UTILITY CONFLICT MANAGEMENT (UCM)

INTRODUCTION

Utility conflict management is a comprehensive multi-stage process that involves the systematic identification and resolution of utility conflicts as part of the overall process to deliver transportation projects. UCM is one of five sets of interconnected processes that make up the practice of utility engineering at transportation agencies. The five interconnected processes are:

- Utility investigation
- Utility conflict management
- Utility coordination
- Utility design
- Utility relocation management

Two critical factors that contribute to utility inefficiencies in transportation project delivery are (a) the lack of adequate information about the location and attributes of utility facilities that might be affected by the project, and (b) lack of an effective process to manage conflicts between those facilities and project features and phases. These inefficiencies can result in a number of problems, including, but not limited to, the following:

- Disruptions when utility installations are encountered unexpectedly during construction, either because there was no previous information about those installations or because their stated location on the construction plans was incorrect.
- Damage to utility installations, which can lead to disruptions in utility service, environmental damage, and increased risk to the health and safety of construction workers and the public.
- Delays that can extend the period of project development and/or delivery and increase total project costs through higher bids, change orders and/or damage or delay claims, redesign, and litigation by utility owners or agencies. These delays also result in frustration by the traveling public and negative public perception about the project.
- Unplanned environmental corrective actions.
- Unnecessary utility relocations and project delivery inefficiencies that occur because adequate information about existing utility facilities was not available to enable stakeholders to apply alternative utility conflict resolution strategies.

Potential for utility conflicts exists at most transportation projects, such as in the following situations:

- Interference between utility facilities and transportation design features (existing or proposed).
- Interference between utility facilities and transportation construction activities or phasing.
- Interference between planned utility facilities and existing utility facilities.
- Noncompliance of utility facilities with utility accommodation policies.
- Noncompliance of utility facilities with safety and accessibility regulations.

Detection of utility conflicts as early as possible facilitates the identification and implementation of optimum strategies to resolve those conflicts. The goal of these strategies is to avoid conflicts first, minimize impacts second, and, if neither of these two strategies is feasible, then consider relocating the

utility facility. In practice, strategies to resolve a utility conflict could include one or more of the following:

- Modify the proposed transportation facility, e.g., by changing the horizontal and/or vertical alignment of the project, altering the drainage design to avoid existing utility lines, altering noise walls or traffic signal components, or optimizing construction phases.
- Implement an engineering measure to protect-in-place a utility facility, which does not involve utility relocation or changes to the transportation project alignment.
- Remove, abandon, or relocate the utilities in conflict.
- Accept an exception to policy.

UCM TOOLS

Tools to manage utility conflicts include the following:

- Standalone utility conflict list
- Utility conflict data model and database
- One-day UCM training course

These tools were developed as part of the Second Strategic Highway Research Program (SHRP2), and are currently being implemented nationwide by the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO). The tools and other information of interest are available on the AASHTO website at http://shrp2.transportation.org/Pages/UtilityRelatedProducts.aspx .

Standalone Utility Conflict List

The standalone utility conflict list is a compact tool in Microsoft® Excel® format, which includes a main utility conflict table (Figure 1) and a supporting worksheet to analyze utility conflict resolution alternatives (Figure 2). This tool is designed to serve the dual purpose of (a) documenting utility conflicts and their resolution process and (b) providing a mechanism for exchange of information between a DOT and utility owners. The tool accomplishes this goal by providing columns in the spreadsheet template that are some of the most commonly used by most state DOTs around the country. At the same time, the tool provides flexibility by enabling users to customize the table structure, e.g., by adding columns of particular interest to a state DOT. The standard UCM sheets are designed to be printed on 11x17-inch paper.

Utility Conflict Management (UCM) - Utility Conflict List

Project Owner: _____
Project No.: _____
Project Description: _____
Highway or Route: _____

Note: Use companion sheet to compare utility conflict resolution alternatives

Developed/Revised By: _____
Date: _____
Reviewed By: _____
Date: _____

Utility Owner and/or Contact Name	Utility Conflict ID	Drawing or Sheet No.	Utility Type	Size and/or Material	Utility Conflict Description	Start Station	Start Offset	End Station	End Offset	Utility Investigation Level Needed	Test Hole No.	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status

Figure 1. Standalone Utility Conflict List – Main Table

Utility Conflict Management (UCM) - Analysis of Utility Conflict Resolution Alternatives

Utility Conflict ID	Alternative Number	Alternative Description	Alternative Advantages	Alternative Disadvantages	Impact on Project Delivery Time (Months)	Engineering Cost (Utility)	Direct Cost (Utility)	Engineering Cost (DOT)	Direct Cost (DOT)	Other Costs	Total Cost	Feasibility	Decision

Figure 2. Standalone Utility Conflict List – Analysis of Utility Conflict Resolution Alternatives

Utility Conflict Data Model and Database

The utility conflict data model and database is a scalable conflict list representation that facilitates managing utility conflicts in a database environment. To facilitate implementation, the tool includes the following components:

- Logical and physical data model in AllFusion® Erwin® Data Modeler format, which can be easily exported to database formats such as Oracle® and Microsoft SQL Server®.
- Oracle® schema, which can be used to create a version of the UCM database in Oracle.
- Microsoft Access® database, which can be used to quickly examine tables and queries in a standalone desktop environment.
- Data dictionary.

Conceptually, the database enables the management of six groups of data that are related to utility conflict information: utility conflict, utility facility, utility agreement, document, project, and user. Figure 3 provides a generalized depiction of these six data groups, along with arrows that represent high-level relationships between data group pairs. Each oval in Figure 3 represents a large number of entities or tables that are needed to manage a specific piece of information. For example, the Utility Conflict group contains close to 20 entities or tables that are needed to manage utility conflict data along with several connecting tables that facilitate relationships to other data groups. The model structure is modular, which means that individual data groups could be replaced by existing data systems at the agency, e.g., in the case of the Project, Document, or User groups.

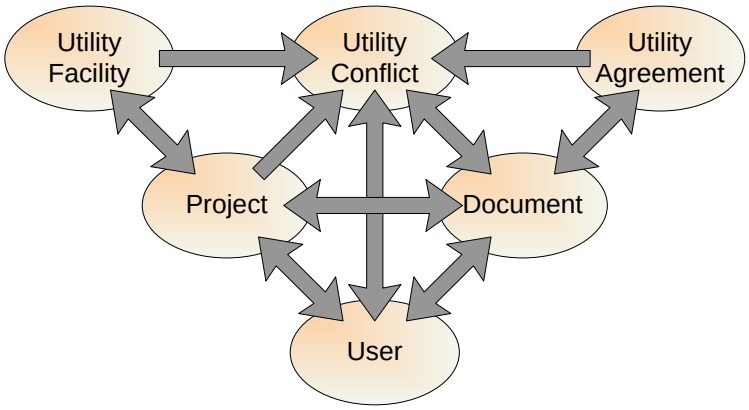

Figure 3. Conceptual Model for the Management of Utility Conflicts

The data model in ERwin format complies with the following requirements and standards:

- Use of information engineering (IE) notation to model entity relationships.
- "Third normal form" normalization level.
- Modular structure based on the six data groups in the conceptual model in Figure 3, with a core entity per data group.
- Entity names that use alphanumeric (no special) characters, have fewer than six words, and are derived from the data description.
- Attribute names that use alphanumeric (no special) characters, have less than six words, and consist of one or more prime words, zero or more qualifier words, and end with one class word.
- Attributes that use standardized data types.

One-Day UCM Training Course

The one-day UCM training course is a standalone tool that includes a lesson plan and presentation materials to assist with the introduction and dissemination of the UCM approach. The one-day UCM training course is divided into six lessons, as summarized in Table 1.

Table 1. One-Day UCM Training Course – Lesson Plan

Time	Topic
8:30 AM– 9:00 AM	Introductions and Course Overview
9:00 AM– 10:15 AM	Utility Conflict Concepts
10:15 AM– 10:30 AM	Morning Break
10:30 AM– 11:45 AM	Utility Conflict Identification and Management
11:45 AM– 1:00 PM	Lunch Break
1:00 PM– 1:20 PM	Use of Database Approach to Manage Utility Conflicts
1:20 PM– 2:20 PM	Hands-On Utility Conflict Management Exercise Part I
2:20 PM– 2:35 PM	Afternoon break
2:35 PM– 3:35 PM	Hands-On Utility Conflict Management Exercise Part II
3:35 PM– 3:45 PM	Wrap-Up

Ideally, UCM course participants should include representatives of the following stakeholder groups:

- Utility engineers and coordinators
- Designers representing specialties such as geometric design, hydraulic engineering, bridge engineering, and traffic engineering
- Project managers
- Construction managers and engineers
- Utility owners
- Highway and utility consultants
- Right of way agents and utility permit reviewers
- Surveyors

The interactive hands-on exercise enables participants, who are organized into small groups of about five or six, to identify and resolve utility conflicts using a set of plans that includes relevant information such as project plan views, profiles, and cross sections; drainage design plan views, profiles, and cross sections; utility investigation plans and test hole sheets, traffic signal design plans, and construction phasing. The exercise includes the following main activities for each group of participants:

- Identify and document utility conflicts using the standalone UCM conflict list based on the information provided.
- For a few conflict locations, examine and document utility conflict resolution alternatives in detail, including a high-level assessment of project delivery time impacts and potential costs (both to the DOT and the utility owner).
- Provide a three-minute oral presentation to the rest of the class, summarizing the process to identify and resolve utility conflicts and lessons learned.

UCM STAGES AND ACTIVITIES

Figure 4 provides a representation of the design-bid-build project delivery process. The diagram depicts both phases (planning, preliminary design, and so on) as well as major functional areas (environmental, real property acquisition, utilities, and so on). Depending on the type of project, some phases or activities might not apply. Utility activities span most phases of the project delivery process (area highlighted in red). As mentioned, utility activities include utility investigation, UCM, utility coordination, utility design, and utility relocation management. These processes are both interconnected and multi-stage.

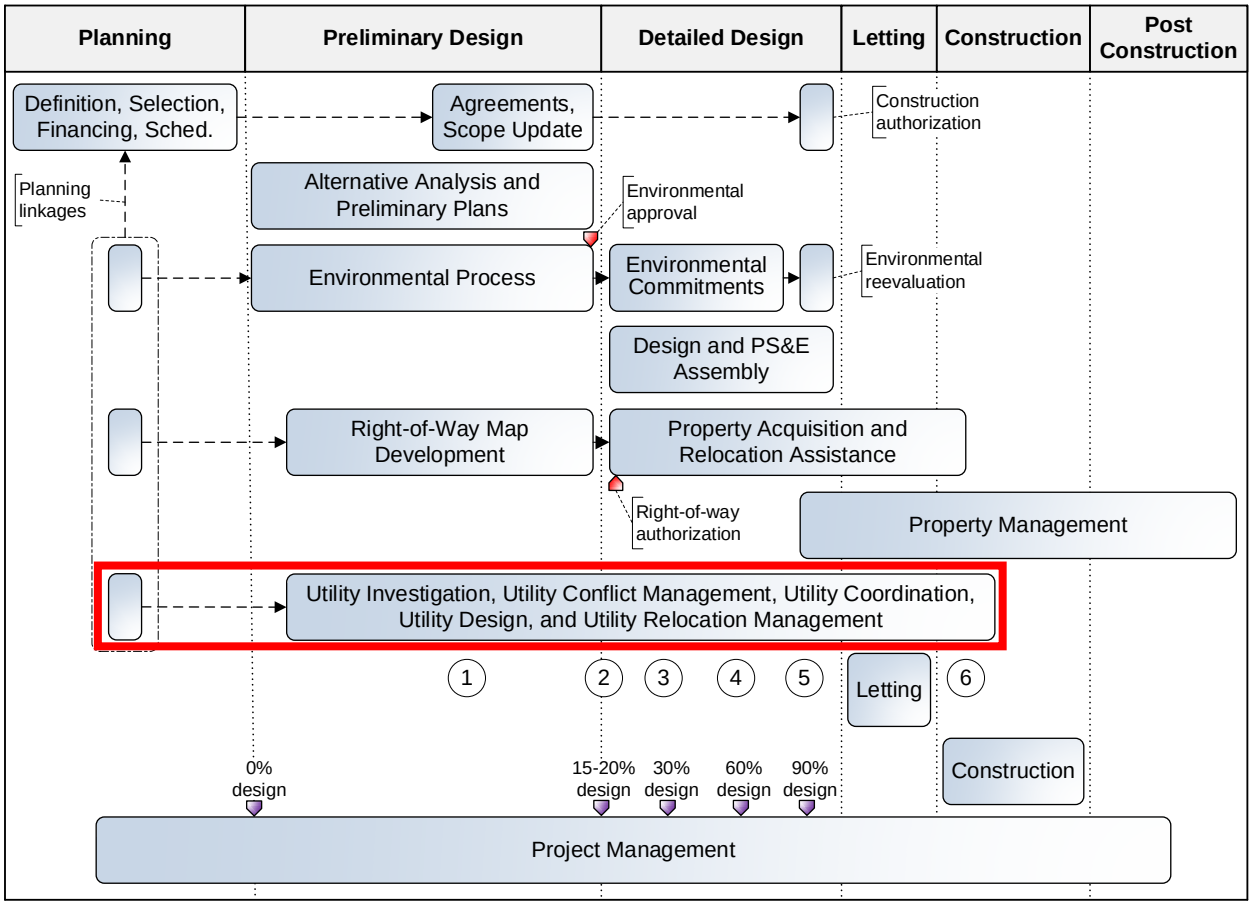

Figure 4. Utility Process within the Project Delivery Process (Traditional Design-Bid-Build Project Delivery Method).

Figure 4 also shows the approximate location of six UCM stages. In practice, the number of UCM stages and activities within each stage can vary widely depending on the specific characteristics and delivery method of the project under consideration. The following sections describe UCM stages and activities for three hypothetical types of projects:

- Significant project that goes through all project delivery phases.
- Project undergoing accelerated project delivery.

- Relative small project for which many elements of the project are known or fixed, but information about existing utility facilities and their impact on the project are largely unknown.

Example 1 – Project that Goes Through All Project Delivery Phases

Table 2 shows a generalized description of six major UCM stages and activities within each stage. Figure 4 shows the approximate location of each of these UCM stages.

Table 2. UCM Stages (Traditional Design-Bid-Build Project Delivery Method) – Example 1

UCM Stage	Description	Activities
1	Stage 1 corresponds to the beginning of the process when potential utility conflicts are identified for the first time during the preliminary engineering phase.	• Conduct preliminary investigation based on existing records. This corresponds to a quality level D (QLD) investigation when using the American Society of Civil Engineers/Construction Institute (ASCE/CI) 38-02 standard. • While requesting information from utility owners about existing records, ask about major physical constraints associated with existing utility facilities, with a focus on constraints that could have an impact on the project alignment or the identification of potential utility conflict resolution strategies in subsequent stages. • Conduct an initial assessment of utility conflicts and impacts. For each potential conflict, determine whether the utility is in potential conflict or whether more accurate data are needed to make a determination. This analysis would also include an assessment of potential impacts based on major constraint information provided by utility owners. • Use the UCM conflict list (Figure 1) and a composite utility plan to document utility conflicts. • Schedule at least one utility coordination meeting. This meeting can also be used to discuss the framework for effective coordination activities during the design phase.

UCM Stage	Description	Activities
2	Stage 2 corresponds to the part of the process (typically at the end of the preliminary design phase or beginning of the design phase) when the agency collects detailed survey data, including visible utility appurtenances.	• Survey visible utility appurtenances and correlate this information with the preliminary utility investigation in Stage 1. The survey should include all aboveground utility facilities, such as poles, guy wires, manholes, and valves. The result corresponds to a QLC investigation when correlated to belowground utility facilities and using the ASCE/CI 38-02 standard. • Assess utility conflicts and corresponding impacts. For each potential conflict, determine whether the utility is in conflict or whether more comprehensive, accurate data are needed to make a determination, including locations that would warrant QLB and/or QLA data. At this point in the design phase, the horizontal and vertical alignment is under development and the drainage design is only in its beginning stages, limiting the ability to confirm a large number of utility conflict locations. However, documenting the status of potential conflicts and the locations where additional utility investigations are needed can save valuable time later in the design phase. • Request input from utility owners to confirm utility conflict locations, assess utility conflict impacts including constructability challenges, and discuss potential conflict resolution strategies. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Schedule at least one utility coordination meeting.

UCM Stage	Description	Activities
3	Stage 3 corresponds to the part of the process, around 30-percent design, when the agency is finalizing the horizontal and vertical alignment, and is undertaking other design activities including drainage design. At this point, it is common to collect detailed information about belowground utility installations and use the resulting data to identify or confirm utility conflicts, as well as analyze and review utility conflict resolution strategies.	• Conduct detailed utility investigations using appropriate geophysical methods at QLB for the location and soil conditions of the project to produce a map of horizontal locations of belowground utility installations. In addition to standard QLB deliverables, geophysical techniques can help to uncover other underground facilities that could have an impact on the project, e.g., old concrete foundations or railroad tracks. • Assess utility conflicts and corresponding impacts. For each potential conflict, determine whether the utility is in conflict or whether QLA test holes are needed to determine or confirm the depth of utility facilities that may be in conflict. • Request input from utility owners to confirm utility conflict locations and assess utility conflict impacts including constructability challenges. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Schedule at least one utility coordination meeting to discuss utility conflict resolution strategies. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other field requirements. Utility relocation schedules should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners. • Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assemble composite utility plans showing all existing and relocated utility installations, and proposed utility conflict resolution strategies.

UCM Stage	Description	Activities
4	Stage 4 corresponds to the part of the process, around 60-percent design (or earlier if possible), when critical elements of the project design are in place, including the horizontal and vertical alignments and the drainage design. At this point, it is common to expose belowground utility installations at specific locations to gather accurate depth data and other critical facility information.	• Conduct detailed utility investigations at QLA at specific locations to gather accurate depth data and other critical facility information. • Assess utility conflicts and corresponding impacts. For each conflict location, determine whether the utility is in conflict or not. • Request input from utility owners to confirm utility conflict locations and assess utility conflict impacts including constructability challenges. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Schedule at least one utility coordination meeting to discuss utility conflict resolution strategies. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. Utility relocation schedules should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners. • Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assemble composite utility plans showing all existing and relocated utility installations, and proposed utility conflict resolution strategies.

UCM Stage	Description	Activities
5	Stage 5 corresponds to the part of the process, around 90-percent design, when the agency begins to assemble final plan, specifications, and estimate (PS&E) documents.	• Assess any remaining utility conflicts and corresponding impacts. At this point in the design phase, the number of new utility conflicts should be low if UCM practices have been followed systematically in previous stages. • Request input from utility owners to confirm utility conflict locations, assess utility conflict impacts including constructability challenges, and discuss potential conflict resolution strategies. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. Utility relocation schedules should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners. • Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assemble composite utility plans showing all existing and relocated utility installations, and proposed utility conflict resolution strategies. • Include utility plans in the PS&E documents. • Prepare utility statement for inclusion in the bid package, showing the status of utility work completed prior to construction, utilities that are not in conflict with the project, and utility work that must be completed during construction.

UCM Stage	Description	Activities
6	Stage 6 corresponds to the part of the process at the beginning of the construction phase. At this point, some utility relocations might still need to be completed. Depending on the situation, utility relocations might also be included in the highway contract. This phase also involves managing new utility conflicts that are identified, including conflicts that were missed earlier in the project.	• Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assess new utility conflicts and corresponding impacts that are uncovered during construction. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Request input from utility owners to confirm utility conflict locations, assess utility conflict impacts including constructability challenges, and discuss potential conflict resolution strategies. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. Utility relocation schedules should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners.

Example 2 – Project Undergoing Accelerated Project Delivery

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

- Consolidate utility investigation activities, e.g., by conducting QLB and QLA investigations together earlier in the process. In effect, this strategy eliminates having to conduct a preliminary utility investigation first at QLD and QLC because these two activities would need to be conducted anyway to gather existing records to prepare QLB deliverables.
- Assess utility conflicts and impacts earlier if critical elements of the design, e.g., horizontal and vertical alignments and drainage design are in place earlier in the process. Similar opportunities might occur if design elements such as noise barrier alignments and traffic signal designs are completed earlier during design.
- Assess utility conflicts and impacts earlier if constructability reviews are implemented earlier in the process.

- Integrate and/or improve coordination between the utility process and the property interest acquisition process, e.g., by completing the identification of parcels to acquire and by starting the parcel acquisition process earlier in the process.

Table 3 shows a consolidated description of UCM stages and activities that includes five stages.

Table 3. UCM Stages (Design-Bid-Build Project Delivery Method) – Example 2

UCM Stage	Description	Activities
1	Stage 1 corresponds to the beginning of the process when potential utility conflicts are identified for the first time during the preliminary engineering phase. The agency is also beginning to undertake certain design phase activities, including the collection of detailed survey data and visible utility appurtenances.	• Conduct detailed utility investigations using appropriate geophysical methods at QLB, supported by necessary data collected at QLC and QLD, for the location and soil conditions of the project to produce a map of horizontal locations of aboveground and belowground utility installations. In addition to standard QLB deliverables, geophysical techniques can help to uncover other underground facilities that may be have an impact on the project, e.g., old concrete foundations or railroad tracks. • Coordinate with the project surveyor to establish survey control for the utility investigation. • While requesting information from utility owners about existing records, ask about major physical constraints associated with existing utility facilities, with a focus on constraints that could have an impact on the project alignment or the identification of potential utility conflict resolution strategies in subsequent stages. • Conduct an initial assessment of utility conflicts and impacts. For each potential conflict, determine whether the utility is in potential conflict or whether more accurate data are needed to make a determination. This analysis would also include an assessment of potential impacts based on major constraint information provided by utility owners. • For each potential conflict, determine whether the utility is in conflict or whether QLA test hole data are needed to determine or confirm the depth of utility facilities that may be in conflict. • Use the UCM conflict list (Figure 1) and a composite utility plan to document utility conflicts. • Schedule at least one utility coordination meeting. This meeting can also be used to discuss the framework for effective coordination activities during the design phase.

UCM Stage	Description	Activities
2	Stage 2 corresponds to the part of the process, around 30-percent design, when the agency is finalizing the horizontal and vertical alignment, and is undertaking or finalizing other critical design activities, such as drainage design.	• Conduct detailed utility investigations at QLA at specific locations to gather accurate depth data and other critical facility information. • Assess utility conflicts and corresponding impacts. For each conflict location, determine whether the utility is in conflict or not. • Request input from utility owners to confirm utility conflict locations and assess utility conflict impacts including constructability challenges. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Schedule at least one utility coordination meeting to discuss utility conflict resolution strategies. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. The utility relocation schedule should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners. • Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assemble composite utility plans showing all existing and relocated utility installations, and proposed utility conflict resolution strategies.

UCM Stage	Description	Activities
3	Stage 3 corresponds to the part of the process, around 60-percent design (or earlier if possible), when critical elements of the project design are in place, and the agency is undertaking or finalizing other design elements.	• Assess utility conflicts and corresponding impacts. For each conflict location, determine whether the utility is in conflict or not. • Request input from utility owners to confirm utility conflict locations and assess utility conflict impacts including constructability challenges. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Schedule at least one utility coordination meeting to discuss utility conflict resolution strategies. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. The utility relocation schedule should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners. • Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assemble composite utility plans showing all existing and relocated utility installations, and proposed utility conflict resolution strategies.

UCM Stage	Description	Activities
4	Stage 4 corresponds to the part of the process, around 90-percent design, when the agency begins to assemble final PS&E documents.	• Assess any remaining utility conflicts and corresponding impacts. At this point in the design phase, the number of new utility conflicts should be low if UCM practices have been followed systematically in previous stages. • Request input from utility owners to confirm utility conflict locations, assess utility conflict impacts including constructability challenges, and discuss potential conflict resolution strategies. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. The utility relocation schedule should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners. • Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assemble composite utility plans showing all existing and relocated utility installations, and proposed utility conflict resolution strategies. • Include utility plans in the PS&E documents. • Prepare utility statement for inclusion in the bid package, showing the status of utility work completed prior to construction, utilities that are not in conflict with the project, and utility work that must be completed during construction.

UCM Stage	Description	Activities
5	Stage 5 corresponds to the part of the process at the beginning of the construction phase. At this point, some utility relocations might still need to be completed. Depending on the situation, utility relocations might also be included in the highway contract. This phase also involves managing new utility conflicts that are identified, including conflicts that were missed earlier in the project.	• Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assess new utility conflicts and corresponding impacts that are uncovered during construction. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Request input from utility owners to confirm utility conflict locations, assess utility conflict impacts including constructability challenges, and discuss potential conflict resolution strategies. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. The utility relocation schedule should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners.

Example 3 – Small Project with Many Elements Known or Fixed

Table 4 shows UCM stages and activities for a project with many known or fixed elements, but information about existing utility installations and their impact on the project are largely unknown.

Table 4. UCM Stages (Design-Bid-Build Project Delivery Method) – Example 3

UCM Stage	Description	Activities
1	Stage 1 corresponds to the beginning of the process when potential utility conflicts are identified for the first time. The agency is finalizing the horizontal and vertical alignment, and is undertaking or finalizing other critical design activities, such as drainage design.	• Conduct a utility investigation depending on the level of exposure and risk the agency would be absorbing if this information is not gathered. The utility investigation (including QLD, QLC, QLB, and QLA data) would include a combination of preliminary information and records research, survey of visible appurtenances, targeted geophysical data collection, and test holes at critical locations. • Coordinate with the project surveyor to establish survey control for the utility investigation. • While requesting information from utility owners about existing records, ask about major physical constraints that could have an impact on the identification of potential utility conflict resolution strategies in subsequent stages. • Conduct an assessment of utility conflicts and impacts. For each potential conflict, determine whether the utility is in conflict. This analysis would also include an assessment of potential impacts based on major constraint information provided by utility owners. • Use the UCM conflict list (Figure 1) and a composite utility plan to document utility conflicts. • Schedule at least one utility coordination meeting. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. The utility relocation schedule should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners. • Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assemble composite utility plans showing all existing and relocated utility installations, and proposed utility conflict resolution strategies.

UCM Stage	Description	Activities
2	Stage 2 corresponds to the part of the process, around 90-percent design, when the agency begins to assemble final PS&E documents.	• Assess any remaining utility conflicts and corresponding impacts. At this point in the design phase, the number of new utility conflicts should be low if UCM practices have been followed systematically in the previous stage. • Request input from utility owners to confirm utility conflict locations, assess utility conflict impacts including constructability challenges, and discuss potential conflict resolution strategies. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. The utility relocation schedule should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners. • Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assemble composite utility plans showing all existing and relocated utility installations, and proposed utility conflict resolution strategies. • Include utility plans in the PS&E documents. • Prepare utility statement for inclusion in the bid package, showing the status of utility work completed prior to construction, utilities that are not in conflict with the project, and utility work that must be completed during construction.

UCM Stage	Description	Activities
3	Stage 3 corresponds to the part of the process at the beginning of the construction phase. At this point, some utility relocations might still need to be completed. Depending on the situation, utility relocations might also be included in the highway contract. This phase also involves managing new utility conflicts that are identified, including conflicts that were missed earlier in the project.	• Monitor utility relocations to ensure that (a) relocated utilities are built and surveyed in accordance with project survey accuracy requirements and (b) changes in the field with respect to the design plans are surveyed and depicted on as-built plans. • Assess new utility conflicts and corresponding impacts that are uncovered during construction. • Analyze and review utility conflict resolution strategies, with an emphasis on practices that avoid or minimize utility conflicts first. • Request input from utility owners to confirm utility conflict locations, assess utility conflict impacts including constructability challenges, and discuss potential conflict resolution strategies. • Coordinate utility relocation design with utility owners if relocating a utility facility is the most effective conflict resolution strategy. • Use the UCM conflict list (Figure 1, Figure 2) and a composite utility plan to document and update utility conflict information, as well as potential utility conflict resolution strategies. • Prepare utility relocation plans and utility relocation schedule for inclusion in utility agreements. The utility relocation plans and schedule should reflect UCM analysis and outcome. In addition to proposed utility relocation information, utility relocation plans should show utility excavation and fill zones, overhead spacing requirements, relocation phasing, and other construction requirements. The utility relocation schedule should show activities and duration by phase or location of work, work to be completed prior to the utility relocation, access and coordination requirements with others, and advance notices to utility owners.