



3D Utility Location Data Repository (R01A)

December 5, 2014



TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES



Agenda

- SHRP2 Overview
- Implementation Assistance Program
- Product description & assistance opportunities
- Schedule
- Questions



Source: Ian Abbott,
https://www.flickr.com/photos/ian_e_abbott/14037164038/

What is SHRP2?

(Second Strategic Highway Research Program)

Save lives. Save money. Save time.



- Products developed from objective, credible research
- Solutions that respond to transportation community challenges – safety, aging infrastructure, congestion
- Tested products, refined in the field



Focus Areas



Safety: fostering safer driving through analysis of driver, roadway and vehicle factors in crashes, near crashes, and ordinary driving



Renewal: rapid maintenance and repair of the deteriorating infrastructure using already-available resources, innovations and technologies



Capacity: planning and designing a highway system that offers minimum disruption and meets the environmental, and economic needs of the community



Reliability: reducing congestion and creating more predictable travel times through better operations

SHRP2 Implementation Assistance Program

- Designed to help State DOTs, MPOs, local agencies, and other interested organizations deploy SHRP2 solutions.

Proof of Concept Pilot	Lead Adopter Incentive	User Incentive
To evaluate product readiness.	To help offset costs associated with product implementation and risk mitigation.	To support implementation activities, such as conducting internal assessments, changing processes, and organizing peer exchanges.

- 24 SHRP2 products have been offered in Rounds 1– 4.

3D Utility Location Data Repository

3D data mapping enables easy identification, tracking, storage and retrieval of utility information.



Save Lives

Accurate underground utility location data helps prevent unsafe contact with utility facilities during construction operations.



Save Money

Efficient data storage and retrieval systems help design engineers access utility data so that they can consider designing projects around costly utility conflicts, as well as storing data so that it can be used again on future projects.



Save Time

Early and accurate utility mapping can minimize time delays associated with utility relocations during construction.

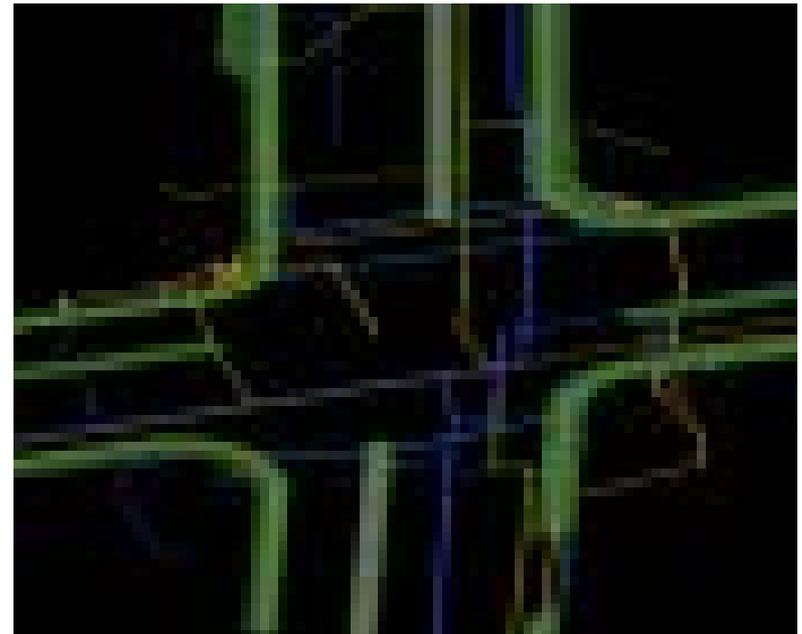
3D Utility Location Data Repository (R01A)

Challenge

- Having reliable and accurate data on the location and depth of utilities.
- Create a storage system from which to retrieve the data for efficient and cost-effective project delivery.
- Store utility data in a format that is accessible so it can be saved for future projects.

Solution

- SHRP2's 3D storage and retrieval data model.



Proof of Concept Pilots



Purpose:

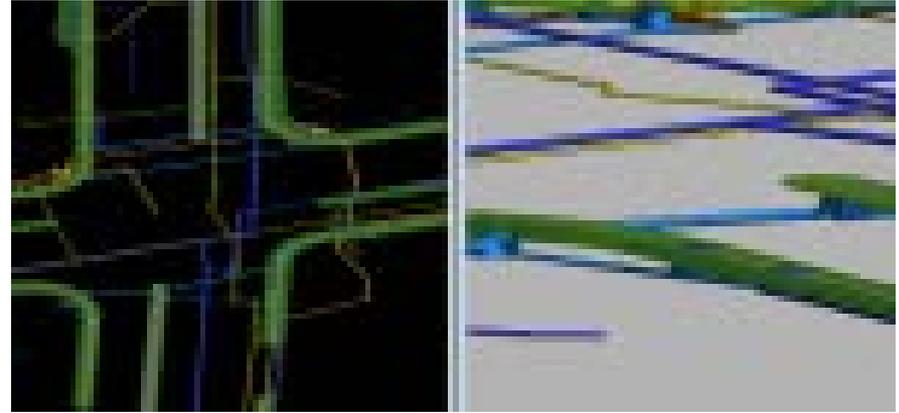
- To use 3D technology and integrate the collection, storage, retrieval and use of 3D utility data into an organization's business processes in order to avoid, minimize or mitigate utility conflicts.

Goals:

- Develop guidelines and specifications to integrate the product in existing utility/design business processes.
- Help refine the products and conduct peer exchanges.
- Coordinate with American Society of Civil Engineers' (ASCE) two committees working on utility standards that are currently in development.

Overview

- ASCE quality level designations
- Initial data loading of 3D repository
- 3D storage system architecture
- Gallows Road pilot example activities



ASCE 38-02 Quality Levels

- **Utility quality level A**

- Precise horizontal and vertical location of utilities obtained by the actual exposure or verification of previously exposed and surveyed utilities.
- Accuracy is typically set to 15-mm vertical and to applicable horizontal survey and mapping accuracy as defined or expected by the project owner.
- Data is sealed by a registered professional certifying compliance with appropriate survey standards and specifications.

- **Utility quality level B**

- Information obtained through the application of appropriate surface geophysical methods for horizontal position of subsurface utilities.
- Quality level B data should be reproducible by surface geophysics at any point of their depiction.

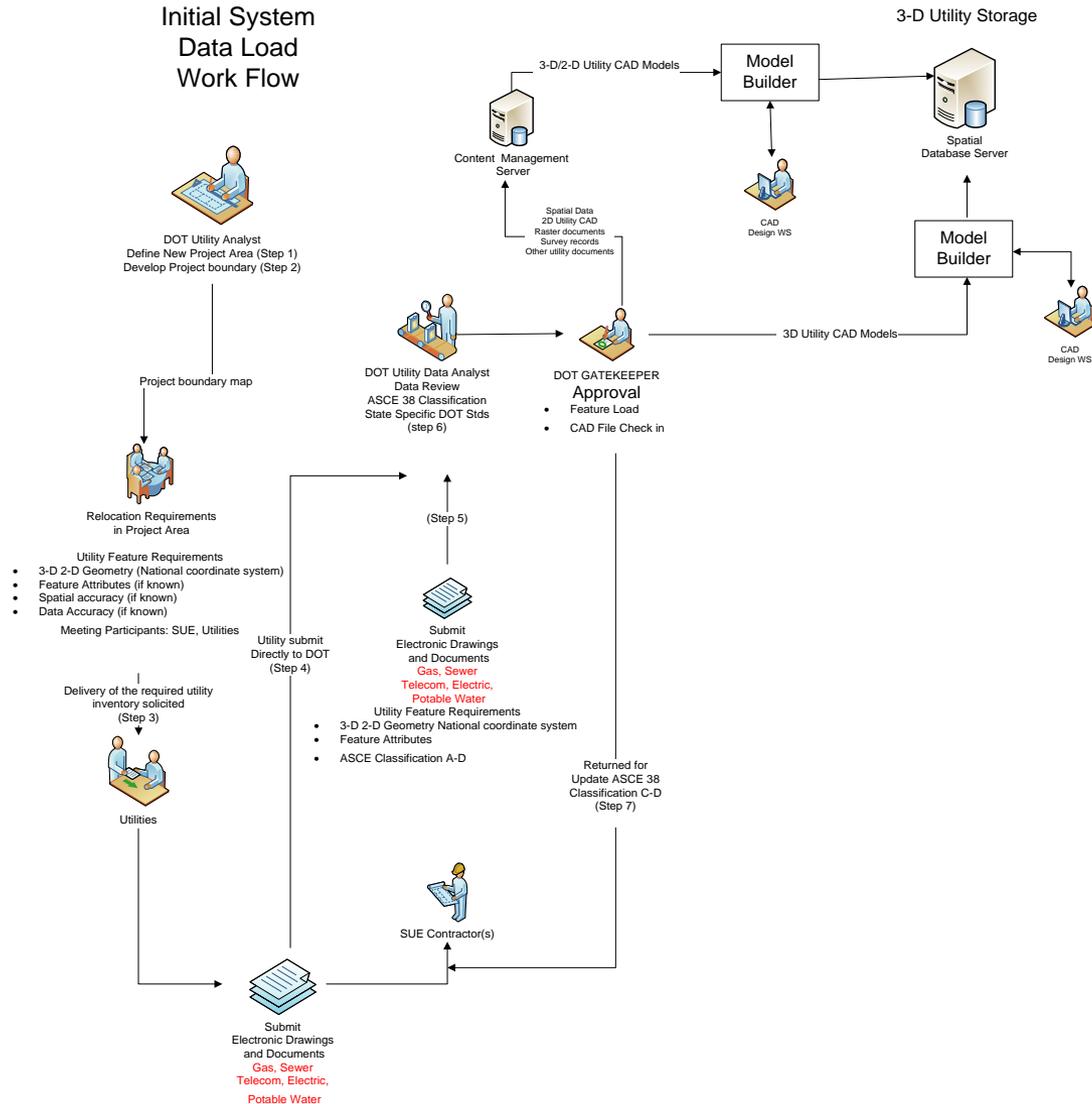
- **Utility quality level C**

- Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to quality level D information.

- **Utility quality level D**

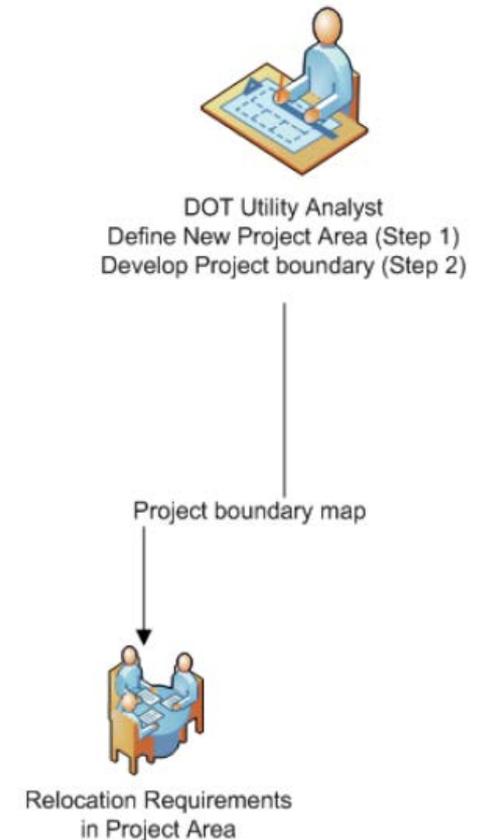
- Information derived from existing records or oral recollections.

Initial System Data Load



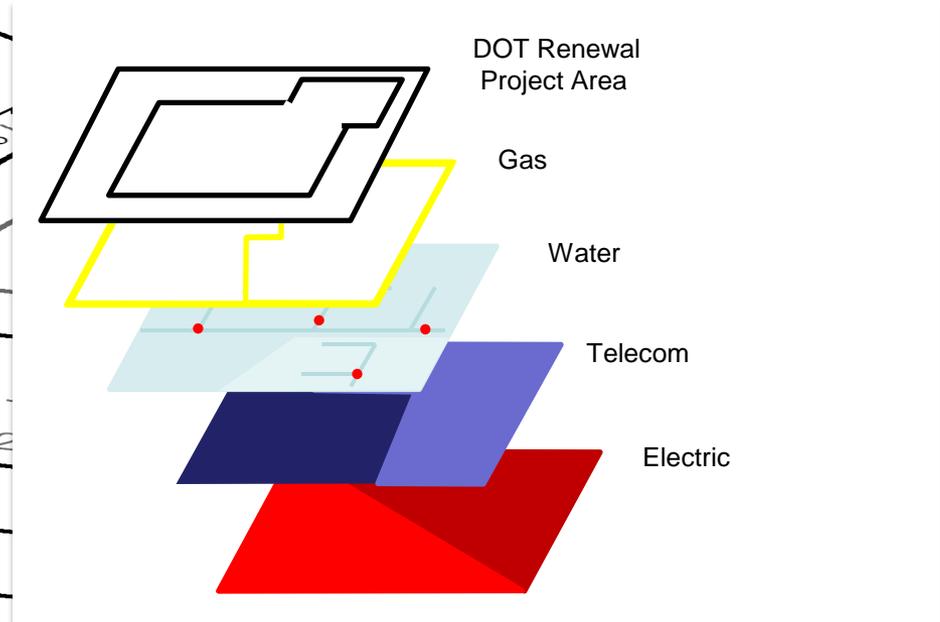
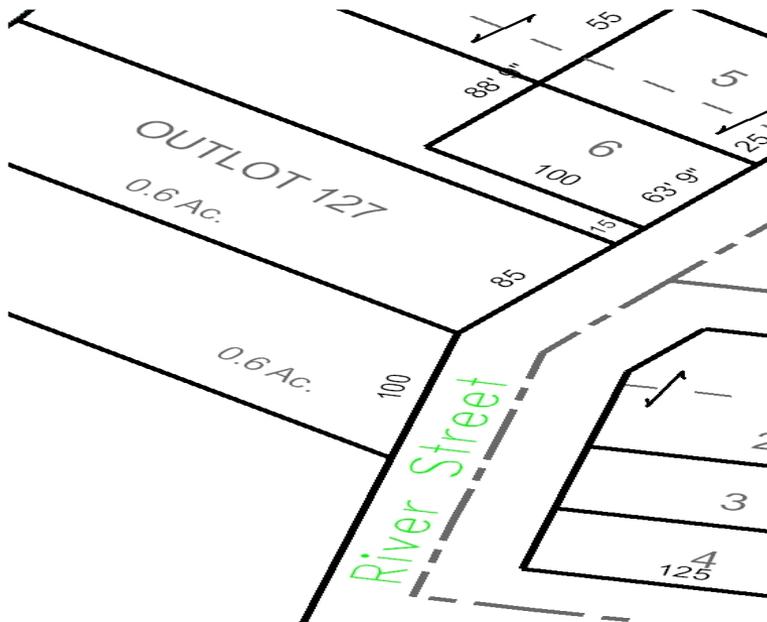
Define Project Boundaries

- Define overall limits of new DOT project from project description.
- Develop polygon boundary of project area.
- Develop right-of-way (ROW) definition required for project.
- Save all documents supporting ROW and Project boundary definitions to content manager.
- Post 2D polygon definitions of ROW and Project boundary to 3D utility storage system.



Planning Project Utility Submittals

1. Identify utility project participants from franchise boundaries and property records.
 - Public utility companies
 - Private (commercial and Industrial) utility operators
 - Permitting entities



Planning Project Utility Submittals

2. DOT meets with Subsurface Utility Engineering (SUE) contractors and utility representatives defining utility submittal requirements within the project boundaries:
 - Project coordinate system.
 - Utility feature definition (taken from 3D storage model).
 - ASCE 38 -02 feature quality level grading requirements.
 - Spatial accuracy project specific
 - Spatial precision project specific
 - Utility feature data requirements (mandatory field information).
 - Verify listing of known utility providers and permitting entities.
 - Discuss the presence of any unknown utilities and document on project polygon boundary.
 - Create utility inventory listing for project boundary and distribute to utility companies and SUE contractor (if used).



Utility Submittals

1. Utility documents (as-built CAD files, survey data, photos, GIS files...) from utilities, are submitted in parallel to SUE contractor and or DOT utility analyst.
2. All utility documents are reviewed by the DOT utility data analyst. Utility documents containing geo-spatial utility feature definition are graded to ASCE 38-02 quality levels (A B C & D) by either the DOT utility analyst or SUE contractor. DOT utility analyst stages all utility documents for gate keeper check-in to content manager.
3. Gate Keeper posts and releases all ASCE 38-02 quality level A B C & D utility features in content manager for incorporation into 3D utility model. All additional utility information is maintained in content manager under a project definition.
4. DOT designers open ASCE 38-02 utility features released by gate keeper with CAD tool(s), creates 3D utility features with model building process, posts 3D utility features to 3D storage system.

ASCE 38-02 quality level A, 3D features in storage system may be used for design.

ASCE 38-02 quality level B-D are posted for further utility feature refinement if needed for highway design.

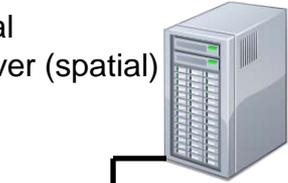
Utility features without ASCE 38-02 quality level remain in content manager.

System Architecture

Server Systems

3D Geo-Spatial Server

Oracle Spatial
MS SQL Server (spatial)
PostgreSQL
ArcServer ...
DBII
Informix



Vault AEC
ProjectWise
Meridian Enterprise
Adept

Content Server



- 3D Utility Features
- 2-D Planning Support Features
- 2D Site Support Features

Project Source Documents

- 3D CAD files
- 2D CAD files
- PDF files
- GIS Files
- Raster content
 - Documents
 - Drawings
 - Photos

Client Systems

Web
(Permitting Application)



CAD
Work
Station



Autodesk
Bentley Systems
Intergraph
etc.

3D Utility Data Repository



3D
Spatial Server

SDSFIE 3.0 *

**Base
Map**

3D Utility Features (public works)	Planning Support Features	Site Support Features
COMMUNICATIONNODE COMMUNICATIONSEGMENT CONFLICTNODE ELECONDUITBANKSEGMENT ELECTRICALNODE ELECTRICALSEGMENT GASNODE GASSEGMENT POLNODE POLSEGMENT THERMALNODE THERMALSEGMENT UTILITYFEATURE WASTEWATERNODE WASTEWATERSEGMENT WATERNODE WATERSEGMENT	CONSTRUCTIONLINE DOTPERMIT EXTERNALPROPERTYINTEREST GRID PROJECTREFERENCE SURVEYJOB SURVEYPOINT	BRIDGE BUILDING CONTROLMONUMENTPOINT ELEVATIONCONTOUR FENCE GUARDRAIL INSTALLATION LANDPARCEL PAVEMENTSECTION RAILTRACK RECREATIONAREA RECREATIONFEATURE RESTRICTEDAREA ROADPATH SIGN SITE STRUCTURE TOWER TRANSPORTATIONTUNNEL WALL WATERCOURSELINE WATERFEATURE

*Spatial Data Standards for Facilities, Infrastructure, and Environment DoD Std.

3D Utility Data Repository Detail

Field (Property)
LABEL
DESCRIPTION
COMMENTS
UTILITYOWNER
GASNETWORKTYPE
GASNODETYPE
QUALITYLEVEL (ASCE 38)
OPERATIONALSTATUS
INVESTIGATIONLEVEL
CONFLICTID
RESOLUTION
RESOLUTIONSTATUS
DATEINSTALLED
DATECHANGED
SOURCEFILE
SITEID

General Properties

Utility-specific Properties

Data Relationships, Quality, & Conflict Resolution Properties common to all features

Field (Property) [cont.]
OBJECTID
UTILITYNODETYPE
FITTINGTYPE
VOLUMETYPE
NODESHAPETYPE
LENGTH
WIDTH
HEIGHT
ELEVATION
ELEVATIONACCURACY
BOTTOMDIAMETER
TOPDIAMETER

Civil Design-specific Properties

Gallows Road Pilot Implementation Processes

- **Established:**
 - Site coordinate system.
 - Project area definition.
- **Loaded content manager.**
 - Gallows road as-built drawings (utilities).
 - Gallows road as-built drawings Site Support Features.
 - Gallows Road RFID marker maps (PDF).
 - Gallows road Base map features for reference.
 - Permits defining change.
 - Base map features for reference.
- **Classified utilities using ASCE 38.**
- **Demonstrated conversion and post of utility files to 3D utility storage system.**
- **Demonstrated design modification of 3D utility and post to 3D utility storage system.**
- **Demonstrated clash detection of 3D utility data extracted from 3D storage system and update of utility features to resolve space conflict.**
- **Demonstrated viewing of 3D utility data.**
 - 3D topology model (inside 3D utility storage system).
 - 3D CAD viewer.
 - Combination views of 2D and 3D data loaded in utility storage system.



Assistance Opportunities (R01A)

Round 5 - Jan 2015	Proof of Concept Pilot	Award Amount
3D Utility Location Data Repository (R01A)	Up to 5 awards	\$200,000-\$400,000, plus technical assistance

Who can apply: **State DOTs, MPOs, local agencies.**

Applicants should document a commitment to:

- Collect ASCE SUE quality level A.
- Use 3D utility data, in a 3D design platform on a suitable project(s).
- Store 3D utility data for future projects.

R01A Technical Assistance

Subject Matter Expert (SME) support for awardees:

- Help preparing guidelines and specifications.
- IT assistance, as needed.
- Status meeting facilitation, note taking, lessons learned/peer exchanges, meetings with ASCE committees, etc.

Application Tips

- ✓ Make your application clear and concise.
- ✓ Describe specifically what the funds will be spent on.
- ✓ Describe the outcomes and deliverables you expect to achieve.
- ✓ Expect to share the results of your product implementation.
- ✓ Submit your application by **February 13, 2015**.
- ✓ Review the 3D Location Data Repository Products prior to applying : <http://shrp2.transportation.org/pages/Renewal.aspx>

Related SHRP2 Utility Products

- R01A 3D Utility Location Data Repository**
- R01 Selection Assistant for Utility Locating Technologies (SAULT)**
- R01B Finding Underground Utilities with Technology**
- R01C Innovations in Location of Deep Utilities**
- R15B Identifying and Managing Utility Conflicts**



Round 5 Product Webinars

(all times are EST)

Renewal	Date	Time
3D Utility Location Data Repository (R01A)	Dec. 5	2 pm
Railroad-DOT Mitigation Strategies (R16)	Dec. 11	2 pm
Performance Specifications for Rapid Renewal (R07)	Dec. 12	11 am
Capacity	Date	Time
Planning Process Bundle (C02/C08/C09/C12/C15)	Dec. 11	11 am

Round 5

Application Period
Jan. 16 – Feb. 13

Recipients Announced
Late March

For More Information

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Save lives.
Save money.
Save time.

The second Strategic Highway Research Program (SHRP2) is at the forefront of transportation innovation—helping the Nation's transportation community improve safety, enhance productivity, boost efficiency, and increase reliability by introducing solutions that improve the country's highway network. [Read More](#)

What's New

New Brochure Highlights How States Will Use SHRP2 Safety Data in 11 Research Efforts

SHRP2 recently completed the largest study of in-vehicle driver behavior. The study collected trio and video data from more than 3,100 drivers over a 1- or 2-year period. A new brochure details how 10 State DOTs will use the newly available SHRP2 Naturalistic Driving Study and Roadway Information databases to pursue safety research across 11 topics.

[More of What's New](#)

Register Now for Implementation Assistance Webinars

Round 5 Implementation assistance opens January 16, 2015. [Register now](#) for upcoming informational Webinars to learn more.

www.fhwa.dot.gov/GoSHRP2

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