Evaluate Environmental Issues and Impacts</td>
</tr>
<tr>
<td>1.2.11</td>
<td>Initiate Writing of Draft E.A.</td>
</tr>
<tr>
<td>1.2.12</td>
<td>Alternative Study &amp; Screening</td>
</tr>
<tr>
<td>1.2.13</td>
<td>Evaluation of Alternatives (SMEs)</td>
</tr>
<tr>
<td>1.2.14</td>
<td>Project Team Meeting / SMEs Present Results of Investigations</td>
</tr>
<tr>
<td>1.2.15</td>
<td>Scope of Impacts Discussion</td>
</tr>
<tr>
<td>1.2.16</td>
<td>Public Involvement</td>
</tr>
<tr>
<td>1.2.17</td>
<td>Stakeholders Meeting #02</td>
</tr>
<tr>
<td>1.2.18</td>
<td>Public Meeting #02</td>
</tr>
<tr>
<td>1.2.19</td>
<td>Alternative Review &amp; Screening</td>
</tr>
<tr>
<td>1.2.20</td>
<td>Avoidance, Minimization and Mitigation Opportunities</td>
</tr>
<tr>
<td>1.2.21</td>
<td>Preliminary Line &amp; Grade Meeting</td>
</tr>
<tr>
<td>1.2.22</td>
<td>Compile Draft Environmental Assessment</td>
</tr>
<tr>
<td>1.2.23</td>
<td>EA Submittal, Review and Approval</td>
</tr>
<tr>
<td>1.2.24</td>
<td>Public Hearing</td>
</tr>
<tr>
<td>1.2.25</td>
<td>Selected Alternative Confirmed</td>
</tr>
<tr>
<td>1.2.26</td>
<td>Draft and Submit DES</td>
</tr>
<tr>
<td>1.2.27</td>
<td>Draft FONSI Preparation</td>
</tr>
<tr>
<td>1.2.28</td>
<td>Design Executive Summary (DES) Approval</td>
</tr>
<tr>
<td>1.2.29</td>
<td>Final Environmental Document Approval</td>
</tr>
<tr>
<td>1.2.30</td>
<td>FONSI / Notice of Availability</td>
</tr>
<tr>
<td>1.3</td>
<td>FINAL DESIGN</td>
</tr>
<tr>
<td>1.3.1</td>
<td>Subsurface Utility Information &amp; Coordination</td>
</tr>
<tr>
<td>1.3.2</td>
<td>Drainage Design &amp; Preliminary Drainage Folder Submittal</td>
</tr>
<tr>
<td>1.3.3</td>
<td>Pavement Design</td>
</tr>
<tr>
<td>1.3.4</td>
<td>roadway Design</td>
</tr>
<tr>
<td>1.3.5</td>
<td>Utility Relocation Analysis</td>
</tr>
<tr>
<td>1.3.6</td>
<td>Geotechnical Investigation Request</td>
</tr>
<tr>
<td>1.3.7</td>
<td>Traffic Control Devices</td>
</tr>
<tr>
<td>1.3.8</td>
<td>Roadway Sign Concepts</td>
</tr>
<tr>
<td>1.3.9</td>
<td>Roadside Safety Design</td>
</tr>
<tr>
<td>1.3.10</td>
<td>Access Management</td>
</tr>
<tr>
<td>1.3.11</td>
<td>Traffic Management Plan Development</td>
</tr>
<tr>
<td>1.3.12</td>
<td>Intersection Design</td>
</tr>
<tr>
<td>1.3.13</td>
<td>ROW Layout / Revisions</td>
</tr>
<tr>
<td>1.3.14</td>
<td>Erosion Control Plan Development</td>
</tr>
<tr>
<td>1.3.15</td>
<td>Final Survey</td>
</tr>
<tr>
<td>1.3.16</td>
<td>Right-of-way Inspection</td>
</tr>
<tr>
<td>1.3.17</td>
<td>Pavement Design Submittal</td>
</tr>
<tr>
<td>1.3.18</td>
<td>Final Joint Inspection</td>
</tr>
<tr>
<td>1.3.19</td>
<td>Drainage Inspection</td>
</tr>
<tr>
<td>1.3.20</td>
<td>Final Inspection Report</td>
</tr>
<tr>
<td>1.3.21</td>
<td>Advance Folder Drainage Submittal</td>
</tr>
<tr>
<td>1.3.22</td>
<td>Final Right-of-way Plans Submittal</td>
</tr>
<tr>
<td>1.3.23</td>
<td>Final Processing and Letting</td>
</tr>
<tr>
<td>1.3.24</td>
<td>Final Structure Design Plans Review</td>
</tr>
<tr>
<td>1.3.25</td>
<td>Final Design Plans &amp; Specifications Submittal</td>
</tr>
<tr>
<td>1.3.26</td>
<td>Final Processing and Letting</td>
</tr>
</tbody>
</table>

**Key Decision Points**

**Figure 6. Gant Chart - KYTC Highway Design Process**
Once the WBS of the highway design process was completed, the research team had all the design development process activities identified. The next step was identifying the sequence between these activities, which was portrayed in a Gantt Chart (Figure 6). The research team noticed that the narratives of the manual provide indications of when activities are supposed to take place, but that depiction is not always clear, making it difficult to understand the sequence that the design process activities follow. However, the manual also provides two flowcharts that the research team used to understand how this process flows. These flowcharts are presented in Appendix F of this report. The Gantt Chart allowed depicting the sequence that the activities of the design process follow considering their alignment within the percentages intervals that the research team set up within the design development process.

As shown in Figure 6, the preliminary design stage and the final design stage were divided into percentage intervals considering three milestones at 30%, 60%, and 80% design complete. The KYTC Highway Design Guidance Manual does not describe the design process using percentage information. It describes the process based on the preliminary and final design stages. The only percentage data the research team found in the manual was that the Final Joint Inspection occurs at approximately 80 percent of the design stage. That made it a little difficult to locate each activity within the percentage intervals set up. However, the research team found some percentage data in the report of the research project Tools for Applying Constructability Concepts to Project Development (Design) [21]. This report indicates that the Preliminary Line and Grade occurs approximately when 30 to 40 percent of the design is complete. At this time, alternative alignments are selected, the preliminary plans show a general layout for the proposed alignment, and the environmental documents have been approved. It also indicates that the Final Joint Inspection meeting is generally held when between 75 to 90 percent of the
design is complete, matching with the percentage (80%) that the KYTC Design Guidance Manual states. These few percentage facts were used to set up the percentage intervals within the KYTC design development process. Some other complementary sources of information used by the research team to understand how the KYTC design development process works are:

a) The Flow Chart number 2 developed in the research project *Methods to Expedite and Streamline Utility Relocation for Road Projects* [2], presented in Appendix A

b) The Flow Chart developed in the research project *Critical Path for Project Development*, that can be found in the Kentucky Transportation Center Webpage

(http://ktc.uky.edu/ismyprojectonschedule/)

The Gantt Chart presented in Figure 6 also shows the following activities highlighted in 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 (iii)
- Design Executive Summary (DES) Approval
- Final Joint Inspection

Four of these activities (i, ii, iii, iii) were highlighted because they are the four key decision points in the preliminary design stage where significant design decisions for the project are made. The other ones were highlighted because they represent significant milestones in the design process. A further explanation of the importance of these activities will be discussed later in this report.
3.2 Review of the KYTC Utility Coordination Process

Similarly, the research team conducted a review of the KYTC Utility Coordination Process. To conduct this review, the research team began by reviewing the KYTC Utilities & Rails Guidance Manual [19], which is the primary source of information on this procedure. Chapters five through eighteen in the guidance manual describe the whole utility coordination process, which was analyzed in detail by the research team. As mentioned before, this research project has considered the utility coordination process at the Indiana DOT as a benchmark for demonstrating how careful the integration of the DOTs and utility companies can reduce the project's risks and streamline the delivery process. Thus, the review process of the KYTC utility coordination procedure required analyzing it in the same way as the analysis for the InDOT utility coordination process was conducted, which is presented in Appendix B of this report. This analysis allowed the research team to identify some aspects that can be improved in the utility coordination process at KYTC. This analysis is presented in Appendix G. Some complementary sources of information used by the research team were the flowcharts developed as part of the project Critical Path for Project Development [20] and the flowcharts developed in the research project Methods to Expedite and Streamline Utility Relocation for Road Projects [2]. Based on the information collected, the research team developed the Work Breakdown Structure and the Gantt Chart for the KYTC Utility Coordination Process, both presented in Figures 7 and 8, respectively. As shown in Figure 7, the WBS has been organized hierarchically with three levels of organization, as described below:

- **Level one:** Illustrates the KYTC 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 7. Work Breakdown Structure – KYTC Utility Coordination Process
## KYTC 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 & PROGRAMMING 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 Brain 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)

### 2.3 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 Joint Utility Meeting

| 2.3.4 Request of Utilization of a Consultant Engineer
| 2.3.5 Engineering Agreements and Authorization

### 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 Assess Improvement Needs - Agreements
| 2.4.5 Utility Relocation Review and Coordination
| 2.4.6 Approve Company Submissions
| 2.4.7 Class A - Estimates Determination
| 2.4.8 Calculate 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 Preliminary 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 8. Gantt Chart - KYTC Utility Coordination Process
As in the review of the design process, the intent of the WBS of the Utility Coordination Process (Figure 7) was to identify all the activities that are part of this process at KYTC. Once all the activities were identified, the Gantt Chart (Figure 8) was developed to depict the sequence that the process follows. Even though the narratives of the manual provide indications of when activities are supposed to take place, it was necessary to use additional sources of information to understand how the process flows, such as the flowchart I developed in the research project *Methods to Expedite and Streamline Utility Relocation for Road Projects* [2] and presented in Appendix A. The Gantt Chart of the utility coordination process (Figure 8) shows the following tasks highlighted in yellow:

- Initial Contact Letter
- Utility Contact List Development
- U-Phase Funding Authorization
- Project Authorization Letter
- Joint Utility Meeting (JUM)
- Utility Relocation Proposal Package Submittal

These tasks were highlighted because they represent important milestones for the utility coordination process. A further explanation of the importance of these activities will be described later in this report.

### 3.3 Current Alignment between the Highway Design Process and the Utility Coordination Process at KYTC

Once the KYTC highway design process and the utility coordination process were reviewed individually, the next step was to understand how both processes work together. That
is, how the activities of the utility coordination process are integrated into the design process. During the review of the Highway Design and the Utilities and Rails Guidance Manuals, the research team noticed that there is not much specific information about the alignment of both processes. One of the references provided by those guidance manuals is the following figure:

![Figure 9. Utilities & Rails Coordination Lifecycle relative to Highway Construction Project Lifecycle][19]

The KYTC Utilities and Rails Guidance Manual [19] states that the Request of Funding for utility relocations occurs around the same time or after the final right-of-way plans are submitted and the right-of-way funds are approved. It also states that the estimates for utility relocations are periodically reviewed and updated at different milestones in the process, as described below:

- **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 proposal to the Cabinet, and the utility agent (UA) approves it.

That information was complemented with Flow Chart number 2, presented in Appendix A of this report, to help the research team to understand how the utility coordination activities are aligned within the design development process. Based on that, the research team developed the Gantt Chart of the Current Alignment between the Highway Design Process and the Utility Coordination Process at KYTC, illustrated in Figure 10. This Gantt Chart depicts the current alignment of the highway design process and the utility coordination process, not only locating the utility coordination activities within the preliminary and final design stages but also within the percentage intervals (30%, 60%, and 80%) set up in the design development process. The activities highlighted in orange are the ones that the guidance manuals provide information that helped to understand this alignment. It is important to mention that the actual project development process can deviate from the general process portrayed in Figure 10, depending on the specific characteristics and requirements of each KYTC project. Besides, throughout the development of the WBSs and the Gantt Charts, getting and incorporating feedback from the KYTC Study Advisory Committee (SAC) and different Subject Matter Experts (SMEs) was necessary to validate the information portrayed in the deliverables. Thus, the research team held several virtual meetings with the SAC to assess the WBSs and Gantt Charts. Those meetings allowed the research team to get the necessary feedback that included comments and corrections that were addressed to develop the final versions of the deliverables presented in this report.
Figure 10. Gantt Chart of the Current Alignment between the Highway Design Process and the Utility Coordination Process at KYTC
CHAPTER 4. DEVELOPMENT OF AN INTEGRATED APPROACH FOR THE UTILITY COORDINATION AND HIGHWAY DESIGN PROCESSES AT KYTC

This chapter intends to address objective number 3 of this research project. In the previous chapter, the highway design process and utility coordination process were portrayed together by developing a Gantt Chart (Figure 10) of the current alignment between both processes in KYTC transportation projects. The next step was to evaluate the integration of both processes to determine what can be improved by incorporating the utility coordination management practices identified through the literature review and then propose a new approach to better integrate the highway design and utility coordination processes. The following sections of this chapter describe in detail how the research team developed this new integrated approach.

4.1 Assessment of the Current Utility Coordination Approach in the Highway Design Process at KYTC

The first step to assess the current utility coordination approach in the highway design development process was to evaluate the current alignment between both processes. As shown in the Gantt Chart of the KYTC Utility Coordination process (Figure 8), some tasks were highlighted in yellow. These tasks were highlighted because they are critical documents and/or milestones in the utility coordination process; therefore, the research team paid special attention to them during this assessment. A brief description of each of these tasks, according to the KYTC Utilities and Rails Guidance Manual, is presented below:

- **Initial Contact Letter:** Once a road project is identified, the utility agent (UA) or project engineer (PE) prepares and mail or email an initial contact letter to each utility company that may have facilities within the project area. This letter intends to notify utility companies of the proposed project construction and its potential impact on their facilities.
• **Utility Contact List Development:** The KYTC Utilities and Rails Guidance Manual [19] states that there are two contact lists. The General Contact List, which shall include all utility owners identified within the district, and the Project-Specific Contact List, which includes all utility companies within the project area.

• **U-Phase Funding Authorization:** Funding request packages are submitted through the Kentucky Utility and Rail Tracking System (KURTS) and shall include, at minimum, Class A, B, or C estimates. Then, the package is 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 state letter. This letter is issued by the Utility Supervisor (US) once the appropriate funding is secured and sent to the utility companies whose facilities may be affected by the highway project. The project authorization letter authorized the utility or rail company to proceed with the preliminary and planning services.

• **Joint Utility Meeting (JUM):** The JUM is the first official meeting of potentially affected utility companies with the district staff. According to the guidance manual, this meeting is 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 utility companies to identify and resolve conflicts with their relocation plans.
  
  e) Identify reimbursable and nonreimbursable 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 both compensable and noncompensable utility relocations. Prompt submission of these packages is critical for the Cabinet to ensure that all relocated facilities avoid physical conflicts with the road project, avoid conflicts with other relocated facilities, and comply with Cabinet utility accommodation policy. Only reimbursable utility companies are responsible for submitting both detailed relocation plans and cost estimates.

Based on these descriptions provided by the KYTC Utilities and Rails Guidance Manual, the research team identified some important takeaways:

- After sending the Initial Contact Letter, the next official contact with utility companies is the Joint Utility Meeting. This meeting is scheduled through the Project Authorization Letter, which is issued once the appropriate funding is secure. The utility funding authorization is issued simultaneously or shortly after the Right-of-way authorization, which is issued after the Final Joint Inspection when the design is 80% complete. That means that according to the guidance manual, the first official meeting of the district staff with utility companies is held when the design is around 80% complete.

- According to the guidance manual, the required results of a successful JUM are addressing all the applicable JUM purposes previously described above, convey pertinent project data and material, develop the project utility contact lists in KURTS, identify any needs to foster utility relocations, and schedule any necessary future meeting. That means
that according to the guidance manual, the Cabinet staff wait until holding the JUM (design is 80% complete) to officially work collaboratively with the utility companies to identify facility conflicts with the highway design, examine potential resolutions or define possible relocation to address these conflicts, look for minor highway redesign options to minimize utility relocations, and look for any utility data needs that can be addressed with SUE or surveying. However, by this point, decisions regarding design and main alignments have already been made, making possible design changes quite costly and potentially leading to project delays. Literature review on recommended utility coordination practices indicates that identifying potential conflicts as early as possible (at the 30% design stage or sooner) can allow finding more creative solutions for utility conflicts. So, the Cabinet should consider engaging utility companies and working collaboratively with them way earlier than the JUM. The following figure illustrates what was explained in this bullet point.

![Diagram](image)

**Figure 11. Interaction between Designer and Utility Companies through the Utility Coordination Process – KYTC**
Section UR-803 of the KYTC Utilities and Rail Guidance Manual states that during the JUM, “…the 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. [19]” That means that according to the written procedures, inputs and feedback from UCs on the accuracy of the facilities plotted on the plans are received later in the design development process. Getting feedback on the accuracy of the plans late in the process can cause the designer to not have the appropriate information to make informed decisions during the highway design development.

Section UR-803 of the KYTC Utilities and Rail Guidance Manual also states that “Identifying utility facilities conflicts at a 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.” That means that the efforts during this meeting focus on planning relocations design rather than looking for opportunities to avoid, minimize, or mitigate utility conflicts. This could make sense because avoiding utility conflicts at this stage of the process may require major design changes that usually lead to delays in the design delivery. According to the literature review, that is something that also happens in other states. Designers usually develop the design, and when utility conflicts arise, they just ask utility companies to get out of the way, making utility relocations necessary.

In addition to these takeaways, the research team also took into account the findings of the research project Methods to Expedite and Streamline Utility Relocations for Road Projects.
[2] to assess the current utility coordination approach at KYTC. In this report, Sturgill et al. (2014) found through the applied survey that the major delays that UCs and KYTC utility supervisors view as most responsible for delaying utility relocations are the ones listed below.

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

Source: [2]

The report mentioned before also included the findings of the Right-of-way and Utility Relocation Task Force implemented by the Cabinet. A summary of the findings of this task force was presented in Chapter 2 (Table 2), but some important takeaways regarding the current approach for utility coordination at KYTC are listed below:
KYTC’s current model for project development involved few interactions with UCs until the design had advanced to the point that funding could be authorized for utility relocations. This authorization is usually issued after the Cabinet verifies that all aspects of a project comply with the National Environmental Policy Act (NEPA) regulations. However, by this point, many design decisions related to the design have been made, which means that introducing changes that could potentially affect right-of-way acquisition or design orders can result costly or cause delays to this juncture. So, the influence of UCs in the design decision-making process is limited.

There is a need to emphasize strategic utility conflict avoidance in project design in the Cabinet. However, designers must not adopt changes that would sacrifice safety or project functionality.

There is a need for strategic and routine communication between UCs and the Cabinet. This is that communication should be frequent and conducted based on each party’s needs. A 75 percent of KYTC design employees interviewed in this project felt the communication level was inadequate.

Interviewees and stakeholders observed that there are some areas that may need new training concepts to be implemented to improve project outcomes. These identified areas were a) the use of SUE; 2) conducting training or workshops focused on reading utility plans, and 3) training to coordinate project design, utility relocation, and ROW acquisition.

Training Cabinet designers and utility owners could develop a comprehensive knowledge of utility relocation.
• Improving interaction early in the utility relocation process can boost collaboration on the analysis of potential design solutions for utility conflicts and open communication lines between KYTC and UCs.

• There is a lack of communication, coordination, credibility, and trust among 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 both KYTC and UCs.

4.2 Potential Strategies to Improve Integration of Utility Coordination and Highway Design Processes at KYTC

This section of the chapter describes how the research team identified the potential strategies to be tailored and incorporated into the KYTC procedures to better integrate the utility coordination process and highway design process in Cabinet’s projects. To identify these utility coordination strategies, the research team evaluated the takeaways of the assessment described in the previous section (4.1). Based on the takeaways of this assessment and the utility coordination strategies identified through the literature review, the research team developed the following list of potential strategies that somehow address the identified improvement needs of the current utility coordination approach. These strategies are listed below:

• Involve utility coordination staff in the transportation planning phase.

• Include utility experts on the design team early in the process and keep them involved and informed as the design progresses.

• Involve utility companies early in the design phase, especially when major relocations are anticipated. Provide them with a notice of the proposed highway improvements and preliminary plans early in the project development process.
• Involve utility owners in the determination of right-of-way needs to ensure the acquisition of enough right-of-way for utility purposes.
• Allow all parties with facilities within the right-of-way to have the opportunity to examine and consider the impact of proposals affecting that ROW.
• Identify potential utility conflicts early in the highway project development to find the most efficient and cost-effective resolution alternative during the design stage and prior to construction.
• Send preliminary plans of the highway project to utility owners asking for feedback (on the accuracy of plans, identification of conflicts, and potential resolutions) during the early design phase.
• Meet with utility companies 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 utility owners to input relocation issues and do any necessary coordination. If necessary, meet individually with all utility owners. Utility coordination meetings held during the design phase are highly recommended, but another option could be holding a meeting prior to each major phase of the transportation project, including planning, design, and construction.
• Conduct plan-in-hand on-site meetings with utility owners to identify potential conflicts and find the appropriate resolutions.
• Use of SUE on all time-sensitive projects, on projects where underground utilities are presented, or high-quality information is necessary for design purposes. Ensure depiction of utility facilities at appropriate quality levels.

• Collect QLB and QLA data on all transportation projects that might involve utility adjustments. Collect QLB during the preliminary design phase. Use QLA, especially at key locations where there is a concentration of utilities or where critical utilities are located.

• Encourage designers to efficiently use SUE information to design around existing utilities and so 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 the state transportation agency and UCs.

• Maintain a lessons-learned database that should be shared among all districts.

• Develop standards of practice on how utility information is conveyed, including details on quality levels, information, symbols, etc.

• Provide one point of contact in the agency to work with utility company representatives from inception to completion of the project.

• Ask utility companies to establish and provide information of one point of contact for future work on utility conflict resolutions.
• Encourage the state transportation agency and utility companies to operate as a team (partnership).

• Provide training to project managers and design team personnel on utility issues and to consultant and utility companies’ personnel on topics related to coordination processes and issues and highway plan reading. Be able to speak the other’s language.

• Develop a standardized format for identifying and resolving utility conflicts as the design progresses.

• Conduct utility impact analysis at critical project development milestones.

To further evaluate the feasibility of the incorporation of these strategies into the KYTC procedures, the research team paid special attention to the strategies already identified in the research project *Methods to Expedite and Streamline Utility Relocations for Road Projects* [2] presented in Table 1, and the findings of the Utility Relocation Task Force described in Table 2 of this report.

One last important aspect regarding the identification of the potential utility coordination strategies to be implemented in the KYTC utility coordination process was the assessment of the practices identified in the InDOT utility coordination process. As mentioned before, the work on utility coordination that the Indiana Department of Transportation has been performing has been considered as a benchmark for this research project. InDOT has demonstrated how careful the integration of the state transportation agency and the utility companies can reduce the project's risks and streamline the delivery process. Therefore, this research team decided to take as a reference how the utility coordination and the project development processes are aligned in InDOT projects and also to consider the feasibility of incorporating some of the InDOT utility coordination practices in KYTC procedures.
4.3 Development of the Proposed Approach to better Integrate Utility Coordination and the Highway Design Processes at KYTC

Once the preliminary list of strategies was developed, the research team noticed that many of these strategies could be merged or grouped into higher-order categories. Thus, the preliminary list of strategies was narrowed to seven categories, which address the previously identified improvement needs and priorities of the KYTC utility coordination process. These categories are presented in the following figure:

![Figure 12. Categories of Recommended Strategies to be Incorporated into KYTC Procedures](image)

These seven categories of utility coordination strategies were the base for the research team to develop a proposed approach to better integrate the utility coordination process into the highway design development process. This proposed approach was developed by tailoring and incorporating the identified strategies into the utility coordination procedure and also suggesting a few modifications to the current alignment between the utility coordination and highway design milestones in KYTC transportation projects. To better depict the incorporation of these strategies and the suggested modifications, a flow chart that portrays the alignment between both processes was developed (Figure 13). This flowchart contains the same information as the Gantt Chart.
illustrated in Figure 10, just using another way of representation. Then, the research team developed the flowchart for the proposed approach, presented in Figure 14, which includes the recommended strategies and suggested modifications based on the seven categories mentioned above. As shown in Figure 14, this flowchart includes several yellow boxes that represent the changes that the new approach is proposing to achieve better integration of the utility coordination process and the highway design development process. A detailed description of each of these yellow boxes is presented in Chapter 5 of this report as part of the Guidance Document developed by the research team. It is important to mention that the modifications suggested by the research team are presented as "recommended practices" of utility coordination, but their application in KYTC transportation projects is highly encouraged. Moreover, the time frames considered in the Flowchart of the Proposed Approach are intended to serve as general guidelines. Each project and its circumstances may vary significantly, so it is not possible to suggest timeframes for each situation.

Once the flowcharts were developed, the research team conducted several meetings with the KYTC Study Advisory Committee to gather feedback regarding the proposed approach and validate the suggested modifications and incorporated strategies. The flowcharts presented in Figures 13 and 14 are the result of a process of getting feedback from the KYTC SAC and addressing the necessary comments and corrections. Lastly, in order to maintain the format of the depiction of the KYTC procedures, the research team portrayed the same information of the Flowchart of the Proposed Approach (Figure 14) in a Gantt Chart presented in Figure 15.
Figure 13. Flow Chart of the Alignment between the Highway Design Process and the Utility Coordination Process at KYTC – Current Approach

Figure 14. Flow Chart of the Alignment between the Highway Design Process and the Utility Coordination Process at KYTC – Proposed Approach
Figure 15. Gantt Chart of the Proposed Approach for the Integration of the Utility Coordination and Highway Design KYTC Processes
CHAPTER 5. GUIDANCE DOCUMENT

This chapter addresses objective 5 of this research project. As mentioned before, the main deliverable of this research effort is a guidance document to assist in the implementation of the recommended strategies and practices of the proposed approach to better integrate the highway design and utility coordination processes in KYTC projects. Intended users of this guidance document include but are not limited to design and utility coordination staff, ROW acquisition staff, utility owners, SMEs, consultants, contractors, etc. The guidance document has been organized into four sections, as listed as follow:

- Implementation of recommended strategies and practices into KYTC procedures.
- Utility Coordination Checklist.
- Roles and responsibilities to promote the implementation of the proposed approach.
- KYTC Utility Companies' Engagement and Communication Management Plan.

5.1 Implementation of Recommended Strategies and Practices into KYTC Procedures

This section of the guidance document should be read in accompaniment to the flowchart presented in Chapter 4, "Alignment between the Highway Design Process and the Utility Coordination Process at KYTC – Proposed Approach." (Figure 14). Comments presented below describe the proposed modifications which improve the alignment of the Kentucky Transportation Cabinet’s (KYTC) highway design and utility coordination processes. The proposed approach portrayed in the mentioned flowchart, and explained in these notes, has been developed by identifying and tailoring multiple strategies known for their success in improving the utility coordination processes of other State Transportation Agencies. The flowchart (Figure 14) and this section of the guidance document have alphabetical reference labels (i.e., (a), (b), etc.) to assist the reader in connecting them.
a) Foster a Change of Mindset, Embrace a New Culture: Work in Partnership

This recommendation aims to encourage stakeholders who work within KYTC projects to change their mindset and embrace a new culture. To achieve different results, process changes must occur. A willingness to embrace change will be fundamental in this new process. The idea of changing the mindset of KYTC personnel may seem daunting and lengthy, so this recommendation should be considered a long-term objective for the Cabinet. Embracing a new culture inside an organization takes time and adjustment. The research team believes that if Cabinet staff demonstrate a culture of partnership, internally and to utility companies, the proposed approach will benefit everyone (Cabinet, utility companies, and public). Partnership among all stakeholders will lead to more efficient transportation projects, and utility companies, among other stakeholders, will have improved responses in the projects to come. Each project will be a step in the change of mindset. The research team has compiled the following criteria to guide the proposed change of mindset:

- **Partnership:** Like a team, each project member plays a key role in completing their portion of the project. Some portions require collaborative efforts. To improve the utility coordination process, it is necessary to understand utility coordination as a series of collaborative steps within the transportation project development and delivery process, inclusive of operating in partnership with associated utility companies. It is important to note and take into account what is important to each project stakeholder, including utility companies, so there is a feeling of collaboration and partnership. The intent is to build and foster relationships that will lead to open lines of communication, trust, and partnership with utility companies.
• **Coordination, cooperation, and COLLABORATION:** When a project requires teamwork, as a transportation project does, it is important to understand and determine how the different functional groups will need to operate. Sometimes, the project team participants make efforts to coordinate and cooperate, but they do not achieve true collaboration. When a team coordinates, they exchange necessary information and resources to support each other's distinct goals. When a project team cooperates, the team members make the required coordinated efforts to perform their assigned portion of a shared process. They have a mutual objective, and their efforts are dependent on one another. When a project team collaborates, the team members show mutual engagement in a co-creative effort to achieve a shared goal. Each member brings a unique contribution to the whole project while respecting each other's contribution. KYTC and utility companies need to develop a collaborative relationship. There should be a mutual engagement of both parties to achieve successful utility coordination. Both KYTC and utility companies have their own contributions to make for the project, and co-creative efforts will obtain optimal project outcomes.

• **Early and proactive engagement of utility companies:** With earlier utility company partner engagement, better utility coordination outcomes are expected. The benefits of engaging utility companies early in the process have been proven. Throughout the development of a project, information and feedback from utility companies is a primary need and should be valued as project information in the same way as geometric data. It is more beneficial if this engagement occurs from the beginning of the project. Utility companies have a key role in the utility coordination process, and their proactive participation is fundamental for a project's success.
• **Create a sense of shared purpose:** A sense of shared purpose is vitally important for a project's success, especially when the project requires copious levels of collaboration. Delivering a transportation project necessitates the active collaboration of different functional groups (design team, utility staff, consultants, utility companies, etc.). Each group must understand the project goals and their functions clearly. It is also important to define the different functional groups' goals, ensure that they align with the project's general goals, and then communicate this shared vision to all project participants. This will lead to everyone working collaboratively toward the same goal.

• **Develop a sense of trust:** A lack of trust between the involved parties in a transportation project will negatively impact its outcomes. Developing a sense of trust is necessary to implement this proposed approach. KYTC staff and utility companies need to build trust-based relationships to achieve an actual shift of mindset and start working in true partnership. This does not mean that information such as letting dates will never change, but there should be open and consistent dialogue about priorities and related information as project details progress.

• **Strategic, timely, and frequent communication:** Communication needs are not the same for all the participants. They often vary throughout the project development process, and vary by project. Thus, KYTC utility coordination staff should make every effort to develop proper strategies to communicate effectively and ensure that information (project and utility) is shared frequently, openly, and in a timely manner. The strategies developed to manage communication in each project must meet the needs of all team members.

• **Consider Lessons learned:** Previous studies suggest that transportation agencies tend to believe that "best practices" stemming from research are not applicable to their specific
agency and therefore do not implement such strategies. The recommended approach is for KYTC to implement the suggested herein, yet document for themselves the lessons learned from the proposed changes. In doing so, the Cabinet will demonstrate to itself and verify what changes are actually work improving utility coordination and project development. This documentation also leads to continued improvement and agency buy-in of recommendations herein. This buy-in is the important first step to a shift in mindset and embracing a new culture.

Critical to the success of these recommended changes is the communication of this proposed approach and its recommended practices among all KYTC personnel and project stakeholders. Marketing a change that will yield benefits to all is fundamental to achieving an actual change in mindset.

**Highway Design Process**

**b) Begin Project Data Collection / Project Data Needs Identification**

Project data collection occurs during the pre-design stage of the project. During this stage, as much information as possible should be obtained regarding the existing infrastructure (e.g., record plans, management system reports, traffic data, crash data, project mapping, right of way, preliminary budget, existing geotechnical information, existing utility locations, and attributes). In this way, the project team begins to understand the project's 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 determine the appropriate and necessary strategies to meet those needs. In regard to project mapping and surveying needs, care should be taken to ensure sufficient coverage to avoid the need for subsequent mapping. An early understanding of
utility infrastructure is imperative to successfully meeting those needs with minimal impacts.

A live conversation with each existing utility owner can also help understand the nature of the facilities within the project area. This understanding is especially important for underground facilities. For example, does the 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 potentially their impacts if there are conflicts, will help in planning 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**

According to the KYTC Utilities and Rail Guidance Manual, within the preliminary design stage, four milestones - purpose and need, range of alternatives, the scope of impacts discussion, and selected alternative - are the key points where significant decisions related to the project design are made. Throughout these four points, the project scope is defined to develop a range of different alternatives, which impacts are then evaluated to narrow the alternatives and select the preferred alignment for the project. It is critical that the utility coordinator for the project be involved in these discussions and decisions.

**Integrating Utility Coordination:** The project team needs sufficient and accurate utility information (location and facility characteristics) to be able to design the alignment around existing utility facilities when feasible. Avoidance should be a priority (when feasible), followed by minimizing impacts and then working collaboratively to mitigate remaining impacts. Some might view these impacts as “utility conflicts,” when in fact, there would be no conflict if there was not a highway project. If the utility is in KYTC right-of-way, they are
likely permitted to be there, and the location is considered to be in the public (ratepayer/taxpayer) interest. As shown in the flow chart (Figure 13), the key decision points occur during preliminary design when the design plans are up to 30% - 40% complete. Therefore, identifying potential conflicts with utilities and contacting the involved utility companies should occur earlier in the process, if possible, as soon as the project scope has been defined. Given the importance of these key points in the conceptual design stage, accurate and sufficient information of utility facilities' location should be available in time to make informed decisions. The research team believes that as the preliminary alternatives are being developed and evaluated (30% design completed), the project team should have the existing utilities' horizontal locations (SUE QL-C minimally, SUE QL-B recommended where engineering requires it), facility attributes of size and material, and understand any 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 survey, SUE investigations, and utility companies' feedback. All this information will assist significantly in the roadway alternative decision-making process. As the project moves forward throughout these four key points, it is also recommended to consider the time and cost of utility impacts for each alternative when discussing alternative selection.

Further, it is recommended to consider "identification of utility conflicts avoidance alternatives" as a key decision point. It is imperative for the project's benefit that avoidance, minimization, or mitigation within the alternatives are evaluated early in the design process by the Project Development Team (PDT) in coordination with project utility staff. This will allow developing the best alternative that eliminates or minimizes utility impacts while meeting the project engineering, environmental, economic, and safety goals.
d) **Further Refine Project Scope / Define Project Goals**

When the development of a project involves the active participation of different functional groups, as a transportation project does, there will likely be a diversity of attitudes, opinions, priorities, and perhaps some inconsistencies in procedures and philosophies across these varying groups. For example, often, the most convenient strategy for designers is to ignore utilities during design and force their relocation if in conflict with the highway construction footprint. Meanwhile, utility coordination staff work to encourage the avoidance of utility relocations when feasible. This difference in the project participants’ goals leads to conflicting efforts, which may end up affecting the project outcomes. Therefore, the project goals must be clearly defined, aligned, and communicated to everyone in the project team as well as proper external stakeholders. Otherwise, it won’t be easy to achieve desired project results.

**Integrating Utility Coordination:** As the project scope is refined, the project team will have a better understanding of the project characteristics, constraints, potential risks, and conflicts. Based on that, the PDT will be able to identify the project goals that will lead the development of the project. Every project is different, so the participants should not assume that the goals of a specific project are the same as any previous project. They need to inform themselves about the defined objectives, internalize and buy into them, and work collaboratively to achieve the project goals. Setting the project goals and communicating them clearly will allow staff in every functional group to share the same vision, strive toward every aspect of their roles and duties, and make decisions with the target in mind to achieve better outcomes. This is the only way to get the project team moving in the same direction. If the project goals include considerations of overall time and budget, utility avoidance is therefore also a project goal until it conflicts with perhaps higher prioritized goals such as improved safety.
e) Preliminary Line & Grade Meeting

As the KYTC Utilities and Rail Guidance Manual states, the Preliminary Line and Grade (PL&G) Meeting is when the PDT uses all the available information and professional judgment to select the preferred alternative for the project.

**Integrating Utility Coordination:** Identifying the selected alternative should include a good understanding of utility facilities' features and locations, utility relocation costs, responsibilities, schedules, and potential easement needs. Therefore, information on the previously mentioned aspects must have been collected by this point to allow the design team to design around existing facilities and avoid relocations when possible. Thus, prior to the Preliminary Line and Grade Meeting, the PDT should have reliable and accurate information in order to make informed project decisions. The best way to ensure the accuracy of the utility facilities' location is by working closely with the utility companies from the project's very start. The PL&G meeting occurs when the design plans are around 30%-40% complete, so communication and coordination with utility companies must start earlier. Early interaction between the design team and the utility companies is highly recommended and is considered a best practice on a national level.

f) Constructability Review I – II – III

The KYTC Highway Design Guidance Manual states that constructability reviews are opportunities to minimize the need for costly change orders that result from design errors and omissions and to evaluate the "buildability" of the record plans prior to letting. Even though the manual points out that requests for constructability reviews should be submitted as early as possible to ensure timely reviews, it does not state specific points in the process for them. It is advisable that the PDT not wait until the final design stages to perform a constructability
review as it could mean a delay for the project if any correction or redesign is necessary. In fact, there should be a constructability review as soon as a preferred alternative has been selected largely for the consideration of right-of-way and utility concerns. The intent of having these reviews early and throughout the process is to change the approach of waiting until the end of the process, which is usually too late to prevent problems and sometimes too late to consider correcting less critical issues. By not considering these reviews earlier, you are not giving your project a fair chance at being as efficient and effective as it could be.

**Integrating Utility Coordination:** Constructability reviews can help minimize project utility risks during project development by identifying, minimizing, and mitigating utility conflicts and avoiding unnecessary relocations when possible. The constructability review can be especially helpful in identifying utility related issues and conflicts, as construction phasing, equipment, and temporary project elements may impact utilities in ways not readily apparent within the highway project design. These reviews will be opportunities to evaluate how the resolutions for identified utility conflicts will impact the feasibility, in both cost and schedule, of the project’s selected alternative and account for constructability issues. Since the constructability reviews may provide important inputs for the utility coordination process and the development of the utility relocation plan, the design team and utility companies should be consulted to review utility facility matters.

Based on a discussion of review timing in the research project *Tool for Applying Constructability Concepts to Project Development (Design)* [21], the research team recommends three constructability reviews (at preliminary line and grade, near final joint inspection, and near plan completion) throughout the process, though there could be more or fewer constructability reviews as determined by the project needs. As stated before, this
proposed approach is intended to serve as a general guideline. Each project and its circumstances will vary significantly, so the PDT will need to decide what best suits the project.

While it may seem like added effort, constructability reviews are shown to save project’s time and money by identifying design errors or omissions, and the same could be said for identifying means to avoid utility relocations. A brief description of the intent of each recommended constructability review is discussed below:

- **Constructability Review I:** The plans are more than 30% complete. As shown in the flowchart, the environmental document is being developed, and critical utility conflicts are being identified and addressed. Having a constructability review once the preferred alternative has been confirmed can assist in identifying any omissions or design errors, or potential areas for avoiding utility impacts before moving forward with a detailed design. Geometric changes to the project become more difficult after this point, so this review provides the optimal opportunity for utility relocation avoidance.

- **Constructability Review II:** The design plans are approximately 75% completed. Having a constructability review at this point can identify any necessary minor design changes. If utilities were not previously avoided, design changes might not be reasonable at this point for convenience alone, but constructability input at this phase is extremely important. This review provides an opportunity to highlight utility impacts that could involve major cost or schedule impacts to the project so they may be discussed and mitigated. This review will also be a good opportunity to ensure that there will be sufficient ROW considered for needed utility relocations, thus confirming potential ROW and easements needs.
• **Constructability Review III:** The design plans are around 95% completed. This review intends to ensure that the design is ready to proceed with the letting process and any known relocation needs can be communicated through the plans and contract documents. This is also a good opportunity to review utility relocation packages, ensure their plans are well coordinated, determine if there are relocations dependent upon one another, and determine if relocations can be executed simultaneously, or if there may be needed concurrent efforts or assistance (i.e. clearing) from the highway construction process. These considerations will help to avoid future problems during the construction phase.

As could be concluded from the recommendations above, the most impactful and potentially cost saving constructability review regarding utilities would be when plans are at 30% complete.

g) **Utility Relocation Analysis**

The KYTC Design Guidance Manual refers to utility relocation analysis during the final design stage. It also states that relocation of existing utility facilities is a primary concern during project development. However, the proposed approach supports the idea that the primary concern should be the appropriate application of utility coordination practices and relocations when necessary. In other words, the research team believes an emphasis on strategic avoidance of utility conflicts during the design stage, as long as the avoidance does not compromise the project design's technical feasibility, will result in reduced necessary utility relocations and, therefore, budget and schedule pressure caused by utility relocations. The design team must not adopt changes that would sacrifice safety or project functionality in order to avoid utility conflicts, but earlier consideration of avoiding utilities offers ample opportunities to achieve these collective project goals. The proposed approach intends to encourage collaborative work
with utility companies to identify the most challenging utility conflicts during the project's early stages so the design team can make necessary efforts to design around utilities as feasible. Collaboration with utility companies early in project development may eliminate or minimize the need for design changes in later stages. KYTC should not wait until the final design stage to engage utility companies because that is often too late to adopt changes, especially in geometry. The Cabinet should make every effort to improve collaboration and communication with them from the beginning of the project, as this will streamline the utility coordination process in the KYTC transportation project.

**Utility Coordination Process**

**h) Begin Utility Research**

As the preliminary design starts for the project, identifying existing utilities in the area provides an opportunity to successfully integrate utilities with the highway project design. The project team should begin researching utility facilities within the project limits by reviewing Cabinet survey maps, existing utility facility maps as procured, as-built plans, and discussions with area residents and known utility owners. A field review to investigate conditions and to visually identify utility facilities is also extremely important. During the field review, the Utility Agent (UA) must look for possible identification of utility owners and physical features (poles, vents, pedestals, fire hydrants, and any other appurtenances) that can be visually identified.

**Integrating Utility Coordination:** Since utility information is critical to project development, early identification of existing utilities is recommended once the project scope is determined. Therefore, the proposed flowchart suggests that utility research should begin as soon as the project scope is defined. The UA and US should review the proposed project scope in order to plan the collection of the necessary utility information. They should also discuss the
appropriate level of accuracy for the utility information needed, which should be commensurate with the potential level of risk that a facility represents to the project. By providing the project team with detailed information regarding the potential infrastructure conflicts, informed decisions can be made for achieving optimal project outcomes.

i) **Initial Utility Risk Assessment**

The initial utility risk assessment should occur during initial project scoping. After beginning the utility research, the PE or UA must assess the project scope and all the information available to identify potential risks related to utilities within the project. Since the 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 actions necessary to handle the identified risks. The earlier that accurate information is obtained, the better. Thus, efforts must be focused on doing enough investigation, as early as possible, to support good planning and decision making.

**Integrating Utility Coordination:** Although the information obtained at this point may not be sufficient for later design stages, the PE can have a general idea of the impacts expected between the proposed highway project and existing utility infrastructure. It is recommended that a list of the potential impacts be developed along with their ability to affect project schedule and cost such that necessary strategies for mitigation actions can begin to be considered and evaluated. The project team members need to be solution-minded and try to find the best way to handle these potential project risks. The recommended list also serves as a prelude to the project’s Utility Conflict Matrix.
j) Initial Contact Letter

While earlier correspondence with utility companies is expected in order to collect information on their facilities, the initial contact letter is the first contact with utility companies to provide them notice of the proposed transportation project. The UA or PE should send the letter to all the utility companies within the project area identified during the utility research.

**Integrating Utility Coordination:** At this point in project development, the information collected about existing utilities may not be comprehensive. Therefore, the initial contact letter allows the Cabinet to ask utility companies 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. It is recommended that a project tracking sheet be developed for these responses. In this way, the UA can follow up with any non-responsive companies. This allows the project team to start engaging the utility companies as partners on the project. The initial contact letter will also ask the companies to provide existing utility facility data and the contact information of a designated contact person who will work with the project team. All the information provided by the utility companies should be shared with the PDT as soon as it is received. Since the initial contact letter is the first official contact with utility companies, it is also the beginning point of coordination and must happen early in the project development. The tracking of the responses and feedback to the initial contact letters, along with the initial risk assessment, will continue to build and progress toward the project’s Utility Conflict Matrix.

k) Red Flag Abbreviate Study (if applicable)

As mentioned before, it is important to have enough high-quality information on utility facilities at the beginning of the project development as possible. This information will allow
the PDT to evaluate proposed alignments and make informed design decisions. There are many sources of information that can be used during the information gathering process, including a Red Flag Abbreviated Planning Study (Red Flag Study). This recommendation was made in the research project Critical Path for Project Development [20]. A Red Flag Study has the goal of the early identification of significant existing features on a project. As part of the information compiled in this study, Subject Matter Experts (SMEs) will provide professional input. For example, ROW agents evaluate property needs, and utility coordinators catalog complex utility facilities. Knowing these features will significantly influence project design decisions as preliminary alternatives are developed and may allow discussing scope of impacts of these features such that 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. The PE should evaluate and decide if a Red Flag Abbreviated Study fits the project information needs.

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

In the same way that the general project goals were determined, critical project success factors need to be identified. Critical success factors are those elements in a project that are critical to the project achieving its mission or goal, and they can be related to any project dimension (schedule, cost, technical characteristics, context, or financing).

**Integrating Utility Coordination:** As mentioned before, when different functional groups are involved in a project, there will likely be a diversity of attitudes, opinions, and priorities among the project participants. Project success can have different meanings to each stakeholder, so they will have different perceptions of the factors that are seemingly critical. These individually should not serve to guide project decisions and actions, so it is important to
correctly define them in order to set the basis for making decisions throughout the project life cycle. Once defined, the PE and UA need to work collaboratively to find the tools to facilitate the identification of these factors and obtain the critical project outcomes. This will allow a clear understanding of utility coordination goals. The goals for this process must be aligned to the general project goals and communicated to each team member and utility companies in order to make sure that everyone in the project has the same understanding of the project target and will work collaboratively to achieve it.

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

According to the KYTC Utilities and Rails Guidance Manual, the project team usually does not analyze right-of-way needs for utility impacts until the final design stage. Late acquisition of ROW and easement needs has been considered one of the main causes of transportation project delays.

**Integrating Utility Coordination**: The research team believes that assessing and identifying ROW and easement property necessary to accommodate utility conflicts that cannot be avoided, relocations, should occur earlier than currently planned. Even though ROW funding is approved at the final design stage, obtaining enough accurate information and engaging utility companies early in the process may allow the project team to begin an assessment of ROW needs during the conceptual design stage as the utility conflicts are addressed. All the information collected and presented on the plans to identify utility conflicts and the utility companies’ input can be used to identify potential ROW issues. If possible, associated cost evaluations for ROW involved for utility relocation would also be assembled. This will enhance the ability of the project development team to make informed decisions. It would
also be recommended to involve ROW staff as early as the planning stages, so they can inform the design team about factors that will significantly affect ROW [22]. A preliminary layout for ROW and proposed placement for utilities can be developed to inform the acquisition process and ensure that all property needs are met once funding is approved. Constructability reviews can also help point out areas of risk within ROW 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 in the project development process, especially when there are large concentrations of facilities or a major utility facility that could significantly impact the project. When more is known about utility locations, more creative solutions could develop during preliminary design. Additionally, there are more opportunities 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. The implementation of Subsurface Utility Engineering (SUE) can deliver this information to planners and designers to help them more accurately locate the utility facilities. Having this information will allow the design team to make informed decisions, avoid uncertainty or guessing on the whereabouts of utilities, and avoid unreliable information. The benefits of SUE applications have been proven; SUE is a systematic approach to utility investigation and categorizes the utility location data to a known level of accuracy. The proposed approach promotes the enhanced use of SUE as a tool to accurately identify utilities on KYTC projects.

**Integrating Utility Coordination:** It is recommended that sufficient and detailed utility information be provided to the design team no later than the 30% design stage and earlier as possible. Therefore, it is important to begin planning the implementation of SUE as soon as
the project team identifies project data needs and the existence of potential utility conflicts within the project area. As shown in the flowchart, as the range of alternatives for the project is being developed and existing utility information is being collected, the PE, US, and UA should discuss and identify potential project areas that may need SUE investigations and the quality level of information needed during the evolution of the project. The project surveyor may also be involved in making recommendations to the project team for SUE investigations. A general discussion on the quality level required for the SUE application is recommended to determine what SUE quality levels may be appropriate in varying areas and at varying stages of the project. The decisions made regarding the implementation of SUE, such as potential areas for investigations and required quality levels, can be used to develop a SUE application plan. This plan should be updated as the project 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 as collected through previous records research. These depictions on the plans should be carefully revised, updated, and noted to indicate the quality level of the information portrayed.

The quality level chosen for SUE should be commensurate with the potential impact of a conflict. The importance of locating a particular utility increases according to the potential for project impacts (i.e. higher quality levels desired for more costly, more impactful or more likely to occur conflicts) and for the given stage of project development. Therefore, specific 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 QLA or QLB information early in the design process may allow the design team to make reasonable adjustments through design
alternatives that avoid or minimize utility relocations. However, because QLA can sometimes be expensive, it may be a better practice to perform QLB along with the project's topographic survey. QLB information should provide approximate depths to 6" accuracy at an interval that matches the project's 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 tolerance zone of a utility, obtaining QLA information would be recommended. These recommendations and needs are very project specific and should be determined within the SUE application plan. A recommended reference for the development of a SUE application plan is the guidelines developed by ASCE, *The Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data* [16].

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

The use of the Utility Conflict Matrix (UCM) has become a nationally recommended practice to improve utility coordination in transportation projects. The UCM is a management tool that can be used to identify potential utility conflicts and track them to resolution. This tool offers a way to organize all the information related to existing utility facilities within the project area. It forces the designers to make decisions about each identified conflict in the project by working collaboratively to analyze where the utility conflicts are located, discuss their impacts, evaluate varying resolutions, select a preferred resolution, document its justification, and track the status of the corresponding conflict along with responsible parties. The use of this matrix is widely recommended since it helps to ensure that utility conflicts are addressed and planned for from early project stages and into construction.
**Integrating Utility Coordination:** The use of a UCM will allow for collaborative input from utility staff, the design team, and utility companies. UCMs enable working under the approach of partnership between the Cabinet and utility companies. The team will work together to identify, document, and find the most efficient and cost-effective resolution to the utility conflicts found during the design stage. As mentioned before, this tool is ideal for documenting, tracking, and resolving utility conflicts since it allows for managing identified utility conflicts from the early design stage through final design and relocations (at every stage of the whole process) and into construction. Thus, after each utility coordination meeting or when any design decision is made, it should be updated until all conflicts have been mitigated.

As shown in the proposed alignment flowchart, utility conflict analysis should occur at every stage of the whole process. According to the KYTC Utilities and Rail Guidance Manual, the Joint Utility Meeting is the first official meeting with utility companies. This meeting is used to determine the accuracy of existing facilities depicted on the plans, identify conflicts, define possible relocations to address the conflicts, and plan the relocations' design and schedules. Performing all these activities can be a challenge to complete in just one meeting. As originally portrayed, the JUM is more suitable for the collaborative development of relocation designs rather than conflict identification, which does not align with the "avoid, minimize, mitigate" mindset recommended by this research. 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 utility conflicts throughout the project development. Therefore, JUM can be used as an opportunity to further synchronize utility conflict resolutions in coordination with the PDT and impacted utility companies. The UCM should be updated by documenting 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 both considered primary factors that impact whether utility conflicts can be avoided or, when necessary, resolved through timely relocation. As conflicts are being identified and addressed, the UA should develop a structured approach to manage the communication and engagement with each utility company throughout the project development process. The information on utility facilities collected, the identified utility conflicts, previous interaction with utility companies, and lessons learned from previous projects will provide the necessary inputs to develop an appropriate approach to manage the project's communication. As mentioned before, the proposed approach supports continued coordination and clear communication between project participants to produce a good project outcome. Therefore, the research team has included as a recommendation for the integrated utility coordination process, the development of a Utility Communication and Engagement Management Plan.

Integrating Utility Coordination: Developing the utility communication management plan consists of identifying and classifying those companies that own utility facilities within the project area based on the desired level of communication that will meet the project information needs. The classification consists of identifying those companies that represent a potential risk for the project, companies with facilities within the project area but do not represent a significant impact, and companies that own facilities in the project area but are not necessarily impacted. Once the companies have been classified, the UA must begin analyzing each utility company's concerns and expectations for the project as well as the project team’s information needs. This will help the UA understand their circumstances and what is important for each of
the partners. This communication level assessment will be used to develop strategies to prioritize communication and interaction with each utility company as needed. Some companies will likely require closer coordination and communication than other companies, and these needs will change as utility conflicts are addressed. In other words, a company that owns facilities that represent a high risk to the project may require frequent communication at the beginning of the design process while the design team is making efforts to avoid, minimize, or mitigate the conflict. However, once the conflict has been resolved, the required communication between the Cabinet and the utility company will be reduced. The UA and the designer can then focus on engaging the companies that still require close coordination and communication. In this context, the utility communication management plan should be dynamic. As the design progresses, communication needs will change, and so the communication management plan needs to be updated. More details about this recommendation will be presented later in this report. By having efficient communication with each utility company involved in the project, the UA can establish relationships as partners 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 the design progresses and utility conflicts are being addressed, coordination with utility companies becomes a primary need for the project. The mantra of the proposed approach is to work in partnership, so utility feels part of the project team. Early coordination is a must. This coordination will allow the designers to make reasonable efforts to avoid, minimize, or mitigate conflicts with existing utility facilities beginning in preliminary design and extending through final design before the construction stage.
**Integrating Utility Coordination:** At this point in the process, the design team has developed a range of alternatives for the project and is discussing the impacts of each. In order to properly discuss the utility related impacts, it is necessary to have sufficient and accurate information for the utility facilities involved. Thus, there is a need to verify the accuracy of the facilities depicted on the plans by working collaboratively with the corresponding utility companies. The UA can either send a set of preliminary plans to the utility companies and ask them for feedback on the accuracy of the utility features plotted or schedule a meeting with the companies and work together through that information. Utility companies have noted that they have employees who have difficulty in reading highway design plans, so an in-person meeting could help ensure accuracy. The utility companies' active participation in the project in providing feedback on the accuracy of facility locations and the design decision-making process will make a positive difference in project outcomes. Early coordination between district utility staff, the design team, and all known utilities in the project footprint will allow for gaining input such that the highway designer can make reasonable efforts to avoid or minimize utility conflicts while at the same time meeting highway project needs.

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

The design team should use the information provided by the utility companies to make reasonable efforts to avoid, minimize, or mitigate impacts to utility facilities (in that prioritized order), even for those utilities that are required to move at their own expense. This does not mean designers should attempt to avoid utility facilities at all costs, but simply that designers should make reasonable efforts to minimize the project's overall cost to the general public. The earlier in the development process that mitigation options are addressed, the more likely 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 have more savings the earlier they occur and should at least occur before the project goes to letting. This will require a collaborative effort among the design and utility staff, as well as utility companies.

**Integrating Utility Coordination:** An excellent option to evaluate possible utility conflict resolutions from different approaches is by engaging utility companies in the process. The UA and the design team should send a set of preliminary plans to the utility companies so that they may consider where the impacted utility facilities will need to relocate. The utility companies' staff may suggest new or the most beneficial alternatives for the project to avoid or minimize utility impacts as they know better how their facilities function. For example, they can highlight specialized or critical utility infrastructure that would be exceedingly costly to relocate. It is important that the PDT be open and listen to their suggestions and concerns. Subject matter experts can also offer potential solutions to the identified conflicts. Cabinet staff and utility companies must work together to develop the recommended avoidance opportunities until all utility conflicts are resolved. Remember that it is not about asking utilities to just get out of the way, but about working with them to avoid the conflict first, minimize the conflict, or accommodate it where needed. If relocations are needed, suggesting alignments for those relocations should occur as a PDT discussion with the utility companies such that “everyone knows where everyone goes.” This allows for ROW considerations as needed for these relocations as well. The new approach proposes a shift to
partnered work by all parties involved, so everyone is bought in and part of the same team working toward the same target.

s) **Confirm ROW & Easement Needs / Verify that ROW and Easement Needs are being Addressed**

According to the KYTC Utilities and Rail Guidance Manual, final ROW plans are submitted after the final joint inspection, when the design plans are around 80% complete. As mentioned before, it is recommended to develop a preliminary layout for ROW and easement needs for utilities during the conceptual design stage. Developing this preliminary layout or even evaluating and identifying the potential property needs early in the design process will improve the ROW and easement property acquisition process. This will allow the right-of-way staff to determine the amount of property needed to accommodate all utility relocations within the project footprint and ensure proper property acquisition. This also provides the opportunity to acknowledge utility relocation ROW needs for consideration in the environmental process. If utility impacts must navigate their own ROW and environmental process for relocation, delays are imminent. It may be too late if the project team waits until the final design stage to evaluate ROW and easement needs for utility relocations. This can lead to required design modifications and the potential for project delays that could have been avoided. ROW acquisition staff should also attend the JUM to listen to any utility relocation requirements to consider their ROW required to accommodate them effectively. As the design and acquisition process progresses, utility staff should track these acquisitions to ensure that the necessary property is acquired on time to allow for relocation schedules. The UCM can serve as a tool for this tracking.
5.2 Utility Coordination Checklist

As shown in the proposed approach's flowchart (Figure 14), five checkpoints (marked with a star) have been established throughout the project development process. Based on these checkpoints, the research team has developed a Utility Coordination Checklist presented in Table 5. The intent of these checkpoints and the corresponded checklists is to help verify needed actions to each checkpoint in the process in order to apply the proposed approach for integrated utility coordination and highway design. Similarly, the checkpoints may help assess design decisions and provide opportunities to justify and document adopted resolutions for each utility conflict. The five checkpoints have been described previously (section 5.1), but they are also listed below:

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

The activities listed in this Utility Coordination Checklist are based on the strategies incorporated into the KYTC's current processes in an effort to integrate the design and the utility coordination processes. Thus, readers will notice that this checklist supports early engagement and frequent communication with utility companies. The activities considered are what the research team believes will help improve the utility coordination process's outcomes. This tool may be used as a reference by those who work on utility coordination in KYTC transportation projects.
## Table 5. KYTC Utility Coordination Checklist

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PROCESS</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLE</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>CHECKPOINT 001: INITIAL UTILITY CONFLICT ASSESSMENT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>D</td>
<td>Collect as much existing data as possible (project mapping, existing right-of-way limits, utility information, record plans, existing utility locations, etc.)</td>
<td>PDM</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>D</td>
<td>Evaluate project needs and assemble the project team. Ensure that the appropriate personnel for utility coordination purposes is considered in the team.</td>
<td>PDM</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>D</td>
<td>Assess the existing information in order to determine the type and extent for coverage for additional project mapping.</td>
<td>PDM / Survey Coord.</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>D</td>
<td>Assess the quality of the existing information and determine potential project data needs.</td>
<td>PDM</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>D/UC</td>
<td>Based on the assessments, request additional project information and mapping (begin utility research).</td>
<td>PDM / US</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>UC</td>
<td>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.</td>
<td>UA</td>
<td></td>
</tr>
<tr>
<td>1.7</td>
<td>UC</td>
<td>Determine facilities in the area by discussing with area residents to determine probable utility locations.</td>
<td>UA</td>
<td></td>
</tr>
<tr>
<td>1.8</td>
<td>UC</td>
<td>Determine facilities in the area by reviewing existing facility maps, as-built plans, Transportation Cabinet survey maps, permit files, Kentucky 911, etc.</td>
<td>UA</td>
<td></td>
</tr>
<tr>
<td>1.9</td>
<td>UC</td>
<td>Analyze project existing data and begin identifying potential project risks.</td>
<td>US</td>
<td></td>
</tr>
<tr>
<td>1.10</td>
<td>UC</td>
<td>Perform an initial assessment of potential problems or conflicts between existing utilities, easements, or other physical features. Identify areas of significant concern.</td>
<td>US</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>CHECKPOINT 002: RANGE OF ALTERNATIVES DEVELOPMENT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>D</td>
<td>Develop project purpose and need statement and define how public involvement will be conducted on the project. (Pre Design Meeting)</td>
<td>PDT</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>D</td>
<td>Refine project scope and gain input from the whole project team to define the project’s general goals.</td>
<td>PDT</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>UC</td>
<td>Prepare, 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 relevant facilities location information. Also, request the contact information of a designated contact person. If possible, include the desired date to get the responses.</td>
<td>UA / PE</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>UC</td>
<td>Verify that the companies have received the initial contact letter and 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 on non-responsive utilities.</td>
<td>UA</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>UC</td>
<td>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.</td>
<td>US / UA / D</td>
<td></td>
</tr>
<tr>
<td>2.6</td>
<td>D</td>
<td>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.</td>
<td>SMEs</td>
<td></td>
</tr>
<tr>
<td>2.7</td>
<td>UC</td>
<td>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.</td>
<td>US / UA</td>
<td></td>
</tr>
<tr>
<td>2.8</td>
<td>UC</td>
<td>Develop the General Contact List (utility owners identified within the district).</td>
<td>US</td>
<td></td>
</tr>
<tr>
<td>2.9</td>
<td>D</td>
<td>Invite and encourage utility companies to participate in all project meetings and stakeholders meetings. Determine if any additional utility coordination meeting would be necessary prior to the JUM.</td>
<td>US</td>
<td></td>
</tr>
<tr>
<td>2.10</td>
<td>UC</td>
<td>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.</td>
<td>US</td>
<td></td>
</tr>
<tr>
<td>2.11</td>
<td>UC</td>
<td>Review existing facility maps, physical surveys of viable facilities with the project limits, as-built drawings, GIS Data, and all available information. Identify and physically locate all utility facilities potentially affected by the project.</td>
<td>US / PE</td>
<td></td>
</tr>
<tr>
<td>2.12</td>
<td>UC</td>
<td>Plot existing utility facilities on plans and begin identification of potential conflicts between the project and utility facilities. Begin drafting the Utility Conflict Matrix.</td>
<td>UA / US / PE</td>
<td></td>
</tr>
<tr>
<td>2.13</td>
<td>UC</td>
<td>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.</td>
<td>US / PE / D</td>
<td></td>
</tr>
<tr>
<td>2.14</td>
<td>D</td>
<td>Identify a reasonable range of competitive alternatives that meet the project’s purpose and need.</td>
<td>PDT</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>CHECKPOINT 003: PRELIMINARY LINE &amp; GRADE MEETING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>UC</td>
<td>Evaluate the first version of the Utility Conflict Matrix and convey information between design and utility staff.</td>
<td>US</td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>D</td>
<td>Perform an early evaluation of the alternatives developed at this point (considering a corridor approach instead of an alignment approach).</td>
<td>PDT</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>D</td>
<td>Present to the PDT the results of their investigation, including the corresponding impacts of each alternative in the alternative matrix. Offer suggestions on the risk associated with moving forward with each alternative and the time frame required to resolve identified issues.</td>
<td>SMEs</td>
<td></td>
</tr>
<tr>
<td>3.4</td>
<td>D</td>
<td>Discuss the scope of impacts of the alternatives developed. Ensure that the scope of impacts discussion is considered avoidance, minimization, and mitigation opportunities.</td>
<td>PDT</td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>D</td>
<td>Determine if additional information is required to further investigate alternatives.</td>
<td>PDT</td>
<td></td>
</tr>
<tr>
<td>3.6</td>
<td>UC</td>
<td>As the design progresses, update the SUE Application Plan for the project. (new potential areas, quality level requirements, etc.)</td>
<td>US / PE / D / PDM</td>
<td></td>
</tr>
<tr>
<td>3.7</td>
<td>UC</td>
<td>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).</td>
<td>US / PE / D / PDM</td>
<td></td>
</tr>
<tr>
<td>3.8</td>
<td>UC</td>
<td>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.</td>
<td>UA</td>
<td></td>
</tr>
<tr>
<td>3.9</td>
<td>UC</td>
<td>Determine the best strategies to achieve the desired level of engagement and communication with utility companies. Develop the Utility Communication and Engagement Management Plan.</td>
<td>UA</td>
<td></td>
</tr>
<tr>
<td>3.10</td>
<td>UC</td>
<td>Evaluate potential project’s ROW needs or permanent easement necessary (If possible, analyze a rough associated cost or develop cost-benefit scenarios).</td>
<td>US / PE / D</td>
<td></td>
</tr>
<tr>
<td>3.11</td>
<td>UC</td>
<td>Summarize the unsignaled plans where the utility companies also ask items to verify the utility facilities accurately 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.</td>
<td>US / D</td>
<td></td>
</tr>
<tr>
<td>3.12</td>
<td>UC</td>
<td>Get required Subsurface Utility Information and analyze findings (Recommended QL-B).</td>
<td>US / D</td>
<td></td>
</tr>
<tr>
<td>3.13</td>
<td>D</td>
<td>Use available data, analysis, and professional judgment to narrow down the alternatives to a preferred alternative.</td>
<td>PDT</td>
<td></td>
</tr>
</tbody>
</table>
CHECKPOINT #04 : CONSTRUCTABILITY REVIEW II

1. Verify that ROW and Easements needs are being adequately addressed (property acquisitions).
2. Evaluate ROW and Easements needs based on the utility companies' proposals. Update the Utility Conflict Matrix documenting the status of questions, errors, or omissions and recommend and coordinate any corrective action as necessary.
3. 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.
4. As the utility conflicts are resolved, update the Communication and Engagement Management Plans to satisfy utility companies and the design team's current needs.
5. 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.
6. 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.
7. Use the Joint Utility Meeting to work collaboratively with all impacted utility companies to seek avoidance, minimization, or mitigation opportunities for utility relocations. If possible, send the most updated plans to the utility agencies and SMEs to ask them for input on opportunities for utility relocations.
8. 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 opportunities to avoid or minimize utility impacts.
9. Review design decisions made and changes in SUE information needs to update SUE Application Plan. If required, request new SUE studies.
10. 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.

CHECKPOINT #05 : CONSTRUCTABILITY REVIEW III

1. 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.
2. Evaluate design decisions made and changes in SUE information needs to update SUE Application Plan. If required, request new SUE studies.
3. 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.
4. 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 opportunities for utility relocations.
5.3 Roles and Responsibilities to Promote the Implementation of the Proposed Approach

The following section of the guidance document describes the recommended roles and responsibilities of the primary participants for an integrated approach to utility coordination and highway design during project development. These roles and responsibilities have been developed considering the proposed integration of utility coordination and highway design processes for improved project and program delivery at KYTC. This manuscript is 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. It is highly encouraged that the multidisciplinary participants of these project teams work collaboratively and consider these recommendations and new strategies in order to improve utility coordination and, more importantly, project delivery outcomes of KYTC transportation projects.

Successful utility coordination requires the active engagement of varying participants from multiple functional groups. Fundamental to the success of a transportation project is that participants have a clear understanding of their responsibilities and that they are committed to working collaboratively to fulfill them. The KYTC Utilities and Rail Guidance Manual considers the following participants as part of 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 the 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 as developed in this guidance.

- Additionally, the expected roles and responsibilities of other project stakeholders, including the design consultant team, survey team, and utility companies, are described below.

**Central Office Personnel**

a) **Utility Area Coordinator (AC)**

As stated in the KYTC Utilities and Rail Guidance Manual, the Utility Area Coordinator (AC) is responsible for working with Cabinet staff, state and federal agencies, and utility companies to facilitate timely, economical, and appropriate utility coordination practices and relocations when necessary. The AC will be the first point of contact in the Central Office for District level utility staff and will be responsible for the following:

- Facilitate the utility coordination process by promoting regular and early communication between all KYTC project team members and utility companies.
- Develop, update, and communicate Cabinet 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 to include utility-related policies, procedures, and deliverables of utility coordination efforts, including a Utility Coordinator Certification program.
• Promote and encourage project team members to work in partnership with utility companies by engaging utility owners in all aspects of project delivery, from planning to maintenance.

• Provide guidance and advice on Cabinet policy compliance and procedures in utility matters as requested by the District utility staff.

• Assist District staff in reviewing utility funding and reimbursement agreements (utility proposals, funding requests, agreements, relocation packages, etc.)

b) Utilities and Rail Branch Manager (UBM)

The Utilities and Rail Branch Manager (UBM) is responsible for providing overall management and programmatic decisions for all branch sections and units to ensure proper economic and efficient operations. The UBM will be responsible for ensuring adherence to KYTC policy and procedures in utility programs. Some of the primary responsibilities of the UBM include:

• Assist in the establishment and implementation of the utility and rail programs.

• Provide technical assistance and prepare reports in the development and interpretation of policy, specifications, processes, etc.

• Make field visits to District offices to resolve utility-related issues and discuss future utility project development.

District Office Personnel

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

According to the KYTC Utilities and Rail Guidance Manual, the Project Development Branch Manager is responsible for 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, so the
PDM assumes all the PM’s responsibilities for the project. On the other hand, if a project is managed by a PM, the PDM is involved programmatically, and the PM is directly in charge of the project.

In those projects requiring the participation of the PDM and PM, their corresponding responsibilities are described below. Where the PDM serves as the PM, they must consider all the following responsibilities.

Recommended responsibilities for the PDM:

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

The Project Manager (PM), or in some cases referred to as the Project Engineer (PE), is responsible for managing the individual transportation project and setting priorities and budgets for the assigned project. They will be responsible for overseeing the project and supporting those involved in the development process, including the utility coordination process, which may require utility relocations. It is recommended that the PM/PE works closely with the designer and the UA in order to be aware of the current status of the project, options for addressing
identified utility conflicts, and possible action plans so he or she can make appropriate decisions to deliver the project successfully. All the recommended responsibilities are important, but the compliance of the primary responsibilities below could be a decisive factor to improve the utility coordination of a project based on the proposed approach. Some of the primary PM/PE responsibilities are:

- Gather as much information as possible for the project as early as possible within the development process, even before the preliminary design stage. Evaluate and communicate the information with applicable stakeholders, especially the UA and/or US. If applicable, determine additional project information needs.

- Work collaboratively with the Project Development Team (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 and study the project area in order to select the type and extent of coverage to limit the need for subsequent mapping.

- Accumulate and track all promises made on the project systematically. The PDM shall retain the responsibility for ensuring that all promises (related to ROW or utility concerns) are ultimately recorded in the CAP (communicating all promises) notes and ensure that the Cabinet delivers on these promises.

- Coordinate regular team meetings with all team members, including utility section staff, to convey 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 all utility conflicts. Discuss different avoidance, minimization, mitigation, or accommodation opportunities for utility facilities.

• Evaluate the use of Design Phase Funding to start utility-related work (preliminary utility engineering) prior to completing NEPA documentation, so utility coordination activities can begin earlier in the process.

• Work collaboratively with project team members to evaluate the application of SUE in the project. If possible, perform cost-benefit evaluations to decide when and how to apply SUE to benefit the project.

• Provide advice and comments regarding potential ROW and easements needs for utility accommodations.

• Coordinate and ensure completion of Constructability Reviews throughout the development process. The proposed approach recommends at least three Constructability Reviews, which the PM/PE should coordinate.

Some **complementary** responsibilities are:

• Ensure that enough and good quality information is gathered in order to develop accurate facility maps.

• Work collaboratively with the UA to identify all utility companies with facilities in the project scope. Determine and evaluate potential utility impacts and develop strategies to engage those companies in the project.

• Coordinate significant project decisions and design changes considering avoidance opportunities for utility conflicts when feasible.
• Manage the project and ensure that all utility conflicts will be addressed on time and will not affect the project delivery.

• Facilitate communication and collaboration between all project participants. Provide guidance, support, and advice when needed.

b) District Utility Supervisor (US)

As stated in the KYTC Utilities and Rail Guidance Manual, the Utility Supervisor is the primary contact between the District Office and Central Office for utility matters. The District US is responsible for overseeing and managing utility agent and consultant utility coordinator activities, issuing decisions in regard to utility problems, and managing the resolution of outstanding utility issues. The US will evaluate staffing needs and partner with project managers to include utility coordination duties in the consultant scope of work when applicable. The research team has divided the US responsibilities into two groups. Based on the proposed integrated approach, all the recommended responsibilities are important, but fulfilling those considered primary responsibilities, could make a positive difference in the utility coordination process outcomes of KYTC projects. The recommended primary US's responsibilities are as follows:

• Host meetings with utility companies within the District, or in cooperation with neighboring Districts, to share long-range plans, share project specifics, and collaborate to discuss utility design and construction considerations.

• Meet with PDM, project managers, and designers to regularly communicate utility-related matters.

• Collaborate with Central Office utility staff to provide updates, challenges, policy concerns, best practices, and lessons learned on utility matters.
• In collaboration with peers, develop utility coordination metrics from cradle to grave to gauge improvements and needs. Then, provide utility reports on these metrics to the District and Central Office.

• On a project basis and in assistance to the UA, consult with utility companies on facility locations and consider needs for SUE investigations. As the project design progresses and utility conflicts are addressed, reevaluate SUE needs for the project (new potential areas, quality level requirements, etc.)

• In coordination with the UA, as the design progresses, continuously evaluate potential project ROW needs or necessary easements to provide recommendations regarding ROW acquisition for utility accommodations.

• Coordinate with the UA to hold project Joint Utility Meetings. Utilize this opportunity to work collaboratively with impacted utility companies and evaluate avoidance, minimization, and mitigation opportunities for utility conflicts. Assist the UA to update the UCM with decisions made in this meeting.

• Support successful and effective utility coordination and relocations by frequently communicating utility matters with project participants to promote working in partnership.

• Ensure that project information and project design decisions are not only documented but also communicated.

• If applicable, establish consultant utility coordinator needs and assignments for the District.
Similarly, the recommended **complementary** responsibilities are as described as follow:

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

**c) District Utility Agent (UA)**

According to the KYTC Utilities and Rail Guidance Manual, the Utility Agent (UA) is responsible for delivering the utility coordination of a specific project. The UA is the liaison between the District and utility owners on project matters. The UA deals directly with utility companies and the project development team, providing information on the project's utility
needs. The US's responsibilities are in support of UA responsibilities, but there are also instances where the US serves as the UA for a project. The research team has divided the UA responsibilities into two groups. Based on the proposed integrated approach, all the recommended responsibilities are important, but fulfilling those considered primary responsibilities, could make a positive difference in the utility coordination process outcomes of KYTC projects. The recommended primary UA's responsibilities are as follows:

- Work collaboratively with the PDM or PM to determine the Critical Success Factors (CSF) of utility coordination for a project. Once defined, ensure that utility coordination goals are aligned with the project's general goals and that all project team members are aware of them and working toward the same objective.

- Prepare and mail or email initial contact letters to applicable utility companies regarding the proposed highway project. Using this letter, ask utility companies to confirm the presence of their facilities within the project limits and request information on the facility characteristics and locations.

- Request utility companies to provide a designated contact person for future coordination of the project. Keep a record of each utility company's contact information and make that information available to all team members (including other utilities involved).

- Verify that utility companies have 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 utility companies, the UA should verify that they have received it and track their responses.

- Collect and report all the responses and information obtained from the utility companies to the US and PM/PE as soon as they are received. Ensure that all information provided
by the utility companies is communicated with the project design team to confirm that all utility facilities are adequately depicted on the plans.

- Document and follow up with non-responsive utility companies to maintain contact with them and attempt feedback for information. A non-response does not always indicate a lack of impacts.

- Identify and classify those utility companies that may represent a potential risk for the project and those that may not have a significant impact.

- Communication with utility companies to identify their concerns and expectations in regard to the proposed highway project. Take care to consider and communicate their concerns, needs, and expectations to work in partnership with all project stakeholders.

- Evaluate what the project will need from each utility company (information, feedback, etc.) and determine the level of interaction, communication, and engagement required to satisfy utility and the project team's needs.

- Based on the previous evaluation, determine the best strategies to achieve the desired level of engagement and communication with the utility companies. Develop the Utility Communication and Engagement Management Plan.

- Maintain constant and effective communication (via letters, emails, phone calls, meetings) with all involved parties in the project, 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 the utility conflicts and the project design. Determine and implement the necessary changes to satisfy the utility company and project team's needs.
• As the design progresses, coordinate with utility companies to verify the accuracy of the utility features depicted on the plans. In cases of inconsistency, notify the design team, provide recommendations to the US, and work closely with the project stakeholders to make necessary corrections.

• Work collaboratively with the US to identify potential conflicts between the proposed project and the utility facilities to develop the Utility Conflict Matrix. As the design progresses and the utility conflicts are addressed, update the Utility Conflict Matrix and share the information with pertinent team members. The UCM must be updated throughout the project and until all utility conflicts have planned resolutions.

• Work collaboratively with affected utility companies 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 any additional utility coordination meetings with utility companies as needed. If applicable, these meetings can be held individually.

• Communicate and provide information to utility companies about conflict resolutions or when design changes are made.

• Utilize sound management skills to ensure utility facilities are successfully avoided when feasible or relocated. Use soft skills to encourage team members to work in partnership and ensure effective and successful utility coordination.

• Proactively engage utility companies 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 the application of Subsurface Utility Engineering (SUE) investigations. Develop a SUE Application Plan.

Similarly, some complementary responsibilities are described below:

• 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, Transportation Cabinet survey maps, permit files, etc.

• Gain input on the possible location of utility facilities through discussions with area residents.

• Meet with the project partners (project development team, utility companies, consultants, etc.) to coordinate and provide recommendations to find alternatives that avoid, minimize, and mitigate or accommodate utility conflicts with that order of prioritization.

• Once the 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 utility companies to gather all the required information to produce accurate facility maps. This includes, but is not limited to, existing facility maps, information on type and size of facilities, and drawings provided by the utility companies, survey results, SUE finding, as-built plans, etc.

• Invite utility companies to public or stakeholders’ meetings. Work with the US to determine if any additional utility coordination meetings will be necessary prior to the Joint Utility Meeting.
• Work with the US to conduct the Joint Utility Meeting. Utilize this meeting to work collaboratively with all impacted utility companies to seek avoidance, minimization, or mitigation opportunities to benefit all the parties involved in the project. Forward all meeting material and information to utility companies absent from the meeting.

• Provide the project development team all the utility-related information that may be necessary for the design stages. Also, provide any data required by utility companies during the development of their relocation packages. Assure that the utility companies have enough and appropriate information regarding 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 in the proposed facility locations or relocation schedules among the utilities.

• Coordinate with the PDM or PM to obtain and share the 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 is responsible for developing the design of the highway project. The designers must be actively involved with the utility companies and in the utility coordination efforts throughout project development. All the recommended responsibilities are important, but compliance with those considered primary responsibilities could be a decisive factor in improving the utility coordination process. Some of the primary Design Consultant Team's responsibilities regarding utility coordination are as follows:
• Identify critical project areas that may represent a significant impact on the project if utility conflicts exist. Provide feedback to the UA to perform further evaluation of those areas, which may include advanced utility investigations.

• Use all the information collected (survey information, as-built plans, SUE, etc.) to depict existing utility facility's locations and attributes on the plans. Update and make the necessary corrections and modifications as more precise information is obtained.

• As the design progresses and the 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 critical success factors, budget, schedule, impacts to the traveling public and develop a utility conflict management plan for the project, including a utility conflict matrix. As the design progresses and the utility conflicts are addressed, communicate design changes and the status of the conflicts to update the UCM.

• Make the necessary efforts to avoid, minimize, or mitigate utility facility conflicts while accomplishing the transportation project's goals. The designer must determine if any cost-effective change can be made in the project as long as the design considers safety, environmental, economic, and engineering factors.

• Document and provide the rationale behind design decisions regarding utility conflicts. For those cases where utility relocations could not be avoided, document and communicate the reasons for the designer's decisions.
• Evaluate the project and identify potential areas for advanced utility investigations.
  Discuss and make recommendations regarding the location and quality levels needed for
  these utility investigations.
• Record and efficiently use results of Subsurface Utility investigations to produce more
  accurate utility locations within the project design plans.
• Provide adequate project plans, exhibits, and reports to the UA as needed to communicate
  with utility owners.
• Coordinate and work collaboratively with the UA to determine the appropriate level of
  engagement and communication required with utility companies.
• Evaluate the project to identify ROW needs for the accommodation of utility relocations.
  Provide recommendations to the ROW acquisition staff to allow them to acquire property
  to account 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 is involved in the key decision points during the
  preliminary design.
• Consider recommendations from SMEs and utility companies 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 collaboratively with utility companies to find utility conflict resolutions.
• Provide all information required by the utility companies to develop their utility
  relocation work packages.
• Work collaboratively with the US to review utility relocation packages submitted by the companies. Ensure that the relocation proposals were developed in accordance with the project design.

• Prepare and provide all the required information for utility coordination meetings and constructability reviews.

b) Surveyor

According to the KYTC Utilities and Rail Guidance Manual, the surveyor is responsible for providing data required by the project team. The surveyor's responsibilities vary and include collecting initial topographic data, identifying features that need to be accommodated by the project design, and conducting construction staking to assist in the construction phase of the highway project. Some of the responsibilities regarding utility coordination are:

• In partnership with the project team, determine if advanced utility investigations such as SUE QLB are needed with the initial project survey. This will include approximate depths collected from electronic readings by the SUE provider.

• Meet with utility owners, the utility coordinator (or UA), and other project team members as needed to ensure adequate collection of utility information is accomplished 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 the utility companies in order to identify their facilities in the field. This may include 811 markings, but this information should be noted as such.

• Provide all information collected (utility facilities measurements, locations, utility type, utility size, etc.) to the design team and other pertinent team members.
• When advanced utility investigations/SUE QLB were not collected with the topo survey, evaluate the information collected and make the necessary recommendations to the PDM or PM/PE for the application of subsurface utility investigations in the project.

• Provide the subsurface utility information in a 3-dimensional layer in the survey deliverable inclusive of the z coordinate.

c) Utility Company

The proactive participation of the utility companies from the beginning of the project is fundamental for a successful utility coordination process. The proposed approach for integrating the utility coordination process and the design development process requires that the utility companies are committed to the project and willing to work in partnership with the Cabinet or consultant staff. Some of the expected responsibilities for utility companies are the following:

• Partner with the statewide team to develop a usable and updated database to define an appropriate contact person who will be the first point of contact between the utility company and the Cabinet or representative personnel.

• Provide a specific contact person to the project team to facilitate communication and coordination for each project.

• Respond to initial contact letter requests with the following:
  o Record drawings of facility locations with as much specificity as possible.
  o Note whether a facility is buried or aerial
  o If aerial, note who owns the pole where the facilities are located
  o If the company owns the pole, identify owners of any attachments on these poles
  o Size and type of material, pressure, or voltage, or other characteristics
o Any unique structures, especially any buried structures, or complexity to consider for the project area

o Any future plans for replacement or maintenance for their facilities

o Full contact information for continued coordination

o Documentation of a property interest, such as an easements

- When initial project plans are provided, provide timely feedback and verify the accuracy of the design plans regarding the location of facilities when required.

- Evaluate and 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 the project goals. The UA must be aware of the utility companies' concerns and expectations and share this information with the entire project team.

- Be responsive to the requests from the UA and other project team members. Do not ignore information/feedback requests and answer them as soon as possible.

- Evaluate project data needs and make recommendations for the SUE application plan of the project.

- Actively participate in project and utility coordination meetings. If required, request additional meetings with the UA or the District US for utility matters.

- Coordinate with other utility companies and railroads that may also be impacted in order to avoid any conflicts or complications during relocation work.

- Develop utility relocation proposal packages in accordance with the project design in the specified time requested.
• Execute the utility relocation work plan as approved by the Cabinet. 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:
  o Direct labor and labor surcharges.
  o Overhead and indirect construction charges
  o Materials, supplies, and equipment
  o Transportation and handling charges.
  o Right-of-way costs.
  o Engineering costs–preliminary engineering and construction engineering
  o Credits–salvage credits, betterment credits, and accrued depreciation credits.
  o Describe specifically any factors included in the utility's overhead and indirect construction charges.
  o Itemize materials where they represent relatively major components or cost in the relocation.

• Prepare a relocation schedule that includes preconstruction and construction activities:
  o Required design time
  o Any permits or internal approvals
  o Time necessary to obtain materials
  o Time to obtain a contractor when using outside forces
  o Time to mobilize after notice to proceed with construction
  o Time to complete relocation and complete site restoration as required

• Submit timely invoices for all reimbursable work
5.4 KYTC Utility Companies’ Engagement Management and Communication Management Plan

Managing engagement of utility companies in transportation projects is about gaining support and building collaborative relationships with each of the companies impacted by the proposed project. Communicating in a strategic, efficient, and effective manner with each utility company can play a critical role in keeping them "on board." Therefore, the proposed approach developed in this research project promotes early engagement and frequent communication with utility companies. Based on that, this section of the guidance document has been organized into two sections 1) Utility Companies' Engagement Management and 2) Project Communications Management.

Utility Companies' Engagement Management

Managing utility companies' engagement during the project development involves many activities, ranging from the correct identification of the utility companies impacted by the project to analyzing their expectations and concerns for developing the most appropriate strategies to achieve the desired engagement. Adequate management of the utility companies' engagement throughout the project life cycle can help the project team gain the necessary support to improve the utility coordination process and the transportation project's outcomes. Managing this engagement may require different strategies and methods, and they could vary from project to project. It will be the Project Manager's (PM) and the District utility agent's (UA) decision to choose the strategies and methods that best suit the project's needs. The Six Edition of the Project Management Body of Knowledge Guide (PMBOK Guide) [23] recommends four processes as part of the project stakeholder management area of knowledge, as illustrated in Figure 16 below. These four processes could be used as a framework to manage utility companies' engagement in
KYTC projects. Figure 16 shows how these processes are related and could be aligned with the development stages of a roadway improvement project.

![KYTC - Utility Companies' Engagement Management](image)

Figure 16. Framework for Utility Companies' Engagement Management

**a) Utility Companies Identification**

As shown in Figure 16, the utility companies' identification process should occur mainly during the planning and preliminary design stages of KYTC projects. Correct identification of companies with facilities within the project's limits early in the project development can increase the chances of successfully addressing utility impacts. Identifying all the impacted companies and their facilities will allow the project team to analyze their main concerns, expectations, and needs related to the project impacts and develop appropriate strategies for gaining their support and commitment to the project and so working in partnership.

The KYTC Utilities and Rails Guidance Manual considers developing the Utility Contact List as part of the planning of utility relocations stage. According to the manual, there are two types of contact lists. The first one is the **General Contact List**, which includes all utility owners...
identified within a region, be it the county, the district, or the state. The second utility contact list is the **Project-Specific Contact List**, which includes all the utility companies identified within the project area and their assigned contact for the identified project. Both lists should be updated periodically and must include all the necessary information (company name, utility type, contact name, title, mailing address, email address, telephone, and fax numbers) to contact the appropriate representative of each company. As mentioned before, developing the Project-Specific Contact List occurs during the planning and preliminary design stages, while the project team is working on collecting all the information on existing utility facilities within the project limits. As the KYTC guidance manuals indicate, once the project is presented, the PDM, PM, and UA should start researching all the information sources available to identify the impacted utility companies. Some of the recommended tasks to gather this information and determine impacted utility companies are listed as follow:

- 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 transportation Cabinet survey maps.
- Request KY811 Design Information Ticket
- Obtain QLD SUE information
Given that the information at the planning stage is not always comprehensive, when the project team is working on identifying the existing facilities in the project's footprint, they likely will not know which facilities will actually be impacted. Thus, the Project-Specific Contact List may include utility companies owning facilities within the project area that the proposed project does impact and companies with facilities located within the project area but may not be directly impacted. As more accurate information is collected, the project team will be able to confirm and identify those utilities that are significantly impacted by the project and those companies that are not directly impacted. Similarly, as the design progresses, significant design decisions will be made related to the proposed project alignment, which might require including new utility companies on the Utility Contact List or changes to impact scope of existing companies. Therefore, it would be necessary to maintain the contact list up to date throughout the process.

The utility companies' identification process will be a critical step not only for the utility companies' engagement management but for the project communications management. This makes it so important to make the necessary efforts to develop an accurate Utility Contact List early in the project development, which will be the key outcome of this process.

Once the Utility Contact List is developed, the PM/PE and UA need to work collaboratively to analyze the identified utility companies. There may be some companies whose active participation and engagement in the project can either positively or negatively impact the utility conflict resolution. Some companies may be interested in participating actively in the project, while others may not care, so the PM and the UA need to categorize them and work out which companies they need to prioritize. Both the PM and the UA will provide different perspectives to perform this analysis. The PM/PE will look at this analysis from the perspective
of the project, while the UA will do it from the perspective of the utility companies. Some aspects to consider to begin the analysis are:

- Potential conflicts between the proposed project and the existing utility facilities
- Potential lack of information on utility facilities location
- Possible utility companies' expectations and concerns about the project
- Required contribution (information and feedback) from the utility companies

Literature review on project management practices points out that there are many ways to categorize project stakeholders, but the technique chosen should be based on the project's needs and complexity. For utility coordination purposes, the research team suggests using the following technique, named "Impact / Interest Grid" to help to categorize identified utility companies in KYTC projects. As shown in Figure 17, this technique has two axes, the interest axis and the impact axis.

![Impact / Interest Grid for Utility Companies' Engagement Prioritization](image)

To use the Impact / Interest Grid, the PM and UA need to evaluate the following aspects:

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

- Potential level of complexity of relocation processes
- Utilities located in critical points within the project area (areas with a lot of concurrent facilities)
- Utilities that may represent either a minor or major conflict for the project
- Utilities whose relocation may represent a significant impact on the project cost
- Utilities whose relocation may require an unusually long period of time to accomplish
- Utilities located in areas with limited right-of-way access
- Utilities which potential relocations may require high-quality, accurate information
- Historically complicated utilities to relocate

**Interest Axis:** This axis depicts the level of interest that utility companies may have in the project, in other words, the level of their concerns about the project's outcomes. Some considerations to categorize utility companies either as high or low interest include but are not limited to:

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

As a result of the utility companies' identification process, the project team will deliver the Utility Contact List containing the identified utility companies and appropriate contact
information as well as the categorization of the companies into the four groups shown in the Impact / Interest Grid (Figure 17).

b) Plan Utility Companies' Engagement Management

As shown in Figure 16, this process should occur during the planning and preliminary design stages of the KYTC projects. This process is about identifying the best strategies and approaches for engaging utility companies. As mentioned before, there can be some companies whose active participation and engagement in the project can have the power either to impact positively or negatively the resolution of utility conflicts. Some companies may be interested in participating actively in the project, while others may not care. Thus, the PM and UA will need to develop different approaches to manage utility companies' engagement based on what they need to know, how they can contribute to the project (information, feedback, etc.), and where the interests lie. To do that, they will need first to identify the project's needs and analyze utility companies' concerns and expectations to prioritize the interaction with them and so gain their support for the project. An appropriate approach for managing the utility companies' engagement can make the difference between utility coordination success and failure.

For this process, the PM and UA need to discover how the involved utility companies feel about the project and work out how best to engage them and how to communicate with them. So, the first step for this process will be starting the interaction with each of the utility companies. According to the proposed approach suggested by the research team for the integrated utility coordination and highway design processes, the Initial Contact Letter is the first official contact with utility companies. This letter intends to inform utility companies about the project and, according to the proposed approach, it should also be used to ask them to confirm the existence of their facilities within the project area and to provide all existing information on
their facilities. Once the letter is sent to the companies, the UA should verify that they have received the initial contact letter, track their answers, and do a follow-up to the non-responsive companies. This initial interaction will allow the UA to evaluate and identify the engagement level that the utility companies show once they are aware of the proposed project. A tracking sheet for the utility companies' responses can be a valuable tool for this evaluation.

Simultaneously, the PM needs to work collaboratively with the design team to identify potential utility conflicts and the companies involved in those conflicts. The PM and design team have to evaluate the existing information to identify potential information/feedback needs and determine the required level of utility companies' engagement to meet project needs. The information of the Utility Conflict Matrix can be helpful in this evaluation. Then, the UA and PM should put together the results of this assessment and develop the Utility Companies' Engagement Management Plan. This plan will describe the necessary actions to achieve the required level of utility companies' engagement. It does not have to be an elaborate plan, as long as it helps to understand which companies the project team should prioritize and focus its efforts to engage them and what actions can be taken to accomplish this goal. The following figure shows how this process works:

Figure 18. Utility Companies' Engagement Evaluation
Some sources of information and considerations that can be taken into account to develop the utility companies' engagement management plan are listed as follow:

- Critical project success factors (CSF) related to utility coordination.
- Utility Contact List and "Impact / Interest" categorization of identified utility companies.
- Tracking sheet for utility companies' responses
- Utility Conflict Matrix information (KURTS)
- KYTC – Utility Companies' Communications Management Plan (explained later in this document)
- Lessons learned from previous projects (*)

(*) Utility coordination can be learned by experience. Knowledge of utility coordination problems from previous projects can help identify potential problems earlier in future projects and so reduce their impact. Similarly, knowledge of effective utility coordination practices from past projects can be used to improve utility coordination in future projects. Therefore, as mentioned before, this research team believes that a recommended practice to improve utility coordination in KYTC projects is developing a Utility Coordination Lessons-Learned Repository. There are many strategies to engage utility companies that are being applied in current KYTC projects and are working effectively. However, these strategies are not a common practice in all the districts because they have not been consistently recorded and shared. Thus, the researchers recommend beginning developing a Lessons Learned Repository for the Cabinet with information about successful and failure utility coordination practices in previous KYTC projects. The idea of this repository is to repeat the positives aspects and not repeat the mistakes for utility coordination. Since this repository would be about utility coordination practices, it may include recommended practices for utility companies' identification, utility conflicts
identification, utility contact list development, effective communication strategies, and engagement of utility companies. Then, this information should be shared with all those who are involved in KYTC transportation projects.

The research team has developed a matrix, presented in Table 6, to organize and manage all this information. Given that each project has its own characteristics and complexity, the matrix may need to be modified, but the version presented below can serve as an initial reference. The second row of the matrix indicates the suggested source of information to fill up the matrix.

Table 7. Utility Companies' Engagement Management Matrix

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

As same as the utility contact list, the Utility Companies' Engagement Management Plan should be revised regularly throughout the development of the project. As the design progresses and the utility conflicts are resolved, the project's needs will change, and so the utility companies' engagement needs. So, this plan must be periodically updated to reflect any change in the engagement strategies.

To summarize this process, the main deliverable of this process will be a Utility Companies' Engagement Management Plan, which consists of the planned strategies and necessary actions to promote the active involvement of utility companies in the project
development based on the assessment of the engagement level required from each impacted company.

c) Manage Utility Companies' Engagement

As shown in Figure 16, this process should occur from the preliminary design stage through the construction stage of the KYTC projects (until utility conflicts have been resolved or necessary relocations are completed). This process consists of executing all the strategies previously developed as part of the Utility Companies' Engagement Management Plan. During this process, the project team communicates and works with all the involved companies to resolve utility conflicts or coordinate necessary relocations. Utility companies need to clearly understand how significant their contribution to successful project completion is. So, the strategies developed must give them the clarity 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 all of them. The most significant benefit of this process is to gain utility companies' support and commitment to involving them at appropriate stages of the project development. This will allow the project team to get all the required information about utility facilities and get the necessary feedback to find the most cost-effective solutions for utility conflicts. Effective communication and interpersonal and team skills will play a key role during this process, so the Communications Management Plan (explained later in this document) will be a helpful tool.

As the project moves forward, the project team will iteratively assess utility conflicts and make reasonable efforts to avoid, minimize or mitigate utility relocations causing changes to the project's needs. Thus, as the PM and UA manage the utility companies' engagement, they will need to update the Utility Companies' Engagement Management Plan and so the matrix presented in Table 6 if they are using it. The PM and UA have to ensure that they are achieving
the desired level of utility companies' engagement according to the project's needs, which is the purpose of the next process, Monitor Utility Companies' Engagement.

d) Monitor Utility Companies' Engagement

Similar to the previous process, monitor utility companies' engagement should occur from the preliminary design stage through the construction stage of the KYTC projects (until utility conflicts have been resolved or necessary relocations are completed). This process is about adequately monitoring utility companies' relationships, evaluating the effectiveness of the applied engagement strategies, and identifying necessary modifications to adjust them. The design team and utility companies need different things at different times, so it is up to the project team to ensure that the 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 have effectively achieved the desired level of engagement for each company. Updates to this matrix should show how the utility companies' engagement is improving as the project evolves and help to identify those companies that the project team requires more effort to engage. To evaluate the effectiveness of the Utility Companies' Engagement Management Plan, feedback from the design team and utility companies will be necessary. Some options to monitor utility companies' engagement are described below:

- Utility coordination meetings or any other project meeting may be good opportunities to assess how the engagement strategies are working. These meetings could serve the PM and UA to get feedback from the companies and other project participants to make the necessary corrections to the Utility Companies' Engagement Management Plan. Face-to-
face meetings are always the best options to perceive how those involved in the project feel about how engagement has been managed.

- Updated Utility Conflict Matrix can also be a good source of information. It will help evaluate whether the engagement strategies have helped resolve utility conflicts and identify which utility companies need to be more engaged in the project.

- Satisfaction surveys can be a good tool to get necessary feedback for this process, especially for those companies that may have no time for in-person meetings since surveys can be emailed.

The result of this process is primarily identifying any necessary modifications to the Utility Companies' Engagement Management Plan. It would be recommended to document this process's positive and negative takeaways in the Lessons-Learned Repository previously mentioned. Each transportation project is unique, but practices that worked well in previous projects could work in future projects. KYTC could use each project as an opportunity to try new practices, and those who work well may become best practices for the agency.

**Project' Communications Management**

Now that the importance of good management of the utility companies' engagement has been set, this guidance can move to discuss the crucial role that effective and efficient communication plays in engaging utility companies early in the project development and keeping them "on board" throughout the project lifecycle. Remember that the aim of effective and efficient communication is building solid relationships with utility companies to win and maintain their support for the transportation project and ensure successful project outcomes and completion. So, let us start defining what will mean *effective* and *efficient* communication for the purposes of this guidance document:
• **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 will allow understanding and addressing utility companies' needs and expectations, exchange necessary information, handle issues as they occur, and achieve active utility companies' participation in the project's decision-making process. Their active participation will help the design team to make reasonable efforts to avoid or minimize utility relocations and effectively mitigate the unavoidable facilities.

As mentioned in the previous section (5.3), the UA is the liaison between the District and utility owners on project matters. The UA deals directly with utility companies and project management, allowing him or her to be aware of all the project's utility needs. It is also part of the UA's responsibilities to build a bridge of effective and efficient communication between the Cabinet and all involved utility companies, who may have different perspectives, concerns, interests, and needs. As stated before, in a transportation project, there can be some utility companies whose active participation and engagement to the project can have the power either to impact positively or negatively the resolution of utility conflicts. Therefore, achieving effective and efficient communication with each of these companies based on project's and utility companies' needs may require different effort levels. Understanding these differences is fundamental to identify the correct approach and strategies to manage communications with each company involved in the project. These strategies will be the starting point to develop a Communications Management Plan, whose correct development, implementation, and monitoring will ensure successful communications in the project. For that reason, the research
team recommends that management of communication with utility companies in KYTC transportation projects should also be strategic. For purposes of this guidance, strategic management of communication means that each party is aware of the other’s needs, so communication is based on the project's characteristics, constraints, and participants’ needs.

The Six Edition of the Project Management Body of Knowledge Guide (PMBOK Guide) [23] recommends three processes as part of the communications management area of knowledge. These three processes could be used as a framework to manage communication with utility companies in KYTC projects. Figure 19 illustrates how these processes are related and aligned with the development stages of a KYTC project. These processes occur and go hand in hand with the utility companies' engagement management processes previously described.

Figure 19. Framework for Utility Companies' Engagement and Communication Management
a) Plan Communications Management

As shown in Figure 19, this process occurs during the planning and preliminary design stages of KYTC projects. This process is about understanding and identifying the information that the utility companies need to receive from the Cabinet and the information they need to provide to them. To achieve this objective, the UA and PM need to work collaboratively to develop the appropriate approaches and strategies to manage effective, efficient, and strategic communication with each company.

As the existing project's information is being collected and the Utility Contact List is being developed, the PM, UA, and design team need to work collaboratively to identify the potential communication needs on utility matters. They also have to analyze and understand how significant the engagement of some utility companies in the project will be to make the necessary efforts to achieve effective and efficient communication with those companies properly. This analysis has already been done in the Utility Companies Identification process by categorizing the companies using the Impact / Interest Grid for Utility Companies' Engagement Prioritization (Figure 17). Based on these categorization results, the UA will be able to determine and develop an appropriate approach to manage communications with each of these companies strategically. Each group of the matrix may have different communication needs, so it would be more convenient to prioritize the efforts for achieving effective and efficient communication with each of these groups according to their needs. Based on this idea, the Impact / Interest Grid for Utility Companies' Engagement Prioritization (Figure 17) has been modified, including the recommended approaches to manage communication with each of these four groups:
For example, the communication with those companies whose facilities represent a low impact on the proposed project and may have low interest in the project should only be monitored. Similarly, the communication with those companies whose facilities represent a high impact or risk to the project and may also have a high interest to participate in the design should be managed closely. Then, based on this analysis to prioritize communication with utility companies, the UA can organize this information in the following matrix and begin developing the strategies and necessary actions to achieve effective and efficient communication with each company.

Table 8. Utility Companies' Communication Management Matrix
Some sources of information that should be considered for this process are listed below:

- **Utility Contact List** to evaluate and address the communication needs of each of the utility companies impacted by the project.

- **Utility Companies’ Engagement Management Plan** to create consistency between the communication strategies with the strategies developed to engage utility companies effectively.

- **KYTC Guidance Manuals**, to consider standardized guidelines to exchange 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 the development of the communications management plan, some other aspects that should be considered are:

- **Format and quality of information to be communicated**: Receiving information with formats and quality levels different from expected may lower the quality of the 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 facilities' location on the plans accurately.

- **Appropriate means and mechanisms to convey project information**: KYTC Guidance Manual has some means and mechanisms established for this aspect, such as official letters, meetings, KURTS, etc. The communication management plan must be elaborated considering compliance with the policy. However, projects and utility companies' needs for coordination may require finding other means and mechanisms
(beyond the conventional ones) for informal communication and coordination with the companies. These mechanisms may not be the same for all the companies because their communications preferences are not the same. For some companies, written documents, formal letters, or meetings could be more effective than informal conversations, remote meetings, or emails. Addressing these preferences could make the difference to achieve effective and efficient communication. It would be recommended not to limit the project communication to only letters, reports, information packages, and other one-way communication methods. Including interactive communication methods, such as face-to-face meetings, phone calls, online meetings, may help to improve the effectiveness of this information exchange process.

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

- **Correct interpretation of shared information (in both ways):** Sometimes, it can be difficult for the utility companies' representatives to understand the highway plans, making the identification of all the utility conflicts difficult. Similarly, designers can have problems reading utility facilities plans. Some communications strategies might include face-to-face or remote meetings to discuss possible misunderstandings about the information. If there is no problem interpreting the information, successful communication could be achieved, and the feedback received will be more beneficial to the project.
The main deliverable of this process is the communication management plan. It does not have to be an elaborate plan but must contain at least the following information:

- Utility companies' communication needs, requirements, and expectations
- Project team members' communication needs, requirements, and expectations
- Information to be communicated (specifications, cost, plans, etc.). Specifying the format, content, and level of detail expected by both parties (designer and utility companies) is important. These information needs may vary at different stages of the project development.
- Reason for the exchange of information. There will be some companies that might need to receive or share more information than other companies. Prioritizing communication with them must be justified after analyzing the impact of the project on their facilities.
- The frequency for distributing the required information and receipt of responses: Communication for utility coordination purposes should be two-way communication and do not be limited to just sending information to utility companies. Responses are required and should be received on time to give the project more opportunities to find more creative solutions for utility conflicts.
- Responsibilities for communicating project information and receiving information from utility companies
- Contact person’s information of each utility company identified. Communications could be more efficient and easier if the person responsible for receiving and sending the information on utility facilities location is determined from the very start.
- Methods or technology selected to convey project information, standardized systems such as KURTS should be considered when planning project communications.
• Any constraints that could impact the effectiveness of the project’s communications
• Glossary of common terminology to avoid any type of miscommunication or misunderstanding between team members and utility companies. Terms used in utility coordination could seem widely known, but different people could have different perceptions and definitions.
• Existing or new guidelines and templates for project status meetings, project letters, e-meetings, emails, meeting minutes

To summarize this process, the Communication Management Plan is how the Cabinet intends to share and obtain project information. Details include what information has to be gathered and shared, information sources, what channels and tools are available, urgency, formality, and determination of methods (formal, informal, written, verbal, etc.).

b) Manage Communications

As shown in Figure 19, this process should occur from the preliminary design stage through the construction stage of the KYTC projects (until utility conflicts have been resolved or necessary relocations are completed). This process consists of actually preparing the communications and distributing them appropriately to ensure timely and appropriate exchange of information between the Cabinet and the utility companies throughout the project development. This process is about managing all the required aspects to achieve strategic, effective, and efficient communication by applying the appropriate communication mechanisms, methods, means, and strategies.

According to the proposed approach for the integrated utility coordination and highway design processes, during the preliminary design stage, the UA notifies the utility companies about the proposed project and asks them to confirm the presence of their facilities within the
project area and to provide all existing information about their facilities. Utility companies are required to respond to this requirement as soon as possible with all the information available. Later in the project, utility companies are required to confirm the accuracy of the facilities plotted on the plans and provide feedback about options to avoid, minimize, or mitigate utility conflicts. All this interaction and exchange of information between the Cabinet and utility companies continues throughout the project development. Using the communications management plan previously developed 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

Same as the previous process, this process should occur from the preliminary design stage through the construction stage of the KYTC projects (until utility conflicts have been resolved or necessary relocations are completed). Monitor communications consist of monitoring the application of the communication plan and ensuring that all the identified information needs are met. It also includes managing any 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 utility companies' communication requirements, project information distribution, format and distribution methods, and other aspects to ensure expectations are being achieved. So, this process is necessary to evaluate the impact of the strategies on project communications and then make the required changes to achieve effective and efficient communication. It would also be recommended to document all the lessons learned from each project and then keep them for the records of the Cabinet. This information may be a valuable source for future projects. The
following options could serve as indicators to monitor communications with utility companies in a KYTC project:

- **Satisfaction surveys** to know the perceptions of the communication effectiveness of the design team and the utility companies' owners or representatives. These surveys have to be applied throughout the project to make the necessary modifications.

- **Discussions** to know the perceptions of the project communications of the design team and the utility companies' owners or representatives. Face-to-face meetings are always the best options to perceive how those involved in the project feel about the way communications have been managing.

- **Lessons learned repository** to evaluate if the strategies have the expected effect or if there is any aspect that has been missing.

- **UCM information** to evaluate if the project communication has helped to resolve the utility conflicts identified in the project. The UCM could also serve to know which potential utility conflict requires to improve the communication and the engagement of the company to find the resolution.
CHAPTER 6. CONCLUSIONS

This study provided the researchers and the KYTC Study Advisory Committee an opportunity to work collaboratively to analyze the current approach of the KYTC’s utility coordination process during highway project development and to put together a guidance document for a proposed approach that includes recommended utility coordination practices to better align and improve the integration of the KYTC utility coordination and highway design processes. This guidance document includes a list of recommended roles and responsibilities for the implementation of these utility coordination practices. Besides, the research team has developed a Utility Coordination Checklist that can become a tool to assist in the implementation of this proposed approach in KYTC projects.

As this research concludes, the research team and the KYTC Study Advisory Committee are working toward the implementation of the recommended strategies and proposed approach to improve the integration of the utility coordination and the highway design processes in KYTC transportation projects. In the next few months, the Integrated Project Development Guidance Document for the KYSPR 20-581 Integration of Utility Coordination and Highway Design research project will be completed. The Integrated Project Development Guidance Document is then expected to be implemented through a concurrent effort developing a Utility Coordination Training and Certification Program for the Kentucky Transportation Cabinet.

It is anticipated that there will be subsequent studies to complement the findings from this research to continue improving the integration of the utility coordination and highway design processes in KYTC projects. These studies will include the development of specific guidance for strategic use of Utility Conflict Matrix (UCM) and Subsurface Utility Engineering (SUE) for the best management and mitigation of utility related project risks in KYTC projects.
Throughout the development of this project, the research team has noticed that there are future research opportunities to investigate. This report has described the basic guidelines to manage utility companies’ engagement throughout the development and application of a Project’s Communications Management Plan. Future research opportunities could further evaluate the benefits of applying this strategy and the procedures to implement it in KYTC projects.

The research team looks forward to presenting the findings from this study to aid the Kentucky Transportation Cabinet in their objective to generate a change of mindset to redefine utility companies from obstacles to partners and achieve a collaborative working relationship between the Cabinet and utility companies to improve utility coordination, and more importantly, KYTC projects delivery outcomes.
REFERENCES


[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.


APPENDIX A. KYTC FLOWCHARTS

As part of the research project *Methods to Expedite and Streamline Utility Relocations for Road Projects* [2] 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:

**PARTICIPANTS OF UTILITY COORDINATION PROCESS - INDIANA DOT**

| Designer (D) | Utility Coordinator (UC) | Surveyor (S) | Utility Company’s Authorized Representative | Utility Oversight Agent (UOA) | Project Manager (PM) |

**UTILITY RESEARCH**

- **Researching Permit Files**: Review INDOT and LPA permit files to determine the names of utility companies that have facilities within the project area.
- **Reviewing map files maintained by the DOT**: Review historical plans from previous projects or contact sponsors.
- **Investigation of field conditions**: Visit the site to look for all facilities in the area (consider types of facilities and private buildings / identify buildings adjacent).
- **Reviewing info. provided by Indiana 811**: It will provide a list of names of utility companies.
- **Contacting local government offices**: To obtain names and numbers (consider also private buildings adjacent to the area).

**Deliverable**: Summary of all the information (name and number of the contact person) of all the utility companies. This information is delivered to the designer and the UOA.

**INITIAL NOTICE**

1. **Letter to inform the utility companies** (identified in the utility research) about the proposed improvement project. They respond in writing.
2. **Within 30 days, informs whether or not the company has facilities** (specifying the type and location of their utilities, and the name of the designated contact person).

* The information is also provided to the surveyor and utility oversight agent.
SURVEY AND DEPICTION OF FINDINGS

- Used to determine, measure and record the location of all utility facilities.
- Can request 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 marked.
- Has to measure and record the horizontal location of the buried facilities once the locations are marked in the field.
- 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 company 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.
- 1. Send the conflict review letter and a copy of the preliminary plans.
- 2. Review the plans and respond if there are any conflicts.
- 3. Provide the inf. from the responses to the companies.
- 4. Work with the PM to determine if cost-effective design changes can be made.
- Outputs: Facilities location plans accurate

VERIFICATION

- Letter to request a utility company to verify that its facilities are shown correctly on the plans.
- 1. Send the verification letter and plans to each utility company with facilities in the project area.
- 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 information to the companies.
- 4. Work with the PM to determine if cost-effective design changes can be made.
- Outputs: Facilities location plans accurate

SUBSURFACE UTILITY ENGINEERING

- Practice of investigating the location and condition of subsurface utility facilities, divided into four categories (Quality, C, B, A).
- Decide if it 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 QRA should be performed early in the design process.
- 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 (plans and profile sheets, cross-section sheets, and utility matrix sheets).

VERIFICATION

- Letter to request a utility company to verify that its facilities are shown correctly on the plans.
- Outputs: Facilities location plans accurate
Unites the facility’s proposed relocation work to the project (a plan to carry out facility relocation).

**WORK PLAN**

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.

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

Once the agreement is properly completed, forward the signed agreement to the UOA for further processing.

**HIGHWAY UTILITY AGREEMENT**

 submitted by a request to INDOT prior to any work being performed.
Provides the terms of reimbursement for reimbursable relocations. 

**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.

*Best guess* of an expected cost to relocate certain facilities. This estimate is based on experience rather than statistical analysis.

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. ROOTS CAUSES OF HIGHWAY CONSTRUCTION DELAYS

Part of the objectives of the research project NCHRP 20-24(12) "Avoiding Delays During the Construction Phase of Highway" [9] was the identification of the root causes of highway construction delays. These root causes were categorized into six broad categories, as presented below:

<table>
<thead>
<tr>
<th>Major Category</th>
<th>Root Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Practices</td>
<td>• Business as usual&lt;br&gt;• Most projects are treated alike&lt;br&gt;• Projects often need to be awarded based on an accelerated schedule&lt;br&gt;• Various team members have different objectives&lt;br&gt;• Budgets restrict the expenditure of project funds across functional boundaries</td>
</tr>
<tr>
<td>Procedures</td>
<td>• Lack of team accountability for timely project completion&lt;br&gt;• Construction expertise is not incorporated into the design (because of time pressure, designers often leave problems to be solved during construction)</td>
</tr>
<tr>
<td>Utilities</td>
<td>• Utilities are unidentified or incorrectly located&lt;br&gt;  o Many smaller utilities have no as-built drawings&lt;br&gt;  o Often, the as-built drawings are incorrect&lt;br&gt;  o As-built location information may not include vertical location&lt;br&gt;  o Utility location information provided on drawings is not straightforward particularly for complex intersections&lt;br&gt;  o The standard of practice for designers concerning communicating utility information on drawings is not clearly defined&lt;br&gt; • Slow response by utilities to improve their processes&lt;br&gt; • Delays in the relocation of utilities&lt;br&gt;  o Utilities may not see SHA work as a priority&lt;br&gt;  o SHA right of way agreement with utilities may not provide adequate terms and conditions to obtain a timely response from the utilities</td>
</tr>
<tr>
<td>Differing or Unforeseen Site Conditions</td>
<td>• The information provided is inaccurate&lt;br&gt;  o Conditions are known but not incorporated into the design because of funding or time pressure issues</td>
</tr>
</tbody>
</table>
| **Contractor and SHA Management of Scheduling and Planning** | • Inadequate planning by contractor  
• Inadequate scheduling by the contractor  
• Inadequate review and administration by SHA |
| **Maintenance of Traffic (MOT)** | • MOT design focuses on traffic management and often is lacking with regard to constructability. |
| **Design Errors and Omissions** | • Designers are not given sufficient time to produce quality designs  
• Designers are not accountable for project performance during construction  
• There is a shortage of experience personnel within the design industry with regard to construction experience |

- The point view that site investigation is done for design, not for construction
- Conditions change after the design is complete
- Conditions are unknown but are easily discoverable
APPENDIX D. UTILITY ISSUES THAT AFFECT HIGHWAY DESIGN PROCESSES

Through the literature review of the report Utility Location and Highway Design [11], 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:

<table>
<thead>
<tr>
<th>Information Source</th>
<th>Design Issues pertaining to relocation decisions for utilities</th>
</tr>
</thead>
</table>
| **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.

<table>
<thead>
<tr>
<th>DOT and Consultant Interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Historical sequencing of solutions to problems because a solution to one problem may create new problems.</td>
</tr>
<tr>
<td>• DOTs are unwilling to allow any changes in their existing utility relocation policies</td>
</tr>
<tr>
<td>• Overlapping permit agencies</td>
</tr>
<tr>
<td>• No comprehensive &quot;Alternate Design&quot; catalog with associated costs.</td>
</tr>
<tr>
<td>• Prevailing attitude that there is not much that can be done to prevent utility issues and procedures in place to address them.</td>
</tr>
<tr>
<td>• DOTs have a tendency to believe research findings or practices to be invalid for their states if they were developed outside of their jurisdiction.</td>
</tr>
<tr>
<td>• 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 or division.</td>
</tr>
<tr>
<td>• Ease of finger-pointing and blame the other entity for the problems.</td>
</tr>
<tr>
<td>• Consistency of procedures and philosophies across departments</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>DOT</th>
<th>Utility Coordination Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pennsylvania DOT</td>
<td>• Publishes a 12-year plan for the potential upcoming projects.</td>
</tr>
<tr>
<td></td>
<td>• 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.</td>
</tr>
</tbody>
</table>
- 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 has 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 E. 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" [13] showed that transportation agencies and utility companies that participated in the project agreed that the most common issues are:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Issue Cited by UCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>• Limited financial and personnel resources&lt;br&gt;• Utility Relocation not an integral part of the design&lt;br&gt;• Coordination with other agencies in the same proximity&lt;br&gt;• Maintenance issues (internal)&lt;br&gt;• Service upgrades (internal)&lt;br&gt;• New customers demand (internal)&lt;br&gt;• Changes to DOT design or schedule&lt;br&gt;• Large turnover at DOT&lt;br&gt;• Acquiring ROW reimbursement&lt;br&gt;• Involving utilities late in the design phase&lt;br&gt;• Ease of exchanging drawing files electronically&lt;br&gt;• Lack of communication between DOT and UC&lt;br&gt;• Development and predictability of overall project plan&lt;br&gt;• UC given too many projects at once&lt;br&gt;• DOT does not follow its own procedures</td>
</tr>
<tr>
<td>Construction</td>
<td>• Limited financial and personnel resources&lt;br&gt;• Coordination with the contractor to establish a project plan to avoid relocating more than once for the same project&lt;br&gt;• Coordination with other utility agencies in the same proximity&lt;br&gt;• Maintenance issues (internal)&lt;br&gt;• Service upgrades (internal)&lt;br&gt;• New customers demand (internal)&lt;br&gt;• System improvements (internal)&lt;br&gt;• Contractor not following specified work plan&lt;br&gt;• Lack of coordination between DOT and contractor&lt;br&gt;• Utility relocation is not an integral part contractor's work plan&lt;br&gt;• Material shortages&lt;br&gt;• Insufficient notice is given to schedule the relocations&lt;br&gt;• Unable to relocate before construction begins&lt;br&gt;• Natural disasters such as hurricanes&lt;br&gt;• Rework required</td>
</tr>
<tr>
<td>Phase</td>
<td>Issue Cited by DOTs</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **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: [13]
Project Delivery Core Processes
("Project ID + Scope" Thru "Road Building" and Maintenance)
APPENDIX G. KYTC UTILITY COORDINATION PROCESS

PARTICIPANTS OF THE KYTC UTILITY COORDINATION PROCESS

<table>
<thead>
<tr>
<th>District Utility Agent (UA)</th>
<th>District Project Engineer (PE)</th>
<th>District Utility Supervisor (US)</th>
<th>Project Development Branch Manager (PDM)</th>
<th>Utility Branch Manager (UBM)</th>
<th>Utility Area Coordinator (AC)</th>
<th>Utility Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>District Office Personnel</td>
<td>Central Office Personnel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

KYTC UTILITY COORDINATION PROCESS DESCRIPTION

FIELD REVIEW
- 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.
- Have to prepare and mail an initial contact letter to each utility company that may have facilities along the proposed route.

UTILITY CONTACT LIST
- Shall maintain an accurate, up-to-date list of utility companies (including utility owners identified).
- Project - Specific Contact Lists
  - Shall be maintained in KURTS for the duration of the project's lifetime.
  - Shall indicate if each utility is impacted by the roadway or simply within the project bounds. (Specifically for each project)
  - Shall be updated as necessary to include company name, utility type, contact information. KURTS facilitates tracking all this information.

FACILITY MAPPING
- Identification and physical location of all utilities potentially affected by the proposed roadway construction.
- 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.

COLLABORATION between them is necessary to produce complete accurate
To identify and locate existing underground utility facilities using various means and levels of accuracy, (Horizontal and vertical locations)

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.

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.

KURST is used to generate and record utility phase estimates and request to program funds for utility relocation

UTILITY ESTIMATING AND PROGRAMMING FUNDS

Estimating process

Request the development of the estimates for U phase funding. Shall initiate the development and update of the estimates.

U phase estimates have to be updated at each of the stages (Class E,D,C,B,A)

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

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

**JOINT MEETING**
- 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.

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.

**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 COMPANY**
- Utility companies shall present relocation packages and the content depends upon the type of relocation (reimbursable or non-reimbursable).
- Drawings, specifications, cost estimates, schedule, cabinet participation percentage analysis, engineering service contracts (if applicable).
- Non-reimbursable relocations may then be issued notice to proceed.

**REIMBURSABLE**
- 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.

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

**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.

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

**UTILITY CONSTRUCTION**

- 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.
- Shall be invited to the road project’s preconstruction meeting

**UTILITY COMPANIES**

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 utility company.