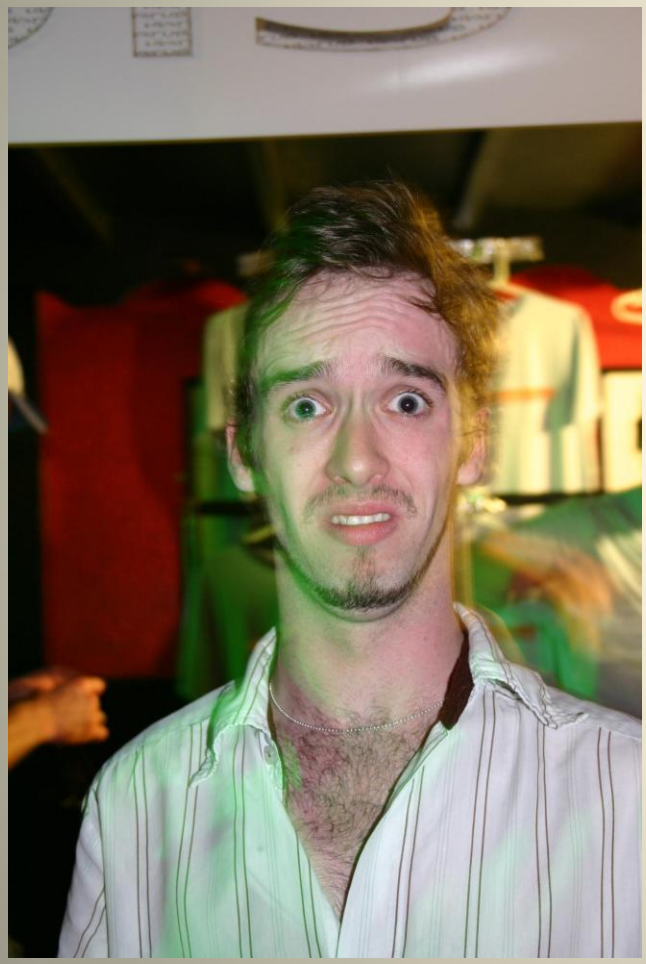
Utility Data Protocol and Repository Development

Rex Harris, P.E.
State Utility Engineer
Utah DOT

Risks Involved with Managing Utility Data?

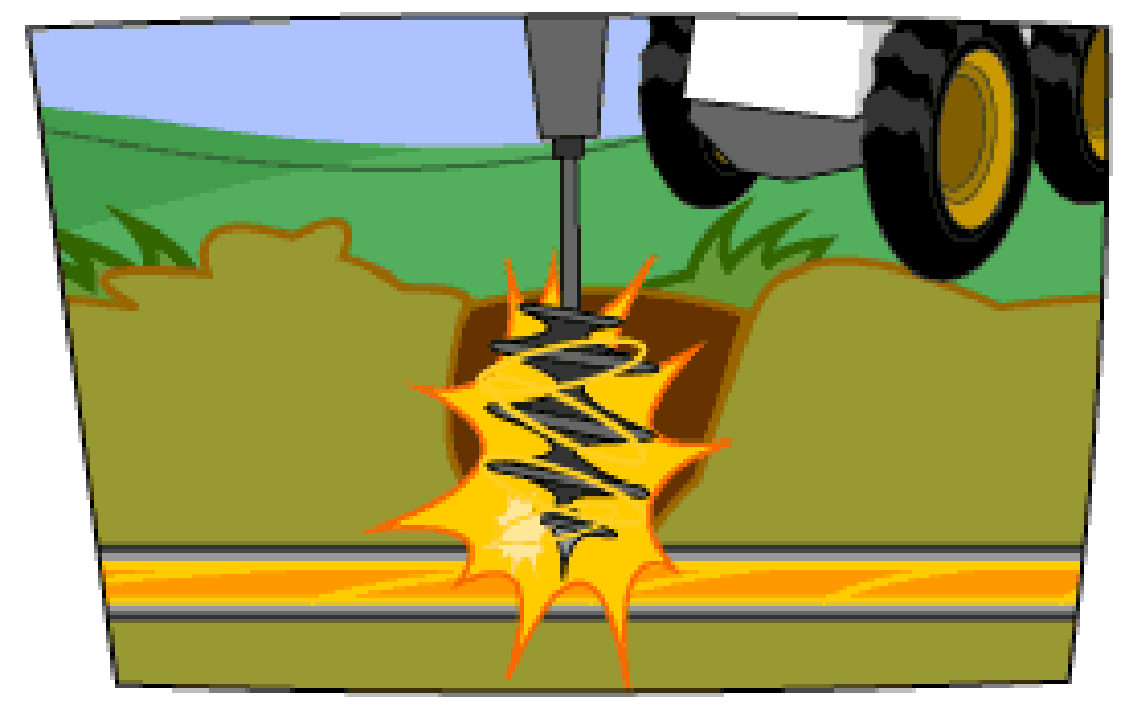


- Unforeseen utility conflicts
- Project delays due to utility conflicts
- Claims and change orders
- Delays due to utility relocates
- Project contingency fees
- Costs caused by conflict redesign
- Cost of project design
- Travel delays during construction to the motoring public
- Utility companies' cost to repair damaged facilities

Risks Involved with Managing Utility Data?

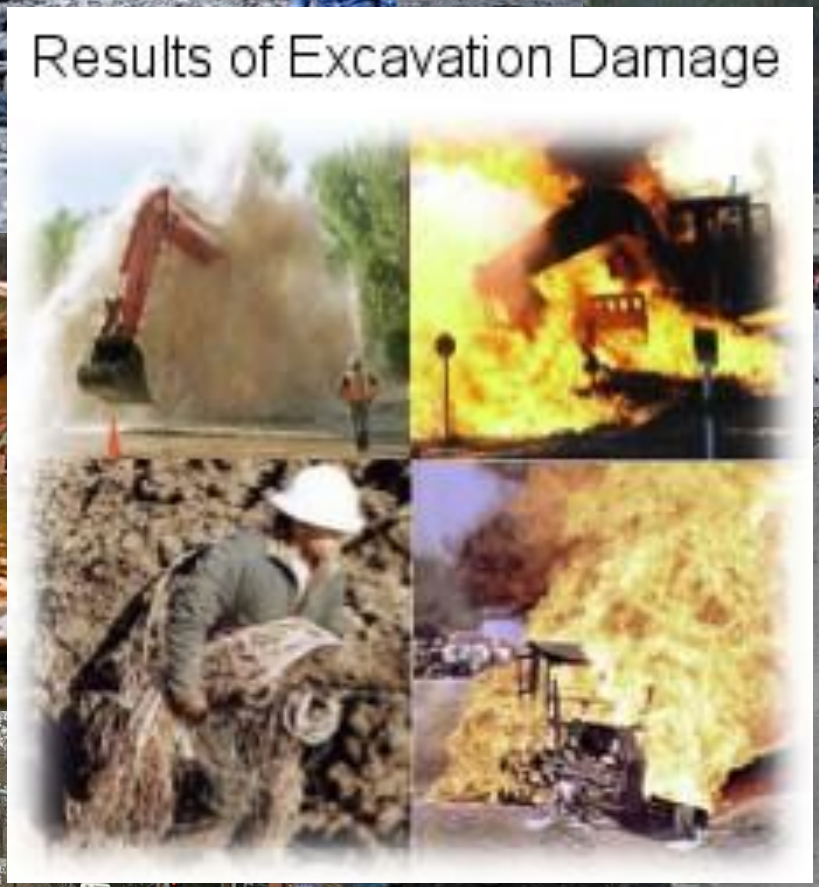
- Increased potential for utility customers' loss of service
- Damage to existing Highway and Utility facilities
- Traffic disruption, decreasing public credibility
- Higher potential for environmental damage
- Higher potential for insurance claims
- Contractor schedule delays
- Increased right-of-way acquisition costs

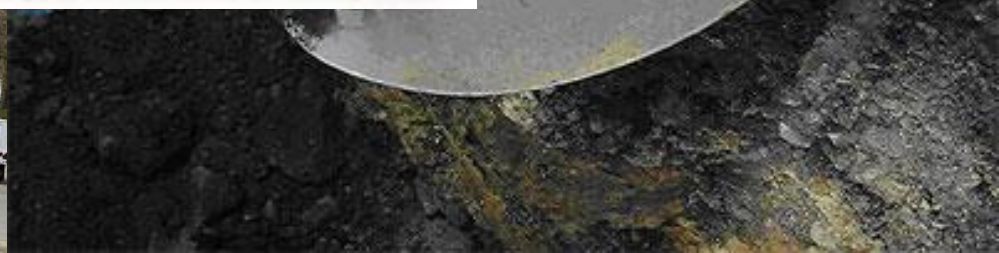
Risks Involved with Managing Utility Data?



- Damage to equipment
- Damage to property
- Loss of life!!!

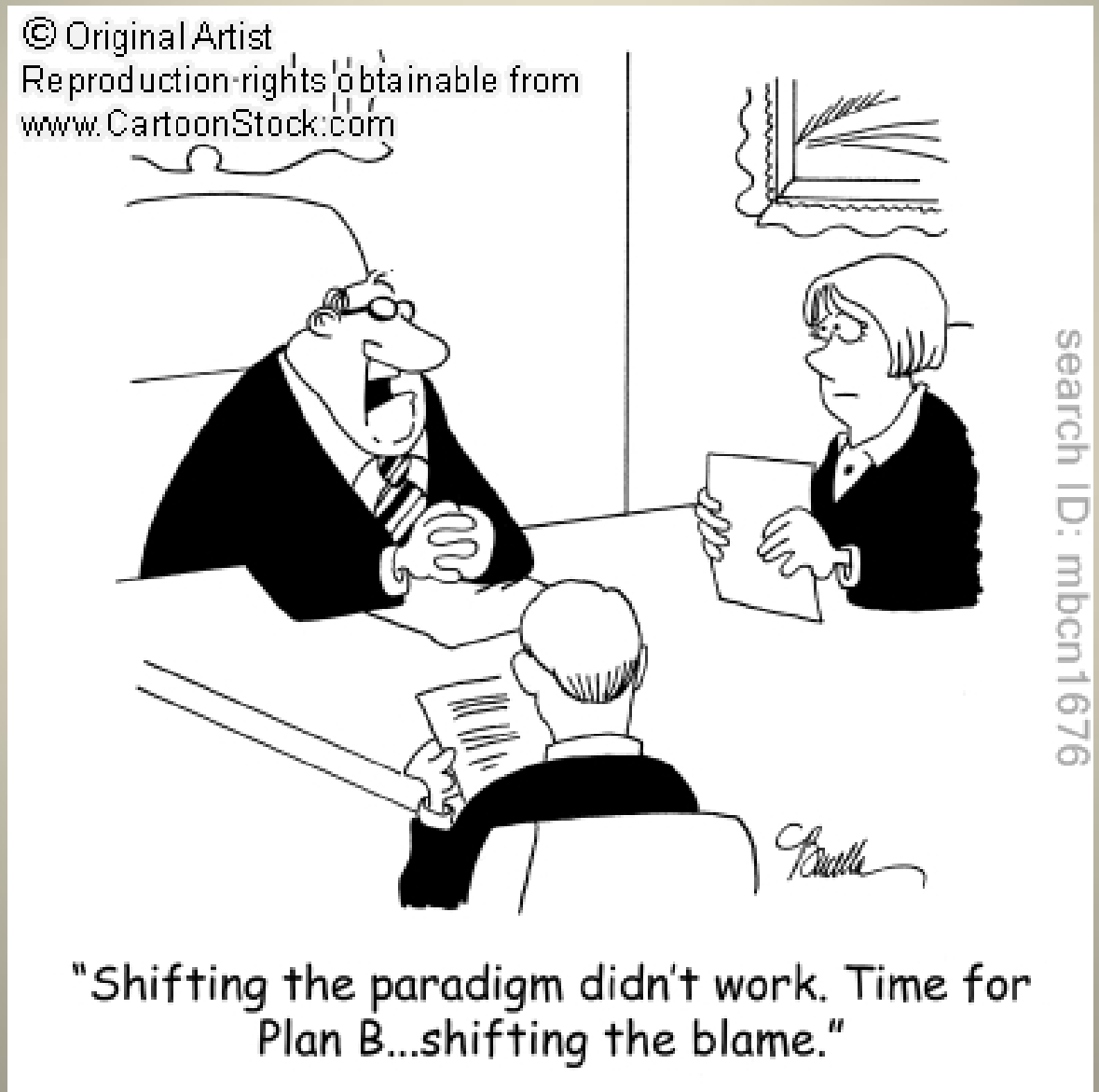
Results of Excavation Damage





A Picture is Worth a Thousand Questions?

Now That We Recognize Risk How Do we Proceed?




Responsibility

NOT IT! NOT IT!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Royston
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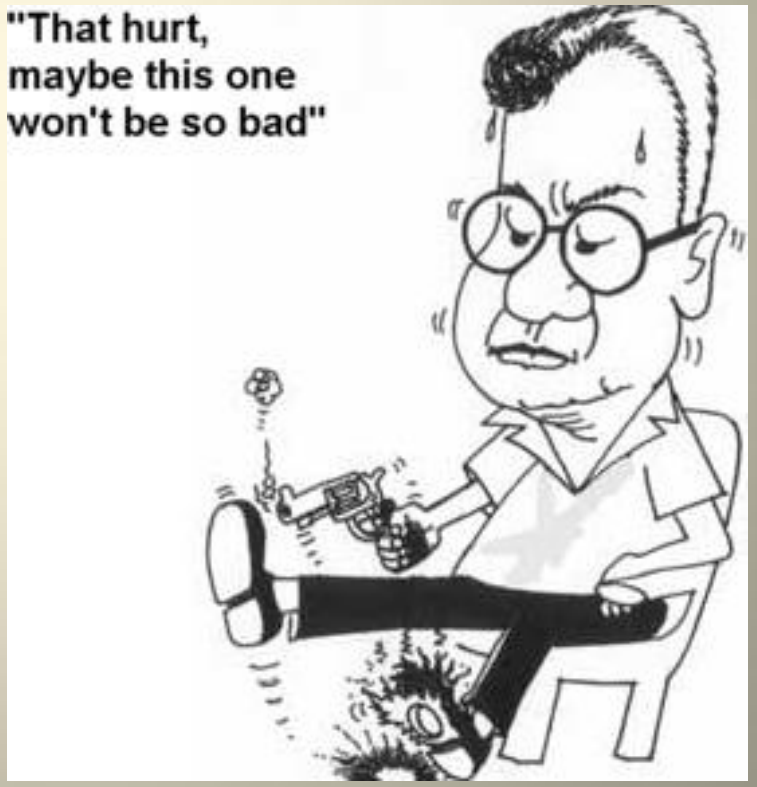
"OK, all those in favour of delegating decision-making, shrug your shoulders"

At the End of the Day Who Pays for Risk?

The OWNER!!!!



FHWA Recognizes Existing Underground Utilities are the Veins and Arteries of our Cities and Roads. Yet, We Know Very Little About Where They Are

- Communication
- Gas / Propane
- Petroleum
- Sewage
- Drainage
- Power
- Steam
- Water
- Irrigation
- Etc.

Right of Way is Living a Growing Animal

How long do we ignore the 800 lb Gorilla???

Answer…

Okay Risk Is Mine! Where Do We Go From Here?

As of January 2004 UDOT Requires SUE on All Projects

Memorandum

DATE: February 18, 2004

TO: Region Preconstruction Engineers, Project Managers, Design Engineers, and Design Consultants

FROM: Jason Davis, P.E.
Engineering Services Director, Project Development

SUBJECT: Use of Subsurface Utility Engineering (SUE) on UDOT Projects

Note: The attached memo is revised from the memo dated January 23 and sent to you on February 6 and posted to Web on February 9.

Reference to FHWA Policy

The Federal Program Guide for the Relocation and Accommodation of Utilities also states "The FHWA should not participate in any construction delay claims caused by conflicts with underground utilities that would have been avoided if subsurface utility engineering had been used." Thus, while there is an initial cost for obtaining this information, we risk delays during construction if it is not done, as well as risking losing money from the FHWA if a delay claim is denied for Federal reimbursement. Subsurface Utility Engineering should be performed on all UDOT projects to prevent this from happening.

SUE Costs and Savings

Redwood Road, 90th South to 104th South

- SUE Cost: $153,000
- Estimated Savings: $220,000

Redwood Road, 118th South to 126th South

- SUE Cost: $131,000
- Estimated Savings: $120,000+time

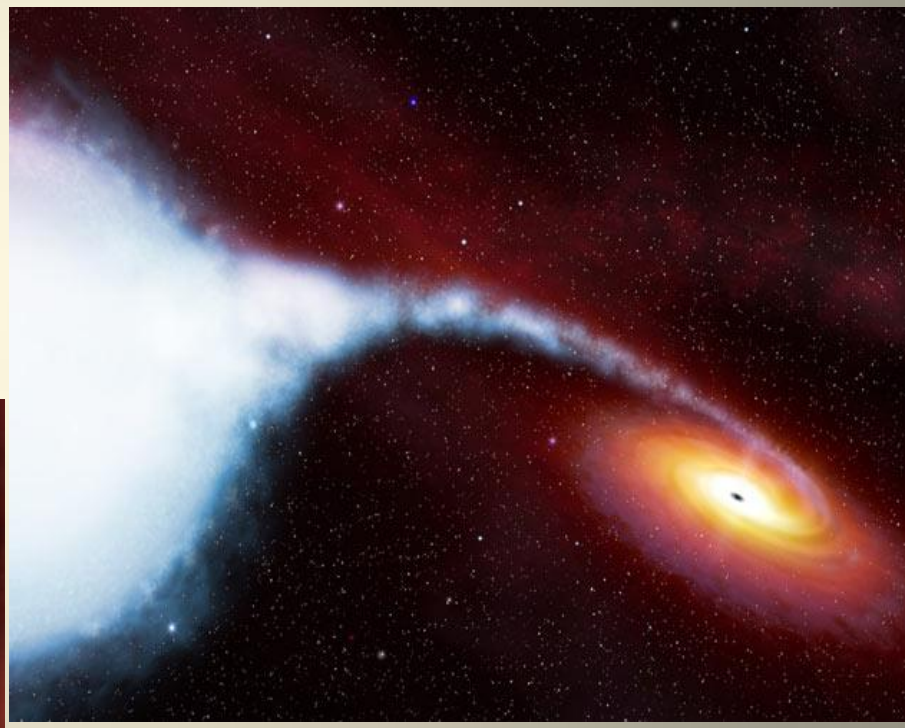
SR-24 Construction

- SUE Cost: $13,000
- Estimated Savings: $50,000+time

$497,000 Spent on S.U.E. and Collecting Utility Data

Where does the information go from here?

Black Hole????



ISSUES WITH AS-BUILTS

- As constructed plans have no defined standards
- Inaccurate
- Paper based versus electronic
- Hard to research and reference
- No central storage

Before S.U.E

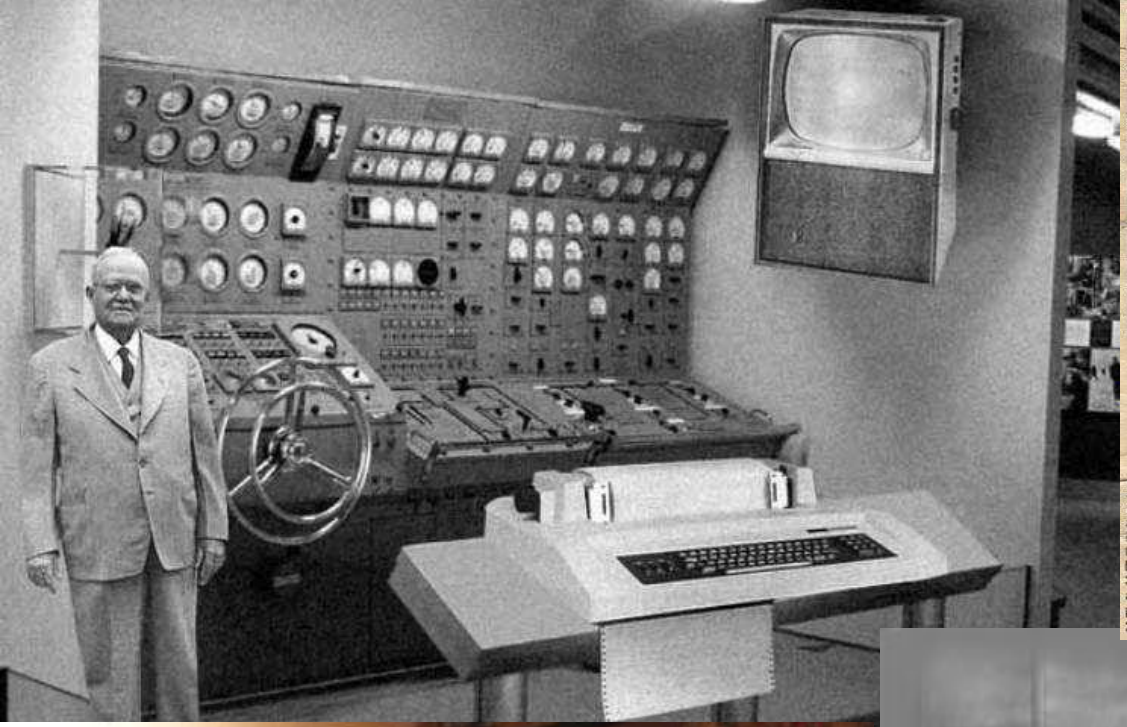
After S.U.E.

Long Story Short

In

Archives

Out



Tandy 5000 MC Professional System

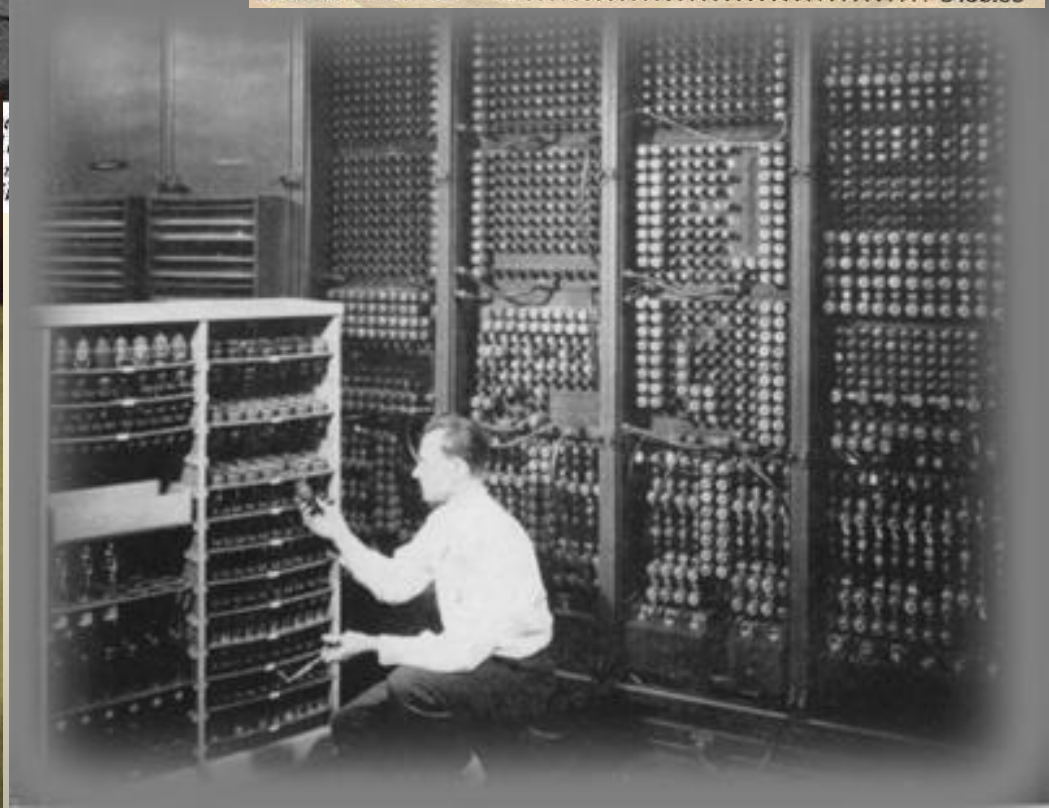
NEW FOR 89 **8499.00**

Monitor and mouse not included

■ 20 MHz Intel® 80386™ Microprocessor ■ VGA Graphics
■ 2 MB RAM (16 MB Capacity) ■ Cache Memory

Our most powerful computer ever! The Tandy 5000 MC Micro Computer is strictly business, from the look of its 256,000-color VGA graphics to the tactile feel of its newly-designed keyboard. Its Intel 80386 processor operates at a lightning-fast 20 MHz, and a memory cache controller provides RAM-fast access to your data. IBM® Micro Channel™ compatible architecture provides a 32-bit wide data path for virtually simultaneous data transfer between peripherals. Will operate MS-DOS® 3.3, MS® OS/2, SCO® XENIX® 386 and network operating software. The 5000 MC's technology, performance and price all add up to an incredible value. VGA graphics, serial and parallel ports and mouse support included.

25-6000 . . . . . **8499.00**




DEF
ABC
Spark Fun
TUV
WXY

Utility Data Protocol and Repository Development

Philip J. Meis, M.S., P.E.
Utility Mapping Services, Inc.

Acknowledgments

- Rex Harris, P.S.E., P.E. – UDOT Statewide Utilities Engineer
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- Edgar Kraus, M.S., P.E. - Texas Transportation Institute (TTI)
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- Bert Granberg – Utah State Geographic Information Database (SGID) of the Utah Automated Geographic Reference Center (AGRC)
- Members of the UDOT Technical Advisory Committee including: Frank Pisani, Chuck Felice, Michelle Verucchi, Chris Glazier, Tim Ularich, Ray Meldrum, Jerry Maio, and Ken Berg.

Agenda

- Scope and Goal of Project
- Researched Practices
- Recommended Standards
  - Spatial, Attribute, Corresponding Metadata
- Data Repository Overview
- Implementation Steps

Scope and Goal

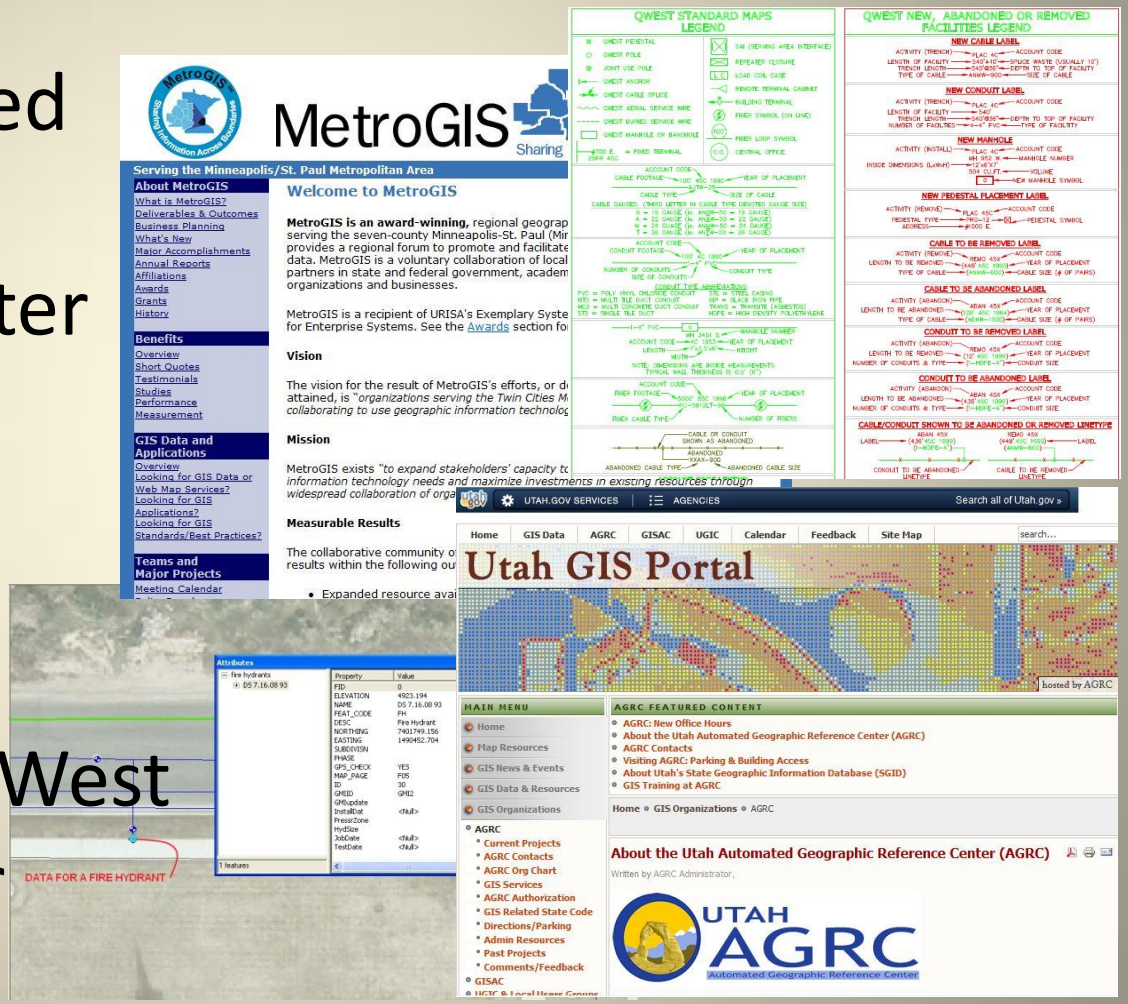
- Develop Protocol for Digital Data Submittals
  - Review Current Practices and Standards
    - International, Federal, State, UDOT, local government, private utilities
  - Recommend Utility Database Schema
    - Stem from TTI work for TxDOT
  - Recommend Standard Utility Submittals
    - S.U.E. Submittals
    - DOT Construction As-Builts
    - Proposed Alignments from Encroachment Permit Applications
    - As-Builts from New Utility Installations

Standards/Guidelines

- Feder
- Open
- Amer
- Intern SO)
- Spatia e, and Envir
- Minn sion 1.2 –
- Stand tion of Subsu
- NGS U NSS Positi

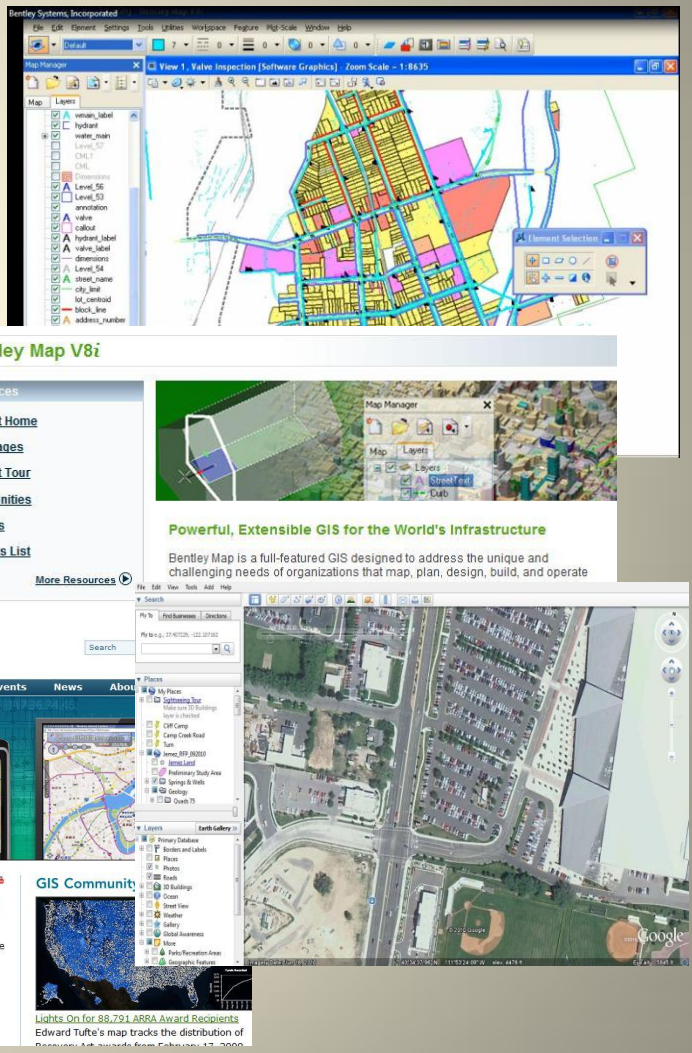
Research – Other Systems

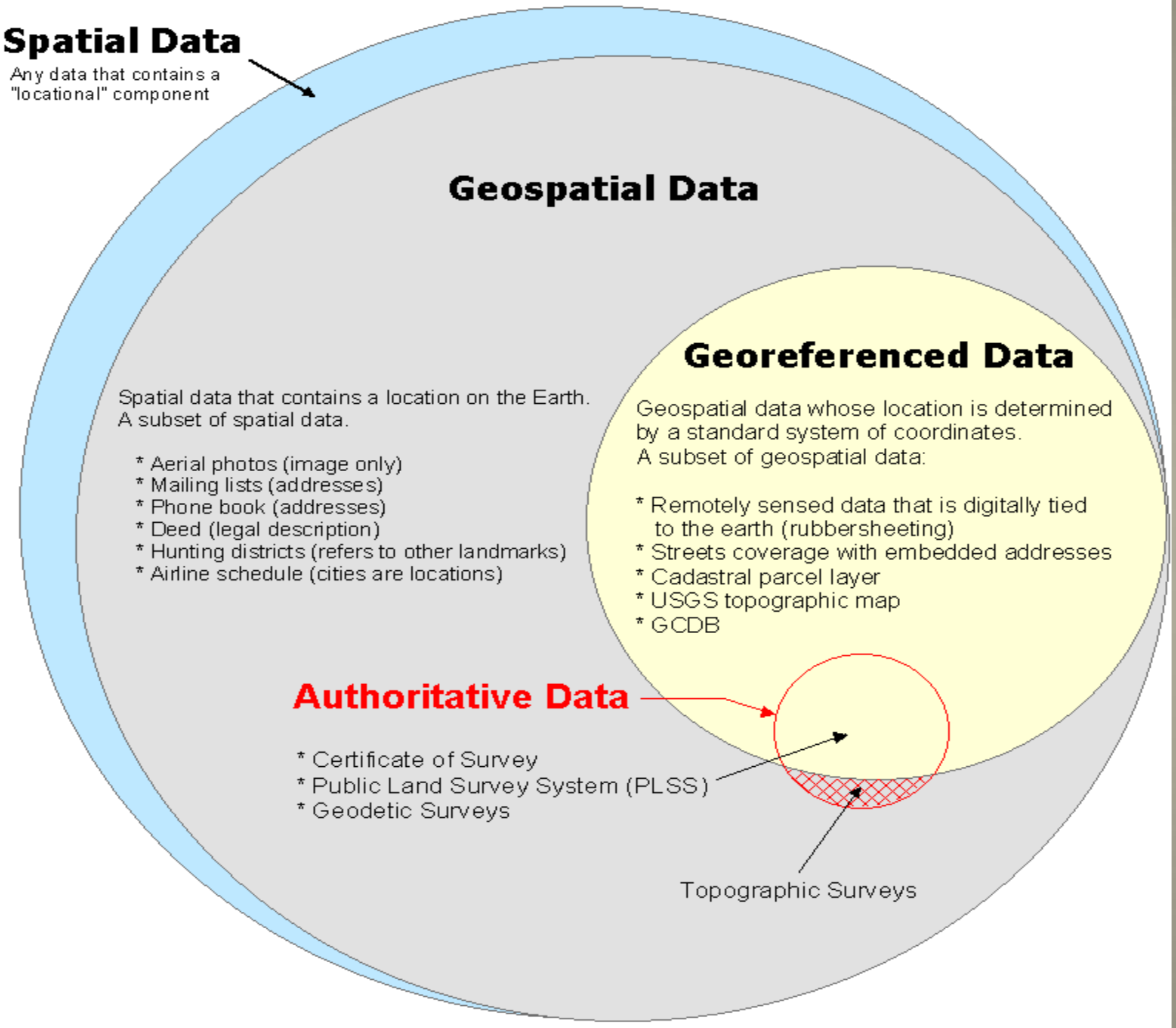
- Utah Automated Geographic Reference Center (AGRC)
- MetroGIS
- UDOT ATMS
- Qwest, City of West Valley, Questar



Research – Software Vendors

- Bentley
  - MicroStation, InRoads, Map, Geospatial Server, GeoPak
- ESRI
  - ArcView, ArcInfo, ArcMap, ArcGIS
- Oracle Spatial
- Google Earth
- Trimble




Spatial Data
Any data that contains a "locational" component
Geospatial Data
Spatial data that contains a location on the Earth.
A subset of spatial data.
* Aerial photos (image only)
* Mailing lists (addresses)
* Phone book (addresses)
* Deed (legal description)
* Hunting districts (refers to other landmarks)
* Airline schedule (cities are locations)
Georeferenced Data
Geospatial data whose location is determined by a standard system of coordinates.
A subset of geospatial data:
* Remotely sensed data that is digitally tied to the earth (rubbersheeting)
* Streets coverage with embedded addresses
* Cadastral parcel layer
* USGS topographic map
* GCDB
Authoritative Data
* Certificate of Survey
* Public Land Survey System (PLSS)
* Geodetic Surveys
Topographic Surveys

State Statutes and Model Law

The 2002 GIS/LIS Addendum to the Report of the Task Force on the National Council of Examiners for Engineers and Land Surveyors (NCEES) Model Law for Surveying recommends ***"GIS-based databases and maps that are intended to be used as the authoritative document for the location of parcels, fixed works, survey monuments, elevation measurements, etc., must be compiled under the responsible charge of a Professional Surveyor or Land Surveyor."***

RTK GPS Survey

NGS User Guidelines for Single Base Real Time GNSS Positioning v. 1.0 January 2010

Class RT2 requires a collection interval of 5 seconds for 1 minute. Precisions: typically 0.02 m – 0.04 m horizontal, 0.03 m – 0.05 m vertical (two sigma or 95 percent confidence). Typically used for densification of control, topographic control, photopoints and utility stakeout. Important vertical features such as pipe inverts, structure inverts, bridge abutments, etc. should have elevations obtained from leveling or total station locations, but RT horizontal locations are acceptable.

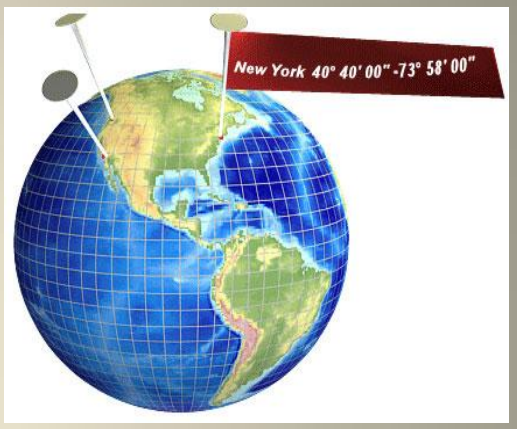
Class RT3 requires a collection rate of 1 second for 15 seconds. Precisions: typically 0.04 m – 0.06 m horizontal, 0.04 m – 0.08 m vertical (two sigma or 95 percent confidence). Typically used for topography, cross sections, agriculture, road grading and site grading.

Authoritative Survey Data (ASD) Model

- Utility 3D Positional Data is a Quagmire:
  - Data model needs to accommodate assortment of QL A through D data.
  - Manage positional data as chains
    - Survey QL A (authoritative)
    - Survey QL B (authoritative)
    - Use graphical COGO to create QL C and QL D chains (non-authoritative)
- Utility systems are complex and constantly changing (including owners).
- Need to be able to push data to CADD/GIS

National Spatial Reference System

- National Oceanic and Atmospheric Administration (NOAA) National Geodetic Service (NGS) National Spatial Reference System (NSRS)
  - North American Datum of 1983 (NAD 83)
  - North American Vertical Datum of 1988 (NAVD88)



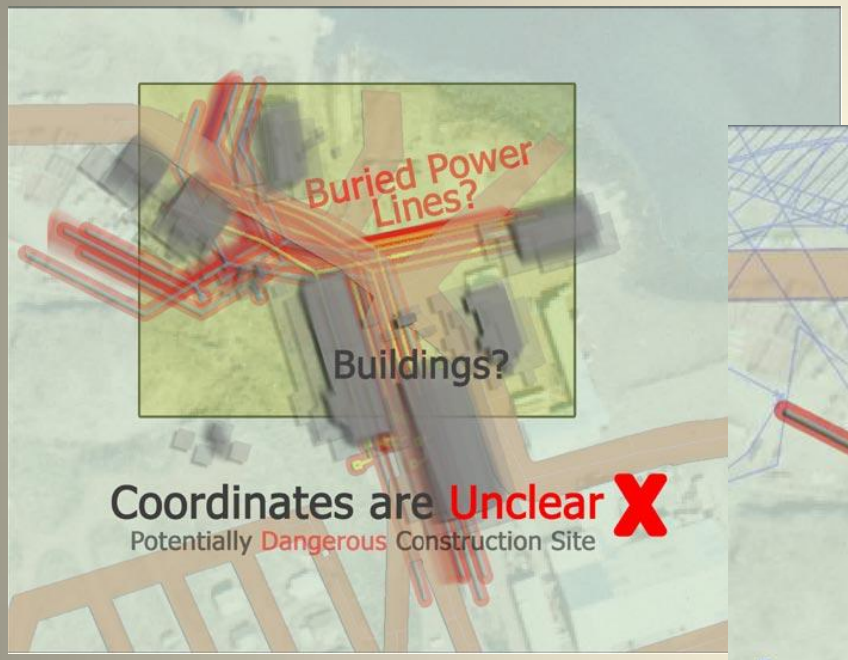
Warning: Most Handheld GPS units use World Geodetic System 1984 (WGS84)

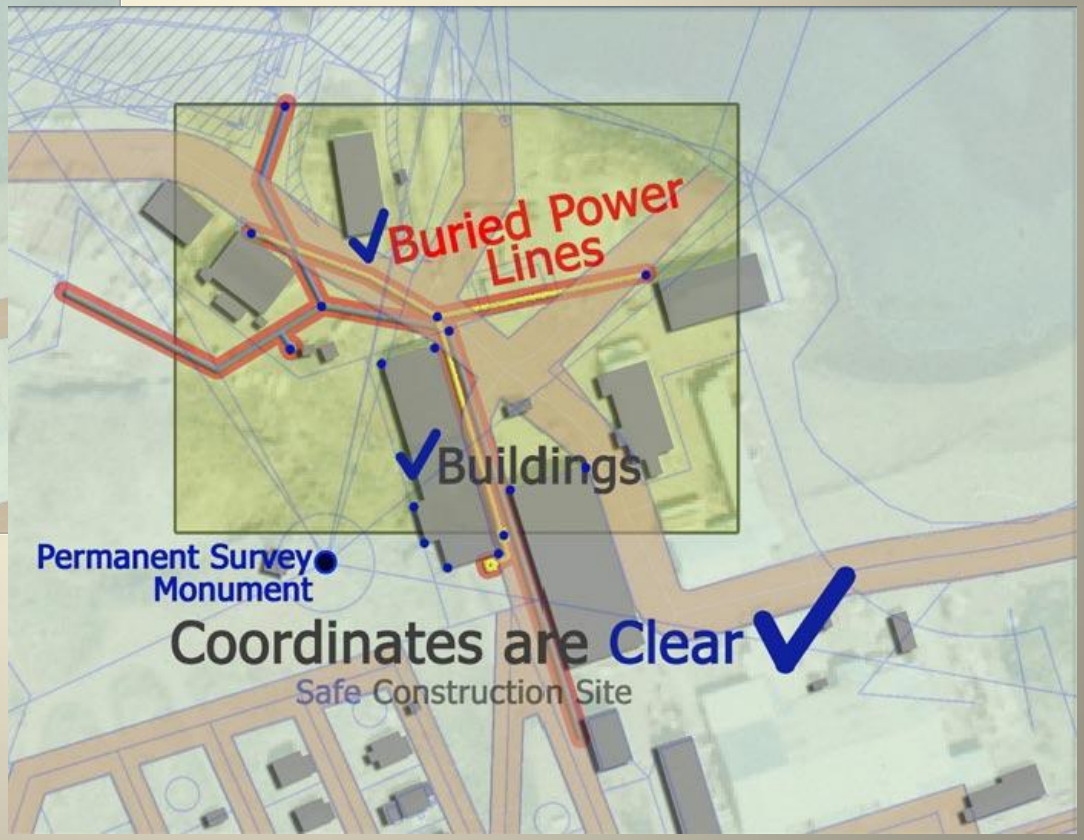
Coordinate Data

- Geodetic
  - Latitude Decimal Degrees
  - Longitude Decimal Degrees
  - Elevation (meters)

- Datum - NAD83, NAVD88, GEOID09

National Spatial Reference System (NSRS)





Attributes

- Utility Feature Type and Attribute

- ANSI SDSFIE (US COE, Vicksburg, MS)
  - INCITS 353-2006 – Schema Conventions
  - SDSFIE 3.0 – Updated names and definitions (2010)

Metadata

- FGDC-STD-001-1998 / MetroGIS
  - Spatial Accuracy Report
- Surveyor Info
- Quality Levels (CI/ASCE 38)
- Project Information

Unique Properties and Benefits

- Transfer cost for collecting this data to utilities
- Minimal additional effort; avoids double handling
- Tied to Earth Centered, Earth Fixed Datum (NSRS)
- Fully compatible with UDOT business practices
- Can be imported into MicroStation and other CADD/GIS systems
- Puts liability on PLS and PE
- Nation’s first digital data standards for utility submittals

What's Next

- Add to permit requirement format for utility as-builts
- Modify utility as-built requirements for project construction work to shift from a paper plan to digital data
- Qualifications for SUE providers requires upgrading
- Standards for SUE submittals requires upgrading
- Provide on-line venue for uploading and accessing data

Additional Steps

- Enterprise Level Web Application
- Implement Processes and Standards
- Begin Capture of Project Data (especially I-15 Core)
- Develop Analytical Tools
  - Utility quantity reports for PS&E
  - 3D Modeling Integration