Utility Conflict Management (UCM)

Iowa Department of Transportation Ames, Iowa (10/06/2025)



Utility Conflict Management (UCM)

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Instructors



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Mo Pashaei, PhD



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Class Materials

- Download .zip file:
 - Hyperlink in email sent before the class
 - File: Utility Conflict Management < Date > .zip
- Extract class materials:
 - Slides (PDF)
 - Utility conflict analysis template (Excel)
 - U.S. 20 Gordon Drive Viaduct Project files:
 - Current plans (PDF), KMZ file, utility investigation report



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Overview

Welcome and Introductions

Introductions

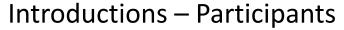
Learning Outcomes and Agenda

Ground Rules

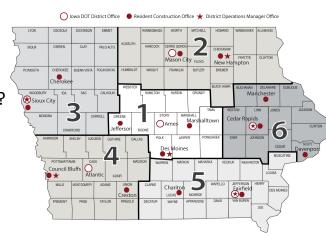


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What's your name?
Where do you work?
Experience with the utility process?
Three pain points related to utilities?





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Learning Outcomes

1

Explain the reasons to conduct effective UCM

2

Explain how UCM is integrated into project delivery

3

Describe the key elements of UCM



Identity and resolve utility conflicts for a sample project



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Agenda

Module	Description	Time			
	Welcome and Introductions	8:00AM-9:00AM			
1	Reasons to Conduct Effective UCM	9:00AM-10:00AM			
2	Integration of UCM into Project Delivery	10:00AM-11:30AM			
	Lunch Break	11:30PM-12:30PM			
3	Key Elements of UCM	12:30PM-2:00PM			
4	Hands-On Utility Conflict Management Exercise	2:00PM-3:45PM			
	Wrap-Up	3:45PM-4:00PM			



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Ground Rules

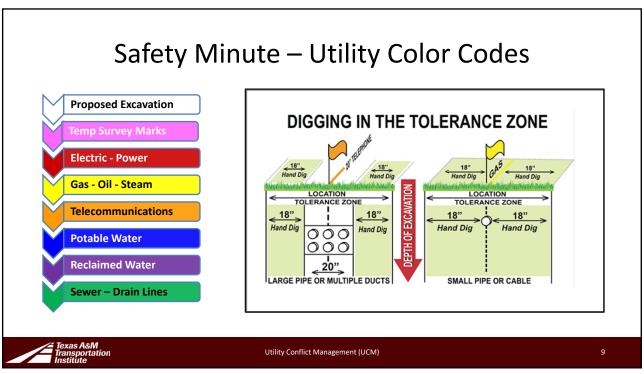
- Turn off email
- Put cell phones on silent





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Module 1 Overview

Module 1: Reasons to Conduct
Utility Conflict Management

Learning Outcome: Explain the reasons to conduct effective UCM

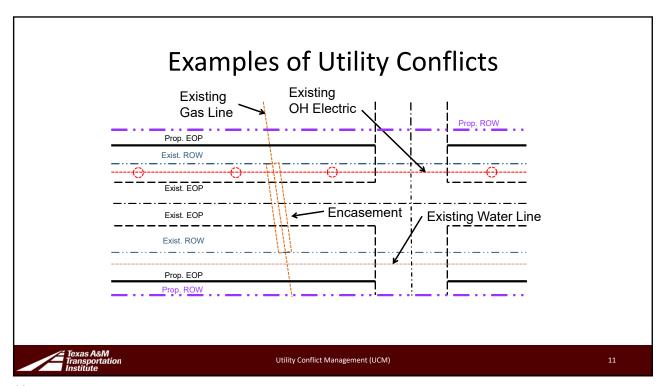
Types of
Utility
Conflicts

Risks of Not
Using Effective
UCM

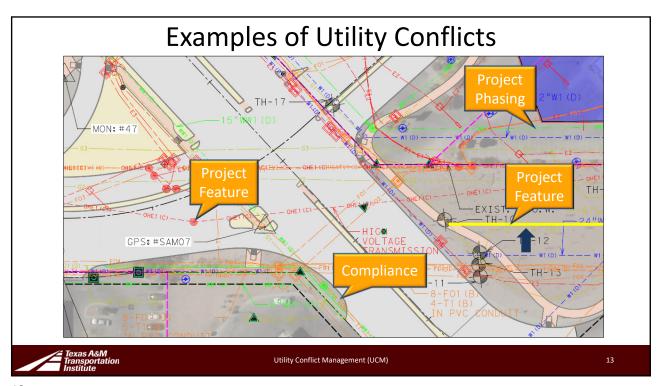
Benefits of
Applying UCM

Transportation
Tr

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Types of Utility Conflicts				
Category	Examples			
Project Feature	Utility facility vs. transportation design feature (existing or proposed) Planned utility facility vs. existing utility facility			
Project Phasing	Utility facility vs. transportation construction activity or phasing			
Compliance	 Noncompliance with: Utility accommodation statutes, regulations, and policies Special provisions (typically project-level or for utility permits) Safety or accessibility regulations Industry standards or specifications 			
Texas A&M Transportation Institute	Utility Conflict Management (UCM) 12			

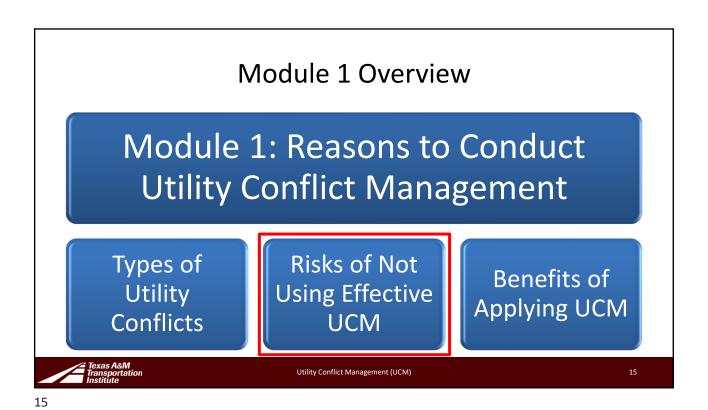


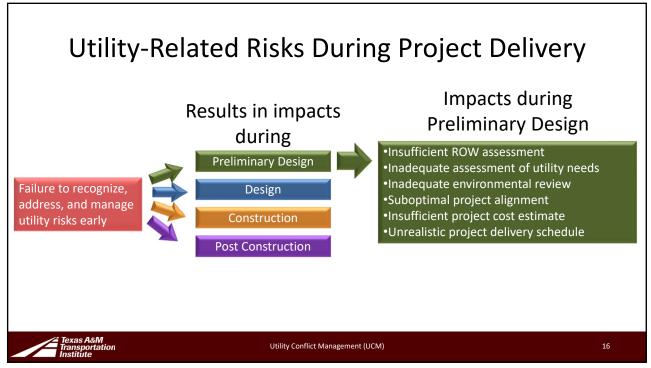
Utility Accommodation Rules

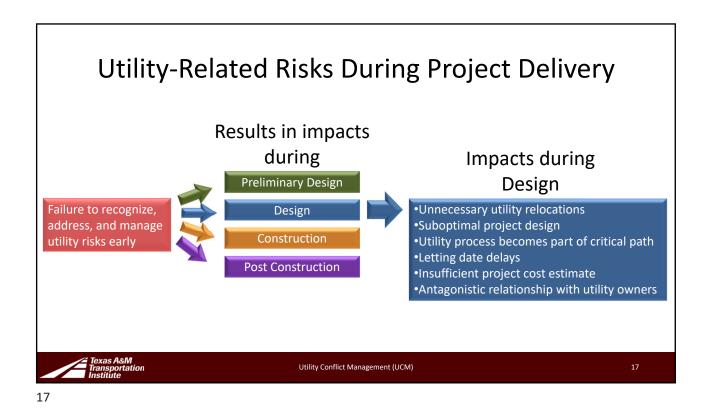
- Iowa Admin. Code r. 761-115 (Policy for Accommodating and Adjustment of Utilities on the Primary Road System)
 - Vertical clearance/depth requirements
 - Encasement
 - Attachments to bridges
 - Longitudinal installations on freeways
 - Longitudinal installations on non-freeways
 - Abandoned/out-of-service utility facilities

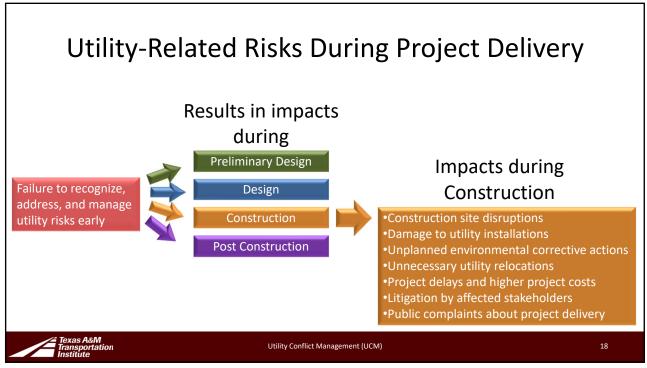


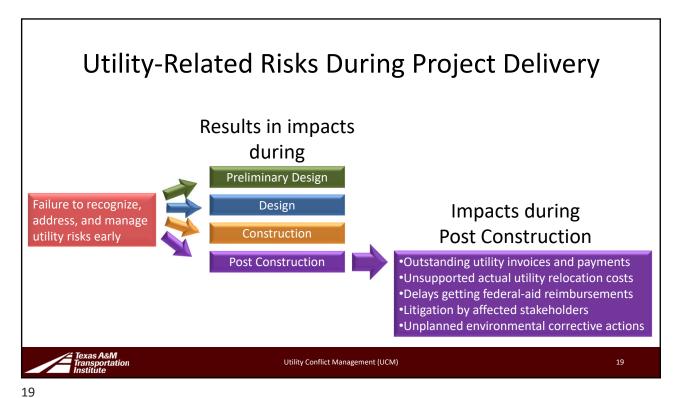
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Project Delay Reasons (Utility Owner Perspective)

- Utility owner's perspective
 - Lack of project definition and detail by project owner
 - Horizontal and vertical alignment
 - · Drainage design
 - · Right of way acquisition
 - Changes in project owner's design and schedules
 - Unrealistic schedule by project owner for utility relocations
 - Other
 - Limited resources (financial and personnel)
 - Internal demands (maintenance, service upgrades)
 - Utility owner's project delivery process protocols



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Construction Site Disruptions

- Unavailable or incorrect information about existing utilities
- Out-of-service lines not shown on the plans
- Wrong or not visible
 One Call markings







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Damage to Utility Installations

- Utility service interruptions
- Release of dangerous, explosive liquids and gases
- Risks to health and safety





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Unplanned Environmental Corrective Actions

- Asbestos-cement pipes
 - Production stopped in 1970s
 - Special care for asbestos
- Underground storage tanks and piping
 - Can be explosive
 - Can leak into the ground





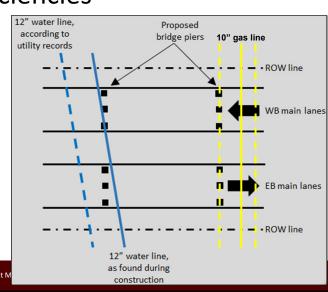
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Unnecessary Utility Relocations and Other Project Inefficiencies

- Inadequate utility information results in:
 - Unnecessary utility relocations
 - Incorrect design of project features



Transportation Institute Utility Conflict M

2001 Study—Top Causes of Project Delays

Cause of Delay	DOTs	Designers	Contractors
Delays in utility relocations	1	1	1
Differing site conditions (DSCs) related to utility conflicts	2	2	3
Errors in plans and specifications	3	13	2
Weather	4	6	4
Permitting issues	5	4	7
Delays in right-of-way acquisition	6	9	11
Delays in environmental process	7	3	8
Insufficient work effort by contractor	8	5	18
Owner-requested changes	11	10	5
Differing site conditions (other causes)	9	7	6
Texas A&M			25

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2024 Study—Utility-Related Change Order Causes

Disaggregated Change Order Reason	Average
Errors and omissions in PS&E	33%
Inaccurate or incomplete data about existing or relocated utility facilities	23%
Changes initiated by project owner, contractor, or utility owner	12%
Delays getting utility owners to schedule utility relocations	11%
Differing site conditions	4%
Difficult or inadequate constructability of highway work or utility relocation	4%
Inaccurate or deficient utility relocation work	2%
Delays acquiring or clearing right-of-way or utility relocation sites	2%
Other	9%
Total	100%

Real-World Situations

- In 2017, contractors building a new bridge in North Carolina drove a steel post through underground electric transmission cables
 - Thousands of residents and tourists were affected/evacuated
 - Class action lawsuit: \$10M
- Bridge project in Georgia affected multiple utilities:
 - Modifying horizontal bridge alignment slightly would not have affected existing utility facilities, right-of-way, or bridge construction
 - Discovered during construction! ... Utility relocation costs = \$5M
- In 2023, contractors drilling a shaft foundation for a rail expansion near Frankfurt Airport hit four 16-ft deep fiber optic cables:
 - Worldwide Lufthansa air traffic control was cut off
 - Several areas in Frankfurt were affected



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Module 1 Overview

Module 1: Reasons to Conduct Utility Conflict Management

Types of Utility Conflicts

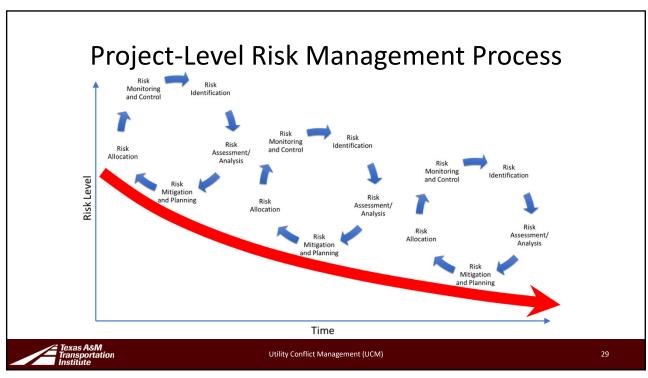
Risks of Not Using Effective UCM

Benefits of Applying UCM



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Benefits of Applying UCM

- Earlier identification of existing utility facilities and conflicts
- Fewer unnecessary utility relocations
- Fewer disruptions and utility damages during construction
- Fewer utility-related change orders and claims
- More effective working relationship with utility owners
- Tangible economic and project delivery time savings



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Break

• We'll continue in 10 minutes



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Module 2 Overview

Module 2: Integration of UCM into Project Delivery

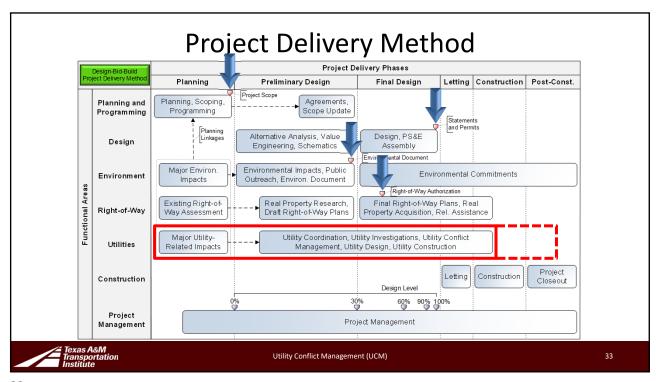
Learning Outcome: Explain how UCM is integrated into project delivery

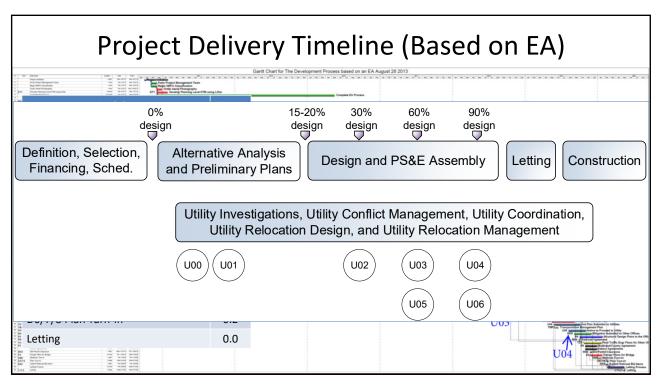
Utility Process within Project Delivery

Utility Engineering Stages Utility
Investigation
Deliverables

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Utility Engineering Framework

 Utility Engineering is a branch of engineering that focuses on the planning, design, construction, operation, maintenance, and asset management of utility systems, <u>as well as the</u> <u>interaction (and interdependence) between utility</u> <u>infrastructure and other infrastructure.</u>



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• Utility Engineering Framework • Utility Entitle plans and asset interactic infrastruc Utility Asset Utility Engineering Utility Engineering

Utility Engineering Framework—Utility Coordination Techniques and procedures to provide effective coordination between project owners Utility Asset Management Utility Investigations and utility stakeholders (including preparation, Utility execution, and Engineering management of utility agreements, as well as Utility Conflict preparation and

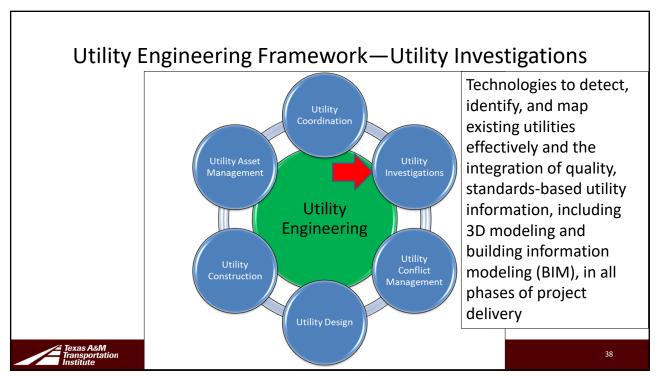
Utility Design

Management

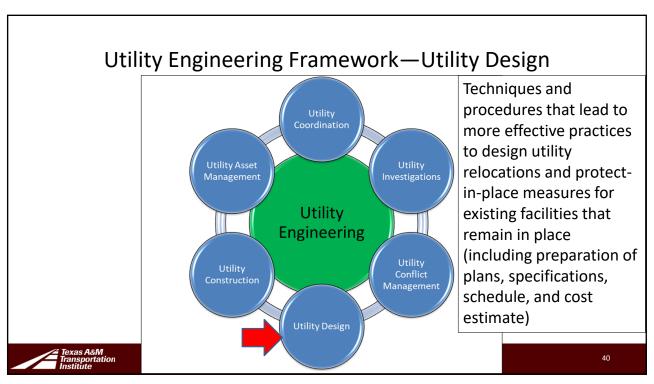
management of utilityrelated documents in bid

packages)

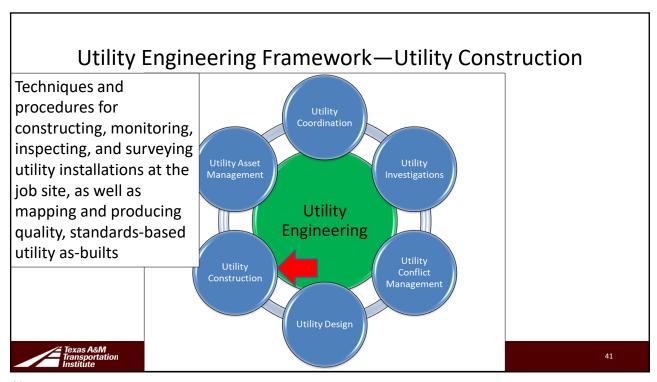
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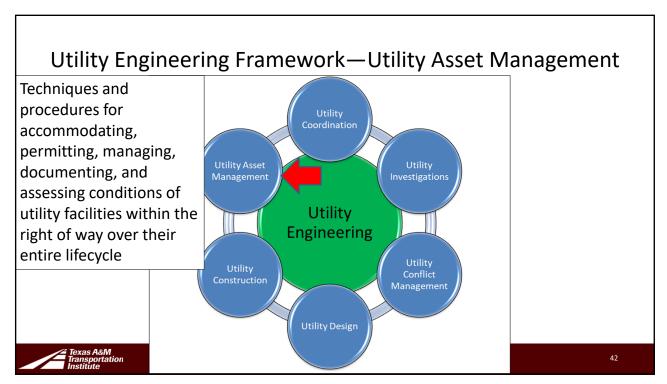


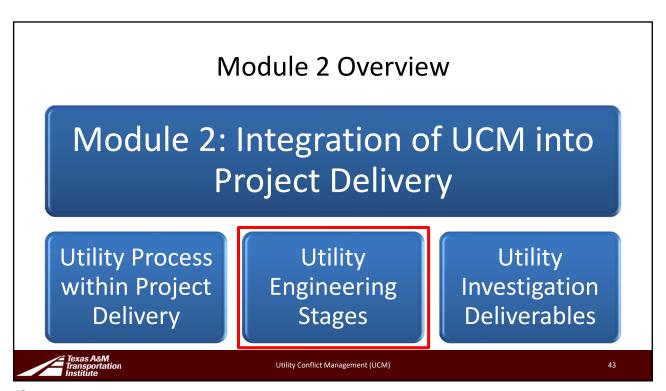
Utility Engineering Framework—Utility Conflict Management Techniques, protocols, and systems that use the avoid, minimize, and accommodate principle Utility Asset Management to identify and resolve conflicts systematically Utility between infrastructure **Engineering** project features or phases and existing or Utility Conflict proposed utility facilities Management Utility Design

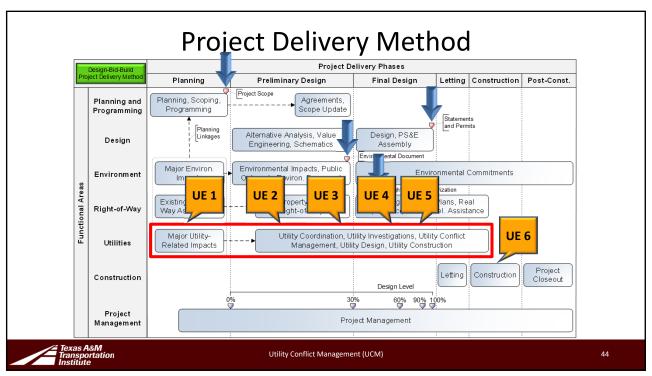


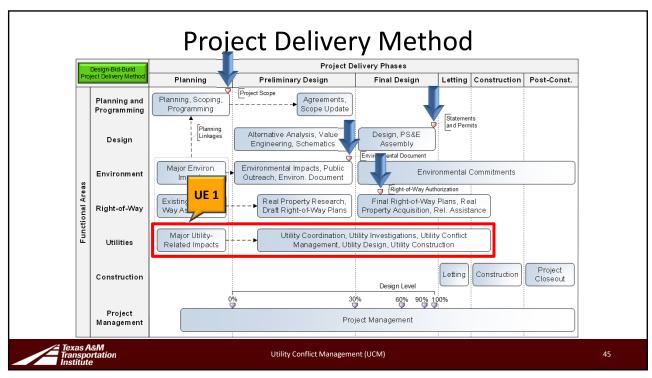
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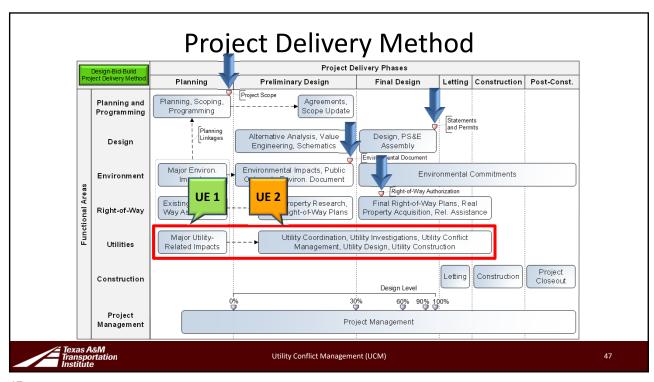


Utility Engineering Stages—Stage 1 (Key Points)

- No project yet
- Prepare realistic project scope (fiscally constrained)
- Identify major utility-related issues affecting the project route, scope, or schedule
- Utility investigation not conducted at this stage
- Meet with utility owners about planned project



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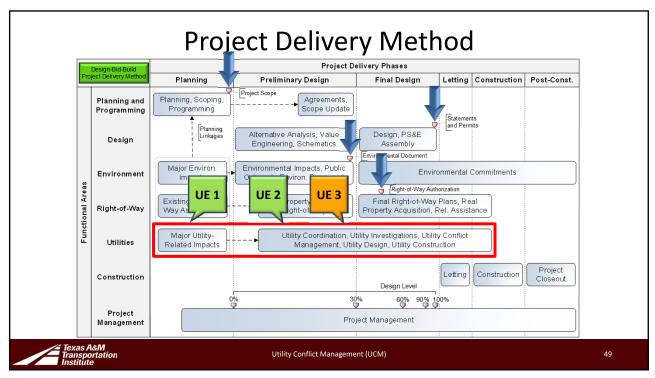
Utility Engineering Stages—Stage 2 (Key Points)

- · Conduct preliminary utility investigation based on existing records
- · Identify utility conflicts and conduct initial assessment
 - Utility layout (in CAD)
 - Preliminary utility conflict list (in Excel)
 - Focus on major physical constraints associated with utility facilities
- Determine where additional utility investigation is needed



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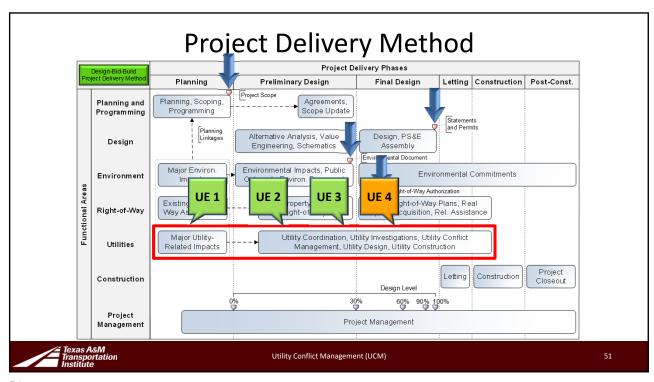


Utility Engineering Stages—Stage 3 (Key Points)

- Survey aboveground utility facilities
- · Conduct utility investigation using geophysical techniques
- Identify/update utility conflicts
 - Utility layout (in CAD)
 - Utility conflict list (in Excel)
- Request utility owners to confirm conflict locations, assess constructability challenges, and discuss potential resolution strategies
- Determine where more detailed investigations are needed
- Develop preliminary critical path schedule for utility relocations



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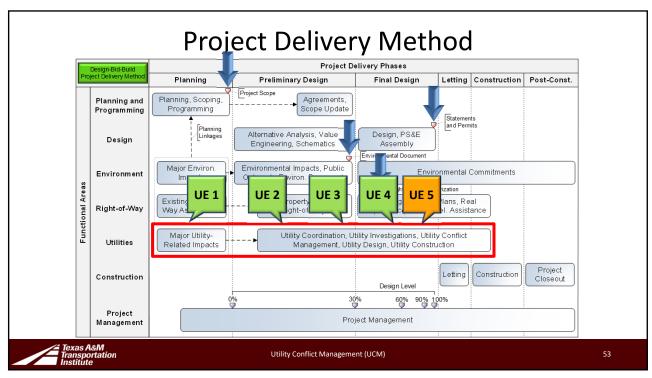


Utility Engineering Stages—Stage 4 (Key Points)

- Conduct geophysical investigation ASAP if not done before
- · Conduct utility test holes at specific locations
- Identify/update utility conflicts
- Analyze and review utility conflict resolution strategies
- Notify utility owners of required relocation or adjustment
- Design/coordinate utility relocation and protect-in-place measures
- Prepare utility relocation plans and schedules for inclusion in utility agreements
- Prepare or revise critical path schedule for utility relocations
- Monitor/inspect utility relocations
- Prepare utility as-built plans



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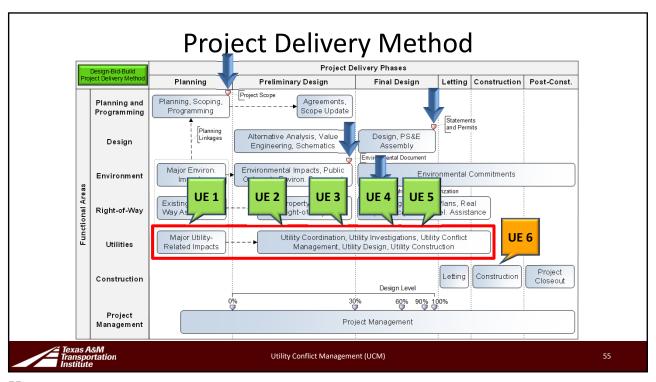


Utility Engineering Stages—Stage 5 (Key Points)

- Need for a utility investigation at this point should be minimal
- Finalize design of utility relocation and protect-in-place measures
- Finalize utility agreements
- Refine utility relocation schedules
- Monitor/inspect utility relocations and prepare utility as-built plans
- · Prepare utility construction plan
- Include utility plans and utility relocation schedules in PS&E package
- Prepare utility statement, showing utility work completed prior to construction, utilities not in conflict with the project, and utility work that must be completed during construction



Utility Conflict Management (UCM)

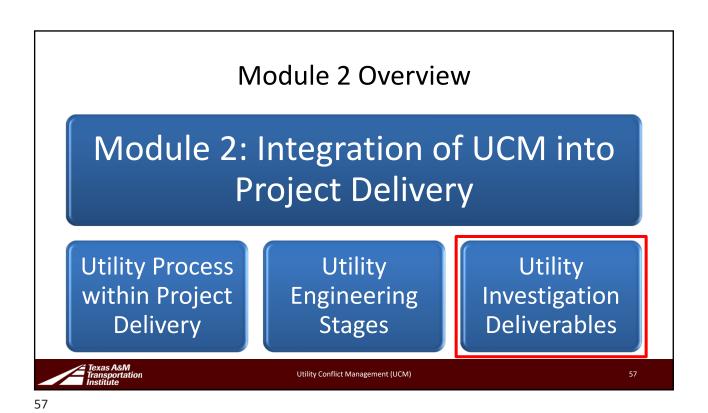


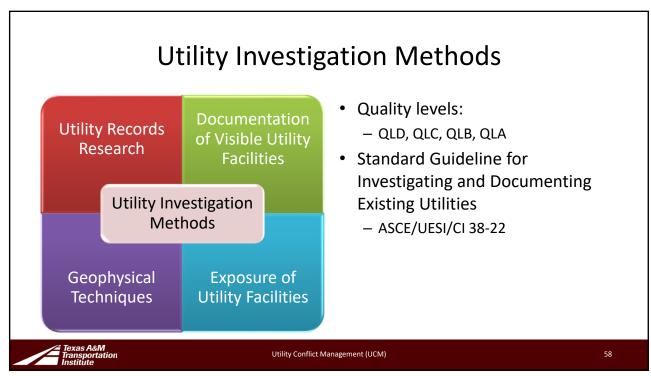
Utility Engineering Stages—Stage 6 (Key Points)

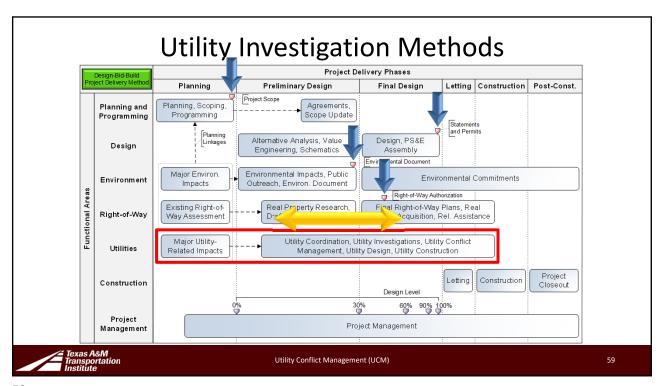
- Need for a utility investigation at this point should be minimal
- · Conduct pre-construction utility coordination meeting
- Conduct construction utility coordination meetings
- Monitor/inspect utility relocations and prepare as-built plans
- Assess and resolve new utility conflicts and corresponding impacts that are uncovered during construction
- Update utility relocation schedules

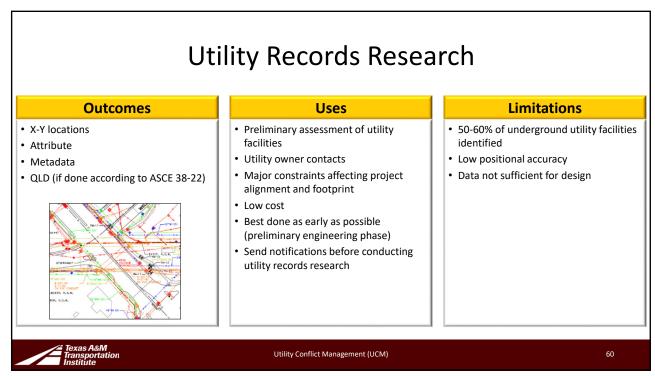


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Documentation of Visible Utility Facilities

Outcomes

- X-Y locations
- Attribute
- Metadata
- QLC, QLD (if done according to ASCE 38-22)





Uses

- Improved reliability of existing utility data
- Tight integration of utility data with project survey control
- · Pole attachments:
 - Increasingly important
 - Ignored in utility records research
 - Need to coordinate with each utility pole tenant

Limitations

- Mislabeled or misidentified utility features
- Surface features paved over or filled with dirt
- Difficult to access manholes and vaults
- Difficult to measure top of pipe inside tight valve boxes
- Information at one location
- Pole attachments not documented



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Geophysical Techniques

Outcomes

- X-Y locations
- Z data (technique dependent)
- Attribute
- Metadata
- QLB, QLC, QLD (if done according to ASCE 38-22)





Uses

- Improved utility data completeness and reliability
- Up to 80-90% of underground utility installations located

Limitations

- Higher costs than for previous utility investigation phases
- More certainty for horizontal locations than vertical locations

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Exposure of Utility Facilities

Outcomes

- X-Y-Z coordinates
- · Grade elevation
- · Map or aerial imagery
- · Picture of utility facility
- · Outside diameter
- · Conduit configuration
- Material
- Condition
- Survey control
- · Pavement thickness and type
- Soil type and conditions
- Metadata
- QLA (if done according to ASCE 38-22)

Uses

- Improved level of confidence about utility locations
- · Reduced level of risk



Limitations

- X-Y-Z data limited to test hole locations
- · Risk of utility damage
- Traffic disruptions at test locations
- Risk to road surface integrity
- Difficulty in confirming exact utility and owner
- Dry holes
- · Who covers the costs



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Utility Investigation Deliverables

- Plans
- Test hole sheets
- Utility investigation report
 - Project description
 - Methods and equipment used
 - Software used to process and depict utility data
 - Description of utilities located and depicted
 - Problems encountered and resolutions

Proposed Excavation

Temp Survey Marks

Electric - Power

Gas - Oil - Steam

Communications

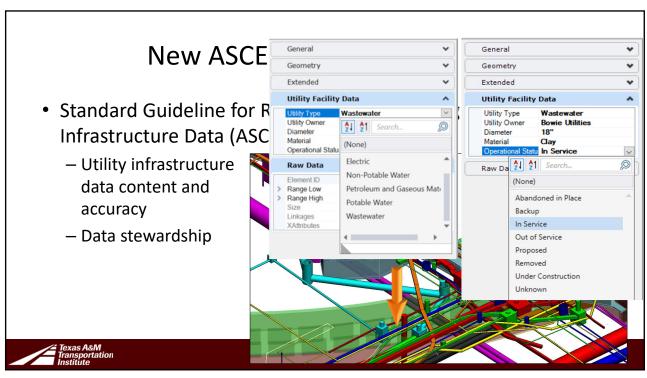
Potable Water

Reclaimed Water

Sewer - Drain Lines

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Best Practices

- · Begin utility investigations early
- Use ASCE 38-22 for conducting utility investigations
- Use ASCE 75-22 for submitting utility investigation deliverables
- MicroStation/OpenRoads Designer:
 - Do not type in annotations/callouts to document utility features
 - Instead:
 - · Use item types and properties to document utility features
 - Use annotations/call outs based on property values



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Break

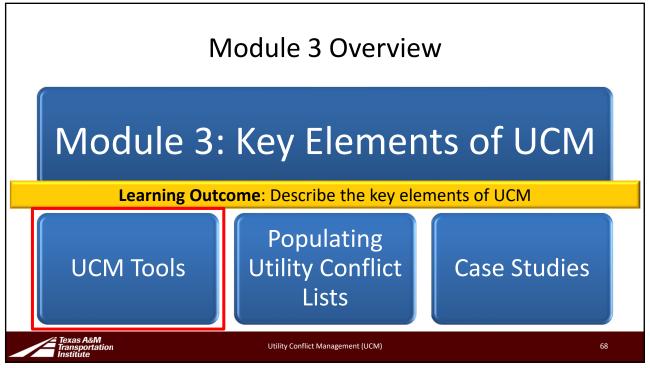
• We'll continue at **12:30 PM**

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UCM Tools

- Utility conflict list and...
- · Utility layout
- Utility investigation deliverables
- Project plans (plan views, profiles, cross sections)
- Field visit information
- · Right of way plans
- · Hydraulic analysis and design
- Schedule (could be input or output)
- Utility installation specifications (could be input or output)
- · Utility accommodation rules and utility industry standards
- · Interactions with utility owners



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Utility Conflict List Utility Conflict Management (UCM) - Utility Conflicts Utility Utility **Utility Owner** Utility Utility **Utility Owner** Utility Owner **Utility Type** Utility Subtype **Utility Feature Utility Conflict Description** Email Property Parcel End End From Latitude From Height/ Alignment Placement Relative t Parcel U Relative to Status Ground Level Type Utility Utility Utility Conflict Estimated Resolution Test Hole Resolution Strategy Selected Status Comment vestigatio (Y/N) hieved Dat (from Resolution Alternatives) (Y/N) Status Date Utility Conflict Management (UCM)

Utility	Utility Conflict List Utility Conflict Management (UCM) - Analysis of Utility Conflict Resolution Alternatives									
Utility Conflict ID	Alternative No.	Alternative Description	Alternative Advantages	Alternative Disadvantages	Impact on Project Delivery Time	Total Cost to DOT (\$)	Total Cost to Utility Owner (\$)	Total Cost (\$)	Feasible (Y/N)	Selected (Y/N)
Texas A&M Transportation Institute Utility Conflict Management (UCM)					71					

Best Practices

- Use utility layout (same highway design software/workspace) to:
 - Identify utility conflicts
 - Show utility conflict locations
 - Assign unique utility conflict IDs
- Integrate utility layout with utility conflict list/matrix to:
 - Prepare/maintain list of utility conflicts
 - Document utility conflict resolution alternatives



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Best Practices

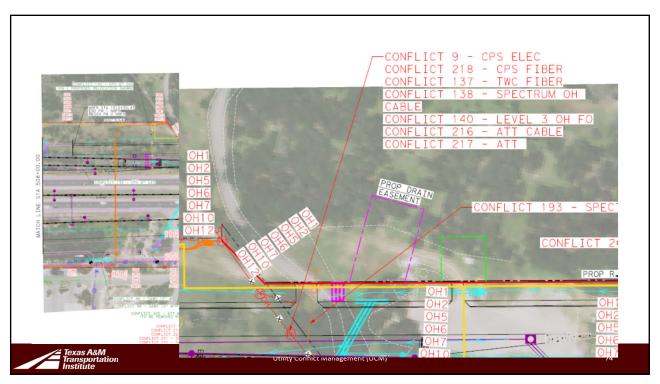
- Maintain and update utility layout and utility conflict list regularly
- Track utility conflicts at the utility facility level
- Start early (best during preliminary design)
- Involve stakeholders in review of utility conflicts and solutions
 - Regardless of reimbursement eligibility

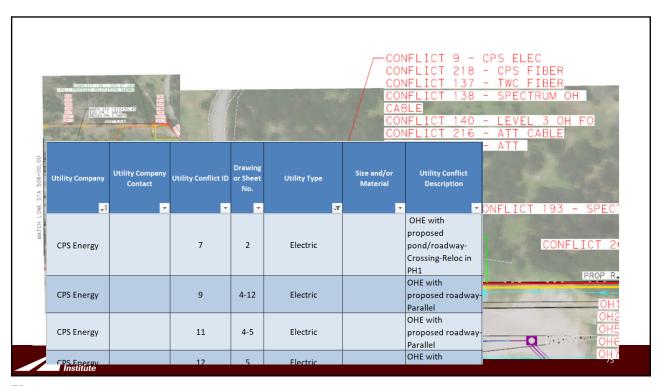


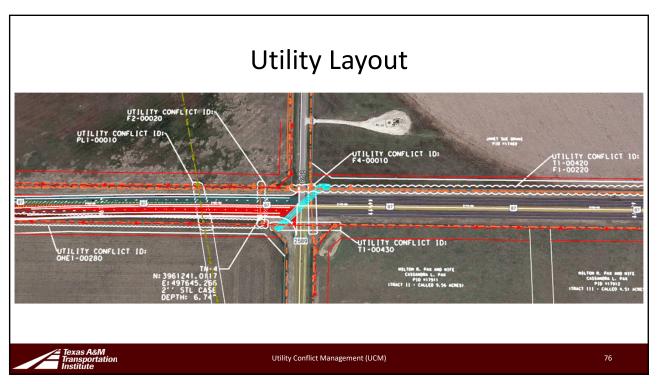
Utility Conflict Management (UCM)

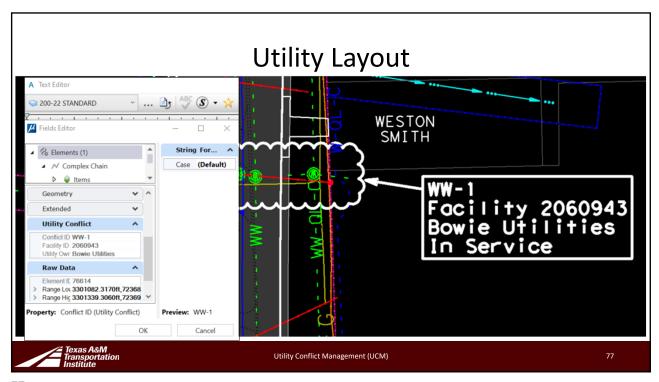
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Best Practices

- Bring to all utility coordination meetings:
 - Utility conflict list
 - Utility layout
 - Schedule (both project and utility relocations)
 - ROW acquisition status and exhibits
 - Environmental review status



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Best Practices

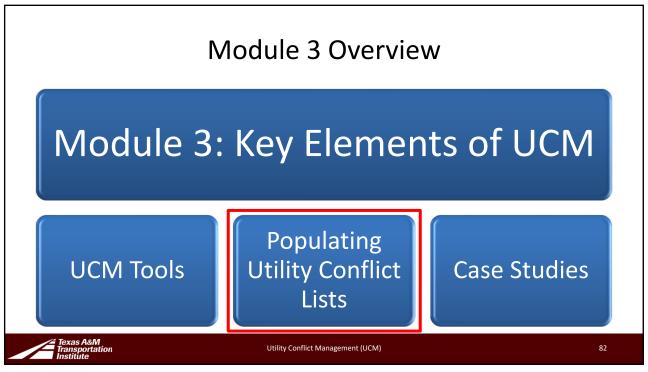
- Use UCM tools to:
 - Generate an inventory of utility conflicts
 - Analyze utility conflict resolution strategies
 - Track the resolution process for each utility conflict
 - Provide a link to other documents, including the utility layout
 - Prepare utility statement (or certification) to include in the PS&E package
- Immediate benefits:
 - Manage utility conflicts more effectively
 - "Tell the story" about how utility conflicts were identified and resolved

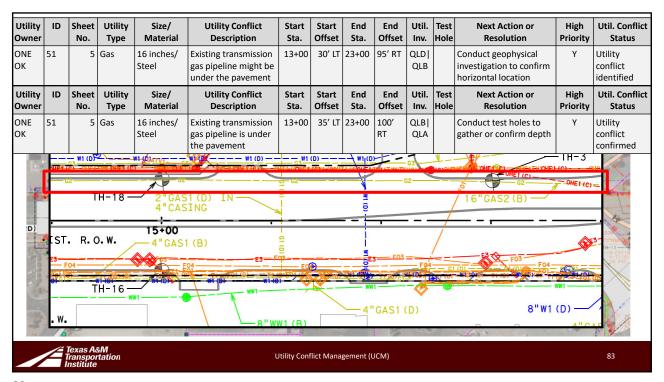


Utility Conflict Management (UCM)

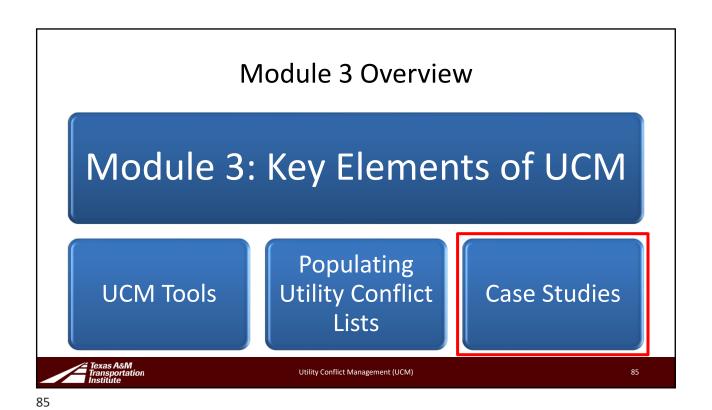
Typical UCM Actors and Roles Populates/ Analyzes/ Conducts Identifies Confirms Coordinates **Approves** Prepares **Maintains** Recommends Actor Utility Utility Utility with Resolution Utility Utility Resolution Investigations Conflicts Conflicts Stakeholders **Strategies** Statement **Conflict Lists** Alternatives Project Manager Project Designer Υ Υ Υ **Utility Coordinator** Existing records **Project Surveyor** Aboveground **Utility Owner SUE Provider** Υ **Project Contractor** Occasionally ** If included in the scope of work *** During construction **A&M** portation September 10, 2024 **Identifying and Managing Utility Conflicts**

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Utility Owner	ID	Sheet No.	Utility Type	Size/ Material	Utility Conflict Description	Start Sta.	Start Offset	End Sta.	End Offset	Util. Inv.	Test Hole	Next Action or Resolution	High Priority	Util. Conflict Status
ONE OK	51	5	Gas	16 inches/ Steel	Existing transmission gas pipeline might be under the pavement	13+00	35′ LT	23+00	100' RT	QLA QLA	3, 18	Compare relocating vs. remaining in place	Y	Utility conflict confirmed
Utility Owner	ID	Sheet No.	Utility Type	Size/ Material	Utility Conflict Description	Start Sta.	Start Offset	End Sta.	End Offset	Util. Inv.	Test Hole	Next Action or Resolution	High Priority	Util. Conflict Status
ONE OK	51	5	Gas	16 inches/ Steel	Existing transmission gas pipeline is under the pavement	13+00	35′ LT	23+00	100' RT	QLA QLA		Remain in place. Do not relocate.	Y	Utility conflict resolved
(DEP 6.	EXIST GRAD TH TOP 20' 4.86	LEV. SU (P.)	H-18— RVEY MAI ASPHA ASPHA	LT_	Manager: Luis Cardoz		SE I		XISTING RADE TOP)	ϕ	I)	Tield Messey, L	US Cardo	01.25.220



• Case 1: Electric transmission line
• Utility conflict

| Transmission line | Transmi

Widening Project

- Resolution alternatives:
 - Relocate transmission line
 - Modify final grade to avoid transmission line
- Decision:
 - Lowered final grade enough to satisfy overhead clearance
 - Maintained sufficient ground cover above gas line at same location
- Benefits:
 - Cost savings: \$3M
 - Time savings: 24 months of project delivery time



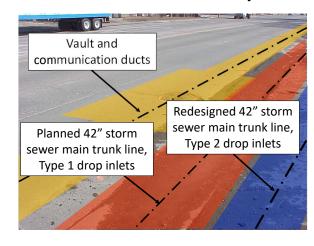
Utility Conflict Management (UCM)

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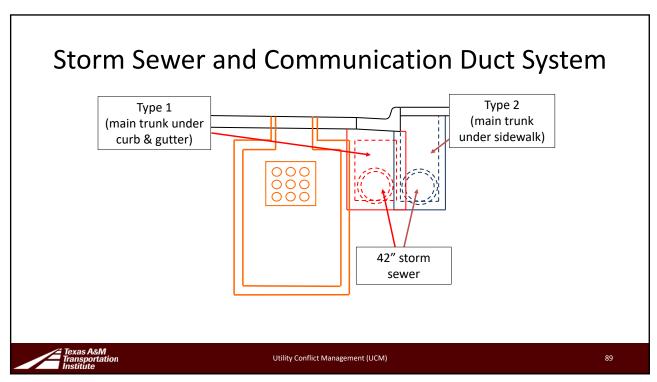
Storm Sewer and Communication Duct System

- Communication ducts along 5 blocks of city streets
- 5 vaults (5 feet x 7 feet x 12 feet) connected with 9 4-inch ducts encased in concrete
- In conflict with planned storm sewer





Utility Conflict Management (UCM)



Storm Sewer and Communication Duct System

• Utility owner's estimate to relocate 9-duct system \$750,000

Additional cost to re-design storm sewer -\$37,270

• Cost savings to consumers/taxpayers \$712,730



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Break

• We'll continue in 10 minutes

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Module 4 Overview

Module 4: Hands-On UCM Exercise

Learning Outcome: Identity and resolve utility conflicts for a sample project

Confirm Utility Conflicts.
Analyze and Compare
Resolution Strategies

Present Findings



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Project Overview

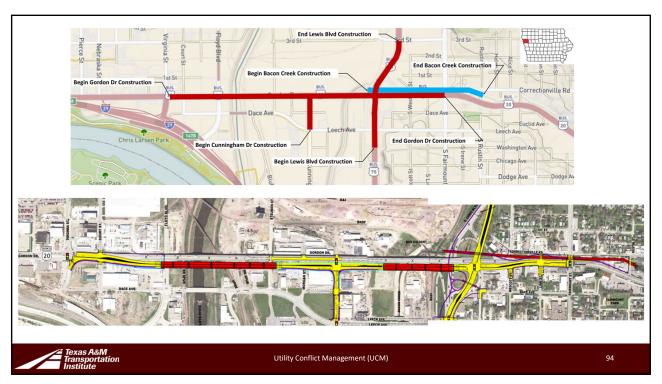
- U.S. 20 (Gordon Drive) in Sioux City
- Scope of improvements:
 - Replace 4,000-ft viaduct
 - Built in 1930s, modified twice in the 1960s
 - Stockyard crossings, industry tracks no longer used
 - Land use is changing
- Multiple utility owners:
 - Communications, electric, gas, water, wastewater



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U.S. 20 Project Schedule

- Preliminary plans
 - D05 plans in December 2024 (utility plans included)
- ROW acquisition
 - 2026 and 2027
 - Utility relocations
- Letting
 - July 2027 (Gordon Drive and Bacon Creek)
- Construction
 - Fall 2027



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Hands-On UCM Exercise

- Understand and confirm conflicts using existing data (15 min)
- Analyze and compare resolution alternatives (60 min)
 - Identify 2 conflicts
 - Develop and compare 3-4 resolution alternatives
 - Select most appropriate resolution alternative
- Present findings (30 min)



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Group Instructions

- Re-introduce yourself to others in your group
- Establish roles within the group
 - Group leader (one person)
 - Display and mark up .pdf and/or .kmz files (one or more)



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Group Instructions

- · Download project files
- Make sure to review ALL project files, not just the layout
 - Plan sheets
 - KMZ file
 - Utility investigation report
- Use Google Earth
- Use Adobe Acrobat/Reader or Bluebeam comment toolbox

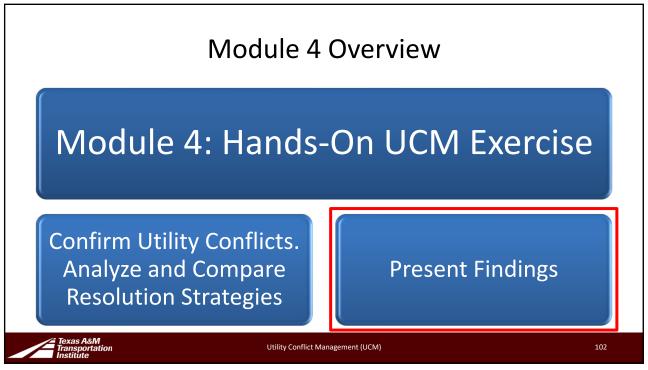


Utility Conflict Management (UCM)

							U	ti	lity	Co	nf	lict l	ist						
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Station C	Origin	Start Station	Start Offset	End Station	End Offset	From Latitude	Fro e Longit		To Latitude	To Longitude	Height/ Depth (ft)	Placement Relative to Ground Level	Alignment Type		t Relative to	Property Interest Type	Parcel U- Number	Parcel Acquisition Status	
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	Á	Texas Transp Institu	ortation						Utility	Conflict Ma	ınagemei	nt (UCM)						99	

ltilit\	Conflic	t Managemer	t (UCM) -	Analysis	of Utility	Conflict Res	alution	Alteri	natives									
Utility Conflict ID(s)	Alternative No.			Alternative Ad		Alternative Disac			A Requirem		cts	Impact o		Total Cost to DOT (\$)	Total Cost to Utility Owner (\$)	Total Cost (\$)	Feasible (Y/N)	Selecti (Y/N
Ow	er/District: Project CSJ:	Management (L					- - -							Pr Re	epared By: viewed By: Date:			
tility nflict ID	Utility Layout/ Sheet No.	Utility Owner and/or Contact Name	Utility Type and Feature	Size and/or Material	Utility Co	onflict Description	Start Station	Start Offset	End Station	End Offset	Util. Inv. Compl.		Test Hole No.	Next Action/Re Strategy Sele		Priority C	,	Estimat Resolut Date

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Utility Conflict ID	Utility Layout/ Sheet No	Utili	ty Owner	Utilit	y Owner act Name	Utility	Owner hone and	Utility Feature	Utility Function	Utility Type		Utility Subtype	e Utility Fo	eature Size	Material	Utility Conflict Description	
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Utility estigat mplete	ion Inves	ility , tigation eded	gation No. Next Action				Resolution Strategy Se (from Resolution Altern			Reimbursable (Y/N)	High Priorit (Y/N)	Utility Conflict Status	Status Achieved Date	Estimated Resolution Date		Comment	



Hands-On UCM Exercise

- Understand and confirm conflicts using existing data (15 min)
- Analyze and compare resolution alternatives (60 min)
- Present findings (30 min)
 - (Each group) Give 5-minute presentation
 - Describe process to analyze and resolve two conflicts
 - Highlight major lessons learned
 - (Everybody) Ask questions



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