# STRATEGIES FOR UTILITY OWNER PARTICIPATION IN TRANSPORTATION PROJECTS

# TRAINING MATERIALS

[Page is intentionally blank]

# TABLE OF CONTENTS

Page

**Module 1 – Presenter Notes** ..... 5

**Module 2 – Participant Handout** ..... 71

[Page is intentionally blank]

# MODULE 1

# PRESENTER NOTES

[Page is intentionally blank]

# MODULE 1

# PRESENTER NOTES

The following pages show the presenter notes as extracted from the PowerPoint file.

[Page is intentionally blank]

# Strategies for Utility Owner Participation

in

Transportation Projects

Texas Department of Transportation

Strategies for Utility Owner Participation (**Course Code**)

Ch 0-1

# Why is It Important?

Difficulty to locate utility facilities/identify conflicts

No legal mechanism to encourage utility owners to start participating early in the PDP

Utility owners usually interested after 60% design

Delays in project development and delivery

Unanticipated utility adjustments

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 0-2

A 2002 survey of state departments of transportation (DOTs), highway contractors, design consultants, and others identified utility adjustments as the most frequent reason for delays in highway construction. Delays and inefficiencies in utility-related activities have a tendency to proliferate into project letting and even construction, frequently resulting in higher bids, change orders and/or damage or delay claims, litigation by utility owners or agencies, safety concerns at the job site, frustration of the traveling public, and negative public perception about the project.

# Research Project 0-6624 Deliverables

0-6624-P1: Guidebook and Training Materials

– Strategies for earlier, more effective utility owner participation in the PDP

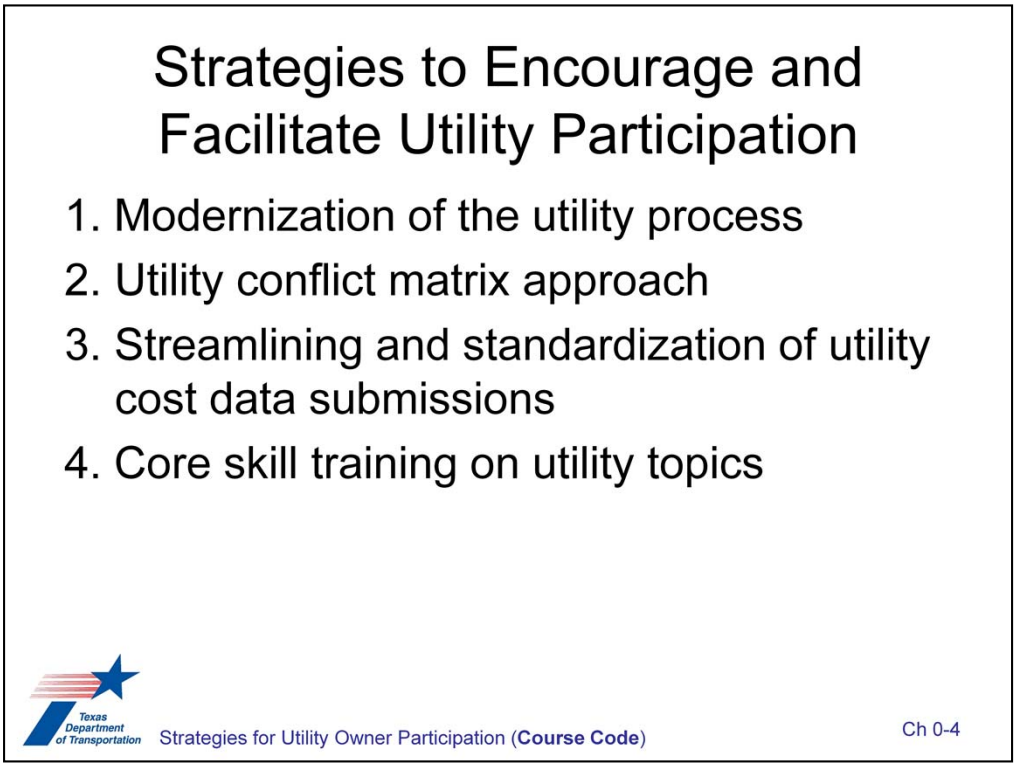
0-6624-1: Research Report

0-6624-S: Summary Report

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 0-3

Project 0-6624 resulted in three deliverables:

- 0-6624-P1: Guidebook and training materials (including this presentation).
- 0-6624-1: Research report.
- 0-6624-S: Summary report.




Project 0-6624 resulted in four strategies that reflect the highest priorities based on stakeholder inputs:

- Modernization of the utility process at TxDOT.
- Use of utility conflict matrices and associated procedures.
- Streamlining and standardization of utility cost data submissions and reimbursement process.
- Core skill training on utility topics.

Strategy 1

# MODERNIZATION OF THE UTILITY PROCESS

Strategies for Utility Owner Participation (**Course Code**)

Ch 1-1

# Current Utility Process

According to the *ROW Utility Manual*:

- Utility Cooperative Management Process – UCMP ("the process")
- Utility adjustment subprocess ("the subprocess")
  - Three adjustment procedures – with diagrams:
    - Federal Utility Procedure (FUP)
    - State Utility Procedure (FUP)
    - Local Utility Procedure (LUP)
  - One adjustment procedure – without a diagram:
    - Non-Reimbursable Procedure

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 1-2

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. 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:

- Federal Utility Procedure (FUP), which applies in situations that include federal fund participation.
- State Utility Procedure (SUP), which applies in situations that do not involve federal fund participation and TxDOT coordinates adjustments with utility owners.
- Local Utility Procedure (LUP), which applies in situations that do not involve federal fund participation and an LPA coordinates adjustments with utility owners.

The *ROW Utility Manual* also mentions a Non-Reimbursable Procedure, which applies in the case of non-reimbursable utility adjustments.

# Issues

Discrepancies between documented process and actual practice

Different practices at districts cause difficulties for utility owners spanning multiple districts

Written documentation

- Complex and difficult to follow
- Lacks flexibility
- Needs updating

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 1-3

There is a need to modernize the utility process at TxDOT. First, there are discrepancies between the manual and the actual practice at the district and division levels. Second, there are difference in the way districts carry out the utility process, which cause difficulties for utility owners that cover multiple TxDOT districts. Third, stakeholders indicated that the utility process described in the documentation is too complex and difficult to follow, lacks flexibility, and needs updating.

# Updated Utility Process

Process depiction using Business Process Model and Notation (BPMN)

Updated descriptions of activities

Three models with increasing detail:

- **Level 1**: High-level depiction of entire PDP
- **Level 2**: Intermediate-level depiction of the PDP
- **Level 3**: Level 2 with a more detailed view of the utility process

Strategies for Utility Owner Participation (**Course Code**) Ch 1-4

In response to stakeholder feedback, the researchers developed a modernized view of the utility process at TxDOT. The researchers used a standard business modeling tool called the Business Process Model and Notation (BPMN) to develop the a graphical depiction of the utility process, along with written descriptions of major activities. 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.

# Project Development and Delivery Process

Planning and programming

Preliminary design

Detailed design

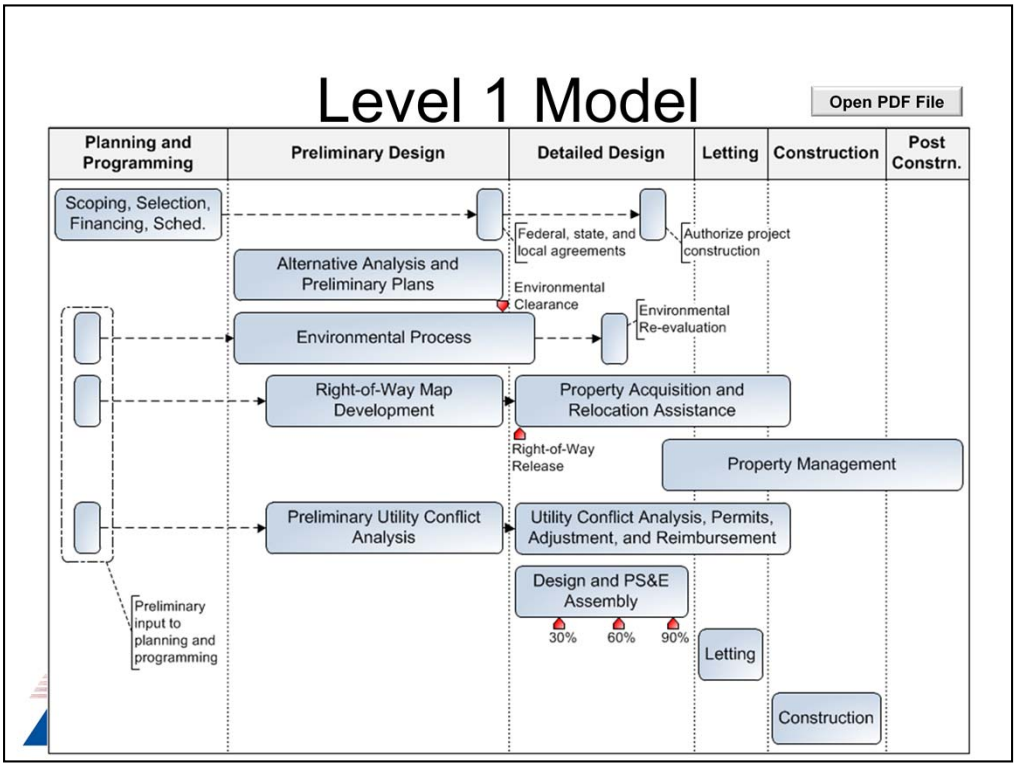
Letting

Construction

Post construction

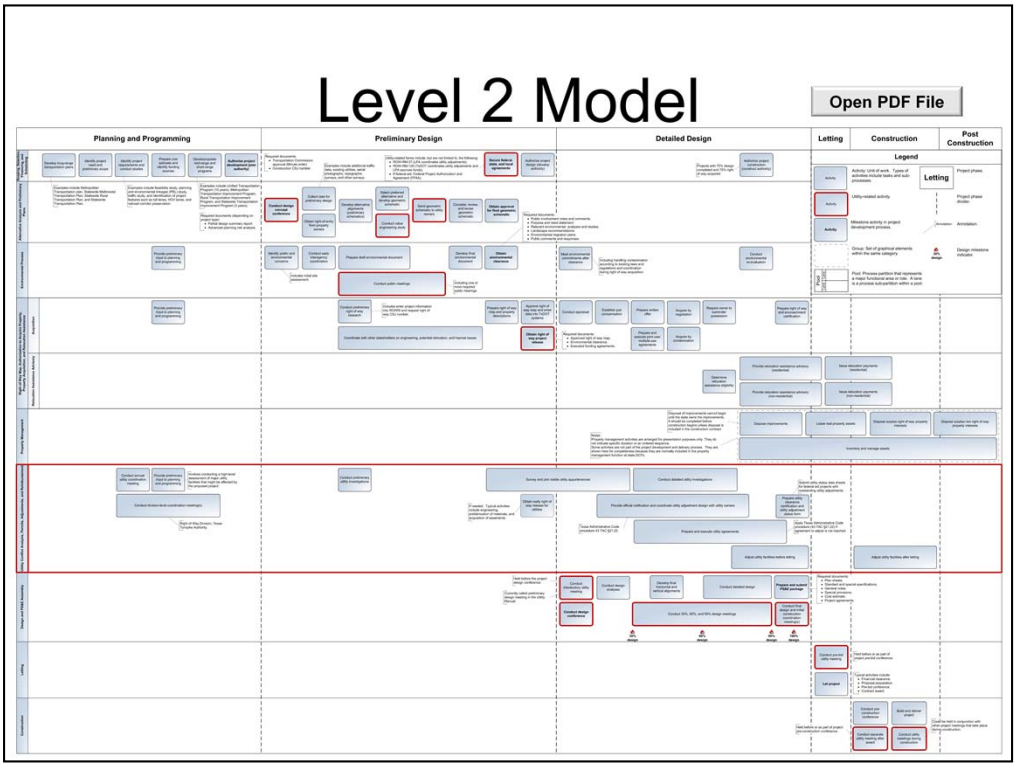
Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 1-5

In the three models, project development activities are generally organized chronologically, consistent with the six major phases in the project development and delivery process.




The Level 1 model provides a high-level view of the entire project development and delivery process. The model considers both phases and functional areas (represented by individual bars) and is suitable for general presentations and handouts. At 100-percent scale, the page size of the Level 1 diagram is 8.5 × 11 inches.

Clicking the Open PDF file button loads a PDF file that includes the Level 1, Level 2, and Level 3 diagrams. This file is located in the \Strategy 1 - Modernization of the Utility Process\ folder. The folder also includes the model in Microsoft® Visio® format.




The Level 2 model provides an intermediate level of detail of the entire project development and delivery process. At 100-percent scale, the page size of the Level 2 diagram is 24 × 36 inches. The purpose of the model is to provide more information about the entire process than Level 1, with some emphasis on right-of-way and utility activities, and how these activities relate to the rest of the project development and delivery process.

Clicking the Open PDF file button loads a PDF file that includes the Level 1, Level 2, and Level 3 diagrams. This file is located in the \Strategy 1 - Modernization of the Utility Process\ folder. The folder also includes the model in Microsoft Visio format.

The following slides provide more information about the diagram structure and content.

# Level 2 Model

Activities arranged in “pools”

– Pools represent groups of activities with similar functions

Pools divided into “lanes” as needed

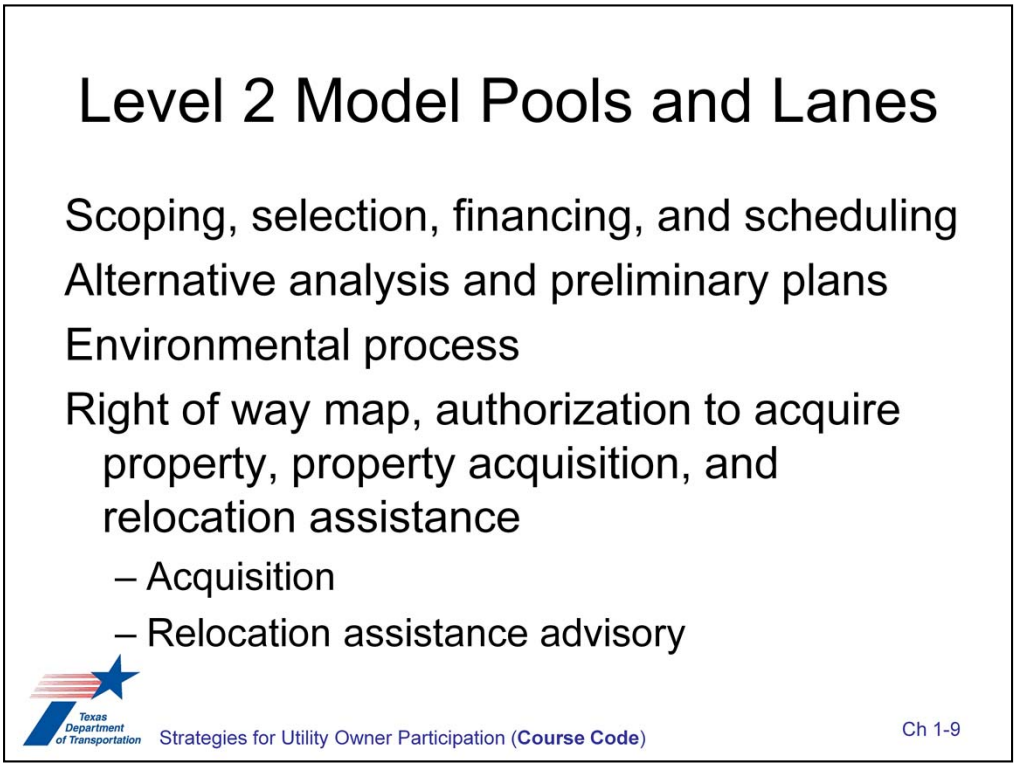
Pool with a red outline is the utility pool

Outside utility pool, activity boxes with a red outline are utility-related

Strategies for Utility Owner Participation (**Course Code**)

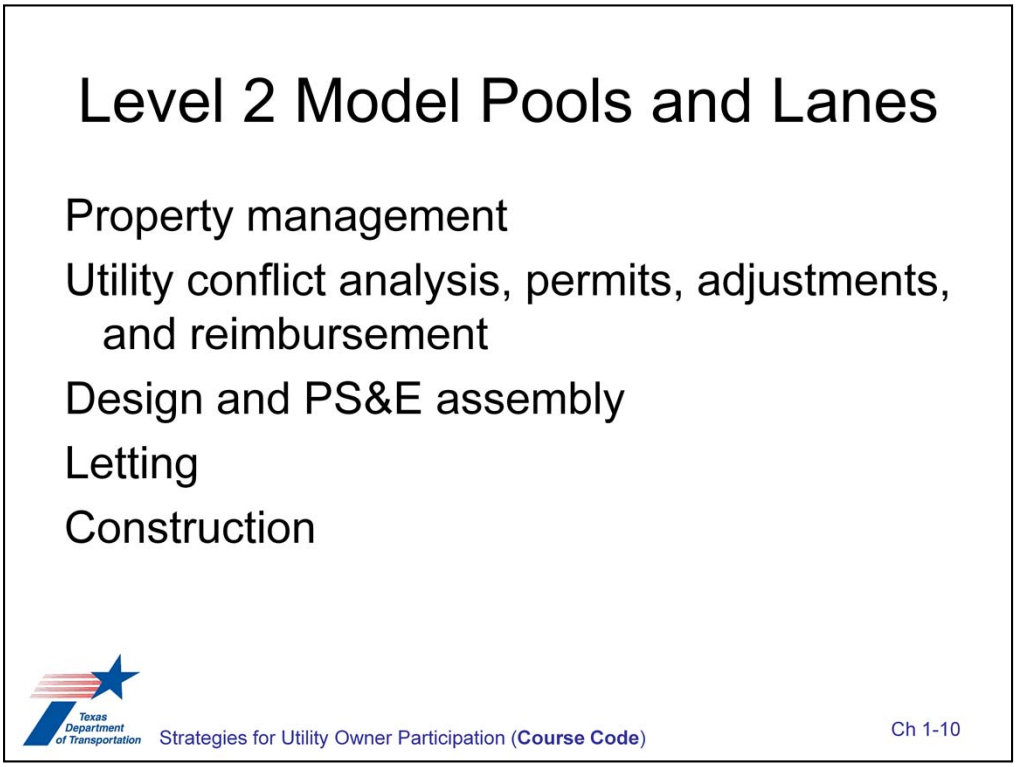
Ch 1-8

In the Level 2 model, 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.



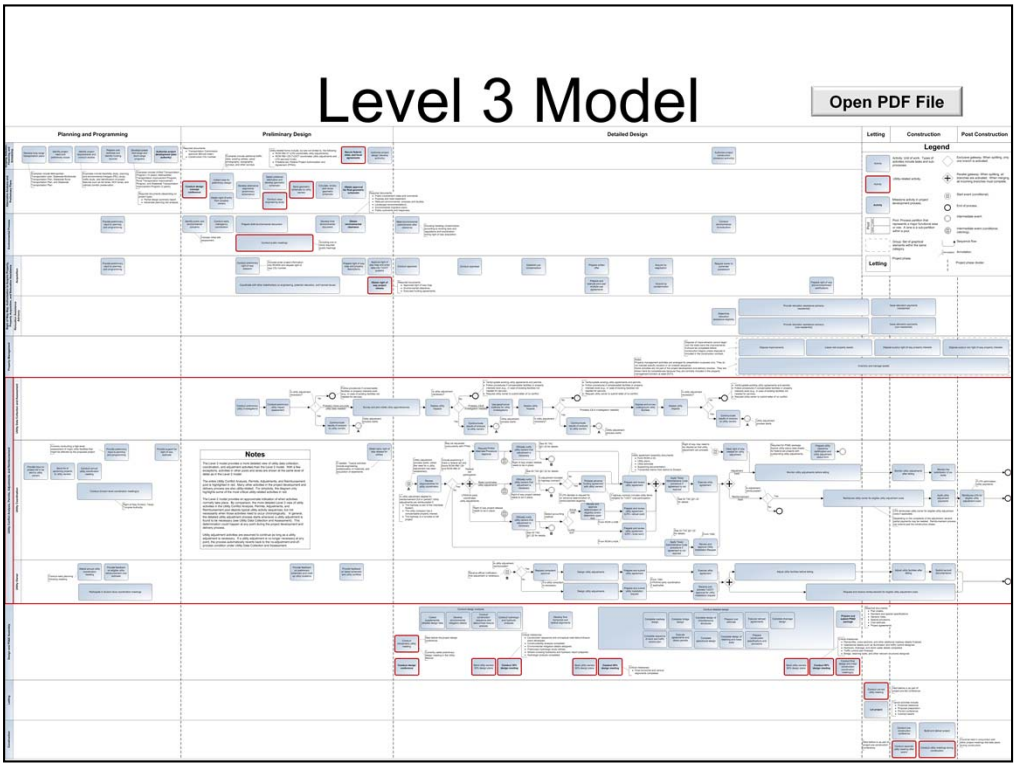

The Level 2 model includes the following major phases or functional areas:

- Scoping, selection, financing, and scheduling.
- Alternative analysis and preliminary plans.
- Environmental process.
- Right of way map, authorization to acquire property, property acquisition, and relocation assistance, which is further divided into two lanes:
  - Acquisition.
  - Relocation assistance advisory.
- Property management.
- Utility conflict analysis, permits, adjustments, and reimbursement.
- Design and PS&E assembly.
- Letting.
- Construction.




The Level 2 model includes the following major phases or functional areas:

- Scoping, selection, financing, and scheduling.
- Alternative analysis and preliminary plans.
- Environmental process.
- Right of way map, authorization to acquire property, property acquisition, and relocation assistance, which is further divided into two lanes:
  - Acquisition.
  - Relocation assistance advisory.
- Property management.
- Utility conflict analysis, permits, adjustments, and reimbursement.
- Design and PS&E assembly.
- Letting.
- Construction.




The Level 3 model is essentially the same as the Level 2 model, except that it provides a more detailed view of utility data collection, coordination, and adjustment activities. At 100-percent scale, the page size of the Level 3 diagram is 36 x 48 inches.

Clicking the Open PDF file button loads a PDF file that includes the Level 1, Level 2, and Level 3 diagrams. This file is located in the \Strategy 1 - Modernization of the Utility Process\ folder. The folder also includes the model in Microsoft Visio format.

# Level 3 Model Pools and Lanes

Same pools as Level 2 model

Outside of utility pool, activities same as Level 2 model

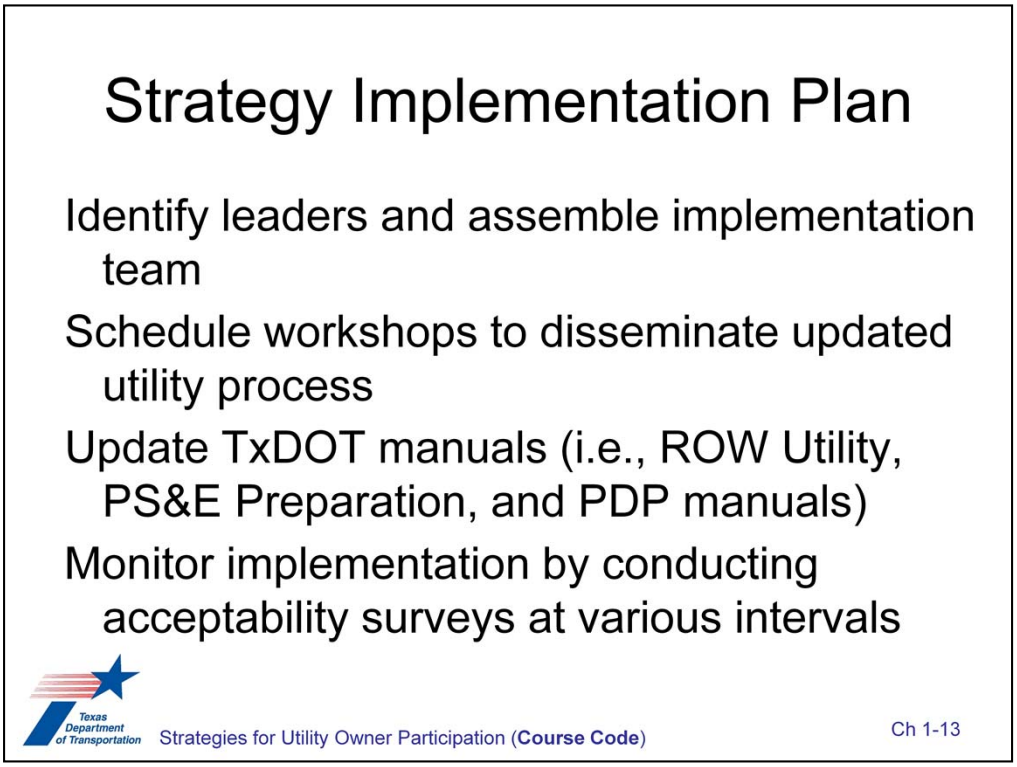
Additional lanes for utility conflict analysis, permits, adjustments, and reimbursement

- Utility data collection and assessment
- Utility coordination
- Utility owner

Strategies for Utility Owner Participation (**Course Code**)

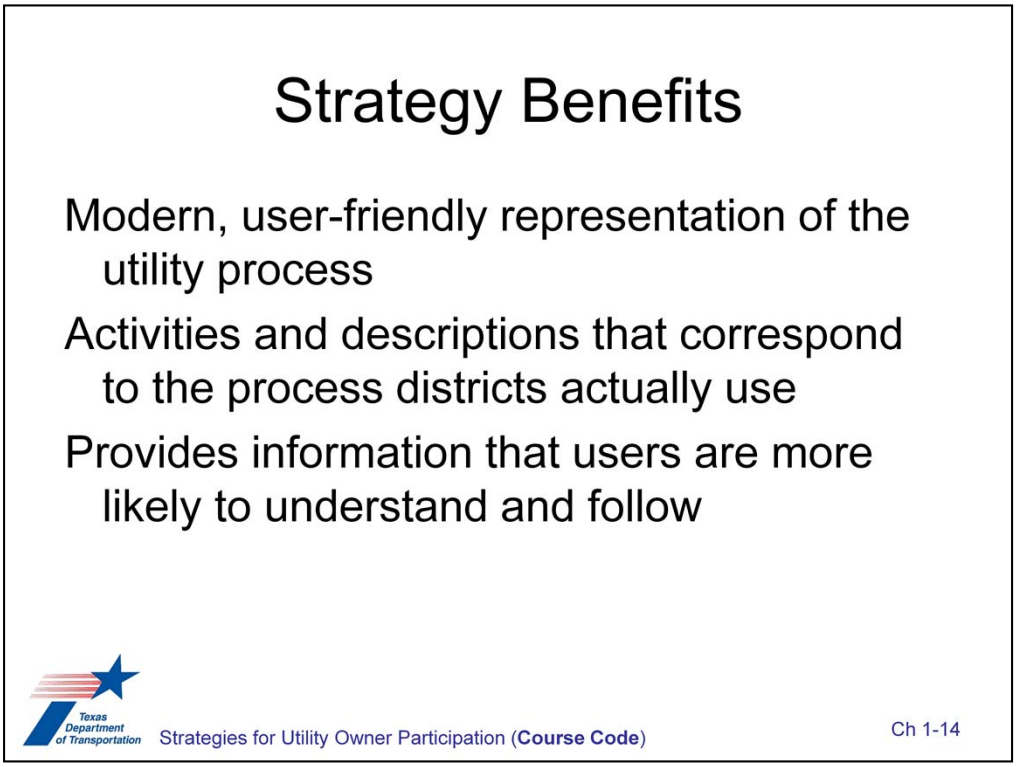
Ch 1-12

The level 3 model contains the same pools as level 2 model. For Level 3, the Utility Conflict Analysis, Permits, Adjustments, and Reimbursement pool is divided into three lanes: Utility Data Collection and Assessment, Utility Coordination, and Utility Owner. With a few exceptions, activities in other pools and lanes are shown at the same level of detail as in the Level 2 model.



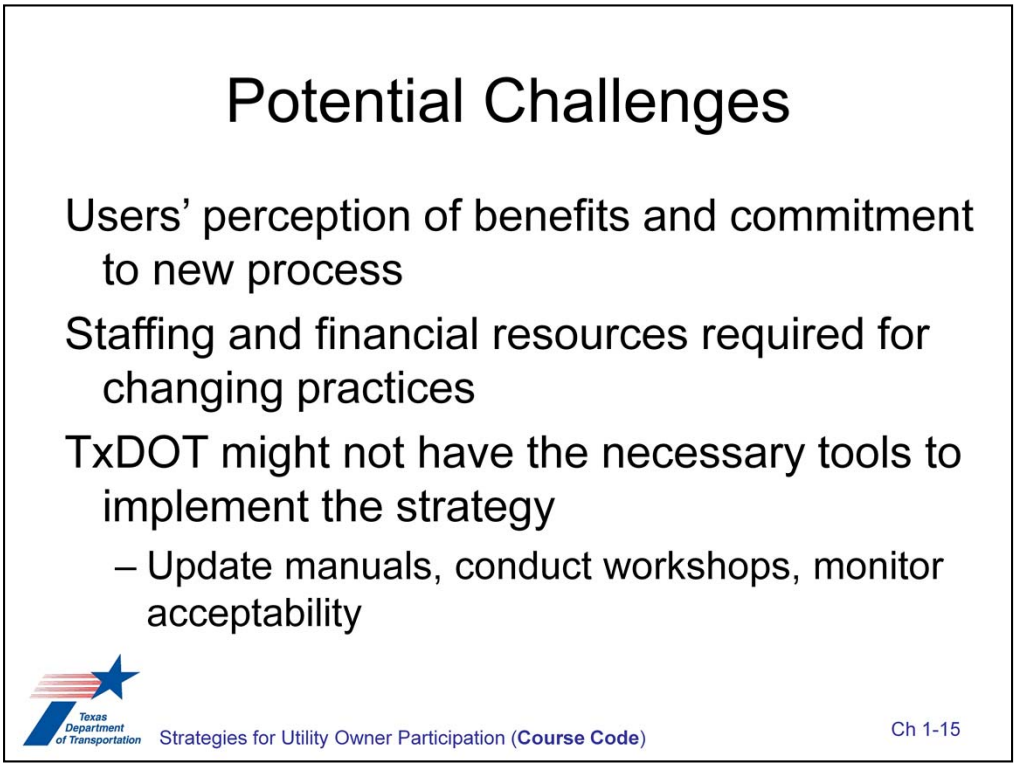

The following are recommendations to implement the modernized depiction of the utility process at TxDOT:

- Identify leaders for the implementation and assemble an implementation team. The Right of Way Division can be the main champion and office of primary responsibility for the implementation.
- Schedule workshops throughout the state to disseminate the updated utility process.
- Update the *ROW Utility Manual* by inserting and/or replacing content, as described in the guidebook..
- Update the *PS&E Preparation Manual* to reflect changes made to the *ROW Utility Manual*.
- Update the *Project Development Process Manual* to reflect changes made to the *ROW Utility Manual*.
- Monitor the implementation of the strategy by conducting acceptability surveys throughout the implementation period.




Anticipated benefits of the strategy include the following:

- Modern, user-friendly representation of the utility process. The updated depiction of the utility process uses clear, easy-to-follow graphical representations of the process complemented by summarized descriptions of critical activities. It eliminates the use of process/sub process diagrams and activity descriptions that make understanding the utility process difficult.
- Activities and activity descriptions that correspond to the process that districts actually use. The new depiction corrects inaccuracies or deficiencies in the current documentation as well as inserts activities that are part of actual practice or that have been recommended as improvements or optimizations of the current practice.
- Provides information that users are more likely to understand and follow, therefore promoting a more effective participation by utility owners in the project development process.




Potential impediments for the implementation of this strategy include:

- Users might decide to ignore the updated utility process in favor of existing practices they have used for years.
- Staffing and financial resources required for changing current practices.
- TxDOT might not have the necessary tools to implement the strategy.

Strategy 2

# UTILITY CONFLICT MATRIX APPROACH

Texas Department of Transportation

Strategies for Utility Owner Participation (**Course Code**)

Ch 2-1

# Strategies to Encourage and Facilitate Utility Participation

1. Modernization of the utility process
2. **Utility conflict matrix approach**
3. Streamlining and standardization of utility cost data submissions
4. Core skill training on utility topics

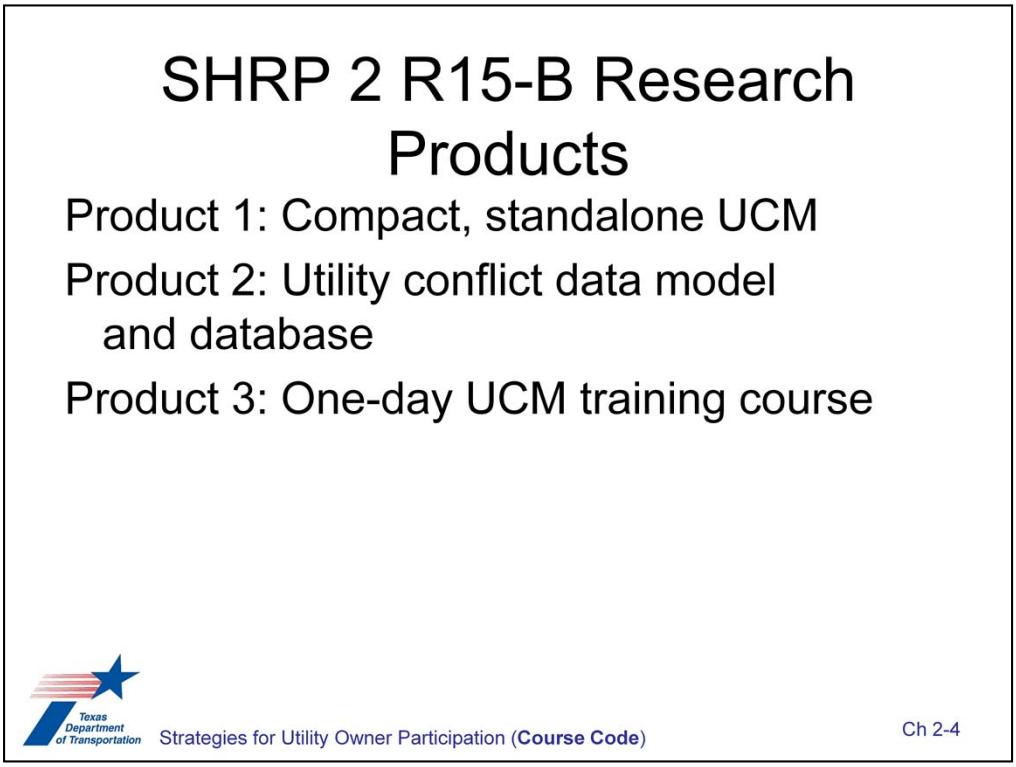
Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-2

# Utility Conflict Matrices (UCMs)

- Utility-related activities involve enormous amount of data and supporting documents
- UCMs enable users to organize and track utility conflict data effectively
- UCMs can support a wide range of related processes

Strategies for Utility Owner Participation (**Course Code**) Ch 2-3

Utility-related activities in the project development process involve the production and exchange of enormous amount of data and supporting documents, including schematics, design files, agreements, and certifications. A critical component of this process is how to document and manage utility conflict data effectively. Utility conflict tables, also known as utility conflict matrices (UCMs) or utility conflict lists, enable users to organize and track utility conflict data. In practice, these tables or matrices support a wide range of related processes, including conflict analyses, utility agreement development, construction letting, as well as utility relocation scheduling, billings, and payments.




As part of the Strategic Highway Research Program (SHRP) 2 Research Project R15-B "Identification of Utility Conflict and Solutions," TTI researchers conducted research to review the state-of-the-practice around the country, identify recommendations for best practices, develop and test a prototype UCM concept, and develop training materials and implementation guidelines. the research resulted in the following products:

- Product 1: 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.
- 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.
- Product 3: UCM training course and course materials. This deliverable is a one-day training course that provides an overview of utility conflict issues and use of the UCM. The one-day UCM training course is divided into six lessons, designed for a total of seven hours and 15 minutes of instruction, from 8:30 AM to 3:45 PM.

# Product 1: Utility Conflict Matrix

Open PDF File

## MS Excel format, includes drop-down lists

| Utility Owner and/or Contact Name | Conflict ID | Drawing or Sheet No. | Utility Type | Size and/or Material | Utility Conflict Description | Start Station |
|---|---|---|---|---|---|---|
| AT&T | 1 | U-1 | Telephone | Fiber Optic | Conflict with construction of frontage road widening. | 21+00 |

| End Station | Start Offset | End Offset | Utility Investigation Level Needed | Test Hole | Recommended Action or Resolution | Estimated Resolution Date | Resolution Status |
|---|---|---|---|---|---|---|---|
| 22+00 | 45' Lt | 45' LT | QLC | | Relocation before construction. | 3/8/2010 | Utility conflict identified. |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-5

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 UCM could be used in a number of ways to support the utility conflict management process. It 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 cost estimate analysis sheet to identify, document, and track optimum utility conflict resolution strategies.

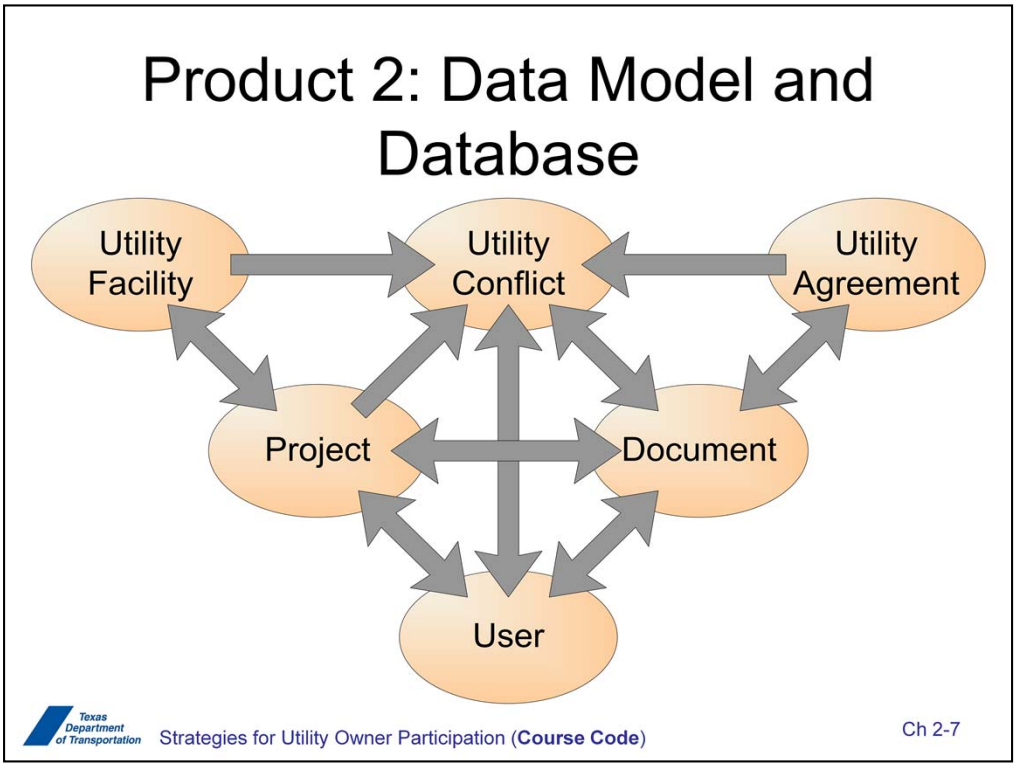
Clicking the Open PDF file button loads a PDF file representation of the UCM. This file is located in the \Strategy 2 - Utility Conflict Matrix Approach\ folder. The folder also includes the UCM in Microsoft Excel® format.

# Product 1: Cost Estimate Analysis

| Alternative Number | Engineering Cost (Utility) | Direct Cost (Utility) | Engineering Cost (DOT) | Direct Cost (DOT) | Total Cost | Feasibility | Decision |
|---|---|---|---|---|---|---|---|
| 0 | $ 10,375.00 | $ 63,875.00 | $ - | $ - | $ 74,250.00 | Yes | Selected |
| 1 | $ 7,875.00 | $ 32,375.00 | $ - | $ - | $ 40,250.00 | No | Rejected |
| 2 | $ - | $ - | $ 95,375.00 | $ - | $ 95,375.00 | No | Rejected |
| 3 | $ - | $ - | $ - | $ - | $ - | No | Rejected |
| 4 | $ 10,375.00 | $ 63,875.00 | $ - | $ - | $ 74,250.00 | No | Rejected |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-6

One of the data items in the initial version of the standalone UCM was cost estimate. During work sessions with a sample of states to discuss properties and features of the UCM, it became clear that having just one field to capture costs was not adequate. For example, this field would not enable an accurate depiction of which agency would be responsible for which costs. It would also not document the process used to select a utility conflict resolution strategy. This realization resulted in the need to use a second table to analyze costs and other elements associated with each utility conflict resolution strategy. This slide shows the design of the subsheet developed as part of the research.




As mentioned previously, Product 2 is a data model for managing utility conflicts and a prototype Access database that provides a physical representation of the data model. The data model is generic and was built using industry standard procedures. The data model is in ERwin Data Modeler format, and can be easily exported to a variety of database environments (e.g., Oracle, SQL Server). In this case, the UCM is actually one of many queries or reports possible.

Based on the conceptual model, 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, including queries and reports to replicate the standalone Excel UCM as well as a sample of UCMs from around the country. 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 provided by the states and fine tuning the data model as needed.

# Product 2: Example

Texas Transportation Institute

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

**Reviewed By:** _____ **Date:** _____

| End Offset | Utility Investigation Level Needed | Test Hole No. | Recommended Action or Resolution | Responsible Party | Estimated Resolution Date | Resolution Status | Cost Analysis |
|---|---|---|---|---|---|---|---|
| 45' Lt | QLC | | Relocation before construction. | U | 3/8/2010 | Utility conflict identified | Detail |
| 37' Rt | QLC | | Relocation before construction. | U | 3/8/2010 | Utility conflict identified | Detail |
| 48' Rt | QLC | | Relocation before construction. | U | 3/8/2010 | Utility conflict identified | Detail |
| 48' Rt | QLC | | Relocation before construction. | U | 3/8/2010 | Utility conflict identified | Detail |
| 49' Lt | QLB | | Design change. | D | 3/8/2010 | Utility owner informed of utility conflict | Detail |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-8

This slide shows an example utility conflict matrix report in report view generated by the Product 2 database. Note the buttons on the right labeled “Detail,” which provide a link to cost estimate analysis sub reports.

# Product 2: Example

ution Alternatives

e Analysis

Texas Transportation Institute

**Date:** 11/24/2010

**Project Owner:** Texas Department o
**Project No.:** 1234-56-789
**Project Description:** Road construction p
**Highway or Route:** I-10 Katy Freeway

| | |
|---|---|
| **Conflict ID:** | 1 |
| **Utility Owner:** | AT&T |
| **Utility Type:** | Telephone |
| **Size and/or Material:** | Fiber Optic |
| **Project Phase:** | 60% Design |

| Alternative Number | Alternative Description | Party | Engineering Cost (Utility) | Direct Cost (Utility) | Engineering Cost (DOT) | Direct Cost (DOT) | Total Cost | Feasibility | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Relocation before construction. | No c no a | $10,375.00 | $63,875.00 | $0.00 | $0.00 | $74,250.00 | Yes | Selected |
| 1 | Protect in-place. | | $7,875.00 | $32,375.00 | $0.00 | $0.00 | $40,250.00 | No | Rejected |
| 2 | Design change. | | $0.00 | $0.00 | $95,375.00 | $0.00 | $95,375.00 | No | Rejected |
| 3 | Exception to policy. | | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | No | Rejected |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-9

This slide shows sample records for the cost estimate analysis in connection with the first utility conflict from the previous slide.

# Product 2: Other Potential Reports

All utility conflicts associated with company X (project, corridor, or timeframe)

Average conflict resolution time for type X utilities

All utility conflicts with resolution time >100 days

Customized UCMs for individual utility companies

Utility certification for inclusion in PS&E package

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-10

One of the advantages of using a database approach for the management of utility conflicts is that it is possible to generate all kinds of reports. This slide shows a sample of additional reports that are possible with the prototype database design developed during the research.

# Utility Conflict Event Tracking

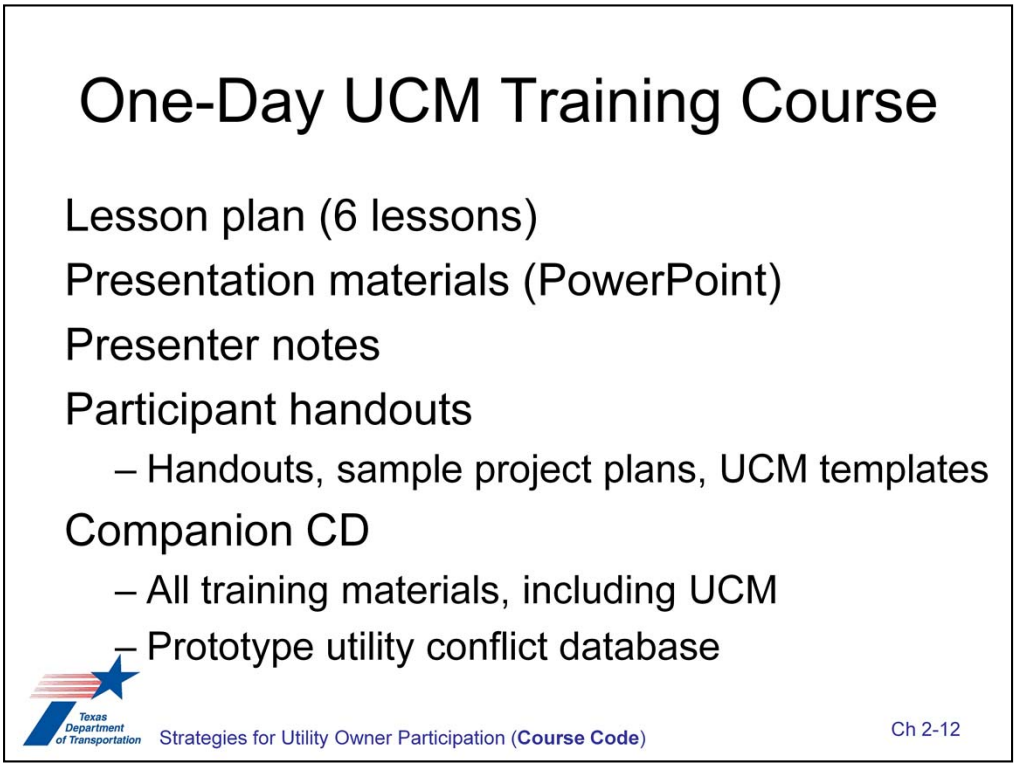
| | | | |
|---|---|---|---|
| 0 | Utility conflict identified | 15 | Required adjustment completion |
| 1 | Comment created | 16 | Estimated adjustment completion |
| 2 | Utility owner informed of utility conflict | 17 | Scheduled adjustment completion |
| 3 | Utility conflict resolved | 18 | Notice to proceed to utility owner |
| 4 | Utility owner acknowledges receipt of document | 19 | Adjustment construction start |
| | | 20 | Adjustment construction end |
| 5 | Document requested | 21 | Permit application |
| 6 | Document sent | 22 | Permit approved |
| 7 | Document received | 23 | Exception requested |
| 8 | Document reviewed | 24 | Exception approved |
| 9 | Document certified | 25 | Plans sufficient sent to utility owner |
| 10 | Document approved | 26 | 30-day notice submitted |
| 11 | Document uploaded | 27 | 90-day notice submitted |
| 12 | Document review, comment, and appro | 28 | Utility conflict resolution strategy selected |
| 13 | Utility coordination meeting | 29 | Utility relocation under construction |
| 14 | ROW cleared for adjustment | 30 | Utility conflict archived |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-11

The database also enables users to track critical events (time stamps) occurred in connection with a utility conflict, such as:

- Utility conflict created.
- Utility owner informed of utility conflict.
- Utility conflict resolution strategy selected.
- Notice to proceed with utility relocation.
- Utility relocation started.
- Utility relocation ended.
- Utility conflict resolved.

The list of event types is flexible to accommodate the needs of a wide range of DOTs.

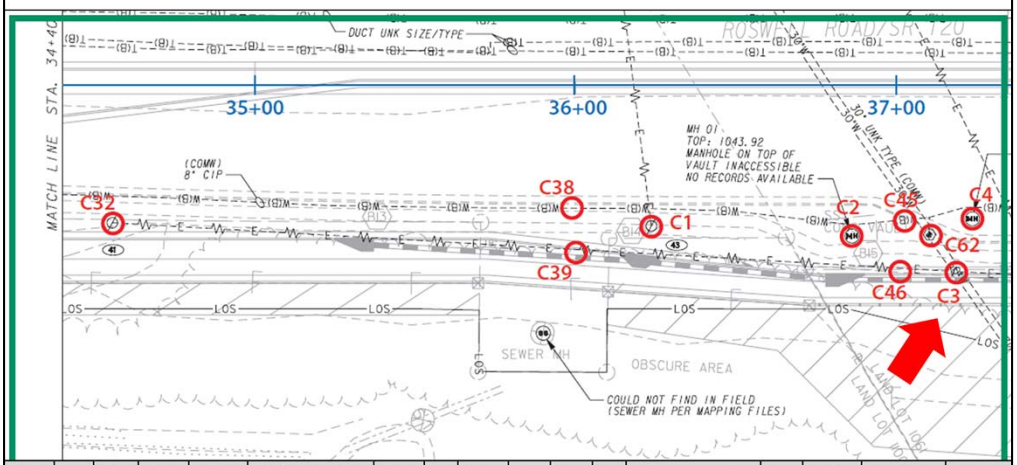



To assist with the dissemination of the research products, the research team developed a one-day UCM training course that includes the following features:

- Lesson plan (6 lessons)
- Presentation materials in PowerPoint format
- Presenter notes
- Participant handouts, including presentation handouts, sample project plans, and UCM templates
- Companion CD, which includes all the training materials and a copy of the prototype utility conflict database.

The presentation materials follow NHI presentation templates.

# Hands-On Utility Conflict Analysis

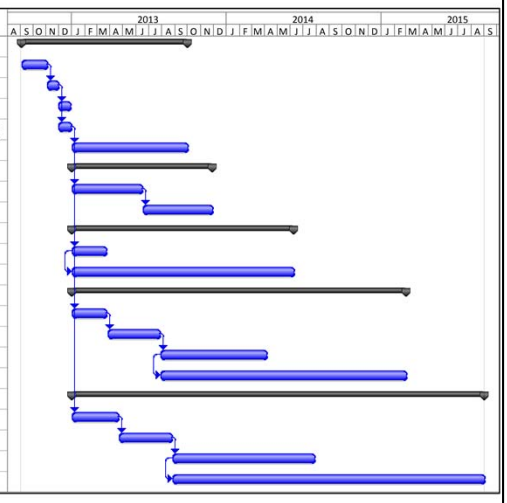



| Utility Owner | ID | Sheet No. | Utility Type | Size/ Material | Utility Conflict Description | Start Sta. | End Sta. | Start Offset | End Offset | Inv. Need | Test Hole | Recommended Action | Rsp. Party | Est. Res. Date | Res. Status | Cost Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C3 | 1 | WM | 30" | Proposed 18" drainage pipe would cross WM. | 37+20 | | 60' Rt | | QLA | 3 | Review possibility of adjusting drainage pipes up to avoid conflict, lowest structure (B13) is at 5.6'. | D | n/a | Utility conflict identified. | |

A critical component of the UCM training course is the hands-on utility conflict analysis where participants analyze a set of plan sheets and other documentation to identify the location of utility conflicts and use a UCM to document and manage each conflict. At the end of the hands-on exercise, participants are given a copy of the “solution sheet” that shows the location of all utility conflicts (shown here) and sample UCM records.

# Implementation Plan

| ID | WBS | Task Name |
|---|---|---|
| 1 | **1** | **Implementation Team** |
| 2 | 1.a | Assemble TxDOT implementation task force |
| 3 | 1.b | Conduct training session with task force |
| 4 | 1.c | Develop implementation plan |
| 5 | 1.d | Establish progress milestones, targets, responsibilities, and funding |
| 6 | 1.e | Promote research products |
| 7 | **2** | **UCM Training Course** |
| 8 | 2.a | Conduct UCM training courses at selected districts or regions |
| 9 | 2.b | Transition UCM training course to long-term training mechanism |
| 10 | **3** | **Standalone UCM Spreadsheet** |
| 11 | 3.a | Select district implementation leaders |
| 12 | 3.b | Conduct and monitor implementation |
| 13 | **4** | **Standalone UCM Access Database** |
| 14 | 4.a | Select districts and district implementation leaders |
| 15 | 4.b | Identify user and system needs |
| 16 | 4.c | Develop and test user interfaces |
| 17 | 4.d | Conduct and monitor implementation |
| 18 | **5** | **Enterprise-Level UCM Solution** |
| 19 | 5.a | Develop detailed implementation plan |
| 20 | 5.b | Identify user and system needs |
| 21 | 5.c | Develop and test user interfaces |
| 22 | 5.d | Conduct and monitor implementation |




Texas Department of Transportation

Strategies for Utility Owner Participation (**Course Code**)

Ch 2-14

This slide shows a preliminary view of the implementation schedule and main activities. For visualization purpose, the figure shows the different components being implemented in parallel. This schedule could easily be modified as needed.

# Anticipated Value and Implementation Cost

| Implementation Product | Value | Cost |
|---|---|---|
| Product 1<br>(standalone UCM, MS Excel) | 20 | $ |
| Product 3<br>UCM training course | 40 | $$ |
| Product 2<br>(standalone implementation, MS Access) | 50 | $$$ |
| Product 2<br>(enterprise-level implementation) | 80 | $$$$ |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-15

This slide shows the expected value and implementation cost of each product. The standalone Excel UCM template (i.e., Product 1) and the one-day UCM training course (i.e., Product 3) are what could be called “low-hanging fruit.” These two products are ready for implementation, and the corresponding implementation cost is low. By comparison, the UCM data model and database representation (i.e., Product 2), while ready for implementation, would require selecting a system platform and developing graphical user interfaces to enable users to interact with the database. Depending on the level of implementation of this product (e.g., standalone Microsoft Access database versus an enterprise web-based system), the implementation cost and horizon could vary substantially.

Value: Subjective measure of the product’s potential to assist an agency in managing utility conflicts effectively. The value scale is 1 (lowest) to 100 (highest).

Cost: Subjective measure of the anticipated cost to implement a product at a transportation agency. The cost scale is $ (lowest) to $$$$ (highest).

# "So What" Questions

What's different about these new tools?

What new capabilities will they provide?

Will they be more difficult to use?

Will they require special training or operation only by specially-trained people?

How will the costs to use these tools compare with those of today's tools?

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-16

# Answers

Systematic treatment of utility conflicts

More effective PDP integration

Easy to use given a correct implementation

Training for all stakeholders is recommended to realize benefits of UCM implementation

Slightly higher front-end costs but potentially much lower costs at the end

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-17

# Potential Challenges

District project managers might not perceive tangible economic benefit

Lack of financial resources to implement strategy

Inconsistent use of UCMs

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 2-18

Strategy 3

# STREAMLINING AND STANDARDIZATION OF UTILITY COST DATA SUBMISSIONS

Texas Department of Transportation

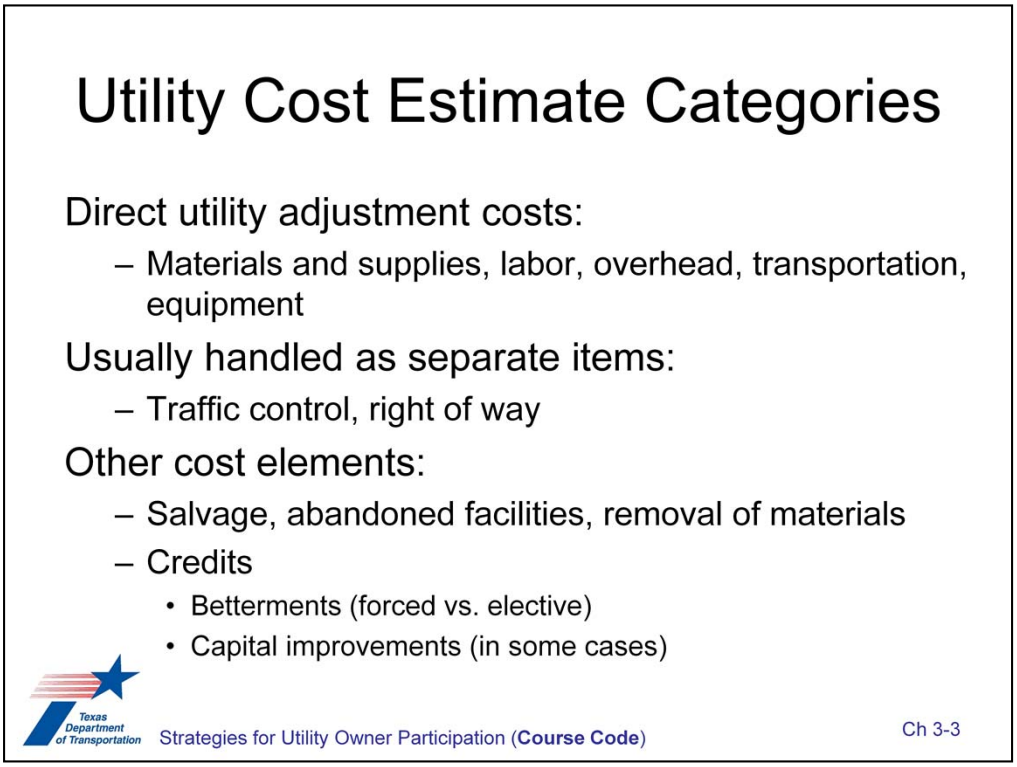
Strategies for Utility Owner Participation (**Course Code**)

Ch 3-1

# Strategies to Encourage and Facilitate Utility Participation

1. Modernization of the utility process
2. Utility conflict matrix approach
3. **Streamlining and standardization of utility cost data submissions**
4. Core skill training on utility topics

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 3-2




Most utility agreements at TxDOT follow the traditional cost category-based approach, in which cost estimates must be broken down into different cost categories. Some of the categories are part of the direct cost to complete the relocation in the field (e.g., materials, supplies, equipment, and so on). Other categories are frequently handled separately as separate items (e.g., traffic control and mobilization), although it is also common to include these items as subsidiary items to other cost elements. Cost estimates must also include elements such as salvage and removal of materials as well as betterments and capital improvements (if appropriate).

It is worth noting that federal and state regulations now enable utility owners to submit cost estimates using a quantity-unit cost approach. In practice, most cost estimates are still prepared using the traditional cost category approach.

**Betterment-Included Estimate**

| | | |
|---|---|---|
| Alpha Construction Co. | | |
| 6,000 feet of 12-inch Water Main | $335,000 | |
| 6,000 feet of 6-inch Sewer Main | $66,700 | |
| Forced Betterment | $16,300 | |
| Beta Inc. Engineering Total Fee | $15,000 | |
| Gamma Surveying Ltd. Fee | $2,500 | |
| Easement Acquisition Cost | $4,500 | $440,000 |

**In-Kind Replacement Estimate**

| | | |
|---|---|---|
| Alpha Construction Co. | | |
| 6,000 feet of 4-inch Water Main | $207,000 | |
| 6,000 feet of 6-inch Sewer Main | $66,700 | |
| Forced Betterment | $16,300 | |
| Beta Inc. Engineering Total Fee | $11,000 | |
| Gamma Surveying Ltd. Fee | $2,500 | |
| Easement Acquisition Cost | $4,500 | $308,000 |
| Betterment Amount | | $132,000 |
| Elective Betterment Credit: | $132,000/$440,000 = 0.3000 | |
| Accrued Depreciation Credit | $0 | |
| Salvage Credit | $0 | |

Current Installation ROW Summary:

| Sheet No. | State ROW | Private ROW | Unit |
|---|---|---|---|
| D-1 | 200 | 1,300 | feet |
| D-2 | 100 | 1,000 | feet |
| D-3 | 400 | 1,100 | feet |
| D-4 | 500 | 1,400 | feet |
| **Total** | **1,200** | **4,800** | **feet** |

| | | |
|---|---|---|
| Total ROW: | 6,000 feet | |
| Eligibility Ratio: | 4,800/6,000 = 0.8000 | |
| Amount eligible for state cost participation: | $308,000 × 0.8000 | $246,400 |

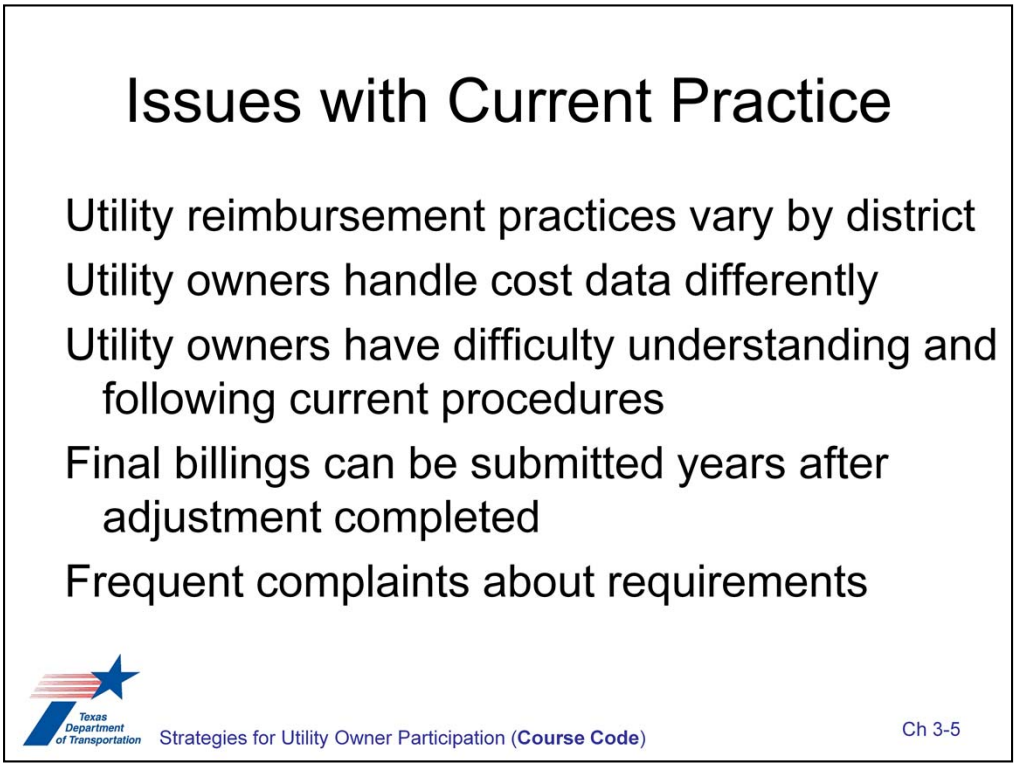
Texas Department of Transportation

Strate

Ch 3-4

The end result of the cost estimation process is a summary that includes direct costs as well as cost elements such as betterments and eligibility calculations. This slide shows a sample estimate summary. Notice that this table does not provide a disaggregation of direct costs (which the utility owner or its consultant would need to provide to support the numbers shown).

In the example, it is necessary to adjust a 4-inch water main and a 6-inch gravity sewer main. Both facilities are located partly on state right-of-way (1,200 feet) and partly on a private easement (4,800 feet) with a total estimated length of 6,000 feet. The utility owner would like to upgrade the diameter of the water line to 12 inches. To adjust the lines, the utility owner needs to acquire a new easement on private property. Further, the meters used in the original installation no longer comply with local codes and need replacement with an upgraded version that is more expensive. The estimate assumes that mobilization and traffic control costs are included as subsidiary items in the bids for the installation of the water and sewer mains. To calculate the amount eligible for state participation, the utility owner submits an in-kind estimate and a betterment estimate, along with information of the existing utility's location on public and private rights-of-way. Only the portion of the facility located on the private easement (4,800 feet) is eligible for reimbursement.




Issues related to the current practice for preparing and submitting utility cost data include, but are not limited to, the following:

- Utility reimbursement practices vary from district to district.
- Utility owners handle cost data in a variety of ways, which means costs may be broken down and submitted in different formats.
- Current procedures require billings to match the estimate. However, actual bids for utility work are often different from what utility owners submitted originally for the utility agreement.
- Utility owners complain that current requirements for the submission of cost estimates, as described in the *ROW Utility Manual*, are difficult to understand and follow.
- Final billings are frequently submitted years after the adjustment is completed in the field. In other cases, utility owners do not submit final billings at all.
- Utility owners frequently complain about documentation requirements, e.g., those associated with partial payments.

## Updated Framework for Developing Utility Cost Estimates

Benefits:

- Support for cost estimates at various phases during the project development process
- Reduction in uncertainty and risk
- Less contentious relationship between TxDOT and utility owners

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 3-6

Implementing an updated framework for the development of utility adjustment cost estimates with the goal to address limitations in the current process 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 at TxDOT.
- More effective, less contentious relationship between TxDOT and utility owners.
- 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.

# Unit Costs vs. Cost Categories

(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** | | | $C_T$ |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 3-7

Using cost categories or quantities/unit costs should produce the same total cost estimate. In practice, it should be possible 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). The key behind this assumption is to divide the project into tangible construction items that can be managed in the field.

Table (a) shows a cost estimate disaggregated by items and cost categories. For simplicity, the table only shows five categories (materials, labor, overhead, transportation, and equipment), although additional cost categories could be added. Table (b) shows the same cost estimate disaggregated by items, quantities, and unit costs. Notice how the total cost associated with each item (last column) is the same regardless of the procedure to develop the cost estimate.

# Cost Estimate Progression

| | | Utility Adjustment Phase | | | | |
|---|---|---|---|---|---|---|
| | | Planning and Programming (Highway Project) | Preliminary Design (Highway Project) | Utility Adjustment Design | Utility Adjustment Letting/Contract | Utility Adustment |
| | | **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% |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 3-8

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, this figure 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 the figure correspond to contingency levels that are commonly used in the highway construction industry.

# Prototype Utility Cost Estimate Submission Forms

Microsoft Excel file with four integrated worksheets

Open PDF File

- Items
- Unit Cost Analysis
- Item Disaggregation Analysis
- Cost Category Summary

Texas Department of Transportation Strategies for Utility Owner Participation (Course Code) Ch 3-9

To assist in the process of submitting standardized utility cost estimates, the researchers prepared a Microsoft Excel file with four integrated worksheets.

Clicking the Open PDF File button loads a PDF file representation of the utility cost estimate template. This file is located in the \Strategy 3 - Standardization of Utility Cost Data Submissions\ folder. The folder also includes the template in Microsoft Excel format. Notice that the Excel file contains macros, hence the .xlsm file extension.

# Items Worksheet

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 | |

Texas Department of Transportation

St

Ch 3-10

The Items worksheet enables utility owners to add a list of items. These items represent logical divisions of work in the field. 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.

This slide 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 (see next slide). 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.

# Unit Cost Analysis 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 | $ - | $ - |

The Unit Cost Analysis 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.

This slide shows the list of items, units, quantities, and unit costs for the example shown in the previous slide.

Notice that this 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.

# Items Worksheet (Example 2)

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 | |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 3-12

This slide 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 (see next slide).

# Item Disaggregation Analysis

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** | |

Texas Department of Transp

n 3-13

The Item Disaggregation Analysis 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 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.

For this 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, the slide 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).

This 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.

# Cost Category Summary 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 |

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 3-14

The Cost Category Summary 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.

This slide shows a summary of category costs for the example shown in the previous two slides.

| | |
|---|---|
| **Specification Number** | XXXX |
| **Specification Title** | Ground boxes |
| **Description** | Furnish and install ground boxes (such as handholes, junction boxes, pull boxes, splice enclosures, pedestals, or other similar boxes) used for communication or electric installations. |
| **Previous Specifications** | 2004 Special Specification 6155, "Communications Ground Box"<br>2004 Special Specification 6513, "Concrete Ground Boxes"<br>2004 Special Specification 6539, "Communications Ground Box"<br>1993 Special Specification 1383, "Communications Ground Box"<br>1993 Special Specification 6566, "Ground Box for Surveillance, Communication, and Control (SC&C)"<br>2004 Item 624, "Ground Boxes."<br>DMS-11070, "Ground Boxes." |
| **Proposed Changes** | Create new specification for ground boxes. |
| **Comment** | Existing Item 624, "Ground Boxes," covers electrical ground boxes, but not communication ground boxes or pedestals. The proposed specification is broader in scope. |

| **Bid Item** | **Measurement Unit** |
|---|---|
| Ground Box (several materials) (several sizes) | Each |
| Pedestal (several sizes) | Each |
| ***Note to Specification Writer***: Add other pay items as indicated on the plans or as required by this specification. | |

| **Subsidiary Item (if specified)** | **Referenced Item** | **Subsidiary to** |
|---|---|---|
| Structural Excavation | 400 | Ground Box Installation |
| Backfill | 400 | Ground Box Installation |
| Testing | | Ground Box Installation |
| Seals | | Ground Box Installation |
| Lid | | Ground Box Installation |
| ***Note to Specification Writer***: Add other subsidiary items as indicated on the plans or as required by this specification. | | |

Ch 3-15

A key requirement in the standardization of utility cost data submissions is the use of construction specifications that match the list of items included in the cost estimate.

If the utility owner does not already have a set of construction specifications, it would be necessary to develop it. As part of TxDOT research project 0-4998, the researchers developed a general framework for utility specifications at TxDOT that mimics all the components of a typical highway construction specification. The researchers developed templates for a wide range of utility specifications, including water, sanitary sewer, electric, and communication installations. As an illustration, this slide shows the proposed template for the installation of ground boxes. The generic template is a modified version of TxDOT Form 1814. For each specification, the research team also prepared a set of specification requirements, which could be used to develop the full construction specification following the 2004 TxDOT specification standard.

# Implementation Plan

Select district for pilot implementation

Implement two-day training course on utility cost estimation procedures

Update *ROW Utility Manual*

Standardize the preparation and submission of utility cost estimates statewide

Strategies for Utility Owner Participation (**Course Code**)

Ch 3-16

The researchers recommend the following major steps to implement the strategy:

- 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.

# Potential Challenges

Users might decide to continue to use existing (familiar) procedures

Utility owners might see conflict with their current accounting methods

Lack of resources to implement strategy

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 3-17

Strategy 4

# CORE SKILL TRAINING ON UTILITY TOPICS

Texas Department of Transportation

Strategies for Utility Owner Participation (**Course Code**)

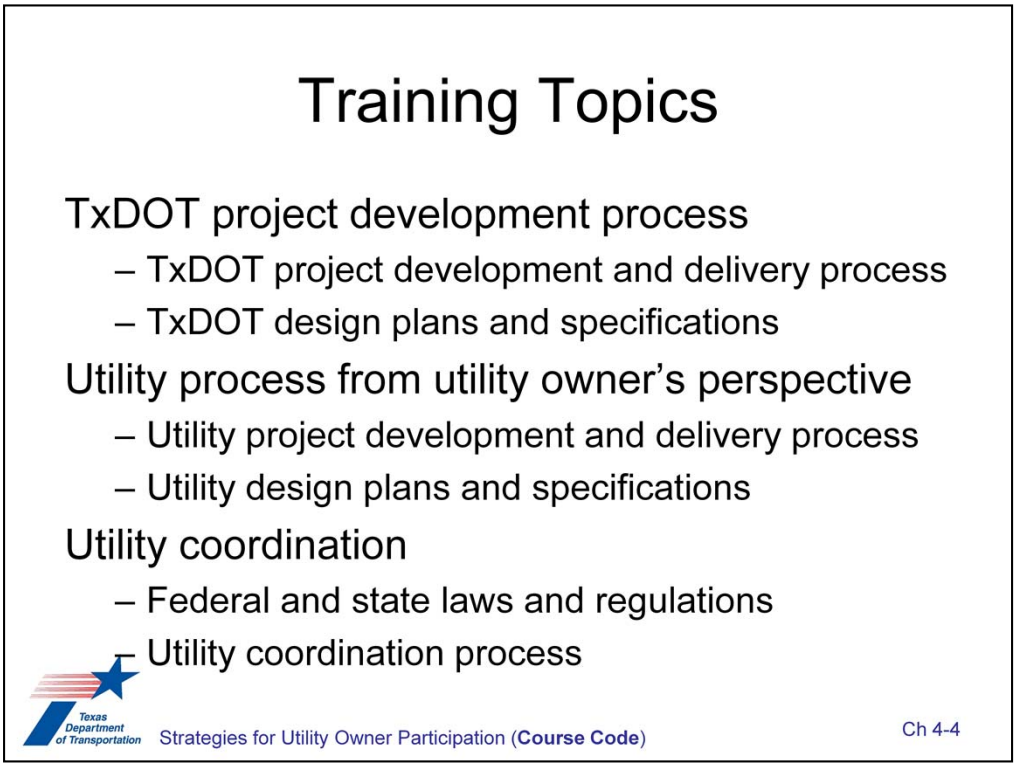
Ch 4-1

# Strategies to Encourage and Facilitate Utility Participation

1. Modernization of the utility process
2. Utility conflict matrix approach
3. Streamlining and standardization of utility cost data submissions
4. **Core skill training on utility topics**

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 4-2

The need for training of staff involved in utility-related activities in the project development and delivery process was a common theme during discussions with various TxDOT district staff, utility owners, and other stakeholders. Training needs are not limited to staff who normally interact with utility owners, e.g., utility coordinators and right of way agents, but extend to staff whose work is likely to be affected by utility issues, such as project managers, design engineers, area engineers, and even planners. The need for training needs also extends to highway and utility consultants and contractors.




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.

# Training Topics

Utility coordination (continued)

- Memoranda of understanding
- Utility investigations
- Utility conflict management
- Utility adjustment cost estimates
- Utility agreement assemblies
- Using ROWIS to manage utility adjustments

Utility permitting

- Preparation, submission, and review of utility permits

Texas Department of Transportation Strategies for Utility Owner Participation (**Course Code**) Ch 4-5

| Category | | Texas Department of Transportation | | | | | | Utility Owner | | | C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ROW Division Staff | Utility Coordinators | Project Managers | Design Engineers | Construction Inspectors | Area Engineers | Executive Level | Staff/Design | Field Staff | Transportation |
| TxDOT Project Development Process | TxDOT P and Deliv | 16+ | 8–16 | 16+ | 16+ | 5–8 | 16+ | 1–4 | 5–8 | 1–4 | 16+ |
| | TxDOT D Specificat | | | | | | | | | | |
| Utility Process from Utility Owner's Perspective | Utility Pr and Deliv | 1–4 | 8–16 | 8–16 | 8–16 | 8–16 | 8–16 | 1–4 | 5–8 | 5–8 | 8–16 |
| | Utility De Specificat | | | | | | | | | | |
| Utility Coordination | Federal a Regulatio | 8–16 | 8–16 | 5–8 | 8–16 | 5–8 | 8–16 | n/a | n/a | n/a | 8–16 |
| | Utility Co | | | | | | | | | | |
| | Memoran Understa | | | | | | | | | | |
| | Utility Co | | | | | | | | | | |
| | Utility In | | | | | | | | | | |
| | Utility Ad Estimates | 5–8 | 16+ | 5–8 | 8–16 | 8–16 | 8–16 | n/a | n/a | n/a | 8–16 |
| | Utility Ag | | | | | | | | | | |
| Utility Permitting | Preparatio Review o | 8–16 | 8–16 | 8–16 | 5–8 | 5–8 | 5–8 | 5–8 | 5–8 | 5–8 | 8–16 |
| | | 8–16 | 8–16 | 8–16 | 8–16 | 1–4 | 8–16 | 1–4 | 8–16 | 1–4 | 8–16 |

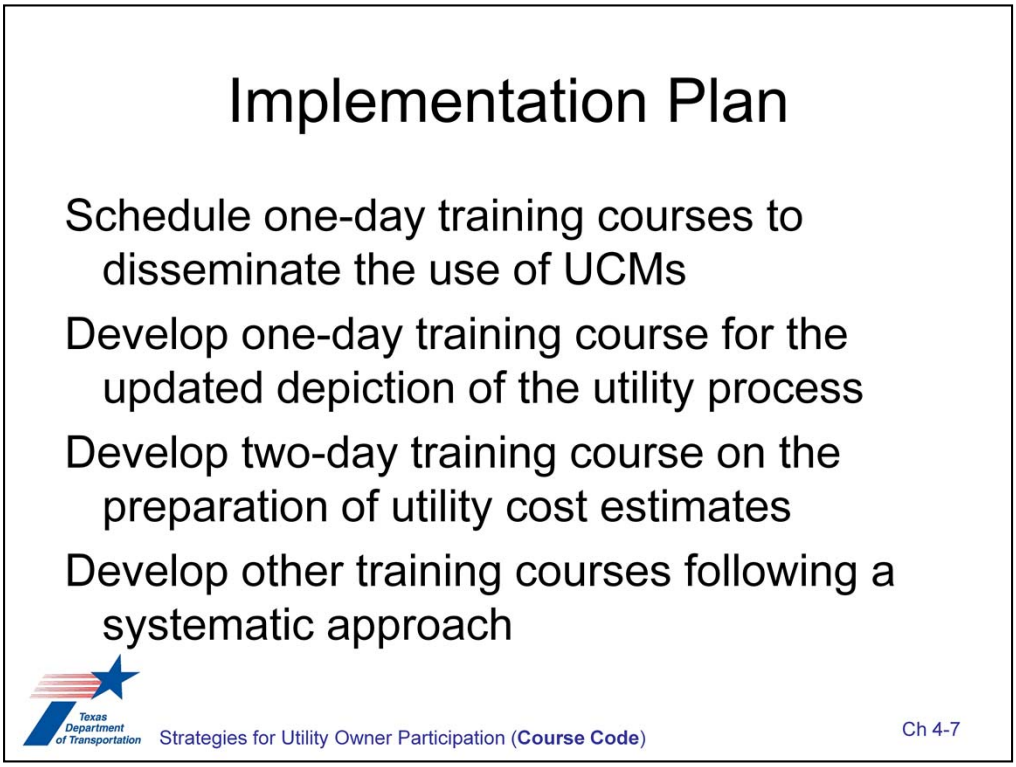
Open PDF File

| akeholder Group | | | | |
|---|---|---|---|---|
| Consultant | | | Contractor | |
| Transportation | Utility Coordination | SUE | Highway | Utility |
| 16+ | 8–16 | 8–16 | 8–16 | 1–4 |
| 8–16 | 8–16 | 8–16 | 8–16 | 8–16 |
| 8–16 | 8–16 | 8–16 | 5–8 | n/a |
| 8–16 | 8–16 | 8–16 | 5–8 | n/a |
| 8–16 | 8–16 | 5–8 | 8–16 | 1–4 |
| 8–16 | 8–16 | 5–8 | 5–8 | 5–8 |
| 1–4 | 1–4 | 1–4 | n/a | n/a |
| 5–8 | 5–8 | 5–8 | 5–8 | 5–8 |
| 8–16 | 8–16 | N/A | 5–8 | 8–16 |
| 8–16 | 8–16 | 1–4 | 1–4 | 1–4 |
| 5–8 | 5–8 | 1–4 | 1–4 | 1–4 |
| 5–8 | 5–8 | 1–4 | 1–4 | 1–4 |

Texas Department of Transportation

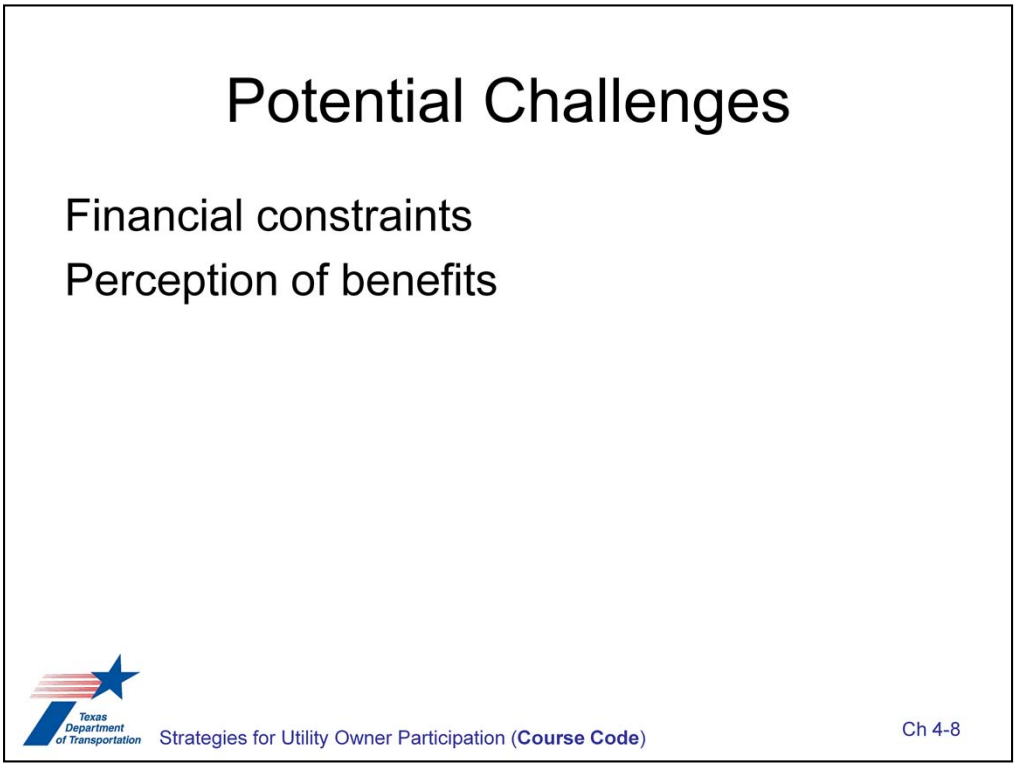
Ch 4-6

This table summarizes the various categories, core skills, brief course description, and a preliminary assessment of minimum number of training hours for each stakeholder group.




The researchers recommend the following major steps to implement the various training courses or modules identified in the previous section:

- 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 depiction of the utility process at TxDOT that was developed as part of the research.
- Develop and pilot a two-day training course on the preparation of utility cost estimates. This course would use the Excel-based template developed as part of the research as a central component 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.




Developing and delivering training requires committing resources that might not be immediately available or that compete against other priorities. While significant, one way to address this challenge is by making the business case that investing in utility-related training can result in short-term and long-term benefits to the department in the form of more effective communication and coordination with utility owners, fewer delays, and fewer opportunities for cost overruns and utility-related change orders and claims.

Some stakeholders might not be convinced that developing and delivering training on utility topics is worth the investment. One way to address this issue would be by providing training (with examples) to project managers, planners, designers, and utility owners on the benefits that can be realized by considering utility conflicts early in the project development phase.

# MODULE 2

# PARTICIPANT HANDOUT

[Page is intentionally blank]

# MODULE 2

# PARTICIPANT HANDOUT

The following pages show the participant handouts as extracted from the PowerPoint file.

[Page is intentionally blank]

# Strategies for Utility Owner Participation

in

Transportation Projects

Strategies for Utility Owner Participation (**Course Code**) Ch 0-1

## Why is It Important?

- Difficulty to locate utility facilities/identify conflicts
- No legal mechanism to encourage utility owners to start participating early in the PDP
- Utility owners usually interested after 60% design
- Delays in project development and delivery
- Unanticipated utility adjustments

Strategies for Utility Owner Participation (**Course Code**) Ch 0-2

## Research Project 0-6624 Deliverables

- 0-6624-P1: Guidebook and Training Materials
  - Strategies for earlier, more effective utility owner participation in the PDP
- 0-6624-1: Research Report
- 0-6624-S: Summary Report

Strategies for Utility Owner Participation (**Course Code**) Ch 0-3

## Strategies to Encourage and Facilitate Utility Participation

1. Modernization of the utility process
2. Utility conflict matrix approach
3. Streamlining and standardization of utility cost data submissions
4. Core skill training on utility topics

Strategies for Utility Owner Participation (**Course Code**) Ch 0-4

Strategy 1

## MODERNIZATION OF THE UTILITY PROCESS

Strategies for Utility Owner Participation (**Course Code**) Ch 1-1

## Current Utility Process

According to the *ROW Utility Manual*:

- Utility Cooperative Management Process – UCMP ("the process")
- Utility adjustment subprocess ("the subprocess")
  - Three adjustment procedures – with diagrams:
    - Federal Utility Procedure (FUP)
    - State Utility Procedure (FUP)
    - Local Utility Procedure (LUP)
  - One adjustment procedure – without a diagram:
    - Non-Reimbursable Procedure

Strategies for Utility Owner Participation (**Course Code**) Ch 1-2

## Issues

Discrepancies between documented process and actual practice

Different practices at districts cause difficulties for utility owners spanning multiple districts

Written documentation

- Complex and difficult to follow
- Lacks flexibility
- Needs updating

Strategies for Utility Owner Participation (**Course Code**) Ch 1-3

## Updated Utility Process

Process depiction using Business Process Model and Notation (BPMN)

Updated descriptions of activities

Three models with increasing detail:

- **Level 1**: High-level depiction of entire PDP
- **Level 2**: Intermediate-level depiction of the PDP
- **Level 3**: Level 2 with a more detailed view of the utility process

Strategies for Utility Owner Participation (**Course Code**) Ch 1-4

## Project Development and Delivery Process

Planning and programming

Preliminary design

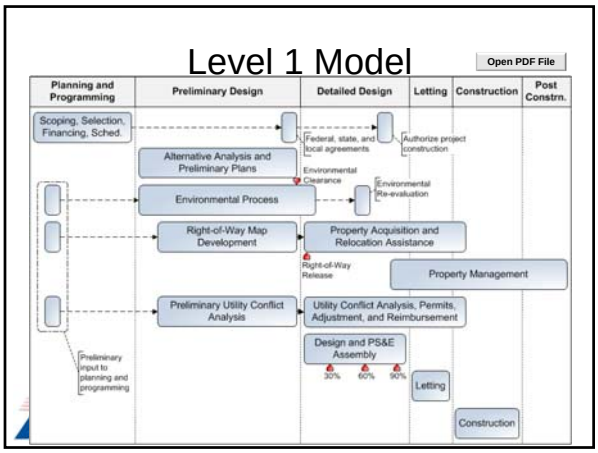
Detailed design

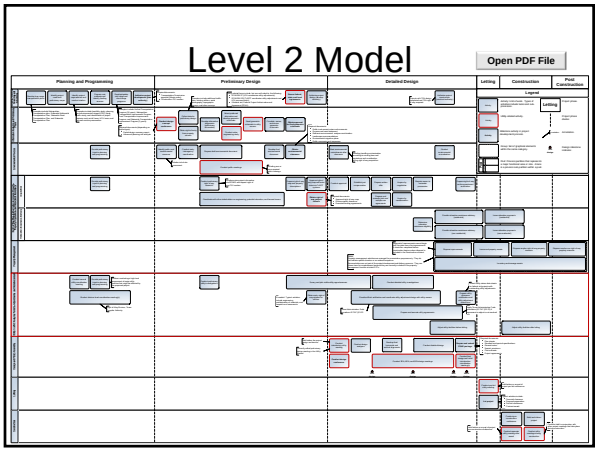
Letting

Construction

Post construction

Strategies for Utility Owner Participation (**Course Code**) Ch 1-5




## Level 2 Model

Activities arranged in "pools"

- Pools represent groups of activities with similar functions

Pools divided into "lanes" as needed

Pool with a red outline is the utility pool

Outside utility pool, activity boxes with a red outline are utility-related

Strategies for Utility Owner Participation (**Course Code**) Ch 1-8

## Level 2 Model Pools and Lanes

Scoping, selection, financing, and scheduling
Alternative analysis and preliminary plans
Environmental process
Right of way map, authorization to acquire property, property acquisition, and relocation assistance
- Acquisition
- Relocation assistance advisory

Strategies for Utility Owner Participation (**Course Code**) Ch 1-9

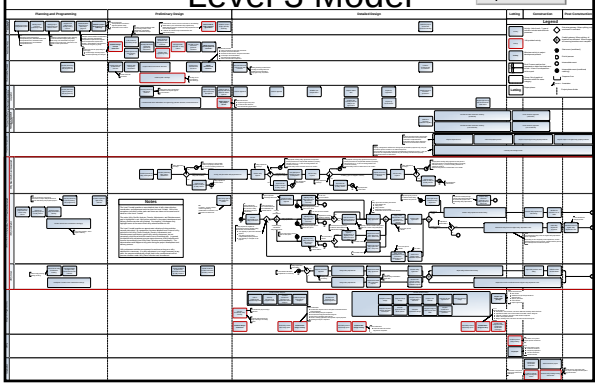
## Level 2 Model Pools and Lanes

Property management
Utility conflict analysis, permits, adjustments, and reimbursement
Design and PS&E assembly
Letting
Construction

Strategies for Utility Owner Participation (**Course Code**) Ch 1-10

## Level 3 Model

Open PDF File



## Level 3 Model Pools and Lanes

- Same pools as Level 2 model
- Outside of utility pool, activities same as Level 2 model
- Additional lanes for utility conflict analysis, permits, adjustments, and reimbursement
  - Utility data collection and assessment
  - Utility coordination
  - Utility owner

Strategies for Utility Owner Participation (**Course Code**) Ch 1-12

## Strategy Implementation Plan

- Identify leaders and assemble implementation team
- Schedule workshops to disseminate updated utility process
- Update TxDOT manuals (i.e., ROW Utility, PS&E Preparation, and PDP manuals)
- Monitor implementation by conducting acceptability surveys at various intervals

Strategies for Utility Owner Participation (**Course Code**) Ch 1-13

## Strategy Benefits

- Modern, user-friendly representation of the utility process
- Activities and descriptions that correspond to the process districts actually use
- Provides information that users are more likely to understand and follow

Strategies for Utility Owner Participation (**Course Code**) Ch 1-14

## Potential Challenges

- Users' perception of benefits and commitment to new process
- Staffing and financial resources required for changing practices
- TxDOT might not have the necessary tools to implement the strategy
  - Update manuals, conduct workshops, monitor acceptability

Strategies for Utility Owner Participation (**Course Code**) Ch 1-15

Strategy 2

## UTILITY CONFLICT MATRIX APPROACH

Strategies for Utility Owner Participation (**Course Code**) Ch 2-1

## Strategies to Encourage and Facilitate Utility Participation

1. Modernization of the utility process
2. **Utility conflict matrix approach**
3. Streamlining and standardization of utility cost data submissions
4. Core skill training on utility topics

Strategies for Utility Owner Participation (**Course Code**) Ch 2-2

## Utility Conflict Matrices (UCMs)

Utility-related activities involve enormous amount of data and supporting documents

UCMs enable users to organize and track utility conflict data effectively

UCMs can support a wide range of related processes

Strategies for Utility Owner Participation (**Course Code**) Ch 2-3

## SHRP 2 R15-B Research Products

Product 1: Compact, standalone UCM

Product 2: Utility conflict data model and database

Product 3: One-day UCM training course

Strategies for Utility Owner Participation (**Course Code**) Ch 2-4

## Product 1: Utility Conflict Matrix

Open PDF File

MS Excel format, includes drop-down lists

| Utility Owner and/or Contact Name | Conflict ID | Drawing or Sheet No. | Utility Type | Size and/or Material | Utility Conflict Description | Start Station |
|---|---|---|---|---|---|---|
| AT&T | 1 | U-1 | Telephone | Fiber Optic | Conflict with construction of frontage road widening. | 21+00 |

| End Station | Start Offset | End Offset | Utility Investigation Level Needed | Test Hole | Recommended Action or Resolution | Estimated Resolution Date | Resolution Status |
|---|---|---|---|---|---|---|---|
| 22+00 | 45' Lt | 45' LT | QLC | | Relocation before construction. | 3/8/2010 | Utility conflict identified. |

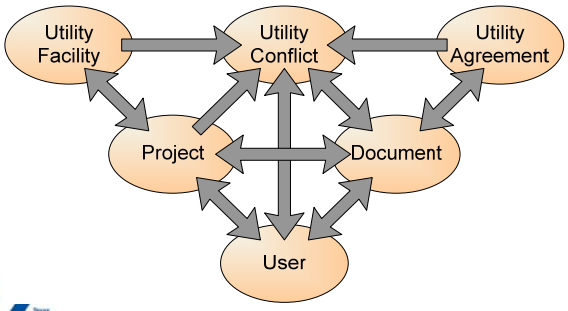
Strategies for Utility Owner Participation (**Course Code**) Ch 2-5

## Product 1: Cost Estimate Analysis

| Alternative Number | Engineering Cost (Utility) | Direct Cost (Utility) | Engineering Cost (DOT) | Direct Cost (DOT) | Total Cost | Feasibility | Decision |
|---|---|---|---|---|---|---|---|
| 0 | $ 10,375.00 | $ 63,875.00 | $ - | $ - | $ 74,250.00 | Yes | Selected |
| 1 | $ 7,875.00 | $ 32,375.00 | $ - | $ - | $ 40,250.00 | No | Rejected |
| 2 | $ - | $ - | $ 95,375.00 | $ - | $ 95,375.00 | No | Rejected |
| 3 | $ - | $ - | $ - | $ - | $ - | No | Rejected |
| 4 | $ 10,375.00 | $ 63,875.00 | $ - | $ - | $ 74,250.00 | No | Rejected |

Strategies for Utility Owner Participation (**Course Code**) Ch 2-6

## Product 2: Data Model and Database




Strategies for Utility Owner Participation (**Course Code**) Ch 2-7

## Product 2: Example

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

**Reviewed By:** _____ **Date:** _____

| End Offset | Utility Investigation Level Needed | Test Hole No. | Recommended Action or Resolution | Responsible Party | Estimated Resolution Date | Resolution Status | Cost Analysis |
|---|---|---|---|---|---|---|---|
| 45' Lt | QLC | | Relocation before construction. | U | 3/8/2010 | Utility conflict identified | Detail |
| 37' Rt | QLC | | Relocation before construction. | U | 3/8/2010 | Utility conflict identified | Detail |
| 48' Rt | QLC | | Relocation before construction. | U | 3/8/2010 | Utility conflict identified | Detail |
| 48' Rt | QLC | | Relocation before construction. | U | 3/8/2010 | Utility conflict identified | Detail |
| 49' Lt | QLB | | Design change. | D | 3/8/2010 | Utility owner informed of utility conflict | Detail |

Strategies for Utility Owner Participation (**Course Code**) Ch 2-8

## Product 2: Example

ution Alternatives

Analysis

Date: 11/24/2010

| | |
|---|---|
| **Project Owner:** | Texas Department o |
| **Project No.:** | 1234-56-789 |
| **Project Description:** | Road construction p |
| **Highway or Route:** | I-10 Katy Freeway |

| | |
|---|---|
| **Conflict ID:** | 1 |
| **Utility Owner:** | AT&T |
| **Utility Type:** | Telephone |
| **Size and/or Material:** | Fiber Optic |
| **Project Phase:** | 60% Design |

| Alternative Number | Alternative Description | arty | Engineering Cost (Utility) | Direct Cost (Utility) | Engineering Cost (DOT) | Direct Cost (DOT) | Total Cost | Feasibility | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Relocation before construction. | No | $10,375.00 | $63,875.00 | $0.00 | $0.00 | $74,250.00 | Yes | Selected |
| 1 | Protect in-place. | | $7,875.00 | $32,375.00 | $0.00 | $0.00 | $40,250.00 | No | Rejected |
| 2 | Design change. | | $0.00 | $0.00 | $95,375.00 | $0.00 | $95,375.00 | No | Rejected |
| 3 | Exception to policy. | | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | No | Rejected |

Strategies for Utility Owner Participation (**Course Code**) Ch 2-9

## Product 2: Other Potential Reports

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

Strategies for Utility Owner Participation (**Course Code**) Ch 2-10

## Utility Conflict Event Tracking

| | |
|---|---|
| 0 Utility conflict identified | 15 Required adjustment completion |
| 1 Comment created | 16 Estimated adjustment completion |
| 2 Utility owner informed of utility conflict | 17 Scheduled adjustment completion |
| 3 Utility conflict resolved | 18 Notice to proceed to utility owner |
| 4 Utility owner acknowledges receipt of document | 19 Adjustment construction start |
| | 20 Adjustment construction end |
| 5 Document requested | 21 Permit application |
| 6 Document sent | 22 Permit approved |
| 7 Document received | 23 Exception requested |
| 8 Document reviewed | 24 Exception approved |
| 9 Document certified | 25 Plans sufficient sent to utility owner |
| 10 Document approved | 26 30-day notice submitted |
| 11 Document uploaded | 27 90-day notice submitted |
| 12 Document review, comment, and appro | 28 Utility conflict resolution strategy selected |
| 13 Utility coordination meeting | 29 Utility relocation under construction |
| 14 ROW cleared for adjustment | 30 Utility conflict archived |

Strategies for Utility Owner Participation (**Course Code**) Ch 2-11

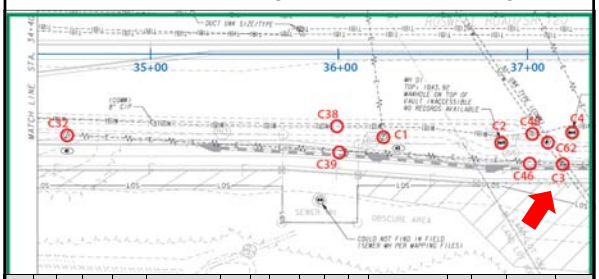
## One-Day UCM Training Course

Lesson plan (6 lessons)
Presentation materials (PowerPoint)
Presenter notes
Participant handouts
- Handouts, sample project plans, UCM templates

Companion CD
- All training materials, including UCM
- Prototype utility conflict database

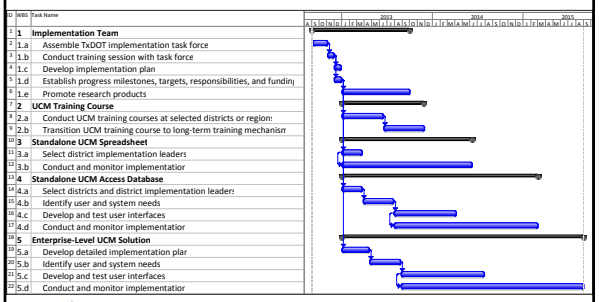
Strategies for Utility Owner Participation (**Course Code**) Ch 2-12

## Hands-On Utility Conflict Analysis




| Utility Owner | ID | Sheet No. | Utility Type | Size/ Material | Utility Conflict Description | Start Sta. | End Sta. | Start Offset | End Offset | Inv. Need | Test Hole | Recommended Action | Rsp. Party | Est. Res. Date | Res. Status | Cost Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C3 | 1 | WM | 30" | Proposed 18" drainage pipe would cross WM. | 37+20 | | 60' Rt | | QLA | 3 | Review possibility of adjusting drainage pipes up to avoid conflict, lowest structure (B13) is at 5.6'. | D | n/a | Utility conflict identified. | |

## Implementation Plan



| ID | WBS | Task Name |
|---|---|---|
| 1 | 1 | **Implementation Team** |
| 2 | 1.a | Assemble TxDOT implementation task force |
| 3 | 1.b | Conduct training session with task force |
| 4 | 1.c | Develop implementation plan |
| 5 | 1.d | Establish progress milestones, targets, responsibilities, and fundin |
| 6 | 1.e | Promote research products |
| 7 | 2 | **UCM Training Course** |
| 8 | 2.a | Conduct UCM training courses at selected districts or region: |
| 9 | 2.b | Transition UCM training course to long-term training mechanism |
| 10 | 3 | **Standalone UCM Spreadsheet** |
| 11 | 3.a | Select district implementation leaders |
| 12 | 3.b | Conduct and monitor implementatior |
| 13 | 4 | **Standalone UCM Access Database** |
| 14 | 4.a | Select districts and district implementation leaders |
| 15 | 4.b | Identify user and system needs |
| 16 | 4.c | Develop and test user interfaces |
| 17 | 4.d | Conduct and monitor implementatior |
| 18 | 5 | **Enterprise-Level UCM Solution** |
| 19 | 5.a | Develop detailed implementation plar |
| 20 | 5.b | Identify user and system needs |
| 21 | 5.c | Develop and test user interfaces |
| 22 | 5.d | Conduct and monitor implementatior |

Strategies for Utility Owner Participation (**Course Code**) Ch 2-14

## Anticipated Value and Implementation Cost

| Implementation Product | Value | Cost |
|---|---|---|
| Product 1 (standalone UCM, MS Excel) | 20 | $ |
| Product 3 UCM training course | 40 | $$ |
| Product 2 (standalone implementation, MS Access) | 50 | $$$ |
| Product 2 (enterprise-level implementation) | 80 | $$$$ |

Strategies for Utility Owner Participation (**Course Code**) Ch 2-15

## "So What" Questions

What's different about these new tools?

What new capabilities will they provide?

Will they be more difficult to use?

Will they require special training or operation only by specially-trained people?

How will the costs to use these tools compare with those of today's tools?

Strategies for Utility Owner Participation (**Course Code**) Ch 2-16

## Answers

Systematic treatment of utility conflicts

More effective PDP integration

Easy to use given a correct implementation

Training for all stakeholders is recommended to realize benefits of UCM implementation

Slightly higher front-end costs but potentially much lower costs at the end

Strategies for Utility Owner Participation (**Course Code**) Ch 2-17

## Potential Challenges

District project managers might not perceive tangible economic benefit

Lack of financial resources to implement strategy

Inconsistent use of UCMs

Strategies for Utility Owner Participation (**Course Code**) Ch 2-18

Strategy 3

**STREAMLINING AND STANDARDIZATION OF UTILITY COST DATA SUBMISSIONS**

Strategies for Utility Owner Participation (**Course Code**) Ch 3-1

## Strategies to Encourage and Facilitate Utility Participation

1. Modernization of the utility process
2. Utility conflict matrix approach
3. **Streamlining and standardization of utility cost data submissions**
4. Core skill training on utility topics

Strategies for Utility Owner Participation (**Course Code**) Ch 3-2

## Utility Cost Estimate Categories

Direct utility adjustment costs:
- Materials and supplies, labor, overhead, transportation, equipment

Usually handled as separate items:
- Traffic control, right of way

Other cost elements:
- Salvage, abandoned facilities, removal of materials
- Credits
  - Betterments (forced vs. elective)
  - Capital improvements (in some cases)

Strategies for Utility Owner Participation (**Course Code**) Ch 3-3

**Betterment-Included Estimate**

| | | |
|---|---|---|
| Alpha Construction Co. | | |
| 6,000 feet of 12-inch Water Main | $335,000 | |
| 6,000 feet of 6-inch Sewer Main | $66,700 | |
| Forced Betterment | $16,300 | |
| Beta Inc. Engineering Total Fee | $15,000 | |
| Gamma Surveying Ltd. Fee | $2,500 | |
| Easement Acquisition Cost | $4,500 | $440,000 |

**In-Kind Replacement Estimate**

| | | |
|---|---|---|
| Alpha Construction Co. | | |
| 6,000 feet of 4-inch Water Main | $207,000 | |
| 6,000 feet of 6-inch Sewer Main | $66,700 | |
| Forced Betterment | $16,300 | |
| Beta Inc. Engineering Total Fee | $11,000 | |
| Gamma Surveying Ltd. Fee | $2,500 | |
| Easement Acquisition Cost | $4,500 | $308,000 |
| Betterment Amount | | $132,000 |
| Elective Betterment Credit: | $132,000/$440,000 = 0.3000 | |
| Accrued Depreciation Credit | $0 | |
| Salvage Credit | $0 | |

Current Installation ROW Summary:

| Sheet No. | State ROW | Private ROW | Unit |
|---|---|---|---|
| D-1 | 200 | 1,300 | feet |
| D-2 | 100 | 1,000 | feet |
| D-3 | 400 | 1,100 | feet |
| D-4 | 500 | 1,400 | feet |
| **Total** | **1,200** | **4,800** | **feet** |

| | | |
|---|---|---|
| Total ROW: | 6,000 feet | |
| Eligibility Ratio: | 4,800/6,000 = 0.8000 | |
| Amount eligible for state cost participation: | $308,000 × 0.8000 | $246,400 |

Strate Ch 3-4

## Issues with Current Practice

Utility reimbursement practices vary by district

Utility owners handle cost data differently

Utility owners have difficulty understanding and following current procedures

Final billings can be submitted years after adjustment completed

Frequent complaints about requirements

Strategies for Utility Owner Participation (**Course Code**) Ch 3-5

## Updated Framework for Developing Utility Cost Estimates

Benefits:

- Support for cost estimates at various phases during the project development process
- Reduction in uncertainty and risk
- Less contentious relationship between TxDOT and utility owners

Strategies for Utility Owner Participation (**Course Code**) Ch 3-6

## Unit Costs vs. Cost Categories

(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** | | | $C_T$ |

Strategies for Utility Owner Participation (**Course Code**) Ch 3-7

## Cost Estimate Progression

| | | Utility Adjustment Phase | | | | |
|---|---|---|---|---|---|---|
| | | Planning and Programming (Highway Project) | Preliminary Design (Highway Project) | Utility Adjustment Design | Utility Adjustment Letting/Contract | Utility Adustment |
| | | **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% |

Strategies for Utility Owner Participation (**Course Code**) Ch 3-8

# Prototype Utility Cost Estimate Submission Forms

Microsoft Excel file with four integrated worksheets

Open PDF File

- Items
- Unit Cost Analysis
- Item Disaggregation Analysis
- Cost Category Summary

Strategies for Utility Owner Participation (Course Code)

Ch 3-9

# Items Worksheet

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 appurtena | |
| | | 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 | |

Ch 3-10

# Unit Cost Analysis Worksheet

Get Items | Update Items | Validate Unit Costs

| Item No. | Item Name | Unit | Quantity | Unit Cost ($/unit) | Amount ($) | Imputed 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 appurtena | 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 | $ - | $ - |

# Items Worksheet (Example 2)

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 | |

Strategies for Utility Owner Participation (**Course Code**) Ch 3-12

# Item Disaggregation Analysis

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 | $ 4,614.91 | $ 4,614.91 | |
| | | | 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 cleaning | Labor | EA | 3 | $ 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 | $ 4,614.91 | $ 4,614.91 | |
| | | | 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 cleaning | Labor | EA | 3 | $ 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 | 36 | $ 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 | 48 | $ 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 | |

Strategies for Utility Owner Participation (**Course Code**) Ch 3-13

# Cost Category Summary Worksheet

Get Items and Category Costs

| Item No. | Item Name | Cost Category: Materials and Supplies | Cost Category: Labor | Cost Category: Overhead | Cost Category: Transportation and Equipment | Total |
|---|---|---|---|---|---|---|
| 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** |

Strategies for Utility Owner Participation (**Course Code**) Ch 3-14

| | |
|---|---|
| **Specification Number** | XXXX |
| **Specification Title** | Ground boxes |
| **Description** | Furnish and install ground boxes (such as handholes, junction boxes, pull boxes, splice enclosures, pedestals, or other similar boxes) used for communication or electric installations. |
| **Previous Specifications** | 2004 Special Specification 6155, "Communications Ground Box"<br>2004 Special Specification 6513, "Concrete Ground Boxes"<br>2004 Special Specification 6539, "Communications Ground Box"<br>1993 Special Specification 1383, "Communications Ground Box"<br>1993 Special Specification 6566, "Ground Box for Surveillance, Communication, and Control (SC&C)"<br>2004 Item 624, "Ground Boxes."<br>DMS-11070, "Ground Boxes." |
| **Proposed Changes** | Create new specification for ground boxes. |
| **Comment** | Existing Item 624, "Ground Boxes," covers electrical ground boxes, but not communication ground boxes or pedestals. The proposed specification is broader in scope. |

| **Bid Item** | **Measurement Unit** |
|---|---|
| Ground Box (several materials) (several sizes) | Each |
| Pedestal (several sizes) | Each |
| ***Note to Specification Writer***: Add other pay items as indicated on the plans or as required by this specification. | |

| **Subsidiary Item (if specified)** | **Referenced Item** | **Subsidiary to** |
|---|---|---|
| Structural Excavation | 400 | Ground Box Installation |
| Backfill | 400 | Ground Box Installation |
| Testing | | Ground Box Installation |
| Seals | | Ground Box Installation |
| Lid | | Ground Box Installation |
| ***Note to Specification Writer***: Add other subsidiary items as indicated on the plans or as required by this specification. | | |

Ch 3-15

## Implementation Plan

- Select district for pilot implementation
- Implement two-day training course on utility cost estimation procedures
- Update *ROW Utility Manual*
- Standardize the preparation and submission of utility cost estimates statewide

Strategies for Utility Owner Participation (**Course Code**) Ch 3-16

## Potential Challenges

- Users might decide to continue to use existing (familiar) procedures
- Utility owners might see conflict with their current accounting methods
- Lack of resources to implement strategy

Strategies for Utility Owner Participation (**Course Code**) Ch 3-17

Strategy 4

## CORE SKILL TRAINING ON UTILITY TOPICS

Strategies for Utility Owner Participation (**Course Code**) Ch 4-1

## Strategies to Encourage and Facilitate Utility Participation

1. Modernization of the utility process
2. Utility conflict matrix approach
3. Streamlining and standardization of utility cost data submissions
4. **Core skill training on utility topics**

Strategies for Utility Owner Participation (**Course Code**) Ch 4-2

## Training Needs

TxDOT
- Utility coordinators
- Design engineers, project managers, area engineers
- Right of Way Division officials
- Construction inspectors

Utility Owners
- Executive level, design staff, field staff

Consultants and contractors
- Transportation, utility coordination, utility investigations

Strategies for Utility Owner Participation (**Course Code**) Ch 4-3

## Training Topics

TxDOT project development process
- TxDOT project development and delivery process
- TxDOT design plans and specifications

Utility process from utility owner's perspective
- Utility project development and delivery process
- Utility design plans and specifications

Utility coordination
- Federal and state laws and regulations
- Utility coordination process

Strategies for Utility Owner Participation (**Course Code**) Ch 4-4

## Training Topics

Utility coordination (continued)
- Memoranda of understanding
- Utility investigations
- Utility conflict management
- Utility adjustment cost estimates
- Utility agreement assemblies
- Using ROWIS to manage utility adjustments

Utility permitting
- Preparation, submission, and review of utility permits

Strategies for Utility Owner Participation (**Course Code**) Ch 4-5

| | Texas Department of Transportation | | | | | | Utility Owner | | | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | ROW Division Staff | Utility Coordinators | Project Managers | Design Engineers | Construction Inspectors | Area Engineers | Executive Level | Staff/Design | Field Staff | Transportation |
| | 16+ | 8–16 | 16+ | 16+ | 5–8 | 16+ | 1–4 | 5–8 | 1–4 | 16+ |
| | 1–4 | 8–16 | 8–16 | 8–16 | 8–16 | 8–16 | 1–4 | 5–8 | 5–8 | 8–16 |
| | 8–16 | 8–16 | 5–8 | 8–16 | 5–8 | 8–16 | n/a | n/a | n/a | 8–16 |
| | 5–8 | 16+ | 5–8 | 8–16 | 8–16 | 8–16 | n/a | n/a | n/a | 8–16 |
| | 8–16 | 8–16 | 8–16 | 5–8 | 5–8 | 5–8 | 5–8 | 5–8 | 5–8 | 8–16 |
| | 8–16 | 8–16 | 8–16 | 8–16 | 1–4 | 8–16 | 1–4 | 8–16 | 1–4 | 8–16 |

Open PDF File

Ch 4-6

## Implementation Plan

- Schedule one-day training courses to disseminate the use of UCMs
- Develop one-day training course for the updated depiction of the utility process
- Develop two-day training course on the preparation of utility cost estimates
- Develop other training courses following a systematic approach

Strategies for Utility Owner Participation (**Course Code**) Ch 4-7

## Potential Challenges

- Financial constraints
- Perception of benefits

Strategies for Utility Owner Participation (**Course Code**) Ch 4-8

[Page is intentionally blank]