I-435
I-35
K-10

INTERCHANGE

DESIGN-BUILD AND SUBSURFACE UTILITY ENGINEERING

MARCH 14, 2019

AD ASTRA PER ASPERA

Kansas

"The quality of your decisions is only as good as the quality of your information"

AGENDA

- Overview
  - Gateway Project
  - Design-Build
  - Subsurface Utility Engineering
- Weeds
  - SUE Benefits
  - Design-Build Utility Strategies

AGENDA

- Overview
  - Gateway Project
  - Design-Build
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- Weeds
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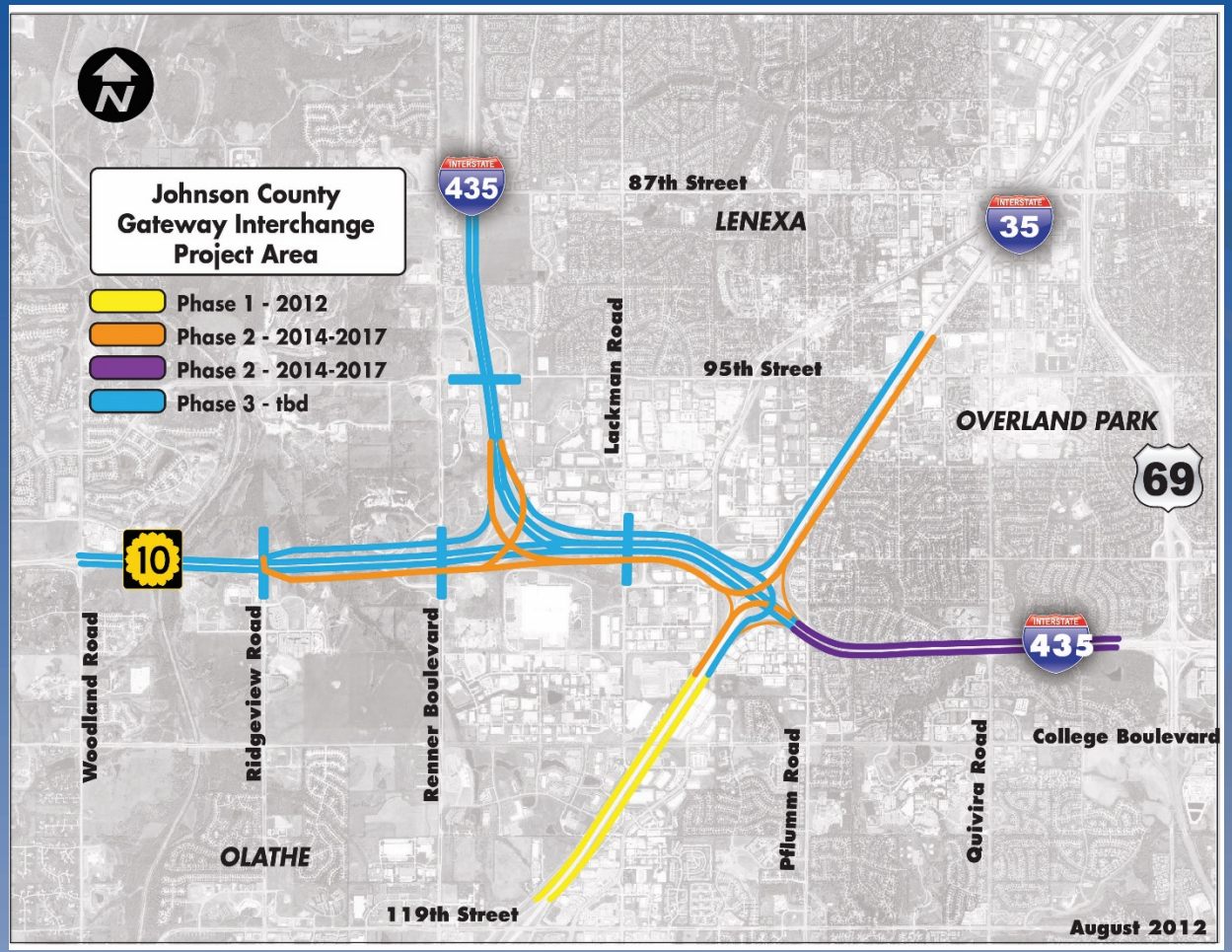
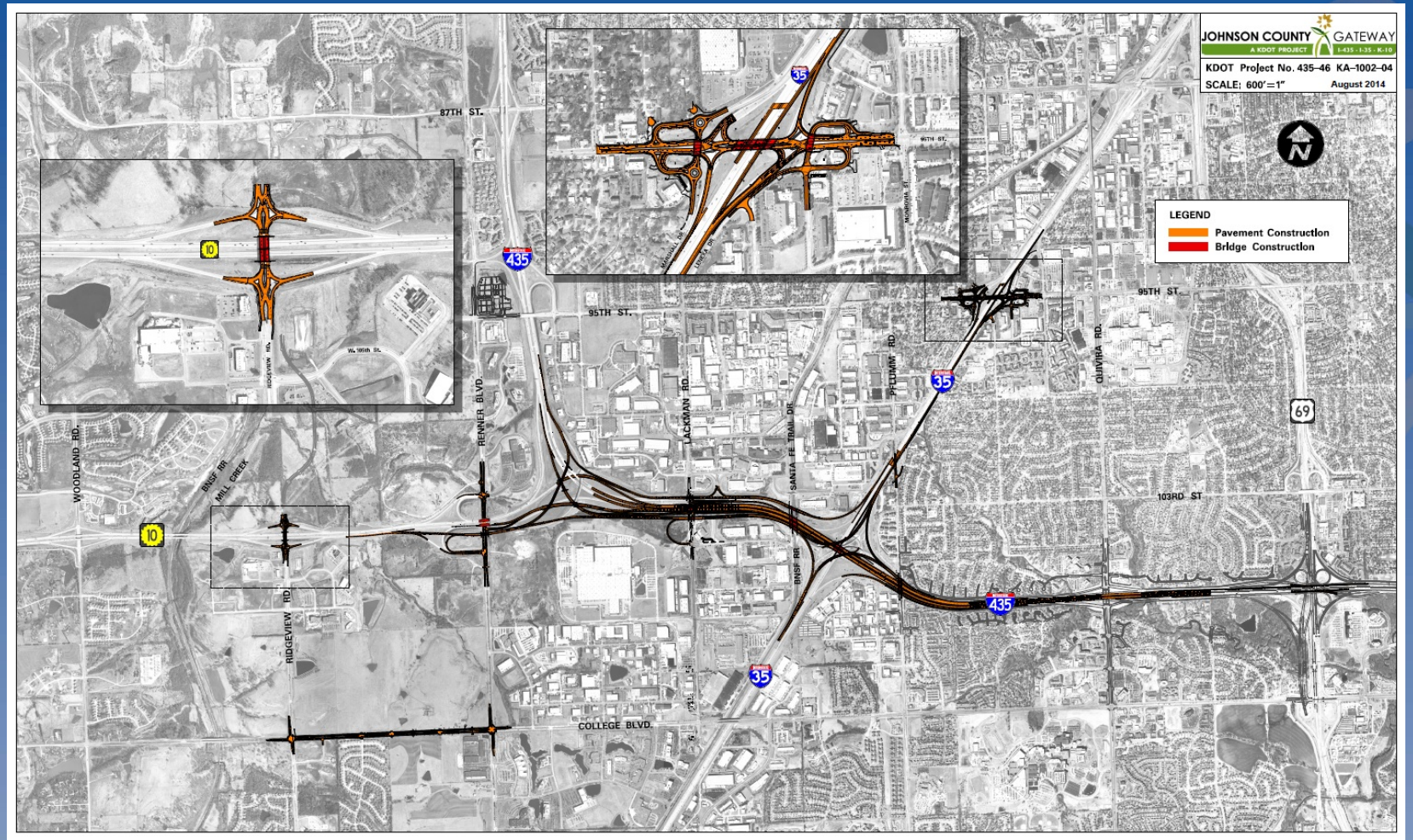
  - Design-Build Utility Strategies

PRELIMINARY DESIGN

JOHNSON COUNTY GATEWAY
A KDOT PROJECT
I-435 · I-35 · K-10



CONTRACTED SCOPE OF WORK



CONTRACTED SCOPE OF WORK

JOHNSON COUNTY GATEWAY
A KDOT PROJECT I-435 · I-35 · K-10

- 27 New or Rehabilitated Bridges
- 68 New Retaining Walls
- 56 New Lane-Miles
- 230,000 Vehicles per Day
- 750,000 SY of New Pavement
- 4,700,000 CY of Earth Moved
- 1,000,000,000 $$$ of Economic Benefit

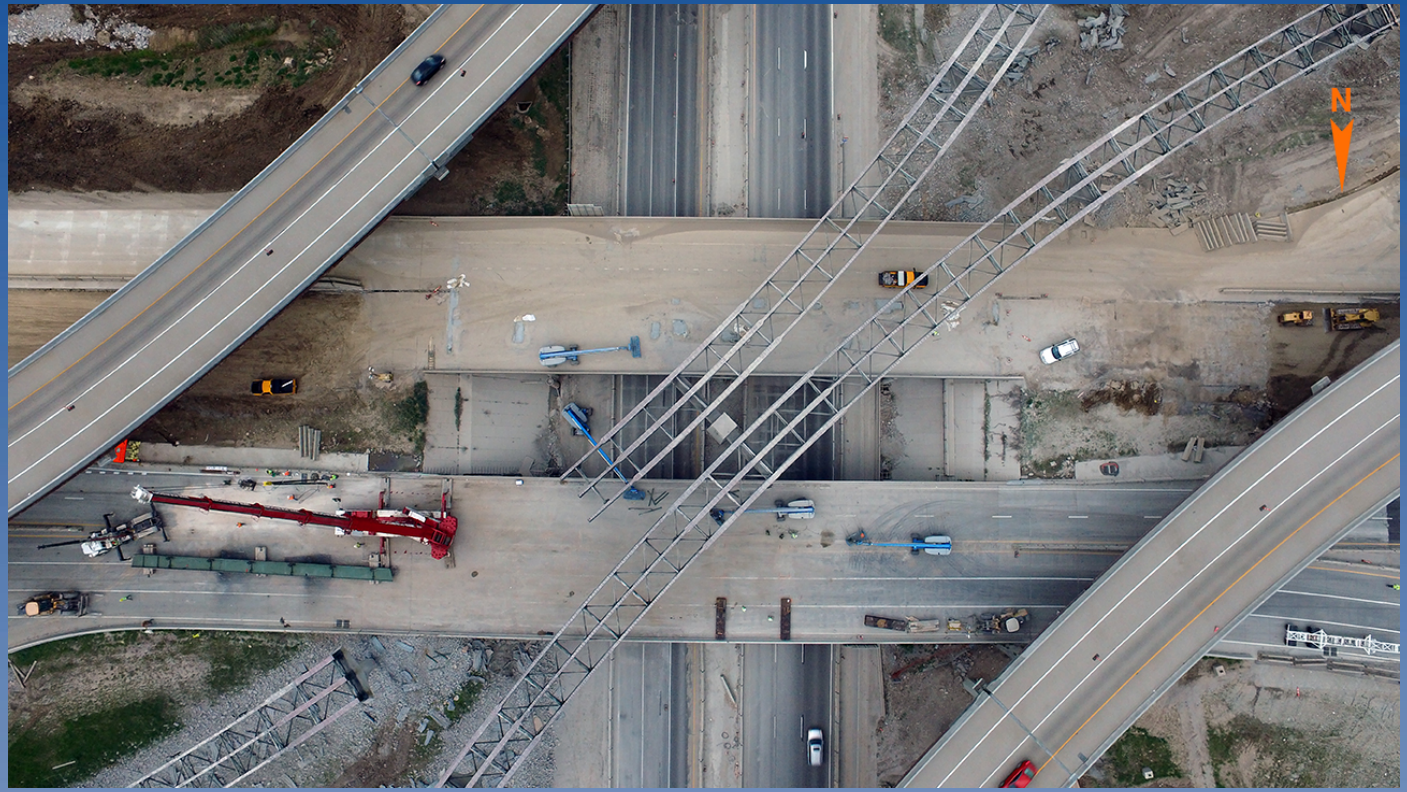
JOHNSON COUNTY GATEWAY
A KDOT PROJECT
I-435 · I-35 · K-10


N
DEERE
CALC
SYSTEM


N

JOHNSON COUNTY GATEWAY
A KDOT PROJECT I-435 · I-35 · K-10

JOHNSON COUNTY GATEWAY
A KDOT PROJECT I-435 · I-35 · K-10




DEERE
N

JOHNSON COUNTY GATEWAY
A KDOT PROJECT I-435 · I-35 · K-10


N

AGENDA

- Overview
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WHAT IS DESIGN-BUILD

An alternative delivery method to design-bid-build in which a design-build team works under a single contract with the project owner to provide design and construction services.

WHAT IS DESIGN-BUILD

JOHNSON COUNTY GATEWAY
A KDOT PROJECT I-435 · I-35 · K-10

An alternative delivery method to design-bid-build in which a design-build team works under a single contract with the project owner to provide design and construction services.

WHAT IS DESIGN-BUILD
(DESIGN-BUILD PROCESS)

JOHNSON COUNTY GATEWAY
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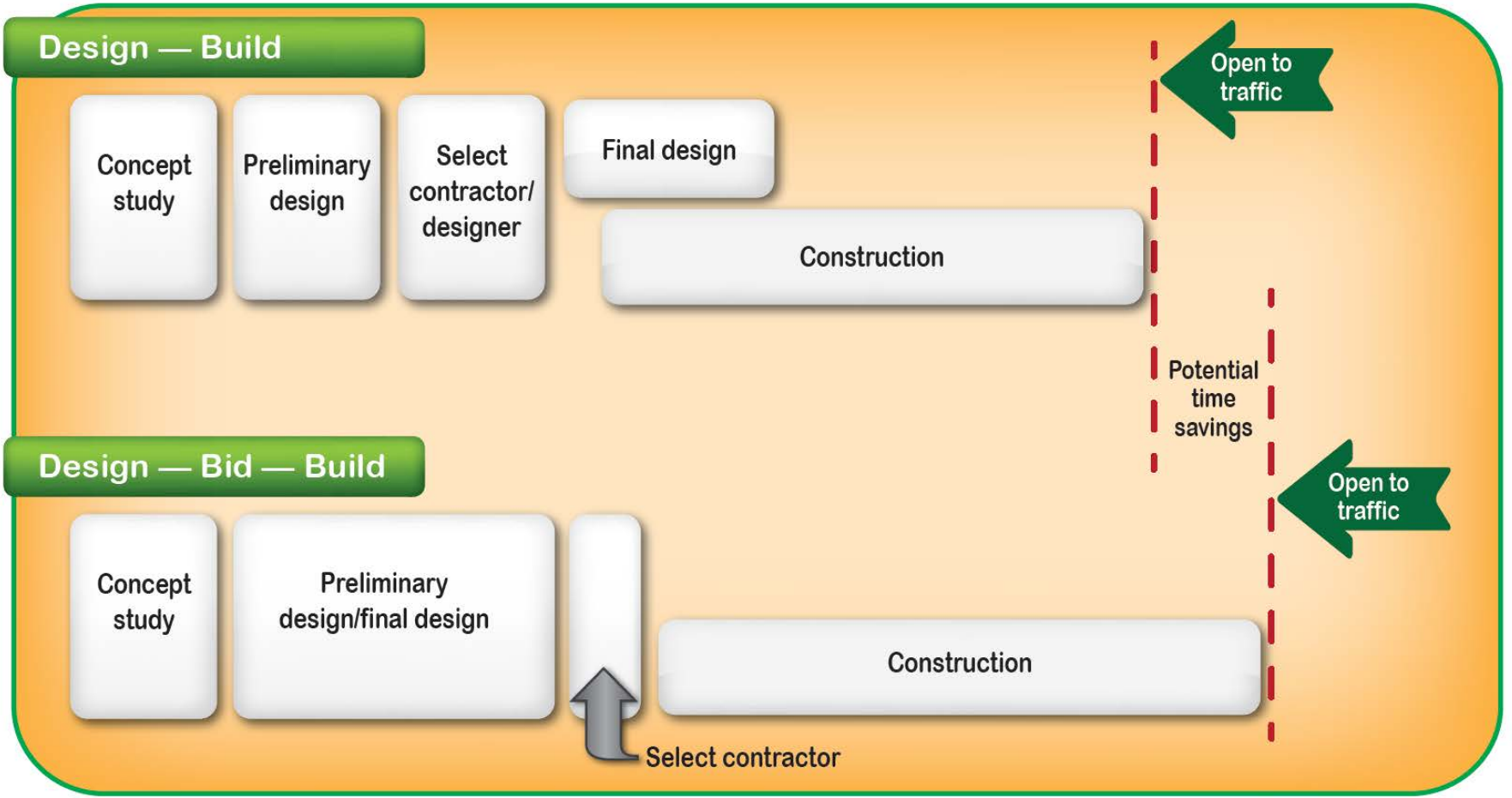

WHY DESIGN-BUILD
(FROM THE OWNER'S PERSPECTIVE)

JOHNSON COUNTY GATEWAY
A KDOT PROJECT
I-435 · I-35 · K-10

- Faster delivery
- Predictable costs
- Innovations
- Single-point responsibility
- Decreased administration burden

WHY DESIGN-BUILD
(FROM INDUSTRY'S PERSPECTIVE)

JOHNSON COUNTY GATEWAY
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- Innovation
- Constructability / design to strengths
- Better scheduling
- Shorter decision time

AGENDA

- Overview
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WHAT IS SUE?

Data Collection:

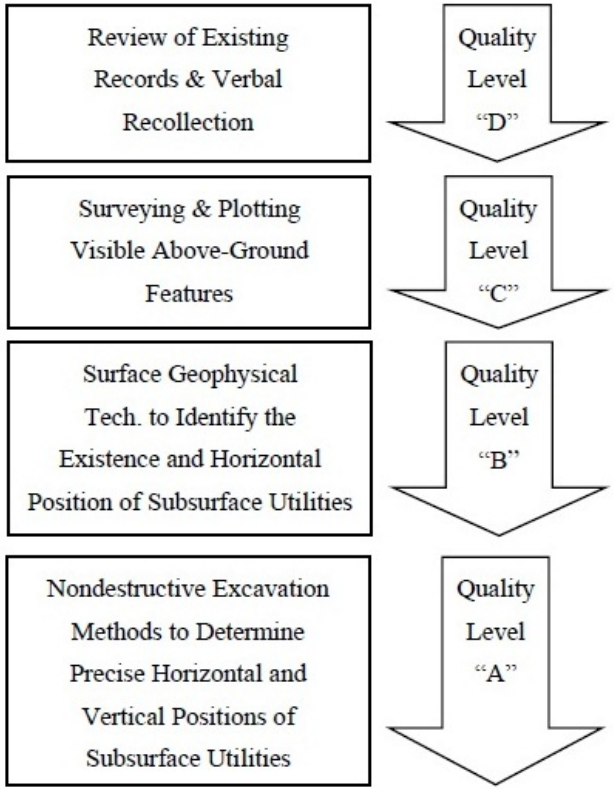

Figure 2-1. Quality Levels of SUE.

WHAT IS SUE?

JOHNSON COUNTY GATEWAY
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Subsurface Utility Engineering:

A branch of engineering practice that involves managing risks associated with utility…

- Mapping
- Condition Assessment
- Coordination
- Relocation Design
- Communication
- Cost Estimates
- Agency Policy
- Schedule

WHAT IS SUE?

JOHNSON COUNTY GATEWAY
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Subsurface Utility Engineering:

A branch of engineering practice that involves managing risks associated with utility…

- Mapping
- Condition Assessment
- Coordination
- Relocation Design
- Communication
- Cost Estimates
- Agency Policy
- Schedule

GATEWAY SUE (PRE-PROPOSAL)

JOHNSON COUNTY GATEWAY
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- 28 Utility Owners
- 43 Coordination Meetings
- 9808 Survey Shots
- 409,955 LF of Utilities = 78 Miles

SUE STANDARDS

JOHNSON COUNTY GATEWAY
A KDOT PROJECT
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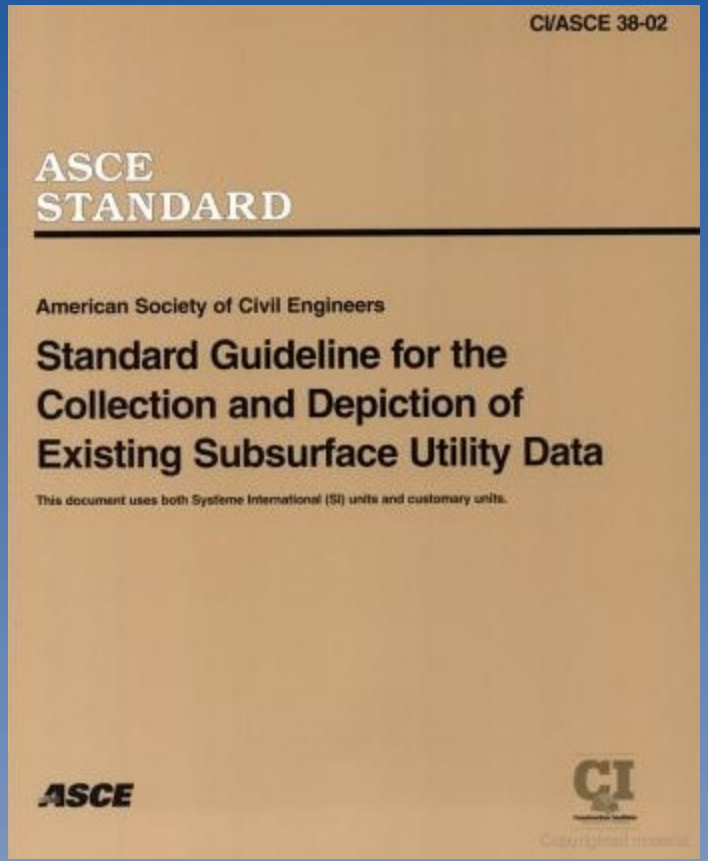
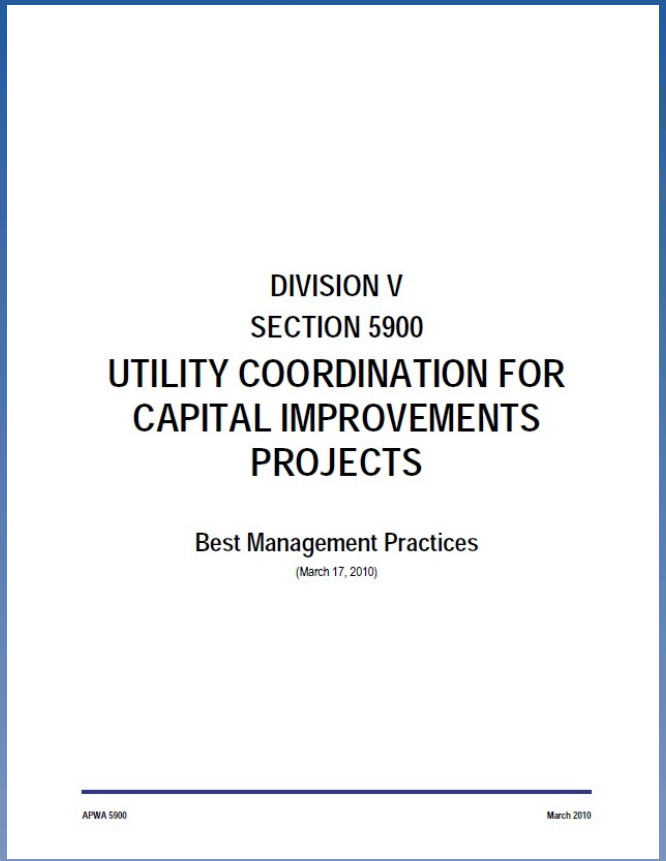
National Data Standards



Local Coordination Standards



SUE STANDARDS

SUBSURFACE UTILITY ENGINEERING

Over the decades, highway designers have had a difficult time obtaining reliable subsurface utility information. Now, this information is available through the use of an engineering process called Subsurface Utility Engineering

MAJOR SUE ACTIVITIES:

Scope of Work – The process of developing a written project-specific work plan package that consists of scope of work, levels of service vs. risk allocation, project schedule and desired project delivery method. This SUE work plan package is agreed upon by the SUE provider and the client, describing the SUE work to be performed.

Designating – The process of using a surface geophysical method or methods to interpret the presence of a subsurface utility and mark its horizontal position on the ground surface or on above-ground surface markers.

Locating – The process of exposing and recording the precise vertical and horizontal location and providing utility size and configuration of a utility.

Data Management – The process of surveying, designating, and locating information to project control and transferring it into the client's CADD system, GIS files, or project plans.

Conflict Analysis – The engineering process of using a conflict matrix to evaluate and compare depicted designating information with proposed plans (highway, bridge, drainage, and other) in order to inform all stakeholders of potential conflicts, potential resolutions and costs to cure.

Project Application

STANDARD OF CARE

The American Society of Civil Engineers (ASCE) has developed an important standard of care guideline, *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data*, CI/ASCE 38-02.

This standard guideline describes four quality levels of utility depiction:

Quality Level D – Information derived from existing records or oral recollections.

Quality Level C – Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to Quality Level D.

Quality Level B – Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities.

Quality Level A – Precise horizontal and vertical location of utilities obtained by the actual exposure and subsequent measurement of subsurface utilities, usually at a specific point.

To order a copy of ASCE Standard 38-02, please go to the ASCE Bookstore: http://www.pubs.asce.org or call 1-800-548-2723.

SUE EXPERTISE

Competence. SUE providers should be able to demonstrate a thorough knowledge and understanding of the major SUE activities and should be able to provide these services to the extent desired by the contracting agency.

Experience. Individuals assigned by the SUE provider to carry out the work should be well-trained, experienced, and capable. Those in responsible charge of the work and responsible for certifying deliverables should be engineers, geologists, and land surveyors employed by the SUE provider in accordance with state professional registration requirements.

Equipment. A wide range of equipment is necessary to detect the variety of subsurface utilities that may be present. Equipment available for utilization by the provider should include, but not be limited to, state-of-the-art designating equipment; vacuum excavation or comparable non-destructive locating equipment; state-of-the-art surveying and data recording equipment; and software systems compatible with those of the contracting agency.

Timeliness. Resources of the provider should be adequate to carry out the SUE work in a timely manner, considering other possible commitments of work and the contracting agency's anticipated needs.

Financial Capacity. SUE providers should have the financial capacity to provide the required services.

Insurance. SUE providers should have adequate insurance covering all aspects of work. Minimum amounts should be in accordance with the contracting agency's requirements.

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SUE QUALITY LEVELS

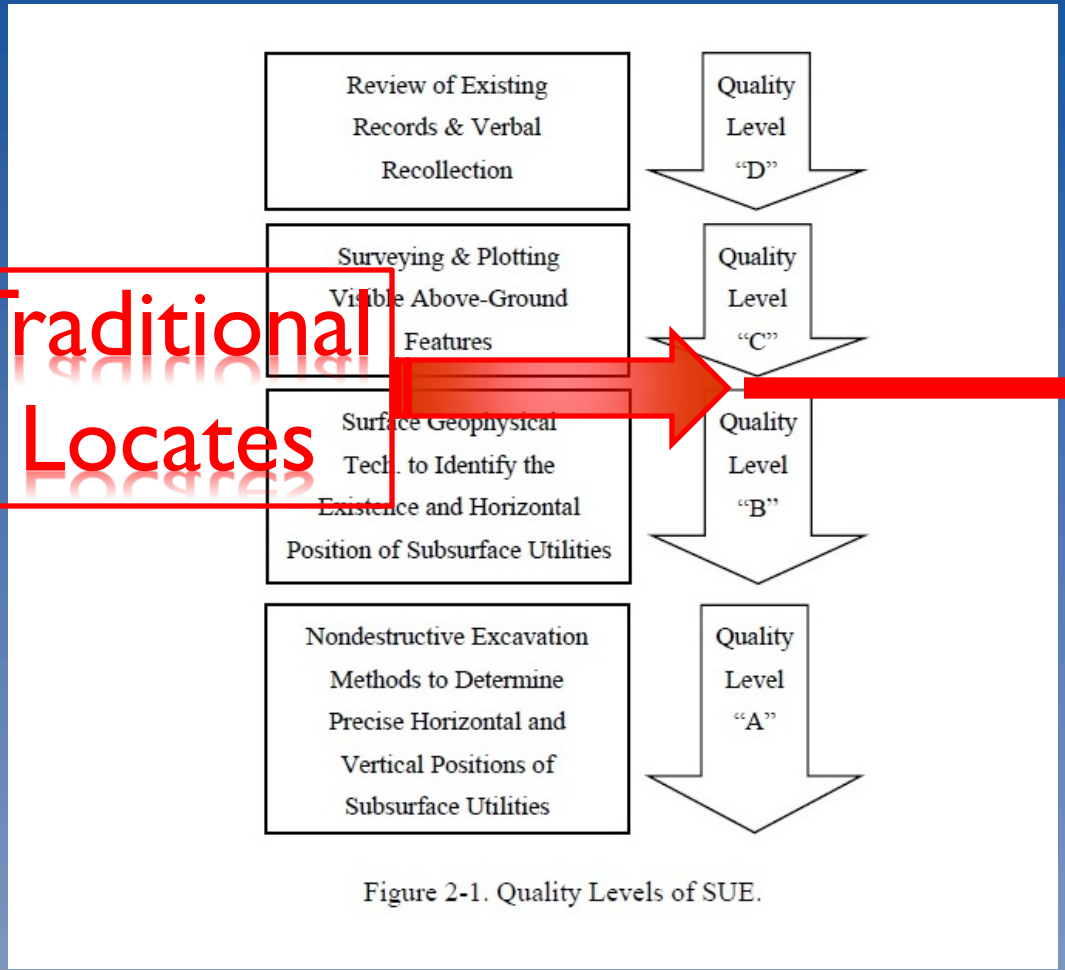

Figure 2-1. Quality Levels of SUE.

PFLUMM & LENEXA DRIVE

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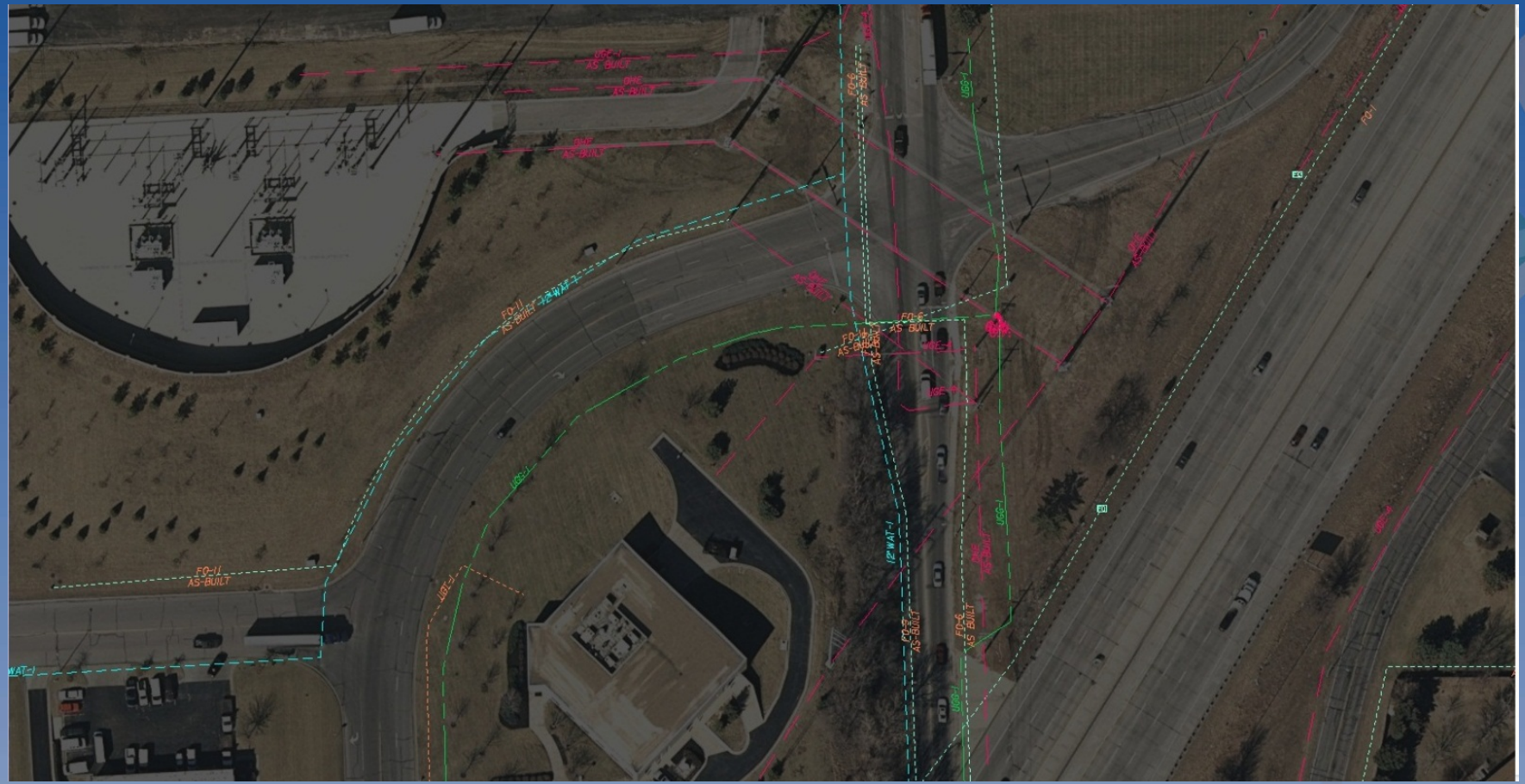
Traditional Locates:



PFLUMM & LENEXA DRIVE

JOHNSON COUNTY GATEWAY
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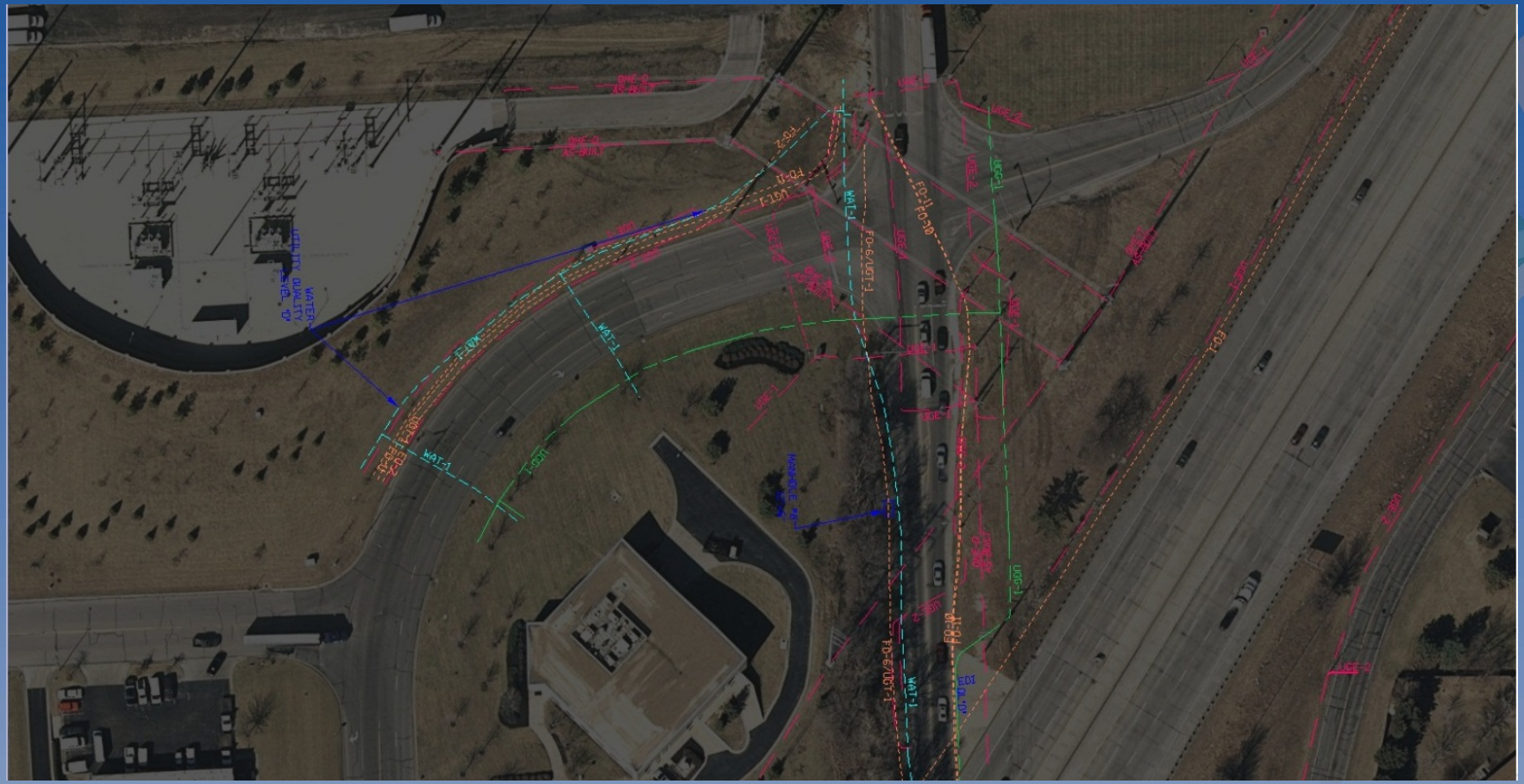
SUE Level B:



95TH EAST OF I-35

JOHNSON COUNTY GATEWAY
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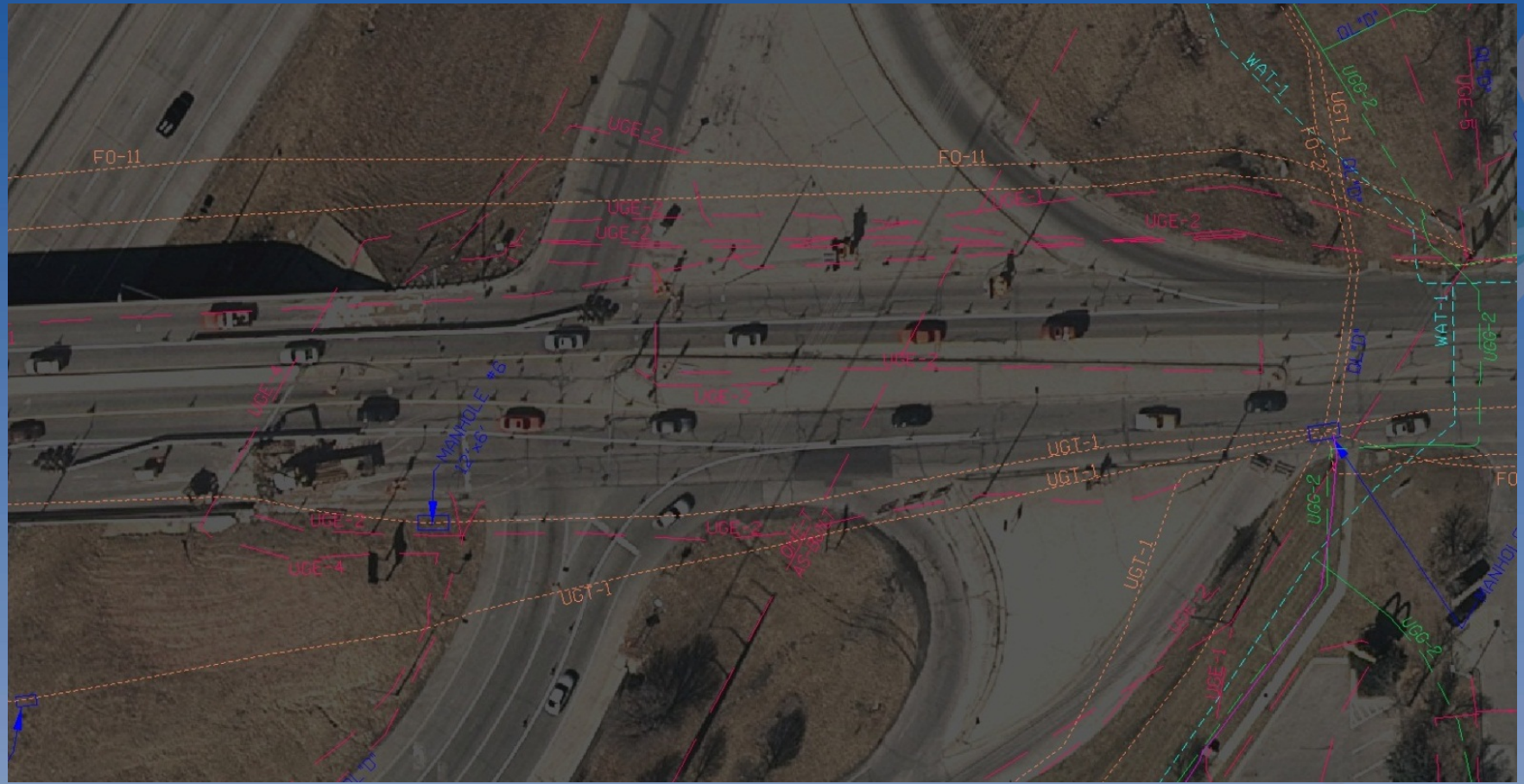
Traditional Locates:

95TH EAST OF I-35

JOHNSON COUNTY GATEWAY
A KDOT PROJECT
I-435 · I-35 · K-10

SUE Level B:



SUE LEVEL B

- Locates
  - Limited time & money
  - Low expectation
  - Low accountability
- SUE Level B
  - Best Equipment
  - Professional Training
  - Sufficient Time
  - High Accountability

SUE QUALITY LEVELS

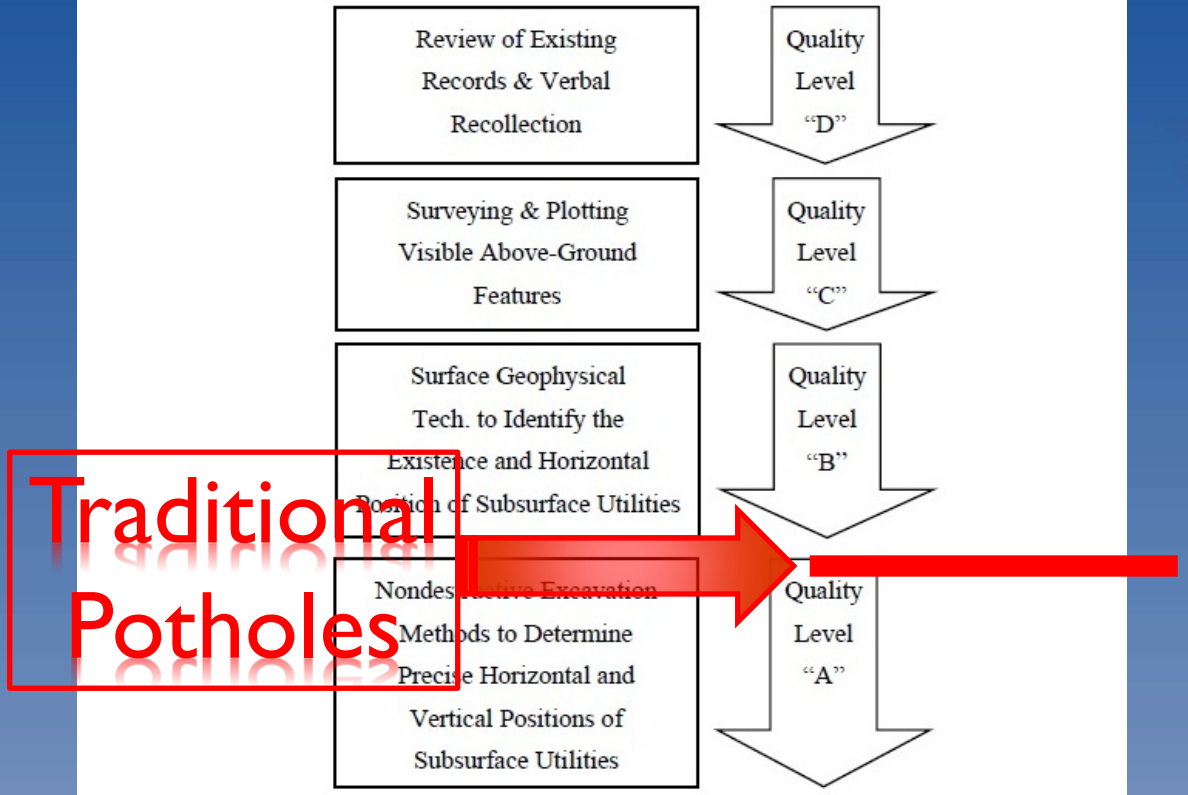


Figure 2-1. Quality Levels of SUE.

SUE LEVEL A

SUE LEVEL A


TBE GROUP
Utilities Divis
INDY
OFFICE
PROJ# KS COL-001.00
DATE 7-25-2012
T.H.# 21
UTIL FOC
MAT'L CONCRETE ENCASED
SIZE 10"
DEPTH 2.44"
CREW JG, ND

SUE LEVEL A

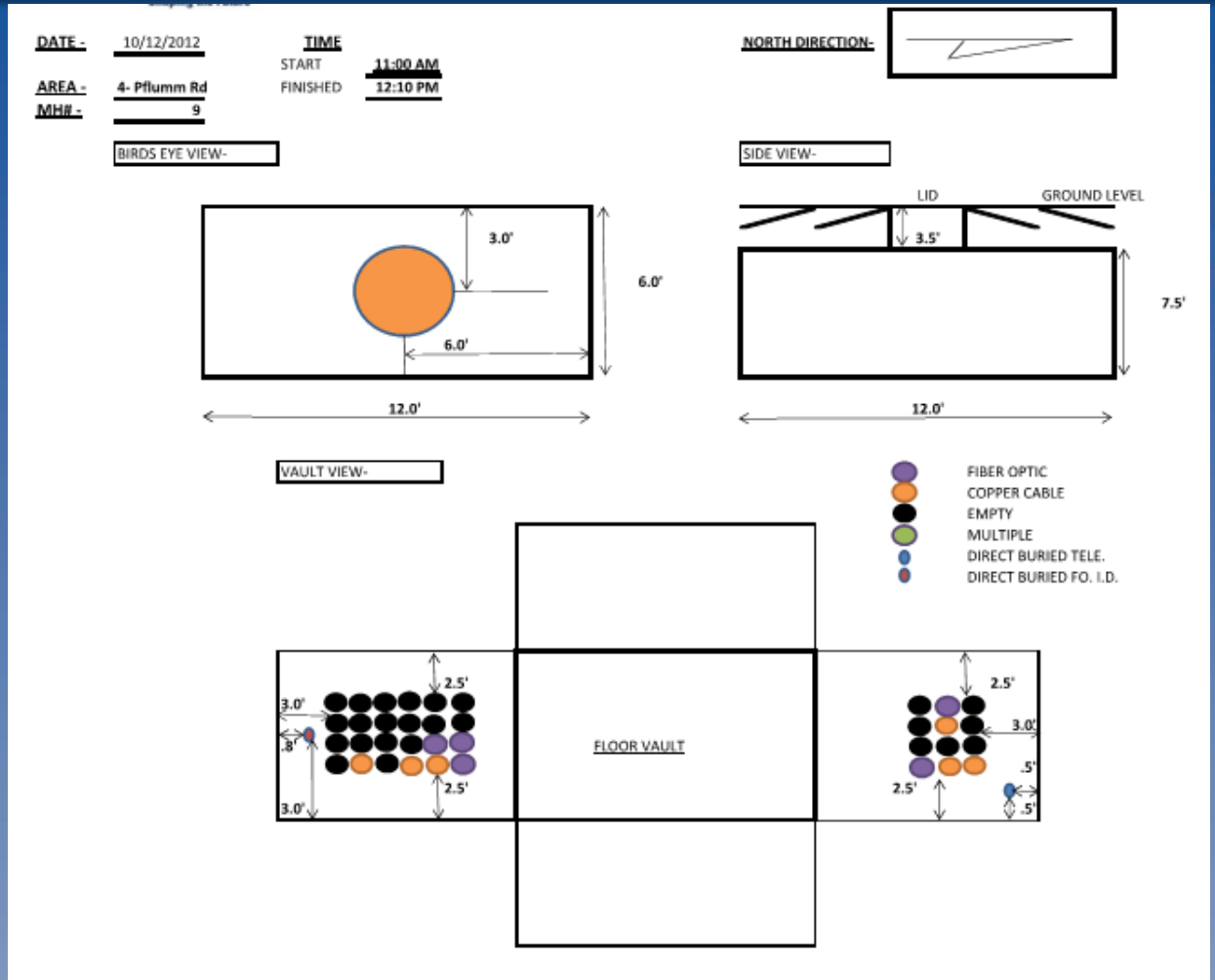
SUE LEVEL A

Test Hole Date	Man Hole No.	Utility Type	Utility Material	Utility Size (Nom.) in. ^ mm.	Approx. Station	Approx. Offset Distance ft. ^ m. L	Approx. Offset Distance ft. ^ m. R	Offset From	Manual Depth (Top) ft. ^ m.	Cross Sectional View	Utility Direction	ID'd By	Surface Type	Pvmnt. Thick-ness in. ^ mm.
7/25/12	21	FOC	14	10"	N/A	4.0		39	2.44	◌	↘	24	NG	N/A
7/24/12	22	G	14	10"	N/A	2.6		39	3.47	◌	↘	24	NG	N/A
7/24/12	23	PL	14	12"	N/A	2.8		39	3.52	◌	↘	24	NG	N/A
7/26/12	24	PL	SEE NOTE	SEE NOTE	N/A	3.3		39	8.15	◌	↘	24	NG	N/A
8/15/12	25	PL	1	16"	N/A		1.8	39	3.30	◌	↘	24	NG	N/A
8/16/12	26	PL	1	16"	N/A		4.1	39	3.48	◌	↘	24	NG	N/A
8/15/12	27	FOC	1	12"	N/A		4.6	39	3.75	◌	↘	24	NG	N/A
8/16/12	28	PL	1	12"	N/A		2.7	39	3.26	◌	↘	24	NG	N/A
8/17/12	29	FOC	1	12"	N/A		3.1	39	3.32	◌	↘	24	NG	N/A

SUE LEVEL A

Test Hole No.	Top of Utility	Reference Point	Manual Depth (FT)	UTILITY QUALITY	Notes
21	8.73	6.29	**2.44**	A	
22	9.33	5.86	**3.47**	A	
23	9.94	6.42	**3.52**	A	
24	MANUAL	DEPTH	**8.15**	B	UNABLE TO EXPOSE DUE TO GROUND CONDITIONS. 16" CASING IS PER RECORDS FROM BRIAN WITH PHILLIPS 66.
25	MANUAL	DEPTH	**3.30**	A	COULD NOT FULLY EXPOSE PIPE. SIZE IS 16" CASING AS PER ALLEN WITH MAGELLAN.
26	8.60	5.12	**3.48**	A	
27	8.45	4.70	**3.75**	A	
28	8.48	5.22	**3.26**	A	FOUND END OF 12" METALLIC CASING HOUSING 10" CONCRETE CASING. END OF 12" CASING IS 1.1' FROM REFERENCE PIN TOWARDS ROW FENCE.
29	8.17	4.85	**3.32**	A	FOUND END OF 12" METALLIC CASING HOUSING 10" CONCRETE CASING. END OF 12" CASING IS 2' FROM REFERENCE PIN TOWARDS ROW FENCE.

SUE LEVEL A


DATE - 10/12/2012
TIME
START 11:00 AM
FINISHED 12:10 PM
AREA - 4- Pflumm Rd
MH# - 9
NORTH DIRECTION-
BIRDS EYE VIEW-
3.0'
6.0'
6.0'
12.0'
SIDE VIEW-
LID
GROUND LEVEL
3.5'
7.5'
12.0'
VAULT VIEW-
FIBER OPTIC
COPPER CABLE
EMPTY
MULTIPLE
DIRECT BURIED TELE.
DIRECT BURIED FO. I.D.
FLOOR VAULT
2.5'
3.0'
.5'
2.5'
3.0'
2.5'
3.0'
.5'
.5'

SUE LEVEL A

- Potholes
  - Depth
  - Approximate location
- SUE Level A
  - Depth and Elevation
  - Surveyed Location
  - Size
  - Condition
  - Pictures
  - Dimensioned Manhole Sketches
  - Continuity w/ Level B Data

IDENTIFYING PROJECTS FOR SUE

JOHNSON COUNTY GATEWAY
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- FHWA commissioned Purdue Study, 1999

Conclusions

The Federal Highway Administration (FHWA) commissioned Purdue University to study the effectiveness of subsurface utility engineering (SUE) as a means of reducing costs and delays on highway projects. From a study of 71 projects with a combined construction value in excess of $1 billion, the results indicated the effectiveness of the study was a total of $4.62 in savings for every $1.00 spent on SUE. The costs of obtaining QL B and QL A data on these 71 projects were 0.5 percent of the total construction costs, resulting in a construction savings of 1.9 percent by using SUE. Qualitative savings were non-measurable, but it is clear that those savings are also significant and may be many times more valuable than the quantifiable savings.

This is somewhat less than the $7.00 to $1.00 (previous VDOT study), $18.00 to $1.00 (previous MDSHA study), and $10.00 to $1.00 (Society of American Value Engineers) returns on investment that were previously reported in literature. However, the quantity of studied projects is much higher; the projects are more random in nature; and no qualitative costs were included in the total. Indeed, one individual project had a $206.00 to $1.00 return on investment (NCDOT). Only three of 71 projects had a negative return on investment. This leads to the conclusion that SUE is a viable technologic practice that reduces project costs related to the risks associated with existing subsurface utilities and should be used in a systemic manner. Using the SUE savings factor data from this study and a national expenditure in 1998 of $51 billion for highway construction that was provided by the FHWA, the use of SUE in a systemic manner should result in a minimum national savings of approximately $1 billion per year.

IDENTIFYING PROJECTS FOR SUE

JOHNSON COUNTY GATEWAY
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- Study Results - SUE Level A & B
  - $4.62 saved per $1 invested in SUE
  - SUE cost = 0.5% of construction cost
  - SUE savings = 1.9% construction cost
- Applying Results to Theoretical Examples
  - $1M construction: $5k SUE = $19k savings
  - $100M construction: $500k SUE = $1.9M savings
- **Gateway Example**
  - **$250M construction: $500k SUE = $4.75M savings?**

IDENTIFYING PROJECTS FOR SUE

JOHNSON COUNTY GATEWAY
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- Qualitative Considerations
  - Safety
  - Impacts to residents and businesses
  - Cost to utility owners
  - Utility owner relationships
  - Risk management

IDENTIFYING PROJECTS FOR SUE

- PennDOT Study, 2007

Sweet Spot

Table 5-5. Complexity Level, SUE Quality Level, Project Risk Level, and SUE Benefits Level.

SUE Decision Matrix for Highway Projects

Utility Related Risk Level								SUE Benefits Level (Positive)
	80-100	SUE Quality Level C&D					0-20	
	60-80	SUE Quality Level B/C	SUE Quality Level C&D				20-40	
	40-60	SUE Quality Level B	SUE Quality Level B/C	SUE Quality Level C&D			40-60	
	20-40	SUE Quality Level A/B	SUE Quality Level B	SUE Quality Level B/C	SUE Quality Level C&D		60-80	
	0-20	SUE Quality Level A	SUE Quality Level A/B	SUE Quality Level B	SUE Quality Level B/C	SUE Quality Level C&D	80-100	
Utility Complexity Level		5	4	3	2	1	Utility Complexity Level	
Utility Related Risk Level	0-20		SUE Quality Level A	SUE Quality Level A/B	SUE Quality Level B	SUE Quality Level B/C	0-20	SUE Benefits Level (Negative)
	0-20			SUE Quality Level A	SUE Quality Level A/B	SUE Quality Level B	20-40	
	0-20				SUE Quality Level A	SUE Quality Level A/B	40-60	
	0-20					SUE Quality Level A	60-80	
	0-20						80-100	

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D-B UTILITY STRATEGIES

JOHNSON COUNTY GATEWAY
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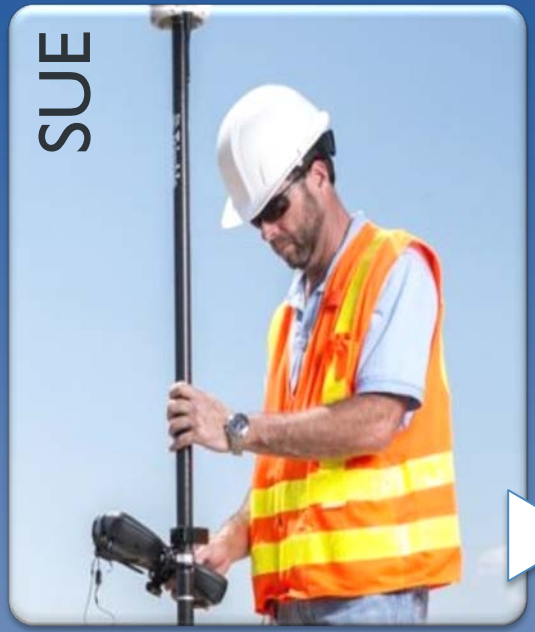
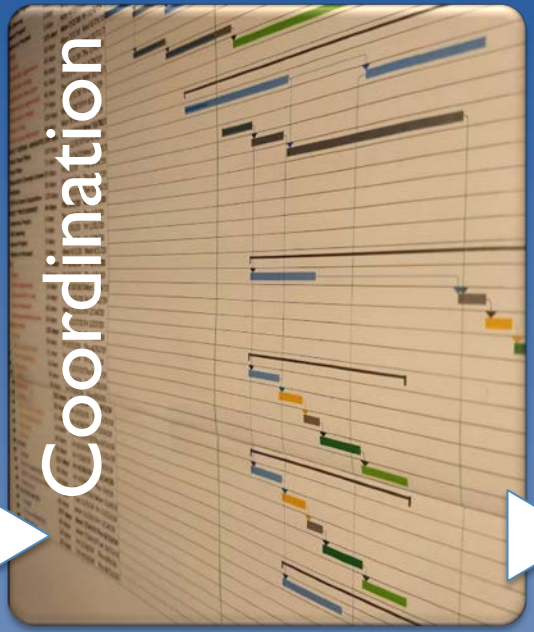
Decide for each… When? By Whom?

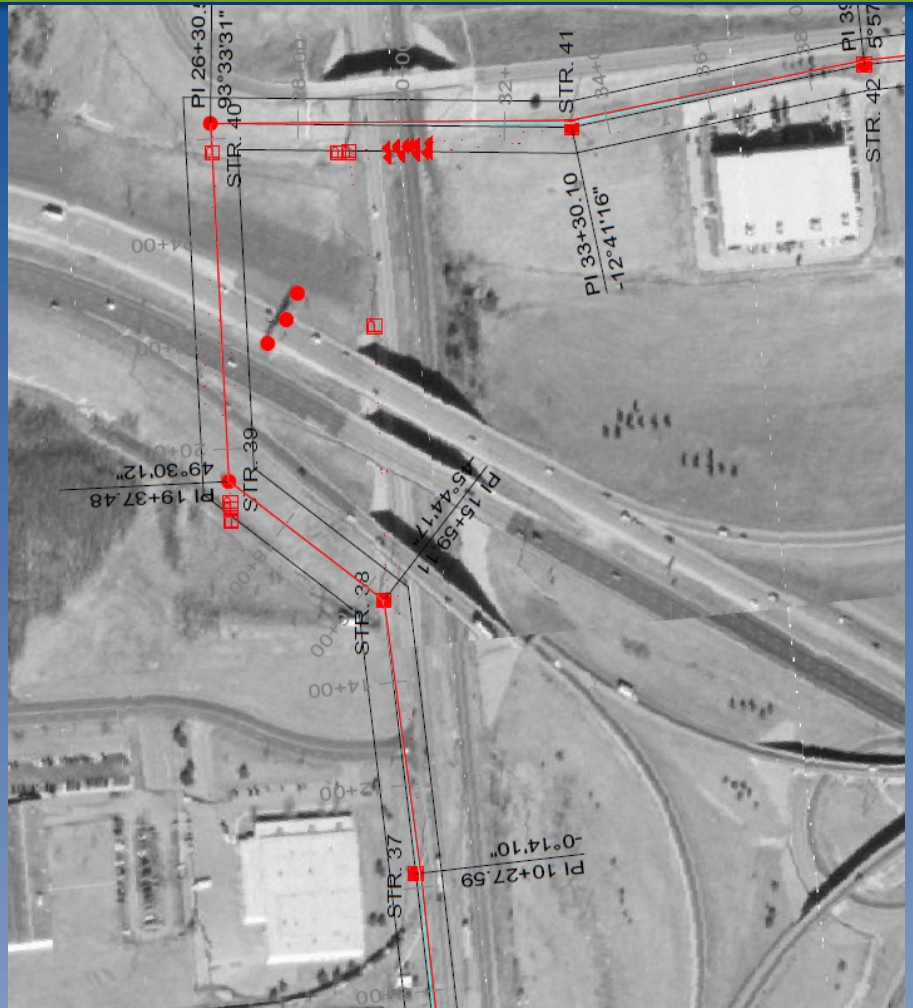


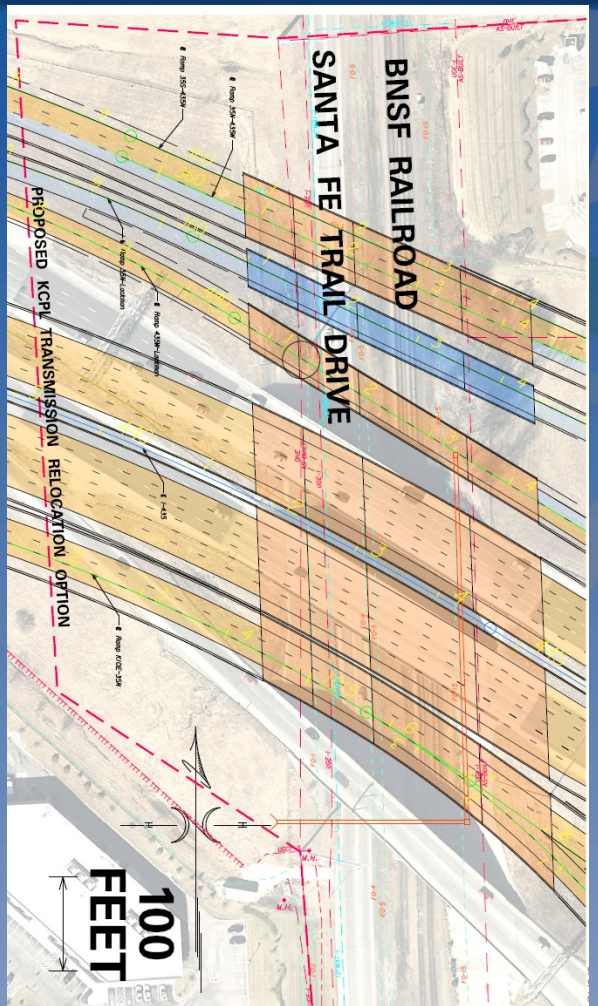


D-B UTILITY STRATEGIES

- Gateway Pre-Proposal Relocations
  - KCPL Transmission
  - Axon Duct Bank
  - Detour Route
- Gateway Post-Award Relocations

PRE-PROPOSAL RELOCATIONS





PRE-PROPOSAL RELOCATIONS

JOHNSON COUNTY GATEWAY
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PRE-PROPOSAL RELOCATIONS

JOHNSON COUNTY GATEWAY
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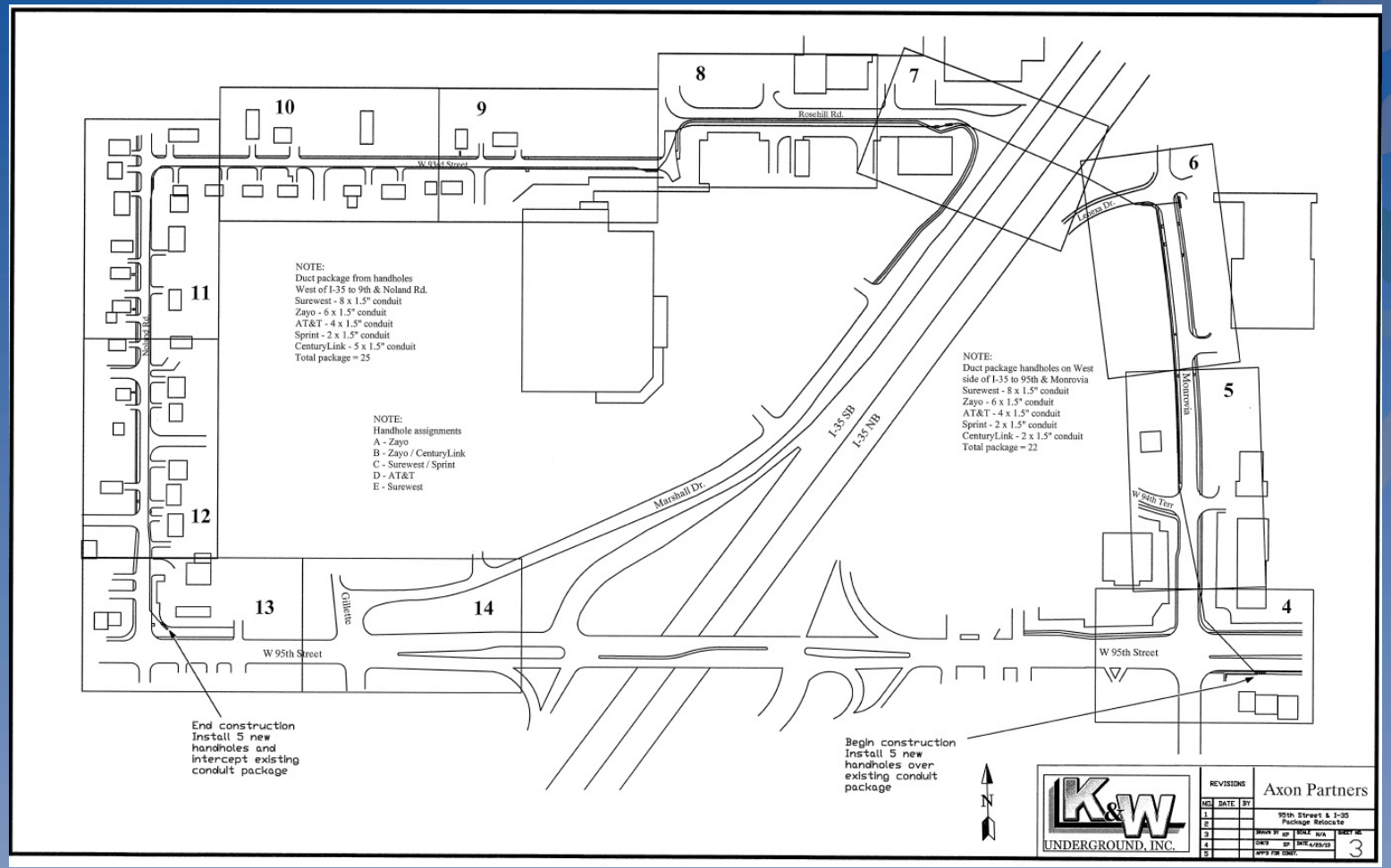

PRE-PROPOSAL RELOCATIONS

JOHNSON COUNTY GATEWAY
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PRE-PROPOSAL RELOCATIONS

JOHNSON COUNTY GATEWAY
A KDOT PROJECT I-435 · I-35 · K-10

D-B UTILITY STRATEGIES

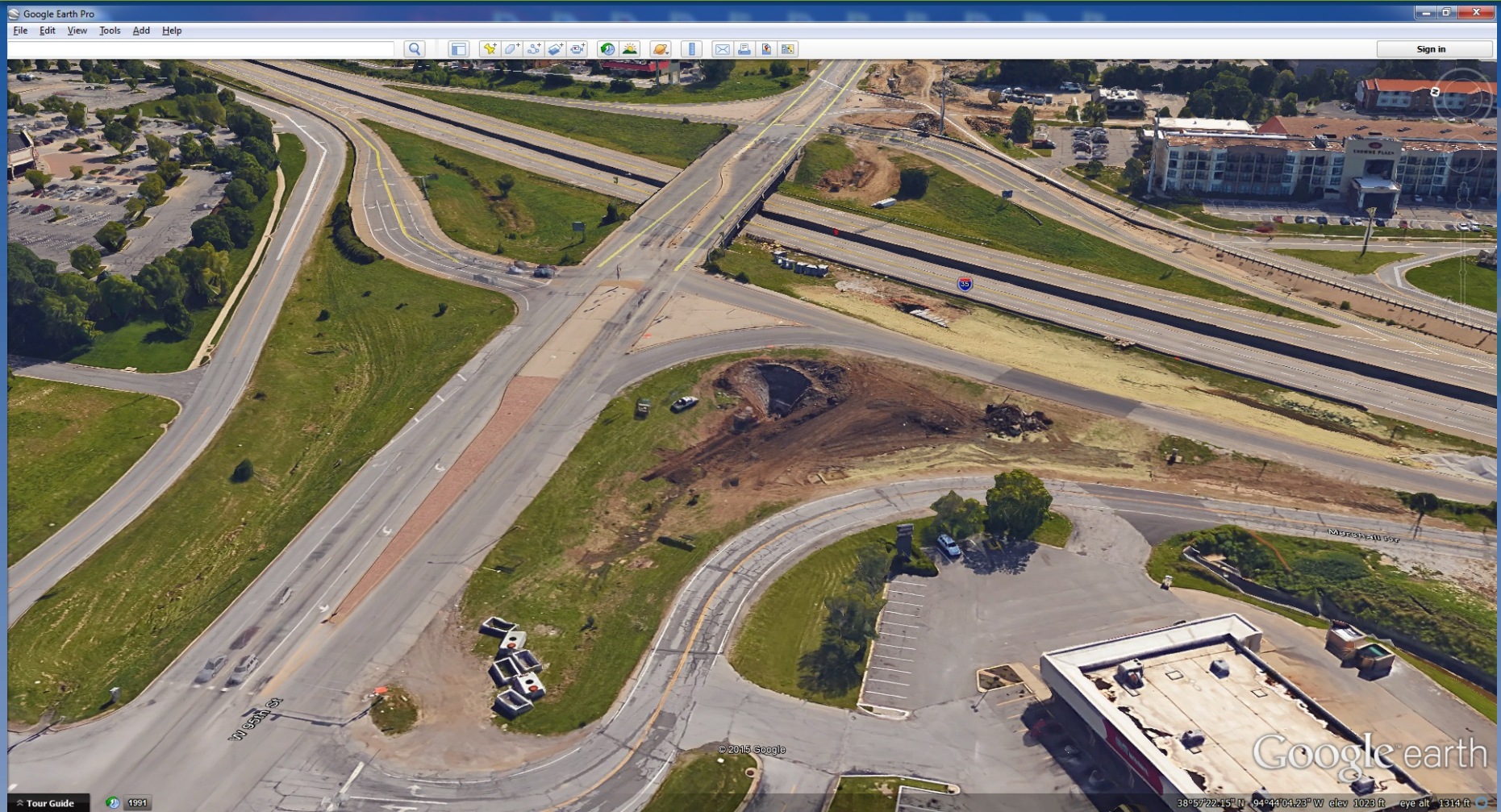
- Gateway Pre-Proposal Relocations
  - KCPL Transmission
  - Axon Duct Bank
  - Detour Route
- Gateway Post-Award Relocations
  - All Other Utilities
  - 2 Examples: AT&T I-35 Crossings

POST-AWARD RELOCATIONS

JOHNSON COUNTY GATEWAY
A KDOT PROJECT
I-435 · I-35 · K-10

POST-AWARD RELOCATIONS

JOHNSON COUNTY GATEWAY
A KDOT PROJECT
I-435 · I-35 · K-10



POST-AWARD RELOCATIONS

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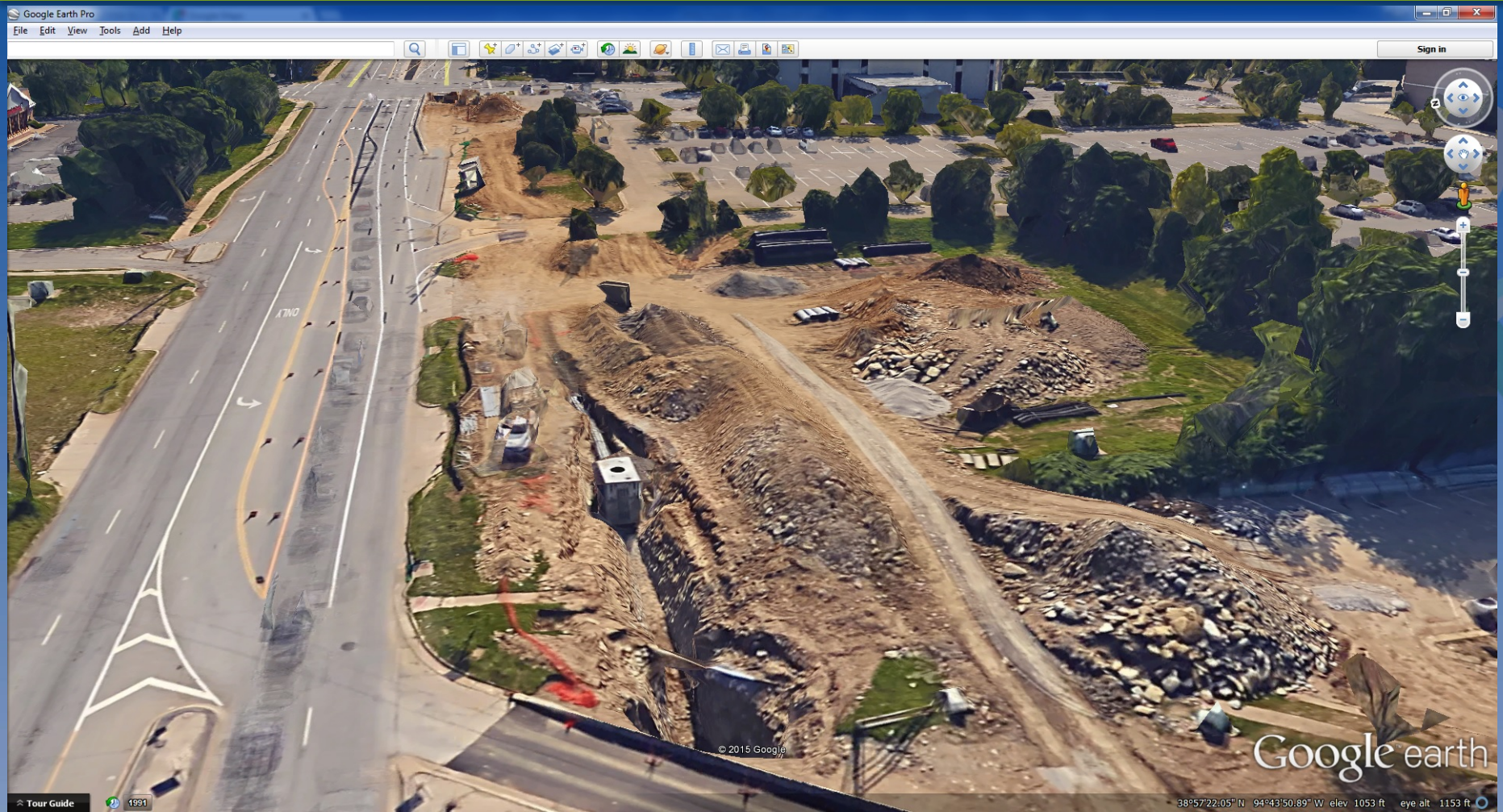
I-435 · I-35 · K-10



POST-AWARD RELOCATIONS

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POST-AWARD RELOCATIONS

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POST-AWARD RELOCATIONS

D-B UTILITIES STRATEGIES

JOHNSON COUNTY GATEWAY
A KDOT PROJECT I-435 · I-35 · K-10

- Contract Considerations?
  - Master Utility Agreement?
  - Relocation Agreements?
  - Utility Cost Structure?
  - Contract Language?
  - Billing & Invoicing?
  - Owner’s Rep?

"The quality of your decisions is only as good as the quality of your information"

DISCUSSION

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