Six Pillars of Utility Engineering will begin shortly but while you wait…

WE NEED YOUR HELP!

UESI, an institute of ASCE, is conducting a survey on what utility coordination looks like nationally. Please use the QR code to participate in the survey. Thanks!

Six Pillars of Utility Engineering

- Cesar Quiroga, Texas A&M Transportation Institute (TTI)
- Natalie Parks, USI Consultants, Inc.

Six Pillars of Utility Engineering – National Perspective

Cesar Quiroga, Ph.D., P.E., F.ASCE

106th Purdue Road School, 03/10/2020

Reality Check…

- Frequently cited reasons for project delays (DOT perspective):
  - Short timeframe for developing projects
  - Project design changes
  - Environmental process delays
  - Utility-related inefficiencies
    - Inaccurate location and marking of existing utility facilities
    - Identifying utility conflicts late in the design phase
    - Disagreements on recommended utility-related solutions
    - Utility relocation costs not handled properly

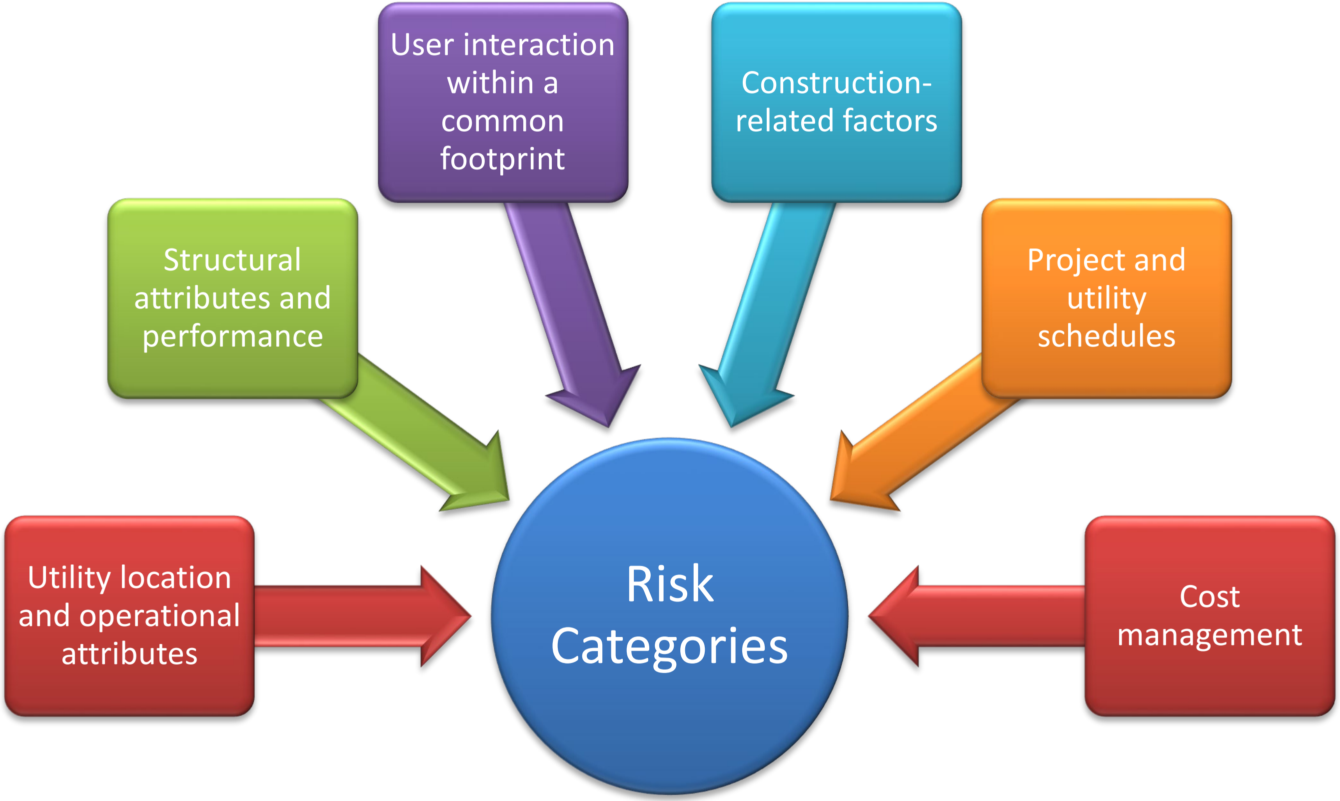
Reality Check… (2)

- Frequently cited reasons for project delays (utility owner perspective):
  - Limited resources (financial and personnel)
  - Internal demands (maintenance, service upgrades)
  - Utility owner’s project development process protocols
  - Coordination with other stakeholders during design
  - Coordination with other stakeholders during construction
  - Changes in DOT design and schedules
  - Unrealistic schedule by DOT for utility relocations

Impacts of Inefficiencies in Utility Process

- Construction site disruptions
- Damage to utility installations
- Risks to public health and safety
- Unnecessary utility relocations
- Project delays and higher project costs

Risk Factors Related to Utilities



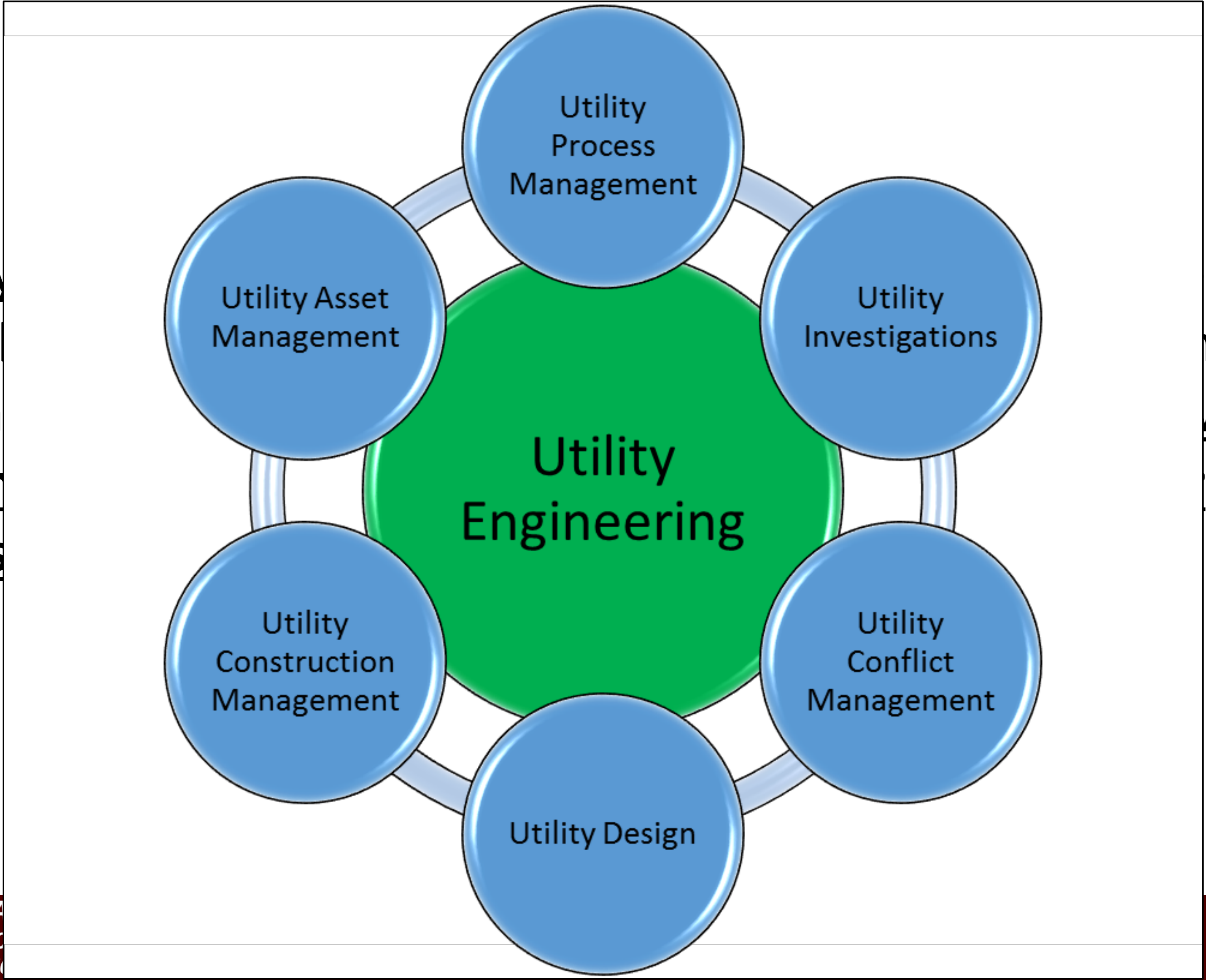
To Bridge the Gap…

- Must understand BOTH agency and utility needs
- Be knowledgeable of BOTH agency and utility owner policies, procedures, and requirements
- Have "cross discipline" design experience in BOTH transportation and utilities
- Experienced in identifying, prioritizing, and mitigating risks for BOTH transportation and utilities
- Have a design understanding of highways, drainage, structures, traffic, right of way, etc.

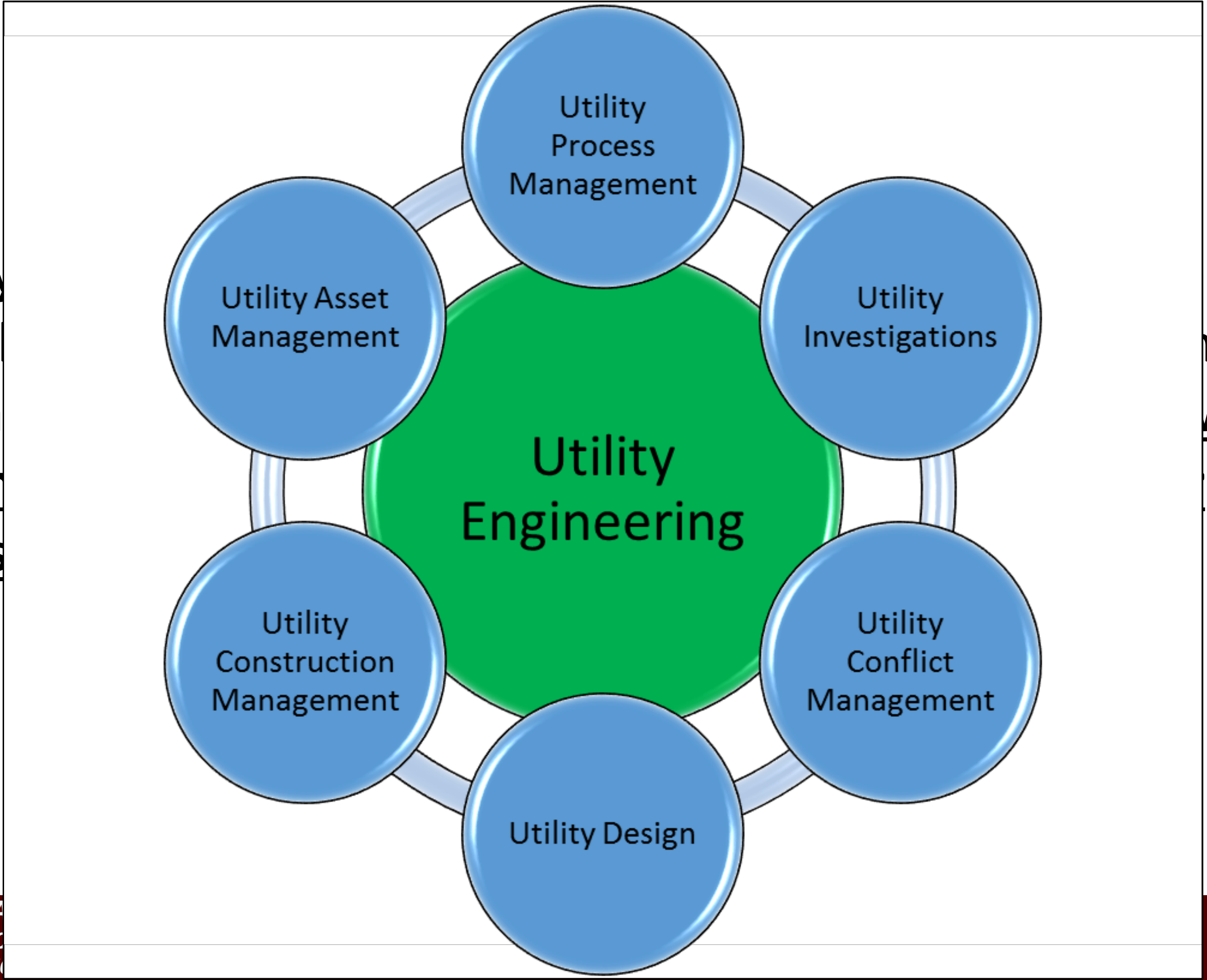
To Bridge the Gap… (2)

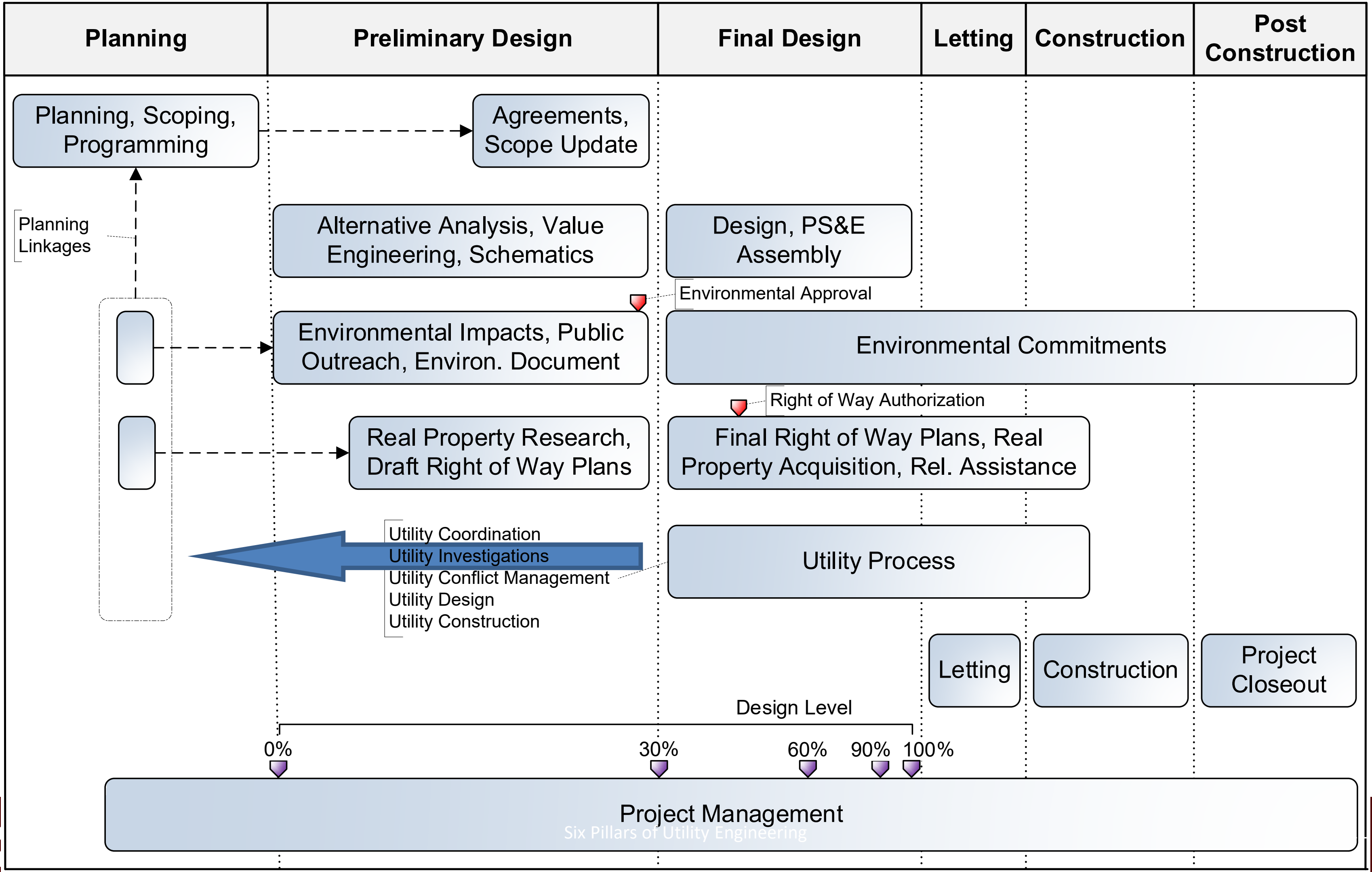
- Experience in resolving utility field construction issues
- Ability to perform constructability reviews involving BOTH transportation and utilities
- Understand construction staging and sequencing constraints for BOTH transportation and utilities
- Ability to establish relationships, based on mutual understanding and trust
- Ability to recognize time and cost innovative utility solutions

- Utility … s on the pl… nce, and a… **well as the in… infras…**

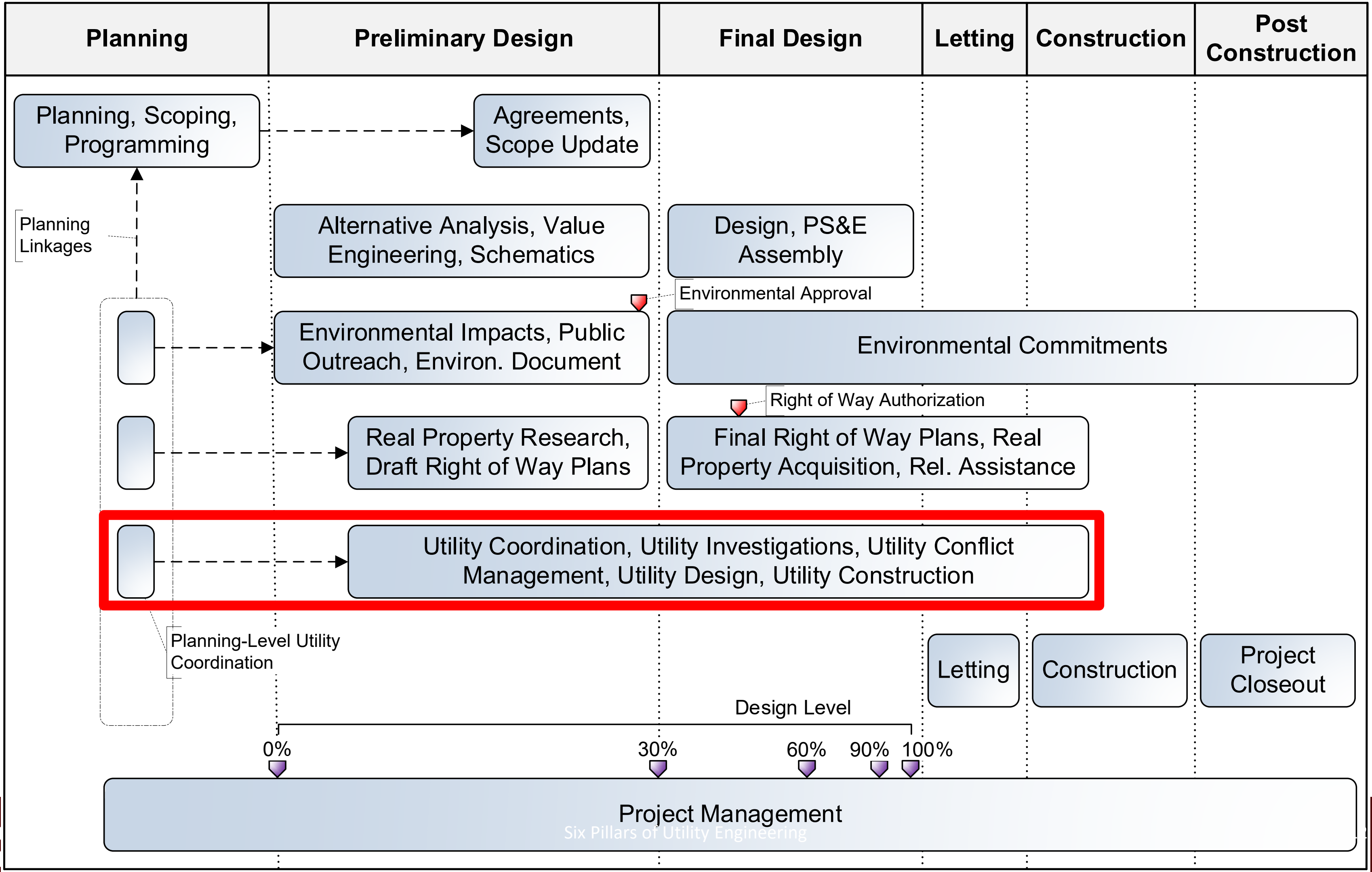


- Utility … s on the pl … nce, and a … **well as the in … infras**





Planning
Preliminary Design
Final Design
Letting
Construction
Post Construction
Planning, Scoping, Programming
Agreements, Scope Update
Planning Linkages
Alternative Analysis, Value Engineering, Schematics
Design, PS&E Assembly
Environmental Approval
Environmental Impacts, Public Outreach, Environ. Document
Environmental Commitments
Right of Way Authorization
Real Property Research, Draft Right of Way Plans
Final Right of Way Plans, Real Property Acquisition, Rel. Assistance
Utility Coordination
Utility Investigations
Utility Conflict Management
Utility Design
Utility Construction
Utility Process
Letting
Construction
Project Closeout
Design Level
0%
30%
60%
90%
100%
Project Management


Planning
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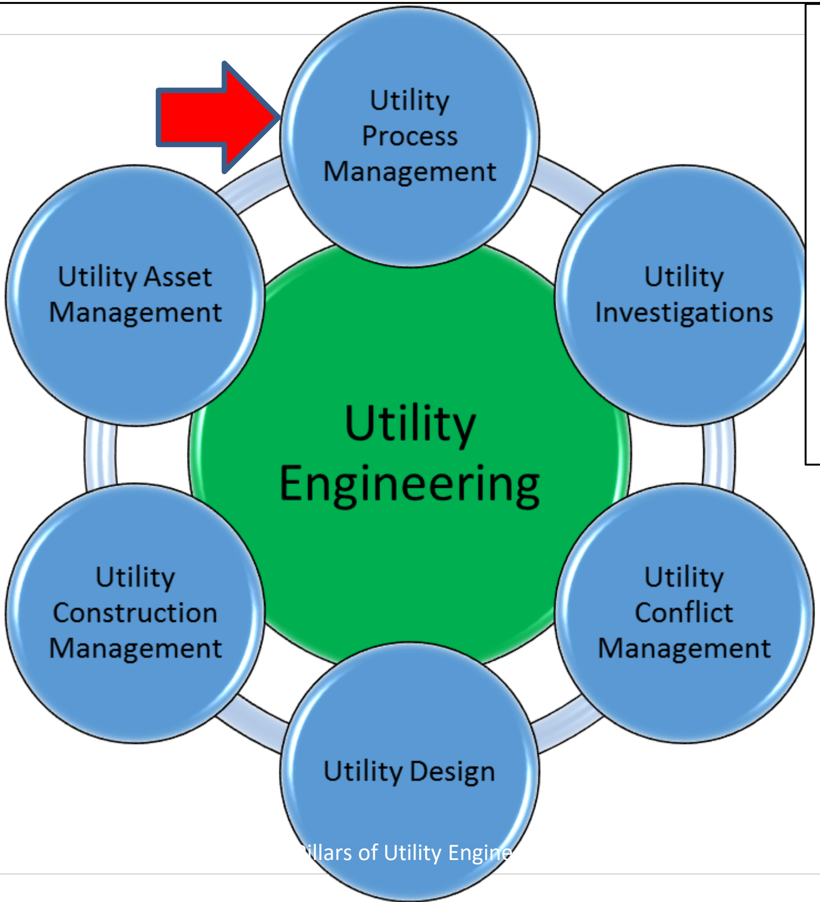
Utility Coordination, Utility Investigations, Utility Conflict Management, Utility Design, Utility Construction
Planning-Level Utility Coordination
Letting
Construction
Project Closeout
Design Level
0%
30%
60%
90%
100%
Project Management

Six Pillars of Utility Engineering (2)

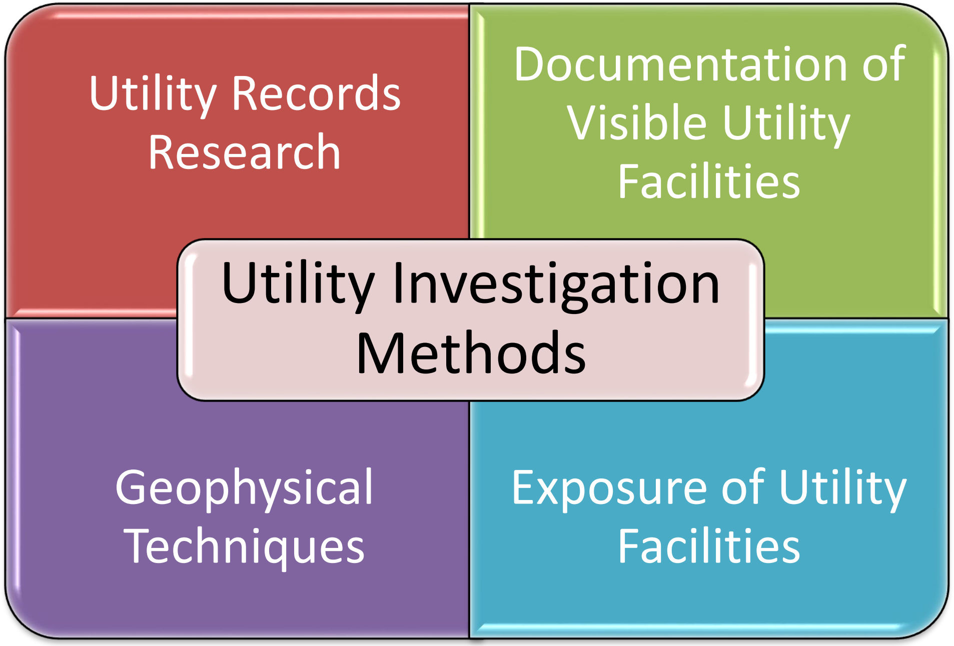


Techniques and procedures to effectively provide coordination between project owners and utility stakeholders and manage utility programs

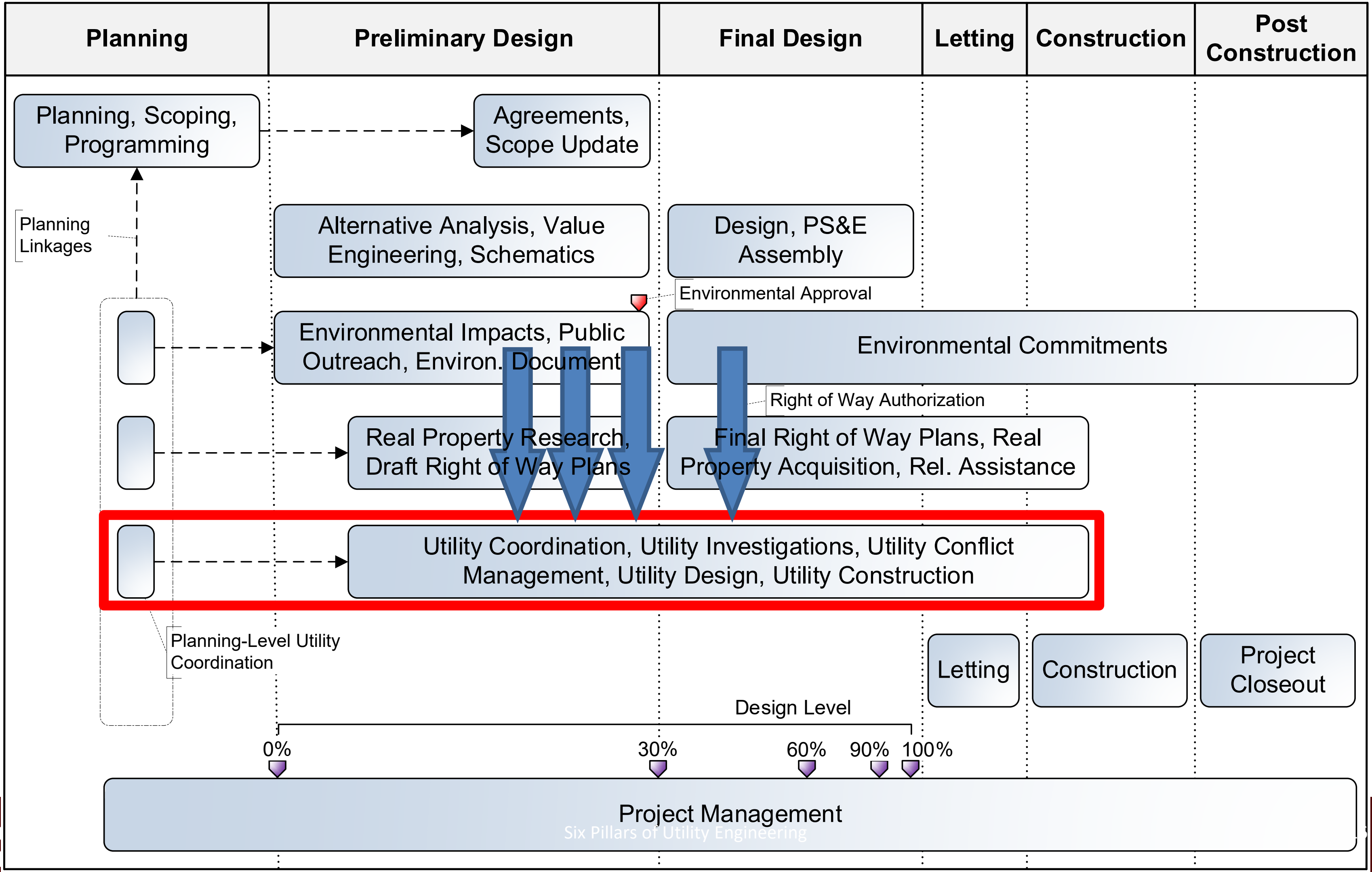
Six Pillars of Utility Engineering (3)

Technologies to detect, identify, and map existing utilities effectively and the integration of quality, standards-based utility information, including 3D modeling and building information modeling (BIM), in all phases of project delivery

Utility Investigation Methods



- Quality levels:
  - QLD
  - QLC
  - QLB
  - QLA
- ASCE Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (ASCE/CI 38-02)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Preliminary Design
Final Design
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Planning-Level Utility Coordination
Letting
Construction
Project Closeout
Design Level
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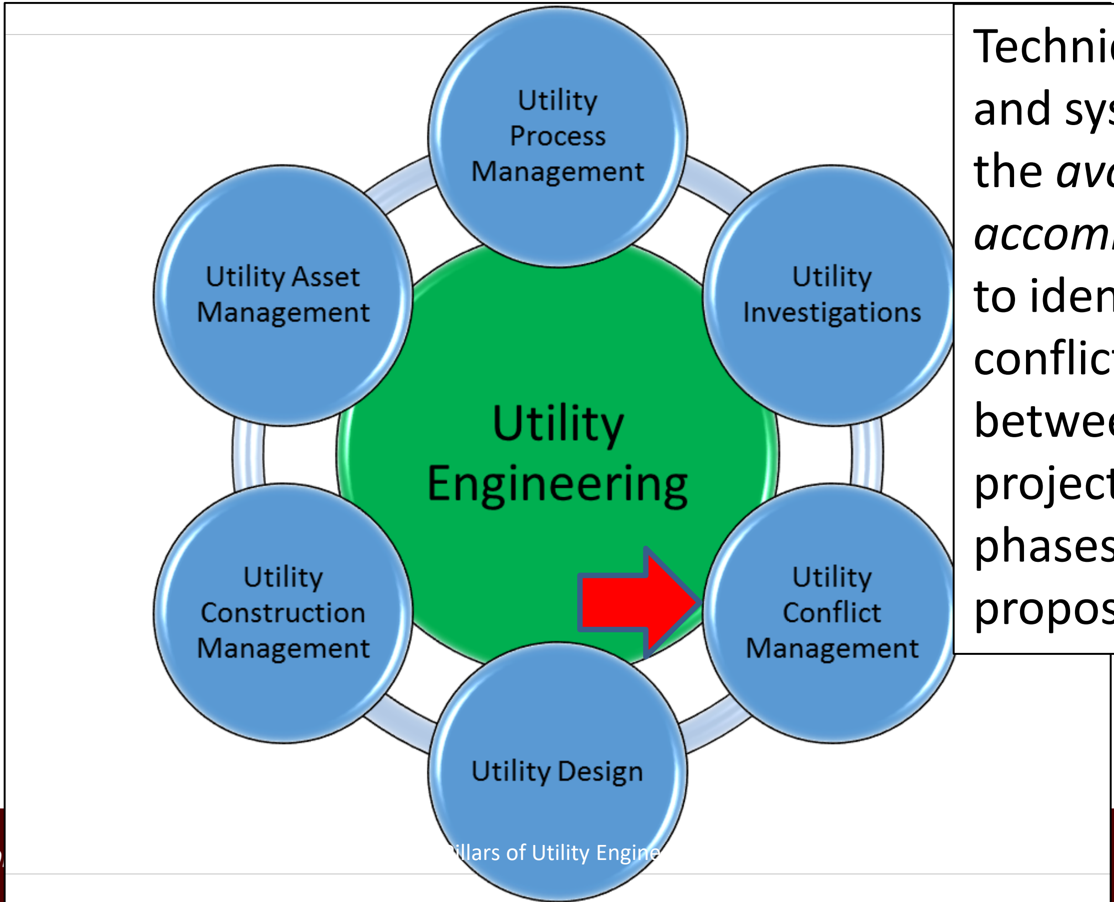
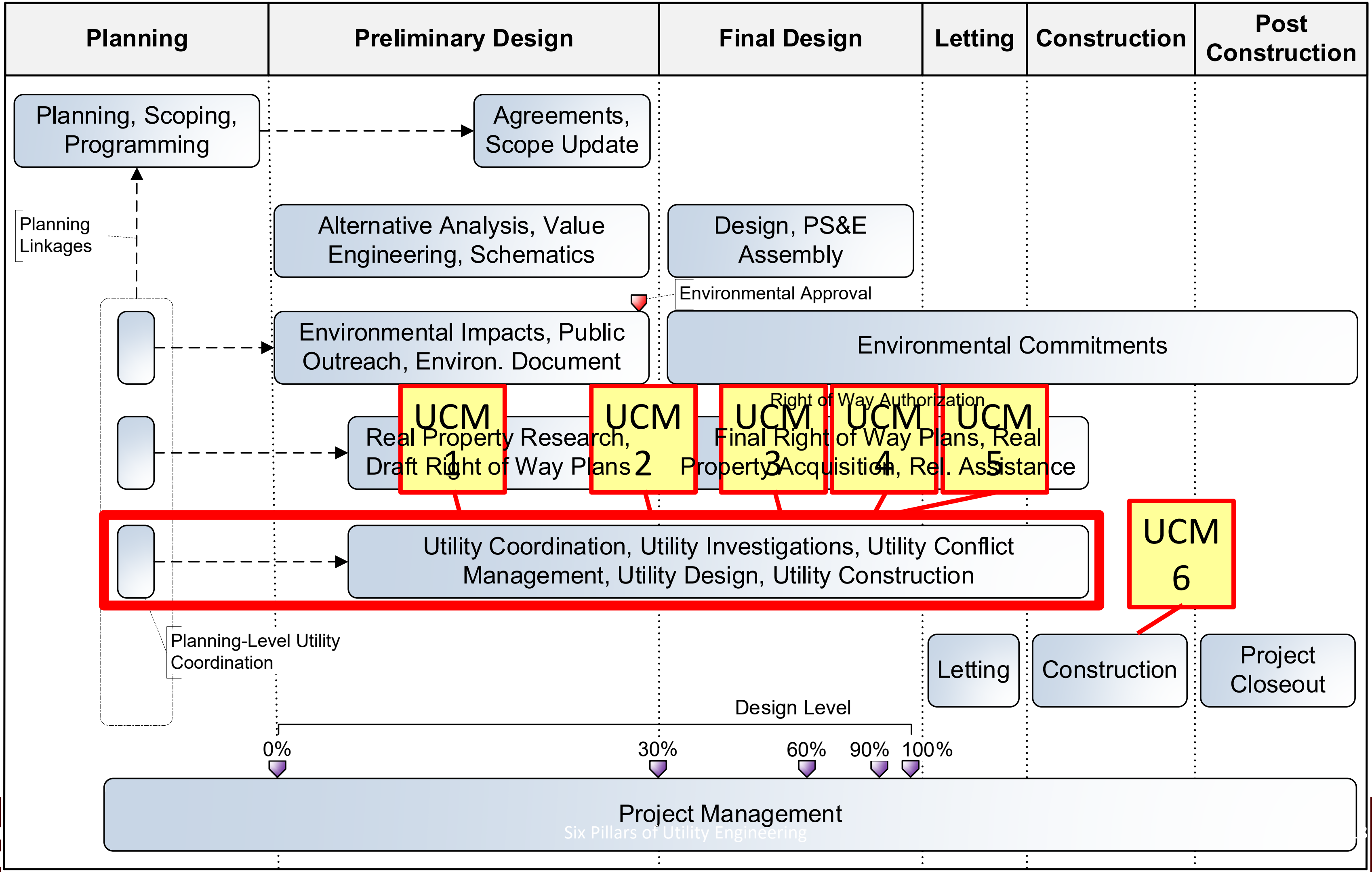
60%
90%
100%
Project Management

Six Pillars of Utility Engineering (4)



Techniques, protocols, and systems that use the *avoid, minimize, and accommodate* principle to identify and resolve conflicts systematically between infrastructure project features or phases and existing or proposed utility facilities


Planning
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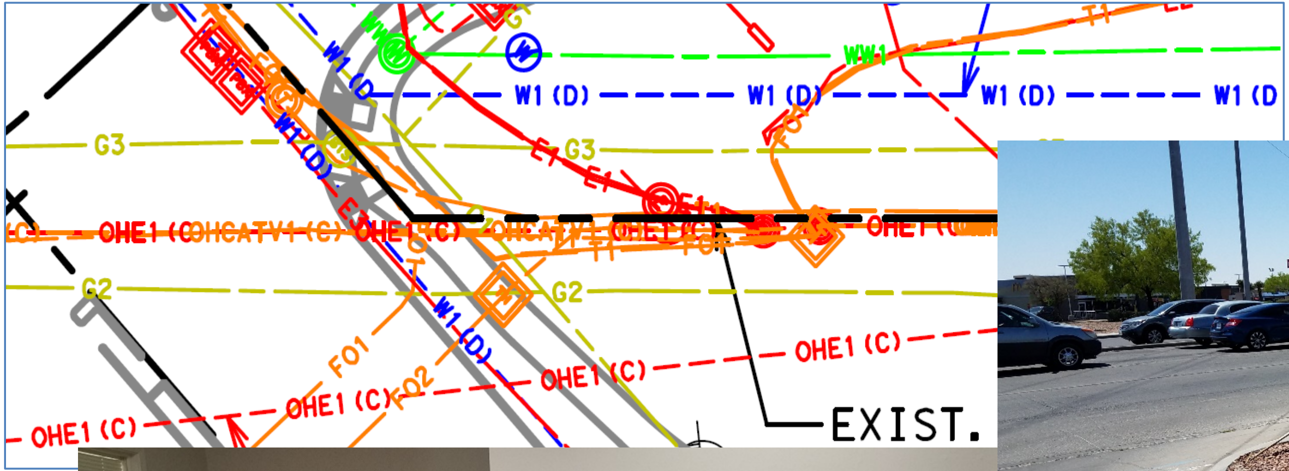
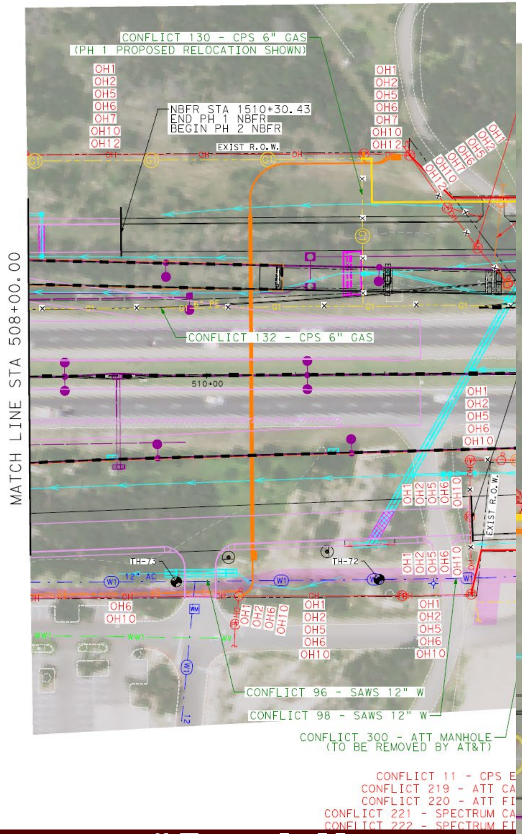
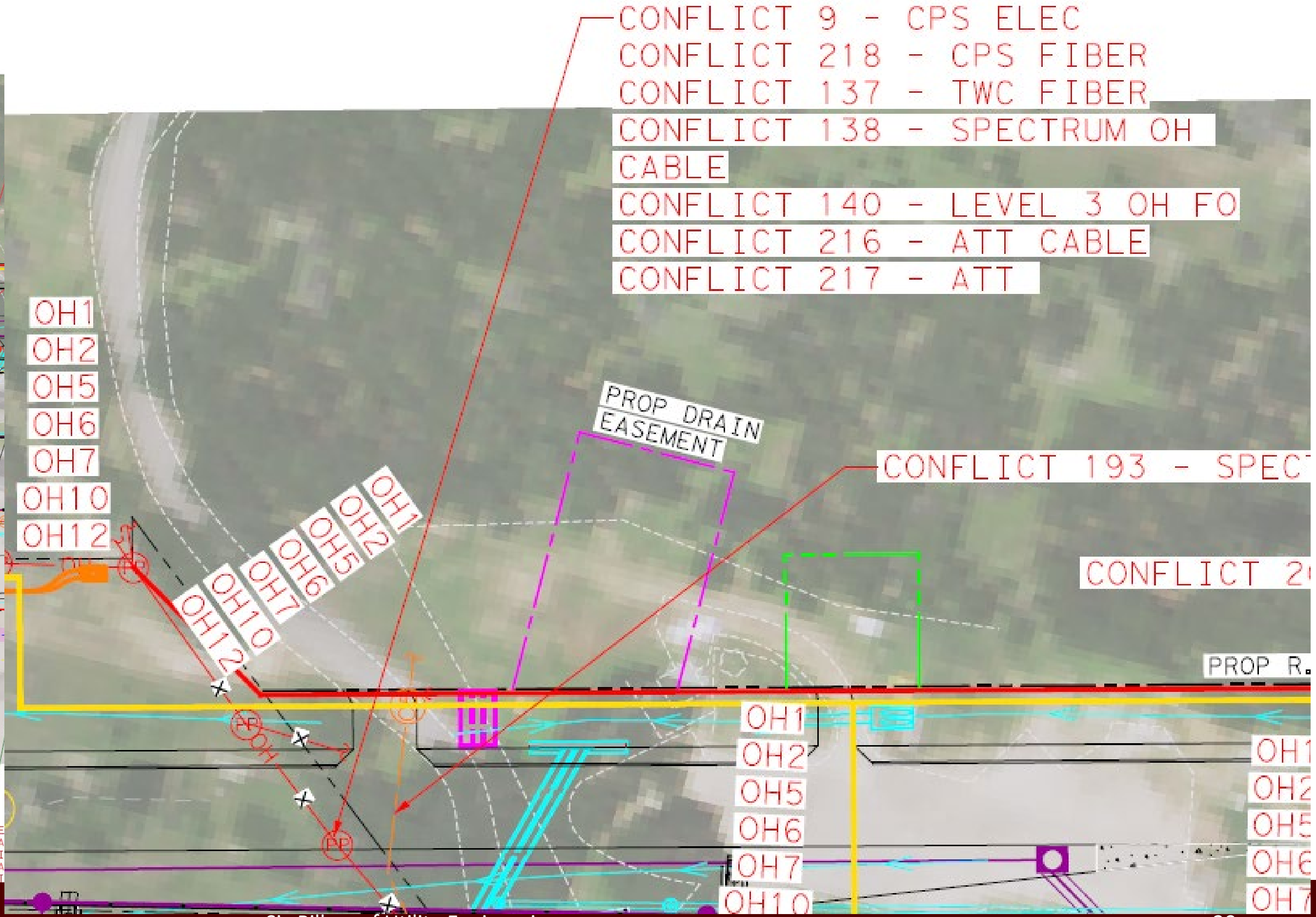
Real Property Research, Draft Right of Way Plans
Final Right of Way Plans, Real Property Acquisition, Rel. Assistance
UCM 1
UCM 2
UCM 3
UCM 4
UCM 5
UCM 6
Utility Coordination, Utility Investigations, Utility Conflict Management, Utility Design, Utility Construction
Planning-Level Utility Coordination
Letting
Construction
Project Closeout
Design Level
0%
30%
60%
90%
100%
Project Management

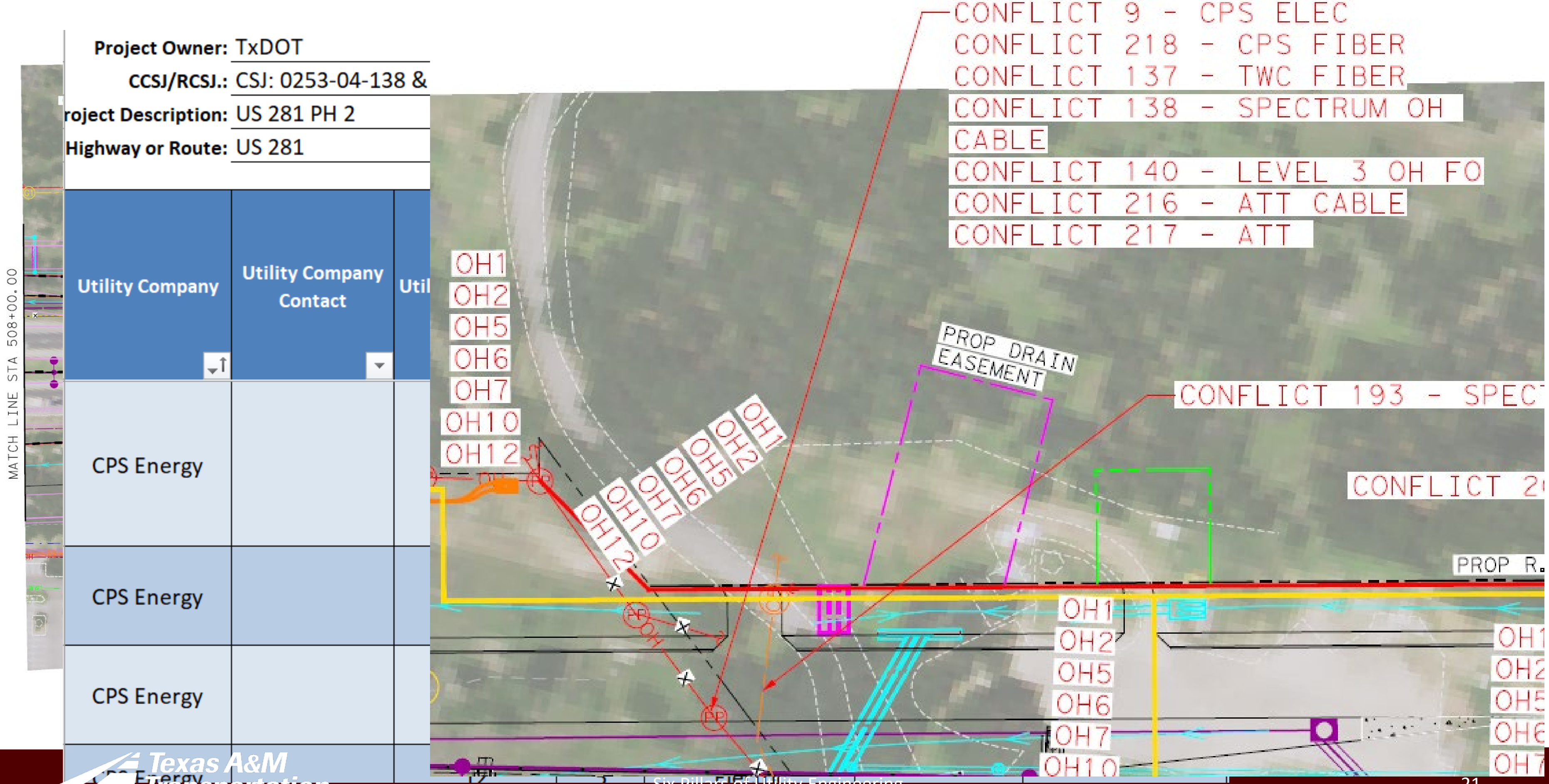

W1 (D)
W1 (D)
W1 (D)
W1 (D
WW1
G3
G3
G2
G2
OHE1 (C)
OHE1 (C)
OHE1 (C)
OHE1 (C)
FO1
EXIST.


CONFLICT 130 - CPS 6" GAS
(PH 1 PROPOSED RELOCATION SHOWN)
NBFR STA 1510+30.43
END PH 1 NBFR
BEGIN PH 2 NBFR
EXIST R.O.W.
MATCH LINE STA 508+00.00
CONFLICT 132 - CPS 6" GAS
510+00
CONFLICT 96 - SAWS 12" W
CONFLICT 98 - SAWS 12" W
CONFLICT 300 - ATT MANHOLE
(TO BE REMOVED BY AT&T)
CONFLICT 11 - CPS E
CONFLICT 219 - ATT CA
CONFLICT 220 - ATT FI
CONFLICT 221 - SPECTRUM CA
CONFLICT 222 - SPECTRUM FI

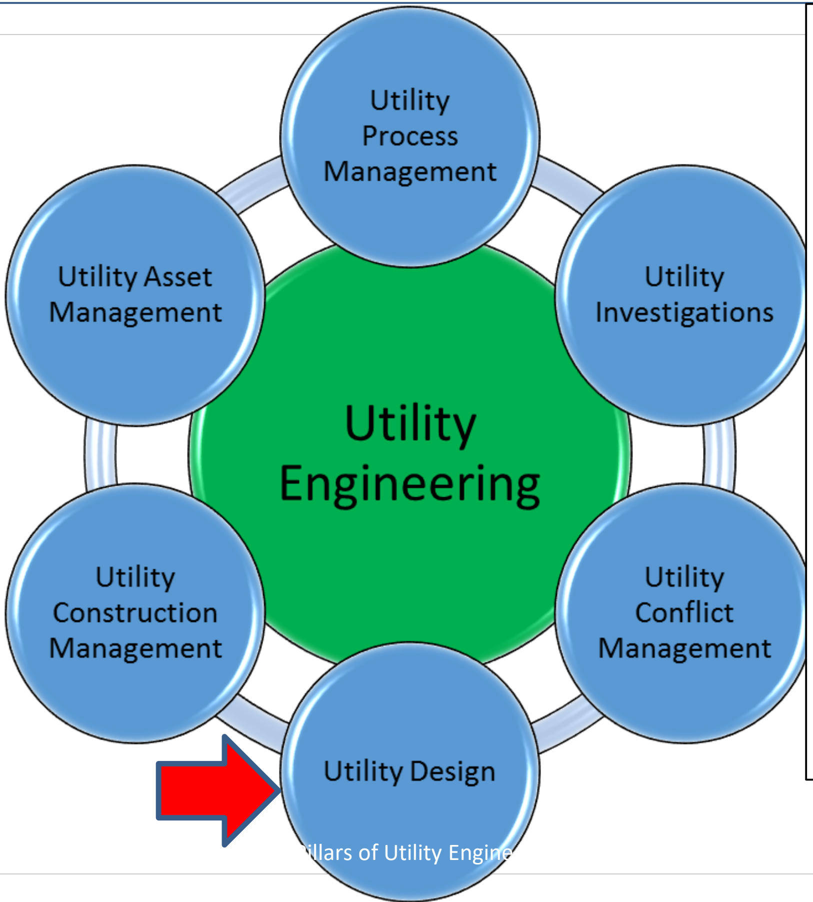

CONFLICT 9 - CPS ELEC
CONFLICT 218 - CPS FIBER
CONFLICT 137 - TWC FIBER
CONFLICT 138 - SPECTRUM OH
CABLE
CONFLICT 140 - LEVEL 3 OH FO
CONFLICT 216 - ATT CABLE
CONFLICT 217 - ATT
OH1
OH2
OH5
OH6
OH7
OH10
OH12
PROP DRAIN
EASEMENT
CONFLICT 193 - SPEC
CONFLICT 2
PROP R.

Project Owner: TxDOT
CCSJ/RCSJ.: CSJ: 0253-04-138 &
roject Description: US 281 PH 2
Highway or Route: US 281

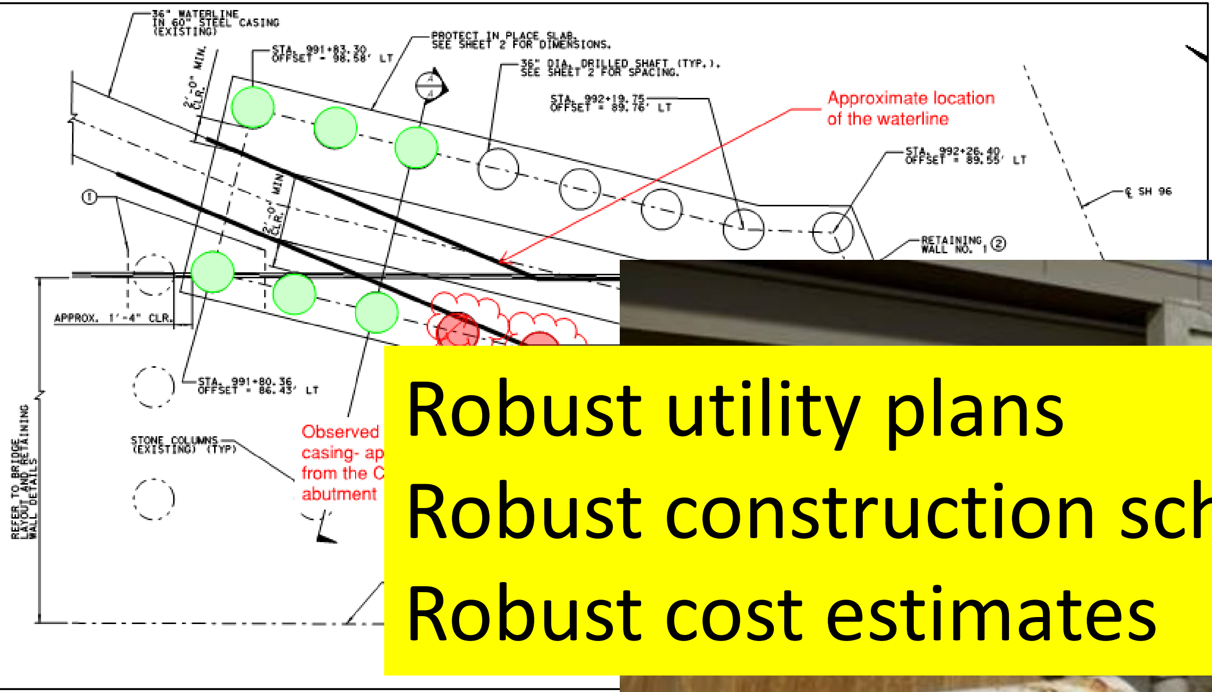
Utility Company	Utility Company Contact	Util
CPS Energy		
CPS Energy		
CPS Energy		
CPS Energy		



Six Pillars of Utility Engineering (5)



Techniques and procedures that lead to more effective practices to design utility relocations and protect-in-place measures for existing facilities that remain in place (including preparation of plans, specifications, schedule, and cost estimate)



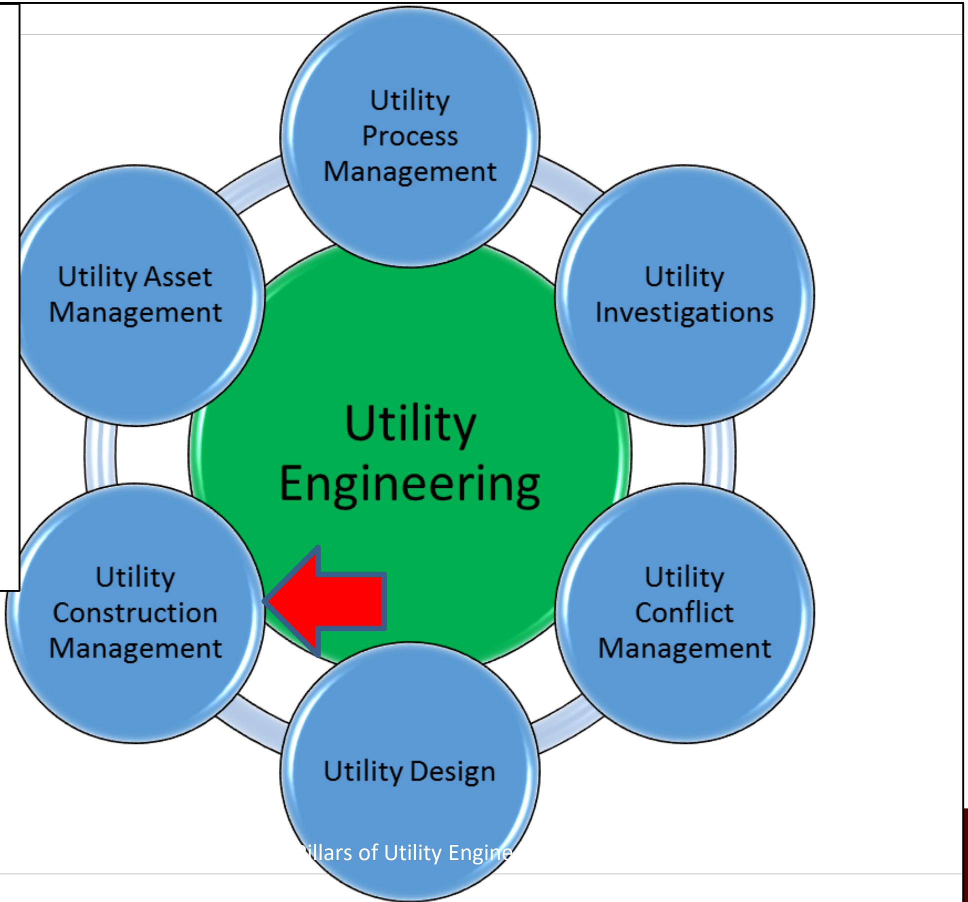
Robust utility plans

Robust construction schedules

Robust cost estimates

Six Pillars of Utility Engineering (6)

Techniques and procedures for monitoring, inspecting, and surveying utility installations at the job site, as well as mapping and production of quality, standards-based utility as-builts

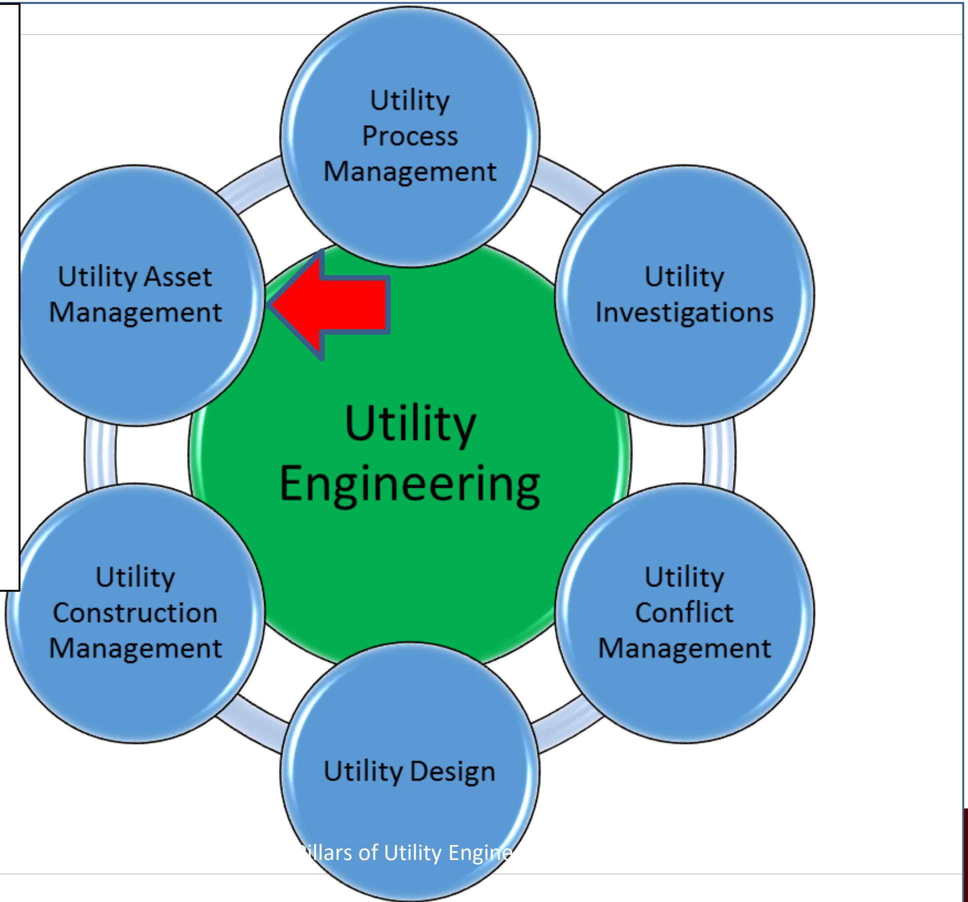


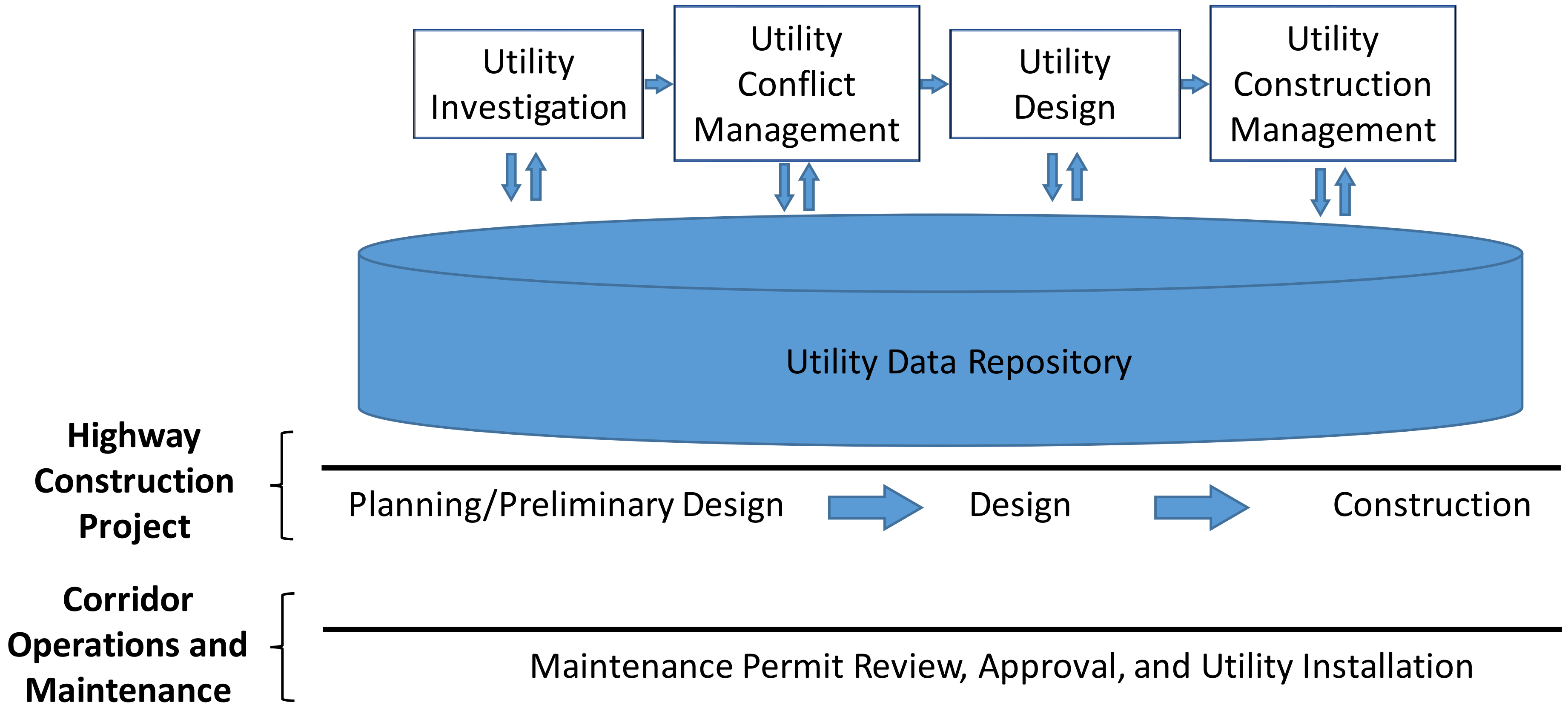
Utility Construction Management

- Coordination of utility construction
  - Pre and post letting
- Inspection and verification
- Compliance with policies (e.g., utility accommodation rules, traffic control, SW3P, OSHA, etc.)
- Payment request reviews
- Gathering or preparing as-built plans

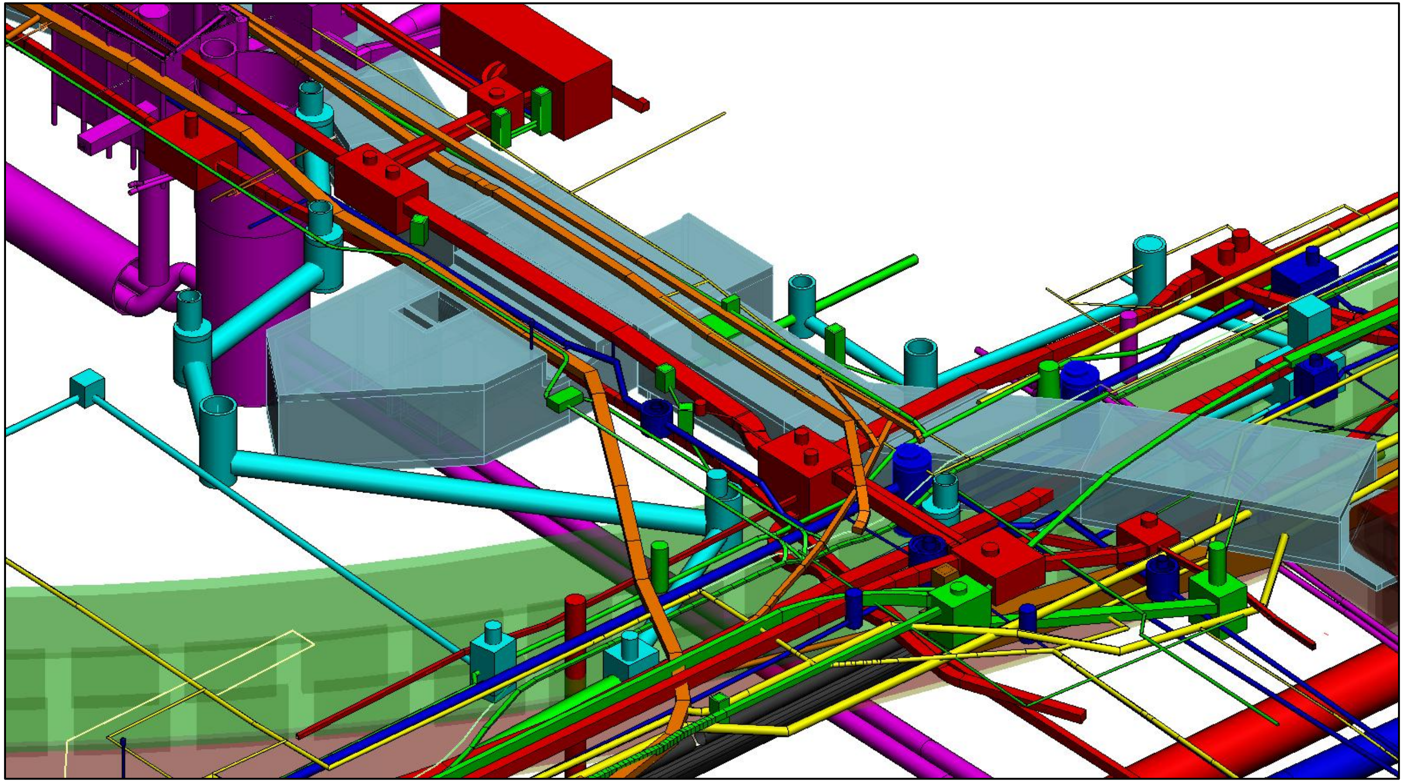
Six Pillars of Utility Engineering (7)

Techniques and procedures for accommodating, permitting, managing, documenting, and assessing conditions of utility facilities within the right of way over their entire lifecycle

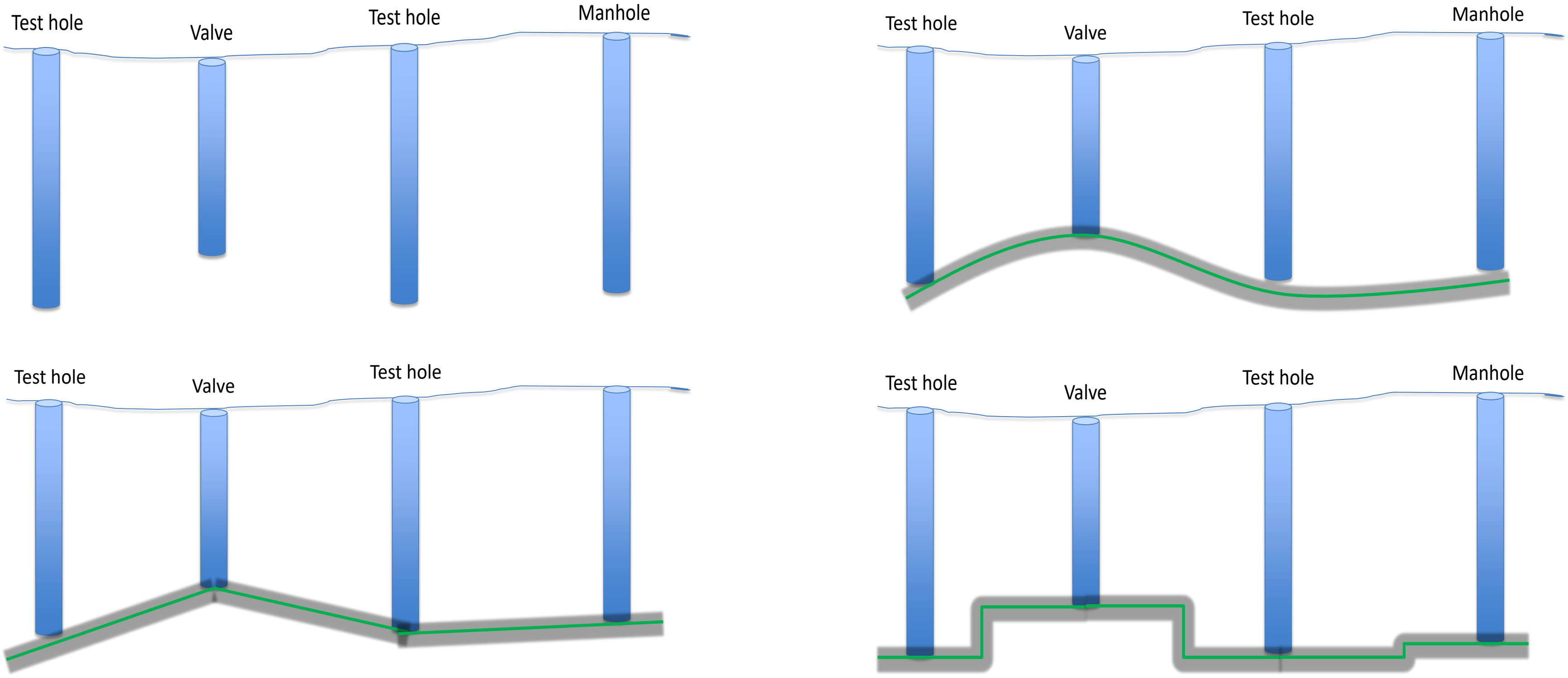



Utility Investigation
Utility Conflict Management
Utility Design
Utility Construction Management
Utility Data Repository
Highway Construction Project
Planning/Preliminary Design
Design
Construction
Corridor Operations and Maintenance
Maintenance Permit Review, Approval, and Utility Installation

Utility Data Management in 3D (BIM)



Challenges for Developing Reliable 3D Models

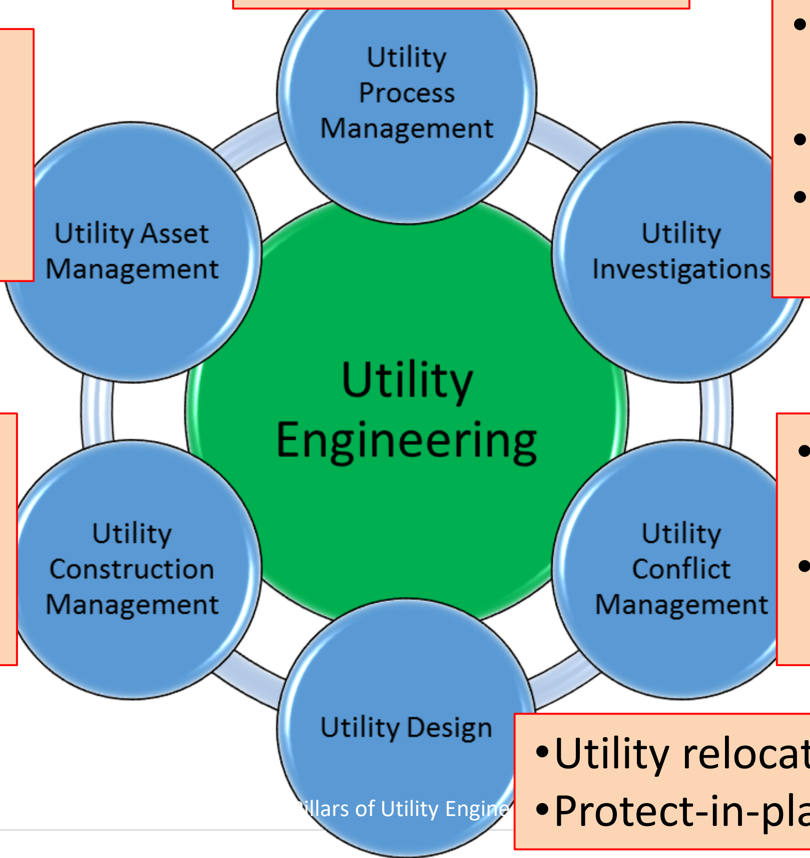


Six Pillars of eering (8)

- Utility coordination
- Utility program management

- Utility records research
- Documentation of visible utility facilities
- Geophysical techniques
- Exposure of utility facilities

- Utility permitting
- Utility accommodation
- Utility documentation
- Condition assessment



- Utility construction
- Inspection and verification
- Utility as-builts

- Utility conflict identification
- Utility conflict resolution strategies

- Utility relocation design
- Protect-in-place design

UESI Activities and Initiatives

- Conferences
  - Pipelines Conference, San Antonio, Texas, Aug 8-12, 2020
  - Survey and Geomatics: Conference Cincinnati State U, June 1-3
  - SUE for Municipalities: Prequalifications and scopes
  - Utility Investigation School:
    - CSM (Dec 2019), LTU (March), UTA (Spring), Purdue (Summer), CSM (Winter)
  - Accreditations:
    - Subsurface utility professional/designator
    - Utility process manager
    - Utility project coordinator

For Additional Information

- Cesar Quiroga
  - Senior Research Engineer
  - Texas A&M Transportation Institute
  - Email: c-quiroga@tti.tamu.edu
  - Phone: (210) 321-1229

Six Pillars of Utility Engineering Indiana Perspective

Natalie Parks, P.E.
Lead Utility Coordinator
USI Consultants, Inc.

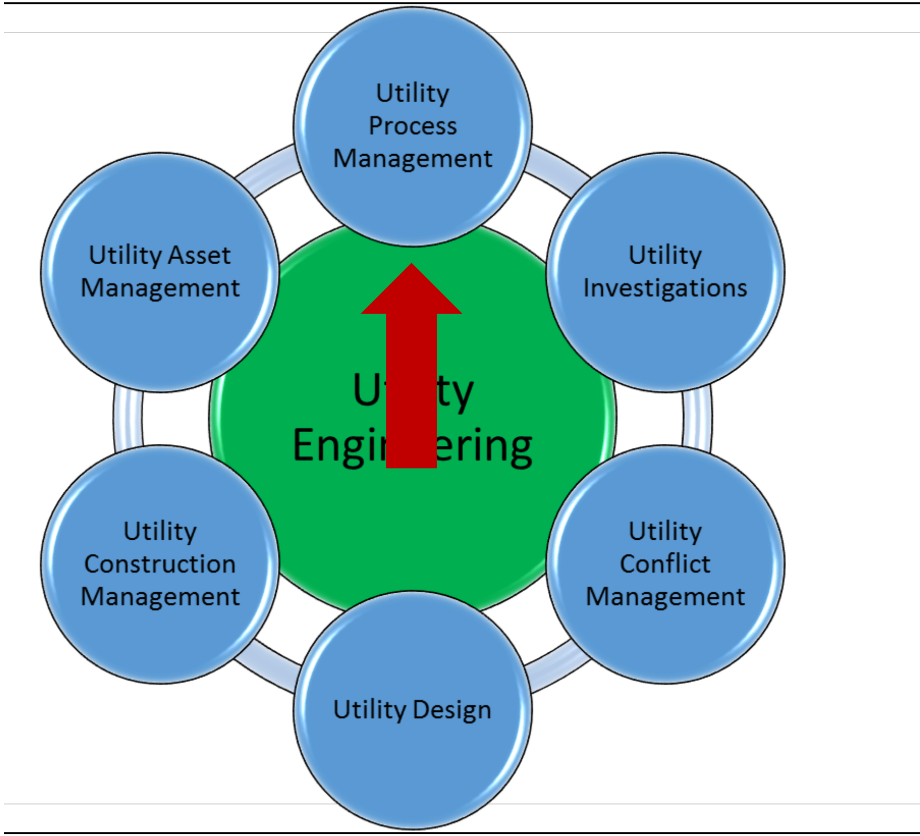
Utility Engineering is a branch of engineering that focuses on the planning, design, construction, operation, maintenance, and asset management of any and all utility systems, **as well as the interaction between utility infrastructure and other infrastructure**.

Is there more to “utility coordination” than the 81 steps we follow in the Design Manual?

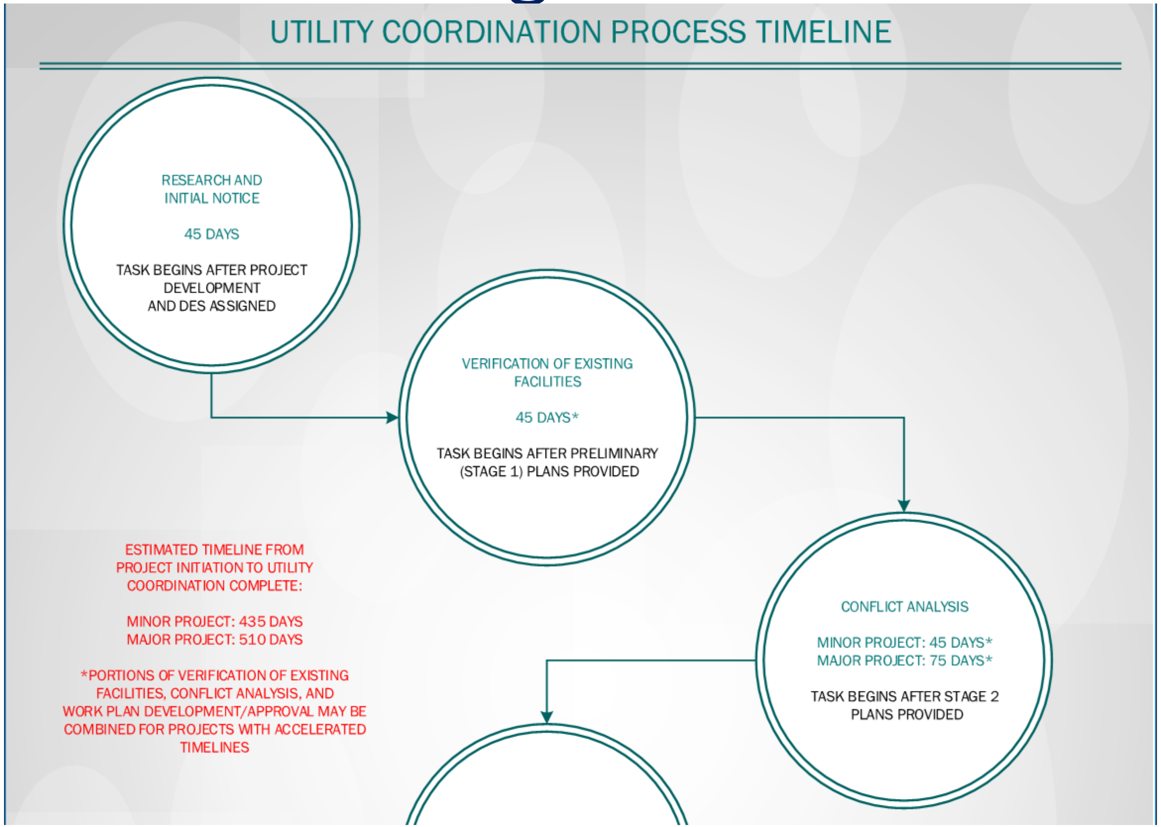
How do we apply the 6 pillars and the above definition to our work as Utility Coordinators?

Utility Process Management

- Techniques and procedures that enable a more effective management of the utility process during all phases of project delivery, as well as a more effective coordination and contractual relationship between project owners and utility stakeholders.
- This is UTILITY COORDINATION as we currently know it.
- 105 IAC 13
- IDM Chapter 104 defines this process for INDOT/LPA projects

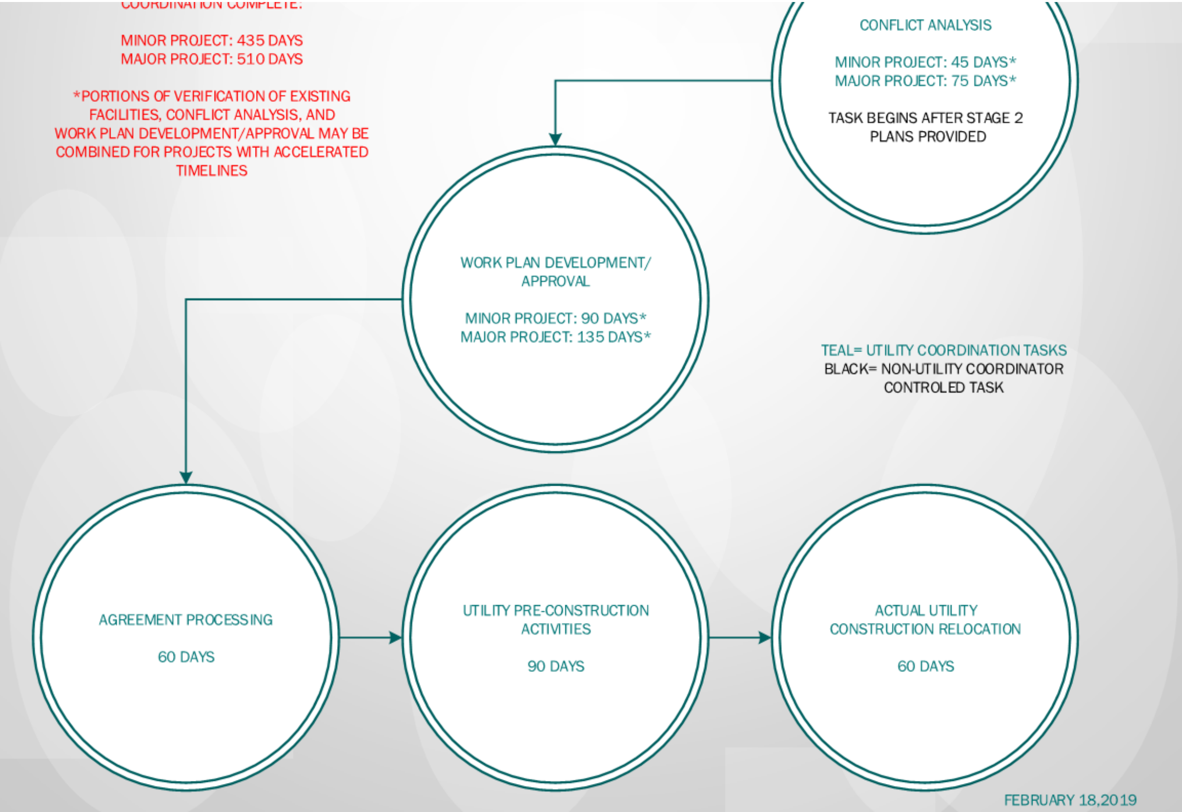


Utility Process Management



Source: INDOT UTA Template Library – "Utility Coordination Timeline.pdf"

Utility Process Management

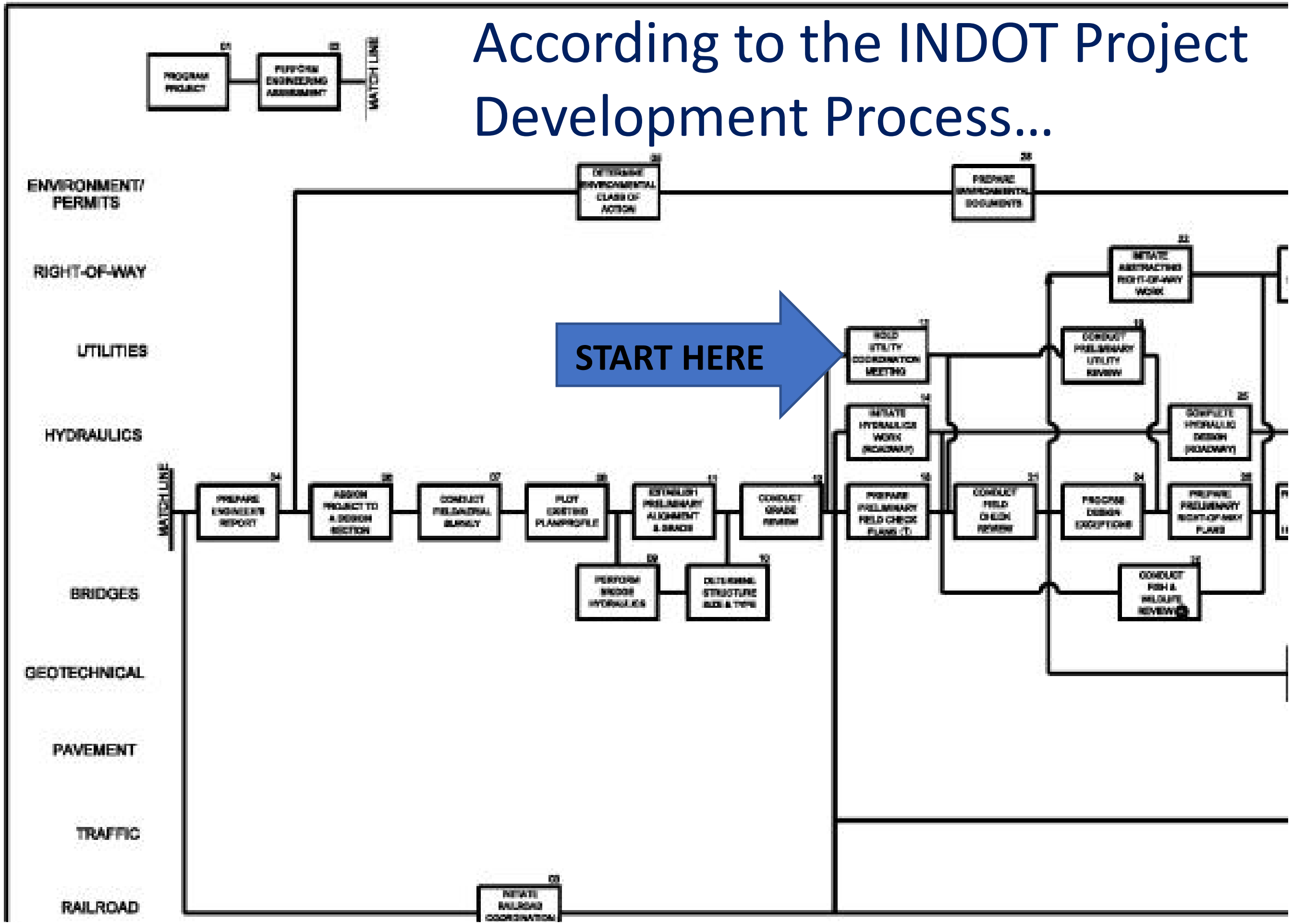


Source: INDOT UTA Template Library – "Utility Coordination Timeline.pdf"

IDM Chapter 104

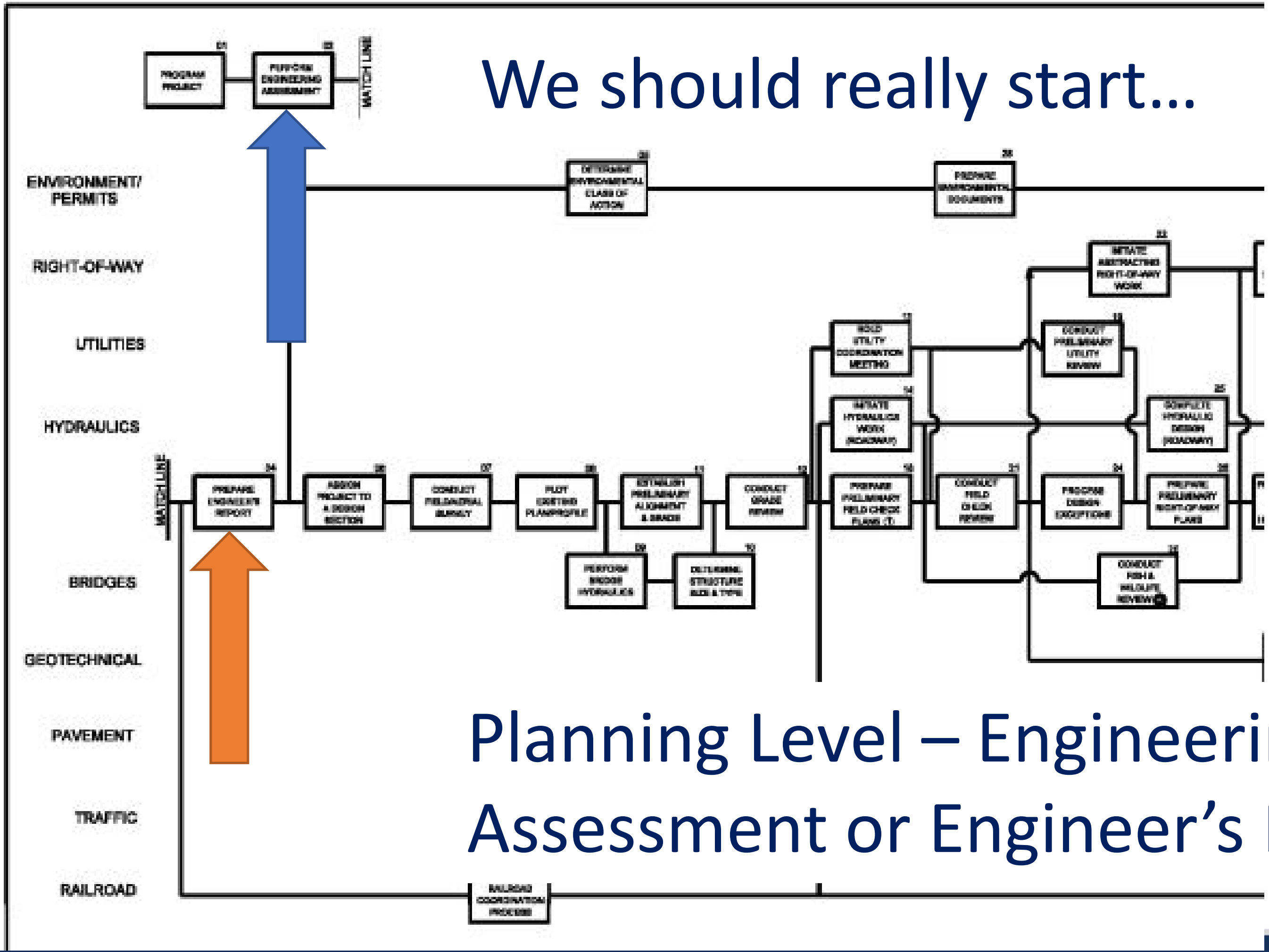
- Utility coordination steps linked with PDP Tasks for Major and Minor projects
- Utility Research – PDP Task 6.01
- Initial Notice
  - Survey and Depiction of Findings on Plans – PDP Task 6.01.08
  - Determination for the use of SUE
- Verification – PDP Task 6.15
- Conflict Analysis – PDP Task 7.06
- Work Plan

According to the INDOT Project Development Process…



Source: https://www.in.gov/indot/design_manual/design_manual_2012.htm#

We should really start…



Planning Level – Engineering Assessment or Engineer's Report

Source: https://www.in.gov/indot/design_manual/design_manual_2012.htm#

Why Start at Planning?

- Purpose of Engineering Assessment/Engineer's Report
  - Determine project need
  - Determine project scope
  - Determine risk factors
  - Establish approximate costs

- How does an assessment/engineer's report include Utility Risk and Costs if no coordination has been completed?

Why Start at Planning?

- Solution – Initial Notice & Utility Assessment
  - Project Type – Engineering Assessment
  - Establishes eligibility for reimbursement
  - Establishes potential risks

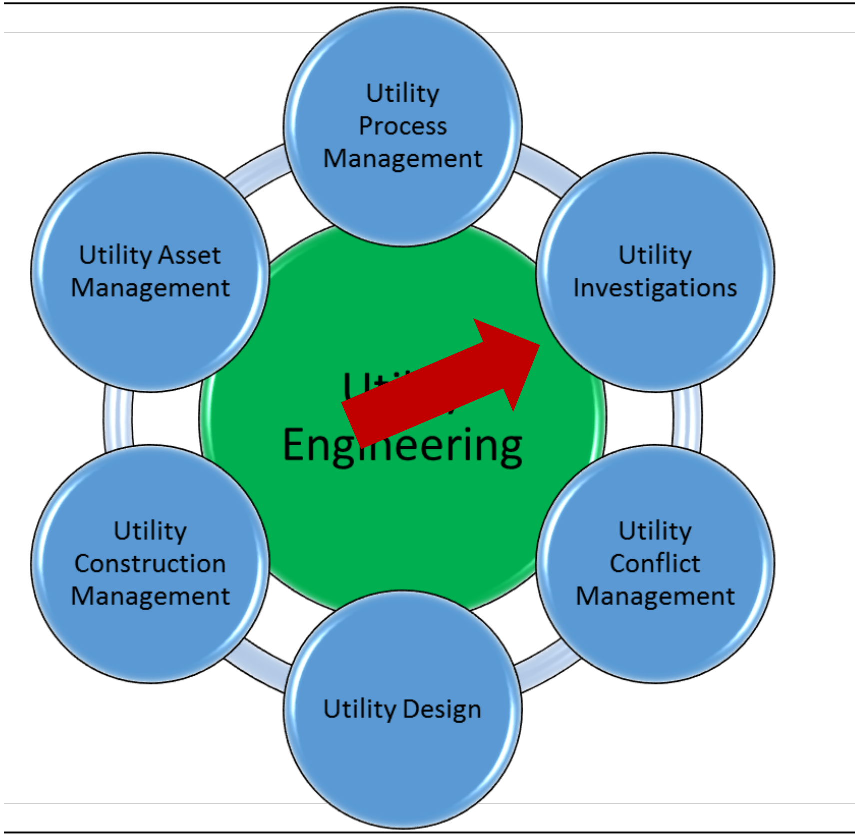
WITHOUT ADEQUATE UTILITY INFORMATION, RISK OF UTILITY CONFLICTS INCREASES…AS DOES PROJECT COST

After Planning…

- Survey
- Existing Profile
- Decisions are made…
  - Project Alignment
  - Hydraulics
  - Bridge Structure, Size, and Type
  - Preliminary Right-of-Way limits
  - Project budgets are established

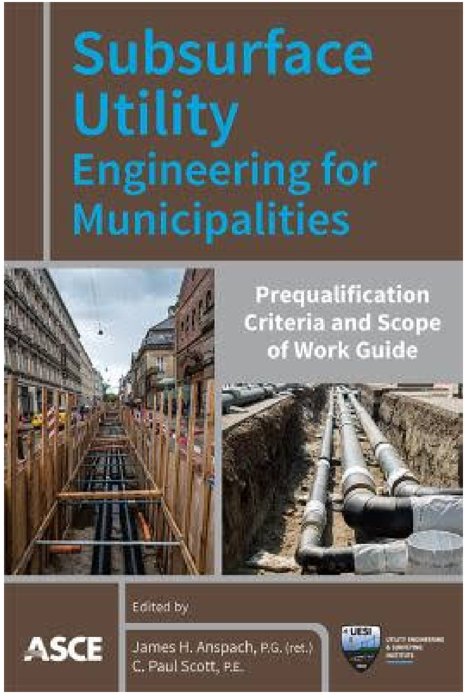
Utility Investigations

- Technologies to detect, identify, and map existing utilities effectively and the integration of quality standards-based utility information, including 3D modeling and building information modeling (BMI), in all phases of project delivery
- Typically call this SUE and refers to potholing (QL-A)
- Typically start this at conflict analysis, after PFC



Utility Investigations

- ASCE 38-02
  - QL-D = existing maps, as-builts, etc.
  - QL-C = topographic survey
  - QL-B = Precise horizontal information = "designating"
  - QL-A = Precise horizontal & vertical information = "locating"
- New publication – Subsurface Utility Engineering for Municipalities



Utility Investigations

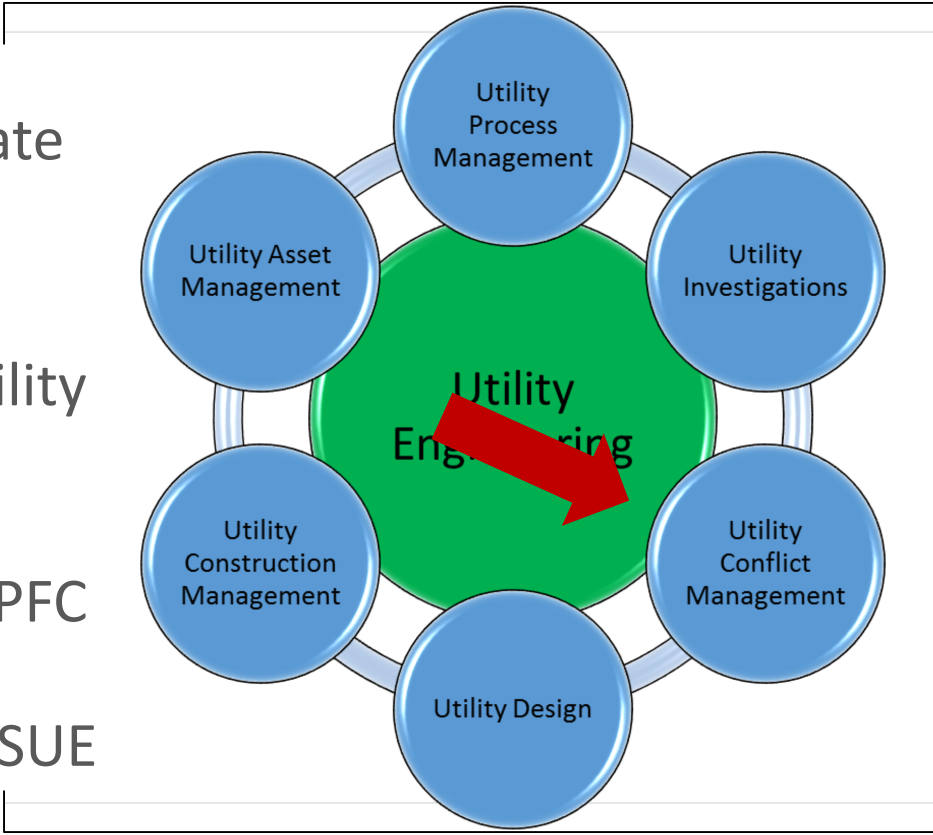
- Isn't survey enough?
  - Accuracy in location
  - All underground facilities depicted
  - All above ground facilities depicted
- QL-B gives more precise horizontal information
- For some projects this makes sense
  - Urban with a lot of underground facilities
  - Critical schedule
    - For others this does not make sense
      - Rural
      - Project scope/size
      - Fewer/no underground facilities

Utility Investigations

- For others this does not make sense
  - Rural
  - Project scope/size
  - Fewer/no underground facilities
- Why start earlier?
  - More accurate information for survey
  - Design assumptions made based on more accurate information
  - Can compare QL-D with QL-B and make necessary corrections

Utility Conflict Management

- Techniques, protocols, and systems that use the avoid, minimize, mitigate principle to identify and resolve conflicts systematically between infrastructure project features or phases and existing or proposed utility facilities.
- Conflict Analysis – PDP Task 7.06
  - Typically occurs coincident with PFC
  - Conflict Matrix
  - Determination for need of QL-A SUE

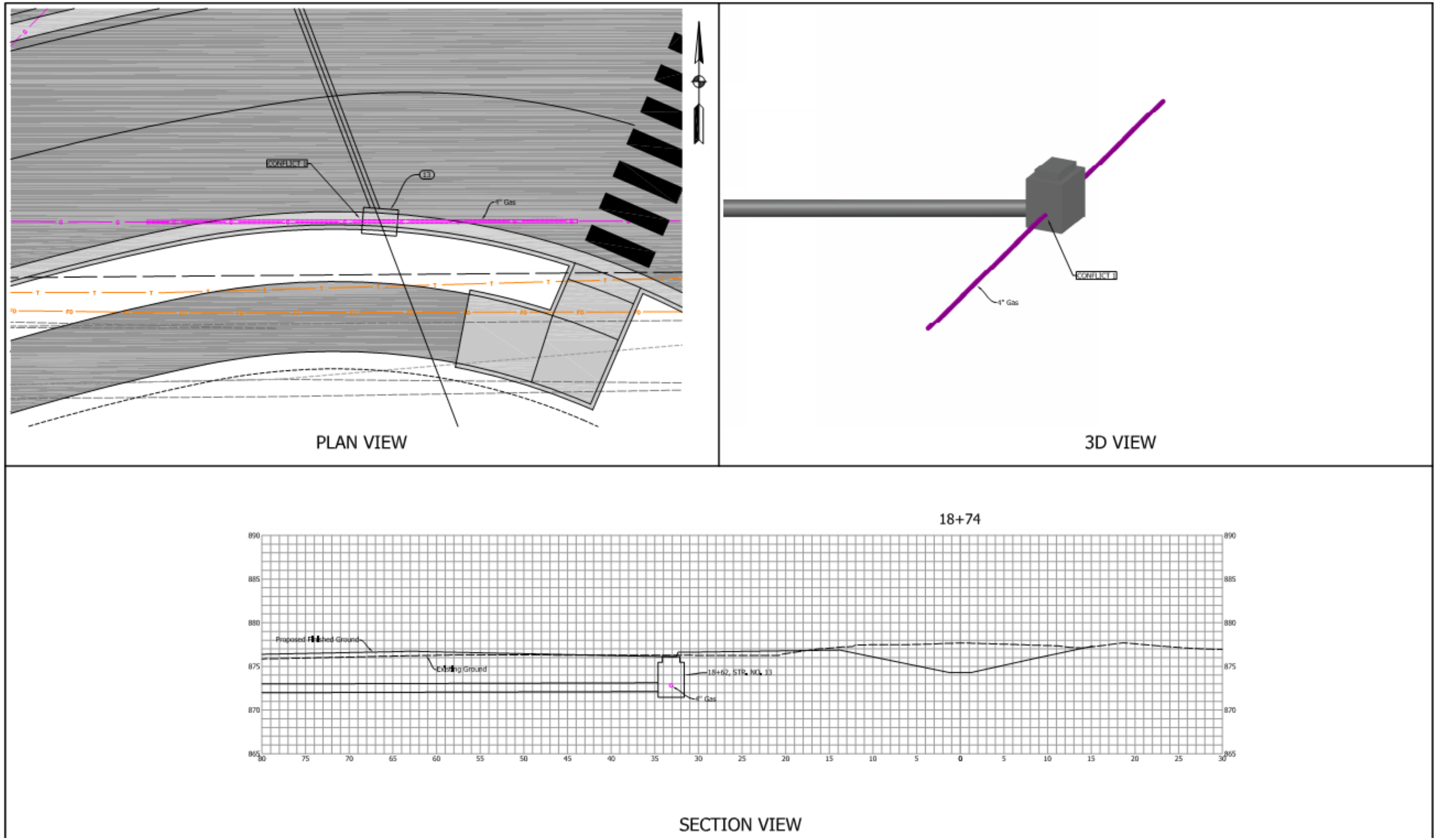


Utility Conflict Management

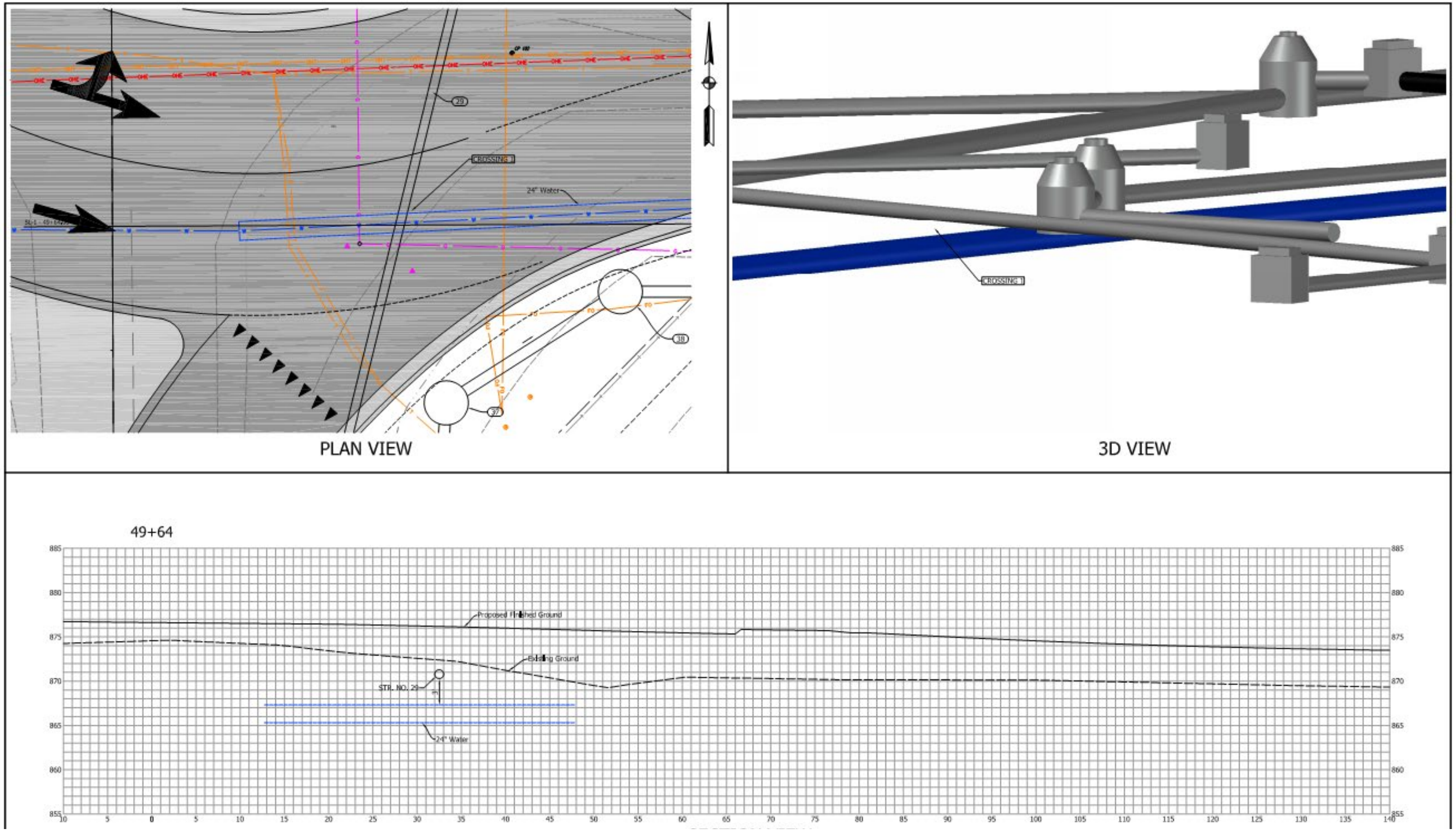
UTILITY CONFLICT MANAGEMENT

CONFLICT ID	UTILTIY ID	SHEET NO	UTLITY TYPE	MATERIAL	SIZE	CONFLICT DESCRIPTION	START STA	START OFFSET	END STA	END OFFSET	SUE LEVEL REQ'D	TES
1	G	28	Gas	Steel		Pavement/Grading	78+41	15'RT	112+50	38' LT		
2	G	28-36	Gas	Steel		Pavement	78+41	16.8' LT	104+00	16.75' LT		
3	G	28	Gas	Steel	4"	STR 7- 42" Storm Pipe	78-+71	26' LT				
4	W	28	Water	Cast Iron		STR 7A-15" Storm Inv. 731.80'	78+89	37.75' LT	79+05	29.5'LT	A	
5	W	28-30	Water	Cast Iron		Ditching/Grading & STR 7A	79+00	LT	86+35	31' LT		
6	G	28	Gas	Steel		Ditching/Riprap	79+43	14.5'RT	79+43	32.5'RT		
7	E	28	Electric	Pole		Ditching-pole bury depth-guys	80+78	34'RT				
8	E	28	Electric	Pole		Ditching-pole bury depth-guys	81+10	37'LT				
9	SS	28	Sanitary	VCP	8"	Ditching/Gas	81+68	23'RT	81+68	29'RT		
10	SS	28	Sanitary	VCP	8"	Ditching/Grading/Water	81+90	22.5' LT	81+92	30'LT		
11	SS	28	Sanitary	VCP	8"	STR 7 to STR 8, 36" Storm Pipe	81+82	5.8' LT				
12	G	28	Gas	Steel			81+93	13'RT	81+93	17.75'RT		
13	E	28	Electric	Pole		Ditching-pole bury depth-guys	81+95	34'RT				
14	W	28	Water	Cast Iron		STR. 8, 36" storm pipe	82+91	6'LT	82+91	6'LT		
15		28	Gas	Steel		STR. 8A Inlet						
16	W	28	Water	Cast Iron		Ditching/Grading/Riprap	82+91	23'RT	82+91	32'RT		
17	SS	28	Sanitary	VCP	8"	Riprap for STR 7D	82+92	31' LT	82+92	31'LT		
18	SS	28	Sanitary	VCP	8"	Riprap for STR 8A	83+09	30'LT	83+09	30'LT		
19	E	28	Electric	Pole		Ditching-pole bury depth-guys	83+58	35'LT				
20	SS	28	Sanitary	VCP	8"	Riprap for STR 8A	83+60	30'LT	83+60	30'LT		
21	G	28	Gas	Steel		Pavement	83+65	14.5'LT	83+65	27'LT		
22	G	28	Gas	Steel		Ditching/Grading	83+65	27'LT	83+56	32.5'LT		

Utility Conflict Management

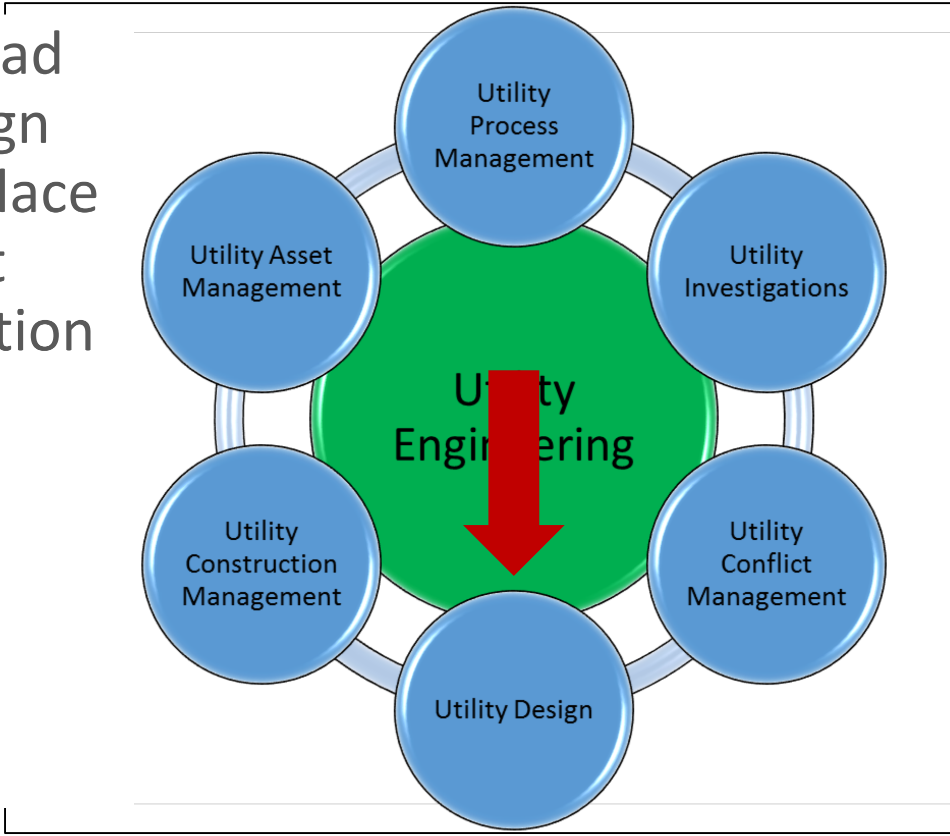


Utility Conflict Management



Utility Design

- Techniques and procedures that lead to more effective practices to design utility relocations and protect-in-place measures for existing facilities that remain in place (including preparation of plans, specifications, and cost estimate)
- "Design" is typically interpreted to mean the actual design of infrastructure for utility facilities



Utility Design

- Review and approve work plans
  - Verify locations of proposed facilities
  - Verify conflicts remediated
  - Verify no conflicts with other utilities
- Know your plans
- Suggest design revisions or modifications
- Utility corridor design
- Know your options for protect-in-place
- Ask the right questions

Utility Construction Management

- Techniques and procedures for monitoring, inspecting, and surveying utility installation at the site, as well as mapping and production of quality, standards-based utility as-builts

Utility Construction Management

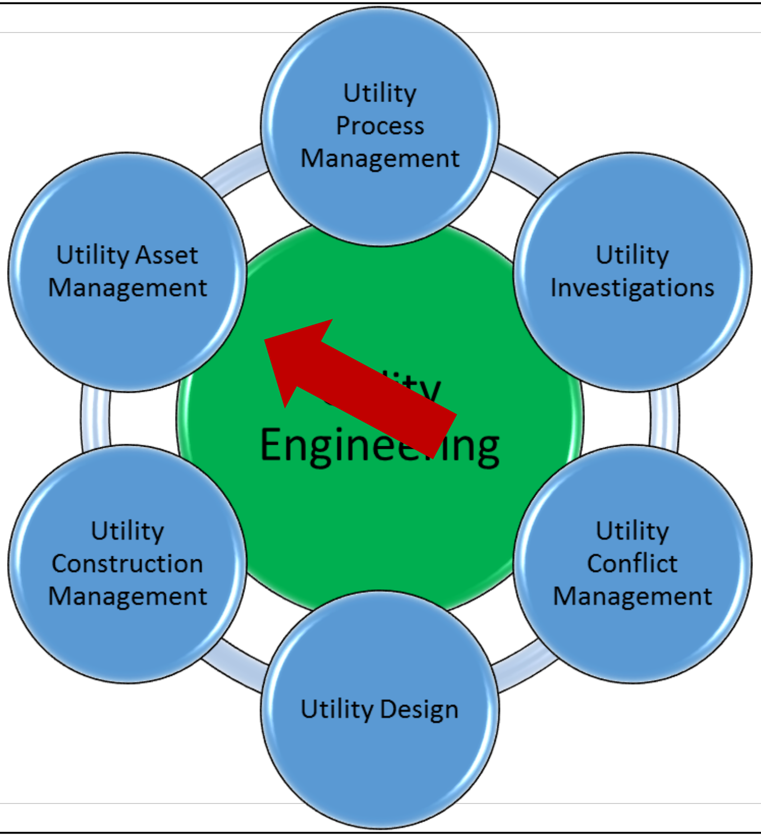
- IDM 104.
  - Provide Notice of Work Plan Approval (Item 62)
  - Review modified utility work plans (Item 63)
  - Provide Notice to Proceed (Item 65)
  - Resolve utility-related issues during construction (Item 66)
  - Manage the schedule for utility relocation work, attend weekly construction meetings and report weekly progress of utility relocation work to the utility oversight agent, construction engineer, and project manager (Item 70)

Utility Construction Management

- Current process does not include the inspection of utility installations
  - Can this be done as a separate inspection contract?
  - For utility relocations being completed during construction, can the inspection be done at that time?
- Currently do not require as-builts of utility relocations
  - Rely completely on relocation drawings and/or amendments
  - Develop overall relocation drawing (Item 57)

Utility Asset Management

- Techniques and procedures for accommodating, permitting, managing, documenting, and assessing conditions of utility facilities within the right-of-way over their entire life cycle
- Currently not included in what we consider the utility coordination process
- Assumes utility owner involvement
- Discuss with utilities obtaining as-builts
- Most commonly done through permitting



- Utility Coordination is more than just sending and receiving information, attending meetings, and reviewing work plans.
- Our process can assist utility owners with the planning of their facility infrastructure projects.
- Our process can assist in designing utility corridors for utility placement on design projects.
- Our process does enable us to understand basic operation and maintenance requirements of our utility partners which enables us to better design our projects.
- **Our process focuses on the interaction between utility infrastructure and other infrastructure**.

- We ENGINEER relationships:
  - Between existing utilities and proposed design
  - Between utility designs and proposed design
  - Between utility needs and right-of-way needs
  - Between utility relocations and construction
  - Between all project stakeholders:
    - INDOT and Local Public Agency
    - Design Team
    - Environmental
    - Right-of-Way
    - Utility Owners
    - Public

QUESTIONS?

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