Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/TX-13/0-6624-1		

4. Title and Subtitle	5. Report Date
OPTIMIZING UTILITY OWNER PARTICIPATION IN THE PROJECT DEVELOPMENT AND DELIVERY PROCESS	November 2012 Published: April 2013
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Cesar Quiroga, Yingfeng (Eric) Li, Edgar Kraus, and Jerry Le	Report 0-6624-1
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Texas A&M Transportation Institute College Station, Texas 77843-3135	11. Contract or Grant No. Project 0-6624
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Texas Department of Transportation Research and Technology Implementation Office P. O. Box 5080 Austin, Texas 78763-5080	Technical Report: September 2010–August 2012
	14. Sponsoring Agency Code

15. Supplementary Notes

Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.

Project Title: Improving the Response and Participation by Utility Owners in the Project Development Process

URL: http://tti.tamu.edu/documents/0-6624-1.pdf

16. Abstract

Coordination with utility owners during the project development and delivery process involves multiple activities, such as requesting and collecting data about the location and characteristics of existing facilities to identifying and analyzing utility conflicts, coordinating with utility stakeholders for the resolution of those utility conflicts, preparing and executing utility agreements, coordinating and inspecting utility adjustments, and coordinating reimbursements and audits. Effective communication, cooperation, and coordination among utility stakeholders are critical to keeping transportation projects on schedule. Unfortunately, these elements are frequently lacking during project development and delivery to allow for the adoption of cost-effective solution strategies. This report documents the results of research completed to develop strategies to improve the participation and response of utility owners in the project development and delivery process. To achieve this objective, the researchers (1) reviewed strategies that the Texas Department of Transportation (TxDOT) and other agencies use to engage utility owners, (2) developed a set of strategies designed to optimize utility owner participation, (3) conducted stakeholder meetings and workshops to gauge the potential acceptability of these strategies, and (4) developed recommendations for changes to business processes and procedures. The four sets of strategies are: (1) modernization of the utility process, (2) utility conflict matrix approach, (3) streamlining and standardization of utility cost data submissions, and (4) core skill training on utility topics. The research also included the development of an implementation plan and standalone guidebook and training materials to assist in the implementation of each of these strategies.

17. Key Words	18. Distribution Statement
Utility Coordination, Utility Conflict Management, Project Development and Delivery Process, Utility Cost Estimates, Training	No restrictions. This document is available to the public through NTIS: National Technical Information Service Alexandria, Virginia 22312 http://www.ntis.gov

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	166	

OPTIMIZING UTILITY OWNER PARTICIPATION IN THE PROJECT DEVELOPMENT AND DELIVERY PROCESS

by

Cesar Quiroga, P.E.
Senior Research Engineer
Texas A&M Transportation Institute

Yingfeng (Eric) Li
Assistant Research Scientist
Texas A&M Transportation Institute

Edgar Kraus, P.E.
Associate Research Engineer
Texas A&M Transportation Institute

and

Jerry Le
Software Applications Developer
Texas A&M Transportation Institute

Report 0-6624-1
Project 0-6624
Project Title: Improving the Response and Participation by Utility Owners in the Project Development Process

Performed in cooperation with the
Texas Department of Transportation
and the
Federal Highway Administration

November 2012
Published: April 2013

TEXAS A&M TRANSPORTATION INSTITUTE
College Station, Texas 77843-3135

DISCLAIMER

The contents of this document reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). This document does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. The engineer in charge of the project was Cesar Quiroga, P.E. (Texas Registration #84274).

The United States Government and the State of Texas do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

ACKNOWLEDGMENTS

This research was conducted in cooperation with TxDOT and FHWA. The researchers acknowledge the advice and assistance of the project director and research advisors at TxDOT:

- Tommy Jones, West Region (project director).
- David Roberts, Houston District.
- Guy Sledge, Lubbock District.
- Stephen Stakemiller, Houston District.
- Dean Wilkerson, Information Technology Division.
- Charon Williams, Right of Way Division.

The researchers met with numerous other individuals at TxDOT and other agencies and conducted several field visits to gather and/or complement data and information needed for the analysis. They gratefully acknowledge the valuable help and information received throughout the process.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

LIST OF ACRONYMS, ABBREVIATIONS, AND TERMS

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average daily traffic
ANSI	American National Standards Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BPMN	Business Process Model and Notation
CAD	Computer-aided design
CE	Categorical exclusion
CFR	Code of Federal Regulations
CPS	City Public Service
CSJ	Control section job
DCIS	Design and Construction Information System
DOT	Department of transportation
EA	Environmental assessment
EIS	Environmental impact statement
EST	Environmental Screening Tool
ETAT	Environmental Technical Advisory Team
ETDM	Efficient Transportation Decision Making
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
FPAA	Federal Project Authorization and Agreement
FUCC	Florida Utilities Coordinating Committee
FUP	Federal utility procedure
GDOT	Georgia Department of Transportation
GIS	Geographic information systems
GISST	Geographic Information System Screening and Analysis Tool
GPS	Global Positioning System
GSOC	Gopher State One Call
IDOT	Illinois Department of Transportation
IEEE	Institute of Electrical and Electronics Engineers
IRWA	International Right of Way Association
IT	Information technology
ITS	Intelligent transportation systems
LPA	Local public agency
LUP	Local utility procedure
MDOT	Michigan Department of Transportation
MDT	Montana Department of Transportation
MLT	Modernization leadership team
Mn/DOT	Minnesota Department of Transportation
MOU	Memorandum of understanding
NCHRP	National Cooperative Highway Research Program
NEMA	National Electrical Manufacturers Association

NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHI	National Highway Institute
NHS	National Highway System
NSW	New South Wales
PDF	Portable document format
PennDOT	Pennsylvania Department of Transportation
PS&E	Plans, specifications, and estimate
QLA	Quality level A
QLB	Quality level B
QLC	Quality level C
QLD	Quality level D
RDA	Restricted development area
RFID	Radio frequency ID
ROW	Right of way
ROWIS	Right of Way Information System
RTI	Research and Technology Implementation Office
SAWS	San Antonio Water System
SHRP	Strategic Highway Research Program
SUE	Subsurface utility engineering
SUP	State utility procedure
TAC	Texas Administrative Code
TPWD	Texas Parks and Wildlife Department
TUC	Transportation and utility corridor
TxDOT	Texas Department of Transportation
UACT	Utility Accommodation and Conflict Tracker (UACT)
UAR	Utility accommodation rules
UCD	Utility Conflict Database
UCM	Utility conflict matrix
UCMP	Utility cooperative management process
UIR	Utility Installation Review
USC	U.S. Code
VDOT	Virginia Department of Transportation
VE	Value engineering

CHAPTER 1. INTRODUCTION

The utility accommodation rules (UAR) in the Texas Administrative Code (TAC) provide guidance and a regulatory framework for the accommodation and adjustment of utility facilities within the right of way of the state highway network (*1*). Utility owners must also comply with a host of applicable federal and state laws, regulations, and policies, as summarized in the Texas Department of Transportation (TxDOT) *Right of Way (ROW) Utility Manual* (*2*), as well as many other laws ranging from the Texas Engineering Practice Act (*3*) to the Federal Clean Water Act (*4*) and the Americans with Disabilities Act (*5*). At the federal level, 23 Code of Federal Regulations (CFR) 645 describes requirements that apply to federal-aid projects regarding the accommodation and adjustment of utility facilities (*6*).

In addition to existing laws and regulations, utility owners must comply with a wide range of relevant industry standards and specifications. A small sample includes those developed by the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), the American Society of Civil Engineers (ASCE), the American Water Works Association (AWWA), the Institute of Electrical and Electronics Engineers (IEEE), the National Electrical Manufacturers Association (NEMA), and the National Fire Protection Association (NFPA).

Coordination with utility owners during the project development and delivery process is multifaceted and involves a wide range of activities. Examples include gathering information from utility owners about existing facilities, collecting field data and translating that information into project drawings, identifying and analyze utility conflicts, coordinating with utility stakeholders for the resolution of those utility conflicts, preparing and executing utility agreements, coordinating and inspecting utility adjustments, and coordinating reimbursements (if a utility adjustment is eligible) and audits.

A 2002 survey of state departments of transportation (DOTs), highway contractors, design consultants, and others identified utility adjustments as the most frequent reason for project delays (*7*). Two critical factors that contribute to inefficiencies in the management of utility issues during project development and delivery are (a) the lack of accurate, complete information about utility facilities that might be in conflict with the project and (b) the resolution and overall management of those conflicts. These inefficiencies can result in problems, such as 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 that can lead to disruptions in utility service, environmental damage, and risks 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 for the traveling public and negative public perception about the project.

Effective communication, cooperation, and coordination among utility stakeholders are critical to keep transportation projects on schedule (*8*). Unfortunately, these elements are frequently lacking during project development and delivery to allow for the adoption of cost-effective solution strategies. Reasons frequently cited to explain this situation include lack of familiarity of project managers about utility issues, project uncertainties that discourage utility owners from participating earlier in the process, and lack of high-quality utility facility data.

This report documents the results of research completed to develop strategies to improve the participation and response of utility owners in the project development and delivery process. To achieve this objective, the researchers reviewed strategies that TxDOT and other agencies use to engage utility owners, developed a set of strategies designed to optimize utility owner participation, conducted stakeholder meetings and workshops to gauge the potential acceptability of these strategies, developed recommendations for changes to business processes and procedures, and developed training materials.

The report is organized as follows:

- Chapter 1 is this introductory chapter.
- Chapter 2 provides a review of existing and innovative strategies.
- Chapter 3 provides a summary of stakeholder meetings and workshops.
- Chapter 4 discusses Strategy 1 (modernization of the utility process).
- Chapter 5 discusses Strategy 2 (utility conflict matrix approach).
- Chapter 6 discusses Strategy 3 (streamlining and standardization of utility cost data submissions).
- Chapter 7 discusses Strategy 4 (core skill training on utility topics).
- Chapter 8 includes conclusions and recommendations.

CHAPTER 2. REVIEW OF EXISTING AND INNOVATIVE UTILITY OWNER PARTICIPATION STRATEGIES

INTRODUCTION

This chapter summarizes lessons learned from a literature review of strategies that a number of jurisdictions have implemented (or are planning to implement) to encourage participation of utility owners in the project development process. The literature review includes a Texas-level review and a national-level review.

TEXAS-LEVEL REVIEW

Project Development and Delivery Process at TxDOT

The main source of information concerning the project development process at TxDOT is the *Project Development Process Manual* (*9*). This manual includes six chapters, as follows:

- Planning and programming.
- Preliminary design.
- Environmental.
- Right of way and utilities.
- Plans, specifications, and estimate (PS&E) development.
- Letting.

Each chapter in the manual includes sections, subsections, and tasks. Tasks typically include topics such as description, responsible party, subtasks, helpful suggestions, critical sequencing, and reference material. Each task has a four-digit code that represents the corresponding chapter. For example, Task 2000 (Conduct preliminary design conference) is the first task in Chapter 2 (Preliminary Design). The project development process manual includes almost 200 tasks that apply to a wide range of project types and characteristics. Figure 1 shows a widely used graphical representation of the project development process at TxDOT.

Depending on project characteristics, requirements, and status, a highway construction project could have one of the following authorization levels (see Figure 1):

- **Plan**. This level authorizes TxDOT districts to complete preliminary design activities and right of way determination, study route alternatives, perform environmental studies, and hold public hearings.

- **Develop**. This level authorizes TxDOT districts to prepare construction plans, acquire right of way, and perform utility adjustments. Districts should substantially complete project construction plans, right of way acquisition, and utility adjustments prior to moving to the Construct authorization level.

- **Construct**. This level authorizes TxDOT districts to complete construction documents and award construction contracts.

The actual project development process can deviate from the general framework in Figure 1 depending on specific project characteristics and requirements. For example, as Table 1 shows, a project could be non-freeway resurfacing or restoration (2R); non-freeway rehabilitation (3R); new location and reconstruction (4R); mobility corridor (5R); and special facilities. Different design criteria apply in each case, resulting in different groups of project development process tasks and, therefore, different project scopes, durations, and sequencing. Likewise, project delivery methods such as design-build methods can accelerate task durations and alter the sequencing of certain project development process tasks.

A small sample of critical documents and/or milestones associated with these authorization levels, which are related to utility activities, follows:

- **Geometric schematic approval**. For many projects, e.g., for projects requiring control of access or an environmental impact statement (EIS), the Design Division must approve geometric schematics developed in the preliminary engineering design phase before presenting the schematics at a public hearing (*9*). There are exceptions to this requirement, e.g., in the case of rural projects with few abutting property owners. If there are changes to previously approved schematics after the public hearing, the schematics must be resubmitted to the Design Division for final approval.

- **Right of way map**. This document includes right of way maps, parcel plats, and property descriptions. Preparing the right of way map is frequently on the critical path of project development and, as a result, it is essential to have clear, effective means to exchange accurate, relevant right of way documentation among all involved parties.

- **Environmental clearance**. This process involves preparing, and obtaining approval for, an environmental document appropriate with the project scope, which could be a categorical exclusion (CE), an environmental assessment (EA), or an EIS.

- **Right of way release**. The right of way release is an authorization by the Right of Way Division to conduct specific right of way and utility-related activities. Types of right of way releases include the following (*2*):

    - Early acquisition (hardship, protective buy, and donation).
    - Limited release for utility investigation.
    - Limited release for appraisal work only.
    - Partial release.
    - Full release.
    - Limited release for relocation assistance only.
    - Limited release for utility work only.

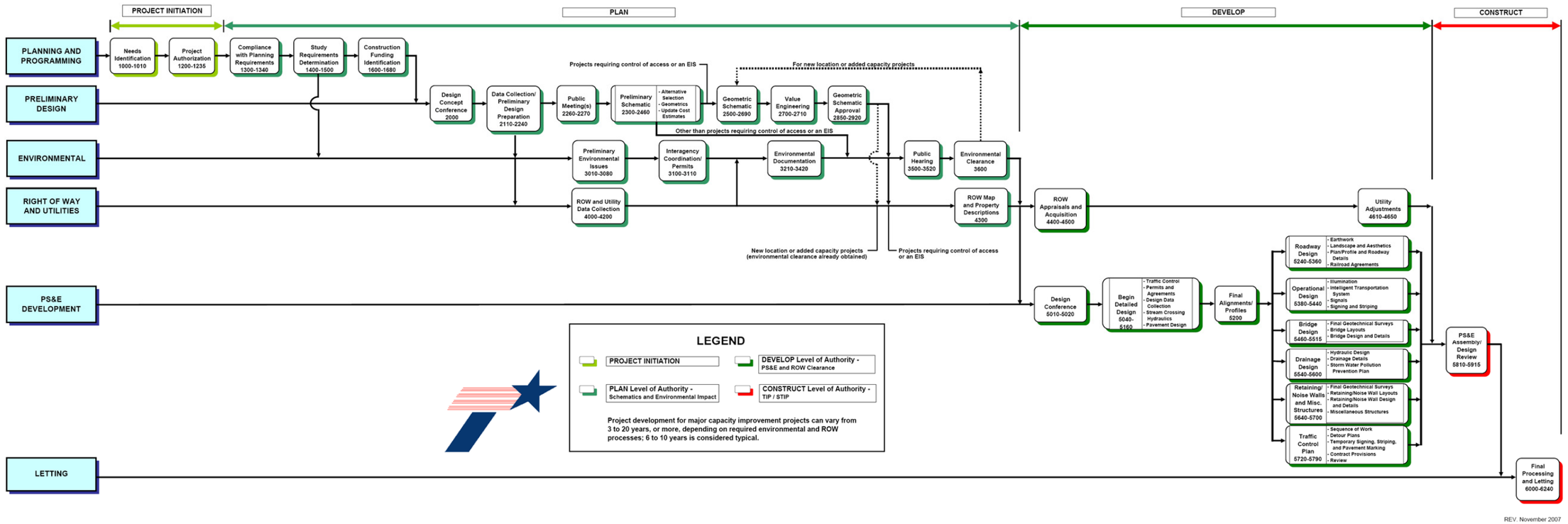


Figure 1. ***Project Development Process Manual*** **Diagram (*9*).**

Table 1. Highway Project Design Criteria (*9*, *10*).

Type	Description
2R	**Non-freeway resurfacing or restoration projects**. 2R projects consist of non-freeway work on facilities with an average daily traffic (ADT) of up to 3000 and are not on National Highway System (NHS) routes, which propose to restore the pavement to its original condition. Adding through travel lanes is not permitted for 2R projects. However, adding continuous two-way left-turn lanes, acceleration or deceleration lanes, turning lanes, and shoulders are acceptable as long as the existing through lane and shoulder widths are maintained. 2R projects could include upgrading roadway components as needed to maintain the roadway in an acceptable condition.
3R	**Non-freeway rehabilitation projects**. 3R projects consist of non-freeway work that extends the service life and enhances the safety of a roadway. In addition to resurfacing and restoration, 3R projects could include upgrading the geometric design and safety of a transportation facility. However, work does not include adding through travel lanes. Work may include upgrading geometric features such as roadway widening, minor horizontal realignment, and improving bridges to meet current standards for structural loading and to accommodate the approaching roadway width. 3R projects address pavement needs and/or deficiencies and substantially follow the existing horizontal and vertical alignments. The scope of 3R projects ranges from thin overlays and minor safety upgrading to more complete rehabilitation work.
4R	**New location and reconstruction projects**. 4R projects consist of work associated with new locations or reconstruction of transportation facilities such as urban streets, suburban roadways, two-lane rural highways, multilane rural highways, and freeways. In general, the result is a new roadway or upgrade to an existing roadway to meet geometric design criteria for new facilities. In addition to resurfacing, restoration, and rehabilitation, 4R projects could include reconstruction work, which typically involves substantial changes to the road such as additional through lanes, horizontal and/or vertical realignment, and major pavement structure improvements. Reconstruction work includes bridge replacement work.
5R	**Mobility corridor projects**. 5R projects consist of work associated with new locations or reconstructions of facilities intended for high-speed mobility (i.e., design speeds up to 100 miles per hour [mph]). Mobility corridors are intended for long distance travel and could include "multiple modes such as rail, utilities, freight, and passenger" (10). A 5R project can include all work associated with 4R projects, but different design standards apply because of the roadway's higher design speed and multiple participating transportation modes.
n/a	**Special facilities**. Special facility projects consist of work associated with facilities that do not fall under any of the previous categories. Examples include off-system bridge replacement and rehabilitation projects, historically significant bridge projects, Texas Parks and Wildlife Department (TPWD) park road projects, and bicycle facilities.

These releases require a right of way control section job (CSJ) number, and districts are encouraged to request that number as early as possible in order to conduct activities such as utility investigations and advance acquisitions. Typical activities that can be charged to the right of way CSJ number include right of way acquisition and adjustment assistance, condemnation proceedings, utility agreement processing, utility adjustments, and reimbursement of eligible utility adjustment costs. Preliminary engineering costs that are right of way related (such as right of way surveys, property descriptions, right of way maps, utility investigations, preparing right of way cost estimates, and right of way staking) are charged to the construction CSJ, not the right of way CSJ.

- **Utility and right of way certifications**. These certifications, which are included in the PS&E package that districts send to the Design Division at the end of the design phase, document the status of required right of way acquisitions and utility adjustments, as well as estimated schedules for pending right of way acquisitions and utility adjustments.

Utility Coordination and Conflict Resolution Process at TxDOT

The *ROW Utility Manual* describes a utility cooperative management process (UCMP) (called 'the process') that TxDOT encourages districts to use for managing utility-related activities (*2*). Figure 2 shows a flowchart diagram of the UCMP. A component of the UCMP is a utility adjustment sub-process (called 'the sub-process') that describes utility adjustment activities in more detail. The sub-process includes three major utility adjustment procedures (see Figure 3):

- **Federal Utility Procedure (FUP)**. The FUP applies in situations that include federal-aid participation. Utility adjustments are eligible for reimbursement depending on the kind of project or corridor (e.g., 100 percent in the case of interstate highway corridors or if a utility facility have a prior compensable property interest). TxDOT is responsible for all utility adjustment coordination activities.

- **State Utility Procedure (SUP)**. The SUP applies in situations where TxDOT coordinates adjustments with utility owners. In this case, utility owners are eligible for reimbursement if they have a prior compensable property interest.

- **Local Utility Procedure (LUP)**. The LUP applies in situations where a local public agency (LPA) coordinates adjustments with utility owners. In this case, TxDOT reimburses the LPA for a portion (typically 90 percent) of eligible adjustment expenditures.

The UCMP includes 10 high-level process activities (see Figure 2). The federal, state, and local procedures involve 13 sub-process activities (see Figure 3).

The *ROW Utility Manual* also mentions a Non-Reimbursable Procedure, which applies to non-reimbursable utility adjustments, although it does not include a corresponding workflow diagram. The manual does indicate that utility adjustments for non-reimbursable adjustments should be assigned a "U" number and should be listed on the right of way map when submitted to the Right of Way Division. The manual also requires utility owners to submit Form 1082 ("Utility Installation Request") and supporting plans.

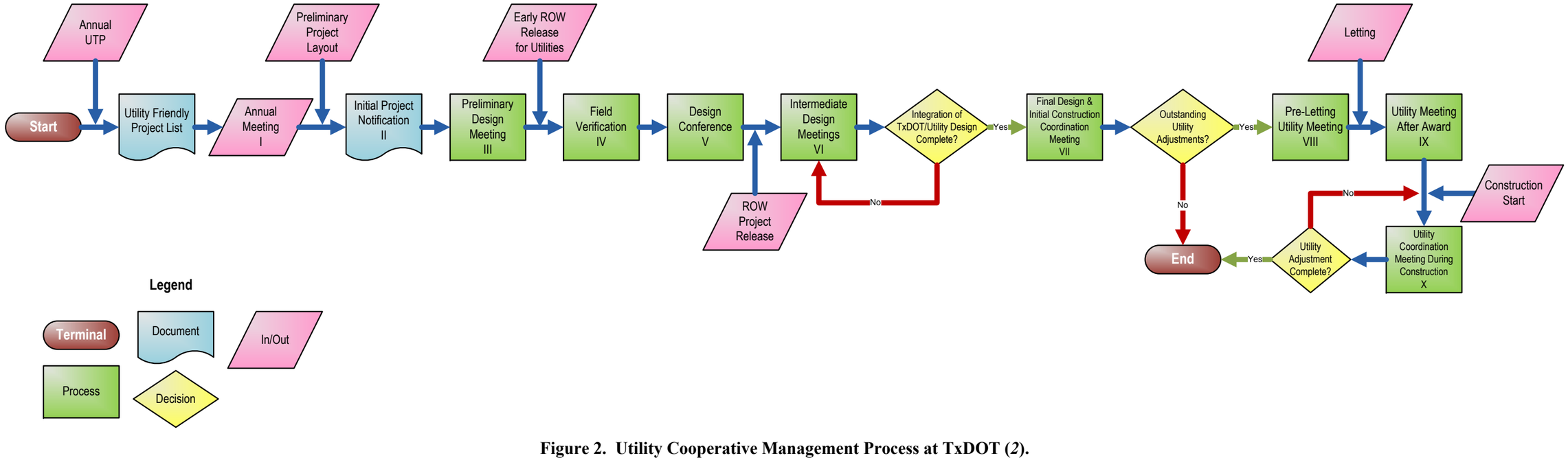


Figure 2. Utility Cooperative Management Process at TxDOT (*2*).

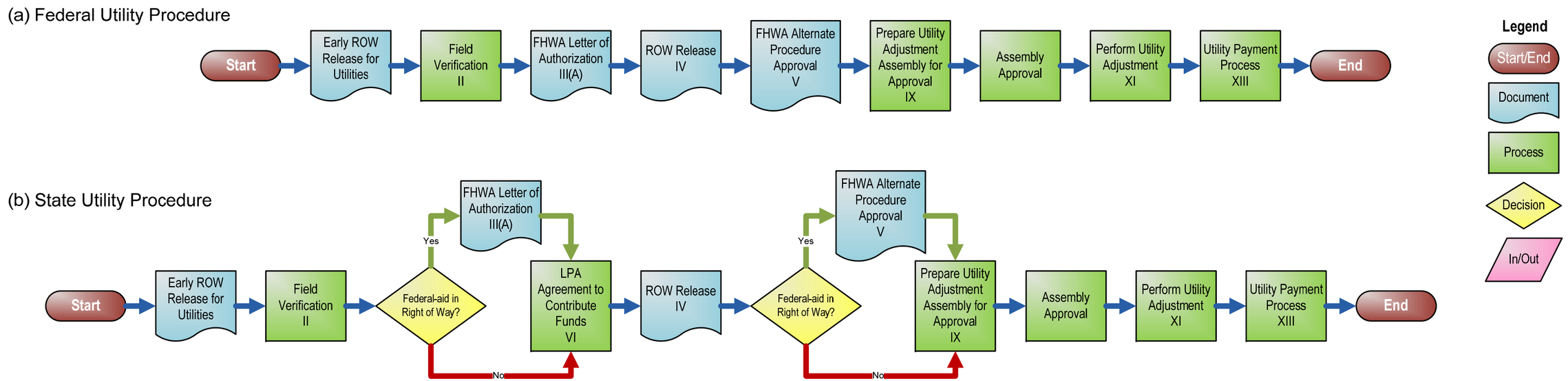


Figure 3. Sub-Process Activities. Federal, State, and Local Utility Procedures (*2*).

As part of the process, TxDOT is required to provide timely, adequate information to utility owners about the location of proposed transportation projects, and utility owners are required to provide adequate, sufficient information about their facilities (*1, 11*). For example, 43 TAC 21.22 (a) requires TxDOT to provide adequate plans to enable utility owners to determine the future location and characteristics of their adjusted facilities. 43 TAC 21.37 (b) requires utility owners to assess whether other utility facilities exist in the proposed installation area and to ensure that the proposed installations are compatible with existing and approved future utility facilities. 43 TAC 21.37 (c) requires utility owners to provide plans that include horizontal and vertical alignments of their proposed installations, relationship to existing highway facilities and right of way lines, and location of existing utilities that the proposed utility facilities may affect. Utility owners must provide this information using TxDOT's survey datum. 43 TAC 21.37 (c) includes a similar requirement for as-built plans or certified as-installed construction plans after completing adjustments in the field.

Texas Utilities Code Section 251.107 (b) requires Class A utility owners (i.e., other than water, slurry, or wastewater) to provide maps, grid locations, or other identifiers indicating the location of underground facilities to a One Call notification center and update this information as changes occur or at least quarterly. Interestingly, the notification center is not allowed to require utility owners to conduct a survey of their underground installations. Texas Utilities Code Section 251.157 (a) requires Class A utility owners to mark the approximate location of their facilities on the ground before excavation starts after receiving notice from a One Call notification center.

Issues that Affect the Usability of Project Development Process and Utility Process Documentation

Project Development Process Issues

Task sequencing information in the *Project Development Process Manual* is at a high, aggregated level. Some sections provide a general statement about task sequencing, e.g., "these tasks may be performed concurrently" or "tasks are listed in approximate chronological order." Although useful, these general statements can be misleading. For example, Chapter 4, Section 4 (Utility Adjustments) contains the following five tasks and a comment that these are listed in approximate chronological order:

- Task 4610 (Coordinate utility adjustment plans).
- Task 4620 (Prepare and execute utility adjustment agreements).
- Task 4630 (Utility owners adjust facilities).
- Task 4640 (Prepare utility clearance certifications).
- Task 4650 (Reimburse utility owners for eligible adjustment costs).

In reality, some of these tasks may occur concurrently, may be skipped, or may be performed in a different sequence, especially when dealing with more than one utility company.

Information about relationships between chapters, sections, and tasks is frequently missing in the project development process manual. Consider the following examples:

- There is little information about the relationship between Chapter 4 (Right of Way Utilities) and Chapter 5 (PS&E Development).

- There is little information about the relationship between Chapter 5, Section 7 (Drainage Design) and Chapter 4, Section 4 (Utility Adjustments).

- In Chapter 5, there is little information about the relationship between Section 4 (Roadway Design) and Section 7 (Drainage Design).

- In Chapter 4, there is no information how Section 3, Task 4400 (Obtain contractual agreements with local public agencies) relates to Section 4, Task 4610 (Coordinate utility adjustment plans).

Although the chart in Figure 1 is useful, some chart characteristics warrant further discussion. For example, the boxes in the chart, which represent project development process manual sections, follow the order provided in the *Project Development Process Manual*. Arrows appear to indicate precedence between task groups. Dotted arrows appear to indicate conditional relationships that are relevant only for certain project types. However, the exact meaning of the arrows is not clear since there are no arrow entries in the legend box.

Some task groups are shown in sequence in Figure 1, but these can actually occur concurrently. For example, depending on the type of project (or the relative status of utility adjustments versus right of way acquisition), "Utility Adjustments 4610-4650" can start before "ROW Appraisals and Acquisition 4400-4500." Similarly, "ROW Map and Property Descriptions 4300" can actually happen concurrently with "ROW and Utility Data Collection 4000-4200" tasks.

Utility Coordination and Conflict Resolution Process Issues

As mentioned, the UCMP includes 10 high-level process activities, and the federal, state, and local procedures involve 13 sub-process activities. The appendix includes a description of each activity or sub-activity and the researchers' detailed assessment of issues related to the usability of the UCMP and the sub-processes. Table 2 and Table 3 provide a summary of that assessment.

Table 2. Assessment of Existing Utility Cooperative Management Process Activities.

Level	Activity	Name	Phase	Comment
UCMP	Process Activity I	Annual Meeting	Planning and Programming	In practice, it may be unclear how the "utility friendly" project list should be developed cooperatively between TxDOT and utility owners.
UCMP	Process Activity II	Initial Project Notification	Preliminary Design	The description suggests a preliminary schematic or general layout of the project is required but then also mentions that a project design engineer and a design consultant have been selected. The former would suggest that the initial notification takes place in the middle of the preliminary design phase, but the latter suggests near the end of the preliminary design phase after the final geometric schematic has been approved. Although it appears the activity should take place at the beginning of the detailed design phase, it is difficult to confirm this assumption. The activity description is silent whether the notification requires the completion of the environmental document (this could be assumed because of the presumption that TxDOT is ready to start the project design).
UCMP	Process Activity III	Preliminary Design Meeting	Design	The preliminary design meeting takes place at the beginning of the design phase before the official project design conference. The preliminary design meeting is not the same as the project *conceptual design meeting*, which takes place at the beginning of the preliminary design phase. Until recently, the name for the conceptual design meeting in the *Project Development Process Manual* was 'preliminary design meeting,' and many districts are still using the old name. Using the same name for two different activities can be a source of confusion when determining the appropriate timing for this meeting. The description mentions three types or levels of utility owner involvement: Level 1, Level 2, and Level 3. However, it does not define what those levels are or represent. It is unclear why, at this meeting, a date should be set for the Design Conference.

Table 2. Assessment of Existing Utility Cooperative Management Process Activities (continued).

Level	Activity	Name	Phase	Comment
UCMP	Process Activity IV	Field Verification	Design	As described, the scope of field verification is consistent with detailed utility investigations. The description does not explicitly include a requirement for field verification to take place before the design conference. The UCMP diagram assumes that field verification takes place *before* the design conference and *before* the right of way release. A sub-process activity, also called Field Verification, takes place during the preliminary design phase and requires an early right of way release for utilities
UCMP	Process Activity V	Design Conference	Design	This meeting is the same as the design conference described in the TxDOT *Project Development Process Manual*, which takes place at the beginning of the design phase. However, this is not necessarily clear from the description, suggesting a separate meeting only focusing on utility issues. The description of the design conference in the TxDOT *Project Development Process Manual* is considerably different.
UCMP	Process Activity VI	Intermediate Design Meeting(s)	Design	From the description, it is not clear if these intermediate meetings are the same as other official design-level meetings (e.g., 30-, 60-, or 90-percent meetings). The description seems to suggest the intermediate meetings are utility-specific. It is not clear how utility owners with Level 2 involvement resolve conflicts and discontinue participating in the process during intermediate design meetings.
UCMP	Process Activity VII	Final Design & Initial Construction Coordination Meeting	Design	The name of the activity is confusing because the meeting is intended to take place *while* the district is finalizing the PS&E assembly for submission to Austin, so there is probably little construction coordination at this meeting. From the description, it is not clear whether the required activities actually take place at a meeting, e.g., prepare utility special provisions and special specifications, determine sequencing of utility work, identify and charge utility bid items to a separate right of way CSJ number, and finalize details of the escrow agreement with LPAs.

Table 2. Assessment of Existing Utility Cooperative Management Process Activities (continued).

Level	Activity	Name	Phase	Comment
UCMP	Process Activity VIII	Pre-Letting Utility Meeting	Letting	This meeting could be the same as (or different from) the project pre-bid conference. The project design engineer and/or the project construction engineer make that determination. If it is different from the pre-bid conference, the recommendation would be to have the pre-letting utility meeting *earlier* than the project pre-bid conference.
UCMP	Process Activity IX	Utility Meeting After Award	Construction	This meeting could be the same as (or different from) the project pre-construction conference. The project construction engineer makes that determination. If it is different from the pre-construction conference, the recommendation would be to have the utility meeting *earlier* than the project pre-construction conference.
UCMP	Process Activity X	Utility Coordination Meeting During Project Construction	Construction	The name of the activity is confusing because it suggests there is only one utility coordination meeting during construction. In reality, there could be several utility coordination meetings (as included in the description). Utility coordination meetings could be the same as (or different from) other project meetings that take during construction. The project construction engineer makes that determination.

Table 3. Assessment of Existing Right of Way Utility Adjustment Sub-Process Activities.

Level	Activity	Name	Phase	Comment
FUP, SUP, LUP	Sub-Process Activity I	Early Right of Way Release for Utilities	Preliminary Design	There is an inconsistency between the timing of this activity (according to the description) and the corresponding timing as depicted on the UCMP flowchart diagram. The UCMP flowchart diagram shows the early right of way for utilities as taking place between Preliminary Design Meeting (Process Activity III) and Field Verification (Process Activity IV). As mentioned previously, these two activities take place at the beginning of the design phase, whereas the early right of way release for utilities should take place after the Design Concept Conference and before the beginning of the detailed design phase. The first sentence suggests that an early right of way release is required for all projects.
FUP, SUP, LUP	Sub-Process Activity II	Field Verification	Preliminary Design	As described, the scope of field verification is vague. In general terms, it seems to be consistent with quality level D (QLD), quality level C (QLC), or quality level B (QLB) investigations. However, the description suggests a scope of work consistent with preliminary engineering design requirements. This *sub-process* field verification activity is not the same as the UCMP *process* field verification activity, which is a design-phase activity and takes place after the right of way release. A suggestion would be to rename this activity to clarify the difference.
FUP, SUP	Sub-Process Activity III(a)	Federal Project Authorization and Agreement (FPAA)	Preliminary Design	The second sentence in the description mentions the FPAA is a prerequisite for the TxDOT Right of Way Division. However, it does not explain the purpose of that prerequisite.
SUP, LUP	Sub-Process Activity III(b)	TxDOT-LPA Right of Way Contracts	Preliminary design	There is an inconsistency in the diagrams. The LUP diagram includes a box for Sub-Process Activity III(b). However, the SUP diagram does not. There is an inconsistency with Sub-Process Activity VI, which indicates that LPA agreements to contribute funds are executed under Sub-Process Activity III(b). If this is the case, it is not clear what the purpose of Sub-Process Activity VI is.
FUP, LUP, SUP	Sub-Process Activity IV	Right of Way Release	Design	Bullets 2, 3, and 4 may not be actual requirements.

Table 3. Assessment of Existing Right of Way Utility Adjustment Sub-Process Activities (continued).

Level	Activity	Name	Phase	Comment
FUP, SUP, LUP	Sub-Process Activity V	Alternate Procedure Approval from FHWA	Design	The FUP, SUP, and LUP show the alternate procedure approval as taking place after the right of way release. The request for the alternate procedure approval can be submitted concurrently with the request for the FPAA (Sub-Process Activity III[a]). The most likely scenario is that the alternate procedure approval needs to be in place *before* the step that follows the right of way release (i.e., preparing utility agreement assemblies [Sub-Process Activity IX in the case of the FUP and SUP]). It is not clear why this activity is needed in connection with the state or local utility procedures.
SUP	Sub-Process VI	LPA Agreement to Contribute Funds	Preliminary Design	The purpose of this activity is not clear because Sub-Process Activity III(b) would include executing agreements with LPA to contribute funds.
LUP	Sub-Process VII	Request for Determination of Eligibility	Design	The LUP diagram is confusing and makes it very difficult to understand and follow the decision-making process. One of the reasons is that TxDOT's determination of eligibility is represented by a box on the diagram, but the activity does not have an activity number and is directly connected with the request for eligibility. The sub-process activity includes a note to the effect that this activity is related to Sub-Process Activity XII, Determination of Upper Limit.
LUP	Sub-Process VIII	District Approves Utility Consultant Contract	Design	It is unclear if this is a consultant for the LPA to perform utility coordination, or a consultant for the utility owner to design an adjustment. It is unclear on what basis TxDOT could reject a utility consultant. Also unclear is whether this activity is required for all procedures.
FUP, SUP, LUP	Sub-Process Activity IX	Prepare Utility Adjustment Assembly for Approval	Design	Lump-sum agreements require a three-way agreement under the LUP.

Table 3. Assessment of Existing Right of Way Utility Adjustment Sub-Process Activities (continued).

Level	Activity	Name	Phase	Comment
FUP, SUP, LUP	Sub-Process Activity XI	Perform Utility Adjustment	Design	The goal at TxDOT is to complete utility adjustments prior to letting. Depending on the situation, utility adjustments can take place after the design phase is complete. Both activity descriptions and diagrams are silent on the procedure to follow when utility adjustments are included in the highway contract.
LUP	Sub-Process Activity XII	Determination of Upper Limit	Design, Letting, Construction	Although the description says this activity is mandatory, it is actually a suggested activity at the discretion of the LPA.
FUP, SUP, LUP	Sub-Process Activity XIII	Utility Payment Process	Design, Letting, Construction, Post-Construction	Utility Joint Use Acknowledgement is now Utility Joint Use and Occupancy.

In the UCMP, activity descriptions typically include a list of participants, activity objectives, and a narrative. Activities in the manual have a number (in roman numerals). However, activity numbers across utility procedures are not unique. For example, there are two activities IV: one at the process level (Field Verification) and a second one at the sub-process level (Right of Way Release).

Although activity narratives in the manual provide some indication of when activities are supposed to take place, that depiction is not always clear. As a result, a casual reader would have to use the process and sub-process diagrams (Figure 2, Figure 3) as the main source of information about presumed activity sequencing. However, the structure of both manual and diagrams would make this process challenging.

An explicit cross-reference between process and sub-process diagrams is missing. For example, it is not clear where to connect the sub-process diagram 'Start' and 'End' points to the process diagram, which makes it difficult to understand how the sub-process fits into the larger process. Some process and sub-process boxes share similar names, e.g., 'Early ROW Release for Utilities,' 'Field Verification,' and 'ROW Release,' which enabled the researchers to use those common elements as anchor points. However, given the ad hoc nature of the diagrams, it is only possible to use the anchor points as rough guidelines. In several cases, the researchers made educated guesses about the location of, and relationship between, common elements and discussed the findings with TxDOT officials.

The process and sub-process diagrams use different box types (e.g., 'Process,' 'Document,' 'In/Out,' 'Decision,' and 'Terminal') to represent activities. However, the use of different box types is inconsistent, making it difficult to use the diagrams to understand information flows. For example, a document in one diagram could appear as an in/out box in another diagram.

Likewise, it is not clear what a process box is or what the difference is between a process box and a document box.

Current Use of Utility Conflict Matrices at TxDOT

As part of the Strategic Highway Research Program (SHRP) 2 R15-B project recently completed (see National Level Review section), TxDOT provided sample utility conflict tables. Examples of lists that districts use include those shown in Figure 4 through Figure 11. According to information that TxDOT district officials provided, creating and maintaining these tables requires a significant time commitment. However, those officials consider the use of utility conflict lists to be worth the effort, considering that delay claims by a contractor resulting from an overlooked utility conflict can be costly to the department. Utility conflict lists at TxDOT have many different names, such as utility conflict lists, utility impact lists, utility coordination lists, utility adjustment reports, right of way and utilities status reports, and utility conflict matrices. There are considerable differences in the types of data these tables collect, and officials recognize that using different utility conflict lists in a district, or even in one office, make the utility coordination process more difficult. Not surprisingly, TxDOT is increasingly aware of the need to standardize utility conflict lists.

Some TxDOT districts do not use a utility conflict list but rather track the status of the documentation associated with utility facilities that need to be adjusted. Figure 4 is an example of this approach.

Problems during construction are frequently related to utility conflicts. To address this issue, many districts attempt to produce utility conflict lists as early as possible to give utility coordinators and designers more time and flexibility to deal with utility conflicts. The first utility conflict list is frequently developed during planning, which at this point is simply a list of utilities or a list of potential utility conflicts. The preliminary design group updates this list and includes information from utility owners and data from utility permits. Once the detailed design phase starts, the project designer develops a detailed utility conflict list, which also includes utility facilities that are not in conflict or only potentially in conflict. This practice is useful in case a design modification changes potential utility conflicts to actual utility conflicts or if utility conflicts appear during construction, which might require change orders.

Frequently, if a utility in conflict is not identified during the preliminary design phase, it becomes more difficult to avoid a utility adjustment. Preliminary design-level utility conflict lists are often called ‘potential utility conflict lists’ because often utilities are not confirmed and established as conflicts until a project’s detailed design is around 60 percent complete.

Updating utility conflict lists is typically the designer’s responsibility, but the right of way section helps where possible. Typically, the right of way section has better information about utility names and contacts. As a minimum, utility conflict lists are revised at 30-, 60-, and 90-percent design. Sometimes districts keep two different versions of the same list: 1) one version that includes all data items that are used for daily utility conflict management activities, and 2) a second version that is forwarded to the district engineer, which only includes the most important data items.

Although the official process calls for sending design plans to utility owners in preparation for 30-, 60-, and 90-percent design meetings, TxDOT sometimes does not send the 30-percent design drawings to utility owners because of the realization that utility owners tend not to get involved at that point. Most utility conflict management activities take place between 60- and 90-percent design. At project meetings, TxDOT provides design plans to utility owners and lets them determine how to resolve the utility conflicts. In practice, based on anecdotal information provided in the past, utility owners prefer TxDOT to take the lead in determining "who goes where."

During utility adjustments, some districts make an effort to "certify" the utility installation drawings that utility owners include in permit requests or utility agreements. These districts use an internal form that the utility inspector uses to note if the utility facility was inspected as planned or if any deviations from the previously submitted plan occurred. If there are significant changes, the utility inspector may request a new set of plans. Otherwise, the utility coordinator modifies or annotates the original plans, which then become the as-built plans. Some districts request utility facility plans that a professional engineer has signed and sealed. However, small projects and small utility owners typically do not have staff professional engineers.

TxDOT uses utility conflict lists to prepare PS&E package certifications. Those documents certify that the project is clear of all utility installations and ready for construction, except for the utility installations listed on the utility certification. Utility certifications typically only include a small amount of the information contained in utility conflict lists. In many cases, TxDOT also lists the number of days from the time of letting to actual start of roadway construction, typically 60 to 180 days. This strategy gives contractors time to clear and stake the right of way, provides utility companies time to adjust unresolved utility conflicts, and helps to prevent delay claims.

The district typically prepares the utility certification, often relying on ad hoc procedures, previously developed utility conflict lists, and often providing only a rough estimate of the actual status of utility conflicts on a project. Since most of the utility coordination is completed at the district level, utility coordinators at the division level mostly see the utility certification, not the more extensive utility conflict list.

TxDOT has started to use web-based map applications such as Google® Earth™, Google Maps™, and Microsoft® Bing™ Maps to review locations that might involve utility conflicts. Utility coordinators can make preliminary assessments if a utility is in conflict or not, and confirm the assessment through a field visit. Some districts have also started to plot global positioning system (GPS) coordinate data of utility installations on geographic information system (GIS) platforms such as ESRI® ArcGIS®.

RIGHT OF WAY UTILITY RELOCATION SUMMARY
REPORT DATE: April 6, 2009

Project: BU 287P **County:** Tarrant
From: On Rosedale St. Fr IH35
To: Riverside in Ft worth
Description: Widen 4ln to 6ln
CSJ No: 0172-01-042 ROWCSJ 0172-01-046

Area Engineer: Joe Fossett
Proj. Design Manager: **Ram Gupta (817) 370-6637**
Utility Coordinator: Joseph Bennett (817) 370-6883
Utility Consultant:
Letting Date: LET August 2008

Utility Company and Description	(NOPC) Notice of Proposed Construction	Level B SUE Received ** sent to Design	30% plans& SUE made available to Utilities	60% plans to Utilities (Strom Drain & cross section Included)	Level A 60 day 90% plans to utility Co.'s (Adequate Plans)	Permit or Agreement Received Date	R.O.W. Clear for Adjustment	Begin Adjustment Date	End Adjustment Date	Paid In Full
AT&T	N/A	07-23-04	N/A	03-01-07	05-15-07	P9/22/08	03-31-04	09-30-08	04-09	NA
Oncor ELECTRIC DELIVERY(U 12217)	N/A	07-23-04	N/A	03-01-07	05-15-07	P2/25/08	03-31-04	04-11-08	05-09	NA
CHARTER COMMUNICATION	N/A	07-23-04	N/A	03-01-07	05-15-07	P04/09	03-31-04	03-27-09	04-03-09	NA
City of Ft. Worth (Water, Sewer) (U 12373)	N/A	07-23-04	N/A	03-01-07	05-15-07	P11-15-07	03-31-04	02-25-08	05-09	NA
LEVEL3 COMMUNICATION	N/A	07-23-04	N/A	03-01-07	05-15-07	A05-09	03-31-04	05-09	08-09	$500, 000
KOCH	N/A	07-23-04	N/A	03-01-07	05-15-07	A05-09	03-31-04	06-09	08-09	$400, 000
Atmos gas (U 12218)	N/A	07-23-04	N/A	03-01-07	05-15-07	P11-15-07	03-13-04	01-07-08	04-03-08	NA
Oncor Transmission	N/A	07-23-04	N/A	03-01-07	05-15-07	P10-07	03-13-04	11-01-07	12-27-07	NA

(A) Agreement, (JA) Joint use acknowledgement, (EX) Executed date (*) There will be more to come; (**) Utility location sent to design: (NA) The utility is clear and ready for TxDOT construction.

COMMENTS: This project let in June 08 and has been held up waiting on RR agreement. There are two utility companies on the RR that will have to be adjusted after the RR agreement is signed.
11-18-08 spoke to Micheal Hyzak of Division bridge design, Division let the project in august. The construction contract was awarded to Texas Sterling. A pre-con meeting date hasn't been set yet.

There is two utilities on the bridge, level3 and kochpipeline.

Figure 4. TxDOT Sample Right of Way tility Adjustment Summary.

OWNER & CONTACT	UTILITY DESCRIPTION	CONFLICT STA AND OFFSET	CONFLICT DESCRIPTION	ADJUST. DATE	REMARKS
AT&T Texas Contact: Address: City: Phone Number: Email Address:		The location of all facilities are called out in an approximate way only. The contractor shall determine the exact location before commencing work.			
	SBC Buried Cable	STA 21+09, 45' LT	Prop. Storm Sewer		SBC/AT&T will adjust or place new cable (B1)
	SBC Buried Cable	STA 21+88, 37' RT	Prop. Storm Sewer and Pavement		SBC/AT&T will adjust or place new cable (B2)
	SBC Buried Cable	STA 27+50 TO STA 30+00, 48' RT	Prop. Storm Sewer		SBC/AT&T will adjust or place new cable (B3)
	SBC Buried Cable	STA 44+40 TO STA 45+15	Prop. Storm Sewer and Pavement		SBC/AT&T will adjust or place new cable (B4)
	Telephone Pedestal	STA 45+12, 49' LT	Prop. Pavement		
	SBC Buried Cable	STA 45+81, 57' LT	Prop. Storm Sewer		SBC/AT&T will adjust or place new cable (B5)
	SBC Buried Cable	STA 47+00 TO STA 50+40, 43' RT	Prop. Storm Sewer		SBC/AT&T will adjust or place new cable (B6)
	SBC Buried Cable	STA 50+53, 31' RT	Prop. Storm Sewer		SBC/AT&T will adjust or place new cable (B7)
	SBC Buried Cable	STA 53+07, 45' RT	Prop. Storm Sewer		SBC/AT&T will adjust or place new cable (B8)
	SBC Buried Cable	STA 53+50, 45' RT	Prop. Storm Sewer		SBC/AT&T will adjust or place new cable (B9)
	SBC Buried Cable	STA 53+72, 87'LT	Prop. Storm Sewer		SBC/AT&T will adjust or place new cable (B10)
	9-4" MCD	STA 12+50 TO 15+50, 49' LT	Prop. Storm Sewer		Look at design alternative (C1)
	9-4" MCD	STA 15+92, 40' LT	Prop. Storm Sewer		Field verify (C2)
	9-4" MCD	STA 20+40, 115' RT	Prop. Storm Sewer		Field verify (C3)
	9-4" MCD	STA 22+33, 80' RT	Prop. Storm Sewer		Field verify and look at design alternative (C4)
	9-4" MCD	STA 25+81, 55' RT	Prop. Storm Sewer		Field verify and look at design alternative (C5)
	9-4" MCD	STA 28+05, 62' RT	Prop. Storm Sewer		
	9-4" MCD	STA 33+15, 65' RT	Prop. Storm Sewer		Field verify (C7)
	ALL MANHOLES		Prop. Pavement		
CenterPoint Energy Electric Contact: Address: City: Phone Number: Email Address:		The location of all facilities are called out in an approximate way only. The contractor shall determine the exact location before commencing work.			
	Power Poles	Parallel to LT/RT ROW along Project	Prop. Sidewalk		
	Power Pole	STA 21+09, 47' LT	Prop. Storm Sewer and Sidewalk		
	Power Poles	Parallel to Airport	Prop. Pavement		
	Power Poles	Ave N and Homestead	Prop. Pavement		
	Power Poles	Reading	Prop. Pavement		
	Power Poles	Town Center Blvd.	Prop. Pavement		
	Power Poles	Intersection at FM 2218/FM 1640	Prop. Storm Sewer and Pavement		

Figure 5. TxDOT Utility Conflict List, Example A.

TxDOT- Houston District
IH 10: from Gelhorn to Mercury Dr.
US 90: from IH 10 to 0.29 miles west of Mercury Dr.
CSJ: 0508-01-166
CSJ: 0028-02-081

UTILITY CONFLICT LIST - CENTER POINT ENERGY ELECTRICAL

Item Number	Owner	Utility	Utility Size/ Material	Location	Crossing	Conflict	Sheet Number	Conflict Status	Estimated Conflict Resolution Date	Agreement Assembly	Agreement Status	Agreement Submittal Date	Comments
1	Centerpoint Energy	Electrical Conduit	18" Conduit Duct	Sta 115+36.31 (US 90)	Underground	Proposed Pavement , Ditch	Utility Sketch - Centerpoint Electric Sheet 1 of 1	Ongoing	3/1/2006	JUA A			CPEE completed design
2	Centerpoint Energy	Transmission Tower	N/A	Sta 115+57 (US 90)	Underground	Proposed Pavement	Utility Sketch - Centerpoint Transmission Sheet 1 of 1	Ongoing	TBD	JUA B			CPEE completed design
3	Centerpoint Energy	Transmission Lines	N/A	Sta 114+56 (US 90)	Overhead	Minimum Clearance requirement	Utility Sketch - Centerpoint Transmission Sheet 1 of 1	Ongoing	TBD	JUA A			CPEE completed design
4	Centerpoint Energy	Distribution Line	N/A	IH 10 at Oates Rd	Overhead	Minimum Clearance requirement	N/A	Closed	1/12/2006	JUA B			CPEE completed design
5	Centerpoint Energy	Distribution Line	N/A	US 90 WBFR Sta 102+00	Overhead	Minimum Clearance requirement	N/A	Ongoing	TBD	JUA B			CPEE completed design
6	Centerpoint Energy	Distribution Line	N/A	US 90 Sta 129+00	Overhead	Minimum Clearance requirement, Proposed Bridge at Oates Rd	Utility Sketch - Centerpoint Distribution Sheet 1 of 1	Ongoing	TBD	JUA B			CPEE completed design

Figure 6. TxDOT Utility Conflict List, Example B.

LETTING SCHEDULE		HIGHWAY / I-SECTION	CSJ / PROJECT NO.	DESCRIPTION OF WORK	SURVEYOR & ESTIMATED DATE FOR PROJECT TO BE SURVEYED	DESIGNER / OFFICE OF PROJECT	DUE DATE OF INFORMATION NEEDED FROM DESIGNER:		OUTSTANDING R.O.W. PARCELS			
FY	CALENDAR MONTH & YEAR						PLAN & PROFILE SHEETS W/ UTILITIES	PROPOSED CROSS-SECTIONS	PARCEL NUMBER	OWNER, ADDRESS, & PHONE NUMBER	INITIAL DATE OF CONTACT FROM DISTRICT R.O.W.	ESTIMATED ACQUISITION DATE TO BE COMPLETED
FY 2000	Aug-00	US 82 # 1,2,3	0045-19-026	NEW LOCATION	ALREADY COMPLETED UNDERWOOD	CLAY & BOB	1-Jun-00	1-Jun-00	2/2E	Larry Hoodgendorn 204 Laurel Ridge Sherman,TX 75090 Tel. (903)813-1434)	2/2/2000	RTE
									5/5E	Harold N. Shannon 5927 Over Downs Circle Dallas,TX 75230-4039	5/27/1999	ROE 6/1/00
									10	Charlotte Durbin & Felicia Eichner 11038 Westmore Circle Dallas,TX 75230-3552	3/1/2000	ROE 6/1/00
									12E	Same as Parcel 10	3/1/2000	ROE 6/1/00
									13	Nolene Morphew 415 S. Hazelwood St. Sherman,TX 75090-6210	5/13/1999	RTE
									14	Glen E. Moore 207 N. Tolbert Ave. Sherman, TX 75092	5/13/1999	RTE
									15	Shafer Plaza III, LP 4514 Cole Suite 1201 Dallas,TX 75205-000	5/27/1999	ROE 6/1/00
									18/18E	Gary Andrews & Patsy Andrews 27726 Snow Rd Bakersfield, CA 93312-9591	2/7/2000	ROE 6/1/00
									25	L.O Cherry Heirs c/o Mrs. George Perry, Jr. Route 2 Box 5B Henrietta,TX 76365	6/25/1999	(Curative)ROE 6/1/00
									27/27E	Walter W. Jansen 565 Watson Rd. Bells,TX75414-9724	8/20/1999	ROE 6/1/00
									32/32TE	Mr. James Laster & Mrs. Teresa Hill 1269 Watson Rd. Bells,TX 75414	9/18/1999	RTE
									33/33E	L.V. Owens & Shirley 11355 Watson Rd. Bells,TX 75414	9/10/1999	RTE

UTILITIES LOCATED WITHIN THE PROJECT AND POSSIBLE CONFLICTS											
UTILITY COMPANIES					DATE OF INITIAL LETTER TO THE UTILITIES FROM PARIS DISTRICT R.O.W. OFFICE	DATE OF LETTER OR PHONE CALL FROM THE SHERMAN AREA OFFICE	ADJUSTMENT NEEDS BY OR NO ACCOMMODATION FOR UTILITY COMPANIES	HANDOUT DATE OF R.O.W. MAP, PLAN & PROFILE SHEETS, AND X-SECTIONS	DATE OF SIGNED UTILITY AGREEMENT RETURNED TO SHERMAN AREA OFFICE OR DISTRICT R.O.W.	DATE ESTIMATED UTILITY ADJUSTMENTS TO BE COMPLETED	UTILITY STATUS AND/OR DATE COMPLETED
INVOLVED	TYPE	STATION BEGIN	STATION END	LOCATION							
VERIZON / GTE	PHONE	ALL COUNTY ROADS	ALL COUNTY ROADS	UG	UNKNOWN	4/1/2000	LINES NEED TO BE RELOCATED & NO ACCOMODATIONS	6/1/2000	NOT NEEDED	12/1/2000	NO WORK YET 2/5/2000
PINK HILL WATER	WATER/SEWER	ALL COUNTY ROADS	ALL COUNTY ROADS	UG	UNKNOWN	4/1/2000	ALL LOCATIONS NEED TO BE RELOCATED	3/24/2000	6/1/2000	8/1/2000	9/6/2000
TXU PIPELINE(TUFCO)	GAS	STA 1415+00 STA 1537+75	STA 1450+00 STA 1547+00	UG	UNKNOWN	4/1/2000	BOTH LOCATIONS NEED TO BE RELOCATED	4/5/2000	NOT SIGNED	12/1/2000	NO WORK YET 2/5/2000
KOCH PIPELINE	GAS	APPROX. STA 1596+00	APPROX. STA 1598+00	UG	UNKNOWN	4/1/2000	NO RELOCATION NEEDED BUT DITCH BLOCKS MUST BE PUT IN	4/1/2000	NOT SIGNED	12/1/2000	NO WORK YET 2/5/2000
GRAYSON/COLLIN	ELECTRIC	ALL COUNTY ROADS	ALL COUNTY ROADS	OH	UNKNOWN	4/1/2000	ALL LOCATIONS NEED TO BE RELOCATED	6/1/2000	NOT SIGNED	12/1/2000	NO WORK YET 2/5/2000
AT&T	FIBER OPTIC	APPROX. STA 1340+00	APPROX. STA 1345+00	UG	UNKNOWN	4/1/2000	NO RELOCATION NEEDED	6/15/2000	-	-	-
ARCO	GAS	APPROX. STA 1524+55	APPROX. STA 1529+80	UG	UNKNOWN	8/1/2000	NO RELOCATION NEEDED	8/1/2000	-	-	-

Figure 7. TxDOT Sample Right of Way and Utility Update Report.

County Highway ROW CSJ	Name of Utility	Reimbursable?	Location of Agreement Package	Packet Status?	Current Action	Adjustment Status	Responsible TxDOT Employee	Amount Approved	Amount Billed	90% Payment	Audit Exceptions	10% Retainage	Outstanding Balance
HOPKINS SH 11 ROW CSJ: **0083-03-046** SH 19 **0108-09-039**	Verizon	No	ROW	Approved	U11114: Relocation is complete. NR	Complete	Keith Hollje						
	TXU Electric	Yes	ROW	Approved	U11655: Relocation & Reimbursement is complete	Complete	Keith Hollje	$ 74,397.96	$ 62,850.69	$ 56,565.62	$ -	$ 6,285.07	$ -
	Atmos Energy (Trans)	Yes	ROW	Approved	U12208: Relocation & Reimbursement is complete	Complete	Mike Powers	$ 235,912.59	$ 184,436.76	$ 165,993.08	$ -	$ 18,443.68	$ -
	Atmos Energy (Distribution)	No	ROW	Approved	U12446: Relocation is complete. NR	Complete	Mike Powers						
	SS Water & Sewer	No	ROW	Approved	U12450: Relocation is complete. NR	Complete	Mike Powers						
	TXU Distribution	No	ROW	Approved	U12614: Relocation is complete. NR	Complete	Mike Powers						
	Sudden Link Communication	No	AO	Approved	Relocation is complete by Permit. NR	Complete	Tim Taylor						
	People's Telephone	No	AO	Approved	Relocation is complete by Permit. NR	Complete	Tim Taylor						
	Shady Grove WSC	No	AO	Approved	Relocation is complete by Permit. NR	Complete	Tim Taylor						
								$ 310,310.55	$ 247,287.45	$ 222,558.70	$ -	$ 24,728.75	$ -
HUNT US 380 ROW CSJ: **0135-06-022**	Caddo Basin	Yes	ROW	Approved	U11423: Relocation & Reimbursement is complete.	Complete	Mike Powers	$ 853,746.47	$ 783,618.01	$ 705,256.21	$ -	$ 78,361.80	$ -
	Verizon	No	ROW	Approved	U11450: Relocation is complete. NR	Complete	Mike Powers						
	One OK Pipeline	Yes	ROW	Approved	U11523: Relocation is complete. Reimbursement has not been submitted.	Complete	Keith Hollje	$ 229,170.00	$ -	$ -	$ -	$ -	$ 229,170.00
	Cap Rock Energy	Yes	ROW	Approved	U11524: Relocation & Reimbursement is complete.	Complete	Mike Powers	$ 741,668.69	$ 741,668.69	$ 667,388.42	$ (27,771.80)	$ 46,508.47	$ -
	AT&T	No	ROW	Approved	U11526: Relocation is complete. NR	Complete	Mike Powers						
	Explorer	Yes	ROW	Approved	U11534: Relocation & Reimbursement is complete.	Complete	Keith Hollje	$ 191,805.22	$ 201,206.44	$ 181,085.80	$ -	$ 20,120.64	$ -
	Energy Transfer (Gas)	Yes	ROW	Approved	U11695: Relocation is complete. Reimbursement returned to Utility 4/29/09. No Coorespondence!	Complete	Mike Powers	$ 370,006.39	$ 420,136.25	$ -	$ -	$ -	$ 370,006.39
	GEUS	No	ROW	Approved	U11850: Relocation is complete. NR	Complete	Mike Powers						
	AT&T	No	ROW	Approved	U12358: Relocation is complete. NR	Complete	Mike Powers						
	TMPA	No	n/a	n/a	No effect (no adjustment required)	n/a	Mike Powers						
	Comcast	No	n/a	n/a	No effect (no adjustment required)	n/a	Mike Powers						
	Kinder-Morgan	No	n/a	n/a	No effect (no adjustment required)	n/a	Mike Powers						
								$ 2,386,396.77	$ 2,146,629.39	$ 1,553,730.43	$ (27,771.80)	$ 144,990.91	$ 599,176.39
HUNT US 380 ROW CSJ: **0135-07-037**	AT&T	No	ROW	Approved	U11525: Relocation is complete. NR	Complete	Mike Powers						
	Atmos Energy (Pipeline)	Yes	ROW	Approved	U12012: Relocation & Reimbursement is complete.	Complete	Mike Powers	$ 193,912.59	$ 73,187.29	$ 65,868.56	$ -	$ 7,318.73	$ -
	Atmos Energy (Distribution)	No	ROW	Approved	U12013: Relocation is complete. NR	Complete	Mike Powers						
	Caddo Basin	Yes	ROW	Approved	U12026: Relocation & Reimbursement is complete.	Complete	Mike Powers	$ 651,005.00	$ 383,518.60	$ 345,166.74	$ -	$ 38,351.86	$ -
	TMPA	Yes	ROW	Approved	U12076: Relocation is complete. Supplemental Agreement approved 8/06/09.	Complete	Mike Powers	$ 514,097.06	$ 516,702.66	$ 462,196.85	$ -	$ 51,355.21	$ 51,355.21
	GEUS	No	ROW	Approved	U12077: Relocation is complete. NR	Complete	Mike Powers						
	TXU Electric(Transmission)	No	ROW	Approved	U12079: Relocation is complete. NR	Complete	Mike Powers						
	GEUS	Yes	ROW	No	U12445: Utility Package approved 5/19/09. Utility working on relocation.	35%	Mike Powers	$ 88,073.29	$ -	$ -			$ 88,073.29
	City of Greenville (Water)	No	AO	n/a	City has already moved utility on private easement. (no agreement required)	n/a	Mike Powers						
	City of Greenville (Sewer)	No	AO	n/a	City has already moved utility on private easement. (no agreement required)	n/a	Mike Powers						
	Cap Rock Energy	No	AO	n/a	No effect (no adjustment required)	n/a	Mike Powers						
								$ 1,447,087.94	$ 973,408.55	$ 873,232.15	$ -	$ 97,025.80	$ 139,428.50

Figure 8. TxDOT Sample Utility Adjustment Report.

County:
Highway:
ROW CSJ: Construction Control CSJ:
Phase I CSJ: Limits: From: To:
Phase II CSJ: Limits: From: To:
Phase III CSJ: Limits: From: To:

Utility Name	ROW Map & Notice of Construction Sent to Utility	Date of 2nd Notice (If Needed)	ROW Map Markups Received from Utility	Agreement Package						Estimated Relocation Cost	Notice to Proceed Sent to Utility	Begin Adjustment	Adjustment Completed	Billing						Utility Adjustment Closed Out	Remarks
				Sent to Utility	Received from Utility	Sent Back to Utility for Corrections	Resubmitted by Utility w/ Corrections	Sent to ROW Division	Approved by ROW Division					Received from Utility	Sent Back to Utility for Corrections	Resubmitted by Utility w/ Corrections	Sent to ROW Division	90% Payment Issued to Utility	10% Retainage Issued to Utility		
Phase I																					
Phase II																					
Phase III																					

Figure 9. TxDOT Sample Utility Coordination Report.

Highway County	Construction Limits	R.O.W. Limits	Utility Company TxDOT U.C.	U-Number Procedure	C.C.S.J. Joint Bid	R.C.S.J. U.C.S.J.	R.O.W Release Requested/Approved	Approved ROW Map Env Clearance	Alternate Procedure (AP) Requested/Received	Alternate Procedure (AP) Submitted/Approved
IH 10	0.12 Mi. S	FILE CLOSED	AT&T	U8200	0072-12-159	0072-12-151	UnKnown	Unknown	Unknown	March 7, 2002
Bexar	0.32 Mi. S		Rick Hanks	FUP	No	N/A	August 15, 1991	November 16, 1987	Unknown	March 18, 2002
IH 10	0.12 Mi. S. of Callaghan Rd.	0.2 Mi. S. of Callaghan Rd.	CPS Energy UG	U8207	0072-12-159	0072-12-151	UnKnown	Unknown	Unknown	March 7, 2002
Bexar	0.32 Mi. S. of N. Crossroads Blvd.	N. Crossroads Blvd.	Rick Hanks	FUP	No	N/A	August 15, 1991	November 16, 1987	February 27, 2002	March 18, 2002
IH 10	0.12 Mi. S. of Callaghan Rd.	0.2 Mi. S. of Callaghan Rd.	TWC	U8212	0072-12-159	0072-12-151	UnKnown	Unknown	March 5, 2002	March 7, 2002
Bexar	0.32 Mi. S. of N. Crossroads Blvd.	N. Crossroads Blvd.	Rick Hanks	FUP	No	N/A	August 15, 1991	November 16, 1987	March 6, 2006	March 18, 2002
IH 10	0.12 Mi. S	FILE CLOSED	CPS Energy Gas	U8217	0072-12-159	0072-12-151	UnKnown	Unknown	February 19, 2002	March 7, 2002
Bexar	0.32 Mi. S		Rick Hanks	FUP	No	N/A	August 15, 1991	November 16, 1987	February 21, 2002	March 18, 2002
IH 10	0.12 Mi. S. of Callaghan Rd.	0.2 Mi. S. of Callaghan Rd.	SAWS	U8311	0072-12-159	0072-12-151	UnKnown	Unknown	February 19, 2002	March 7, 2002
Bexar	0.32 Mi. S. of N. Crossroads Blvd.	N. Crossroads Blvd.	Rick Hanks	FUP	Yes	N/A	August 15, 1991	November 16, 1987	February 21, 2002	March 18, 2002
IH 10	0.12 Mi. S	FILE CLOSED	City of Balcones Heights	U10425	0072-12-159	0072-12-151	UnKnown	Unknown	Unknown	December 1, 2004
Bexar	0.32 Mi. S		Rick Hanks	FUP	Yes	N/A	August 15, 1991	November 16, 1987	Unknown	December 20, 2004
IH 37	LP 13 (SV	FILE CLOSED NO CONFLICTS	AT&T Texas	U11445	0073-08-148	0073-08-161	August 9, 2007	March 19, 2007	October 5, 2006	N/A
Bexar	0.2 Mi. N.	Ave.	Rick Hanks	FUP	No	0073-08-161	November 2, 2007	April 27, 2007	N/A	N/A
IH 37	LP 13 (SV	FILE CLOSED NO CONFLICTS	CPS Energy Gas	U11446	0073-08-148	0073-08-161	August 9, 2007	March 19, 2007	October 5, 2006	N/A
Bexar	0.2 Mi. N.	Ave.	Rick Hanks	FUP	No	0073-08-161	November 2, 2007	April 27, 2007	N/A	N/A
IH 37	LP 13 (SV	FILE CLOSED NO CONFLICTS	CPS Energy OH	U11447	0073-08-148	0073-08-161	August 9, 2007	March 19, 2007	October 5, 2006	N/A
Bexar	0.2 Mi. N.	Ave.	Rick Hanks	FUP	No	0073-08-161	November 2, 2007	April 27, 2007	N/A	N/A
IH 37	LP 13 (SW Military Dr)	LP 13 (SW Military Dr)	SAWS	U11448	0073-08-148	0073-08-161	August 9, 2007	March 19, 2007	October 5, 2006	November 13, 2007
Bexar	0.2 Mi. N. of New Braunfels Ave.	0.2 Mi. N. of New Braunfels Ave.	Rick Hanks	FUP	Yes	0073-08-161	November 2, 2007	April 27, 2007	November 28, 2006	November 15, 2007
IH 37	LP 13 (SV	FILE CLOSED NO CONFLICTS	TWC	U11491	0073-08-148	0073-08-161	August 9, 2007	March 19, 2007	November 8, 2006	N/A
Bexar	0.2 Mi. N.	Ave.	Rick Hanks	FUP	No	0073-08-161	November 2, 2007	April 27, 2007	N/A	N/A

Alternate Procedure (AP) Estimate	Utility Plans Certified Project Manager	Agreement Assembly (AA) Requested/Received	Agreement Assembly (AA) Submitted/Approved	State Cost Actual Cost	Joint Bid Cost Actual Cost	Total State Cost Total Actual Cost	Joint Use Only Submitted/Approved	Exception Requested/Approved	DOE / EWA Requested/Approved	Adjustment Completion Date Agreement / Actual	Letting Date Status
$254,100.00	N/A	March 20, 2002	Unknown	$217,921.04		$217,921.04	N/A	N/A	---	April 7, 2003	July 25, 2002
	Rick Butler	Unknown	April 28, 2003	$200,298.42		$200,298.42	N/A	N/A	August 7, 2002	April 17, 2003	Closed (Paid Out)
$168,000.00	N/A	September 12, 2002	September 25, 2002	$214,527.00		$214,527.00	N/A	N/A	N/A	January 31, 2004	July 25, 2002
	Rick Butler	September 20, 2002	October 4, 2002	$171,621.60		$171,621.60	N/A	N/A	N/A		Pending SA Submission
$95,650.00	N/A	Unknown	October 4, 2002	$75,790.90		$75,790.90	N/A	N/A	N/A		July 25, 2002
	Rick Butler	September 25, 2002	October 10, 2002				N/A	N/A	N/A		Pending Billing Submission
$164,450.00	N/A	March 20, 2002	October 17, 2002	$16,200.00		$16,200.00	N/A	N/A	N/A		July 25, 2002
	Rick Butler	October 11, 2002	November 4, 2002				N/A	N/A	N/A		Closed
$455,200.00	N/A	Unknown	February 20, 2003	$455,195.79	$423,137.00	$878,332.79	N/A	N/A	N/A	Joint Bid	July 25, 2002
	Rick Butler	Unknown	March 28, 2003		$566,228.38	$566,228.38	N/A	N/A	N/A	Joint Bid	Pending Billing Submission
$100,000.00	N/A	January 7, 2005	District Tier 1	$23,325.00	$5,429.00	$28,754.00	N/A	N/A	December 7, 2004	Joint Bid	July 25, 2002
	Rick Butler	May 25, 2006	August 29, 2006	$ 27,505.12	$ 18,935.53	$46,440.65	N/A	N/A	December 20, 2004	Joint Bid	Closed (Paid Out)
$1,237,400.00				$1,002,959.73	$428,566.00	$1,431,525.73					
				$399,425.14	$585,163.91	$984,589.05					
	N/A	October 5, 2006	N/A				N/A	N/A	N/A		June 28, 2007
	Lizette Colbert	N/A	N/A				N/A	N/A	N/A		Closed (No Conflicts)
	N/A	October 5, 2006	N/A				N/A	N/A	N/A		June 28, 2007
	Lizette Colbert	N/A	N/A				N/A	N/A	N/A		Closed (No Conflicts)
	N/A	October 5, 2006	N/A				N/A	N/A	N/A		June 28, 2007
	Lizette Colbert	N/A	N/A				N/A	N/A	N/A		Closed (No Conflicts)
$1,500,000.00	Joint Bid	October 5, 2006	December 3, 2007	$103,576.00	$1,338,685.00	$1,442,261.00	N/A	N/A	N/A	Joint Bid	June 28, 2007
	Lizette Colbert	January 17, 2007	December 14, 2007		$1,296,357.00	$1,296,357.00	N/A	N/A	N/A	Joint Bid	Pending Billing Submission
	N/A	November 8, 2006	N/A				N/A	N/A	N/A		June 28, 2007
	Lizette Colbert	N/A	N/A				N/A	N/A	N/A		Closed (No Conflicts)
$1,500,000.00				$103,576.00	$1,338,685.00	$1,442,261.00					

Figure 10. TxDOT Sample Utility Status Chart.

CSJ	HWY	DIV OST #	Tot. Adj's.		Adj. Comp.	Adj. Outst.		Let Date	Comments: RCSJ 0675-08-089, 0.717 MI NORTH OF NORTH LOOP 336 TO 0.118 MI NORTH OF SOUTH LOOP 336. WIDEN TO 8 MAIN LANES W/ 2-3 LANE FRONTAGE ROADS, RAMPS, GRADE SEPARATIONS & PROVISION FOR FUTURE HOV AND TMS
0675-08-052	45	$9,770,863	18		1	17		Aug-07	

U#	Utility	Anticip. Agreement Date	Agreement Date	Est. Fld. Comp. Date	Actual Fld. Comp. Date	AP Estimate	Agreement Estimate	Prior to FY 07 Payments	FY 07 Payments	FY 07 Anticip. Payments	FY 08 Payments Made	FY 08 Anticip. Payments	FY 09 Payment Made	FY 09 Anticip. payments	FY 10 Anticip. Payments	FY 10 Payment Made	FY 11 Anticip. Payments	FY 11 Payment Made	FY 12 Anticip. Payments	FY 12 Payment Made	FY 13 Anticip. Payments	FY 13 Payment Made	Total Paid to Date	Est or AP Balance (if any)	Total Remainder to be Paid	Type of Payment
U11494	Chaparall		7/25/2007		9/26/2007	$200,000	$269,137	$0	$0	$0	$206,731	$0	$22,970	$0									$229,701	$39,436	$0	FP-AP
U11495	Copano	Feb-08	6/18/2008	10/1/2008		$200,000	$220,189	$0	$0	$0	$0	$0	$254,443			$28,271							$282,714	$0	$0	FP-AP
U11495 S1							$62,525																			
U11496	Valero	2008	Adjustment not required			$0		$0	$0	$0	$0	$0		$0									$0	$0	$0	VOID
U11499	CPE Gas	2008		FY10		$2,200,000	$312,198	$0	$0	$0	$0				$312,198								$0	$312,198	$312,198	
U11501	AT&T Trans.	6/30/2009 Terry Hopper	8/17/2009	Sep-09		$1,200,000	$26,470	$0	$0	$0	$0	$0			$26,470								$0	$26,470	$26,470	
U11502	AT&T	Apr-08	Aug-09			$900,000	$2,721,907	$0	$0	$0	$0	$0			$2,721,907								$0	$2,721,907	$2,721,907	rev. agmt.
U11503	Wave	6/30/2009		2009		$200,000	$141,378	$0	$0	$0	$0	$0			$201,874								$0	$200,000	$141,378	
U11503s1	Supplemented on 11/23/09		Nov-09				$60,496																			
U11504	Consolid		07/25/07	FY10			$422,521	$0	$0	$0	$9,040	$0			$422,521								$9,040	$413,481	$413,481	PP
U11505	Phono		09/24/07	2/1/2008		$66,227	$66,227	$0	$0	$0	$0	$66,227		$0									$0	$66,227	$66,227	
U11510	Level 3	6/30/2009	Nov-09	Aug-10		$1,000,000	$2,289,645	$0	$0	$0	$0	$0			$2,289,645								$0	$2,289,645	$2,289,645	awaiting adjustment and inv.
U11528	SuddnInk	2008	03/07/08	2009		$1,000,000	$76,152	$0	$0	$0	$0	$0			$79,152								$0	$76,152	$76,152	
U11819	Entergy	6/30/2009	Sep-09	Mar-10		$1,500,000	$60,538				$0	$0		$0	$60,538								$0		$60,538	No Inv Yet
The total Entergy adjustment cost will be ~$589,249, to be																										
U11868	Consolid		Jun-07	FY 2010			$2,528,841	$0	$0	$0	$0	$0	$0	$0		$127,632							$0	$136,263	$136,263	PP
U11868 S1	Consolid		Jun-09	Note - Reduction Supplement.			-$2,264,946																			
U11500	Entergy		09/2008	Oct-08		$900,000	$650,372				$0	$0		$19,331	$650,372								$0	$669,703	$669,703	
U11500 S1	Entergy		Jun-09				$19,331																			
U12645	ATT	DO NOT USE																								
U11506	Conroe - Waterline		13-Sep-07	PS&E = $3,100,288 + $109,608							$0	$0		$3,209,896									$0	$3,209,896	$0	
U11507	Conroe Sewerline		12-Sep-07	PS&E = $3,271,715 + $62,327							$0	$0		$3,369,950									$0	$3,369,950	$0	
U11497	H&W		NO CONFLICT								$0	$0		$0									$0	$0	$0	
U11498	Brinker		NO CONFLICT								$0	$0		$0									$0	$0	$0	
Totals						$9,366,227	$7,662,981	$0	$0	$0	$215,771	$66,227	$277,413	$6,599,177	$6,764,677								$521,455	$13,531,328	$6,913,962	

Figure 11. TxDOT Sample Utility Conflict Status List.

TxDOT does not have a centralized system for managing utility conflict data. Some districts have developed systems, typically in Microsoft Access® format, to track utility conflicts (Figure 12, Figure 13). Although helpful, those systems tend to be ad hoc with informal table structures and user interfaces. Districts indicated it would be desirable to have a centralized utility conflict tracking system that a server-based utility database supports.

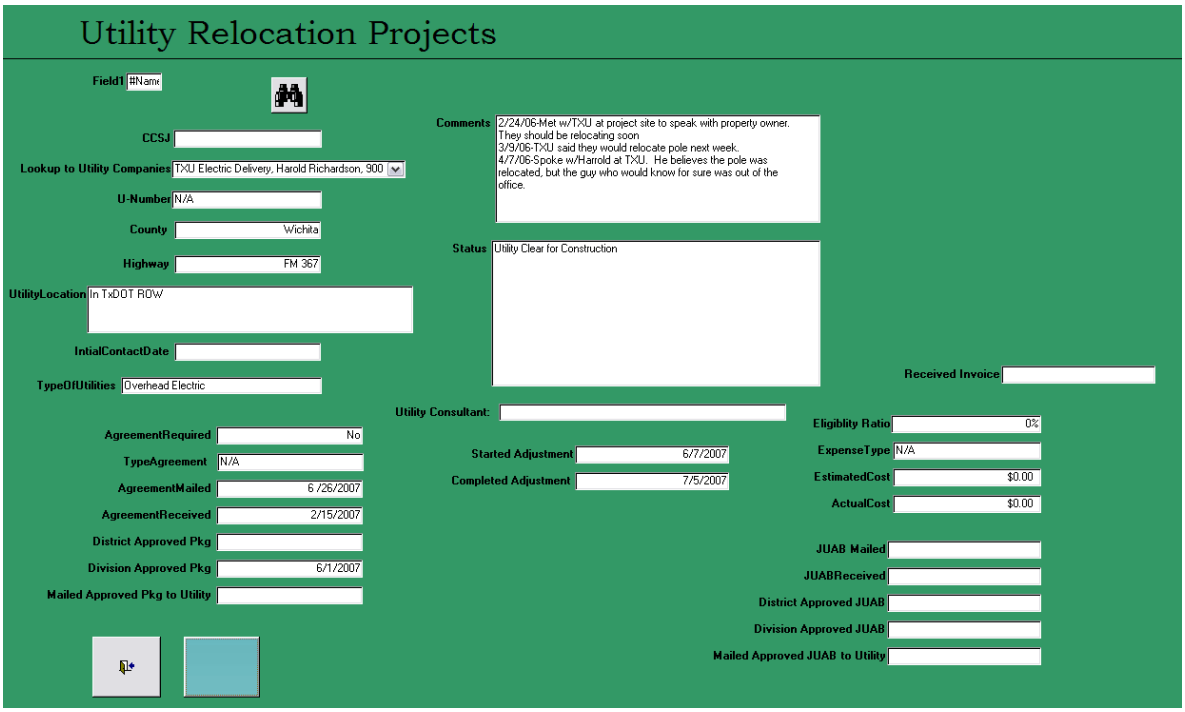


Figure 12. TxDOT District Utility Conflict Database, Utility Adjustment Screen.

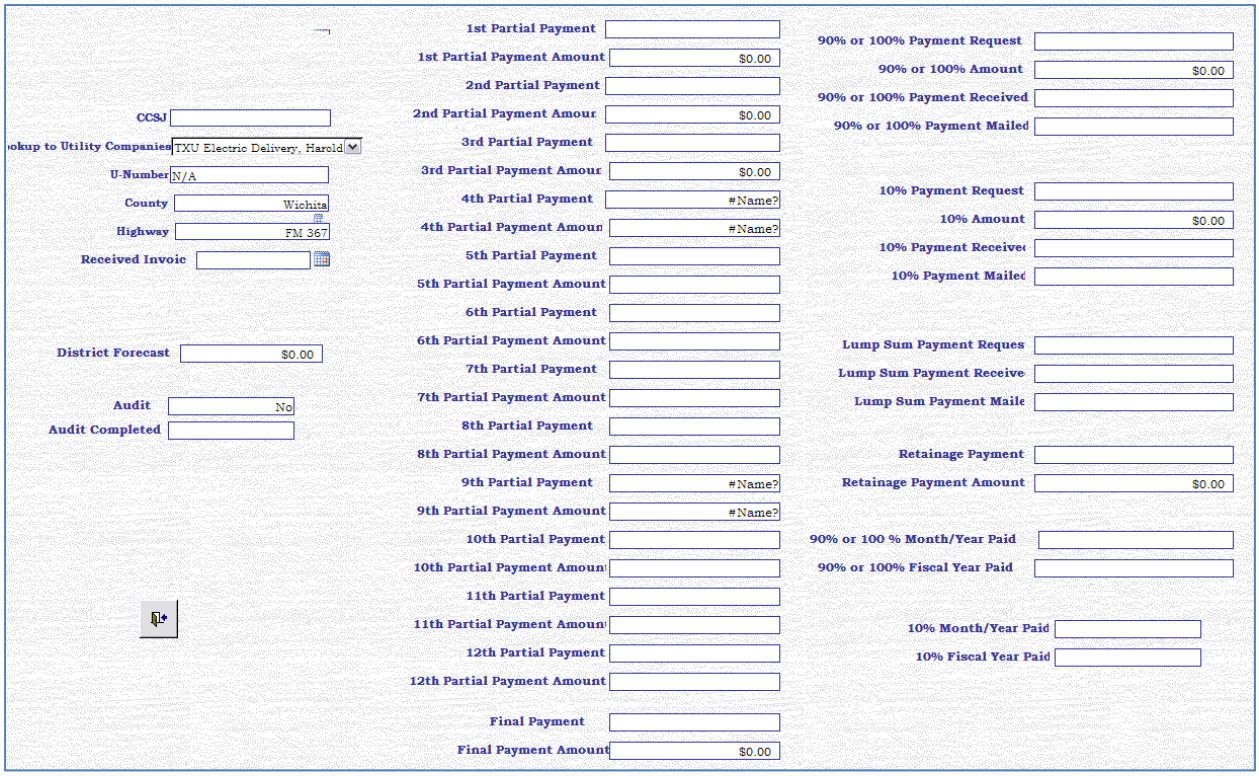


Figure 13. TxDOT District Utility Conflict Database, Utility Adjustment Billing Screen.

Utility Coordination Process at the City of San Antonio

As part of the stakeholder meetings held during the research (see Chapter 3), several utility owners in San Antonio mentioned the utility coordination process at the City of San Antonio as an example of an easy-to-follow depiction of the utility coordination process. The City's *Design Guidance Manual* (*12*) requires design engineers to look beyond the costs of the basic infrastructure being designed and be sensitive to the overall costs associated with utility coordination and adjustment. The general process is as follows:

- Define preliminary project information. The design consultant defines basic project information needed for assessing utility impact. Such information includes project limits, general alignment, roadway configuration, and approximate pavement design.

- Conduct initial utility coordination meeting. The design consultant conducts an initial kickoff meeting to assess the project's utility condition and request preliminary utility information. The consultant identifies all utility owners that may be affected and invites them to the meeting to discuss the impact. The initial notification to the utility owners describes the design engineer's requested procedure for resolving utility conflicts; clearly states that meeting attendance and cooperation is encouraged and expected; includes a statement that utility owners are ultimately responsible for uncovered or unresolved conflicts; and requests unaffected utility owners to furnish a letter of "No Conflict/Non-Involvement" to the project manager.

- Send out maps with preliminary utility data. After preliminary utility data are received, the design consultant sends two copies of the marked maps to utility owners: one for their records and the other one to be returned with comments.

- Conduct second coordination meeting. The design consultant schedules a second utility coordination meeting to confirm that utility owners received the preliminary plans, provide additional information about the project, identify obvious conflicts and possible major adjustments, and discuss potential locations and types of installations.

- Request onsite utility locations. The design consultant requests utility owners to mark their facilities on the project site. Surveyors then survey the marked locations and transfer the information to preliminary plans.

- Further analysis of utility data. The design consultant analyzes the utility data and determines alternatives that minimize utility impacts. Close coordination with utility owners is required throughout this process.

- Conduct third coordination meeting. The design consultant conducts another meeting with utility owners to discuss utility impacts and determine future activities before submission of the 40 percent design to the city. The design process at the City of San Antonio includes the following milestones:

    - Preliminary engineering report (only if required by city).
    - 40 percent design.
    - 70 percent design.
    - 95 percent design.
    - Bid documents.

- Determine further needs to establish utility locations. This may involve the use of quality level A (QLA) subsurface utility engineering (SUE) services to locate utility facilities accurately.

- Coordinate the design of required utility adjustments to make sure the designs are consistent with project requirements. This activity includes sending MicroStation® files to any affected utility owner to facilitate the design process. The design consultant also coordinates with San Antonio Water System (SAWS) and City Public Service (CPS) Energy to finalize the design of water, sewer, and gas adjustment work.

- Document the results of the tasks above and submit the results with the 40 percent design plan submission.

- Complete control surveys for non-joint bid utilities no less than 30 days before utility adjustment starts.

Table 4 shows a checklist that the City of San Antonio uses to assist in utility coordination.

Table 4. City of San Antonio's Utility Coordination Scope and Checklist (*12*).

No.	Task	Complete
Initial Design Submittal (40%)		
1	Conduct initial utility coordination meeting	
2	Identify apparent utilities in the project vicinity and surrounding area by topographic survey, field investigation, by requested marking on the ground, and by available record search	
3	Request and obtain all utility block/facility maps for the project and immediate area	
4	Request record drawings for all utilities in the project area	
5	Prepare initial utility base map sufficient to identify all utilities in the project vicinity	
6	Compare utility locations to proposed project and assess conflicts	
7	Prepare initial list of SUE needs for the project required to fully characterize utilities with potential high impact on the project	
8	Show utilities and quality level designation on initial project schematics	
9	Develop preliminary roadway cross-sections and show vertical locations of existing utilities and identify potential conflicts using best available information	
10	Conduct initial utility conflict analysis for SAWS water and sewer utilities and CPS gas utilities affected by the project	
11	Provide schematic design layout for proposed SAWS water and sewer and CPS gas utilities	
12	Initiate coordination for design of all other utilities that may require adjustment and conduct second utility coordination meeting	
13	Prepare and provide Utility Coordination Report for the Project, attaching phone log, letters, responses, emails and other correspondence related to the Utility Coordination task	
Final Design Submittal (70%)		
1	Act upon 40% submittal recommendations	
2	Complete SUE-related work, obtain results, and incorporate findings	
3	Coordinate design with non-joint bid utilities	
4	Complete utility layout sheets and resolve all known utility conflicts	
5	Complete 70% cross sections to verify existing utility locations	
6	Complete utility proposed design components and incorporate into overall plans	
7	Assess remaining utility conflicts and make recommendations in the final design submittal	
8	Make recommendations for utility locates that will be deferred to the construction phase	
9	Provide Utility Coordination Report supplement to address changes since the initial submittal, including attached letters and other correspondence	
10	Provide Final Design Utility Coordination Needs Assessment	
Construction Plans Submittal (95%)		
1	Address comments from prior phase	
2	Resolve remaining utility conflict resolutions	
3	Finalize plans, sections, and details related to utility coordination	
4	Provide Construction Phase Utility Coordination Needs Assessment	

Recent TxDOT Initiatives

TxDOT Research Project 0-6065 "Integrating Utility Conflict Elimination and Environmental Processes"

The purpose of TxDOT Research Project 0-6065 was to evaluate the feasibility of (a) obtaining more reliable existing utility data during preliminary design and coordinating this activity with the environmental process, and (b) increasing the level of definition of design components during preliminary design without affecting environmental requirements to support the earlier application of utility processes (*13*).

A literature review of state efforts revealed examples of initiatives and business practices in related areas, including the following:

- Florida DOT's Efficient Transportation Decision Making (ETDM), which includes an Environmental Technical Advisory Team (ETAT) (*14*). This team provides coordination throughout the entire project development process, including long-range transportation planning, programming, schematic design, and design.

- Georgia DOT's (GDOT's) interactive training course on methods to determine and avoid utility impacts (*15*). The primary tool of this analysis is a utility conflict matrix that lists all potential utility conflicts. The training includes a discussion of the cost to redesign highway features around utility conflict areas and the resulting cost-benefit analysis.

- Michigan DOT's (MDOT's) re-design of its utility conflict tracking system to optimize processes such as updating data, utility adjustment tracking, and creating and managing standard forms and other documents (*16*). The new system provides a snapshot of all utility conflicts, their status, and relevant information such as whether coordination information has been provided to bidders or utility work is included in the highway contract.

- Minnesota DOT's (Mn/DOT's) re-engineering of its utility coordination process incorporating national best practices (*17*). Worth noting in the Mn/DOT practice is the use of Gopher State One Call (GSOC) to request information from utility owners at critical points in the project development process, including early identification of utility facilities, utility verification during design, and before excavation.

- Pennsylvania Department of Transportation's (PennDOT's) re-engineering of its utility processes that included the development of a decision matrix to identify the conditions under which QLB or QLA data should be collected for a project (*18*).

The analysis resulted in 10 potential optimization strategies, as follows:

- **Involve environmental and utility coordination staff in planning and programming**. Sometimes, a district planner requests involvement by environmental or utility coordination staff before a project is identified. However, involvement of this staff is on

an ad hoc basis and varies from none to very limited (e.g., a few hours as part of a preliminary site visit). Involving environmental and utility coordination personnel more formally in this phase would enable DOTs to identify major environmental and utility issues systematically at a very low cost, which, in turn, could result in time and money saved during project development and construction.

- **Establish planning advisory teams and support tools**. Although federal regulations clarify that linking the planning process and the National Environmental Policy Act (NEPA) process is voluntary (*19*), there has been an increased awareness in recent years of the importance of using environmental data during planning and programming. Tools such as the Geographic Information System Screening and Analysis Tool (GISST) and NEPAssist, which were originally developed to support the NEPA process, can be used to support transportation planning activities (*20, 21*).

  An example of a linkage between planning and the environmental process is FDOT's advisory team implementation as part of their ETDM process (*14*). To facilitate the ETDM process, FDOT implemented a web-based application called Environmental Screening Tool (EST), which enables resource agencies to provide comments online (Figure 14). Benefits that FDOT has reported from the ETDM implementation include fostering a team approach for the identification of solutions, increased awareness of potential negative project environmental impacts and key issues before the start of the preliminary design phase, less costly environmental studies, faster project delivery, and better access to information (*14*).

  For utility-related activities, utility owners do not have regulatory authority over a state DOT. As a result, a planning-level cooperation framework for utility owners would need to be different. A potential strategy to achieve this goal would involve implementing a web-based planning-level system that enables utility owners to view transportation projects at different stages, upload and overlay utility plans, and enable the identification of major conflicts and impacts. As appropriate, the system could include cross references with relevant existing systems at the state DOT, as well as the planning-level web-based system for environmental activities discussed above.

- **Coordinate environmental and utility data collection**. Little (if any) coordination exists between the environmental process and other preliminary design functions concerning the collection of QLD and QLC utility data. However, both types of investigations have common elements. For example, initial environmental site assessments have in common with QLD and QLC utility investigations that they use a review of existing records and surface observations to identify potential conflicts. Coordinating both activities could eliminate redundancy in data collection. Realistically, the processes are sufficiently different and involve personnel with different skill sets as well as different contracting mechanisms. However, just because the activities are different and use different resources does not mean they cannot be coordinated.

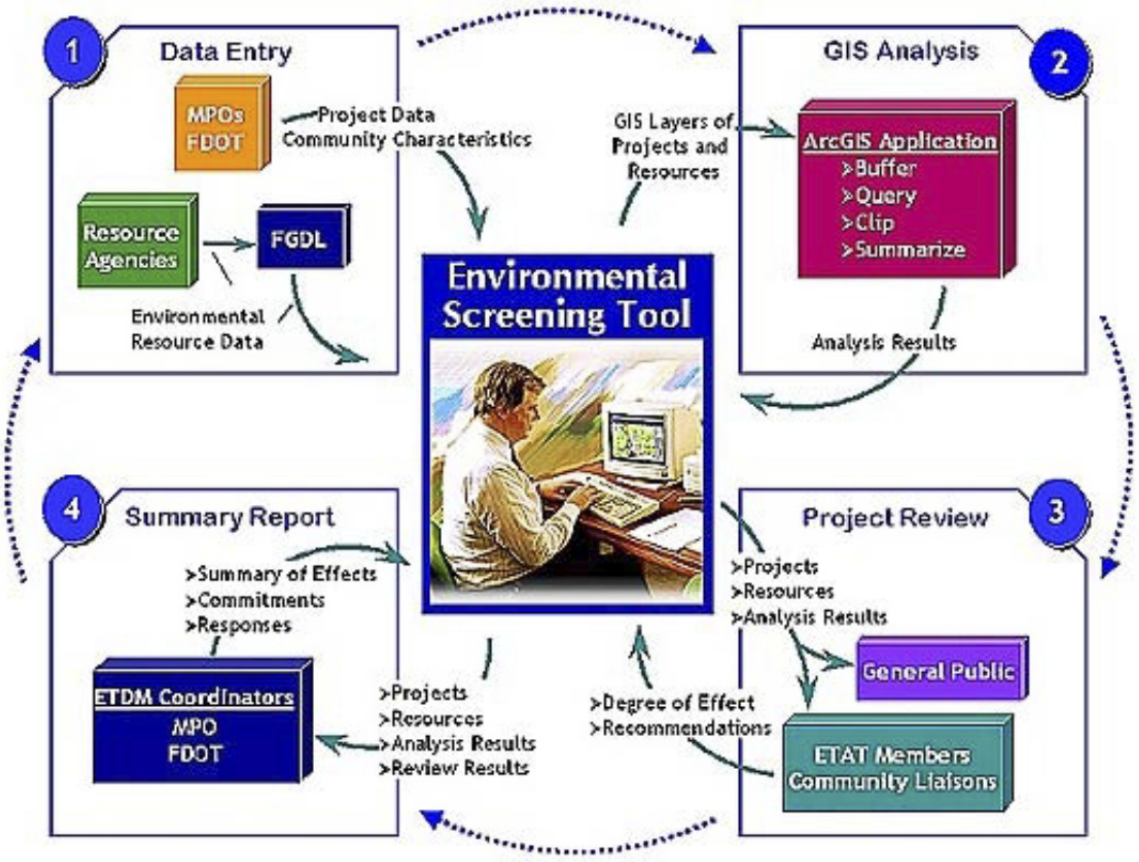


Figure 14. FDOT Environmental Screening Tool (*14*) (Courtesy of FDOT).

- **Enhance and coordinate preparation of scopes of services**. Coordination of environmental and utility data collection may also be possible by making changes to existing contracts and/or scope of work templates to encourage coordination and data exchange. The benefit of coordinating scopes of services would be early identification and potential avoidance of environmental and utility conflicts. For example, utility adjustments in or near suspected areas of contamination could be avoided. Likewise, early utility information could assist in identifying suspected contamination problems earlier in the project. Issues that affect implementation of this strategy include differences in contracting practices and timing between environmental and utility data collection activities. For example, TxDOT uses scientific service contracts to conduct environmental or cultural assessments, primarily during preliminary design. By comparison, utility investigation contracts at TxDOT tend to be professional service contracts, typically during the design phase, at the discretion of the project manager (*22*).

- **Require utility owners to verify utility facility information**. The project development process would benefit if utility owners could verify the location and ownership of utility installations identified during QLD or QLC investigations. Most districts require utility owners to provide information about the approximate location and ownership of their installations as part of the QLD utility data collection, although specific requirements vary from district to district. Beyond this initial information exchange, both state DOT

and utility owners would benefit from the use of a generic data exchange form that describes, at any point during the project development process, the type of information being exchanged. Figure 15 shows an example of a data exchange form. One of the advantages of using a standardized form with check boxes is that the form can be date-stamped and, as such, can serve as a useful record of documentation and information provided by utility owners at different points throughout the project development process.

- **Gather some QLB data during preliminary design**. Collecting QLB data is much more expensive than collecting QLD and QLC data. However, there may be value in collecting targeted QLB data during preliminary design under certain conditions, e.g., if the right of way stays the same and the project involves widening a road or adding extra lanes within the existing available space. Under these conditions, knowing the location of existing underground utility facilities, particularly major longitudinal facilities such as water mains or communication duct banks, can be critical in order to determine the best course of action (e.g., adjust the utility facility, modify the roadway alignment to avoid the utility facility, protect-in-place, or accept an exception to policy). By comparison, if utility facilities are found for new location projects within the proposed right of way, those facilities may be more likely to be adjusted anyway.

  With respect to timing, it appears the most reasonable point at which to collect QLB during preliminary design occurs at the time of selection and analysis of the preferred geometric alignment. After this point, the benefit of collecting QLB data decreases (since the focus of the analysis changes to preparing the environmental document and completing the preliminary design phase) and only starts increasing again during design.

- **Include some drainage design elements in preliminary design**. Many utility conflicts are drainage-related. However, most utility owners avoid getting involved in the utility process until about 60 percent design, once there is a clear definition of the roadway—and drainage—horizontal and vertical alignments. Presumably, completing certain elements of the drainage design earlier (without preempting the environmental process) would make it possible to engage utility owners earlier in the process.

  Sizing cross-drainage structures during preliminary design is frequently possible as long as only preliminary calculations are completed. It may also be possible to estimate the size and probably the depth of pipe locations but not produce accurate assessments about inlet locations. In other cases, the ability to define drainage structures during preliminary design depends on time availability, which means that certain drainage features could be defined during preliminary design but officials decide to postpone that activity until the design phase. Outfalls are a notable case because they must be cleared by the environmental process and can have right of way acquisition requirements, making the definition of outfalls early in the process important (*23*).

Documentation provided to state DOT:

- ☐ *Paper* copies of all known record information available at the utility in relation to the project, such as as-builts (plan, profile, cross sections, and details), GIS file printouts, survey reports, and survey data
- ☐ *Electronic* copies of all known record information available at the utility in relation to the project, such as as-builts (plan, profile, cross sections, and details), GIS files, survey reports, and survey data
- ☐ Pictures, field coordinates, and other documents to facilitate the location of difficult-to-find features such as valve covers, manhole covers, and handhole covers
- ☐ Marked up printed drawings or maps provided by the DOT or an authorized consultant
- ☐ Marked up CAD file(s) provided by the DOT or an authorized consultant
- ☐ Marked up 2-D portable document format (PDF) file(s) provided by the DOT or an authorized consultant
- ☐ Marked up 3-D portable PDF file(s) provided by the DOT or an authorized consultant
- ☐ Marked up GeoPDF file(s) provided by the DOT or an authorized consultant
- ☐ Marked up or updated GIS file(s) provided by the DOT or an authorized consultant
- ☐ Marked up or updated features using an online web-based viewer provided by the DOT or an authorized consultant
- ☐ Other: _____

Field activities:

- ☐ Exposed surface features such as valve covers, manhole covers, and handhole covers that were partially or completely covered or blocked in the field
- ☐ Provided paint markings for those features in the field to enable DOT surveyors to tie those installations to the project survey control
- ☐ Marked existing underground utility facilities on the ground along project (no request from a One Call notification center was necessary) to enable DOT surveyors to tie those locations to the project survey control
- ☐ Marked existing underground utility facilities on the ground along project upon request from a One Call notification center to enable DOT surveyors to tie those locations to the project survey control
- ☐ Other: _____

Other activities:

- ☐ _____
- ☐ _____

Figure 15. Generic Template for Utility Data Exchange during the Project Development Process (*13*).

Whether to undertake drainage design elements during preliminary design depends on factors such as project type, availability of high-quality vertical elevation data, and project urgency. For example, rehabilitation projects substantially follow the existing horizontal and vertical alignment. Cross sections for those projects usually do not change much from preliminary design to design. In contrast, for new location or reconstruction projects, it is common to add capacity and/or substantially deviate from the existing horizontal and vertical alignment. In this case, the purpose of preliminary design is to determine whether the project will fit within the right of way width. The approved schematic would show certain features, e.g., culverts, but there would not be data elements such as actual dimensions. Cross sections for these projects can vary significantly from preliminary design to design, making it risky to define drainage design elements during preliminary design.

- **Include some design elements in preliminary design**. State DOTs usually do not display certain details and structures on preliminary schematics, such as illumination details, intelligent transportation system (ITS) infrastructure, or signal details to avoid giving the impression that a preferred alternative is pre-determined. However, including information that can enable the assessment of impacts that can result in project alignment changes or highlight issues related to the environmental process is desirable. This explains the common inclusion of elements such as control-of-access lines, guide sign locations, and noise wall alignments in preliminary design schematics.

  Including information about typical structure foundation requirements in schematics could be beneficial to assess potential utility impacts and assist in the environmental process. Many structures commonly found in transportation projects, such as guide signs, overhead sign bridges, and sign poles, use standardized geometric, structural, and foundation design details. The foundation requirements for many of these structures are quite substantial. For example, a sign post could require a foundation 42 inches in depth and 12 inches in diameter. A traffic signal pole could require a foundation 6–12 feet in depth and 24–42 inches in diameter. A high mast illumination pole could require a foundation 19–26 feet in depth and 48–66 inches in diameter. The preliminary design schematic could show some of this high-level information, e.g., in the form of anticipated structure locations and a note to indicate the typical foundation depth and diameter (or range of potential foundation depths and diameters). The note could also include a disclaimer that the information provided is approximate and is provided to assist in the assessment of potential project and environmental impacts.

- **Address utility issues in constructability reviews in preliminary design**. The TxDOT project development process includes a constructability review activity during preliminary design to develop a conceptual construction phasing plan and review requirements for access and operation of construction equipment. In the current practice, constructability reviews do not cover utility aspects. However, addressing utility issues in constructability reviews is beneficial because utility issues play a critical role during construction and can be major sources of delay if not properly coordinated with all the affected stakeholders.

- **Develop or update curricula for utility coordination stakeholders**. There is a need for training and professional development for utility coordination stakeholders, including project planners, design engineers, utility coordinators, managers, utility owners, consultants, and contractors. Developing curricula and comprehensive training materials would improve stakeholder understanding of the utility coordination process, improve familiarity with current laws and regulations, and foster a cooperative utility management approach.

TxDOT Research Project 0-4998 "Standardization of Special Provisions and Determination of Unit Costs for Utility Installations"

The purpose of TxDOT Research Project 0-4998 was to develop a prototype framework of construction specification requirements and corresponding unit cost work items for utility adjustments (*24, 25, 26*). The 0-4998 research included a review of utility adjustment and reimbursement practices, a prototype unit cost structure framework, a framework for utility construction specifications, and a framework and methodology for developing early utility cost estimates.

A key conclusion of the research was that, in order to develop a robust framework for utility specifications, a fundamental prerequisite was to have clarity with respect to what cost elements to include in the specifications (both bid items and subsidiary items). One of the reasons is that potential contractors look at those elements when preparing their bids, and if they detect uncertainty or lack of clarity in the identification of cost elements, the result is higher risk for the bidder, which in the end translates into higher costs for the agency. This observation led to the development of a general framework for utility specifications at TxDOT, which included templates for a wide range of utility specifications, including water, sanitary sewer, electric, and communication installations. The generic template was a modified version of TxDOT's Form 1814. The general utility specification framework enables the production of utility cost estimates at different points during the project development process and recognizes that the level of available information and required detail varies depending on the phase.

Most utility agreements at TxDOT follow the traditional cost category-based approach, in which cost estimates are disaggregated into cost categories such as labor, materials, equipment, and transportation. It is reasonable to assume that utility owners submit cost data using this approach because the *ROW Utility Manual* encourages its use (*2*). This manual does indicate that utilities may use construction unit costs, but it does not provide examples on how to submit cost data submissions using a construction cost unit cost methodology. The overall message throughout the manual is that utility owners need to structure cost data in a format that, in the end, is inconsistent with construction unit cost approaches.

One way to address this issue is by requiring utility owners to submit utility cost data in ways that facilitate the exchange of information and trend analysis. The cost estimation framework in Research Project 0-4998 assumed the possibility of translating *cost category-based* information to *construction unit cost-based* information (and vice versa). To illustrate this process, Figure 16a shows a cost estimate disaggregated by items and cost categories. Figure 16b shows a cost estimate disaggregated by items, quantities, and unit costs. For simplicity, Figure 16a shows

only five categories (materials, labor, overhead, transportation, and equipment), although additional cost categories could be added.

(a) Preparation of cost estimates using cost categories

Item	Cost Category					Total
	Materials	Labor	Overhead	Transportation	Equipment	
1	M_1	L_1	O_1	T_1	E_1	C_1
2	M_2	L_2	O_2	T_2	E_2	C_2
3	M_3	L_3	O_3	T_3	E_3	C_3
4	M_4	L_4	O_4	T_4	E_4	C_4
5	M_5	L_5	O_5	T_5	E_5	C_5
Total	**M**	**L**	**O**	**T**	**E**	C_T

(b) Preparation of cost estimates using unit costs

Item	Quantity	Unit Cost	Total
1	Q_1	u_1	C_1
2	Q_2	u_2	C_2
3	Q_3	u_3	C_3
4	Q_4	u_4	C_4
5	Q_5	u_5	C_5
Total			C_T

Figure 16. Comparison of Costs between Construction Unit Costs and Cost Categories.

The research also included a review of practices in other states. Worth noting is the experience at the Montana DOT (MDT) with the implementation of a unit cost approach for managing utility costs. Figure 17 illustrates the MDT utility adjustment cost management process. The process relies heavily on a construction unit cost data gathering exercise in which utility owners that work with MDT—or anticipate working with MDT—have to submit detailed information about construction unit cost data once a year. For submitting unit cost data to MDT, utility owners use a standardized MDT-provided Excel® spreadsheet template that enables utility owners to enter detailed cost data for each unit (such as contractor bids, labor, materials, transportation, overhead, and indirect) and calculate the corresponding construction unit cost (essentially following the approach shown in Figure 16). If a utility owner requests it, MDT may use the prior year's submission for the current year. Likewise, if a utility realizes during the course of a project that it did not submit unit cost data for specific work items, MDT allows the utility to provide new or updated unit cost data for those items.

MDT has implemented a procedure that converts unit cost data from Excel into comma-delimited format and then imports the data into an Oracle® database, where the data reside in anticipation of any utility adjustment project that might take place during the year. In general, MDT validates unit cost data that utility owners submit against average unit cost data but does not check the accuracy of every single piece of detailed unit cost data utility owners submit, relying instead on sporadic detailed audits of a reduced sample of data submissions. While the MDT unit cost database contains a large number of entries, exceptional circumstances and areas

for which inadequate information exists require negotiations between MDT and affected utility owners and/or the determination of default rates.

For utility adjustment projects during the course of a year, utility owners provide plan-in-hand estimates, which MDT validates using plan quantities and the unit cost database. At the conclusion of the project, the system enables MDT to upload actual quantities and create the final bill based on which MDT reimburses the utility owners.

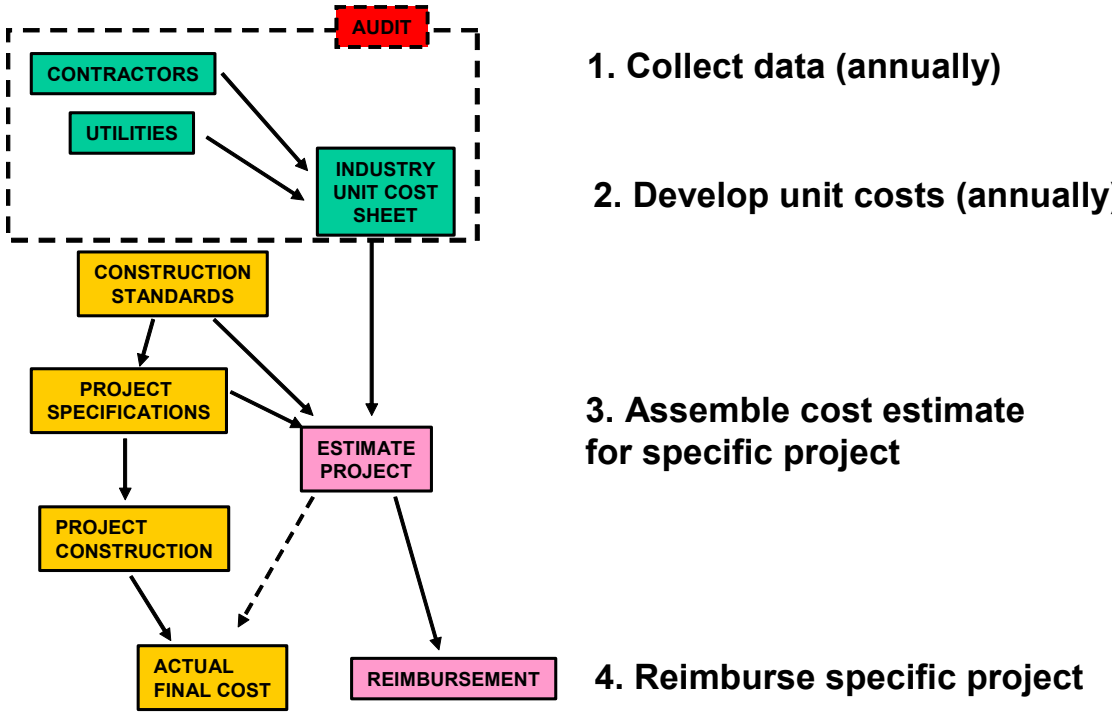


Figure 17. MDT's Utility Adjustment Cost Management Process.

TxDOT Research Project 0-5475 "Collection, Integration, and Analysis of Utility Data in the Transportation Project Development Process"

The purpose of Research Project 0-5475 was to develop and test a web-based tool to automate the exchange of data and information in connection with utility activities in the project development process (*29*). The prototype web-based application was called Utility Accommodation and Conflict Tracker (UACT).

UACT is a web-based system with a GIS interface that facilitates and automates several utility coordination functions, including the exchange and production of utility agreement-related documents. UACT includes client-side components and server-side components. On the client side, a web browser serves as a front-end interface that allows users on client computers to complete utility conflict management activities. Both utility owner users and TxDOT users can act as clients, but their interfaces are different and have different levels of access to system data. On the server side, a database server equipped with Oracle and ESRI® Spatial Data Engine (ArcSDE®) and a web server that includes the UACT code and other components provide the

necessary capabilities to support the system. The prototype allows users to upload documents and coverts those documents to PDF format. The UACT mapping component enables users to create, view, query, and edit utility conflict outlines and attributes (see Figure 18). The data model developed as part of Research Project 0-5475 was used as one of the founding blocks to develop the data model in the SHRP 2 R15-B project (see National-Level Review) section.

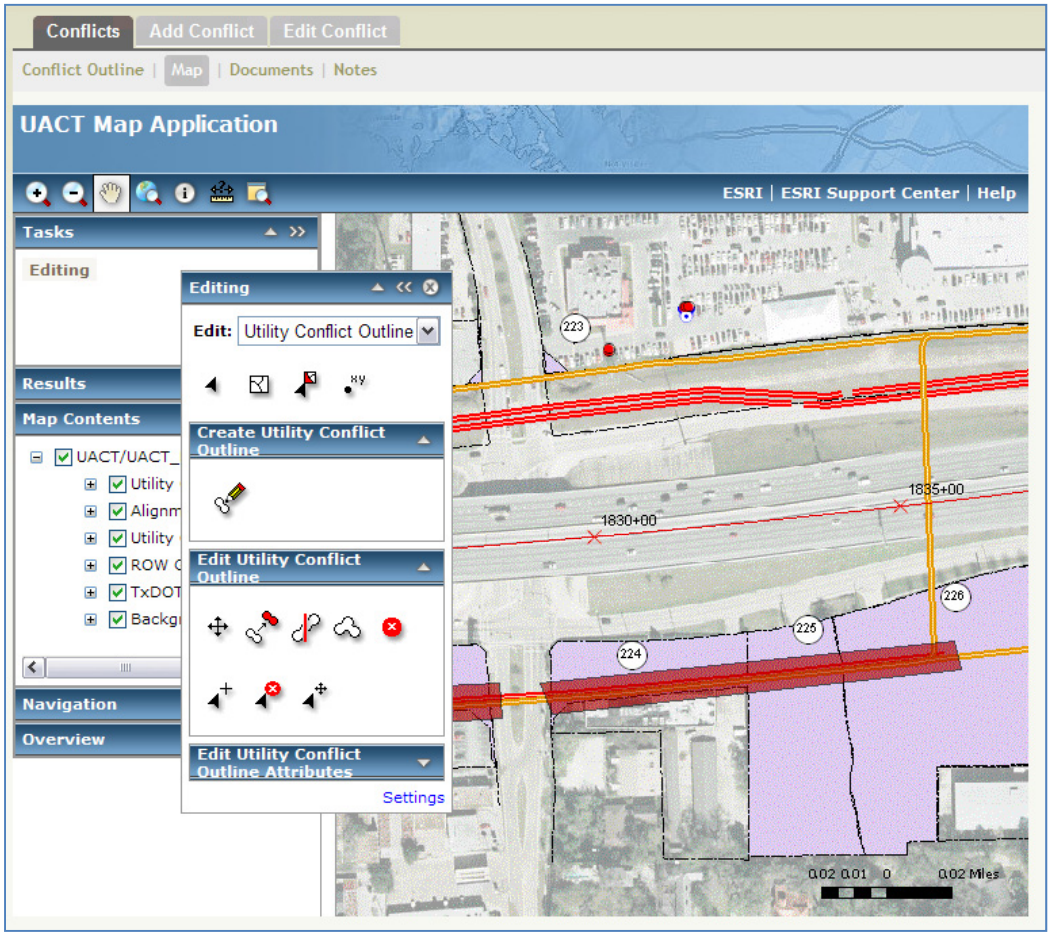


Figure 18. UACT GIS Map Application with Utility Conflict Outline Tool.

Perceived benefits of UACT include the following:

- Visualization of utility conflict, design, and right of way data using a mapping component.
- Standardized utility agreements and supporting documentation.
- Reduced time and cost to produce and process utility agreement assemblies.
- Standardized utility certifications for PS&E documentation.
- Reporting tools to monitor project status and performance.
- Web-based access to project and utility coordination data.
- Elimination of redundancies in data entry.
- Improved quality control and accountability.

TxDOT Modernization Project

In response to a recommendation from the Legislature, the Texas Transportation Commission selected the audit firm Grant Thornton, LLP, to conduct a top-down management and organizational review at TxDOT. Grant Thornton submitted its report in 2010 (*30*). A three-member panel called the TxDOT Restructure Council evaluated this report, as well as other audits and reviews, and submitted a report of priorities and recommendations in 2011 (*31*). The same year, TxDOT established the Modernization Leadership Team (MLT) to champion the TxDOT modernization effort. This team completed its assignment in May 2012 as the modernization efforts transitioned to an 'Operational Excellence' phase.

One of the recommendations in the TxDOT Restructure Council report was to streamline the right of way acquisition and utility accommodation process. In response, TxDOT identified 22 streamlining initiatives ranging from appraisals and negotiations to utility improvements and determination of concurrent processes. Through these initiatives, TxDOT expects to realize annual savings of about $50 million and a 50-percent reduction in overall right way process durations. As part of this initiative, TxDOT developed a generic project schedule template for right of way and utility activities. The template includes the following 18 utility-related activities:

- Preliminary or advance utility coordination.
- Collect utility data and perform initial conflict analysis.
- Utility budget.
- Utility project setup.
- Utility identification.
- 30-percent design phase utility coordination.
- Initial utility coordination.
- Utility eligibility determination.
- 60-percent design phase utility coordination.
- Execute exemptions to policy.
- 90-percent design phase utility coordination.
- Utility agreements and permits.
- Execution of emergency work authorizations.
- Execute agreements-Region.
- Execute agreements-Division.
- Coordinate utility construction, clearance, and completion.
- Monitor field adjustment of utilities.
- Inspect field adjustments.

NATIONAL-LEVEL REVIEW

Accommodation of Utility Facilities on Urban Streets and Highways

In 1974, the American Public Works Association (APWA) and ASCE published a guideline of practices for local governmental agencies and utility owners for the accommodation of utility

facilities within the right of way of urban streets and highways (*32*). The study included the participation of a large number of municipalities and utility owners across the country, as well as state DOTs and FHWA.

The report noted that one way to address the problem of overcrowding of the underground space in central city areas is through the practice of four Cs: cooperation, coordination, compromise, and compulsion. Cooperation and willingness to work together and compromise in an effort to improve coordination is the first requirement to address utility issues. Another vital requirement is the establishment of cooperative relationships between government agencies and utility owners, as well as partnerships between regulating agencies and all other units of government involved in or affected by utility activities. The last component is governmental compulsion through laws and regulations to protect the public interest.

Strategies to improve coordination practices mentioned in the report include the following:

- Notify all utility owners about projects that affect uses of the right of way and conduct pre-planning conferences to discuss those projects.
- Give utility owners adequate lead-time to adjust their facilities.
- Establish utility coordinating committees to serve as the focal point for all utility facilities in the public right of way. Whenever possible, coordinating committees should be structured on a regional basis.
- Establish One Call programs, preferably using single number systems.
- Encourage or require joint trenching and consider the use of ducting systems in order to decrease the demand for underground space.

National Cooperative Highway Research Program (NCHRP) 20-05 Topic 14-03 "Reducing Construction Conflicts Between Highways and Utilities"

In 1984, NCHRP Synthesis 115 documented the results of a review of practices to reduce conflicts between highway projects and utility installations (*33*). A motivation for the study was the recognition of the wide disparity in utility adjustment costs in relation to transportation project costs around the country and the need to reduce utility-related claims. Examples of practices described in the 1984 synthesis report included the following:

- **Utility agreements with all utility owners in New Jersey, even if no utility work was anticipated**. The purpose of the agreements was to fulfill permitting requirements in the event that adjusting utility facilities became necessary.
- **Cooperation credits**. Some state DOTs and utility owners expressed interest in a system of cooperation credits to eliminate communication silos that might result when different stakeholders are involved in different (although related) business processes. An example

of a communication silo mentioned in the report was the practice at many state DOTs in which maintenance sections review and approve utility permits if these permits are not connected with a transportation project (i.e., the utility owner starts the transaction). However, different officials (both at the state DOT and the utility owner) are involved if a state DOT contacts a utility owner in the context of a transportation project.

- **Multitier committees in Florida**. When combined with explicitly stated responsibilities for the Florida DOT (FDOT) and utility owners, these committees were credited with a significant reduction in utility-related claims. Committees mentioned in the report included metropolitan utility coordinating groups, district liaison committees, the Florida Utilities Coordinating Committee (FUCC), and an American Association of State Highway and Transportation Officials/International Right of Way Association (AASHTO/IRWA) liaison committee. FDOT's responsibilities mentioned in the report include the following:

    - Furnish annually a five-year plan, including probable construction dates.
    - During corridor studies, contact all utility owners along the corridor.
    - Notify utility owners of all hearings along the corridor.
    - After the corridor selection, send preliminary plans to utility owners.
    - Consider changes recommended by utility owners to reduce utility costs whether or not such costs are reimbursable.
    - Establish liaison committees in all districts and arrange for regular meetings among them.
    - Include utility owners in pre-construction meetings.

    Utility owners' responsibilities mentioned in the report include the following:

    - Review plans for new utility construction and major changes.
    - Provide area maps of their facilities.
    - Provide data on utility structures and on prospective routes.
    - Cooperate with the liaison committee.
    - Review preliminary plans provided by FDOT.

- **Decentralization of utility responsibilities within the state and requirement to identify high-risk utility facilities by conducting test holes at regular intervals (e.g., every 100 feet) in California**. This requirement enabled districts to record horizontal and vertical locations to the nearest 0.1 foot and transcribe this information to contract plans.

The report also commented on a survey that the American Gas Association System Protection Committee had conducted, in which a gas provider complained that a state DOT "stockpiled" plans and waited to send plans to the utility owner until the final design. By comparison, the report mentioned several examples that another utility owner (Commonwealth Edison) provided, which experienced effective communications with the Illinois DOT (IDOT):

- Eleven poles and 138 underground and 12-kV cables were in conflict with a project. Early sharing of plans with the utility owner and three coordination meetings enabled IDOT to modify their storm sewer and make the utility owner's overhead adjustments less complex. Edison was able to complete 75 percent of the adjustment during the design phase at considerable savings.

- A utility conflict situation included distribution poles and one transmission tower. Because IDOT shared plans early, Edison was able to request pre-letting meetings with eligible contractors to coordinate utility adjustments, particularly to stage work so that Edison could complete utility adjustments by the time the contractor began work in those areas. This coordination also enabled contractors to stage their work to begin where no utility facilities were involved.

- A project involved adjusting six transmission towers. Because Edison knew about the project early from IDOT's fiscal-year improvement program, the utility owner had sufficient time to order new poles and adjust its facilities before construction started.

- Widening a four-mile stretch of highway involved a conflict with 200 poles and 50 overhead crossings. IDOT requested removal of the facilities or placement underground. Edison estimated the cost to move the facilities underground at around $4 million. At the same time, there was a plan for a lighting system for the villages at an estimated cost of $2 million. Coordination with all affected stakeholders resulted in a square tapered pole design that enabled electric conductors to be supported by street light mast arms, accommodating the villages' lighting requirements and enabling Edison to reduce the number of poles from 200 to 90 and the number of crossings from 50 to 10, which satisfied IDOT's requirements. The final cost to Edison was $790,000 instead of the $4 million originally estimated.

- Edison's detailed presentations to IDOT and FHWA resulted in the state's approval to attach a 10-duct system to a proposed bridge over the East River. The detailed presentation demonstrated that alternative routes were not feasible. Edison also agreed to use the state's contractor to do the work. The bridge attachment saved Edison $550,000.

- For a project that involved raising 23 bridges, 18 of which had Edison facilities attached to them, Edison received project plans early, which enabled the utility to plan and design each location and submit detailed plans in a timely fashion to IDOT.

The report concluded with a strong recommendation for the implementation of formal liaison committees as a mechanism to improve coordination between state DOTs and utility owners, noting that formal committees were more likely to be successful than informal committees. The report also highlighted risks affecting the long-term viability of those committees over time. For example, in Florida, FDOT started to notice compliance problems, which they attributed to change in personnel through attrition, lack of familiarity of the new officials about utility concepts, and budget cutbacks because of adverse economic conditions in the state.

FHWA's Highway/Utility Guide

In 1993, FHWA published the *Highway/Utility Guide* (*34*) in an effort to provide guidance for state DOTs, local jurisdictions, and utility owners on highway and utility issues. The guide included the following recommendations for highway agencies to improve coordination between transportation agencies and utility owners:

- Share the highway improvement program with all relevant stakeholders.
- Include all construction and maintenance work in the highway improvement program.
- Hold meetings (at least annually) between with utility owners to discuss upcoming project development and construction activities.
- Notify utility owners of projects prior to 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.
- Convene meetings with 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 owners.
- Provide one point of contact at the agency to work with utility owners on a project from inception to completion.
- 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.

The guide also included the following recommendations for utility owners:

- Develop a utility master plan in conjunction with other public planning efforts.
- Provide capital improvement programs to highway agencies.
- Provide updated utility system plans every two to five years to highway agencies.
- Meet with local or state agencies to discuss projects, determine impacts, and explore alternatives to avoid potential conflicts.

- Provide one point of contact to 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.

AASHTO's Strategic Plan Strategy 4-4 "Right of Way and Utilities Guidelines and Best Practices"

In 2004, the AASHTO Subcommittee on Right of Way and Utilities in cooperation with FHWA published a set of recommended strategies and best practices to optimize right of way and utility processes (*35*). Utility-related recommendations, which included lessons learned from the 2000 European international scan on right of way and utilities (*36*), covered use of technology, coordination with utility owners, and corridor use optimization. Recommended practices in the area of technology included the following:

- Expand the use of GIS to map utility facilities.

- Ensure the depiction of utility facilities at appropriate quality levels on all highway plans.

- Collect subsurface utility data early in the development of all highway projects and use the data to maintain appropriate records.

- Encourage the use of computer-aided design (CAD) software and develop electronic systems for online permitting and transfer of plans and other documents between state DOTs and utility owners.

Recommended practices in the area of coordination with utility owners included the following:

- Provide utility owners with long-range highway construction schedules.

- Host meetings with utility owners to discuss future highway projects and recognize the importance of long-range highway/utility coordination.

- Use long range-planning meetings as a forum to discuss other relevant issues. What begins as a series of informal planning meetings could eventually evolve into a local, regional, or statewide utility coordination committee.

- Organize periodic (monthly, quarterly, annual) meetings with utility owners within a municipality, county, or planning region.

- Solicit information on utility owners' capital construction programs, particularly where the planned expansion or reconstruction of utility facilities might overlap a planned highway project. Look for opportunities to coordinate overlapping projects in order to minimize costs and public impact.

- Provide earlier preliminary notice to utility owners to facilitate adjustment planning.

- Involve utility owners in the design of transportation projects where major adjustments are anticipated. Examples of strategies include the following:

    - Conduct on-site or plan-in-hand meetings with utility owners to determine utility conflicts and appropriate resolutions.
    - Conduct monthly coordination meetings on major projects with all stakeholders.
    - Invite utility owners to preconstruction meetings and encourage or require utility owners, contractors, and project staff to hold regular meetings as needed during construction.
    - Meet individually with all utility owner representatives.
    - Involve utility owners in the determination of right of way needs to ensure there is adequate room for utility facilities.
    - Participate in local One Call notification programs to the maximum extent practicable per state law.

Recommended practices in the area of corridor use optimization included the following:

- Establish utility corridors for future utility use.

- Implement a highway designation that protects the right of way for future expansions, precluding new utility installations.

- Acquire right of way for utility purposes.

- Use pipelines along the highway right of way as a mode of transportation for freight transportation purposes.

- Share the cost to adjust utility facilities, whether on public or private right of way.

- Accommodate fiber optic cables and wireless telecommunication towers within the right of way to facilitate ITS implementations.

- Enable highway contractors to install conduit for future use of utility owners.

- Use standardized master utility agreements.

- Outline clear responsibilities by all parties to reduce delays to contractors.

- Provide standardized utility special provision language in the construction contract.

- Avoid late plan changes.

- If feasible, include utility adjustments in the highway contract.

- Consider the inclusion of utility adjustment work in design-build contracts.
- Develop or enhance utility pole safety programs by locating utility facilities underground.
- Provide training to state DOT and utility owner staff.

International Scan on Right of Way and Utilities

In September 2008, a scan team composed of representatives of several state DOTs, FHWA, private industry, and academia visited Australia and Canada to learn about innovative practices for right of way and utility processes that might be applicable for implementation in the United States (*37*). This scanning study complemented the 2000 scanning study of European countries, which covered Germany, the Netherlands, Norway, and the United Kingdom (*36*).

Relevant utility-related observations from the meetings with Australian and Canadian agencies include the following:

- **'Dial Before You Dig**.' The Dial Before You Dig referral system is similar to the One Call centers in the United States, with two major differences. First, membership includes not just utility owners and operators, but also transportation agencies and railroads, under the premise that these agencies can also provide information about the assets they own to parties that request it. Second, Dial Before You Dig encourages the use of the service earlier in the project development process than what is customary in the United States.
- **Reimbursement of utility adjustments**. Australian states normally reimburse utility owners for the adjustment of utility facilities (but not for betterments). The general policy is that the agency responsible for the transportation project that causes the need for the utility adjustment is also responsible for adjustment costs. In recent years, the Australian utility industry has undergone deregulation, with a large percentage of utility interests now in private hands. However, the policy for reimbursing utility adjustment costs continues.
- **Multilevel memorandum of understanding (MOU) approach with utility owners**. Australian states use multilevel MOUs with utility owners to facilitate the cooperation and coordination process. In a typical situation, a high-level MOU signed by the parties at the executive director level defines general principles and the intent of both parties to work cooperatively. To ensure the MOU is a living document, it might include attachments and other agreements that discuss specific issues, such as standards, specifications, and general procedures for resolving conflicts. Typically, technical personnel from both organizations prepare these documents. There may also be contract-level details and specific provisions that the higher-level MOU, attachments, or agreements do not address. Australian MOUs are more elaborate and stringent than those in the United States. However, utility accommodation policies or rules at the state level,

similar to those commonly found in the United States, do not appear to exist in Australia, which could explain in part the need for more comprehensive MOUs.

- **Transportation and utility corridors**. In Alberta, the Government Organization Act enabled the establishment of restricted development areas (RDAs) to coordinate and regulate the development and use of certain areas. The Calgary and Edmonton RDAs are of particular interest because of the designation of transportation and utility corridors (TUCs) in those RDAs. The TUCs were established on the principle that long-term planning for the accommodation of a number of transportation and utility facilities in a TUC can maximize its use. The TUCs protect loop highways and utility alignments from advancing urban development. Advantages to the use of TUCs include land conservation, limited environmental disruption, administrative efficiency, safety, land use certainty, assured alignments for future users, and open space use.

The scan team identified some 20 potential implementation ideas, including a few that addressed utility-related topics that pertain to this research, as follows:

- **Promote incentive-based reimbursement for utility adjustments**. This implementation idea involves providing incentive-based compensation to utility owners for the adjustment of utility facilities required by transportation projects in situations where the utility owner does not have a reimbursable real property interest and is occupying highway right of way by permit. The incentive compensation (in the form of a reimbursement) may be provided for eligible items of work, such as preliminary engineering, physical adjustment, and materials to the utility, by pre-established utility adjustment milestones set through coordination between the transportation infrastructure owner and the utility owner.

- **Establish standard protocol and lease template for utility attachments to roadway structures**. This implementation idea involves establishing a standard protocol and a lease template for the attachment of utility infrastructure to roadway structures. The protocol and lease template would cover items such as engineering evaluations, maintenance access, damage indemnification, attachment costs, and responsibility for adjustment costs. The origin of the idea was a provision in the Code of Practice for Management of Infrastructure in Road Reserves in Victoria, Australia. In the case of utility attachments to bridges and other road structures, the code recommends that the interested parties enter into a commercial agreement that addresses technical considerations, attachment costs, damages, and adjustment costs.

- **Implement multilevel MOU structures among transportation and utility interests**. This implementation idea involves promoting a multilevel MOU approach to optimize the relationship between transportation agencies and property interests. As mentioned, a high-level MOU outlines general principles, e.g., by establishing a framework that covers issues such as cost distribution, information sharing, strategic planning, project management, work sequencing, and dispute resolution. The MOU could include attachments and other agreements that discuss specific issues, such as standards, specifications, and general procedures for resolving conflict. Typically, technical

personnel from both organizations prepare these documents. For example, in Queensland, Australia, Main Roads and Energex are developing new protocols, procedures, and specifications to address issues on electric utility adjustments, planned utility installations, backfill requirements, preliminary estimates, and power pole safety. Similarly, an agreement between Main Roads and Telstra describes technical requirements for Telstra document submissions to enable Main Roads to review the documentation and reply to Telstra in a timely fashion.

Cooperation can involve multiple parties. For example, the New South Wales (NSW) Streets Opening Conference, a voluntary association of organizations in New South Wales, Australia, has sponsored the development of documents such as a model agreement between transportation agencies and utility interests. The association has also sponsored a guide to codes and practices for street openings; a specification for excavation, backfill, and restoration; and a training course to improve the understanding of plans and the identification of facility components in the field. Membership to the association includes utility owners, local government and road authorities, light rail operators, other government agencies, consultants, and other groups.

- **Promote the use of best practices in utility coordination during construction**. This implementation idea involves promoting the use of best practices in utility coordination during construction, e.g., by requiring contractors to have utility coordinators at the jobsite. This practice is somewhat common in the United States, particularly in the case of major construction projects. Having utility coordinators assigned to a project in a meaningful capacity during construction (either provided by the transportation agency or required as part of the construction contract) has several advantages, including expediting pending utility adjustment work, alleviating conflicts between highway construction and utility adjustment activities, and assisting with utility adjustment inspections. The tradeoff is an additional cost to the project. The expectation is that the resulting benefits to the project would offset those costs.

- **Develop methodology for preliminary utility adjustment cost estimates**. This implementation idea involves developing and promoting methodologies for preparing preliminary utility adjustment cost estimates. As part of the multilevel MOU structure at Main Roads in Australia, a catalog was prepared that shows typical electrical installation facilities and the amount required to adjust those facilities. This catalog allows Main Roads to conduct a quick identification of assets (partly because the catalog contains pictures of typical assets found in the field) and produce a preliminary assessment of utility adjustment costs, which is appropriate for developing early utility adjustment cost estimates in the planning and preliminary design phases. In the design phase, more detailed cost assessments are still necessary.

SHRP 2 R15 "Strategies for Integrating Utility and Transportation Agency Priorities in Highway Renewal Projects"

In 2007, SHRP 2 started a series of utility-related projects in the renewal area. In 2009, project SHRP 2 R01 documented existing technologies for locating and characterizing underground

utility installations, and developed a research plan to identify new, emerging, or potential technologies (*38*). This project resulted in nine recommendations for research initiatives, three of which are currently active.

Project SHRP 2 R15 addressed challenges and strategies to improve coordination between transportation agencies and utility owners (*39*). The research included a literature review and interviews with representatives of 28 state DOTs and utility owners to document coordination challenges as well as strategies to address those challenges. The SHRP 2 R15 report noted that both state DOTs and utility owners agreed that insufficient communication, scheduling, and coordination in the planning, right of way acquisition, design, and construction phases of road construction projects had a negative impact on utility adjustment activities. Examples of issues noted by both transportation agencies and utility owners included the following:

- Lack of understanding of the roles, responsibilities, and priorities of the transportation agency, utility owners, and contractors.

- Lack of agreed-upon policies, procedures, practices, and responsibilities for state or local government units, utility owners, One Call utility locators, and contractors concerning utility adjustments.

- Inaccurate or missing information on the location of existing facilities owned by different stakeholders, including utility owners and local governments.

- Misunderstood or improperly used procedures for utility adjustment requests, resulting in inadequate physical space for utility adjustments or insufficient time to buy supplies, obtain additional right of way, and meet existing customer requirements.

Issues that utility owners expressed as negatively affecting coordination activities with transportation agencies included the following (see detailed list in Table 5):

- Although utility owners might have dedicated resources for adjustment activities, these resources are limited. Sudden changes in state DOT programs or individual project schedules could cause demands in excess of those resources. In addition, emergencies such as extreme weather events take precedence over normal business, and resources may be pulled away to address those events.

- Coordination among utility owners occupying the same facility or space is not optimal. Frequently, utility owners have inadequate processes in place to handle large-scale coordination needs when different facilities share a common structure. One Call systems might also lack the ability to deliver sufficiently reliable and comprehensive markings of existing utility facilities, including difficult areas such as old facilities with no current owner on record.

- Frequently, utility owners or their contractors fail to meet schedule commitments because roadway construction and utility adjustment work are not coordinated. When one party

changes the sequence of work or fails to meet schedule commitments, the entire work process may suffer delays.

- Transportation designers normally focus on designing transportation facilities. As a result, utilities are a secondary consideration. Although state DOTs recognize the need to identify and solve utility conflicts, the typical solution that the DOT outlines is to adjust utility facilities. Frequently, changes to the state DOT designs to minimize adjustment costs start with a recommendation from utility owners. However, utility owners are frequently not members of the design team. Delayed coordination between transportation agencies and utility owners can also result in utility right of way problems if initial design estimates are based largely on DOT roadway project requirements without consultation with the utility owners.

- Transportation agencies have short timeframes to deliver projects and are susceptible to changes in program priorities, preferences, and budgets, as well as political initiatives.

Issues that state DOT utility coordinators and engineers expressed as having a negative impact on utility adjustment activities included the following (see detailed list in Table 6):

- Short plan and design timeframes for transportation projects.

- Project design changes requiring changes to utility adjustment plans.

- Delays in obtaining utility easements.

- Inaccurate location, marking, and mapping of existing utility facilities.

- Limited utility owner resources for maintenance, service upgrades, and adjustment, which might not be adequate to address the requirements identified by a transportation project.

Table 5. Issues Expressed by Utility Owners as Affecting Coordination with Transportation Agencies (adapted from [*39*]).

Phase	Issue	Score
Design	Limited financial and personnel resources	17
	Utility adjustment not an integral part of design	12
	Coordination with other utility agencies in the same proximity or government entities	12
	Maintenance issues (internal)	11
	Service upgrades (internal)	10
	New customer demand (internal)	9
	System improvements (internal)	9
	Changes to DOT design or schedule	6
	Large turnover at DOT	5
	Acquiring right of way easements	3
	Involving utility owners late in design phase	3
	Ease of exchanging drawing files electronically	3
	Lack of communication between DOT and utility owner	3
	Development and predictability of overall project plan	3
	Utility owner given too many projects at once	3
	DOT does not follow its own procedures	2
Construction	Limited financial and personnel resources	17
	Coordination with contractor to establish project plan to avoid relocating more than once for the same project	13
	Coordination with other utility agencies in the same proximity and government entities	12
	Maintenance issues (internal)	11
	Service upgrades (internal)	10
	New customer demand (internal)	9
	System improvements (internal)	9
	Contractor not following specified work plan	6
	Lack of coordination between DOT and contractor	6
	Utility adjustment not an integral part of contractor's work plan	4
	Material shortages	3
	Insufficient notice given to schedule the adjustment	3
	Unable to relocate before construction begins	3
	Natural disasters such as hurricanes	2
	Rework required	1

Table 6. Issues Expressed by State DOTs as Affecting Coordination with Utility Owners (adapted from [*39*]).

Phase	Issue	Score
Planning/ Design	Short time frame for states to plan and design project	26
	Project design changes required changes to utility adjustment	26
	Delays in obtaining right of way for utility installations	23
	Inaccurate locating and marking of existing utility facilities	20
	Utility owners give low priority to adjustments	20
	Obtaining accurate design plans early in design phase	15
	Obtaining environmental permits	13
	Identifying utility facilities late in the design process	11
	No utility coordination meeting held	4
	Hazardous waste issues	3
	Disagreements between DOT and utility owner on engineering solution	3
	High internal turnover at the DOT, personnel shortage	3
	Miscommunication between the design and construction teams in the utility owner	2
	Poor design of utility work plan	2
	Utility owners merging, relocating, or downsizing	2
	Utility adjustment costs not given proper weight in selecting preferred design	2
Construction	Increased workload on utility adjustment crews due to increase in highway and bridge construction	28
	Utility owner lacked financial and personnel resources to execute adjustment	27
	Inadequate coordination or sequencing among utility owners using common poles and ducts	22
	Utility owners give low priority to adjustments	20
	Phasing of construction and utility adjustment work out of sequence	19
	Delays in starting utility adjustment work because utility owners will not start until construction contract is advertised or let	18
	Utility owners are slow to respond to contractor's request to locate and mark underground utility facilities	11
	Material shortages	7
	Natural disasters such as hurricanes	6
	Shortages of labor and equipment for contractor	5
	Utility owner does not follow its own work plan (wrong location, schedule, additional work)	2
	Utility owners merging, relocating, or downsizing	2
	Inexperienced people involved on project	2
	Union labor issues	1

The SHRP 2 R15 report included several recommended practices and actions, many of which echoed findings from previous research initiatives. A sample of strategies and actions follows:

- **Involve utility owners early in the planning and preliminary design phases**. Sample actions include the following:

    - Provide information about the state DOT long-range highway schedule, such as annual budgets, 5- or 10-year plans, projected advertisement dates, or other information available. Discuss right of way corridors or other major project elements and their potential impacts on existing utility facilities.
    - Solicit similar information on utility owner's capital construction programs, particularly where a utility owner's planned expansion or reconstruction might interfere or coincide with a planned transportation project. Look for opportunities to coordinate overlapping projects to minimize costs and public impact.
    - Use the long-range planning meeting to discuss other highway/utility issues, such as accommodation policies and reimbursement.
    - Provide earlier preliminary notice to utility owners to allow the utility owners to budget for adjustments and have sufficient personnel available to do the work. Verify that utility owners understand that potential adjustment dates are subject to change, preliminary plans are subject to change, and that no adjustment work should begin until the state DOT provides notification that work can begin.

- **Involve utility owners early and hold utility coordination meetings throughout the design phase**. Sample actions include the following:

    - Involve utility owners in the design phase of highway projects where major adjustments are anticipated. Recommendations include meeting often with utility owners (both individually and in groups), conducting onsite meetings ('plan-in-hands') with utility owners to determine utility conflicts and appropriate resolutions, and conducting monthly detailed meetings on major projects. Another recommendation is to involve utility owners in the right of way determination phase to ensure there is adequate space for utility facilities.
    - Participate in local One Call notification programs. State DOTs should use One Call centers and provide sufficient oversight to ensure highway contractors participate in One Call notification programs.

- **Use appropriate utility investigation levels**. The report highlighted the four quality levels of utility investigations (i.e., QLD, QLC, QLB, and QLA) as described in the consensus standard ASCE/CI 38-02 "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data" (*40*).

- **Use a rating tool for utility investigations**. Many state DOTs cited the use of utility investigations as a best practice but also noted not knowing where or when to use those investigations. Some states have developed guidelines to help determine what kind and quality level of utility investigation to use.

- **Use a utility conflict matrix**. Utility impact matrices or utility conflict matrices (UCMs) enable the identification and management of utility conflicts.

- **Develop a GIS database of utility facilities**. State DOTs and utility owners have developed a wide range of mapping resources that are used mainly during early project development. Compiling these resources and making them available in a centralized location would benefit state DOTs and utility owners for permitting utility facilities and planning future projects.

- **Provide reimbursement incentives for early adjustments**. Some states have experimented with incentive reimbursement to utility owners for early adjustment. Under certain project situations, those states have concluded that the benefit of obtaining early adjustment offsets the reimbursement cost. Enabling reimbursement for early adjustments may require legislative change.

- **Hold preconstruction and progress meetings**. Sample actions include the following:

    - Invite utility owners to preconstruction meetings and encourage stakeholders (including utility owners, contractors, and project staff) to hold regular meetings during the construction phase of a project.
    - Encourage or require utility owners who must coordinate their adjustment work with the highway construction to attend the project preconstruction conference. The purpose of their participation is to establish contact with the DOT project manager and the contractor's organization, as well as confirm the utility's adjustment plans and verify coordination requirements as described in the project specifications.
    - Depending on the situation, it may be advisable to hold a separate preconstruction meeting with utility representatives and utility subcontractors, which might provide a more comfortable setting for utility owners to address their coordination needs (in addition to freeing time for other DOT and contractor representatives, who may not necessarily need to be involved with utility issues). If serious concerns are identified, the DOT representative can then provide liaison between the utility and the highway contractor.

- **Include utility work in the construction contract**. Including utility adjustment work in the scope of the contractor's work has the potential to avoid many utility coordination and scheduling conflicts. Depending on the type of adjustment, agreements need to be in place to ensure that utility owners reimburse the state. For this strategy to work, the utility owner must allow the state DOT's contractor to perform the work, which in some states might require enabling legislation because of the DOT's increased liability. The state DOT must also develop an agreement structure and process to verify the DOT contractor's skill, experience, and resources to perform the utility adjustment.

- **Use a work site utility coordination supervisor**. Complex projects can warrant the assignment of a project utility coordinator during construction. The Georgia DOT requires construction contractors to hire a site utility coordination supervisor on every

project that that involves utility investigations. This supervisor is also responsible for developing an emergency response plan for the project, taking into consideration foreseeable events (e.g., where the nearest cutoff valve is in case a water main breaks).

SHRP 2 R15-B "Identification of Utility Conflicts and Solutions"

SHRP 2 Research Project R15-B documented the results of a review of practices around the country on the use of utility conflict matrices (*41*). The research also involved developing and testing a prototype UCM concept as well as training materials and implementation guidelines.

An online survey and follow-up interviews with state DOTs around the country revealed a wide range of practices on the use of UCMs. The survey also revealed a range of practices related to when state DOTs complete different phases of utility adjustments and when utility owners typically start coordination activities with state DOTs. A review of 26 sample UCMs, including several from TxDOT, confirmed the use of 144 different data items, with the number of data items per table varying from 4–39. The average was 14 data items per table. The 144 data items covered a wide range of data categories, including projects, project contacts, utility facilities, utility conflicts, right of way acquisition, utility investigations, utility adjustment, utility coordination dates, agreements, costs, billings, and document tracking data.

Research Project R15-B resulted in the following products:

- **Product 1: Compact, standalone UCM spreadsheet**. This is a standalone product in Microsoft Excel format, which includes a main utility conflict table and a supporting worksheet to analyze utility conflict resolution strategies. The spreadsheet uses data elements from the 26 UCMs received from around the country, including TxDOT.

- **Product 2: Utility conflict data model and database**. This standalone product is a scalable UCM representation that facilitates managing utility conflicts in a database environment. The data model is in CA Technologies' ERwin™ Data Modeler™ format, which can be exported to formats such as Oracle and Microsoft SQL Server®. The data model was tested using sample utility conflict tables from across the country. Two implementation scenarios are possible with the data model and database: standalone database, e.g., Microsoft Access, and enterprise solution. The standalone implementation would be adequate at the individual project level, but it has scalability limitations. The enterprise solution would address these limitations by providing an agency-wide approach to the systematic management of utility conflicts.

- **Product 3: UCM training course and course materials**. This product is a one-day training course, divided into six lessons, which provides an overview of utility conflict issues and use of UCMs. The course includes an interactive session in which participants learn how to identify and manage utility conflicts.

Chapter 5 provides additional information about these research products.

NCHRP 20-05 Topic 40-04 Synthesis "Utility Location and Highway Design"

In 2010, NCHRP published the results of a review of practices related to when state DOTs assess utility impacts and make adjustment decisions; what policies, regulations, manuals, and guidelines are used; and how utility owners affect design decisions (*42*). The information-gathering phase included a literature review, a survey, and interviews.

Of the 45 responses received, 20 percent of DOTs reported involving their utility personnel in the project planning stage (which probably included both planning and preliminary design, although this distinction was not clearly established in the report). Involvement typically included identifying utility facilities that might exist within the project limits and, in some cases, preparing a preliminary utility adjustment cost estimate. Approaches for developing the cost estimate varied from worst-case scenario to best-case scenario to most-likely case scenario. Likewise, 10 percent of state DOTs reported starting to get utility information in the topographic survey stage (presumably in connection with preliminary design-level activities). About 52 percent of DOTs wait until the early design phase, while the remaining 18 percent of DOTs wait until later in the design phase or sometimes just before construction. Note: These results are roughly comparable to those obtained as part of the SHRP 2 R15-B study (*41*), except the SHRP 2 R15-B study introduced a finer level of temporal resolution.

State DOTs agreed that general strategies to make optimal design decisions would involve access to accurate and comprehensive utility data, utility adjustment cost data, informed and trained designers, and timely and frequent communications with utility owners. However, although there are several sources of information on best practices, most DOTs surveyed reported paying limited attention to those sources (e.g., less than 30 percent of DOTs reported using AASHTO's guidelines and best practices for right of way and utilities [*35*]), citing constraints included in state statutes, policies, and practices. In addition:

- 60 percent of DOTs considered their project costs more important than what utility adjustment costs would be for utility ratepayers.
- 73 percent of DOTs said they do not consider cost or time factors when making utility adjustment decisions.
- 60 percent of DOTs reported that their designers were not trained on utility issues. More specifically, only two percent of designers had training on utility adjustment costs.

After noting that the traditional approach for addressing utility conflicts has been to relocate utility facilities, the report highlighted that the literature was scant on how or when to make decisions to relocate utility facilities involving a comparison with alternative design options. All state accommodation policies reviewed required utility owners to relocate their facilities if they conflict with the transportation project. Some policies request designers to attempt to minimize adjustments. Except for aboveground, clear zone safety considerations, most state DOTs do not have policies or guidance documents regarding how to make a decision between relocating a utility and designing around a utility conflict. In 64 percent of the states, the assumption is that

such a decision would require a normal chain-of-command process or a formal approval process, which means that the decision would need to originate with the designer.

The report also noted that some state DOTs have begun to include a work category in their consultant contracts to conduct utility conflict analysis and resolution. The level of activity varies from identifying potential conflicts for the selection of test holes to recommending potential changes to the highway design.

The report also provided some information about practices at three state DOTs: PennDOT, Virginia DOT (VDOT), and GDOT. PennDOT assigns a project manager who is responsible for that project from that point on until construction is complete. A utility specialist is also part of the design team. Before the design begins, the specialist gathers utility owner records and makes a field visit to develop a "best guess" utility map (using topographic information received at less than 5-percent design). A preliminary utility cost estimate is generated at this time. At 30-percent design, the project team schedules a second field visit with plans in hand (at this point, the plans show large-scale design elements). During this visit, the utility team member gives advice about adjustment costs, time issues, and other utility issues. At this point, a decision is also made whether to use a SUE consultant.

In Pennsylvania, the Underground Utility Line Protection Law (*43*) enables contractors on PennDOT jobs to perform their own test holes at PennDOT expense if the contractor has reason to believe that utility information depicted on the plans is in error. This law leads PennDOT to request QLA data in the project design stage in an effort to control contractor costs more proactively. A 2006 One Call statute revision (*44*) requires all projects in the state to use the ASCE/CI 38-02 standard (or justify why it should not be used), if the project construction cost is estimated to exceed $400,000.

VDOT assigns a utility coordinator to the project before 30-percent design. This coordinator is responsible for knowing utility locations and issues, and for bringing design versus adjustment issues to the attention of the designers. The utility coordinator produces quarterly updates on the expected utility adjustment costs as design progresses.

A VDOT program in place since 2000 enables the agency to reimburse utility owners for their engineering and design costs regardless of prior rights. As part of the program, VDOT uses consultants to assist with utility adjustment designs if a utility owner decides not to use their own designers or cannot meet project deadlines. These consultants are also responsible for making recommendations on transportation design changes if these changes appear to make more sense than adjusting a utility facility. The report noted that this protocol increased VDOT's ability to hit target dates by 15 percent and decreased project timelines by 5–10 percent (on some projects, VDOT estimated the time savings exceeded one year).

VDOT is also able to negotiate the acquisition of utility easements on behalf of utility owners, with utility owners agreeing to bear their share of any applicable costs (*45*).

GDOT conducts a utility impact analysis as soon as preliminary drainage, erosion control, staging, structures, and construction limits are available (normally between 30 and 60 percent

design). GDOT (or its SUE consultant) reviews all potential utility conflicts, documents recommended resolutions (which might include the possibility of adjusting the proposed design), determines if QLA test holes are necessary, and determines a utility impact with ballpark costs. GDOT documents these items using a utility conflict matrix spreadsheet. GDOT also developed a training program to provide designers and project managers with strategies on how to avoid utility-related problems.

GDOT implemented a MicroStation-based utility redlining tool that facilitates the transmitting of utility plan markups in electronic format for GDOT construction projects and is provided to the utility industry at no cost. Benefits of the software include saving on printing costs for both GDOT and utility owners, improvements in construction plan quality, improvements in utility coordination efforts, and faster plan development.

NCHRP 20-07, Task 269 Synthesis "Feasibility of Using Incentives to Facilitate Utility Relocations"

In 2011, NCHRP completed a synthesis project to assess the feasibility of using incentives to facilitate utility adjustments (*46*). NCHRP 20-07, Task 269 was the result of implementing one of the ideas documented in the 2008 international scan on right of way and utilities (*37*). The motivation for the synthesis was the realization that some state DOTs were using incentives to encourage utility owner cooperation but results were mixed. The objectives of the synthesis were to document experiences state DOTs had using incentives for utility adjustments and investigate how incentives were used to accelerate other critical construction-related activities.

The synthesis report noted that federal laws and regulations preclude federal participation in cash incentives that are over and above actual utility adjustment costs, but do allow state participation to the extent that state laws and regulations allow for this participation. The reported listed a number of incentives (both financial and non-financial) that state DOTs and utility owners have considered or recommended, including the following:

- Financial incentives:
    - Reimbursement.
    - Cash bonuses.
    - Unit costs.
    - Right of way acquisition for utility installations.
    - Clearing, grubbing, staking, and grading.
    - Lane rental.
    - Lump-sum adjustments.
    - Contractor-provided financial incentives.
- Non-financial incentives:
    - Elimination of arbitrary or unnecessary utility adjustments.
    - Highway contract language facilitating coordination, cooperation, and communication.

- Utility corridors.
- Include utility adjustments in highway projects.
- Conduct SUE utility investigations.
- Evaluate utility issues in value engineering studies.
- Simplify utility permitting and documentation requirements.
- Use designated utility coordinators.
- Conduct utility coordination during construction.

AASHTO Subcommittee on Right of Way and Utilities Surveys

Since 1998, the AASHTO Subcommittee on Right of Way and Utilities has conducted informal surveys among state DOTs to gather general information about specific topics of interest (*47*). Typically, one state DOT asks a question and other state DOTs post answers to those questions. In some cases, the responses include attachments and other documentation of interest. Table 7 lists relevant utility-related surveys.

Table 7. AASHTO Subcommittee on Right of Way and Utilities Surveys (*47*).

Date	Utility-Related Survey Topic
11/07/2011	Oversight of title opinions/issues, condemnation actions, outdoor advertising, and utility relocation
02/15/2011	NEPA evaluations
02/15/2011	Fees for locating facilities
02/15/2011	Fees for occupying highway right of way and reimbursement for relocations
12/16/2010	Design-build utility coordination
11/20/2010	Color-coded U.S. map for utility accommodation
11/20/2010	Acquiring easements and takings for utility relocations
11/09/2010	Agency deemed an operator on the construction general permit
08/14/2009	Fiber optic in right of way
07/08/2008	Indian tribes
05/19/2008	SUE contract costing and prequalification
03/18/2008	Compensable rights claims
02/28/2008	SUE costs for scope of work
01/11/2008	Occupation of interstate highways
01/02/2008	Criteria for grade separation for railroad crossing
11/09/2007	Abandonment of underground facilities in right of way
09/28/2007	Local public agency (LPA) resurfacing or minor projects meeting FWHA requirements
09/24/2007	Natural gas allowed and casing requirements
08/31/2007	Right of Way conveyance document with utilities
08/20/2007	Relocation incentive fees
08/20/2007	Fee for encroachment permit and associated inspection fee
07/24/2007	Contract provisions for utility information on contract plans
07/24/2007	Minimizing location of utilities crossings
07/20/2007	Coordination of linear placement
07/12/2007	Liability of public utility easements
06/27/2007	Reimbursement of utility facility relocations
06/07/2007	Permitting for placement of propane
05/22/2007	Accommodation manuals
04/25/2007	Global positioning system (GPS) location data on new installations or prohibition on overhead utility crossings on limited access
04/03/2007	Engineer position description and registered professional engineer requirement
03/08/2007	Leasing of right of way to utilities
03/05/2007	Compensable property interest
02/19/2007	Compensable prior rights
12/21/2006	Coordination and prequalification of utility owners
11/02/2006	Exercise of prior rights of both entities in relocating utilities
10/25/2006	Tree removal
09/27/2006	Utility personnel qualifications
09/14/2006	SUE programs
07/28/2006	Gas intrusive testing
04/17/2006	Authorization to advertise construction projects
10/14/2005	Compensation for telecommunications in controlled access right of way
10/28/2004	Utilities in the right of way
02/27/2004	Erosion control
03/13/2003	Wireless towers in the right of way

CHAPTER 3. POTENTIAL STRATEGIES TO IMPROVE UTILITY OWNER PARTICIPATION

INTRODUCTION

This chapter describes the process the researchers followed to develop a preliminary list of strategies to improve utility owner participation in the project development and delivery process at TxDOT; to obtain and consolidate stakeholder feedback on those strategies; and to develop a shortened, prioritized list of strategies.

PRELIMINARY LIST OF STRATEGIES

Based on the literature review discussed in Chapter 2, the researchers assembled a list of 64 potential strategies to improve utility owner participation in the project development and delivery process at TxDOT (Table 8). The researchers assembled that list in preparation for meetings with relevant stakeholders. For convenience, the potential strategies in Table 8 were grouped into the following categories:

- Communication and coordination (24 strategies).
- Contracts and agreements (17 strategies).
- Utility data collection and management (19 strategies).
- Training (4 strategies).

Table 8. Potential Strategies to Improve Utility Owner Participation in the Transportation Project Development and Delivery Process.

Strategy
Communication and Coordination
Establish or continue state-level utility coordinating groups
Establish or continue district-level utility coordinating groups
Establish or continue metropolitan-level utility coordinating groups
Establish or continue utility engineering/coordination groups within TxDOT
Establish planning advisory teams and support tools
Involve environmental and utility coordination staff in the transportation planning and programming phase
Assign utility coordinators to transportation projects from planning to construction
Provide utility owners with long-range construction schedules
Include utility issues, concerns, or plans in long-range transportation plans
Solicit information on utility owner's capital construction programs
Share transportation project plans early with utility owners
Involve utility owners in the determination of right of way needs
Implement corridor preservation strategies to protect highway right of way for future expansions, including limiting utility installations on protected corridors

Table 8. Potential Strategies to Improve Utility Owner Participation in the Transportation Project Development and Delivery Process (continued).

Strategy
Communication and Coordination
Establish utility corridors parallel or within the transportation right of way for future utility use
Avoid utility adjustments rather than ignoring the impacts of utilities on construction costs and timing
Provide earlier preliminary notice of utility adjustments to utility owners
Formalize utility-related tasks in all value engineering (VE) studies for projects that include utility facilities within the project boundary
Establish effective communications with utility owners regardless of reimbursement eligibility
Involve utility owners in the design phase of all transportation projects that might involve utility adjustments
Conduct detailed monthly stakeholder meetings on major projects
Conduct plan-in-hand on-site meetings with utility owners
Avoid late design changes
Involve utility coordinators and utility owners whenever there are late design changes
Invite utility owners to preconstruction meetings
Contracts and Agreements
Outline clearly defined responsibilities in MOUs
Implement multilevel MOU approach with utility owners
Outline clearly defined responsibilities in utility agreements
Include incentives for early adjustment in utility agreements
Use standardized master utility agreements
Execute utility agreements with all utility owners within the project boundary, even if no utility work is anticipated
Use standardized utility provision language in the construction contract
Participate in the cost to adjust all utility facilities, regardless of prior rights
Implement procedures for preliminary estimation of utility adjustment costs
Implement systematic approach for calculation and monitoring of utility adjustment cost estimates throughout the project development process
Include utility adjustment work in the highway contract
Include utility adjustment work in design-build contracts
Establish template for roles and responsibilities for multiple infrastructure corridor users
Coordinate scopes of services, e.g., environmental scientific services and utility coordination professional services
Evaluate potential environmental implications associated with potential utility adjustments
Establish standard protocols and lease templates for utility attachments to roadway structures
Negotiate private easements on behalf of utility owners at TxDOT's expense
Utility Data Collection and Management
Participate in the One Call program
Use the One Call program for early identification of utility facilities
Use the One Call program for utility verification during design
Use CAD software for markups of existing installations by utility owners

Table 8. Potential Strategies to Improve Utility Owner Participation in the Transportation Project Development and Delivery Process (continued).

Strategy
Implement or expand the use of GIS technology to depict and manage utility facilities and utility conflicts
Collect QLB during the preliminary design phase
Collect QLB and QLA data on all transportation projects that might involve utility adjustments
Develop a decision matrix to identify the conditions under which QLB or QLA data should be collected for a project
Provide a copy of all SUE reports and data to utility owners
Use a worksite utility coordination supervisor, particularly for projects that involved the collection of QLB or QLA utility data.
Use a UCM to manage utility conflicts at every project
Conduct utility impact analysis at critical project development milestones
Allow highway contractor to collect QLA data at TxDOT's expense if the contractor has reason to believe that utility information on the plans is in error
Provide 3-D engineering design plans to utility owners
Include some drainage design elements in the preliminary design phase without preempting the environmental process
Include some standardized design elements in the preliminary design phase without preempting the environmental process
Address utility issues in constructability reviews in preliminary design
Use and document radio frequency ID (RFID) tags for damage prevention during construction
Implement web-based system to track utility conflicts, agreements, and reimbursements
Training
Provide training for utility adjustment personnel on TxDOT plans
Provide training for design engineers and other TxDOT staff on utility coordination and adjustment concepts
Provide training for utility coordinators at TxDOT
Provide training for TxDOT personnel on utility owner plans, business process, and project development

STAKEHOLDER MEETINGS AND WORKSHOPS

The researchers conducted two series of meetings with stakeholders. They first scheduled meetings with TxDOT districts and utility owners to gather feedback with respect to the preliminary list of strategies in Table 8 as well as other additional strategies. TxDOT districts included a sample of urban and rural districts. Utility stakeholders interviewed included operators of various sizes and in different industries such as oil and gas, communications, water, and electricity.

The result of the initial round of meetings was a shortened, prioritized list of potential strategies. After developing these strategies in detail, the researchers conducted five stakeholder workshops to obtain feedback with respect to those strategies and recommendations. The workshops took place in Austin, Fort Worth, Houston, Lubbock, and San Antonio. The Austin workshop was

held in conjunction with a meeting of the TxDOT Right of Way Modernization Team. The other workshops provided remote web-based meeting capabilities. Workshop participants included TxDOT officials from most districts and regions, consultants, and utility owner representatives.

MEETING AND WORKSHOP PARTICIPANT FEEDBACK

This section summarizes the feedback received during the various meetings and workshops. For convenience, the feedback is divided into the following areas:

- Communication and coordination.
- Contracts and agreements.
- Utility data collection and management.
- Training.

Communication and Coordination

Different TxDOT districts follow different practices for utility coordination. Although described in relevant TxDOT manuals, the utility coordination process at individual districts varies due to factors such as staffing, funding resources, and the number and type of projects developed at the district. These differences lead to inconsistencies in how districts interact with utility owners and how they approach utility coordination during project development. The different approaches can be especially difficult for utility owners that deal with multiple districts if requirements for submission of utility agreements change from district to district.

Depiction of the utility coordination process at TxDOT is ineffective. Several utility owners were highly critical of the way the utility coordination process at TxDOT was described in manuals and other documents. Utility owners also highlighted that the depiction of the TxDOT process was outdated and lacked flexibility.

Early information about upcoming projects helps utility owners plan accordingly. Some districts have quarterly or annual meetings with utility owners to discuss planned projects in the next three years. Prior to the meetings, TxDOT sends a list of upcoming projects to utility owners to facilitate the discussions. By comparison, other districts only have project-specific meetings. The lack of knowledge about TxDOT long-term plans causes difficulties for large utility owners to plan major investments accordingly. In lieu of formal annual meetings, several utility owners expressed interest in receiving a list of upcoming TxDOT projects regularly.

For specific projects, some districts involve utility owners early in the project development process through public meetings or coordination meetings. Utility owners find those coordination activities useful. Sometimes districts start the coordination process only when the project proceeds into the design phase. Large utility owners typically have a large number of adjustment projects at any given time, ranging from months to years to complete. Early communications with those utility owners is extremely valuable because it allows them to plan for adjustment activities well in advance of construction. In addition, utility owners suggested

that TxDOT should send a meeting agenda listing potential utility conflicts in advance to facilitate the coordination meetings.

Compressed project development schedules at TxDOT affect the utility coordination process. Compressed project schedules affect the time that utility owners have to adjust their facilities. Challenges in completing right of way acquisition before utility owners start utility adjustments further complicate the adjustment process. There are cases when right of way acquisition extends into construction. This limits the ability of utility owners to develop adjustment projects due to the uncertainty of available right of way and potential environmental issues such as aquifers and endangered species. To help address this issue, some utility owners suggested clearly marking right of way lines on the ground during project development and design to facilitate the identification, design, and development of utility adjustments.

Utility owners are reluctant to commit resources too early due to possible project changes. TxDOT districts and utility owners alike confirmed the utility owners' lack of interest to participate in early project development meetings (i.e., during the planning or preliminary design phases) because, based on previous experience, projects are subject to changes. The utility owners' reluctance of early involvement prevents TxDOT from getting potentially valuable information from these owners on major facilities conflicting with the planned project.

Meaningful involvement by utility owners typically starts somewhere after 30 percent design and, in many cases, much later once drainage design information is available. Utility owners indicated that starting late minimizes their risk of wasting resources due to potential project delays or cancellations. In addition, without sufficient drainage design information, it is difficult to design utility adjustments accurately. However, late in the design phase, utility owners typically have limited time for planning, designing, and executing utility adjustments, especially for conflicts that involve major facilities.

It can be cost-effective to modify the project design to minimize utility impacts. Feedback from both utility owners and TxDOT officials indicated that TxDOT designers are generally willing to work with utility owners to minimize utility impacts, especially when major conflicts are involved. Some designers are more proactive in accommodating utility facilities in the design process. Other designers fail to recognize the impact of utility conflicts and decide to leave those conflicts unresolved during the design phase. Reasons for postponing dealing with a utility conflict include miscommunication within TxDOT and between TxDOT and the involved utility owners, tight design deadlines, and a lack of knowledge or experience by designers on utility-related matters.

Adjustments, including secondary adjustments, need more effective coordination. Late project design changes may cause utility adjustment redesigns or secondary adjustments. Although secondary utility adjustment costs may be eligible for reimbursement depending on the situation, utility owners have to provide sufficient evidence and documentation, which can be time-consuming. As a result, some utility owners prefer to absorb the cost and carry out the readjustments on their own.

A related problem is that, in some situations, a utility owner might decide to proceed with a new installation or an adjustment without notifying TxDOT. Under these conditions, TxDOT designers might continue with the project design assuming the utility facility is still at its original location. Because of the change in local conditions, additional, potentially unnecessary, utility readjustments may be necessary. Sometimes the result is additional damage to utility installations during the construction phase.

There is a need to improve internal communications at TxDOT. Both TxDOT and utility owners highlighted cases where the lack of appropriate internal communications at TxDOT plays a role in utility or other project-related delays. For example, designers might fail to recognize the need to design around utility facilities due to a lack of appropriate field information or because this information has been misplaced or lost, causing redesigns or secondary adjustments. In other cases, there may be a communication disconnect between division and districts, e.g., if the division returns cost estimation submissions that districts have already cleared. Some utility owners indicated it is sometimes difficult to identify the appropriate contact at TxDOT for updates on utility reimbursement status.

There is a need to improve communication and coordination between utility owners. Both utility owners and TxDOT officials suggested a need to improve coordination efforts among utility owners. Projects frequently involve situations where it is critical to coordinate the adjustment of multiple utility facilities. However, due to a lack of communication or concern about the need to protect confidential information, some utility owners may be reluctant to work collaboratively with others. This lack of collaboration results in conflicting or inefficient adjustments, as well as adjustment delays. TxDOT officials also complained about the lack of coordination between utility designers and contractors, as well as the lack of a single utility owner point of contact to interact with TxDOT throughout the entire process.

The SHRP 2 R15-B products are promising and should be implemented at TxDOT. Stakeholders liked the SHRP 2 R15-B products, in particular the utility conflict database. Participants also saw potential in the cost analysis portion of the utility conflict matrix because it focuses on total costs (including costs on the utility owner side), which would facilitate discussions with designers, project managers, and other stakeholders. Participants noted that entering data into the system would take time and offered some ideas as to who should be responsible for that task—more than likely through a combined effort involving support staff, utility section staff, design section staff, and consultants.

Contracts and Agreements

There is interest in implementing master utility agreements. Participants expressed some interest in the concept of multilevel MOUs, but were skeptical about MOUs affecting utility coordination efforts on the ground. The reason is that MOUs are not legally binding documents, and, consequently, efforts to implement such agreements could be hampered by competing, short-term interests and needs. At the same time, participants expressed interest in master agreements with specific utility owners. As opposed to general MOUs, these agreements would include specific wording enabling the parties to address specific areas of concern. They would also be legally binding.

There is a need to simplify utility cost estimation and reimbursement procedures. A protracted process of utility cost estimates preparation and submission is often a problem for utility owners. Several utility owners indicated that the current utility cost estimation and submission process demands a significant level of time and cost to assemble. Utility owners also indicated that they have to comply with different accounting standards based on the agency with which they deal, which increases their cost. While the *ROW Utility Manual* spells out the utility reimbursement process, the actual process varies by district. Furthermore, some districts are stricter than others in applying requirements for the submission of cost estimates and utility agreement documentation, leading to inconsistencies in the way procedures are enforced throughout the state. This phenomenon was particularly evident to utility owners who operate throughout the state.

Utility owners were concerned about the requirement to submit cost information using cost categories that are different from their own accounting methods. While this requirement creates additional work for utility owners, there would be significant improvement if TxDOT could implement procedures that simplify and standardize the submission of utility cost estimates. For example, utility owners questioned the need to provide excruciating detail in connection with low-cost miscellaneous items and highlighted that, in many cases, they now prefer to let projects using lump-sum contracts (even for large amounts) because they can get lower overall project prices from bidders. However, current utility cost data submission procedures at TxDOT lack flexibility in this area. Some utility owners complained about having to disaggregate lump-sum contract information into individual cost categories to satisfy TxDOT's cost data submission requirements.

Utility owners highlighted that spending too much time and effort developing an estimate is counterproductive (and expensive) because, in the end, TxDOT is required to pay for actual utility adjustment costs. Participants also complained that the *ROW Utility Manual* does not provide comprehensive examples showing utility owners how to prepare cost estimates, which leads to additional delays. In one case, a utility owner submitted freight charges for a pipe as a percentage of the pipe cost, indicating that this was a common practice in the industry. However, TxDOT rejected the estimate because the freight charges were not submitted as a separate rate.

In many cases, utility owners provide estimates for certain items that may involve multiple projects (e.g., engineering costs for multiple projects). When they submit cost estimates for a specific project, they need to separate the costs for that project. In general, the district requires costs to be tied to the plan sheets (e.g., if an adjustment involves 2,000 feet of water main adjustment, all the cost items must be clearly associated with those 2,000 feet).

There is a disconnect between utility agreement information and subsequent activities. Lack of proper communication between TxDOT and utility owners between the signing of the utility agreement and the submission of partial/final billings by utility owners is causing friction and inefficiencies. A typical situation is when a utility owner uses a bid from a potential bidder that was not included in the original agreement. In one case, a utility owner had included seven potential bidders in the utility agreement but ended up receiving 15 bids and awarded the

contract to a bidder that was not included in the original agreement. Because of this change, a supplemental agreement was required, which caused considerable delays.

A current procedure requires billings to match the estimate, which can be problematic in practice. Note: The *ROW Utility Manual* indicates that a billing must include all items of work shown in the estimate portion of the utility agreement and the corresponding estimated cost for each item. The total of these items must agree with the total of the estimate.

Participants indicated that the *ROW Utility Manual* requires utility owners to provide justification when there are major changes, i.e., changes that exceed $100,000 or 25 percent of the approved agreement. (Note: The manual requires the justification to be submitted *before* proceeding with the work in the field.) This requirement can be onerous for a utility owner because of the additional time and effort documenting the justification. Although this is understandable in many situations, apparently there have been cases where the actual cost deviated in more than 25 percent of the original estimate—but the cost was *lower* than the original estimate—and TxDOT still required a detailed justification from the utility owner. Utility owners believe this requirement is a waste of time and money. (Note: Strictly speaking, the *ROW Utility Manual* uses the term 'exceed' to indicate an absolute difference between the actual cost and the estimate. The manual does not address what happens if the actual cost is *lower* by more than 25 percent of the approved estimate.)

Some utility owners complained having to submit supplemental agreements every time there is a change in work characteristics. They highlighted that the current process for submission, review, and approval of supplemental agreements is too cumbersome and slow. In some cases, delays in the approval of supplemental agreements cause utility contractors to stop for several weeks, which translate to additional delays and extra costs. Participants agreed that substantial changes should require a supplemental agreement but highlighted that supplemental agreements are frequently required for relatively small changes. One of the reasons the current procedure is troublesome for utility owners is that, frequently, utility owners only know about the change after they get a bill from a contractor. To know about the change during construction, the utility owner would need to hire an additional supervisor.

Utility owners complained about documentation requirements associated with partial payments. Historically, partial payments were meant to assist utility owners for long-duration, high-cost adjustments as the work progressed. In the past, utility owners were able to submit partial billings based on the utility agreement estimate, leaving the submission of detailed 'final audit-quality' documentation for the final billing. (Note: For partial billings, TxDOT pays up to 80 percent of the costs incurred, as shown in each billing. In addition, the total of all partial payments cannot exceed 80 percent of the original estimate in the approved agreement. In effect, TxDOT retains 20 percent on each partial payment. For the final billing, TxDOT retains 10 percent pending completion of the audit.) However, in recent years, utility owners have been required to submit detailed documentation with partial billings (e.g., by providing actual physical receipts). The utility owners' perception is that these new requirements are overkill and should not replace the audit function. Utility owners also highlighted that they are not set up to monitor utility adjustments on a day-to-day base. Doing so would increase utility owner costs.

Although the *ROW Utility Manual* includes provisions for the submission of final billings within a certain time range after completing the adjustment in the field, in practice there are situations when a utility owner submits billings years after the adjustment was completed. In other cases, utility owners do not submit final billings at all. This delay in submitting billings is a source of delay and inefficiency at TxDOT because of the additional time and effort tracking those missing billings and the inability to close projects properly.

Standardization of utility cost data submissions would result in benefits. Standardization of utility cost data submissions would enable TxDOT to compare cost estimates across districts. However, it would be critical to introduce flexibility in the standardization process to address individual utility-specific needs. For example, it should be possible to accommodate new cost items that might emerge later. It should also consider the fact that utility companies vary significantly in size and accounting systems.

Utility Data Collection and Management

One Call is expanding and its use should be encouraged. Most TxDOT districts use one of the two One Call notification centers in Texas (Lone Star 811 or Texas 811) as part of the process to identify utility installations within the project boundaries. Texas law requires utility owners (except water, slurry, or wastewater) to mark the approximate location of their facilities on the ground before excavation starts after receiving notice from a One Call notification center (*48*). The law also requires utility owners to provide maps, grid locations, or other identifiers indicating the location of underground facilities to a One Call notification center. The One Call law in Texas does not apply to contractors working in the public right of way under a contract with TxDOT. It also does not apply if a TxDOT employee excavates on a segment of the state highway system if the excavation is more than 10 feet from the right of way line. Although most tickets are associated with imminent excavation activities, survey or design tickets are also possible. Although the One Call system typically does not provide accurate enough data to make design decisions during the design phase, it does provide valuable information about utility installations at earlier stages in the process.

Texas 811 sponsored the establishment of damage prevention councils throughout the state to facilitate coordination among damage prevention stakeholders (*49*). These councils are open to a variety of stakeholders, such as construction contractors, utility operators, Texas 811, TxDOT, municipalities, utility locators, and engineering firms. Figure 19 shows a map of damage prevention council boundaries in the state, which closely resemble TxDOT district boundaries.

It is worth noting that One Call notification centers only serve as a conduit for relaying information from prospective diggers to utility owners. The notification centers have no control over the data that utility owners give them and are not held liable for the information they provide to utility owners via tickets or for the utility owners' response to those tickets.

There is a range of practices regarding the exchange of utility data with utility owners. The transfer of utility data between TxDOT and utility owners varies by district and by utility owner. In some cases, TxDOT districts send plans to utility owners in electronic format, typically in

MicroStation format or PDF. Other utility owners request paper copies of plans so they can mark up the plans.

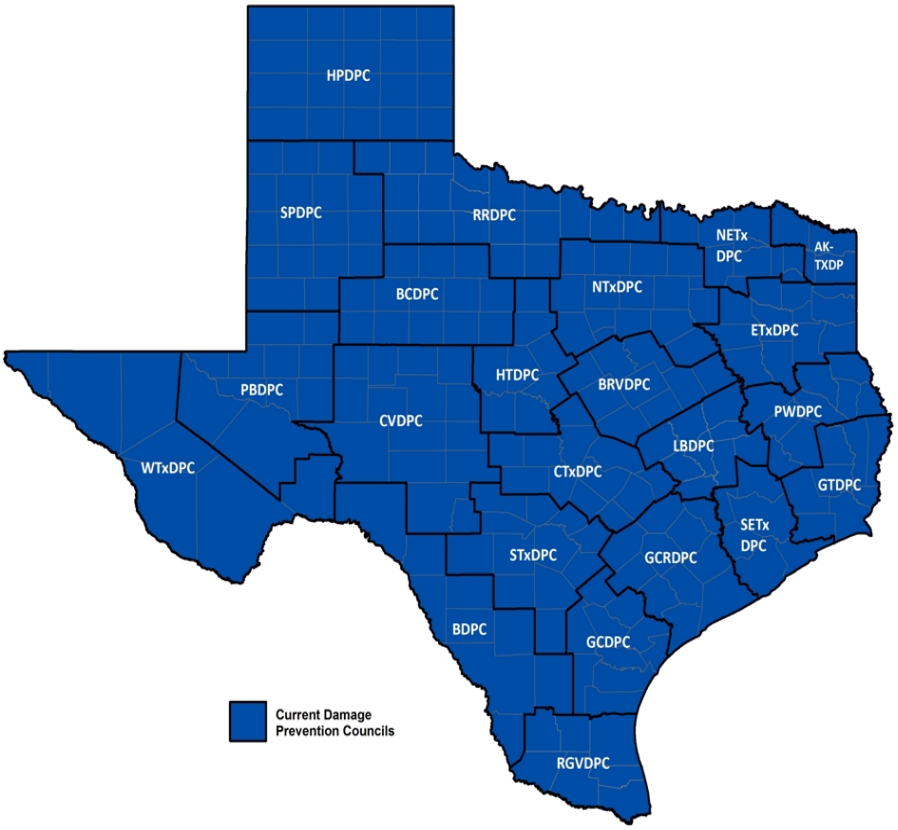


Figure 19. Damage Prevention Councils in Texas (*49*).

There is a reduction in QLB and QLA utility investigations at TxDOT. Due to budgetary constraints at several TxDOT districts, there has been a decrease in the use of QLB and QLA utility investigations. Some districts have not done this type of work for two or three years, even though they have active projects that could have benefitted from more detailed utility investigations. District staff acknowledged that some utility conflicts have been identified during construction, which could have been avoided if QLB and QLA utility investigations had taken place. Furthermore, several utility owners suggested TxDOT to conduct utility investigations more often to help identify underground utility information more accurately.

It is difficult to obtain as-built plans from utility owners after completing the adjustment work in the field. Utility owners are required to provide TxDOT with as-built plans or certified as-installed construction plans of utility facilities that are installed on the state right of way (*1*). In many cases, utility owners do not comply with this requirement, leaving TxDOT with potentially inaccurate information about the actual location of adjusted utility facilities on the ground. Some utility owners see the requirement for the submission of as-builts as a financial burden because of the belief that TxDOT always requires a registered professional to certify as-built documentation. Some utility owners are also reluctant to share information with TxDOT for fear that some of this information might end up being shared with their competitors. In

addition, some districts require utility owners to submit colored plans, which could differ from the utility owners' as-installed construction plans (e.g., in black and white). This leads to additional burden on those utility owners.

A significant issue for TxDOT is that, even when utility owners provide as-builts to TxDOT, they are rarely scaled or geo-referenced and come in a variety of formats, limiting the future usability of the information provided.

Training

TxDOT design engineers need training on utility coordination topics. A typical complaint of district utility coordinators is that design engineers frequently have little interest in the utility coordination process, leading to misunderstanding or misinterpretation of basic utility concepts, requirements, and procedures. Conversely, TxDOT designers who understand utility concepts and problems are normally helpful and cooperative regarding utility issues. District officials also commented that new design staff that are undergoing a training rotation do not spend enough time in the utility section (or do not rotate into the utility section at all). Some TxDOT districts provide ad hoc utility coordination training sessions for utility coordinators and interested design engineers. These sessions are usually project-specific and voluntary, but participation by TxDOT engineers is not consistent. A designer confirmed that utilities are often ignored during the design phase partly because there is a lack of understanding of the issues, and partly because there is not enough useful information about utility installations in the project.

Utility coordinators further highlighted that there is a disconnect between the 30-day notification for utilities in the Texas Administrative Code and reality. Unfortunately, many designers, engineers, and TP&D officials do not understand that 30 days is frequently not enough time for a utility owner to adjust a facility in the field, regardless of what the code says.

TxDOT utility coordinators need training on utility coordination and project development topics. Training on utility coordination topics is an ongoing need. In addition, one of the results of the regionalization initiative was that some district utility coordinators were transferred to the region's right of way section, where they were no longer involved in utility coordination efforts. This restructuring created an experience and knowledge gap in utility coordination. It also eroded relationships with utility owners that had taken a long time to develop. While some new utility coordinators have experience with utility permitting, helping to prepare or review utility agreements requires a different skill set. Some districts indicated a need for training on the details of utility coordination and utility agreements to assist newly assigned utility coordinators.

There is also a need to train utility coordinators on project development process concepts and procedures. In many cases, utility coordinators are only asked to participate in projects in a marginal way, e.g., by only having to provide information about potential utility conflicts at specific project locations but not participating actively in the resolution of those conflicts. Utility coordinators can offer a wealth of expertise that could result in benefits to the project if given the opportunity. Providing training to utility coordinators on project development-related topics could help to achieve this goal.

REFINED LIST OF STRATEGIES

A substantial number of comments from participants pointed to communication and coordination issues and the need to significantly improve the utility process at TxDOT. Many comments were also related to the need to substantially improve the preparation, submission, review, and approval of utility cost data estimates. A common denominator among these improvement areas was the need to develop and provide relevant training opportunities to all utility process stakeholders, including project managers, utility coordinators, and other field personnel at TxDOT, as well as highway and utility owner consultants and contractors.

It also became clear that many of the strategies identified earlier in this chapter could be merged or grouped into higher-order categories. The result of this process was the following list of categories, which reflect the highest priorities identified through meetings with various stakeholders, including TxDOT districts and regions, and utility owners:

- Modernization of the utility process.
- Use of a utility conflict matrix approach.
- Streamlining and standardization of utility cost data submissions.
- Core skills training on utility topics.

The following chapters discuss these strategies in detail.

CHAPTER 4. MODERNIZATION OF THE UTILITY PROCESS

INTRODUCTION

Delays in utility activities can easily result in delays to project delivery and increase to overall project cost. The utility process at many state DOTs, including TxDOT, has evolved over time to include a wide range of procedures, documents, and forms. At the same time, relevant manuals and other documentation are not necessarily kept up-to-date, making it difficult for state DOT officials, utility owners, and other stakeholders to understand and follow the process.

In the case of the TxDOT *ROW Utility Manual* (*2*), there are discrepancies between activity descriptions and sequencing compared to actual practices both at the district and division levels. During the interviews conducted as part of this research, the researchers learned about a number of issues that stakeholders have with the written documentation at TxDOT that describes the utility process. For example, several stakeholders indicated that the utility process described in the documentation is too complex and difficult to follow. Several utility owners were highly critical of the utility coordination process at TxDOT, particularly regarding the way the process is depicted and described in manuals and other documents. Utility owners highlighted that the TxDOT process was outdated and lacked flexibility. In addition, different districts carry out the utility process differently, which cause difficulties for utility owners that service customers spanning multiple TxDOT districts.

To address these issues, the researchers developed an updated, streamlined depiction of the utility process at TxDOT using the Business Process Model and Notation (BPMN), along with written descriptions of activities (*50*). Using BPMN enabled the use of swim lanes to group activities according to specific functions or specialties, while facilitating the development of more detailed (or "zoomed in") views as needed.

The researchers developed three diagrams of the project development and delivery process with increasing detail at each level, as follows:

- **Level 1**. This diagram provides a high-level depiction of the entire process. The diagram considers both phases and functional areas. It is suitable for general presentations and handouts. At 100-percent scale, the page size of the Level 1 diagram is 8.5 × 11 inches.

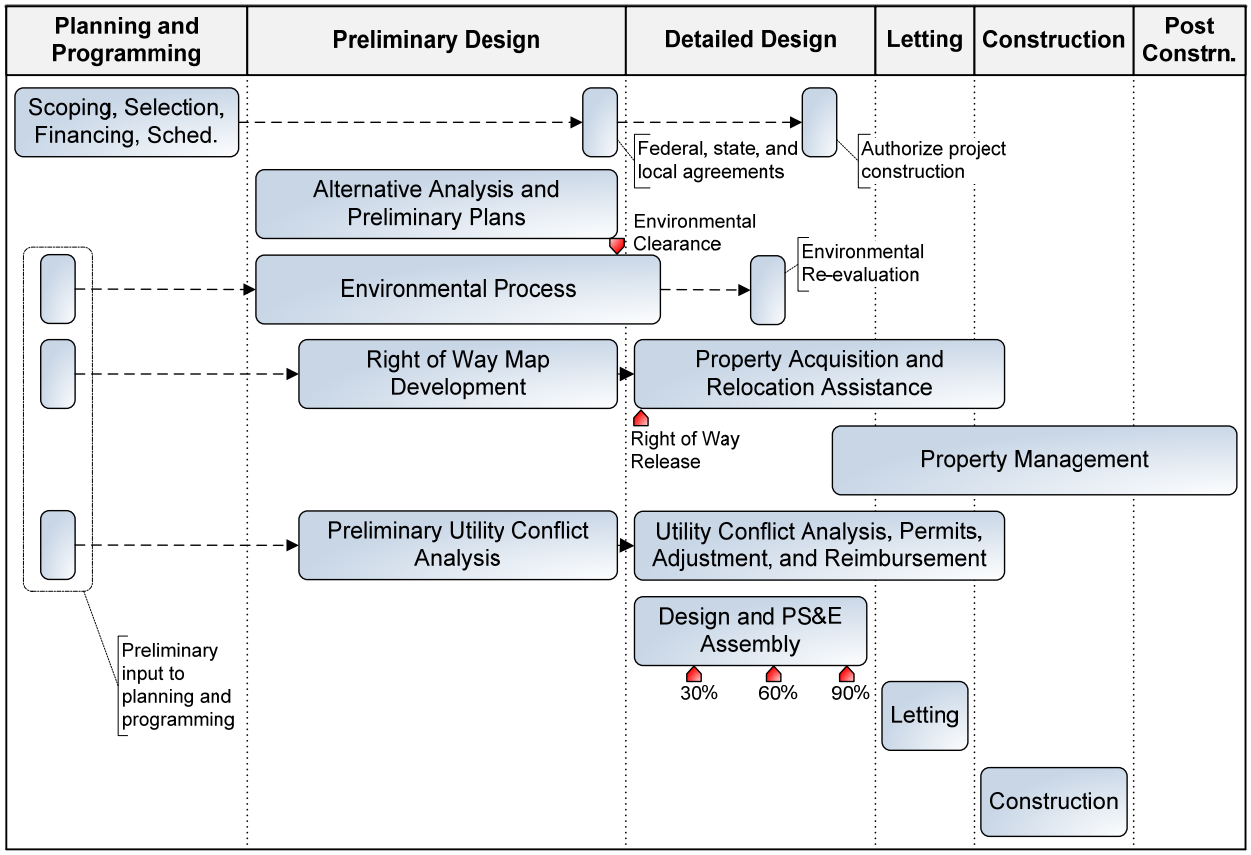
- **Level 2**. This diagram provides an intermediate level of detail for the entire project development process. The following section includes the diagram and zoomed-in views of the activities depicted at this level. At 100-percent scale, the page size of the Level 2 diagram is 24 × 36 inches. A description of each activity of the Level 2 diagram is included in Product 0-6624-P1 (*51*).

- **Level 3**. This diagram provides the same level of detail as Level 2 and, in addition, a more detailed depiction of the utility coordination and conflict resolution process at TxDOT. The last section in this chapter includes the diagram and zoomed-in views. At 100-percent scale, the page size of the Level 3 diagram is 48 × 36 inches. A description of each activity of the Level 3 diagram is included in Product 0-6624-P1 (*51*).

The researchers developed the three diagrams using Microsoft Visio®. A Visio file, along with a PDF version, is provided as a standalone file as part of Product 0-6624-P1 (*51*). This product also includes a proposed implementation plan for these products.

LEVEL 1 BUSINESS PROCESS MODEL

As mentioned, this model provides a high-level depiction of the entire process (Figure 20). The diagram considers both phases and functional areas (represented by individual bars) and is suitable for general presentations and handouts.



Note: Standalone versions of this diagram in Visio format and PDF are also available.

Figure 20. Typical Project Development and Delivery Process (Level 1 Diagram).

LEVEL 2 BUSINESS PROCESS MODEL

Figure 21 shows the Level 2 diagram of the project development and delivery process. Figure 22 through Figure 25 provide zoomed-in views of the Level 2 diagram.

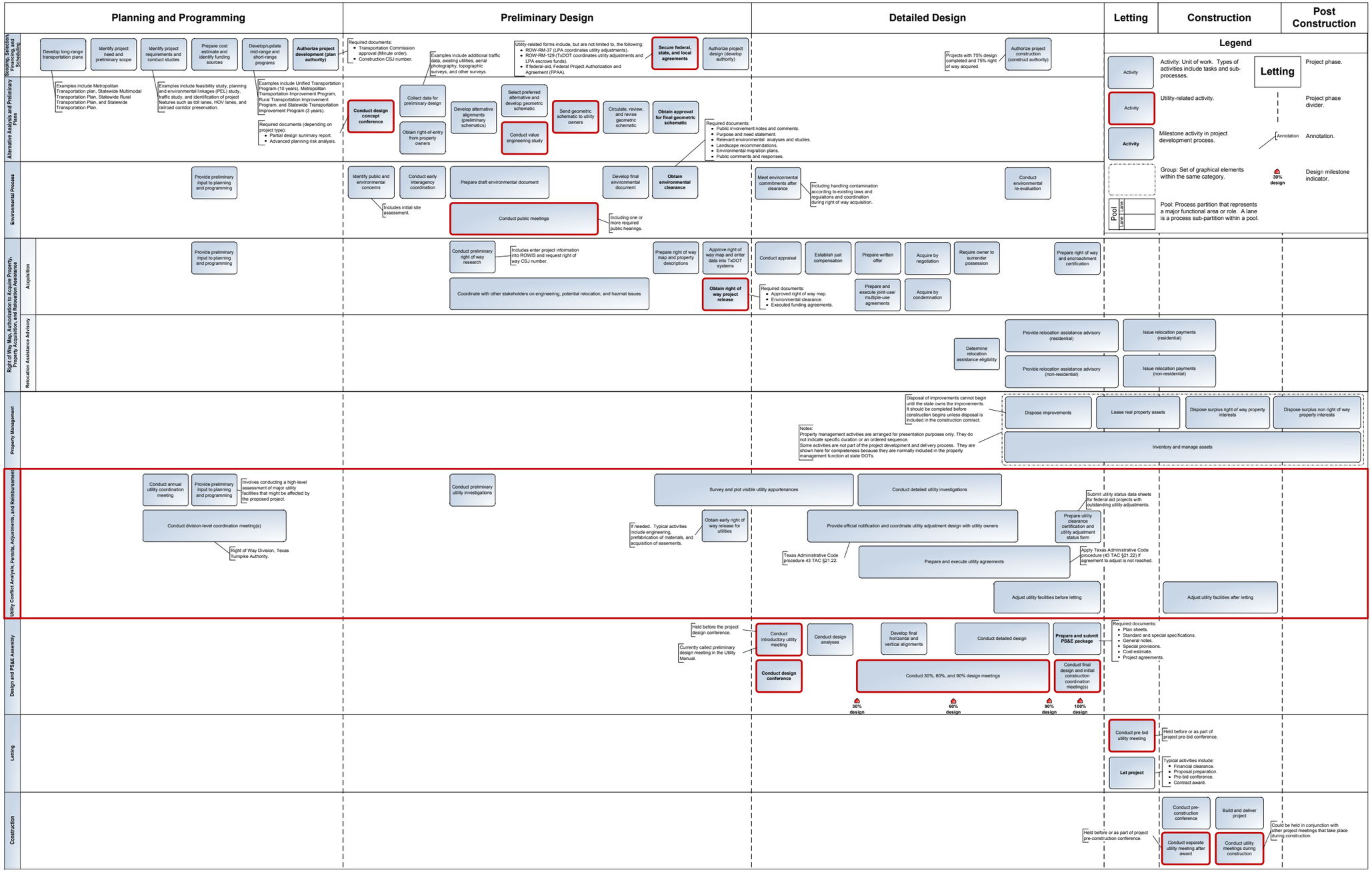


Figure 21. Typical Project Development and Delivery Process (Level 2 Diagram).

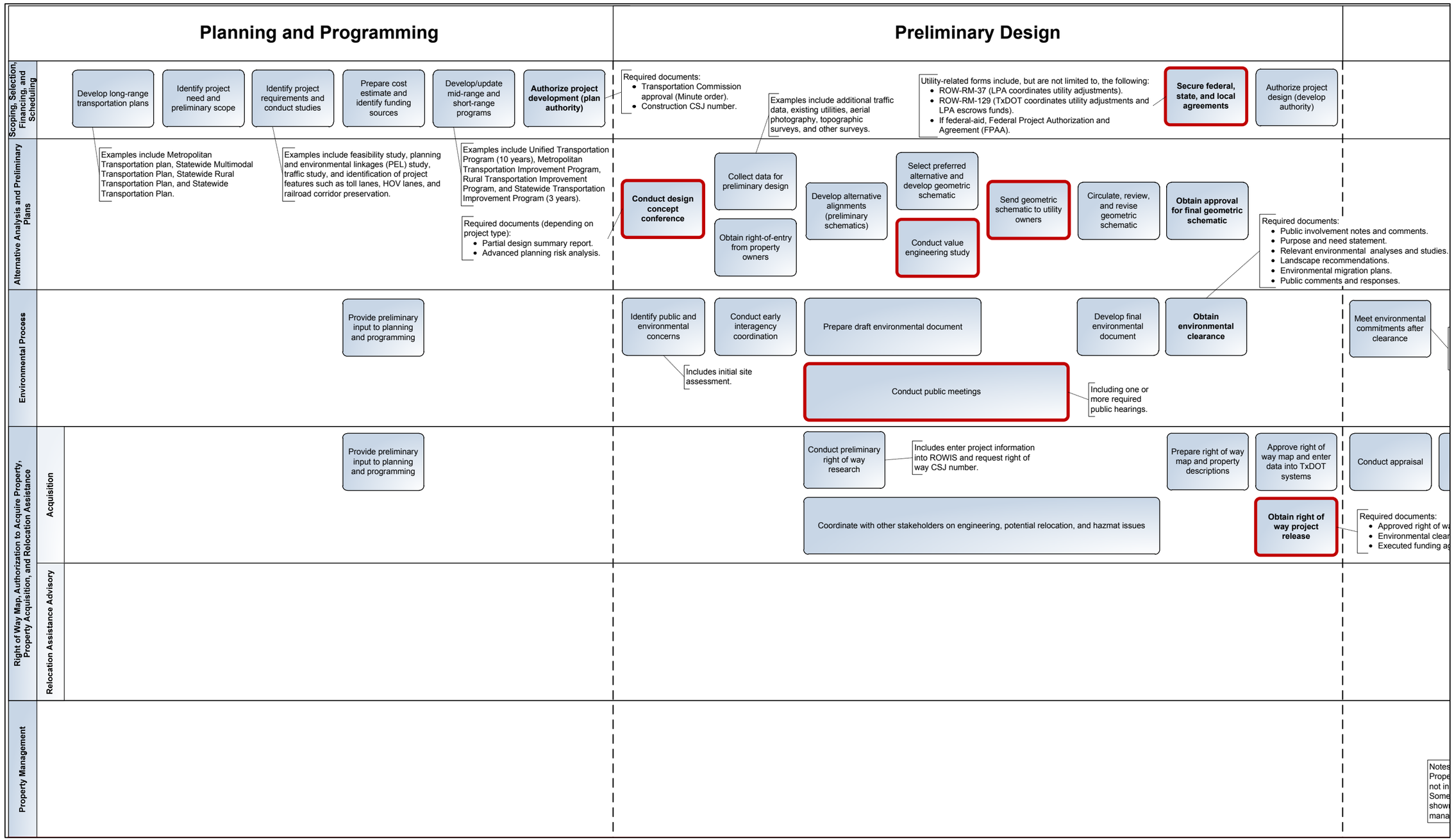


Figure 22. Typical Project Development and Delivery Process (Level 2 Diagram) – Top Left Quadrant.

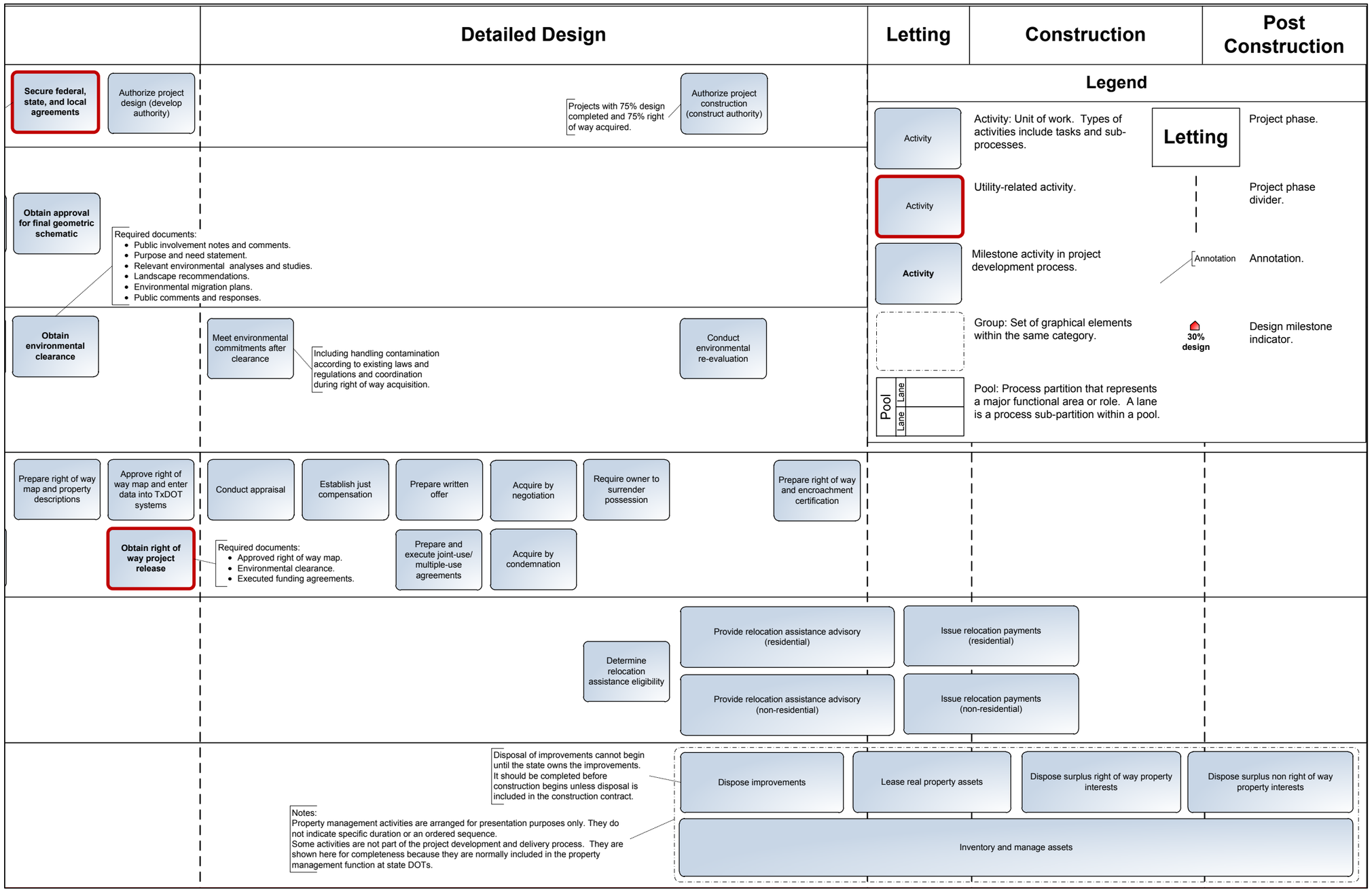


Figure 23. Typical Project Development and Delivery Process (Level 2 Diagram) – Top Right Quadrant.

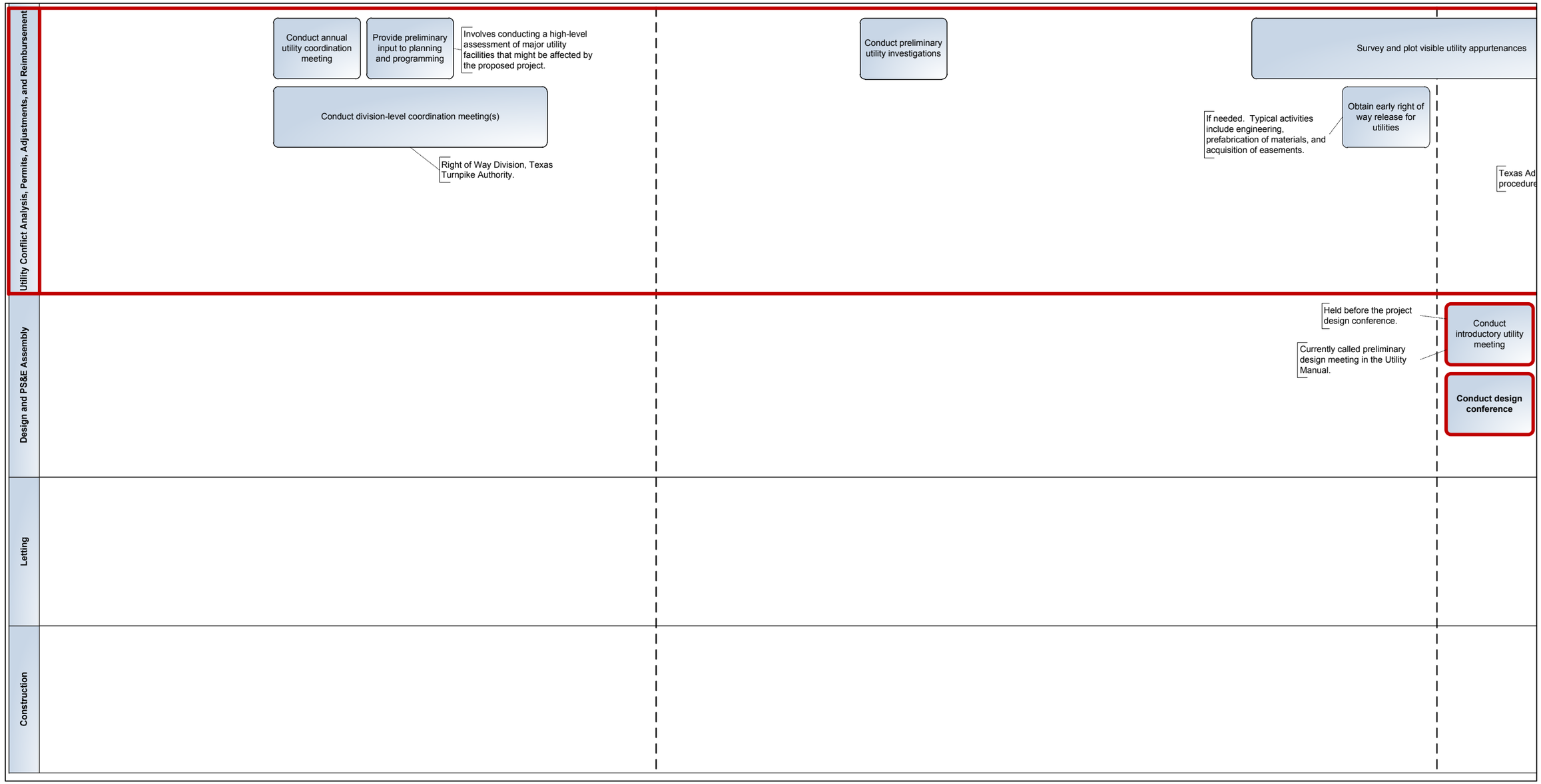


Figure 24. Typical Project Development and Delivery Process (Level 2 Diagram) – Bottom Left Quadrant.

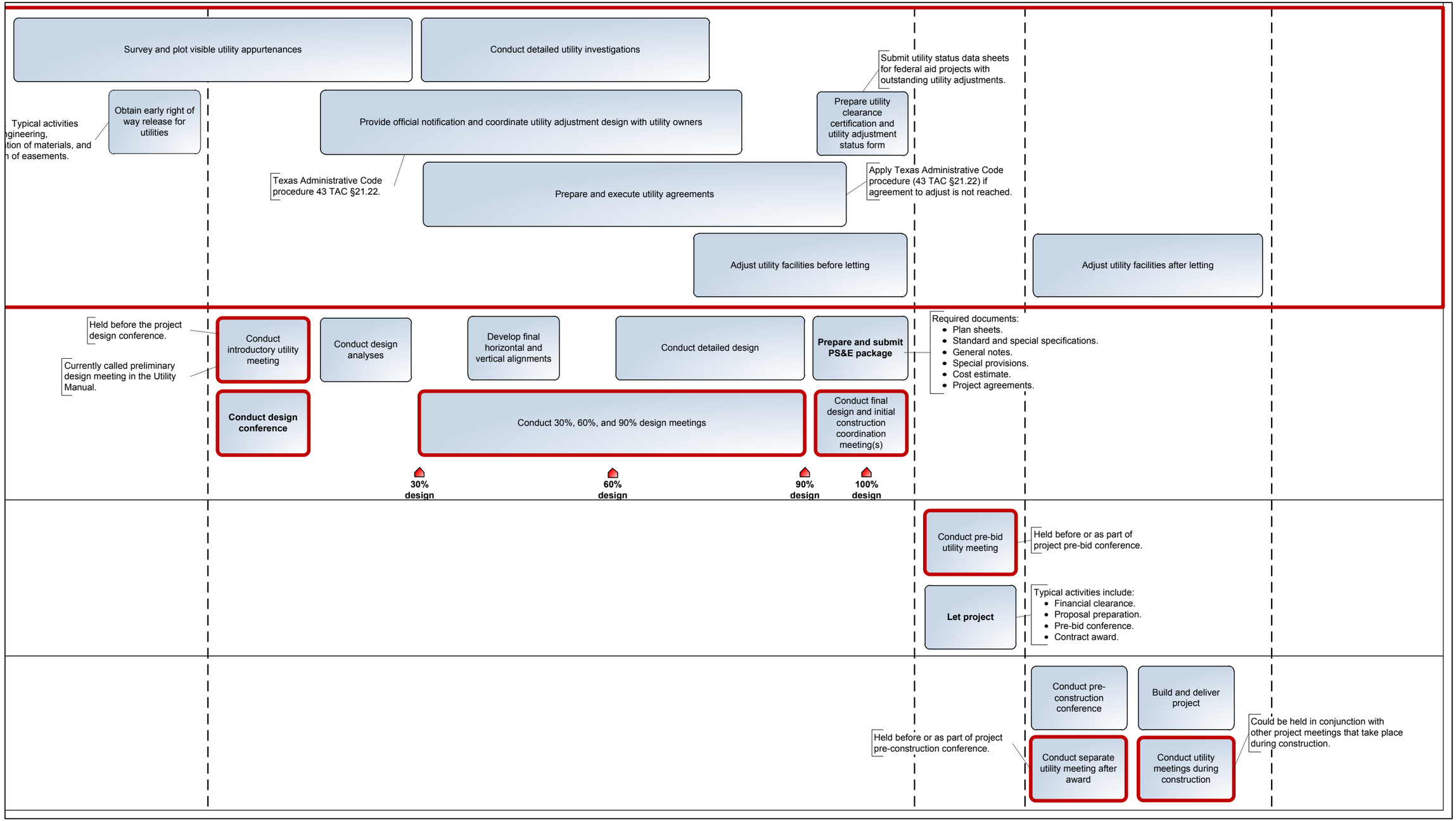


Figure 25. Typical Project Development and Delivery Process (Level 2 Diagram) – Bottom Right Quadrant.

Level 2 activities are arranged in "pools" that represent groups of activities with similar functions, which are further broken down into "lanes" as needed. The pool highlighted with a red outline represents the utility pool ("Utility, Conflict Analysis, Permits, Adjustments, and Reimbursement"). Outside this pool, activity boxes with a red outline represent project development process activities that are typically utility-related.

A description of each activity of the Level 2 diagram is included in Product 0-6624-P1 (*51*). Activity descriptions are based on several sources, including existing manuals, e.g., the *Project Development Process Manual* (*9*), the *Transportation Planning Process Manual* (*52*), the *Transportation Programming & Scheduling Manual* (*53*), the *Environmental Manual* (*54*), the *ROW Utility Manual* (*2*), and the *Plans, Specifications, and Estimate Preparation Manual* (*55*), as well as feedback from stakeholders at the division, region, and district levels.

LEVEL 3 BUSINESS PROCESS MODEL

Figure 26 shows the Level 3 model of the project development and delivery process model with a focus on utility activities. This diagram provides a more detailed view of utility data collection, coordination, and adjustment activities than the Level 2 diagram, by dividing the Utility Conflict Analysis, Permits, Adjustments, and Reimbursement pool into three lanes: Utility Data Collection and Assessment, Utility Coordination, and Utility Owner. Figure 27 through Figure 29 provide more detailed views of these lanes. With a few exceptions, activities in other pools and lanes are shown at the same level of detail as in the Level 2 model, for which the descriptions included in Product 0-6624-P1 apply (*51*).

In the Level 3 model, the entire Utility Conflict Analysis, Permits, Adjustments, and Reimbursement pool is highlighted in red. Many other activities in the project development and delivery process are also utility-related. For simplicity, the diagram only highlights some of the most critical utility-related activities in red.

The Level 2 diagram provides an approximate indication of when activities normally take place during the project development and delivery process. By comparison, the more detailed Level 3 diagram depicts typical utility activities in the Utility Conflict Analysis, Permits, Adjustments, and Reimbursement pool, but not necessarily when those activities need to occur chronologically. In general, the detailed utility adjustment process starts whenever a utility adjustment is found to be necessary (Intermediate Event A). This determination could happen at any point during the project development and delivery process. Utility adjustment activities are assumed to continue as long as a utility adjustment is necessary. If a utility adjustment is no longer necessary at any point, the process automatically reverts to the no-adjustment end-of-process condition under Utility Data Collection and Assessment.

As mentioned previously, TxDOT developed a generic schedule template that includes 18 utility activities. By comparison, the Level 2 diagram includes 12 utility activities, which means that this diagram provides a slightly more aggregated view of the utility process than what TxDOT developed as part of the TxDOT modernization project. However, the Level 3 diagram includes a much larger number of activities (more than 50 activities including TxDOT and utility owner activities), which means that the Level 3 diagram proves a considerably more disaggregated view

of the utility process than what TxDOT developed as part of the TxDOT modernization project. For actual construction projects, it is quite possible that TxDOT might need to increase the number of activities in the generic schedule template to reflect some or all the activities included in the Level 3 diagram. It is worth noting that a version of the utility adjustment schedule for a typical interstate highway project at TxDOT from the early 1990s included 23 activities, not counting preliminary utility coordination activities, detailed utility investigations, or reimbursement activities (*34*). Adding these activities would probably result in a utility adjustment schedule similar in detail to the Level 3 diagram.

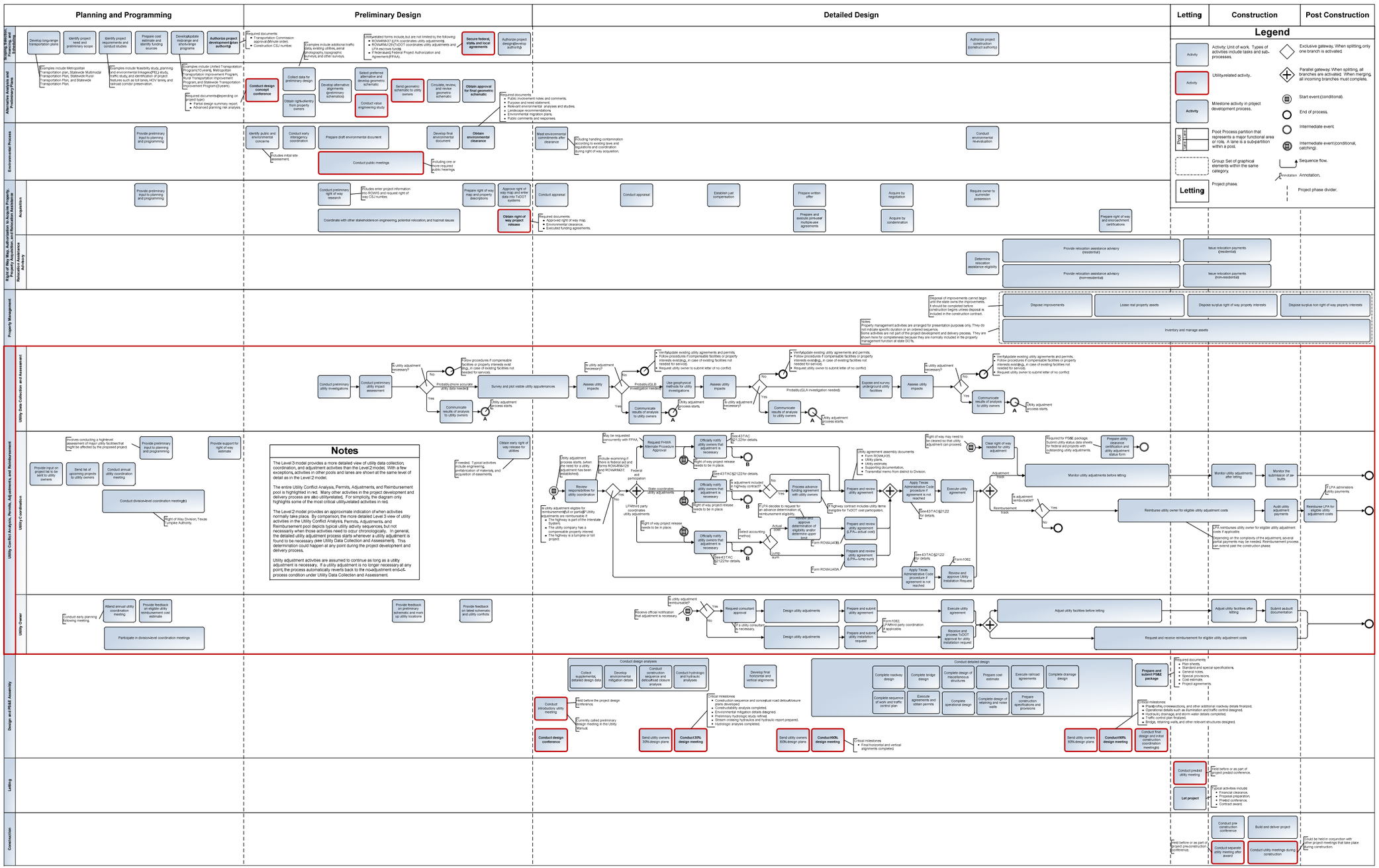


Figure 26. Typical Project Development and Delivery Process (Level 3 Model).

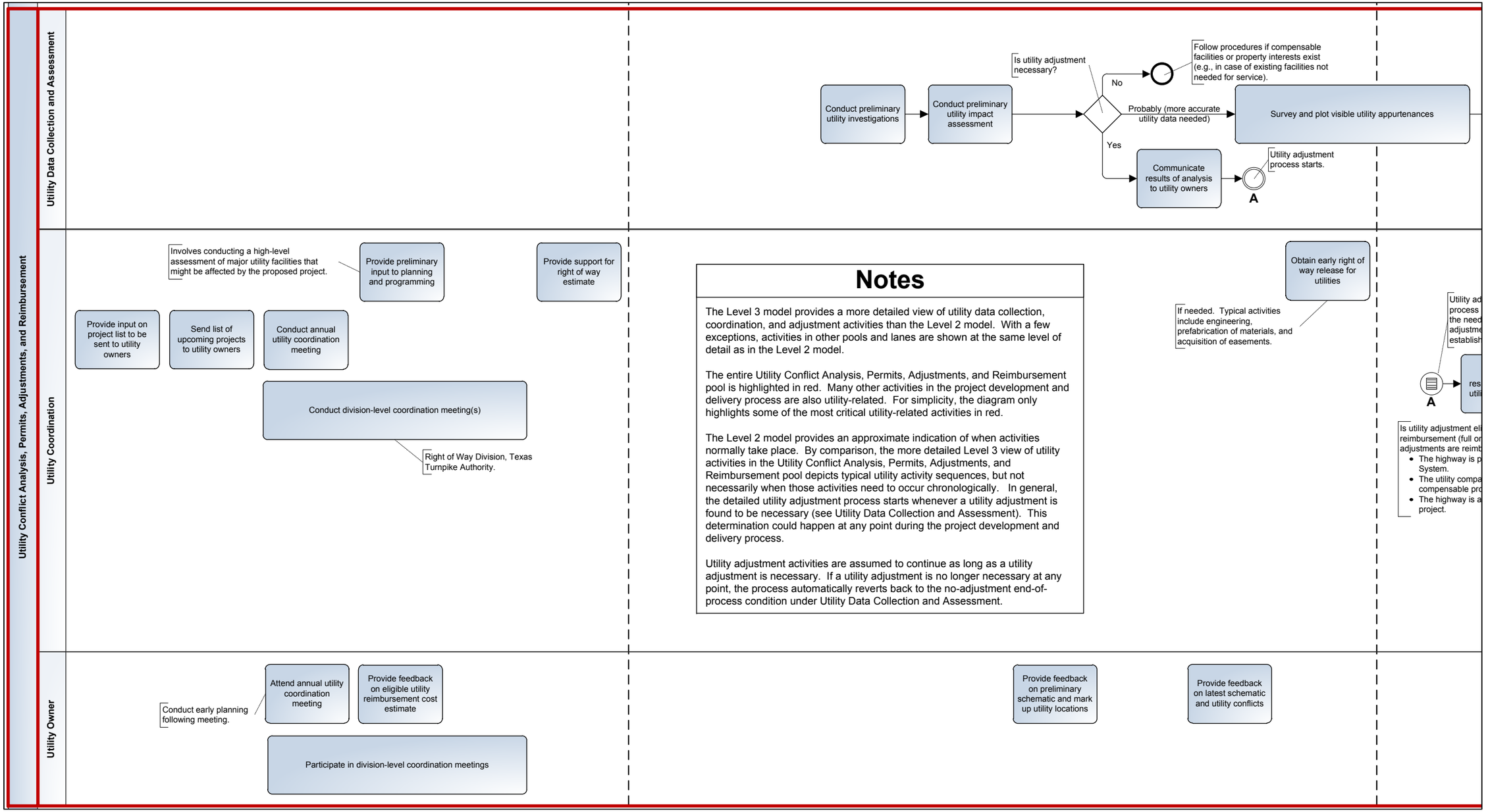


Figure 27. Typical Utility Process (Level 3 Model) – Left Portion.

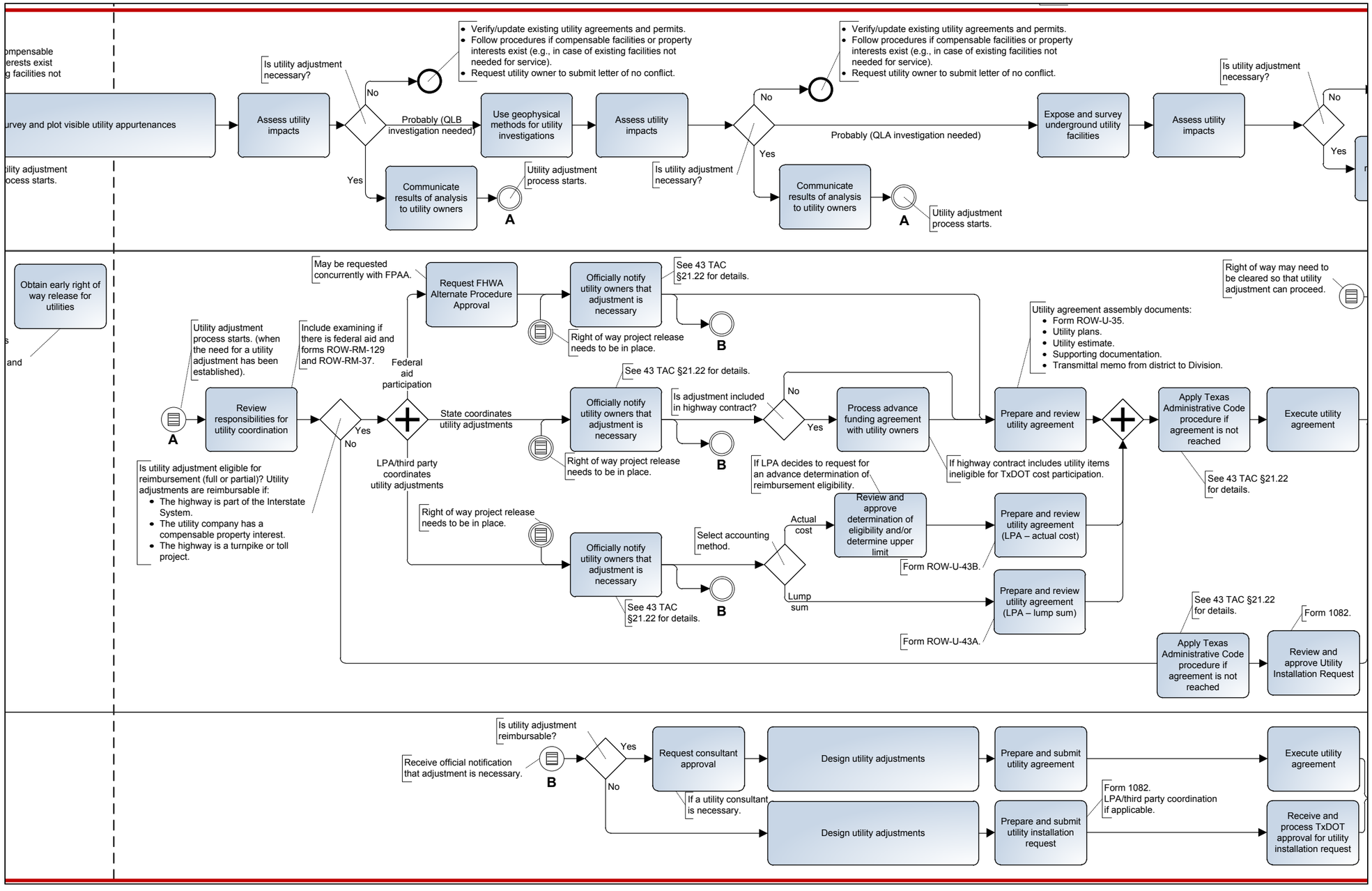


Figure 28. Typical Utility Process (Level 3 Model) – Middle Portion.

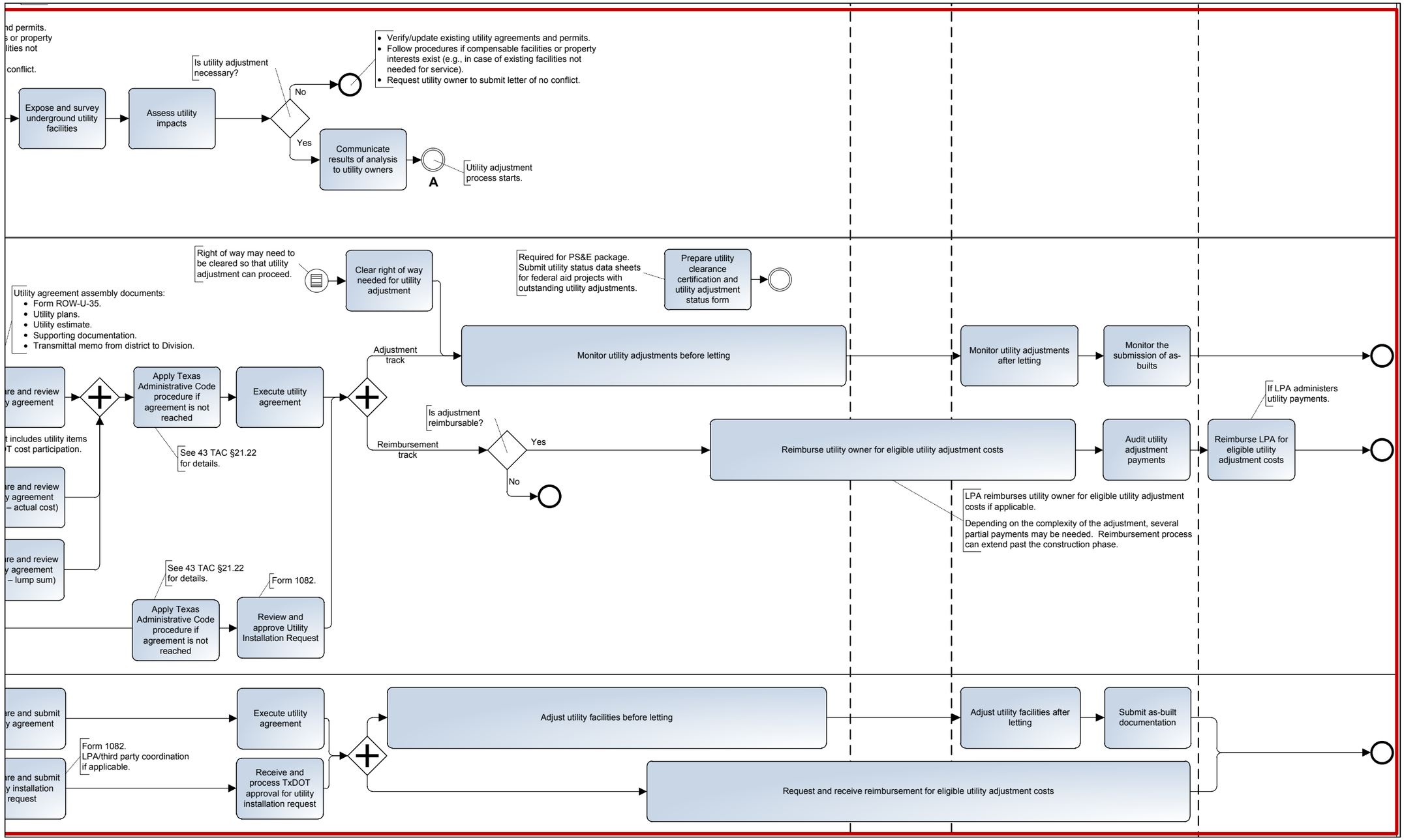


Figure 29. Typical Utility Process (Level 3 Model) – Right Portion.

CHAPTER 5. UTILITY CONFLICT MATRIX APPROACH

INTRODUCTION

As mentioned previously, SHRP 2 Research Project R15-B documented the results of a review of practices around the country on the use of utility conflict matrices (*41*). The research also involved developing and testing a prototype UCM concept as well as training materials and implementation guidelines. This chapter describes the main research products. Product 0-6624-P1 includes a proposed implementation plan of these products at TxDOT.

Research Project R15-B resulted in the following products:

- **Product 1: Compact, standalone UCM spreadsheet**. This is a standalone product in Microsoft Excel format, which includes a main utility conflict table and a supporting worksheet to analyze utility conflict resolution strategies (Figure 30, Figure 31). The spreadsheet uses data elements from the 26 UCMs received from around the country, including TxDOT.

- **Product 2: Utility conflict data model and database**. This standalone product is a scalable UCM representation that facilitates managing utility conflicts in a database environment. The data model is in ERwin Data Modeler format, which can be exported to formats such as Oracle and Microsoft SQL Server. The data model was tested using sample utility conflict tables from across the country. Two implementation scenarios are possible with the data model and database: (a) standalone database, e.g., Microsoft Access, and (b) enterprise solution. The standalone implementation would be adequate at the individual project level, but it has scalability limitations. The enterprise solution would address these limitations by providing an agency-wide approach to the systematic management of utility conflicts.

- **Product 3: UCM training course and course materials**. This product is a one-day training course, divided into six lessons, which provides an overview of utility conflict issues and use of UCMs. The course includes an interactive session in which participants learn how to identify and manage utility conflicts using drawings and other documents from a sample project.

STANDALONE UCM

The researchers analyzed the 26 sample tables from around the country, including TxDOT. The survey also revealed a range of practices related to when state DOTs complete different phases of utility adjustments and when utility owners typically start coordination activities with state DOTs. A review of 26 sample UCMs, including several from TxDOT, confirmed the use of 144 different data items, with the number of data items per table varying from 4–39. The average was 14 data items per table. The 144 data items covered a wide range of data categories, including projects, project contacts, utility facilities, utility conflicts, right of way acquisition, utility investigations, utility adjustment, utility coordination dates, agreements, costs, billings, and document tracking data.

With this information, the researchers developed a composite list of data items by first ranking data items according to frequency of use in the sample documents, then frequency reported in the survey, and finally by combining these two rankings. After reviewing the results of the sample documentation analysis, the results of the survey analysis, and the combined data item ranking, the researchers developed a standalone UCM (Figure 30). Key requirements in determining which data items to include in the UCM were UCM compactness and efficiency with respect to time and resources needed to populate, update, and maintain the UCM. The researchers also developed a cost analysis spreadsheet to track cost estimates related to utility conflict resolution alternatives at various stages of the project development process (Figure 31).

For convenience, the Excel UCM version includes four worksheets: the main UCM, the cost estimate analysis, column or field definitions, and drop-down lists to standardize the population of certain columns in the main UCM.

The prototype standalone UCM could be used in various ways to support the utility conflict management process. In its simplest manner, the UCM (Figure 30) could provide a simple, convenient mechanism to list all utility conflicts associated with a project. However, for maximum benefit, the UCM could be used in conjunction with the alternative conflict resolution sub-sheet (Figure 31) to identify, document, and track optimum utility conflict resolution strategies.

Utility Conflict Matrix

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

Utility Conflict Matrix Developed/Revised By: _____
Date: _____
Reviewed By: _____
Date: _____

Note: Use Cost Estimate Analysis subsheet for analysis of alternatives

Utility Owner and/or Contact Name	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	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status

Figure 30. Prototype UCM.

Utility Conflict Resolution Alternatives

Cost Estimate Analysis

Project Owner: _____

Project No. : _____

Project Description: _____

Highway or Route: _____

Utility Conflict: _____

Utility Owner: _____

Utility Type: _____

Size and/or Material: _____

Project Phase: _____

Cost Estimate Analysis Developed/Revised By _____

Date _____

Reviewed By _____

Date _____

Alternative Number	Alternative Description	Alternative Advantage	Alternative Disadvantage	Responsible Party	Engineering Cost (Utility)	Direct Cost (Utility)	Engineering Cost (DOT)	Direct Cost (DOT)	Total Cost	Feasibility	Decision

Figure 31. Prototype UCM, Cost Estimate Analysis for Utility Conflict Resolution Alternatives.

A generalized process for using the prototype standalone UCM is as follows:

- Identify and list all potential conflicts in a project. This activity is continuous throughout the utility conflict management process. Use a separate line for each utility facility that may be in conflict at the same location. For example, for a conflict location that involves a water line and a gas line, create one record for the water line and a second record for the gas line. Assign a unique utility conflict ID to each record.

- Complete the UCM up to the column that identifies the type of utility investigation needed.

- For each conflict, determine the type of utility investigation needed.

- Collect utility data at the appropriate quality level (QLD, QLC, QLB, or QLA), according to the consensus standard ASCE/CI 38-02 (*40*).

- For QLA data, add the test hole number associated with the utility conflict(s) in question.

- Analyze potential conflict resolution strategies for each utility conflict record. If the available information is not sufficient to make a determination, it may be necessary to collect additional data. In this case, use the Recommended Action or Resolution column to document the need for additional data collection.

- Use the conflict resolution sub-sheet to analyze and document advantages, disadvantages, costs, feasibility, and decision of each alternative resolution considered.

- For the selected conflict resolution strategy, complete the Recommended Action or Resolution, Estimated Resolution Date, and Resolution Status cells in the UCM. This activity is iterative.

- Populate the control fields (name and date) at the top of the UCM.

- Create a historical record of UCM changes by saving the UCM under a different file name each time the information in the table changes.

UTILITY CONFLICT DATABASE

To support a prototype utility conflict database, the researchers developed a utility conflict data model using six first-level (or core) topics or data objects: utility conflict, utility facility, utility agreement, document, project, and user (Figure 32). Each of these data objects represents a real-world object or concept that can be characterized using a set of relevant tables and attributes. It is also possible to define relationships between those objects.

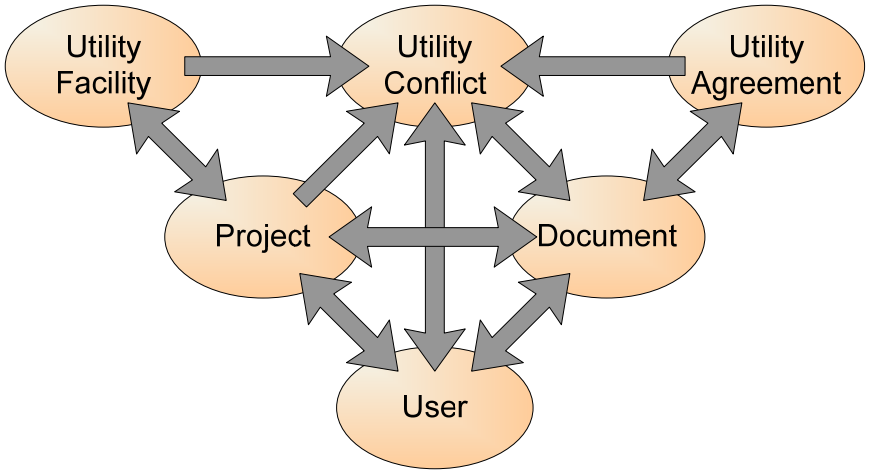


Figure 32. Conceptual Model for the Management of Utility Conflicts.

Based on the conceptual model depicted in Figure 32, the researchers developed a logical data model in ERwin consisting of approximately 115 separate entities and numerous relationships. The researchers also produced a prototype physical database in Microsoft Access based on the logical data model. The name of the prototype application was Utility Conflict Database (UCD). The researchers tested the UCM data model by populating the Access database using data from sample documents that the states provided and then fine-tuning the data model as needed. The researchers also developed queries and reports to replicate the standalone UCM (Figure 30) as well as a sample of UCMs from around the country.

A database approach would enable the production of a wide range of queries and reports. Potential examples include the following:

- Product 1 UCM.
- All utility conflicts associated with company X (project, corridor, or timeframe).
- Average conflict resolution time for electric utilities.
- All utility conflicts with resolution time >100 days.
- Customized UCMs for individual utility companies.
- Utility certification for inclusion in PS&E package.

UCM TRAINING COURSE

The researchers structured a lesson plan and developed training materials to assist with the process to disseminate the research findings. The UCM training course is designed for seven hours of instruction, from 8:30 AM to 3:45 PM, including direct instructor contact and breaks. However, instructors can adjust session and lesson start times and durations, depending on the

audience and the level of participant engagement in the discussions. An integral component of the training materials is the use of actual sample project data to illustrate UCM concepts and procedures. The one-day UCM training course is divided into the following six lessons:

AM Session:

- Lesson 1: Introductions and Seminar Overview (30 minutes).
- Lesson 2: Utility Conflict Concepts and SHRP 2 R15-B Research Findings (75 minutes).
- Lesson 3: Utility Conflict Identification and Management (75 minutes).

PM Session:

- Lesson 4: Hands-On Utility Conflict Management Exercise (90 minutes).
- Lesson 5: Use of Database Approach to Manage Utility Conflicts (45 minutes).
- Lesson 6: Wrap-Up (15 minutes).

CHAPTER 6. STREAMLINING AND STANDARDIZATION OF UTILITY COST DATA SUBMISSIONS

INTRODUCTION

This chapter discusses a proposed streamlined framework for the submission of utility cost data submissions. The chapter is divided into the following sections:

- Relevant federal codes and regulations.
- Relevant Texas codes and regulations.
- Current practices for preparing utility cost estimates.
- Proposed updated framework for developing utility cost estimates.
- Prototype utility cost estimate submission forms.

FEDERAL CODES AND REGULATIONS

In 1946, the Public Roads Administration issued General Administrative Memorandum No. 300, which contained detailed working procedures and requirements to implement the Federal-Aid Highway Act of 1944 (*56, 57*). Among the mandates included in the memorandum were the requirements for a written agreement between a state and a utility owner outlining their respective responsibilities as well as the requirement to document actual construction cost data, as verified by audit of supporting documentation. Required cost data included a variety of categories such as labor, materials, transportation, and equipment rental. These required cost data elements are still in place today.

The Federal-Aid Highway Act of 1956 renamed the National System of Interstate Highways to be the National System of Interstate and Defense Highways (or "Interstate System") and included several provisions to expedite the completion of that system (*58*). Section 111 authorized the reimbursement of utility adjustment costs to the states for projects on the federal-aid primary or secondary systems or on the Interstate System, including extensions within urban areas, in the same proportion as federal funds were expended on the project as long as those payments did not violate state law. The act defined the cost of utility adjustment to include the entire amount paid for the adjustment after deducting any increase in the value of the new facility (i.e., betterment) and any salvage value derived from the old facility. The 1958 update of the Federal-Aid Highway Act placed the language originally found under Section 111 of the 1956 Act into Section 123, where it is found today.

Prior to 1956, utility adjustments were eligible for federal-aid participation as construction costs only to the extent that states were obligated to pay for the adjustment. The 1956 Act lifted this obligation in the case of projects on the federal-aid primary or secondary systems or on the Interstate System. The act made reimbursement dependent on a finding that the adjustment was

necessary for improvement of the highway and that the state had paid costs associated with the adjustment without violating its own law or any provisions of existing contracts between the state and the utility owner.

In 1957, the Bureau of Public Roads issued the new Policy and Procedure Memorandum 30-4 (PPM 30-4) that superseded the 1946 General Administrative Memorandum No. 300 (*59*). A key provision of PPM 30-4 stated that where state law or regulations were more liberal than the requirements of PPM 30-4, the more restrictive provisions should prevail. For example, if the state law provided regulations that did not address certain issues or left an area open to broad interpretation and the policy memorandum provided stricter or more clearly defined standards, the provision in the policy memorandum would apply. Conversely, if state reimbursements were more restrictive than those the policy memorandum authorized, the use of federal funds would be limited to the amount the state law restricted the payment. The memorandum authorized lump-sum agreements up to $2,500.

From 1958 to 1973, several revisions modified Policy and Procedure Memorandum 30-4 (*60*). For example, the 1963 revision increased the limit of lump-sum agreements to $5,000. The 1969 revision documented a new management procedure called the "Alternate Procedure" to facilitate processing of all federal-aid utility adjustments $25,000 or less in value (i.e., some 70 percent of the total number of adjustments). Under the Alternate Procedure, an exchange of correspondence between a state and FHWA would suffice without the need to submit agreements, plans, and estimates for a detailed review. The Alternate Procedure enabled states to act on FHWA's behalf to review plans, agreements, fees, and other matters relating to utility adjustments. A further revision of the Act in 1973 increased the limit of lump-sum agreements to $10,000 and lifted the $25,000 upper limit for minor cost utility adjustments handled through the Alternate Procedure. In 1974, Policy and Procedure Memorandum 30-4 was incorporated into FHWA's *Federal-Aid Highway Program Manual* (*60*).

In 1991, FHWA replaced the *Federal-Aid Highway Program Manual* with the *Federal-Aid Policy Guide* (*61*). The policy guide contained regulatory materials that were essentially relevant CFR sections. It also contained non-regulatory material that supplemented various CFR provisions as well as other non-regulatory material not related to the CFR. Over the years, FHWA has amended the guide, primarily in response to changes in the CFR. For example, the 1995 amendment eliminated the requirement for FHWA to have a pre-award review of preliminary engineering consultant contracts (*62*). It also increased the upper limit for lump-sum agreements from $25,000 to $100,000 and clarified the methodology to compute indirect or overhead rates. The amendment required utility owners to submit final billings within one year following completion of the utility adjustment work, and eliminated the requirements for states to certify the completion of utility work and provide evidence of payment prior to reimbursement. The 2000 amendment eliminated the $100,000 upper limit for lump-sum agreements, allowed the use of unit costs for utility adjustment reimbursements, and deleted the provision encouraging states to use the Alternate Procedure (*63*).

Section 123, Title 23 of the U.S. Code (23 USC 123) enables the use of federal funds to reimburse states for the adjustment of private, public, or cooperatively owned utility facilities needed for the construction of a highway project on any federal-aid system (*64*). The

reimbursement must be in the same proportion as federal fund expenditures on the project after the salvage value from the abandoned facility and any increase in value of the new facility are subtracted. In general, reimbursement to a state occurs once the state has paid utility owners using its own funds. However, 23 USC 124 permits the Secretary of Transportation to authorize an advancement of funds from existing appropriations of the federal amount to be paid for the cost of construction to ensure expeditious right of way acquisition (*64*).

Section 645, Title 23 of the Code of Federal Regulations contains regulations for federal funds to participate in utility adjustments (*65*). A few relevant provisions follow:

- Section 645.113 specifies the state transportation department and the utility company will designate the method of work, either force account or contract, and the method for developing adjustment costs, preferably based on actual direct and related indirect costs. Section 645.107 clarifies that federal funds may participate in amounts actually paid for utility adjustments.

- Section 645.117 regulates the method to use to develop and record costs in order for a state to become eligible for reimbursement from the federal government. For example, work orders should record all costs and show the nature of each addition to or retirement from a facility, including costs and sources of costs. Credit for accrued depreciation applies in the case of major utility facilities such as buildings, pumping stations, plants, and similar operational units. Credit for accrued depreciation is not necessary for operating facilities not being replaced but only being rehabilitated and/or moved or for utility service, transmission, or distribution lines. Likewise, betterment credit is not necessary if:

    - The highway project requires the facility upgrade.
    - Devices or materials replaced are of equivalent standards but are not identical.
    - Devices or materials are no longer regularly manufactured.
    - There is a legal requirement by a governmental entity or regulatory commission.
    - The upgrade results from current design practices at the utility.
    - There is a direct benefit to the highway project.

- Section 645.117 indicates that alternative methods to estimate and reimburse utility adjustment expenditures, e.g., using unit costs, are acceptable. Requirements for the use of alternative methods include the following:

    - Must be founded on generally accepted industry practices and be reasonably supported with recent actual expenditures.
    - If using unit costs, develop unit costs periodically and support those costs annually using a maintained database of adjustment expenses.
    - Take into account the following factors: direct labor costs, labor surcharges, overhead and indirect construction costs, material and supply costs, equipment costs, and transportation costs.
    - Maintain adequate accountability for federal expenditures.
    - Obtain FHWA concurrence for any costing method used other than actual costs.

- Section 645.117 also indicates that reimbursement to a utility owner can occur by progress billings for costs incurred and for project materials stockpiled at the project site. The utility owner must provide a final and complete billing of all costs incurred or the agreed lump sum within one year of the completed adjustment. Billings received after this period may be paid at the discretion of the transportation department. The utility's project cost records and accounts are subject to audit for three years after the utility owner's receipt of the final payment.

- Section 645.119 describes the provisions associated with the Alternate Procedure. Subject to FHWA's approval, utility adjustments are eligible for federal reimbursement if an approved program includes the utility work, and the state transportation department submits a request for authorization of utility work.

TEXAS CODES AND REGULATIONS

Sections 203.091 through 203.095 of the Texas Transportation Code (*66*) include provisions for the adjustment of utility facilities on state-maintained highways. According to the code, utility adjustments are reimbursable under the following circumstances:

- The highway is part of the Interstate System, and the adjustment is eligible for federal participation in the adjustment cost. Eligibility for reimbursement in the case of utility adjustments on Interstate highways has been possible in Texas since 1957, when the Texas Legislature passed House Bill 179 (*67*) in response to the Federal-Aid Highway Act of 1956 (*58*).

- The highway is a state highway, and the utility company has a compensable property interest in the land it occupies prior to the utility adjustment.

- The highway is a state highway the Texas Transportation Commission has designated as a turnpike or toll project before September 1, 2005.

The code also requires TxDOT and utility owners to share equally the cost to adjust utility facilities in connection with new turnpike projects or toll projects, conversion of non-tolled highways to turnpike projects or toll projects, or improvement of non-tolled highways that include adding one or more tolled lanes. These provisions were included in 2005 and were originally set to expire on September 1, 2007. In 2007, the legislature extended the expiration date to September 1, 2013.

The code includes provisions for the timely execution of agreements between TxDOT and utility owners. TxDOT must provide the affected utility owner with plans and drawings that are sufficient to enable the utility owner to develop adjustment plans and cost estimates. If the parties enter into an agreement, the terms and conditions of the agreement govern the utility adjustment process. If the parties do not enter into an agreement, TxDOT must provide a notice of the department's determination about the need to reschedule the utility facility, a final

adjustment plan, and reasonable terms and conditions for an agreement. The utility owner then has 90 days to enter into an agreement with TxDOT. If the utility owner fails to enter into an agreement within this period, TxDOT can adjust the facility at the utility owner's expense.

Sections 21.21 through 21.23, Title 43 of the Texas Administrative Code contain rules related to state participation in utility adjustments, agreement requirements and deadlines, state participation in toll-related adjustments, and state participation in gas pipeline adjustments (*1*). As mentioned, TxDOT and a utility owner have 30 days to enter into an agreement after TxDOT has provided sufficient plans and specifications to enable the utility owner to determine the location and cost estimate for the adjustment. If the agreement is not executed within 30 days, TxDOT must provide a notification to the utility owner that the utility facility must be removed, along with a final adjustment plan and a completion deadline. Ninety days after the utility owner receives this notification, TxDOT may adjust the facility at the utility owner's expense (unless the utility owners executes the agreement, is negotiating with TxDOT in good faith or has received an extension from the department).

TxDOT requires utility owners to pay for adjustment costs up front and request reimbursement for eligible expenses. The *ROW Utility Manual* contains detailed requirements for the preparation and submission of utility agreements (*2*), as summarized in the following section.

UTILITY ADJUSTMENT COST ESTIMATES AND BILLINGS

Cost Categories

Utility owners have to prepare cost estimates broken down into the following cost categories (although quantities and unit costs are also acceptable) (*2*):

- **Materials and supplies**. This category should be shown by item and price. Factors included in the utility's overhead must be clearly identified.

- **Labor**. This category includes anticipated wages and salaries, either actual rates per hour or average rates on the amount paid to individuals under the agreement, including supervisory labor, preparation of plans, and estimate and agreement documents. Overhead included in unit cost for labor must be detailed separately. Charges and expenses must conform to similar charges incurred in the utility's normal operation.

- **Overhead**. Payroll additives should be shown individually to ensure eligibility. Common ineligible costs include advertising, interest on borrowed funds, research, income taxes, fines, and personal expenses such as entertainment.

- **Transportation**. This category includes transportation, meal, and lodging expenses that a utility company's workforces incur in remote areas.

- **Equipment**. Equipment and rental costs include equipment type, size, and actual rate. TxDOT does not allow the use of published rates in place of actual rates. If equipment is

charged as a percentage of another cost, a statement should outline that basis. Charges should reflect the utility owner's normal accounting procedures.

- **Traffic control**. This category includes signs, markings, barricades, safety equipment, and clear zone protective devices.

- **Right of way**. This category includes the costs associated with the acquisition of interest in land. Costs for replacement right of way may include salaries and expenses of employees engaged in valuation and negotiation of right of way, independent fee appraisers, recording costs, and other costs incidental to land acquisition, broken down as separate line items.

- **Salvage, abandoned facilities, and removal of materials**. This category includes salvage value, accrued depreciation, if applicable, including materials removed, restocked, and sold as scrap.

- **Credits**. This category includes elective betterments, and capital improvements (switching stations, power substations, and so on). TxDOT allows reimbursement of capital improvements in some cases, but only the most economical method of adjustment. Therefore, the estimate must list major items of materials and capital improvement credits. This estimate should include accrued depreciation for replaced facilities. However, depreciation should not be included if facilities are only adjusted but not replaced based on the utility's depreciation schedule.

- **Betterments**. The betterments category should distinguish between either elective or forced, i.e., non-elective, betterments. Only forced betterments are usually reimbursable.

Of these cost categories, materials and supplies, labor, overhead, transportation, and equipment are direct utility adjustment costs. Traffic control and right of way could also be considered direct cost components, but it is common to treat these categories as separate items to facilitate analysis and cost comparisons. Salvage, abandoned facilities, and removal of materials; credits; and betterments are usually handled separately.

Elective Betterment Credit

Utility adjustments frequently involve facility upgrades. A forced upgrade (or non-elective betterment) is attributable to the highway construction and not solely for the benefit or at the election of the utility, e.g., if a utility owner needs to upgrade the utility line material to conform to current local codes or industry standards. In contrast, an elective upgrade (or elective betterment) is solely for the benefit and at the election of the utility, e.g., if a utility decides to increase the capacity of its relocated utility line to service an increase in demand. To determine the reimbursable portion of a utility adjustment with elective betterments, TxDOT calculates an elective betterment credit as:

$$Elective\ Betterment\ Credit = \frac{Betterment\ Included\ Estimate - Replacement\ Estimate}{Betterment\ Included\ Estimate}$$

This elective betterment credit represents the portion of the eligible adjustment cost that TxDOT deducts to determine the total reimbursable amount. If a utility agreement includes betterments, TxDOT requires the utility to submit two estimates: one that shows costs of the better facility to be constructed, and another that shows the cost of an in-kind replacement. These two cost estimates provide the basis for an elective betterment credit, which TxDOT applies during the billing process to provide an estimate of the actual betterment amount.

A fundamental assumption behind this procedure is that any relative variation from original utility adjustment cost estimate to final utility adjustment cost is the same as the corresponding relative variation from betterment cost estimate to final betterment cost. Strictly speaking, the two relative variations could be different. However, under normal circumstances it is reasonable to assume that there is a good correlation between utility adjustment cost estimates and betterment cost estimates that carries through construction and billing. For example, if the cost estimate of a utility adjustment is $100,000 for in-kind replacement and $130,000 for betterment-included replacement, the estimated betterment amount is $30,000 and the elective betterment credit is 0.231. If the final bill associated with the utility adjustment is $150,000, TxDOT does not deduct $30,000 from this amount. Instead, TxDOT deducts $34,615 (i.e., 23.1 percent of $150,000) and reimburses $115,385 to the utility owner.

Accrued Depreciation

For major utility facilities such as buildings, pumping stations, plants, and similar operational units, credit must be deducted for accrued depreciation as follows:

$$Accrued\ Depreciation = \frac{Original\ Cost\ of\ Facility \times Actual\ Length\ of\ Service}{Total\ Life\ Expectancy}$$

Eligibility Ratio

If it is necessary to adjust a utility facility located in part on the state right of way and in part on land where the utility owner has a property interest, usually adjacent to the state right of way, only the portion where the utility owner has a property interest in the land is eligible for cost reimbursement. In general, TxDOT determines eligibility by measuring proportional property rights along the centerline of the existing utility facility as follows:

$$Eligibility\ Ratio = \frac{Property\ Interest\ Held\ within\ Proposed\ Highway\ Right\ of\ Way}{Total\ Highway\ Right\ of\ Way\ Occupied\ by\ Utility\ Facility}$$

If there are multiple adjustments at different locations within one project, a composite eligibility ratio (CER) is determined as follows:

$$CER = \frac{\sum_{i=1}^{n} Adjustment\ Cost_i \times Eligibility\ Ratio_i}{\sum_{i=1}^{n} Adjustment\ Cost_i}$$

where

$Adjustment\ Cost_i$ = Adjustment cost associated with location i.
$Eligibility\ Ratio_i$ = Eligibility ratio associated with location i.
n = Number of locations.

TxDOT uses the eligibility ratio to determine the percentage of the total utility adjustment cost reimbursable to a utility on property interest grounds.

Final Bill

Following the utility adjustment, utility owners should submit a final bill. In practice, the final bill includes a total amount that might differ from the original estimate. If the utility adjustment includes betterments and/or an eligibility ratio applies, the betterment and eligibility ratios determined in the estimate apply to the final bill. The betterment ratio applies before deducting accrued depreciation and salvage values.

UPDATED FRAMEWORK FOR DEVELOPING UTILITY COST ESTIMATES

For developing a proposed framework for the development of utility adjustment costs, it may be useful to visualize the current process to develop utility cost estimates using the process to develop cost estimates for highway construction as a reference. Although there are many differences between highway construction and utility adjustments, there are also similarities. More importantly, valuable lessons from the highway construction cost estimate process could be drawn to help improve the production of utility cost estimates.

Table 9 summarizes the process to develop cost estimates for highway construction projects at different phases, from planning and programming to construction. Table 10 summarizes the process to develop cost estimates for utility adjustments. For each phase, both tables address items such as cost estimate type and characteristics, typical data source and parties responsible for developing cost estimates, commonly used strategies to improve estimates and control costs, cost estimate uncertainty, and the degree to which TxDOT has access to cost estimate data. The tables are not intended to provide a comprehensive review of the processes to develop cost estimates but rather a high-level view of current practices to illustrate similarities and differences.

Table 9. Development of Cost Estimates for Highway Construction Projects.

Topic	Planning and Programming	Preliminary Design	Detailed Design	Letting	Construction
Cost estimate type	Planning estimate	Preliminary estimate	30%, 60%, 90% estimates. Engineer's estimate.	Winning bid. Losing bid(s).	Contractor billings. Change orders. Claims.
Main characteristics	Project level. High levels of project activity aggregation.	Activity group level of cost data disaggregation.	Individual construction item level of disaggregation. One-to-one relationship between construction specifications and cost estimates. Standard construction specifications, supplemented by special specifications. Standardized specification format and content. Standardized cost estimate format and content.	Plan quantities. Proposed unit prices (locked-in). Cost estimate may vary with respect to Engineer's estimate.	Locked-in unit prices. Plan quantities as specified. Actual quantities as specified.
Typical cost estimate data sources	Aggregated project-level data from archived unit cost database. Prior project history and experience.	Aggregated group-level data from unit cost database. Prior project history and experience.	Historical unit costs. Estimated unit costs. Highway cost index. Regionalized estimates. RS Means.	Winning bid. Losing bid(s).	Contractor invoices. Change orders. Measurement and verification by inspectors.
Party that normally develops cost estimate	TxDOT districts. MPOs. Local jurisdictions. Consultants.	TxDOT districts. Consultants.	TxDOT districts. Consultants.	Bidders.	Contractor.
Commonly used strategies to improve estimates and control costs	Use of total project costs in Design and Construction Information System (DCIS). Systematic use of archived unit cost database.	Use of total project costs in DCIS. Systematic use of archived unit cost database.	Use of total project costs in DCIS. Systematic use of plan quantities and estimated/historical unit costs. Robust construction specifications that clearly identify item purpose, bid items, and subsidiary items. Comparison with projects of similar characteristics.	Unbalanced bid analysis.	Robust inspection practices. Use of performance-based specifications. General engineering consultant. Good documentation.
Cost estimate uncertainty	Pre-contract contingency: 40% Post-contract contingency: 10%	Pre-contract contingency: 30% Post-contract contingency: 10%	Pre-contract contingency: 0-25% Post-contract contingency: 10%	Post-contract contingency: 10%	Post-contract contingency: 10% Problems during inspection.
Sources of uncertainty	Poorly defined project.	Poorly identified project scope. Inadequate environmental process. Project complexity.	Poor construction specifications and provisions.	Unbalanced bids. Rapidly changing prices.	Ineffective, insufficient inspection.
TxDOT access to cost data	Yes.	Yes.	Yes.	Yes (planned quantities and proposed unit costs).	Yes (planned or actual quantities and locked-in unit costs).

Table 10. Development of Cost Estimates for Utility Adjustments.

Topic	Planning and Programming (Highway Project)	Preliminary Design (Highway Project)	Utility Adjustment Design	Utility Adjustment Contract/Letting	Utility Adjustment
Cost estimate type	Planning estimate	Preliminary estimate	Cost estimate prepared for utility agreement.	Winning bid. Losing bid(s).	Utility owner partial bills. Utility owner final bill.
Main characteristics	Project level. High levels of project activity aggregation. Common to estimate utility cost as a percentage of highway construction cost.	Activity group level of cost data disaggregation. Common to estimate utility cost as a percentage of highway construction cost.	Requirement to use cost categories (materials and supplies, labor, overhead, and transportation and equipment). Focus on actual costs. Construction unit costs allowed, but not encouraged. Lack of relationship between construction specifications and cost estimates. Lack of standard for utility cost estimate submissions.	Plan quantities. Proposed unit costs. Lump-sum proposals. Not necessarily tied to cost estimate in utility agreement.	Requirement to submit detailed cost data, including receipts. Construction unit costs rarely used. Focus on actual costs, with goal to match cost estimate in utility agreement (frequently unmet). Relationship with utility owners often confrontational.
Typical cost estimate data sources	Prior project history and experience. Historical unit costs for items included in highway contracts.	Prior project history and experience. Historical unit costs for items included in highway contracts. Utility owners (some).	Cost data according to cost categories (materials and supplies, labor, overhead, and transportation and equipment). Quotes and estimates provided by potential utility bidders. Level of disaggregation varies.	Utility contractor winning bid. Utility contractor losing bid(s).	Utility owner partial bills. Utility owner final bill.
Party that normally develops cost estimate	District utility coordinator.	District utility coordinator. TxDOT consultant. Utility owners (some).	Utility owner. Utility consultant.	Utility contractor bidders.	Utility owner. Utility consultant.
Commonly used strategies to improve estimates and control costs	Limited.	Limited. Engaging utility owners during preliminary design phase (some).	Detailed review of individual data items submitted by utility owners. High-level comparison with other similar projects.	Unknown. TxDOT rarely sees utility contractor bid data.	Requirement to submit detailed cost data, including receipts. Desk audit.
Cost estimate uncertainty	High. Lack of historical data to assess uncertainty level.	High. Lack of historical data to assess uncertainty level.	High. Lack of historical data to assess uncertainty level.	Medium.	Medium. TxDOT inspectors have little involvement.
Sources of uncertainty	Lack of standardization of utility cost estimates. Lack of inventory of existing facilities.	Poorly identified project scope. Inadequate environmental process. Project complexity. Lack of inventory of existing facilities.	Lack of relationship between construction specifications and cost estimates. Lack of standard for utility cost estimate submissions.	Rapidly changing prices. TxDOT is not involved in this phase. Utility owner contact in this phase not the same as contact who developed cost estimate for utility agreement.	Ineffective, insufficient inspection. Lack of standardization of utility cost estimates. Difficulty to compare estimate with historical data.
TxDOT access to cost data	Very limited.	Very limited.	Yes (cost data according to cost category).	No. TxDOT is not involved in this phase.	Yes. Utility owners submit detailed cost data.

Implementing an updated framework for the development of utility adjustment cost estimates with the goal to address limitations in the current process would have the following benefits:

- Support for the development of utility adjustment cost estimates at various stages in the utility adjustment process.

- Reduction in the level of uncertainty and risk for managing utility adjustments at TxDOT.

- More effective, less contentious relationship between TxDOT and utility owners.

- Support for federal and state laws and regulations concerning utility reimbursement requirements. As mentioned, requirements in 23 CFR 645.117 for alternative methods to estimate and reimburse utility adjustment expenditures include the following:

    - Must be founded on generally accepted industry practices and be reasonably supported by recent actual expenditures.
    - If using unit costs, develop unit costs periodically and support those costs annually using a maintained database of adjustment expenses.
    - Take into account the following factors: direct labor costs, labor surcharges, overhead and indirect construction costs, material and supply costs, equipment costs, and transportation costs.
    - Maintain adequate accountability for federal expenditures.
    - Obtain FHWA concurrence for any costing method used other than actual costs.

- More effective coordination with the highway project development and delivery process, e.g., for the determination of total project costs and the production of utility cost estimates when the highway contract includes utility adjustments.

Most utility agreements at TxDOT follow the traditional cost category-based approach. It is possible that a substantial number of utility owners do not currently use construction unit costs as part of their business operations. However, it is perhaps more reasonable to assume that utility owners submit cost data using the traditional cost category-based approach because the *ROW Utility Manual* encourages the use of the traditional approach (*2*). The *ROW Utility Manual* does indicate that utilities may use construction unit costs, but it does not provide examples on how to submit cost data submissions using a construction cost unit cost methodology. The overall message throughout the manual is that utility owners need to structure cost data in a format that, in the end, is inconsistent with construction unit cost approaches.

One way to address this issue is by requiring utility owners to submit utility cost data in ways that facilitate the exchange of information and trend analysis. The most expedited strategy to accomplish this goal is by requiring utility cost data submissions in such a way that it should be possible to easily translate *cost category-based* information to *construction unit cost-based* information (and vice versa).

To illustrate this process, Figure 33(a) shows a cost estimate disaggregated by items and cost categories. Figure 33(b) shows a cost estimate disaggregated by items, quantities, and unit costs.

For simplicity, Figure 33(a) shows only five categories (materials, labor, overhead, transportation, and equipment), although additional cost categories could be added.

(a) Preparation of cost estimates using cost categories

Item	Cost Category					Total
	Materials	Labor	Overhead	Transportation	Equipment	
1	M_1	L_1	O_1	T_1	E_1	$\mathbf{C_1}$
2	M_2	L_2	O_2	T_2	E_2	$\mathbf{C_2}$
3	M_3	L_3	O_3	T_3	E_3	$\mathbf{C_3}$
4	M_4	L_4	O_4	T_4	E_4	$\mathbf{C_4}$
5	M_5	L_5	O_5	T_5	E_5	$\mathbf{C_5}$
Total	**M**	**L**	**O**	**T**	**E**	$\mathbf{C_T}$

(b) Preparation of cost estimates using unit costs

Item	Quantity	Unit Cost	Total
1	Q_1	u_1	$\mathbf{C_1}$
2	Q_2	u_2	$\mathbf{C_2}$
3	Q_3	u_3	$\mathbf{C_3}$
4	Q_4	u_4	$\mathbf{C_4}$
5	Q_5	u_5	$\mathbf{C_5}$
Total			$\mathbf{C_T}$

Figure 33. Comparison of Costs between Construction Unit Costs and Cost Categories.

In Figure 33(a), the total cost C_T is given by:

$$C_T = M + L + O + T + E$$

where M, L, O, T, and E are total material, labor, overhead, transportation, and equipment category costs, respectively. Disaggregating the project into n work items results in:

$$C_T = \sum_{i=1}^{n} C_i = \sum_{i=1}^{n} (M_i + L_i + O_i + T_i + E_i)$$

where M_i, L_i, O_i, T_i, and E_i are total material, labor, overhead, transportation, and equipment category costs, respectively, for each work item.

In Figure 33(b), the total cost C_T is given by:

$$C_T = \sum_{i=1}^{n} C_i = \sum_{i=1}^{n} (Q_i \times u_i)$$

where Q_i and u_i represent the quantity and unit cost for each work item i, respectively.

If there is an appropriate mapping between cost categories and unit costs, it should be possible to express C_T using either cost categories or construction unit costs. In this case,

$$C_T = \sum_{i=1}^{n} C_i = \sum_{i=1}^{n} (M_i + L_i + O_i + T_i + E_i) = \sum_{i=1}^{n} (Q_i \times u_i)$$

and it is possible to express u_i as:

$$u_i = m_i + l_i + o_i + t_i + e_i$$

where m_i, l_i, o_i, t_i, and e_i represent decomposed material, labor, overhead, transportation, and equipment unit costs, respectively, for each work item i (*27*).

It is not always possible or practical to map certain cost categories to work items, nor is it always practical to use a unit decomposition approach. Examples include engineering fees and right of way acquisition. In this case, it is advisable to treat those categories as separate items. In other cases, it may be possible to map cost categories to work items through the application of joint cost allocation methods (*27*).

A critical cost element that is frequently ignored is related to contingencies. In general, contingencies tend to decrease throughout the project development process. As a result, there is a progression of milestones where the methodology to produce utility adjustment costs could change depending on the information available. Although each particular utility adjustment is different, Figure 34 provides a roadmap for the production of utility cost estimates that takes into consideration both pre-contract contingencies and post-contract contingencies at different phases in the utility adjustment process. The percentages shown in Figure 34 correspond to contingency levels that are commonly used in the highway construction industry.

		Utility Adjustment Phase				
		Planning and Programming (Highway Project)	Preliminary Design (Highway Project)	Utility Adjustment Design	Utility Adjustment Letting/Contract	Utility Adjustment
		Utility Adjustment Cost Estimate Source				
		% of highway cost. Historical data.	% of highway cost. Historical data. High-level quantities and historical unit costs.	Disaggregated cost categories and components. Lump sum estimates. Outstanding plan quantities and estimated/historical unit costs.	Disaggregated cost categories and components. Lump sum bids. Outstanding plan quantities and bid unit prices.	Actual disaggregated cost categories and components. Lump sum amounts. Final quantities and locked-in unit prices.
		Utility Pre-Contract / Post-Contract Contingency Levels				
Highway Project Phase	Planning and Programming	40% / 10%	40% / 10%			
	Preliminary Design	40% / 10%	40% / 10%	0-25% / 10%	0% / 10%	
	30% Design			0-25% / 10%	0% / 10%	
	60% Design			0-25% / 10%	0% / 10%	0% / 0%
	90% Design			0-25% / 10%	0% / 10%	0% / 0%
	100% Design			0-25% / 10%	0% / 10%	0% / 0%
	Letting				0% / 10%	0% / 0%
	Construction					0% / 0%

Figure 34. General Progression of Procedures to Estimate Utility Adjustment Costs.

PROTOTYPE UTILITY COST ESTIMATE SUBMISSION FORMS

To assist in the process of submitting standardized utility cost estimates, the researchers prepared a prototype Microsoft Excel-based template with four integrated worksheets, as follows:

- **Items**. This worksheet enables utility owners to add a list of items. These items represent logical divisions of work and are consistent with the definition of items in Figure 33 and subsequent formulations. Ideally, the list of items should be the result of cooperation between the utility owner and TxDOT to ensure a utility adjustment project is divided into manageable pieces of work that facilitate the development of reliable cost estimates and monitoring of construction activities in the field. A useful strategy to achieve this goal is to use construction specifications as a tool to define items. In many cases, the utility owner already has a set of construction specifications (either standard or special) that could be used for that purpose. Alternatively, a suitable construction specification might be available at TxDOT or from an external source.

- **Unit Cost Analysis**. This worksheet enables utility owners to provide utility cost data using a unit cost approach. With this approach, users load the list of items from the Items worksheet and provide unit, quantity, and unit cost data for each item. The worksheet automatically calculates the total cost for each item and for the entire project.

- **Item Disaggregation Analysis**. This worksheet enables utility owners to provide utility cost data using a cost category approach. With this approach, users load the list of items from the Items worksheet and provide disaggregated cost component information for each item according to one or more of the following cost categories: materials and supplies, labor, overhead, and transportation and equipment. For each component, users provide unit, quantity, and unit rate (or unit price). The worksheet automatically calculates the total cost for each component, for each item, and for the entire project.

- **Cost Category Summary**. This worksheet enables utility owners to prepare a summary tabulation of the cost items provided in the Item Disaggregation Analysis worksheet. All cost data elements come from this worksheet, which means that users do not need to enter any data manually.

The Unit Cost Analysis worksheet is not mandatory because utility owners have the option to use a cost category approach to develop cost estimates. However, if users also provide cost category data, the Unit Cost Analysis worksheet enables users to validate unit cost data by importing total dollar amounts per item from the Item Disaggregation Analysis worksheet and by developing a separate "validated" unit cost estimate. Likewise, the Item Disaggregation Analysis worksheet is not mandatory because utility owners have the option to use a unit cost approach to develop cost estimates. However, if users also provide unit cost data, the Item Disaggregation Analysis worksheet enables users to import total dollar amounts per item from the Unit Cost Analysis worksheet.

As an illustration, Figure 35 shows items associated with the adjustment of a water main. In this case, the utility owner provided quantities and unit costs for each item, which enabled the use of the Unit Cost Analysis Worksheet directly (Figure 36). Each item in the table corresponds to a construction item in the field (with the exception of engineering fees, for which the utility owner provided a separate tabulation disaggregating engineering charges into seven categories and travel). Figure 36 shows the quantities and units used for each of these categories.

Figure 37 shows items associated with the adjustment of an electric transmission line. In this case, the utility owner did not provide quantities and unit costs for each item. Instead, the utility owner provided disaggregated cost data for each item by cost category, which made it necessary to use the Item Disaggregation Analysis worksheet (Figure 38). Figure 39 shows a summary of category costs using the Cost Category Summary worksheet.

For the electric transmission line example, the utility owner provided a highly disaggregated list of materials for the pole assemblies (down to the quantity and unit cost for each individual bolt, nut, rod, and so on) but did not indicate which components were associated with each type of pole (90 ft versus 95 ft). For simplicity, Figure 38 shows the total dollar amount for these materials equally divided by two for each type of pole. Similar considerations apply to other cost categories, where the utility owner provided total costs but did not disaggregate them by type of pole (90 ft versus 95 ft).

Remove All Items

+	-	Item No.	Group/Item Name	Item Description
			General	
		1	Mobilization, bonds, and insurance	
			Earth Work	
		2	Clear and grub ROW	
		3	Crushed rock for trench stabilization	
			Lines, Pipes, and Other Linear Features	
		4	Remove and dispose of existing water line	
		5	18" DIP water line with polywrap	
		6	30" Steel casing with 18" carrier pipe by dry bore	
		7	30" Steel casing with 18" carrier pipe by open cut	
		8	Trench protection	
			Appurtenances	
		9	Remove air release valve, manhole, and appurtenar	
		10	Install air release manhole	
		11	18" gate valves	
		12	Ductile iron fittings	
		13	Ties into existing 18" water line	
		14	Water line marker	
			Other	
		15	Silt fence	
		16	Seeding areas disturbed by construction	
		101	Engineering - principal	
		102	Engineering - project manager	
		103	Engineering - design technician	
		104	Engineering - survey field party	
		105	Engineering - project assistant	
		106	Engineering - secretary	
		107	Engineering - project representative	
		108	Travel	

Figure 35. Example 1 (Water Main Adjustment) – Items Worksheet.

Get Items | Update Items | Validate Unit Costs

Item No.	Item Name	Unit	Quantity	Unit Cost ($/unit)	Amount ($)	Imported Amount ($)	Validated Unit Cost ($)
1	Mobilization, bonds, and insurance	LS	1	$ 20,085.00	$ 20,085.00		$ -
2	Clear and grub ROW	STA	17	$ 600.00	$ 10,200.00		$ -
3	Crushed rock for trench stabilization	CY	200	$ 40.00	$ 8,000.00		$ -
4	Remove and dispose of existing water line	LF	730	$ 15.00	$ 10,950.00		$ -
5	18" DIP water line with polywrap	LF	1120	$ 75.00	$ 84,000.00		$ -
6	30" Steel casing with 18" carrier pipe by dry bore	LF	110	$ 400.00	$ 44,000.00		$ -
7	30" Steel casing with 18" carrier pipe by open cut	LF	790	$ 275.00	$ 217,250.00		$ -
8	Trench protection	LF	1910	$ 1.50	$ 2,865.00		$ -
9	Remove air release valve, manhole, and appurtenar	EA	1	$ 1,000.00	$ 1,000.00		$ -
10	Install air release manhole	EA	1	$ 4,000.00	$ 4,000.00		$ -
11	18" gate valves	EA	2	$ 10,000.00	$ 20,000.00		$ -
12	Ductile iron fittings	LB	4000	$ 5.00	$ 20,000.00		$ -
13	Ties into existing 18" water line	EA	2	$ 5,000.00	$ 10,000.00		$ -
14	Water line marker	EA	7	$ 250.00	$ 1,750.00		$ -
15	Silt fence	LF	700	$ 3.50	$ 2,450.00		$ -
16	Seeding areas disturbed by construction	AC	0.75	$ 600.00	$ 450.00		$ -
101	Engineering - principal	HR	4	$ 145.00	$ 580.00		$ -
102	Engineering - project manager	HR	104	$ 110.00	$ 11,440.00		$ -
103	Engineering - design technician	HR	98	$ 60.00	$ 5,880.00		$ -
104	Engineering - survey field party	HR	28	$ 90.00	$ 2,520.00		$ -
105	Engineering - project assistant	HR	16	$ 55.00	$ 880.00		$ -
106	Engineering - secretary	HR	55	$ 40.00	$ 2,200.00		$ -
107	Engineering - project representative	HR	181	$ 55.00	$ 9,955.00		$ -
108	Travel	MI	180	$ 0.58	$ 104.40		$ -
Total					$ 490,559.40	$ -	$ -

Figure 36. Example 1 (Water Main Adjustment) – Unit Cost Analysis Worksheet.

Remove All Items

+	-	Item No.	Group/Item Name	Item Description
			General	
		1	138 kV pole assembly (90 ft.)	
		2	138 kV pole assembly (95 ft.)	
			Earth Work	
			Lines, Pipes, and Other Linear Features	
			Appurtenances	
			Other	
		3	Contract labor, engineering	
		4	Environmental study and surveying	
		5	Inspection services	

Figure 37. Example 2 (Transmission Line Adjustment) – Items Worksheet.

Get Items | Update Items | Calculate Total | Import Amounts

Item	+	-	Component	Item/Component Name	Cost Category	Unit	Quantity	Rate or Unit Price ($/unit)	Amount ($)	Imported Amount ($)
1				**138 kV pole assembly (90 ft.)**					**$ 79,360.41**	
			1	Pole, concrete, 90 ft., H-frame str.	Materials and Supplies	EA	4	$ 5,000.00	$ 20,000.00	
			2	Materials (per list)	Materials and Supplies	EA	1	$ 3,434.91	$ 3,434.91	
			3	Purchasing and stores	Materials and Supplies	EA	1	$ 679.50	$ 679.50	
			4	Non-contract labor regular time	Labor	HR	41.5	$ 28.00	$ 1,162.00	
			5	Non-contract labor overtime time	Labor	HR	6	$ 42.00	$ 252.00	
			6	Non-productive time clearing	Labor	EA	1	$ 187.50	$ 187.50	
			7	Employment benefit loading	Overhead	EA	1	$ 70.50	$ 70.50	
			8	Retirement plan loading	Overhead	EA	1	$ 50.00	$ 50.00	
			9	Payroll taxes	Overhead	EA	1	$ 624.50	$ 624.50	
			10	Other employee benefit loading	Overhead	EA	1	$ 25.00	$ 25.00	
			11	Construction contract labor	Labor	HR	586.5	$ 80.00	$ 46,920.00	
			12	Construction overhead	Overhead	EA	1	$ 5,728.50	$ 5,728.50	
			13	Transportation	Transportation and Equipm	EA	1	$ 226.00	$ 226.00	
2				**138 kV pole assembly (95 ft.)**					**$ 79,360.41**	
			1	Pole, concrete, 95 ft., H-frame str.	Materials and Supplies	EA	4	$ 5,000.00	$ 20,000.00	
			2	Materials (per list)	Materials and Supplies	EA	1	$ 3,434.91	$ 3,434.91	
			3	Purchasing and stores	Materials and Supplies	EA	1	$ 679.50	$ 679.50	
			4	Non-contract labor regular time	Labor	HR	41.5	$ 28.00	$ 1,162.00	
			5	Non-contract labor overtime time	Labor	HR	6	$ 42.00	$ 252.00	
			6	Non-productive time clearing	Labor	EA	1	$ 187.50	$ 187.50	
			7	Employment benefit loading	Overhead	EA	1	$ 70.50	$ 70.50	
			8	Retirement plan loading	Overhead	EA	1	$ 50.00	$ 50.00	
			9	Payroll taxes	Overhead	EA	1	$ 624.50	$ 624.50	
			10	Other employee benefit loading	Overhead	EA	1	$ 25.00	$ 25.00	
			11	Construction contract labor	Labor	HR	586.5	$ 80.00	$ 46,920.00	
			12	Construction overhead	Overhead	EA	1	$ 5,728.50	$ 5,728.50	
			13	Transportation	Transportation and Equipm	EA	1	$ 226.00	$ 226.00	
3				**Contract labor, engineering**					**$ 30,024.00**	
			1	Contract labor, engineering	Labor	HR	417	$ 72.00	$ 30,024.00	
4				**Environmental study and surveying**					**$ 7,418.00**	
			1	Environmental study	Labor	HR	38	$ 65.00	$ 2,470.00	
			2	Surveying - registered surveyor	Labor	HR	3	$ 73.00	$ 219.00	
			3	Surveying - AutoCAD services	Labor	HR	13	$ 63.00	$ 819.00	
			4	Surveying - three man field crew	Labor	HR	46	$ 85.00	$ 3,910.00	
5				**Inspection services**					**$ 6,656.00**	
			1	Inspection services	Labor	HR	128	$ 52.00	$ 6,656.00	
Total									**$ 202,818.82**	

Figure 38. Example 2 (Transmission Line Adjustment) – Item Disaggregation Analysis Worksheet.

Get Items and Category Costs

Item No.	Item Name	Cost Category				Total
		Materials and Supplies	Labor	Overhead	Transportation and Equipment	
1	138 kV pole assembly (90 ft.)	$ 24,114.41	$ 48,521.50	$ 6,498.50	$ 226.00	**$ 79,360.41**
2	138 kV pole assembly (95 ft.)	$ 24,114.41	$ 48,521.50	$ 6,498.50	$ 226.00	**$ 79,360.41**
3	Contract labor, engineering	$ -	$ 30,024.00	$ -	$ -	**$ 30,024.00**
4	Environmental study and surveying	$ -	$ 7,418.00	$ -	$ -	**$ 7,418.00**
5	Inspection services	$ -	$ 6,656.00	$ -	$ -	**$ 6,656.00**
Total		**$ 48,228.82**	**$ 141,141.00**	**$ 12,997.00**	**$ 452.00**	**$ 202,818.82**

Figure 39. Example 2 (Transmission Line Adjustment) – Cost Category Summary Worksheet.

CHAPTER 7. CORE SKILL TRAINING ON UTILITY TOPICS

INTRODUCTION

This chapter discusses a proposed training framework on core skills related to utility topics. The chapter is divided into the following sections:

- Existing training programs at TxDOT.
- Existing training programs at other agencies.
- Training needs.
- Core skill requirements.

EXISTING UTILITY-RELATED TRAINING PROGRAMS AT TXDOT

TxDOT's training catalog includes a wide range of training opportunities (*68*). Table 11 shows a list that includes 125 courses offered at TxDOT.

Table 11. List of Courses Offered at TxDOT (*68*).

Course Title	Code
404 Permit Application and Compliance	ENV202
ABS/Hydraulic Brake System	MNT512
ABS/Pneumatic Brake System	MNT516
Admin of FHWA Planning Grants	PLN303
Advanced Adjustment Workshop–National Highway Institute (NHI)	ROW201
Advanced Freight Planning-NHI	PLN212
Basic Geotechnical Engineering for Roadways	GEO101
Basic Hydrology and Hydraulics	DES601
Basic Adjustment-NHI	ROW202
Best Practices for Microsurfacing	MNT706
Bridge Construction Inspection	BRG100
Bridge Inspection Refresher Training	BRG200
Bridge Maintenance Training	MNT801
Bridge Welding Training	MNT606
Building Roads the TxDOT Way	DES121
Business Adjustment Uniform Act	ROW208
Common Mistakes on TxDOT Elect	TRF812
Construction Of Portland Cement Concrete Pavement	CON406
Conduit Installation Requirements	TRF811
Confined Space Safety	SFH110
Conflict Management-Environmental NHI	ENV601
Construction Contract Administration	CON118
Contractor's Equipment Testing Requirements	TRF810
Critical Path Scheduling-Construction	CON116

Table 11. List of Courses Offered at TxDOT (*68*) (continued).

Course Title	Code
Construction/Maintenance Contract System: Post-Letting	MNT901
Construction/Maintenance Contract System: Pre-Letting	MNT900
Culvert Analysis and Design	DES604
Culvert Design-NHI	DES608
Culvert Inspection and Operation	TRF530
Design, Construction and Maintenance of Highway Safety Appurtenances	TRF702
Design of Mechanically Stabilized Walls-NHI	DES816
Design Concepts From AASHTO	DES102
Design Intersection for Safety	DES812
Design of Work Zone Traffic Control Plans	TRF502
Drilled Shafts-NHI	GEO201
Electrical Conductor Splicing Options Acceptable to TxDOT	TRF806
Electrician, Basic Maintenance	MNT100
Environment in Project Development	ENV101
EPD-Air Quality Training	ENV116
EPD-Biological Resources	ENV119
EPD-Community Impacts	ENV117
EPD-Cultural Resources	ENV113
EPD-Environmental Process	ENV120
EPD-Environmental Documentation	ENV121
EPD-Hazardous Materials Management	ENV114
EPD-Highway Traffic Noise Analysis	ENV115
EPD-Public Involvement	ENV112
EPD-Water Resources	ENV118
Excavation and Shoring Safety	SFH610
Flaggers in Work Zone	TRF521
FOCUS on Safety III	SFH401
Fracture Critical Inspect-NHI	DES803
Fund Title VI/Environmental Justice-NHI	DEV800
Freeway Design and Operation	DES106
Geotechnical Application for Transportation Projects	GEO102
Ground Box Installations	TRF809
Guidelines on use of Microsurfacing	MNT705
Hazwoper For Clean Up Operations	SFH210
Hazwoper Refresher	SFH215
Heavy Equipment Hydraulics	MNT208
HEC-RAS River Analysis System-NHI	DES802
Highway Capacity	TRF110
Highway Program Financing	PLN302
HMA Evaluation and Rehabilitation	CON407
Hot-Mix Asphalt Construction-NHI	CON404
Inspection of Flexible Base and Embankments	CON411
Installation and Maintenance of Pavement Markings	TRF510

Table 11. List of Courses Offered at TxDOT (*68*) (continued).

Course Title	Code
Installation and Maintenance of Signs	TRF515
Installation Requirements for Temporary Wiring	TRF807
Instructor Development Course	DEV425
Introduction to Construction and Maintenance Inspection	CON105
Introduction to Highway Project Development	DES116
Introduction to Project Management	DEV415
Introduction to Traffic Operations	TRF201
Introduction to Urban Travel Demand Forecast	PLN304
Local Government Project Procedures	CON812
LRFD Highway Bridge Superstructures-Concrete-NHI	BRG101
LRFD Highway Bridge Superstructures-Steel	BRG102
Maintenance Bridge Inspection	MNT127
Materials Control and Acceptance-NHI	CON402
Managing Road Impacts on Stream Ecosystems-NHI	ENV122
Managing Traffic Incidents and Roadway Emergencies	SFH510
Night Road Work-Planning and Implementation	TRF333
Planning Work Zone Traffic Control	PLN210
Portland Cement Concrete Materials	CON405
Practical Highway Hydrology-NHI	DES808
Preliminary Design Process	DES119
Principles of Writing Highway Contract Specifications	CON403
Project Management-Risk Assessment	DEV417
Project Management-Resource Management	DEV418
PS&E Package	DES109
Public Involvement in Transportation Decisions	ENV402
Right of Way Considerations	DES110
Risk Management and Tort Liability	TRF203
Roadside Safety Design-NHI	TRF701
Roadway Design	DES111
School Area Traffic Workshop	IPR015
Safety Inspection of In-Service Bridges-NHI	DES804
Small Quantity Spill Response	SFH410
Soils And Foundations Workshop-NHI	GEO202
Storm Water Pollution Prevent Plan	ENV103
Storm water Erosion and Sediment Day 1	ENV300
Storm water Erosion and Sediment Day 2	ENV301
Stream Stability/Scouring at Highway Bridges	DES805
Stream/Scour Instability-Countermeasures	DES807
Subsurface Investigations-NHI	CON413
The Grounding Electrode System	TRF804
Traffic Signal Design	TRF301
Troubleshooting Common Problems in Illumination Systems	TRF805
TxDOT Electrical Requirements for Installation of Traffic Signal Systems	TRF453

Table 11. List of Courses Offered at TxDOT (*68*) (continued).

Course Title	Code
TxDOT Roadway Illumination and Electrical Installation	TRF450
TxDOT's Ground and Bonding Requirements	TRF808
Urban Drainage Design-NHI	DES607
Urban Storm Drain Design	DES602
Urban Street Design	DES108
Using the Material Producer's List (MPL)	TRF813
Watershed Modeling/HEC-HMS	DES606
Welding, Gas Metal Arc (GMAW)	MNT604
Welding, Gas Tungsten (GTAW)	MNT605
Welding, General Shop #1	MNT600
Welding, Shield Metal Arc-Advanced	MNT603
Welding, Shield Metal Arc-Basic	MNT602
Wetland Plant-ID	ENV201
Work Zone Traffic Control	TRF520
Work Zone Traffic Control Refresh	TRF525

From the list of courses in Table 11, the researchers identified the following courses, which are directly or indirectly related to utility coordination topics:

- **Building Roads the TxDOT Way (Code DES121)**. This non-technical course provides an overview of what is involved in building a major highway in a metropolitan area. It introduces terminology and aspects of what designers, planners, environmental specialists, right of way agents and others have to consider when building roads the TxDOT way in Texas. The duration of the course is eight hours and is targeted at non-engineering staff. The course includes explaining factors that affect planning, design, and construction of highways, as well as describes the basic project development responsibilities of TxDOT divisions and districts.

- **Business Adjustment Uniform Act (Code ROW 208)**. This course provides information on the various aspects of business adjustments and is designed to address the adjustment of businesses, farms and nonprofit organizations. The main topics include eligibility, moving payments and benefits, advisory services, actual direct loss of tangible personal property, substitute personal property payments, reestablishment expenses, and fixed payment in lieu of payments. This course is part of the Certificate of Accomplishment in Adjustment under the Uniform Act. Participants should have at least two years of general adjustment experience. The duration of the course is 24 hours and is targeted at TxDOT right of way staff, adjustment agents, FHWA, and federal and local public agencies.

- **Introduction to Highway Project Development (Code DES116)**. This course includes an overview of the development process for highway projects. The course focuses on major project development process activities, beginning with the initial identification of

the need for a highway project and culminating with the bid letting. The course is structured to take 28 hours to complete and is designed for an audience of engineers and engineering technicians.

- **PS&E Package (Code DES 109)**. This course describes the process to assemble and review project plans, specification, and estimates. The course objectives are to explain the importance of an accurate PS&E package, describe the process of assembling a PS&E package, explain the importance of accurate entries into DCIS, identify factors that can affect unit bid prices, explain the purpose of General Notes, and describe the differences between a district review and a division review. The course duration is 16 hours.

- **Right of Way Considerations (DES110)**. This course provides an overview of right of way issues, including utilities, that a designer needs to consider when planning and developing a transportation project. The course is designed to take 16 hours to complete and targets engineers, engineering assistants and technicians with less than two years in transportation projects, or experienced engineers desiring to expand their knowledge of right of way issues in project development.

In 2001, at TxDOT's request, the Texas Engineering Extension Service (TEES) developed the course "Coordinated Solutions of Utility Conflicts in Transportation Projects" (*69*). The course was based primarily on an older edition of the *ROW Utility Manual* and covered topics such as the TxDOT-utility cooperative management process, the utility adjustment sub-process, utility statutes and policy, utility agreement assembly and construction management, review and approval of utility agreements, and reimbursement procedures. The course has not been updated since 2001 and is no longer offered.

Part of the implementation of the web-based Utility Installation Review (UIR) system included the development of training materials on how to use the system (*70*). The training materials include presentations in Microsoft PowerPoint® format, as well as presenter notes and participant handouts. During the initial deployment of UIR, training was provided to TxDOT and utility owner staff. Currently, TxDOT provides training to district personnel who are involved in the utility permitting process on an as-needed basis. The typical duration of these training events is about four hours. District personnel also provide training to utility owner staff and consultants as needed.

EXISTING TRAINING PROGRAMS AT OTHER AGENCIES

The need to develop training on utility-related topics is a nationwide phenomenon. There are not many examples of training modules, courses, or materials in this general area. The FUCC in Florida has recently been organizing utility coordination certification (UCC) training programs as part of its annual and semi-annual meetings (*71*). The certification training is broken up into five modules as follows: Legal, coordination, design, construction management, and cost estimating and invoicing.

In Georgia, GDOT developed a training program ("Avoiding Utility Project Impacts") to provide designers and project managers with strategies on how to avoid utility-related problems. This

tool is an interactive training course on methods to determine and avoid utility impacts. The primary tool of this analysis is a utility conflict matrix that lists all potential utility conflicts. The training includes a discussion of the cost to redesign highway features around utility conflict areas and the resulting cost-benefit analysis (*15*).

In Minnesota, Mn/DOT developed a two-day training course for staff, utility owners, consultants, and local government representatives to explain its new utility coordination process (*17*). The course was free and was made available at three locations throughout the state. In addition to information about Mn/DOT's utility coordination process, the course also provided information on best practices in utility coordination and applications to local projects.

In New South Wales, Australia, the NSW Streets Opening Conference developed a pilot training course to improve the understanding of plans and the identification of facility components in the field. Membership in the association (which started in Sydney in 1909) includes utility owners, local government and road authorities, light rail operators, other government agencies, consultants, and other groups interested in utility issues (*37*).

TRAINING NEEDS

Providing adequate training on utility topics is recognized as a best practice for improving the response and participation of utility owners in the project development process. Based on the various discussions with stakeholders during the research as well as a review of practices both at the state and national levels, the researchers developed a summary of training needs in the following utility-related topics at TxDOT:

- **Training for TxDOT utility coordinators**. Utility coordinators face an increasing set of challenges. For example, regionalization and the One DOT initiative are forcing staff to become well-versed in a wide range of topics and assist with projects at many different geographic locations. Standardization of procedures will become the norm, and utility coordinators will need to adapt to this new reality. Utility coordinators will need to become more knowledgeable of the entire project development process and how to manage utility conflicts effectively. However, at some districts, utility coordinators do not actively participate in the project development process until the design phase. Even then, their involvement is limited to providing information on potential utility conflicts at specific project locations.

- **Training needs for TxDOT design engineers on utility coordination issues**. Currently, some TxDOT districts provide ad hoc utility coordination training sessions for utility coordinators and interested design engineers. These sessions are usually project-specific and voluntary (some TxDOT engineers acknowledged not having attended any such training). There is a need for formal training for TxDOT design engineers on the entire utility coordination process. This training would address topics such as communications with utility coordinators and utility owners, utility adjustment design and construction challenges, utility project development process, utility adjustment cost estimates, and methods for designing around utility conflicts. This training would enable design engineers to become more sensitive to the short-term and

long-term impacts of utility conflicts in the project development and delivery process. It would also foster more effective communications with utility owners.

- **Training for other TxDOT staff**. Other staff involved in the project development process would require training to provide the necessary knowledge base to improve communication and coordination with utility owners. These include TxDOT division and region staff, project managers, area engineers, and construction inspectors.

- **Training for utility owner staff on transportation project development topics**. There is a need to provide training for utility owner staff on critical issues that affect the relationship between utility owners and TxDOT. During the various discussions with stakeholders, the researchers noted that utility owner representatives lack understanding of basic transportation project development and delivery concepts. This lack of understanding is similar as that in connection with the development of utility projects by transportation officials. Training for utility owners should vary according to the level and type of interaction with TxDOT. For example, training for managerial or executive level staff would focus on a high-level depiction of the transportation project development process as well as budgeting and financial matters. Training for design and construction staff would focus on more detailed project-level topics, including data collection and exchange, utility conflict analysis and resolution, coordination meetings, construction schedules, and inspection coordination.

- **Training for consultants and contractors**. Highway and utility consultants and contractors would benefit enormously from participating in critical, highly targeted utility-related training opportunities. TxDOT and utility owners should make every effort to make those opportunities available to their consultants and contractors. Private sector participation in the development and delivery of projects, both at TxDOT and in the utility industry, is increasing. A common theme during the various discussions with stakeholders was that TxDOT and utility officials have become in essence contract managers because their agencies' own forces conduct very little design or construction work. This situation highlights the need to provide adequate training opportunities to consultants and contractors in critical areas.

CORE SKILL REQUIREMENTS

The researchers identified several categories where the need for training opportunities to address the needs of stakeholders in the area of utility coordination was the greatest. Within each category, the researchers identified specific core skills that could serve as the foundation for proposed training courses or modules and identified a basic set of requirements for different levels of instruction. For each level of instruction, the researchers estimated the minimum number of training hours required to provide a basic level of understanding of the topic under consideration. Table 12 summarizes the various categories, core skills, brief course description, and a preliminary assessment of the minimum number of training hours for each stakeholder group.

The researchers also developed a summary of instruction content requirements associated with each course or module. This summary could provide the foundation for the development of actual courses or modules. Product 0-6624-P1 includes the summary of requirements associated with each course of module (*51*).

Table 12. Utility Area Core Skill Training Matrix.

Category	Course or Module	Description	Level of Training Needs (Hours) for Each Stakeholder Group														
			TxDOT						Utility Owner			Consultant			Contractor		
			Right of Way Division Staff	Utility Coordinators	Project Managers	Design Engineers	Construction Inspectors	Area Engineers	Executive Level	Staff/Design	Field Staff	Transportation	Utility Coordination	Utility Investigations	Highway	Utility	
TxDOT Project Development Process	TxDOT Project Development and Delivery Process	Different phases of the project development and delivery process, including activities under each phase. The course provides special emphasis on utility-related activities.	16+	8–16	16+	16+	5–8	16+	1–4	5–8	1–4	16+	8–16	8–16	8–16	1–4	
	TxDOT Design Plans and Specifications	Elements in a typical highway project design plan, including plans, profiles, and the process to assemble project files. The course includes a discussion of factors that affect unit prices.	1–4	8–16	8–16	8–16	8–16	8–16	1–4	5–8	5–8	8–16	8–16	8–16	8–16	8–16	
Utility Process from a Utility Owner's Perspective	Utility Project Development and Delivery Process	Description of how utility owners develop and execute projects, including utility adjustments associated with highway projects. This course addresses different types of utility projects, including oil and gas, water and sewer, electric, and communications.	8–16	8–16	5–8	8–16	5–8	8–16	n/a	n/a	n/a	8–16	8–16	8–16	5–8	n/a	
	Utility Design Plans and Specifications	Understanding of utility facility location maps and construction plans.	5–8	16+	5–8	8–16	8–16	8–16	n/a	n/a	n/a	8–16	8–16	8–16	5–8	n/a	
Utility Coordination	Federal and State Laws and Regulations	Understanding of federal and state laws and regulations that affect project development and utility adjustments and accommodation.	8–16	8–16	8–16	5–8	5–8	5–8	5–8	5–8	5–8	8–16	8–16	5–8	8–16	1–4	
	Utility Coordination Process	Principles and best practices of utility coordination, with an emphasis on early communication and coordination.	8–16	8–16	8–16	8–16	1–4	8–16	1–4	8–16	1–4	8–16	8–16	5–8	5–8	5–8	
	Memoranda of Understanding	The purpose of MOUs and how to use them to facilitate communication, coordination, and cooperation between TxDOT and utility owners.	5–8	5–8	5–8	1–4	1–4	1–4	5–8	5–8	1–4	1–4	1–4	1–4	n/a	n/a	
	Utility Investigations	State of the practice in utility investigation techniques and analysis of their potential use to assist in the identification and management of utility conflicts.	5–8	8–16	5–8	8–16	1–4	1–4	1–4	5–8	1–4	8–16	8–16	N/A	5–8	8–16	
	Utility Conflict Management	Identification, management and resolution of utility conflicts during the project development and delivery process.	5–8	5–8	5–8	5–8	5–8	5–8	1–4	1–4	1–4	5–8	5–8	5–8	5–8	5–8	
	Utility Adjustment Cost Estimates	Components of utility cost estimates, accounting methods, TxDOT requirements, and challenges associated with cost estimation.	8–16	8–16	8–16	8–16	1–4	5–8	5–8	8–16	1–4	8–16	8–16	1–4	1–4	1–4	
	Utility Agreement Assemblies	Items included in the utility agreement assembly, requirements, and challenges of putting the agreement together.	5–8	16+	5–8	5–8	5–8	5–8	1–4	16+	5–8	5–8	8-16	1–4	1–4	1–4	
	Using ROWIS to Manage Utility Adjustments	Use of the Right of Way Information System (ROWIS) to create and manage records in connection with utility adjustments. The course also covers the use of ROWIS to generate reports to assist in the utility coordination process.	5–8	5–8	1–4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Utility Permitting	Preparation, Submission, and Review of Utility Permits	Requirements for the submission, review, approval, and management of utility permit applications; training on the use of the UIR system.	5–8	5–8	5–8	5–8	5–8	5–8	1–4	5–8	1–4	5–8	5–8	1–4	1–4	1–4	

CHAPTER 8. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Coordination with utility owners during the project development and delivery process involves multiple activities. Examples include requesting and collecting data about the location and characteristics of existing facilities to identifying and analyzing utility conflicts, coordinating with utility stakeholders for the resolution of those utility conflicts, preparing and executing utility agreements, coordinating and inspecting utility adjustments, and coordinate reimbursements and audits. Effective communication, cooperation, and coordination among utility stakeholders are critical to keep transportation projects on schedule. Unfortunately, these elements are frequently lacking during project development and delivery to allow for the adoption of cost-effective solution strategies.

The researchers reviewed strategies that TxDOT and other agencies use to engage utility owners and assembled a list of 64 potential strategies to improve utility owner participation in the project development and delivery process. This list was based on a comprehensive review of existing and recommended practices at various levels, including local, state, and national levels. The potential strategies were grouped into the following categories:

- Communication and coordination (24 strategies).
- Contracts and agreements (17 strategies).
- Utility data collection and management (19 strategies).
- Training (4 strategies).

The researchers also held meetings with TxDOT districts and divisions, project advisors, utility owners, and other relevant agencies in the state. These meetings enabled stakeholders to provide input into the strategies identified from the detailed literature review and recommend additional strategies.

The result of the meetings with various stakeholders, including project advisors, TxDOT districts and regions, and utility owners was a consolidation and ranking of potential strategies. The following strategies were selected for further development, reflecting the highest priorities that stakeholders identified:

- **Modernization of the utility process**. The researchers developed a modernized, streamlined view of the utility process at TxDOT using BPMN, along with written descriptions of activities. The researchers produced three diagrams with increasing level of detail: Level 1 (which provides a high-level depiction of the entire process), Level 2 (which provides an intermediate level of detail of the entire process and shows where utility-related activities fit into that process), and Level 3 (which provides a more detailed view of the process and is intended for utility coordinators).

- **Utility conflict matrix approach**. UCMs enable users to organize and track utility conflict information. SHRP 2 Research Project R15-B "Identification of Utility Conflicts and Solutions" involved the development and testing of a prototype UCM concept and development of training materials. The researchers adapted the findings from the SHRP 2 R15-B project to facilitate the implementation of the resulting research products at TxDOT: Product 1 (compact, standalone UCM spreadsheet), Product 2 (utility conflict data model and database), and Product 3 (UCM training course and course materials).

- **Streamlining and standardization of utility cost data submissions**. To assist utility owners during the preparation and submission of standardized utility cost estimates, the researchers prepared a prototype Microsoft Excel-based template with four integrated worksheets: Items, Unit Cost Analysis, Item Disaggregation Analysis, and Cost Category Summary. Implementing an updated framework for the development of utility adjustment cost estimates would have a number of benefits, including the following:

    - Support for the development of utility adjustment cost estimates at various stages in the utility adjustment process.
    - Reduction in the level of uncertainty and risk for managing utility adjustments.
    - More effective, less contentious relationship between TxDOT and utility owners.

- **Core skill training on utility topics**. The researchers developed a summary of training needs in utility-related topics at TxDOT and identified categories where the need for training opportunities was the greatest. Within each category, the researchers identified specific core skills that could serve as the foundation for proposed training courses or modules, and identified a basic set of requirements for different levels of instruction. For each level of instruction, the researchers estimated the minimum number of training hours required to provide a basic level of understanding of the topic under consideration.

RECOMMENDATIONS

The researchers developed an implementation plan and standalone guidebook and training materials (Product 0-6624-P1) to assist in the implementation of each of the four strategies described above (*51*). Intended users of these materials include stakeholders such as division and district officials, utility owners, consultants, and contractors. The implementation plan includes recommended actions, a description of anticipated benefits, impediments that might hinder the successful implementation of the strategies, and performance measures to evaluate the effectiveness of the implementation of the strategies.

Critical recommendations to implement the updated utility process at TxDOT (see Product 0-6624-P1 for additional information) include the following:

- Identify leaders for the implementation and assemble an implementation team. The researchers anticipate the Right of Way Division to be the main champion and office of primary responsibility for the implementation. However, the implementation team should also include representatives of other divisions as well as regions and districts.

- Schedule workshops throughout the state to disseminate the updated utility process. Potential participants in these events include TxDOT officials at different levels (e.g., division staff, utility coordinators, project managers, design engineers, construction inspectors, and area engineers), utility owners, transportation and utility consultants, and highway and utility contractors.

- Update relevant manuals and increase the level of detail in the generic schedule template developed as part of the TxDOT modernization project. This template provides a slightly more disaggregated view of the utility process than the Level 2 diagram. However, it provides considerably less detail than what the Level 3 diagram does. For actual construction projects, it is quite possible that TxDOT might need to increase the number of activities in the generic schedule template to reflect some or all the activities included in the Level 3 diagram.

Critical recommendations to implement a systematic use of the UCM approach at TxDOT include the following:

- Assemble a task force and agree on an implementation plan that defines, at a minimum, which UCM products should be implemented and in what sequence, as well as what districts should be involved in the implementation. In addition, the plan should outline the strategy to provide UCM training, including location, frequency, and participant groups.

- Conduct UCM training courses throughout the state. Trainers who are selected for this task should have a thorough knowledge of utility coordination and utility conflict management topics, as well as how the interaction between utility activities and other project development process components. Part of this effort will be a dissemination of the standalone UCM and associated process to manage utility conflicts.

- Develop a detailed implementation plan for an enterprise-level UCM solution. The implementation team should develop a detailed plan that addresses issues such as the following:

    - Expected use in the current business process.
    - Level of access by expected database users.
    - Expected linkage to existing systems.
    - Need for user interfaces and forms.
    - Need for data access over networks.
    - Data storage expectations and requirements.
    - Data safety requirements.
    - Other expected outcomes of the implementation.

    This plan should conform to existing standards and specifications for the development and implementation of information technology (IT) applications. The plan should include the identification and documentation of user and system needs and requirements.

- Develop and test user interfaces. Based on the user and system requirements identified in the previous task, the developer should develop and test the necessary user interfaces. There should be coordination among districts to ensure that user interfaces, queries, forms, and reports are standardized and address district, region, and division needs.

Critical recommendations to implement a streamlined, standardized approach for preparing utility cost estimates at TxDOT include the following:

- Select a sample district to pilot the use of the Excel-based template for the submission of utility cost data estimates by utility owners. The pilot test would likely involve one or more projects and include monitoring how users react to the various components of the template. Based on user feedback, an updated version of the template might be developed, as needed.

- Develop and pilot a two-day training course on the preparation of utility cost estimates. Stakeholders would include TxDOT officials, consultants (both highway and utility), and utility representatives.

- Capture feedback from districts and update the *ROW Utility Manual* to reflect the updated, streamlined process to prepare and submit utility cost estimates.

- Standardize the preparation and submission of utility cost estimates throughout the state based on the experience gathered with the pilot implementation above.

Critical recommendations to implement relevant utility-related training courses or modules at TxDOT include the following:

- Schedule one-day training courses to disseminate the systematic use of UCMs in the project development process. The one-day UCM training course, which was developed as part of Project SHRP 2 R15-B, is ready for deployment. The course content could be easily customized to suit TxDOT needs, as needed.

- Develop and pilot a one-day training course or module to describe the updated utility process at TxDOT that was developed as part of this research.

- Develop and pilot a two-day training course on the preparation of utility cost estimates. This course would use as a central component the Excel-based template developed as part of the research and would enable participants to learn how to develop cost estimates for a variety of project conditions.

- Develop and pilot other training courses following a systematic approach that includes conducting a survey of user needs and takes into consideration factors such as availability of existing courses that could be updated to address relevant utility issues and financial constraints.

REFERENCES

1. 43 TAC 21. Texas Administrative Code, Title 43, Part 1, Chapter 21. http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=43&pt=1&ch=21 Accessed August 31, 2012.
2. *ROW Utility Manual*. Texas Department of Transportation, Austin, Texas, February 2011. http://onlinemanuals.txdot.gov/txdotmanuals/utl/index.htm. Accessed August 31, 2012.
3. Texas Engineering Practice Act. Occupations Code, Title 6, Subtitle A, Chapter 1001, Engineers. http://www.statutes.legis.state.tx.us/Docs/OC/htm/OC.1001.htm. Accessed August 31, 2012.
4. 33 USC 1251 et seq. Clean Water Act. http://www.gpo.gov/fdsys/pkg/USCODE-2011-title33/html/USCODE-2011-title33-chap26.htm. Accessed August 31, 2012.
5. Americans with Disabilities Act of 1990, as Amended. Department of Justice, Washington, D.C., 2009. http://www.ada.gov/pubs/ada.htm. Accessed August 31, 2012.
6. 23 CFR 645. Code of Federal Regulations, Title 23, Part 645, Utilities. http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title23/23cfr645_main_02.tpl. Accessed August 31, 2012.
7. R. Ellis and H. Thomas. The Root Causes of Delays in Highway Construction. 81st Annual Meeting of the Transportation Research Board, Washington, D.C., 2002.
8. Right of Way and Utilities Guidelines and Best Practices. Strategic Plan 4-4, Subcommittee on Right of Way and Utilities, AASHTO Standing Committee on Highways, Federal Highway Administration, Washington, D.C., 2004.
9. *Project Development Process Manual*. Texas Department of Transportation, Austin, Texas, June 2009. http://onlinemanuals.txdot.gov/txdotmanuals/pdp/index.htm. Accessed August 31, 2012.
10. 43 TAC 15.120-15.122. Texas Administrative Code. Title 43, Part 1, Chapter 15, Subchapter J. http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=43&pt=1&ch=15&rl=121. Accessed August 31, 2012.
11. 5 TUC 251. Texas Utilities Code, Title 5, Chapter 251. http://www.statutes.legis.state.tx.us/Docs/UT/htm/UT.251.htm. Accessed August 31, 2012.
12. *Design Guidance Manual.* City of San Antonio Capital Improvements Management Services, San Antonio, Texas, June 2008.
13. C. Quiroga, E. Kraus, J. Overman, and N. Koncz. *Integration of Utility and Environmental Activities in the Project Development Process*. Publication FHWA/TX-10/0-6065-1, Texas Transportation Institute, College Station, Texas, 2010.

14. Florida's ETDM Process. Environmental Management Office, Florida Department of Transportation, Tallahassee, Florida, August 2006. https://etdmpub.fla-etat.org/est/. Accessed August 31, 2012.

15. Optimizing SUE on GDOT Projects (PDP). Training materials for the SUE Training Course "Avoiding Utility Project Impacts." Georgia Department of Transportation, Atlanta, Georgia, undated. http://www.dot.state.ga.us/doingbusiness/utilities/sue/Documents/AvoidingUtilityProjectImpacts_GDOT_Portion_Only.pdf. Accessed August 31, 2012.

16. N. Lefke. Utility Conflict Data Management. AASHTO Subcommittee on Right of Ways and Utilities Conference, Grand Rapids, Michigan, 2008.

17. Announcement of New Mn/DOT Utility Coordination Process. Memorandum from Marilyn Remer, Mn/DOT Utilities Engineer to public utility owners. Minnesota Department of Transportation, Utility Agreements and Permits Unit, St. Paul, Minnesota, June 2007. http://www.dot.state.mn.us/utility/files/pdf/policy/public.pdf. Accessed August 31, 2012.

18. *Design Manual Part 5. Utility Adjustment*. Pennsylvania Department of Transportation, Harrisburg, Pennsylvania, 2010.

19. 23 CFR 450. Code of Federal Regulations. Title 23, Subchapter E, Part 450, Planning Assistance and Standards.

20. Assessment Screening Tools. Region 6, Environmental Protection Agency, Dallas, Texas, 2012. http://www.epa.gov/region6/6en/xp/enxp2a3.htm. Accessed August 31, 2012.

21. NEPAssist. Environmental Protection Agency, Washington, D.C., 2012. http://nepassisttool.epa.gov/nepassist/entry.aspx. Accessed August 31, 2012.

22. TxDOT Draft for Indefinite Deliverable Contracts. Scope of Work: Utility Engineering Investigation, Utility Adjustment Coordination, Utility Engineering, Utility Construction Management and Verification. Texas Department of Transportation, Austin, Texas, undated.

23. Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s). U.S. Environmental Protection Agency, Washington, D.C., March 2009. http://cfpub.epa.gov/npdes/stormwater/munic.cfm. Accessed August 15, 2012.

24. C. Quiroga, S. Kranc, D. Ford, E. Kraus, and T. Taylor. *A Unit Cost and Construction Specification Framework for Utility Installations*. Publication FHWA/TX-07/0-4998-1, Texas Transportation Institute, College Station, Texas, 2007.

25. C. Quiroga, S. Kranc, D. Ford, E. Kraus, and T. Taylor. *Construction Specification Requirements for Water and Sanitary Sewer Installations*. Publication FHWA/TX-07/0-4998-2, Texas Transportation Institute, College Station, Texas, 2007.

26. C. Quiroga, D. Ford, T. Taylor, S. Kranc, E. Kraus, and E. Park. *Specification Framework for Communication Utilities and Estimation of Utility Adjustment Costs*. Publication FHWA/TX-08/0-4998-3. Texas Department of Transportation, Austin, Texas, 2007.

27. C. Hendrickson. *Project Management for Construction. Fundamental Concepts for Owners, Engineers, Architects and Builders*. Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, 1998. http://www.ce.cmu.edu/pmbook. Accessed August 31, 2012.

28. Major Project Program Cost Estimating Guidance. Federal Highway Administration, Washington, D.C., January 2007. http://www.fhwa.dot.gov/ipd/project_delivery/tools_programs/cost_estimating/guidance.htm. Accessed August 31, 2012.

29. E. Kraus, C. Quiroga, N. Koncz, and H. Dawood. *Development of a Utility Conflict Management System*. Report FHWA/TX-09/0-5475-4, Texas Transportation Institute, College Station, Texas, 2009.

30. *Management and Organizational Review. Final Report*. Grant Thornton, Texas Department of Transportation, Austin, Texas, May 2010.

31. *A Revitalization of TxDOT*. TxDOT Restructure Council, Department of Transportation, Austin, Texas, January 2011.

32. *Accommodation of Utility Plant within the Rights of Way of Urban Streets and Highways: Manual of Improved Practice*. American Public Works Association, American Society of Civil Engineers, Chicago, Illinois, and New York, New York, July 1974.

33. O. Riley. *Reducing Construction Conflicts between Highways and Utilities*. NCHRP Synthesis of Highway Practice 114, Transportation Research Board, Washington D.C., 1984.

34. J. Thorne, D. Turner, and J. Lindly. *Highway/Utility Guide*. Report FHWA-SA-93-049, Federal Highway Administration, Washington, DC, June 1993.

35. *Right of Way and Utilities Guidelines and Best Practices*. Strategic Plan 4-4, Subcommittee on Right of Way and Utilities, AASHTO Standing Committee on Highways, Federal Highway Administration, Washington, D.C., 2004.

36. R. Moeller, J. Pestinger, M. Frierson, W. Kennedy, A. McCormick, C. Colan Muth, J. Myers, P. Scott, and S. Waymack. *European Right of Way and Utilities Best Practices*. Report No. FHWA-PL-02-013, Office of International Programs, Federal Highway Administration, American Association of State Highway and Transportation Officials, Washington, D.C., August 2002.

37. J. Campbell, G. Solomon, G. Fawver, R. Lorello, D. Mathis, C. Quiroga, B. Rhinehart, B. Ward, J. Zaharewicz, and N. Zembillas. *Streamlining and Integrating Right of Way and Utility Processes with Planning, Environmental, and Design Processes in Australia and Canada*. Report FHWA-PL-09-011, Office of International Programs, Federal Highway Administration, American Association of State Highway and Transportation Officials, Washington, D.C., June 2009.

38. R. Sterling, A. Allouche, J. Simicevic, C. Rogers, K. Weston, and K. Hayes. *Encouraging Innovation in Locating and Characterizing Underground Utilities*. SHRP 2 Report S2-R01-RW, Transportation Research Board, Washington, D.C., 2009.

39. R. Ellis, M. Venner, C. Paulsen, J. Anspach, G. Adams, and K. Vandenbergh. *Integrating the Priorities of Transportation Agencies and Utility Companies*. Report S2-R15-RW, Strategic Highway Research Program 2, Transportation Research Board, Washington, D.C., August 2009.

40. *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (38-02)*. American Society of Civil Engineers, Reston, Virginia, 2002.

41. C. Quiroga, E. Kraus, P. Scott, T. Swafford, P. Meis, and G. Monday. *Identification of Utility Conflicts and Solutions*. Report S2-R15B-RW-1, Strategic Highway Research Program 2, Transportation Research Board, Washington, D.C., July 2011.

42. J. Anspach. *Utility Location and Highway Design*. NCHRP Synthesis 405, NCHRP Project 20-05, Topic 40-04, National Cooperative Highway Research Program, Transportation Research Board, Washington, D.C., 2010.

43. Underground Utility Line Protection Law, Section 5. Act 287 of 1974, as amended. http://www.portal.state.pa.us/portal/server.pt?open=514&objID=552996&mode=2. Accessed August 31, 2012.

44. Pamphlet Laws 1593, No. 2006-181, November 29, 2006. http://www.palrb.us/pamphletlaws/20002099/2006/0/act/0181.pdf. Accessed August 31, 2012.

45. *VDOT Utility Manual. Manual of Instructions. Utility Relocation Policies and Procedures*. Virginia Department of Transportation, Richmond, Virginia, January 2011. http://www.virginiadot.org/business/resources/Right_of_way/Utility_Manual02132012_TechRev.pdf. Accessed August 31, 2012.

46. P. Scott. *Feasibility of Using Incentives to Facilitate Utility Relocations*. National Cooperative Highway Research Program Project 20-07/Task 269, Transportation Research Board, Washington, D.C., April 2011.

47. Subcommittee Surveys. AASHTO Subcommittee on Right of Ways and Utilities, undated. http://rightofway.transportation.org/Pages/Home.aspx. Accessed August 31, 2012.

48. Underground Facility Damage Prevention and Safety Act. Utilities Code, Title 5, Chapter 251, Underground Facility Damage Prevention and Safety. http://www.statutes.legis.state.tx.us/Docs/UT/htm/UT.251.htm. Accessed August 31, 2012.

49. Texas 811, Dallas, Texas, 2012. http://www.texas811.org/. Accessed August 31, 2012.

50. Business Process Model and Notation (BPMN). Object Management Group, January 2011. http://www.omg.org/spec/BPMN/2.0. Accessed August 15, 2011.

51. C. Quiroga, E. Kraus, Y. Li, and J. Le. Strategies to Encourage and Facilitate Utility Owner Participation in Transportation Projects – Guidebook. Product 0 6624-P1. Texas Department of Transportation, Austin, Texas.

52. *Transportation Planning Process Manual*. Texas Department of Transportation, Austin, Texas, September 2001. http://onlinemanuals.txdot.gov/txdotmanuals/prc/index.htm. Accessed August 31, 2012.

53. *Transportation Programming & Scheduling Manual*. Texas Department of Transportation, Austin, Texas, August 2012. http://onlinemanuals.txdot.gov/txdotmanuals/sch/index.htm. Accessed August 31, 2012.

54. *Environmental Manual*. Texas Department of Transportation, Austin, Texas, August 2004. http://onlinemanuals.txdot.gov/txdotmanuals/env/index.htm. Accessed August 31, 2012.

55. *PS&E Preparation Manual*. Texas Department of Transportation, Austin, Texas, May 2012. http://onlinemanuals.txdot.gov/txdotmanuals/pse/index.htm. Accessed August 31, 2012.

56. *General Administrative Memorandum No. 300*. Public Roads Administration. Federal Works Agency, Washington, D.C., May 1946.

57. *Federal-Aid Highway Act of 1944*. Public Law No. 521, Washington, D.C., 1944.

58. *Federal-Aid Highway Act of 1956*. Public Law No. 627, Chapter 462, Washington, D.C., 1956.

59. *Policy and Procedure Memorandum 30-4*. Bureau of Public Roads, U.S. Department of Commerce, Washington, D.C., December 1957.

60. J. Kirk. *Utility Adjustment and Accommodation: A History of Federal Policy under the Federal-Aid Highway Program. Part I: Utility Adjustment*. Federal Highway Administration, Washington, D.C., June 1980.

61. *Federal-Aid Policy Guide*. Federal Highway Administration, Washington, D.C., December 1991. http://www.fhwa.dot.gov/legsregs/directives/fapg/1trans01.htm. Accessed August 31, 2012.

62. Utilities: Final Rule. Federal Highway Administration. *Federal Register*, Vol. 60, No. 128, 1995, pp. 34846-34851. http://www.gpoaccess.gov/fr/retrieve.html. Accessed August 31, 2012.

63. Utilities: Final Rule. Federal Highway Administration. *Federal Register*, Vol. 65, No. 226, 2000, pp. 70307-70312. http://www.gpoaccess.gov/fr/retrieve.html. Accessed August 31, 2012.

64. 23 USC. U.S. Code, Title 23. http://frwebgate.access.gpo.gov/cgi-bin/usc.cgi?ACTION=BROWSE&TITLE=23USCC1&PDFS=YES. Accessed August 31, 2012.

65. 23 CFR 645. Code of Federal Regulations, Title 23, Part 645. http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=b7f7c4449f0f70b7da723fbaaac8d4ce&rgn=div5&view=text&node=23:1.0.1.7.26&idno=23. Accessed August 31, 2012.

66. *Transportation Code, Chapter 203, Subchapter E, Adjustment of Utility Facilities, Sections 203.092-203.0941*. http://www.statutes.legis.state.tx.us/Docs/TN/htm/TN.203.htm. Accessed August 31, 2012.

67. *House Bill 179*. 55th Legislature, Regular Session, State of Texas, Austin, Texas, 1957.

68. Course catalog on the Texas Department of Transportation Training and Professional Development website. http://www.dot.state.tx.us/hrd/tdp/ecatalog/catalogtoc.htm. Accessed on August 31, 2012.

69. *Coordinated Solutions of Utility Conflicts in Transportation Projects*. Prepared by Transportation Training Division, Texas Engineering Extension Service, Texas A&M University. April 2001.

70. C. Quiroga, Y. Li, and J. Le. Utility Installation Review (UIR) System Training Materials. Product 5-2110-03-P2. Texas Department of Transportation, October 2008.

71. Florida Utilities Coordinating Committee (FUCC). http://fucc.org/FUCC/homepage.htm. Accessed September August 31, 2012.

APPENDIX. ASSESSMENT OF EXISTING UTILITY COOPERATIVE MANAGEMENT PROCESS ACTIVITIES

Table 13 and Table 14 include a description of each activity or sub-activity and provide the researchers' assessment of issues related to the usability of the UCMP and the sub-processes.

Table 13. Existing Utility Cooperative Management Process Activities.

Level	Activity	Name	Description (Source: *ROW Utility Manual* [2])	Phase	Comment
UCMP	Process Activity I	Annual Meeting	This meeting is held each year following approval of the TxDOT State Transportation Improvement Program (STIP). Prior to the meeting, a utility friendly chronological listing of the upcoming year's proposed construction letting schedule should be prepared for general distribution to local utility industry representatives. This project listing is prepared with focus on TxDOT projects and project information of particular interest to utilities and in a format that is clear and understandable to the public. To ensure clarity, the project listing should be prepared as a cooperative TxDOT-utility owner effort. Projects should be listed in chronological order by proposed letting. Projects without anticipated utility impacts should be eliminated from this customized listing (i.e., overlays, pavement markings, and maintenance contracts). TxDOT conducts the Annual Meeting, which is intended to provide a forum for discussion of the TxDOT construction schedule with local utilities. Particular emphasis is placed on early awareness of the major utility concerns associated with accommodating TxDOT construction. Early communication of this type provides utilities with the opportunity to do fiscal planning for upcoming construction with consideration given to utility budget cycles, construction schedules, and consumer service requirements.	Planning and Programming	In practice, it may be unclear how the 'utility friendly' project list should be developed cooperatively between TxDOT and utility owners.
UCMP	Process Activity II	Initial Project Notification	Prerequisites include completion of a preliminary schematic or other general representation of the proposed project layout. The TxDOT Project Design Engineer has been appointed and, if applicable, a TxDOT Design Consultant has been retained. A list of potentially impacted utilities is compiled, right of way mapping has begun, and TxDOT is ready to begin design of the facility. This activity typically is in the form of a project-specific letter prepared for distribution to all known utilities and other concerned parties. The purpose is to advise utilities of the general characteristics of an upcoming TxDOT project and to provide an illustration of the project footprint for mark up of utility facility locations, which occupy the project area. The notification will also introduce the responsible party and other TxDOT contacts for the project and request the submittal of utility block maps, as-built plans or system drawings to indicate utility facility locations and other features. The Initial Project Notification will announce the time and location of the **Preliminary Design Meeting (Process Activity III)** below and should be sent out no less than two weeks before to ensure full attendance and to allow adequate time for compiling requested information by the utilities.	Preliminary Design	The description suggests a preliminary schematic or general layout of the project is required, but then also mentions that a project design engineer and a design consultant have been selected. The former would suggest that the initial notification takes place in the middle of the preliminary design phase, but the latter suggests near the end of the preliminary design phase after the final geometric schematic has been approved. Although it appears the activity should take place at the beginning of the detailed design phase, it is difficult to confirm this assumption. The activity description is silent whether the notification requires the completion of the environmental document (this could be assumed because of the presumption that TxDOT is ready to start the project design).
UCMP	Process Activity III	Preliminary Design Meeting	The Preliminary Design Meeting is held within approximately two weeks after the **Initial Project Notification (Process Activity II)**. This meeting is different from the Design Conference. At this meeting, TxDOT and Utility Design Representatives are introduced, including any consultants that they may use in the design process. TxDOT describes the proposed improvements, the anticipated schedule and potential impact on utilities. The discussion of TxDOT design includes items of particular interest to utilities, such as drainage facilities, typical sections, structures, and other roadside features. TxDOT's UAR and reimbursement eligibility criteria are explained. It is important to identify conditions that would prevent compliance with the UAR and propose potential solutions. An action plan for locating affected utility facilities can be developed after a determination has been made whether the field verification is to be accomplished jointly or independently. Concerns to be addressed in the action plan are as follows: • The immediate need for horizontal and vertical alignment information. • Physical constraints affecting the methods and equipment to be used in the locating process. • Anticipated schedule and response time of the information provider(s). During the Preliminary Design Meeting, a determination is made regarding the level of utility involvement for each utility. Those identified as being *Level 3* require no further involvement. Those identified as being *Level 2* or *Level 1* will continue as active participants in 'The Process.' A milestone is identified or a date set for the **Design Conference (Process Activity V)**. An appropriate milestone is a project related activity that triggers the need to start detailed design coordination (i.e., completion of drainage design or availability of field verification information).	Design	The preliminary design meeting takes place at the beginning of the design phase before the official project design conference. The preliminary design meeting is not the same as the project *conceptual design meeting*, which takes place at the beginning of the preliminary design phase. Until recently, the name for the conceptual design meeting in the *Project Development Process Manual* was 'Preliminary Design Meeting,' and many districts are still using the old name. Using the same name for two different activities can be a source of confusion when determining the appropriate timing for this meeting. The description mentions three types or levels of utility owner involvement: Level 1, Level 2, and Level 3. However, it does not define what those levels are or represent. It is unclear why, at this meeting, a date should be set for the Design Conference.

Table 13. Existing Utility Cooperative Management Process Activities (continued).

Level	Activity	Name	Description (Source: *ROW Utility Manual* [*2*])	Phase	Comment
UCMP	Process Activity IV	Field Verification	Accurate Field Verification of some utility facilities on complex projects will be required to design TxDOT features to avoid conflicts, to relocate the utility or to conclude that neither is necessary. The extent of information needed, and the information provider for each facility, will have been decided by mutual agreement between the TxDOT Project Design Engineer and the Utility Design Representative at the **Preliminary Design Meeting (Process Activity III)**. It should be noted that in some situations, this information would not be warranted. For instance, if it is obvious that adjustment is imperative, such as an existing overhead pole line located in the proposed pavement, additional verification is an unnecessary expense. Field Verification information can be obtained from a number of sources: the utility's forces, a utility design consultant, TxDOT survey or maintenance crews, a One Call locator service, or a SUE provider. In order for a utility to incur reimbursable costs or for TxDOT to retain a SUE provider, it is imperative that a right of way release be in place. If the foregoing has not occurred, the information must be obtained at no expense to TxDOT. The Field Verification information should be supplied in TxDOT control datum to accurately apply the locations to TxDOT drawings. This will help to resolve any identified conflicts.	Design	As described, the scope of field verification is consistent with detailed utility investigations. The description does not explicitly include a requirement for field verification to take place before the design conference. The UCMP diagram assumes that field verification takes place *before* the design conference and *before* the right of way release. A sub-process activity, also called Field Verification, takes place during the preliminary design phase and requires an early right of way release for utilities
UCMP	Process Activity V	Design Conference	The Design Conference provides a forum to discuss potential utility impacts and promote cooperative solutions before the development of more detailed preliminary design. The participants will exchange the field verification results, investigate alternatives, and propose recommendations to minimize impacts. To facilitate this discussion, the TxDOT Project Design Engineer should present at this meeting anticipated location and type of drainage facilities, structures, and other roadside features. Right of way issues to be discussed may include adequacy of the proposed right of way, sequencing of parcel acquisition critical to anticipated construction phasing, utility accommodations, environmental concerns and obstacles (e.g., petroleum storage tank systems [PSTS], hazardous materials). Utility issues to be discussed may include necessity, justification, and scope of work for any proposed utility adjustment, UAR compliance, and possible TxDOT design modifications to minimize utility conflicts. Contracting options for utility adjustments to be considered are work to be performed by the utility, joint bids between utilities and incorporation of the utility work in the transportation project contract. Other issues that may be applicable are escrow agreements for non-reimbursable utility work included in the TxDOT Plans, Specifications, and Estimate (PS&E). The Design Conference will provide an initial opportunity to integrate the projected construction time lines of all parties with the TxDOT design schedule. Consideration should also be given to setting the schedule for the first **Intermediate Design Meeting (Process Activity VI)**.	Design	This meeting is the same as the design conference described in the TxDOT *Project Development Process Manual*, which takes place at the beginning of the design phase. However, this is not necessarily clear from the description, suggesting a separate meeting only focusing on utility issues. The description of the design conference in the TxDOT *Project Development Process Manual* is considerably different.
UCMP	Process Activity VI	Intermediate Design Meeting(s)	At the discretion of the TxDOT Project Design Engineer, the frequency of the Intermediate Design Meetings will be commensurate with the complexity of the TxDOT-Utility collective design effort. The meetings are intended to track the progress of ongoing design processes, further develop design concepts from previous meetings, identify design conflicts, and investigate solution alternatives. The first meeting in this series must begin before the design plan is one-third completed. Adequate design progress of features relevant to utility facilities must have occurred at this point in "The Process." During this phase of project development, utilities may begin actual physical adjustment of facilities. Should it be anticipated that the work would be eligible for reimbursement, the utility must initiate required documentation in accordance with **the Right of Way Sub-Process Activity IX (Prepare Utility Agreement Assembly)** before beginning work. Right of way parcel acquisition is ongoing; therefore, the right of way map and full project release for right of way acquisition must have been secured before the Intermediate Design Meetings. These meetings provide an opportunity to reconfirm or adjust right of way acquisition priorities in recognition of design/construction phasing. Consideration should be given to any required hazardous materials remediation. If design moves forward without consideration of the right of way acquisition process, a flaw to effective TxDOT-Utility project coordination results. Utilities with *Level 2* involvement will typically resolve conflicts and discontinue participation in "The Process" during the Intermediate Design Meetings.	Design	From the description, it is not clear if these intermediate meetings are the same as other official design-level meetings (e.g., 30-, 60-, or 90-percent meetings). The description seems to suggest the intermediate meetings are utility-specific. It is not clear how utility owners with Level 2 involvement resolve conflicts and discontinue participating in the process during intermediate design meetings.

Table 13. Existing Utility Cooperative Management Process Activities (continued).

Level	Activity	Name	Description (Source: *ROW Utility Manual* [2])	Phase	Comment
UCMP	Process Activity VII	Final Design & Initial Construction Coordination Meeting	The Final Design & Initial Construction Coordination Meeting is the last meeting before submittal of the PS&E to Austin for approval. The TxDOT Project Design Engineer is responsible for preparation of the utility Special Provisions and special specifications. The sequencing of TxDOT construction and utility work are coordinated for inclusion into the PS&E submission. Overall utility workload must be considered in order to ensure that personnel and equipment are available at the time of proposed construction. The TxDOT Utility Liaison should be included in the development of utility special specifications for utility construction to be included in the TxDOT construction project to ensure compliance with the TxDOT UAR. Utility bid items must be separated from the TxDOT items for the transportation project. If the utility adjustment is reimbursable, the utility bid items must be charged to a separate ROW CSJ number. Finalize details of escrow agreements and obtain mutual agreement among local parties before submission of PS&E. The TxDOT Right of Way Representative will be responsible for compiling current right of way acquisition and adjustment assistance information for preparation of the corresponding special provisions and certifications. Priorities are established for the acquisition of outstanding right of way parcels.	Design	The name of the activity is confusing because the meeting is intended to take place *while* the district is finalizing the PS&E assembly for submission to Austin, so there is probably little construction coordination at this meeting. From the description, it is not clear whether the required activities actually take place at a meeting, e.g., prepare utility special provisions and special specifications, determine sequencing of utility work, identify and charge utility bid items to a separate right of way CSJ number, and finalize details of the escrow agreement with LPAs.
UCMP	Process Activity VIII	Pre-Letting Utility Meeting	The Pre-Letting Utility Meeting is held due to the lapse of time and likelihood of design modifications that may affect utility adjustments after PS&E submittal. This meeting is conducted before the TxDOT **Pre-bid Conference** to identify utility concerns for prospective bidders. The purpose of the Pre-Letting Utility Meeting may be served by including local utilities in the TxDOT Pre-Bid Conference, if held locally. In this instance, the responsible party becomes the TxDOT Project Construction Engineer. When a separate Pre-Letting Utility Meeting is held, it is the TxDOT Project Design Engineer's responsibility to ensure that pertinent information is conveyed at the Pre-Bid Conference. This meeting will provide a final opportunity to refine special provisions before receipt of bids. Particular attention should be given to the coordination of outstanding utility adjustments with the TxDOT sequence of work.	Letting	This meeting could be the same as (or different from) the project pre-bid conference. The project design engineer and/or the project construction engineer make that determination. If it is different from the pre-bid conference, the recommendation would be to have the pre-letting utility meeting *earlier* than the project pre-bid conference.
UCMP	Process Activity IX	Utility Meeting After Award	The primary purpose of this meeting is to transfer responsibility for the project from the TxDOT Project Design Engineer to the TxDOT Project Construction Engineer. This utility coordination meeting will occur after the contract award and before the start of construction. It may be combined with the normal TxDOT Preconstruction Conference on less complex jobs as determined by the TxDOT Project Construction Engineer. The Utility Meeting After Award provides the opportunity to identify and discuss the status of outstanding acquisition of parcels identified in the Special Provisions. It is also appropriate at this meeting to identify the various methods by which utility adjustments will be coordinated with the TxDOT project. It is important to distinguish those adjustments that are included as bid items accomplished in the TxDOT contract from those to be accomplished by the utility and coordinated with TxDOT construction. For those utilities to be adjusted outside of the TxDOT contract, discussion should focus on current status of adjustments in reference to clearance dates identified in the Special Provisions and TxDOT project sequencing necessary to accommodate the schedule. If the contractor elects to re-sequence construction activities, the TxDOT Project Construction Engineer is responsible for assuring that utility concerns are incorporated in the revised sequence of work. Discussion of utility work to be accomplished in the TxDOT contract will include coordination of inspection responsibilities with affected parties.	Construction	This meeting could be the same as (or different from) the project pre-construction conference. The project construction engineer makes that determination. If it is different from the pre-construction conference, the recommendation would be to have the utility meeting *earlier* than the project pre-construction conference.
UCMP	Process Activity X	Utility Coordination Meeting During Project Construction	This series of coordination meetings may be conducted in conjunction with regularly scheduled partnering sessions. The frequency and format of meetings for this phase of coordination are established as needed at the discretion of the TxDOT Project Construction Engineer. Continuous utility coordination during project construction is essential to minimize delays and reduce contractor claims. By establishing a forum for the regular exchange of information as the construction of the project progresses, the TxDOT Project Construction Engineer can track and thus ensure that schedules established in the Special Provisions of the contract are maintained. In the case of reimbursable adjustments, coordination with utilities is invaluable for clarifying inspection requirements and ensuring that complete information on utility personnel, materials, and equipment employed in the adjustment are recorded.	Construction	The name of the activity is confusing because it suggests there is only one utility coordination meeting during construction. In reality, there could be several utility coordination meetings (as included in the description). Utility coordination meetings could be the same as (or different from) other project meetings that take during construction. The project construction engineer makes that determination.

Table 14. Existing Right of Way Utility Adjustment Sub-Process Activities.

Level	Activity	Name	Description (Source: *ROW Utility Manual* [2])	Phase	Comment
FUP, SUP, LUP	Sub-Process Activity I	Early Right of Way Release for Utilities	To properly coordinate utility activities with advance project development, an Early Right of Way Release for Utilities must be obtained. The early right of way release provides the authority for TxDOT to incur costs for preliminary utility activities before the normal right of way release. Normal right of way release is contingent upon completion of environmental studies, route studies and receipt of the right of way map by the TxDOT ROW Division. These prerequisites may not always be complete at this point. Types of utility activities that will typically be the subject of this early release include location determination, potential conflict identification, and preliminary cost estimate preparation. Documentation is necessary to establish TxDOT internal controls for audit purposes. The early right of way release must originate with a written request that the District prepares with approval granted of the TxDOT ROW Division. Costs incurred for utility activities under the early right of way release will not be subject to Local Public Agency (LPA) participation. If Federal cost participation is requested on the project, the early utility activities must be included as components of the environmental investigations.	Preliminary Design	There is an inconsistency between the timing of this activity (according to the description) and the corresponding timing as depicted on the UCMP flowchart diagram. The UCMP flowchart diagram shows the early right of way for utilities as taking place between Preliminary Design Meeting (Process Activity III) and Field Verification (Process Activity IV). As mentioned previously, these two activities take place at the beginning of the design phase, whereas the early right of way release for utilities should take place after the Design Concept Conference and before the beginning of the detailed design phase. The first sentence suggests that an early right of way release is required for all projects.
FUP, SUP, LUP	Sub-Process Activity II	Field Verification	The purpose of the Field Verification is to determine the type, location, and ownership of utility facilities. Field Verification activities will require securing an "**Early Right of Way Release for Utilities - Right of Way Sub-Process Activity I**" to incur the associated costs if necessary. If Federal cost participation is involved in the project, reimbursable field verification activities will be considered as incidental to environmental studies for preliminary engineering up to, and including, the determination of horizontal location without excavation. Field Verification services may be provided by a Subsurface Utility Engineering (SUE) provider, by individual or groups of utilities, or by TxDOT personnel. In reference to the Right of Way Sub-Process, the involvement of right of way personnel will be to provide payment where applicable, and to assist in coordination activities incidental to payment.	Preliminary Design	As described, the scope of field verification is vague. In general terms, it seems to be consistent with QLD, QLC, or QLB investigations. However, the description suggests a scope of work consistent with preliminary engineering design requirements. This *sub-process* field verification activity is not the same as the UCMP *process* field verification activity, which is a design-phase activity and takes place after the right of way release. A suggestion would be to rename this activity to clarify the difference.
FUP, SUP	Sub-Process Activity III(a)	Federal Project Authorization and Agreement (FPAA)	The Federal Project Authorization and Agreement (FPAA) (or "FHWA Letter of Authorization") documents the approval for Federal cost participation in a right of way project. It must be obtained as a prerequisite for the TxDOT ROW Division. Necessary information for the FPAA will include the utility name(s), locations of existing facilities by station number and estimated cost of adjustment(s) by utility. The FPAA may be requested concurrently with the **Alternate Procedure Approval (Sub-Process Activity V)**.	Preliminary Design	The second sentence in the description mentions the FPAA is a prerequisite for the TxDOT Right of Way Division. However, it does not explain the purpose of that prerequisite.

Table 14. Existing Right of Way Utility Adjustment Sub-Process Activities (continued).

Level	Activity	Name	Description (Source: *ROW Utility Manual* [2])	Phase	Comment
SUP, LUP	Sub-Process Activity III(b)	TxDOT-LPA Right of Way Contracts	It is necessary to determine the authorization for the proposed adjustment of utility facilities to decide how to proceed in obtaining approval of utility adjustment agreements. It is also necessary to confirm that the LPAs will transfer responsibility to TxDOT for acquisition of right of way and utility adjustments, and/or if you have contractual documentation of LPA participation in eligible costs before you start the process of preparing an agreement assembly. When there is Federal-Aid in right of way, inclusive of utility costs, the **Federal Project Authorization and Agreement (FPAA)- Right of Way Sub-Process Activity III (a)**" is FHWA's authorization for TxDOT to assume total oversight of the utility adjustment process. When there is no federal cost participation in right of way, inclusive of utility adjustments, contractual agreements with LPA participants are required. The execution of contractual agreements establishes responsibilities for acquisition of right of way, adjustment of utilities and cost sharing between the LPA(s) and TxDOT. The type of contract to be used is determined by whether the LPA desires to administer right of way activities and payments or defer those responsibilities to TxDOT. There are two general types of contractual agreements as follows: • On non-Federal-Aid right of way projects where TxDOT is to administer the payments to utility entities, it is necessary to execute ROW-RM-129, Agreement to Contribute Funds, with the LPA. This agreement is the LPA's assignment to TxDOT of the responsibility to oversee the utility adjustment and payment process. In return, the LPA will escrow to TxDOT the agreed percentage of cost participation based on the right of way project estimate and amendments. • On non-Federal-Aid right of way projects when the LPA administers the payments to utility entities, it is also necessary to execute ROW-RM-37, Contractual Agreement for Right of Way Procurement (Local Government). This agreement allows the LPA to assume oversight of the utility adjustment payment process. In return, TxDOT will reimburse the LPA the agreed percentage of actual eligible expenditures. It is the responsibility of the TxDOT Right of Way Representative, in cooperation with the LPA, to determine and prepare the appropriate agreement for execution. The execution of this agreement by the LPA and TxDOT is a prerequisite for establishment and release of a right of way project. The type of contract selected, as it relates to utility adjustments will dictate the path to follow in **Right of Way Sub-Process Activity VI (see "LPA Agreement to Contribute Funds - Right of Way Sub-Process Activity VI.")**.	Preliminary design	There is an inconsistency in the diagrams. The LUP diagram includes a box for Sub-Process Activity III(b). However, the SUP diagram does not. There is an inconsistency with Sub-Process Activity VI, which indicates that LPA agreements to contribute funds are executed under Sub-Process Activity III(b). If this is the case, it is not clear what the purpose of Sub-Process Activity VI is.
FUP, LUP, SUP	Sub-Process Activity IV	Right of Way Release	The Right of Way Release is the TxDOT ROW Division's authorization for the District to begin right of way project activities. The Right of Way Release is a prerequisite to subsequent Right of Way Sub-Process activities required to authorize reimbursable utility adjustments. It also acts as a notice to the TxDOT Finance Division to issue fund authorization. The District initiates the request for Right of Way Release, which must be accompanied by a statement that the District is prepared to start the work. The release is conditioned upon completion of the following requirements: • Right of way map approval. • Adjustment plan. • Rodent control documentation. • Right of way project cost estimate. • Environmental release. • Executed contractual agreement, with funding if applicable.	Design	Bullets 2, 3, and 4 may not be actual requirements.

Table 14. Existing Right of Way Utility Adjustment Sub-Process Activities (continued).

Level	Activity	Name	Description (Source: *ROW Utility Manual* [2])	Phase	Comment
FUP, SUP, LUP	Sub-Process Activity V	Alternate Procedure Approval from FHWA	Where there is Federal-Aid in right of way, inclusive of utility costs, the Alternate Procedure Approval is FHWA authorization for TxDOT to assume total oversight of the utility adjustment process. Necessary information for the Alternate Procedure Approval includes the utility name(s), locations of existing facilities by station number, and estimated cost of adjustment(s) by utility. Alternate Procedure Approval may be requested concurrently with the **Federal Project Authorization and Agreement (FPAA)- Right of Way Sub-Process Activity III (a)**.	Design	The FUP, SUP, and LUP show the alternate procedure approval as taking place after the right of way release. The request for the alternate procedure approval can be submitted concurrently with the request for the FPAA (Sub-Process Activity III[a]. The most likely scenario is that the alternate procedure approval needs to be in place *before* the step that follows the right of way release (i.e., preparing utility agreement assemblies (Sub-Process Activity IX in the case of the FUP and SUP). It is not clear why this activity is needed in connection with the state or local utility procedures.
SUP	Sub-Process VI	LPA Agreement to Contribute Funds	On non-Federal-Aid right of way projects when TxDOT is to administer the payments to utilities, it is necessary to execute an ROW-RM-129, Agreement to Contribute Funds (Local Government), with the LPA. This agreement is the LPA's assignment to TxDOT of the responsibility to oversee the utility adjustment and payment process. In return, the LPA escrows to TxDOT the agreed percentage of cost participation based on the right of way project estimate and amendments. This agreement would have been executed under **TxDOT-LPA Right of Way Contracts - Right of Way Sub-Process Activity III (b)**.	Preliminary Design	The purpose of this activity is not clear because Sub-Process Activity III(b) would include executing agreements with LPA to contribute funds.
LUP	Sub-Process VII	Request for Determination of Eligibility	At their discretion, the LPA may request that TxDOT provide an advance determination of reimbursement eligibility. This request must be submitted before the LPA authorizes the work. Before the LPA makes commitments to utilities, TxDOT will confirm eligibility and establish the ratio that will be used for reimbursement to the LPA. The TxDOT ROW Division reviews the preliminary plans and estimates regarding the scope and economics of the proposed adjustment, extent of eligibility in respect to compensable interests held by the utility, eligibility of items reflected in the estimate, UAR, betterment, and other matters in order to ensure that a definite understanding is reached concerning the proposed adjustment. If the LPA chooses not to request this early determination of eligibility, the amount of reimbursement to the LPA is not determined until the work is completed and the utility owner has billed the LPA. Failure to exercise this option presents an element of risk, in that all costs incurred may not be included in the final determination of the upper limit of TxDOT cost participation and therefore would not be reimbursable. For this reason, TxDOT encourages LPAs to exercise the option to request a determination of eligibility.	Design	The LUP diagram is confusing and makes it very difficult to understand and follow the decision-making process. One of the reasons is that TxDOT's determination of eligibility is represented by a box on the diagram, but the activity does not have an activity number and is directly connected with the request for eligibility. The sub-process activity includes a note to the effect that this activity is related to Sub-Process Activity XII, Determination of Upper Limit.
LUP	Sub-Process VIII	District Approves Utility Consultant Contract	The review and approval of the utility consultant contract is a TxDOT District responsibility. This should be a comprehensive review to include: • Justification of need for service. • Qualifications of the consultant. • Scope of services to be performed. • Fee structure. Consideration should be given to continuing contracts that the utility may have with a consultant. Typically, the Utility Consultant Contract Approval will take the form of a letter to the utility from the TxDOT Utility Section.	Design	It is unclear if this is a consultant for the LPA to perform utility coordination, or a consultant for the utility owner to design an adjustment. It is unclear on what basis TxDOT could reject a utility consultant. Also unclear is whether this activity is required for all procedures.

Table 14. Existing Right of Way Utility Adjustment Sub-Process Activities (continued).

Level	Activity	Name	Description (Source: *ROW Utility Manual* [2])	Phase	Comment

FUP, SUP, LUP	Sub-Process Activity IX	Prepare Utility Adjustment Assembly for Approval	The Standard Utility Agreement Assembly is compiled by means of a cooperative effort by the District Utility liaison and the utility representatives. The goals of a Utility Agreement Assembly are as follows:
			
			• To compile a complete assembly of documentation for TxDOT approval of reimbursable utility adjustments. Payments for eligible adjustments cannot be made before TxDOT approves a completed and fully executed Utility Agreement. If an adjustment is not eligible for TxDOT cost participation, effort should be made to assist the utility through information concerning grades, scope of project, help with UAR compliance and funding alternatives such as the State Infrastructure Bank.
			• To establish property interests, reimbursement eligibility, betterment, UAR compliance, and scope of utility work. The agreement assembly must be in sufficient detail to allow reviewers to easily understand whether improvements to existing facilities are the result of the utility owner's desire to improve their facilities, or if obsolescence of material or the design of the proposed project caused these.
			• Secure documentation of the future relationship for joint use of TxDOT right of way by utility entities. The property interests defined to establish eligibility must be reviewed to determine if the utility can be allowed to continue to occupy their existing location, if their rights can be shifted within the limits of the project or if it will be necessary to quitclaim their interests to the State. TxDOT's Utility Joint Use Acknowledgement form establishes the relationship between the utility entity and TxDOT where they will continue to occupy common right of way after the adjustment.
			
			The standard utility adjustment assembly consists of:
			
			• The appropriate Standard Utility Agreement form.
			• Itemized estimate.
			• Detailed utility plans in support of estimate and sufficient for joint use purpose.
			• Appropriate property ownership form, if required.
			• Statement covering contract work, if applicable.
			• Appropriate Utility Joint Use Acknowledgement form.
			• Statements of work scheduling.
			• Statement of location of records and availability of records for audit.
			• Statement listing components of overhead rates.
			• Betterment analysis.
			• Additional documentation, as appropriate.
			
			TxDOT's joint-use form establishes the relationship between the utility and TxDOT where they continue to occupy common right of way after the adjustment. These forms must be completed according to instructions. Eligibility ratios, UAR compliance, and scope of work must be adequately defined by the detailed plans submitted as part of the Utility Agreement Assembly. Betterment and compensable interests are determined and supported by additional documentation as appropriate.
			
			The following is a current listing of forms used in conjunction with the Utility Agreement Assembly:
			
			• ROW-U-1A, ROW-U-1B, or ROW-U-1C, Affidavit of Compensable Interest, as appropriate.
			• ROW-U-84, Attorney Certificate.
			• One of the following Standard Utility Agreements:
			  ○ ROW-U-43A, Lump Sum – Local Government.
			  ○ ROW-U-43B, Actual Cost – Local Government.
			  ○ ROW-U-35, Standard Utility Agreement.
			• Either of the following Utility Joint Use Acknowledgements:
			  ○ ROW-U-JUAA, Utility Joint Use Acknowledgement.
			  ○ Form 1082, Utility Installation Request.
			• ROW-U-48, Statement (Covering Contract Work).
			• ROW-U-139, Indemnity Agreement for Fiber Optic Facility.
			• ROW-U-139A, Master Indemnity Agreement for Fiber Optic Facilities.
				Design	Lump-sum agreements require a three-way agreement under the LUP.

Table 14. Existing Right of Way Utility Adjustment Sub-Process Activities (continued).

Level	Activity	Name	Description (Source: *ROW Utility Manual* [2])	Phase	Comment
FUP, SUP, LUP	Sub-Process Activity XI	Perform Utility Adjustment	With particular emphasis placed on the proper documentation of material, labor, and equipment incorporated in the work, it is important that both TxDOT and the utility provide for proper inspection. This will also ensure compliance with the UAR. The TxDOT Utility Liaison will be responsible for assuring that adequate communication and coordination occurs between the appropriate participants to accomplish the adjustment and documentation in a competent manner.	Design	The goal at TxDOT is to complete utility adjustments prior to letting. Depending on the situation, utility adjustments can take place after the design phase is complete. Both activity descriptions and diagrams are silent on the procedure to follow when utility adjustments are included in the highway contract.
LUP	Sub-Process Activity XII	Determination of Upper Limit	When LPAs are responsible for administering utility adjustments, a Determination of Upper Limit must be made to establish the extent of TxDOT cost participation before payment. The LPA initiates the request for TxDOT to provide a determination of the upper monetary limit. Before the LPA makes payment to the utilities, TxDOT confirms reimbursement eligibility, establishes the eligibility ratio, and sets the upper monetary limit that will be used for reimbursement of utility costs paid by the LPA. The TxDOT ROW Division reviews the plans and utility billing with reference to the scope, necessity and economy of the utility adjustment, compensable interests held by the utility, eligibility of items reflected in the billing, UAR, betterment, and other matters that may be necessary to ensure that a definite understanding is reached concerning the determined limit of TxDOT cost participation. If the LPA previously opted to use a **Request for Determination of Eligibility (Right of Way Sub-Process Activity VII**), many of these prepayment requirements would have already been completed during that determination. This request is submitted after adjustment work is complete.	Design, Letting, Construction	Although the description says this activity is mandatory, it is actually a suggested activity at the discretion of the LPA.

Table 14. Existing Right of Way Utility Adjustment Sub-Process Activities (continued).

Level	Activity	Name	Description (Source: *ROW Utility Manual* [2])	Phase	Comment
FUP, SUP, LUP	Sub-Process Activity XIII	Utility Payment Process	TxDOT utility cost participation is founded in the concept of just compensation being provided in return for the acquisition of real property interests. TxDOT's payment for eligible utility adjustment costs will be made to the utility except when reimbursement is made to the LPA under the terms of the Contractual Agreement for Right of Way Procurement (Local Government). When the LPA requests payment, certification and appropriate documentation is required to indicate that they have made the appropriate reimbursement to the utility. Utility billings should be prepared and submitted in a format that is compatible with the approved estimate and in sufficient detail for analysis and documentation. The utility billing should follow the order of items in the estimate as closely as possible. The totals for labor, overhead, construction cost, travel, transportation, equipment, materials, supplies or other services will be shown in such a manner regarding permit comparison with the approved estimate. The billing will set out the approved eligibility ratio, appropriate credits and the correct Personal Identification Number (PIN), including the mail code for payment delivery. Payments are made commensurate with work performed. A variety of payment methods are available which include monthly partials, pre-approved lump sum or a single final billing upon completion of work. Partial payments may be made as frequently as each month, in an amount not to exceed 80% of the approved estimated cost of work completed to date. Lump sums are one payment of the amount stated in the approved utility adjustment assembly and is not subject to audit. Payment is most frequently based on a single final billing submitted upon completion of the utility work. This payment is subject to 10% retention pending completion of a TxDOT audit. All payment requests must be accompanied by supporting documentation. Final billings are not processed until compensable interest issues are resolved and documented through the use of Utility Joint Use Acknowledgement, Quitclaim Deed, Release of Easement, or Subordination of Mineral Lease as applicable. The utility provides a final bill within one year following completion of the utility work, otherwise previous payments may be considered final. The following is a current listing of the forms used in conjunction with the Utility Payment Process: • ROW-N-30, Quitclaim • ROW-N-85 Subordination of Mineral Lease (Non-controlled Access) • ROW-N-88, Subordination of Mineral Lease (Controlled Access) • ROW-N-17, Release of Easement • Utility Joint Use Acknowledgment, (either ROW-U-JUAA, Utility Joint Use Acknowledgment, or Form 1082, Utility Installation Request).	Design, Letting, Construction, Post-Construction	Utility Joint Use Acknowledgement is now Utility Joint Use and Occupancy.