
esri

Esri International User Conference
San Diego, California

Technical Workshops | July 27, 2012

Using CAD Data in ArcGIS

Jeff Reinhart & Phil Sanchez

Agenda

- Overview of ArcGIS CAD Support
- Using CAD Datasets in ArcMap
- Loading CAD features into a Geodatabase
- Geoprocessing with CAD Data
- Exporting GIS features to CAD drawings
- Using GIS Data in CAD systems

CAD Drawings

- Geometry, text, and symbols comprise CAD entities/elements
- Organized into layers or levels
- Symbology represents information
- Can have data attached to entities

CAD in the Geospatial context

- CAD drawings are a large source of GIS data

- Surveying
- Cadastre
- Civil engineering
- Architecture
- Landscape Architecture
- Planning

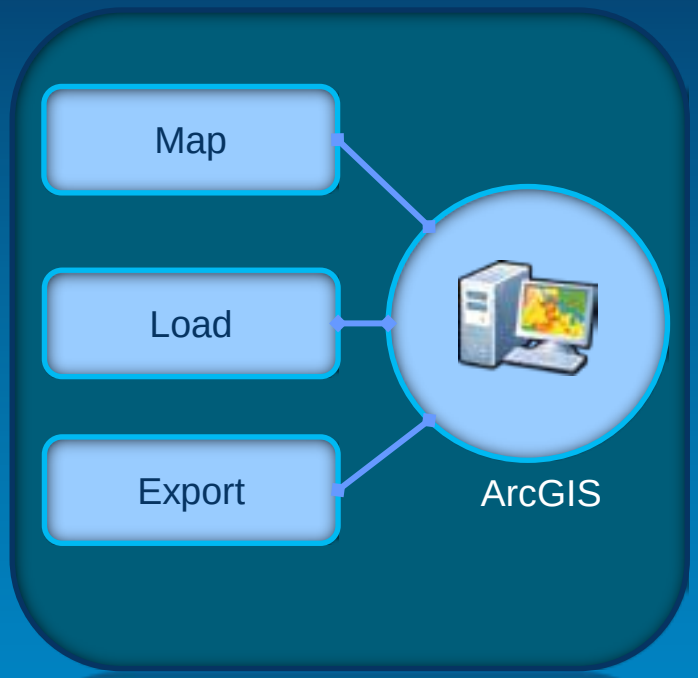
ArcGIS CAD Data Support

- ESRI has long provided CAD support and integration tools

- Out of the box
  - No extension required
- Direct read
  - Conversion not required
- Current version support:
  - AutoCAD DWG/DXF: Up to 2012
  - MicroStation DGN: Up to V8

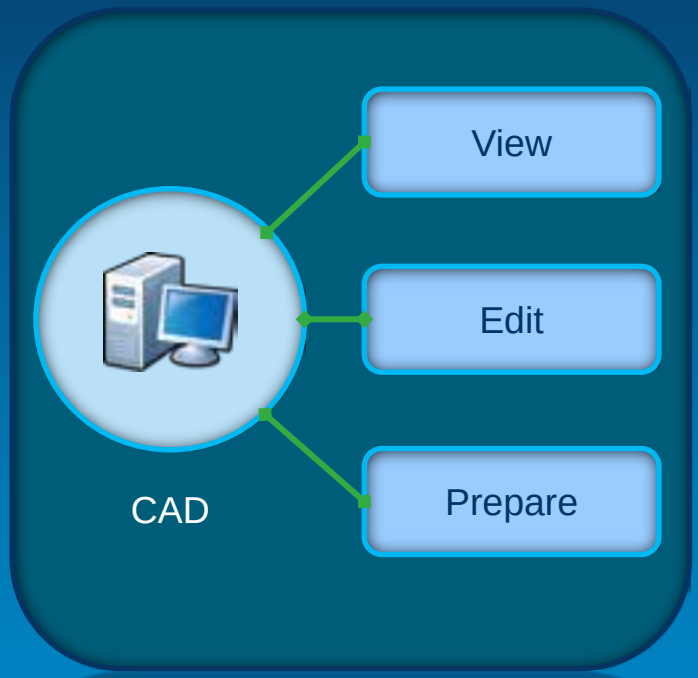
CAD/GIS Interoperability Scenarios

- **ArcGIS user who needs to…**
  - **Display CAD data in maps**
  - **Load CAD data into their Geodatabase**
  - **Deliver GIS data in a CAD format**



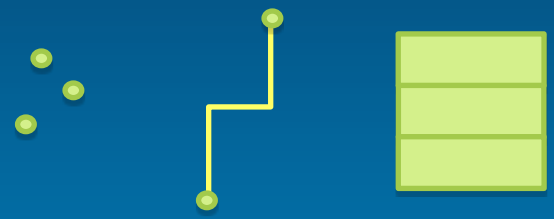
CAD/GIS Interoperability Scenarios

- **CAD user who needs to…**
  - **View GIS data in CAD**
  - **Edit GIS data in CAD**
  - **Provide drawings to GIS users**



CAD Datasets in ArcGIS

Geometry



CAD entity geometry organized into feature classes

Attributes

CAD properties, tags, and database links are stored in attribute tables

Coordinate System

CAD data can be reprojected to overlay with other GIS layers

World File

CAD drawings can be transformed from local coordinates to projected coordinates

Contents of a CAD Dataset

City.dwg

Annotation — Text, tags, and attribute definitions

Multipatch — Polygons and is useful for 3D representation

Point — Points, blocks, and cells

Polygon — Closed areas such as polygons, ellipses, and circles

Polyline — Lines, polylines, and arcs

City.prj — Projection files define a coordinate system for a CAD dataset. They are recommended but not required.

Demo: Using CAD Datasets in ArcMap

Add

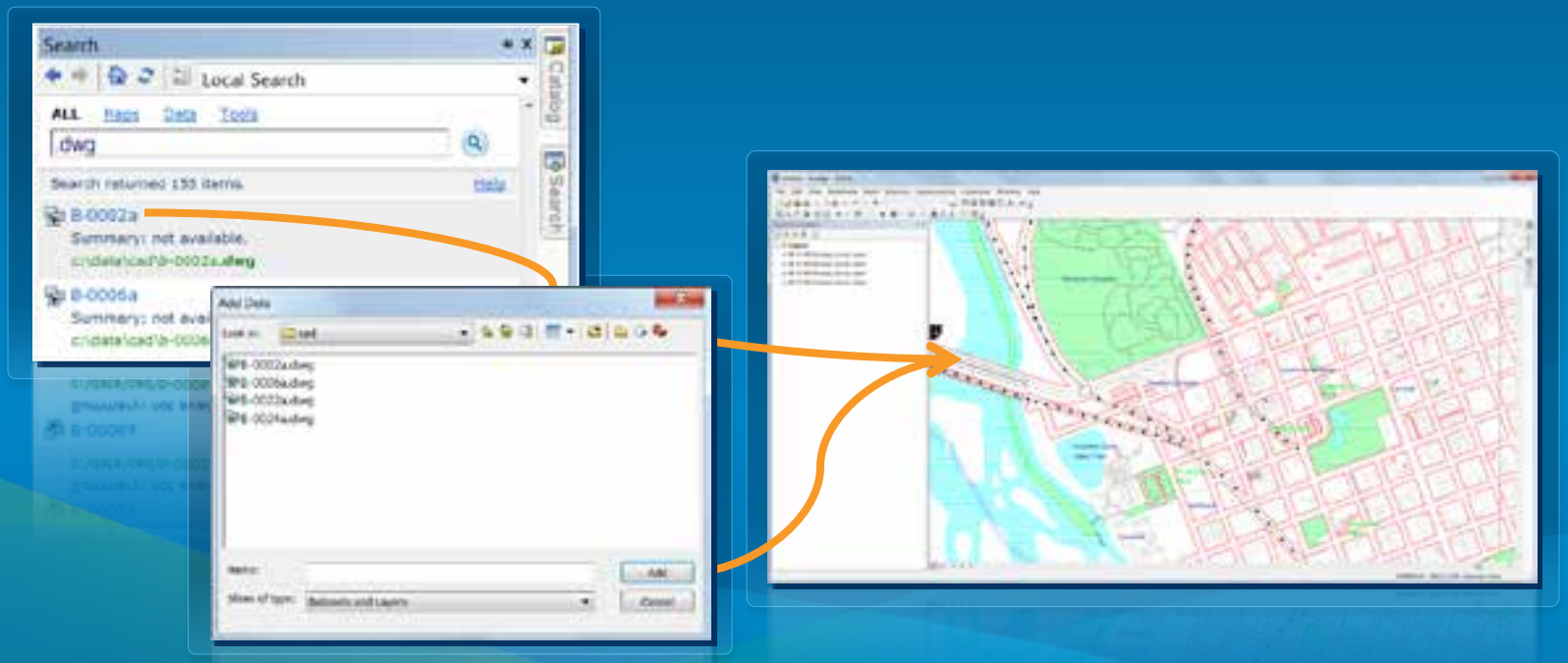
Georefence

Filter

Render

Search & Add

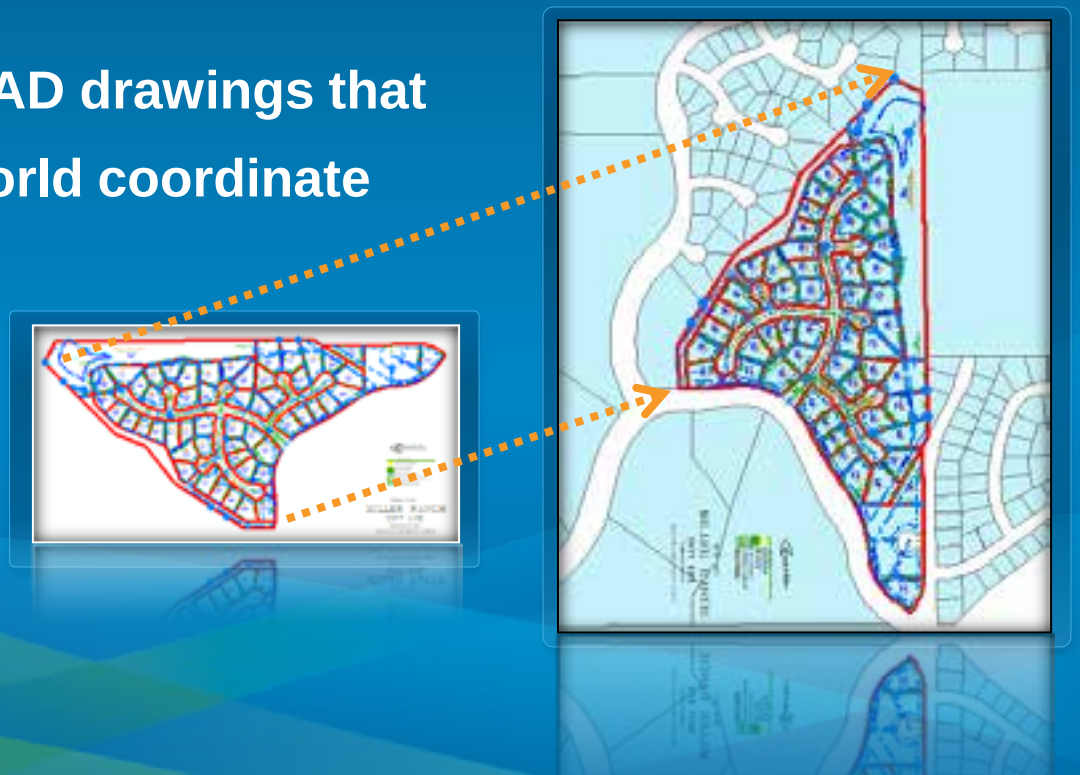
- CAD datasets can be found using the Search tool
- CAD datasets can be added directly to ArcMap
  - No conversion required



Georeferencing

- Reposition CAD datasets to align with GIS layers
  - Move, Rotate, & Scale
- Assign coordinate system for map reprojection

- NOT required for CAD drawings that are drawn in real-world coordinate location

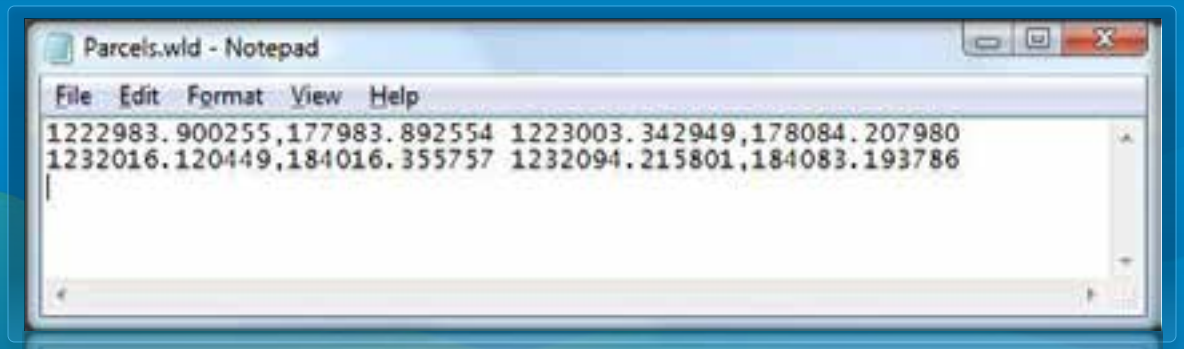


Georeferencing Toolbar

- **Georeferencing toolbar – use mouse pointer to move layer and create control points in map**
  - **Rotate, Scale, and Shift tools**

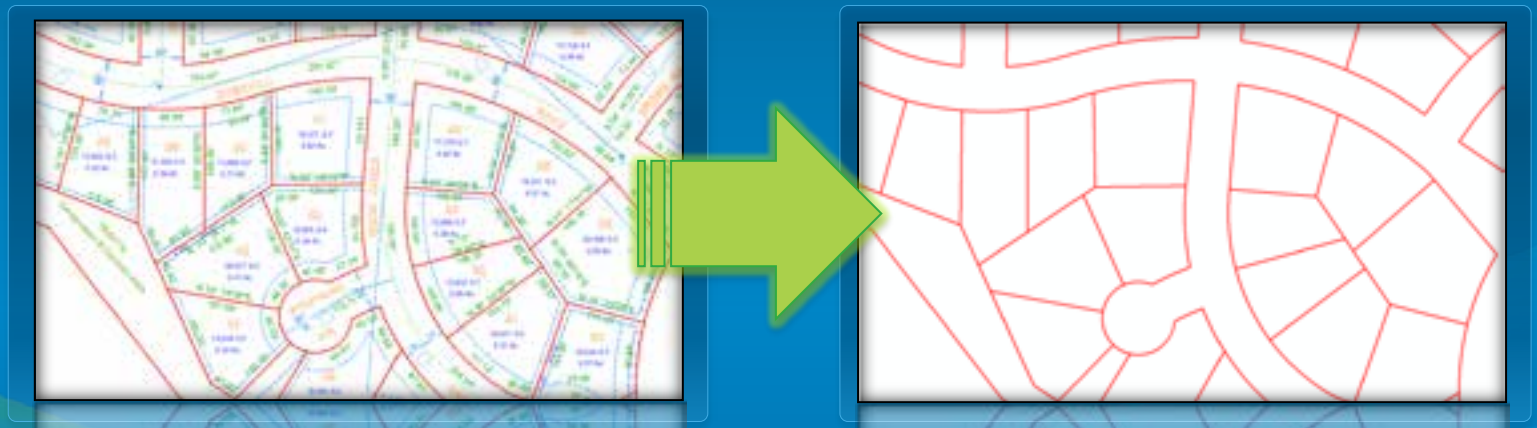
Georeferencing Method

- Two-point Similarity transformation method
  - Aspect ratio always maintained
  - Cannot skew or ‘rubber sheet’ CAD drawing
- Transformation managed by World Files
  - World file must use CAD file name prefix, reside in same folder as CAD drawing
  - Simple text file containing coordinates



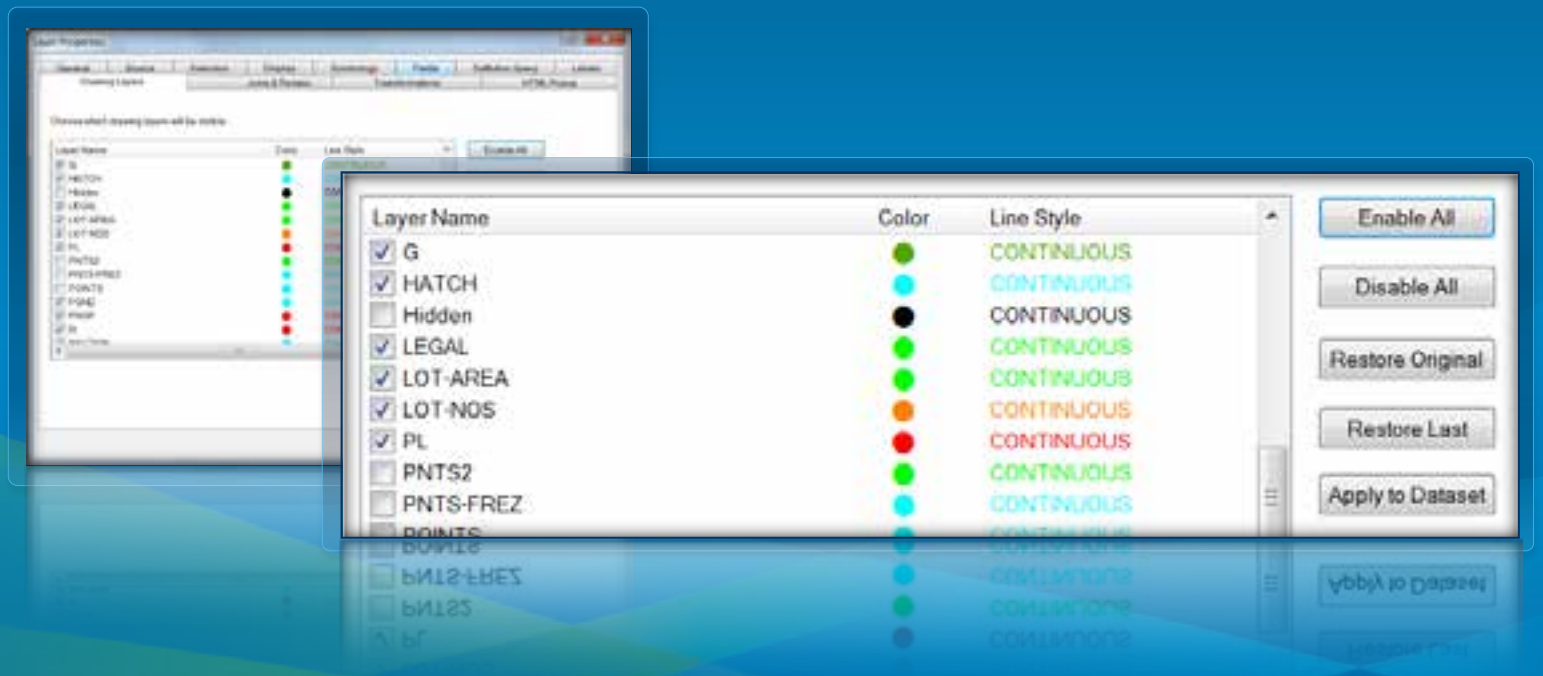
Filter CAD Features

- Isolate the CAD data you need to work with using…
  - Specific CAD Feature Classes
  - Drawing layer visibility
  - Definition Query



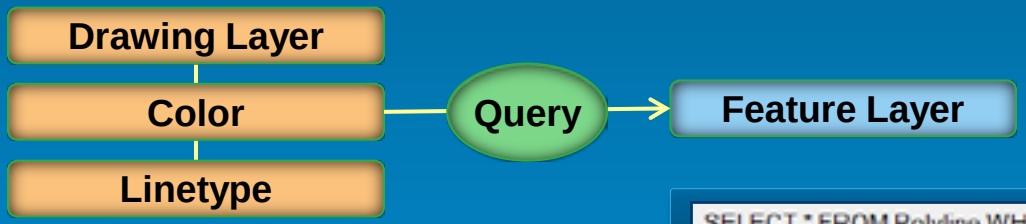
Display Control

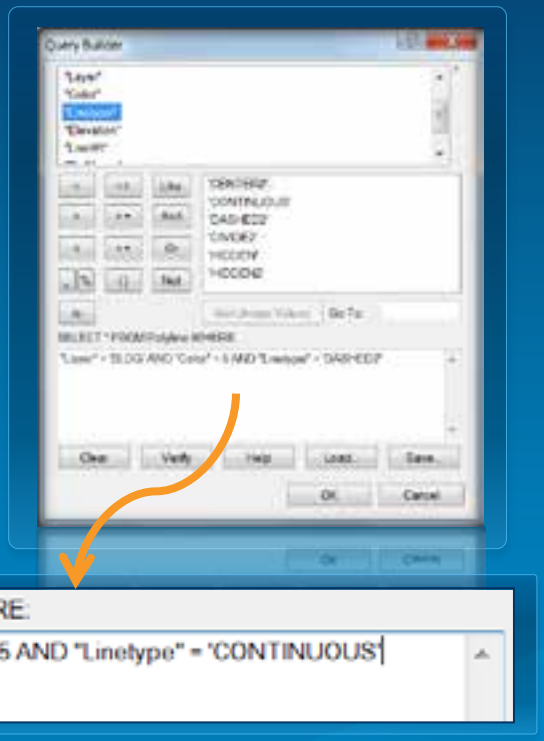
- Turn layers off and on to control feature display
  - Saved in the .MXD or .LYR
  - Apply to the entire dataset
  - Restore back to original rendering



Filter CAD Features

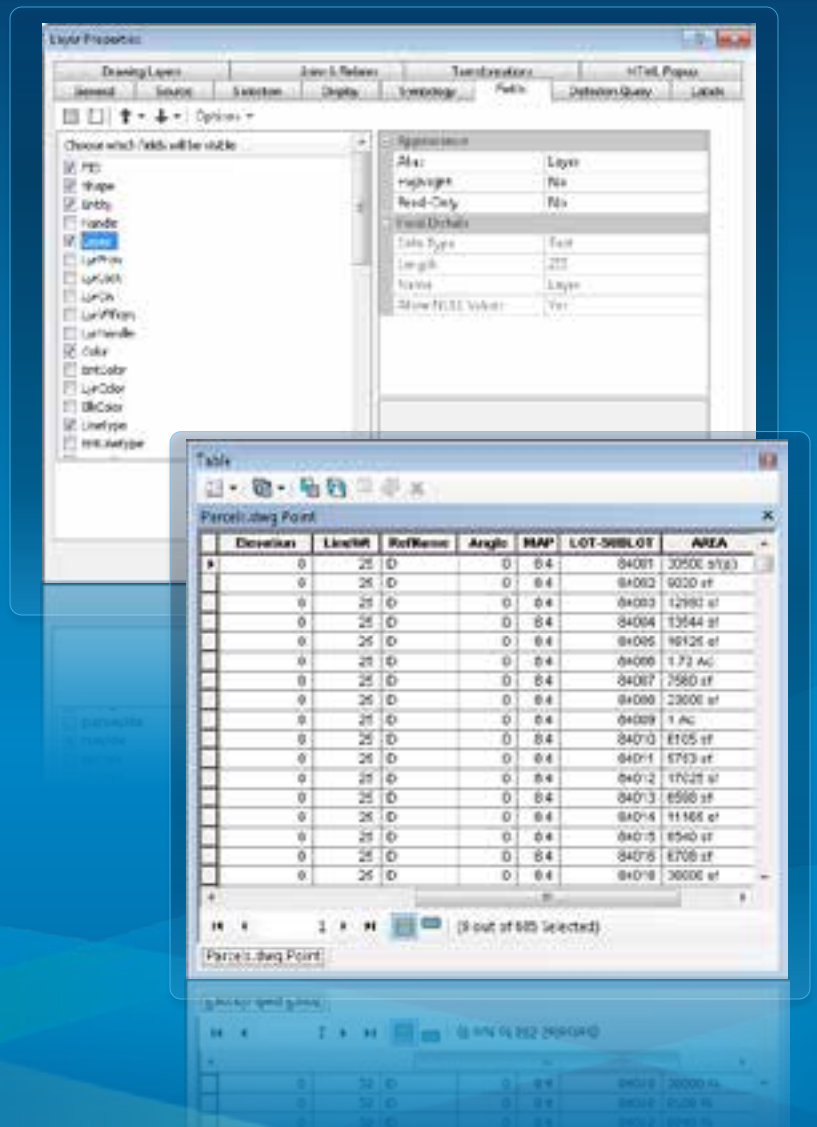
- Use Definition Queries to create subsets
  - Saved in the .MXD or .LYR
  - Expressions can be saved to .EXP files for reuse





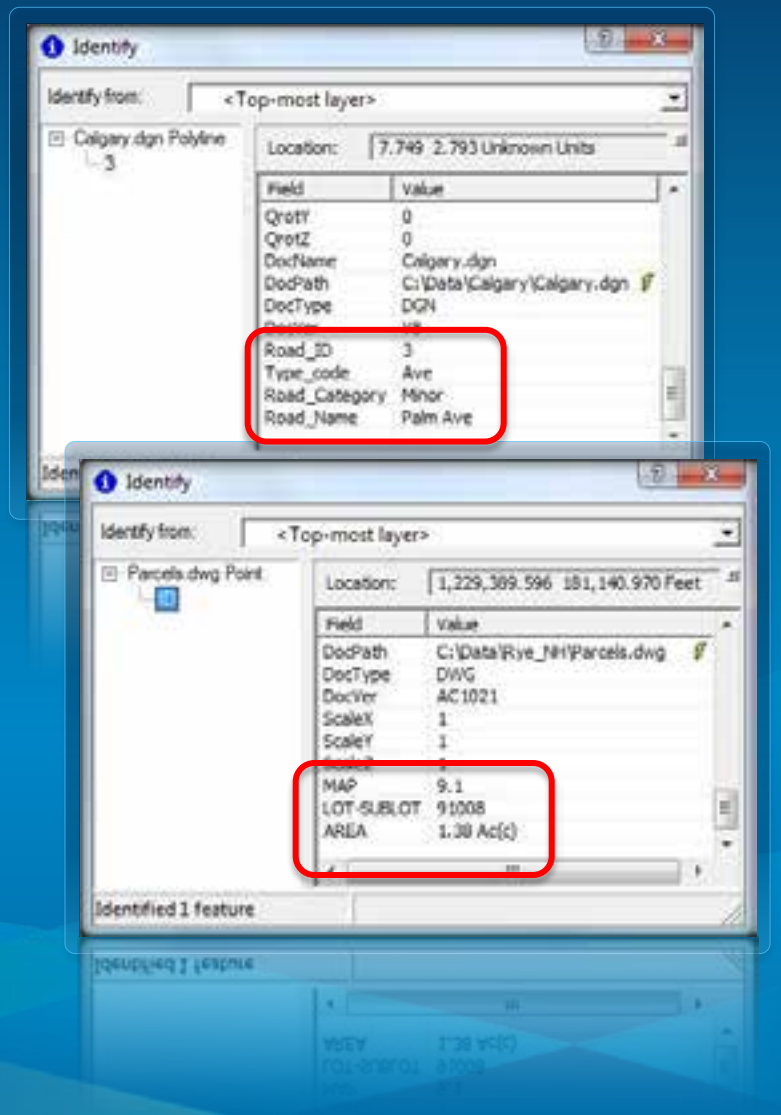
CAD Properties as Feature Attributes

- Common CAD properties
  - Color, level, linetype, handle, line weight, etc…
- User defined data
  - Tags and Attributes
- CAD attributes support queries
  - Display
  - Geoprocessing input
  - Conversion



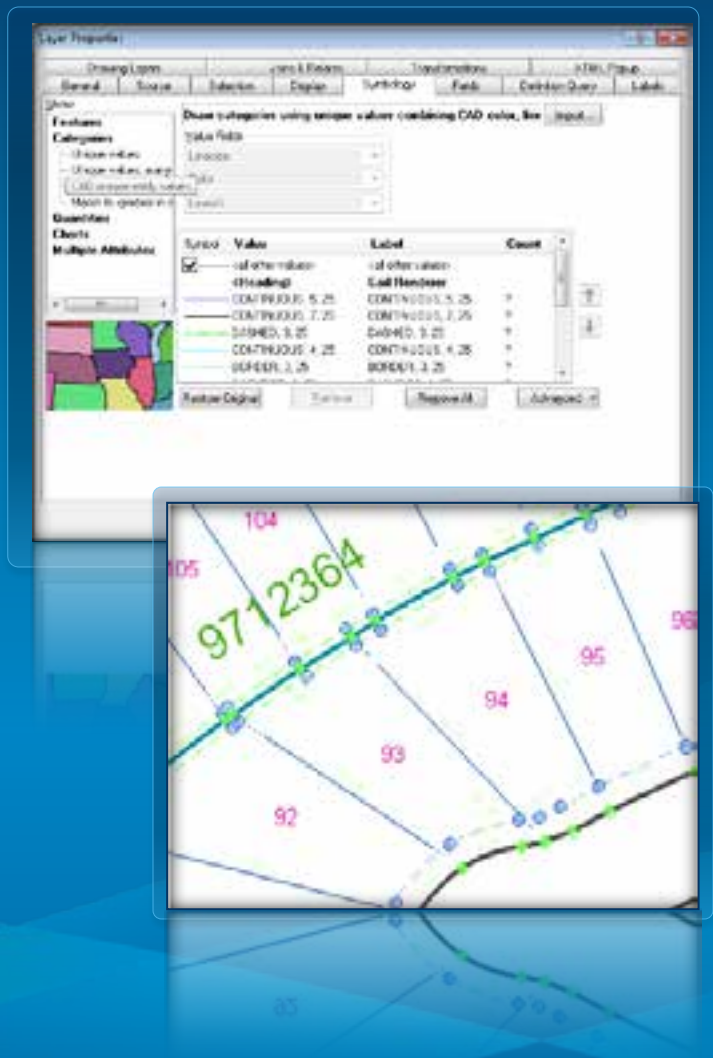
DGN Tags and DWG Block Attributes

- **Effective way for attaching information to elements and entities**
- **Tags and Block Attributes are represented as Fields**
- **Tag Values = Attribute Values**

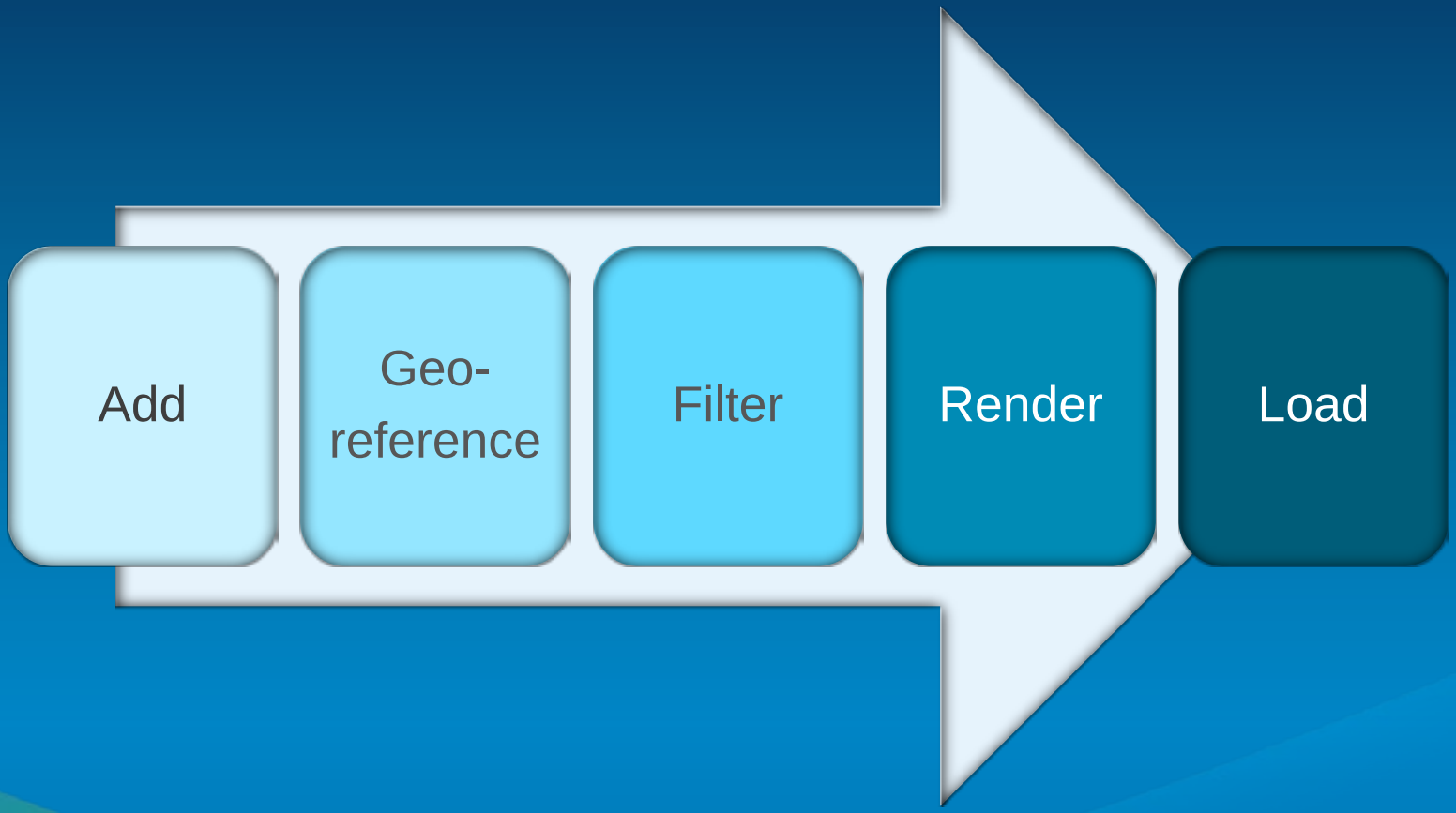


CAD Feature Rendering

- CAD map style in Categories
- Color, Linetype, and Lineweight properties mapped to ArcMap symbols
- Text styles mapped to True Type fonts
- Supports common AutoCAD and MicroStation line types



CAD Data Integration Stages



Loading CAD Data to a Geodatabase

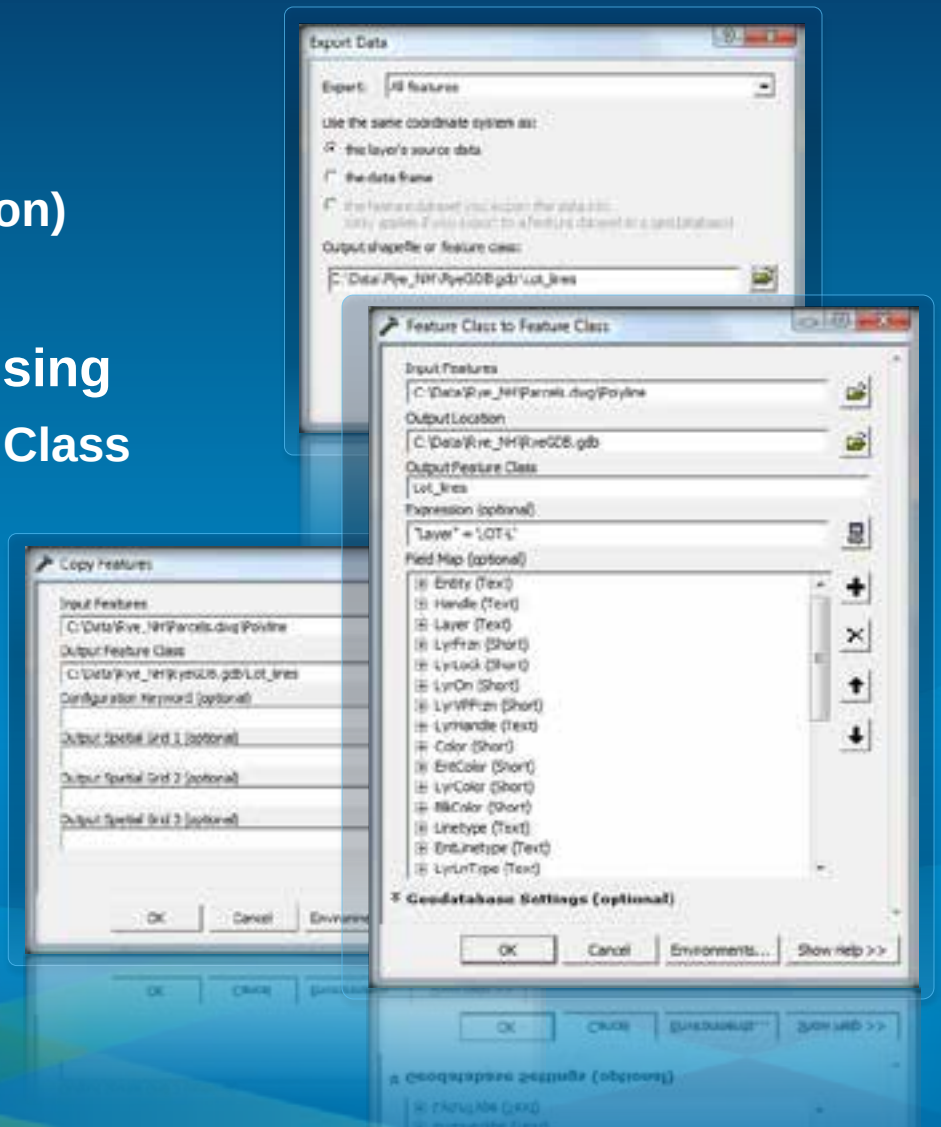
Demo: Loading CAD data to the Geodatabase

Why load CAD Data to the Geodatabase?

- Add to Geodatabase feature classes or create new Geodatabase from CAD
  - As-built updates
  - Editing requirements
  - Advanced Geodatabase tasks (i.e., Geometric Networks, Topology, etc.)
- Conversion supported by the Geoprocessing framework and ArcMap tools
- Can be combined with other Geoprocessing functions
  - Spatial Joins
  - Geometry manipulation

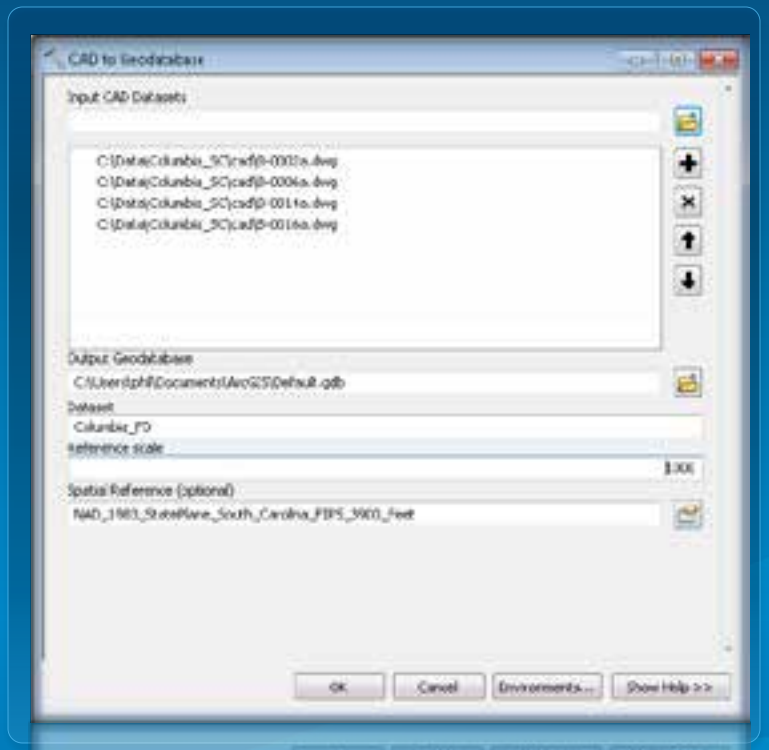
CAD Conversion Tools

- ArcMap
  - Export Data
  - Copy & Paste (Edit session)
- ArcToolbox – Geoprocessing
  - Feature Class to Feature Class
  - Copy Features
  - Import CAD Annotation



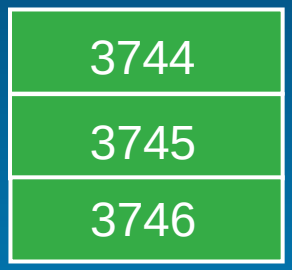
CAD to Geodatabase

- Designed for bulk loading CAD datasets into a Geodatabase
- Works at the dataset level
- Combines Copy Features, Merge and Import CAD Annotation into single tool

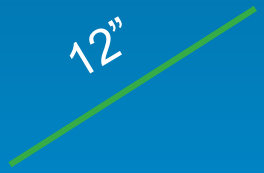


Geoprocessing Scenarios

- CAD text inside polygons



- CAD text near lines



- Line segments to polygons

- CAD to Geodatabase

- Append to existing Geodatbase

- Merge with other layers

Exporting Geodatabase features to CAD Drawings

Demo: Exporting Geodatabase features to CAD drawings

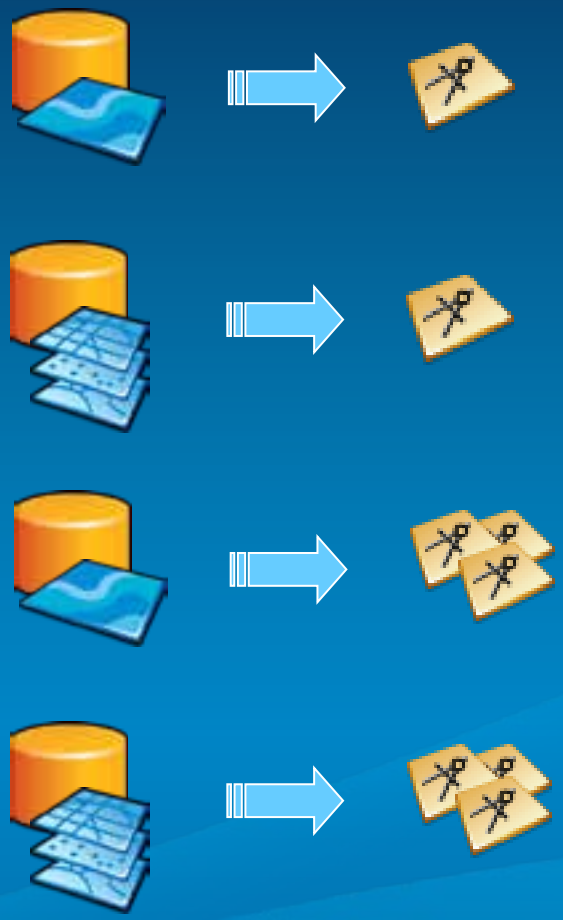
Export to CAD Tool

Exporting Geodatabase Features to CAD

- Allows GIS users to share Geodatabase content with CAD users
  - Project collaboration
  - Contractual obligations
- Supported by Geoprocessing's Export to CAD tool
  - Simply drag and drop layers into tool and export
  - Leverage Geodatabase information to control export
- Use Export to CAD to adhere to CAD standards using…
  - Fields and attributes
  - Seed/template files

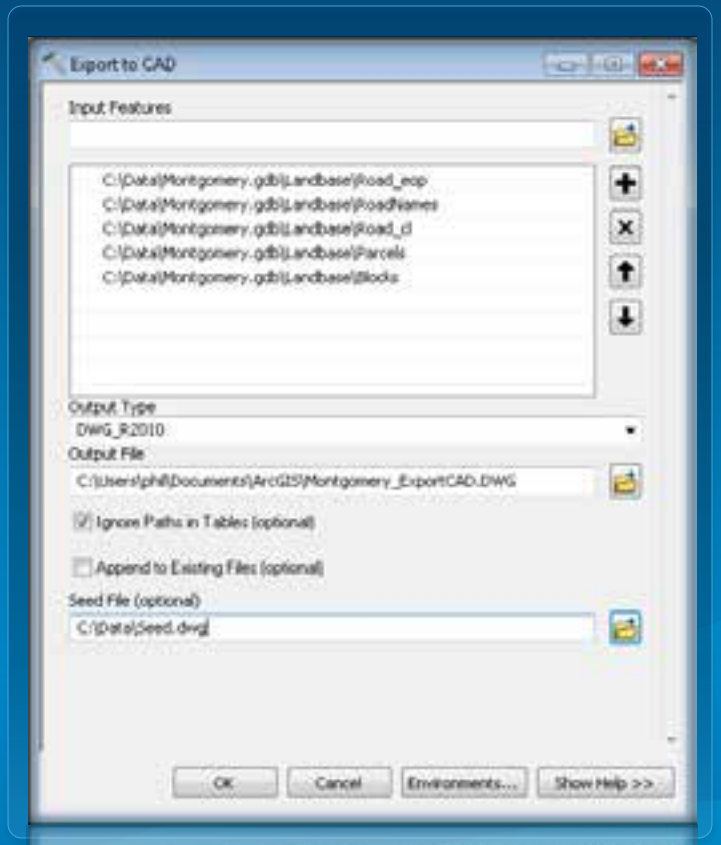
Exporting Scenarios

- Single feature class to a single CAD drawing
- Multiple feature classes to a single CAD drawing
- Single feature class to multiple CAD drawings
- Multiple feature classes to multiple CAD drawings



Export to CAD

- Output features to native CAD format
  - DGN V8
  - DWG/DXF Release 14 to 2012
- Supports appending to existing CAD drawings
- Available at all license levels



Attribute Driven Export

- **Use Fields and their attributes to control how elements and entities are generated**

- **Key areas:**
  - **Entity types, geometry**
  - **Elevation**
  - **Blocks and attributes**
  - **Text styles and position**
  - **Document names and paths**

Seed & Template Files

- Blank template used to define a new file
- Seed file allows the default symbology of the seed drawing will be used
- Used to control Blocks definitions utilized by Export to CAD

- Microstation requires a seed file for design file creation
- Microstation seed file topics for Export to CAD
  - Design plane, appropriate dimensions, units and origin

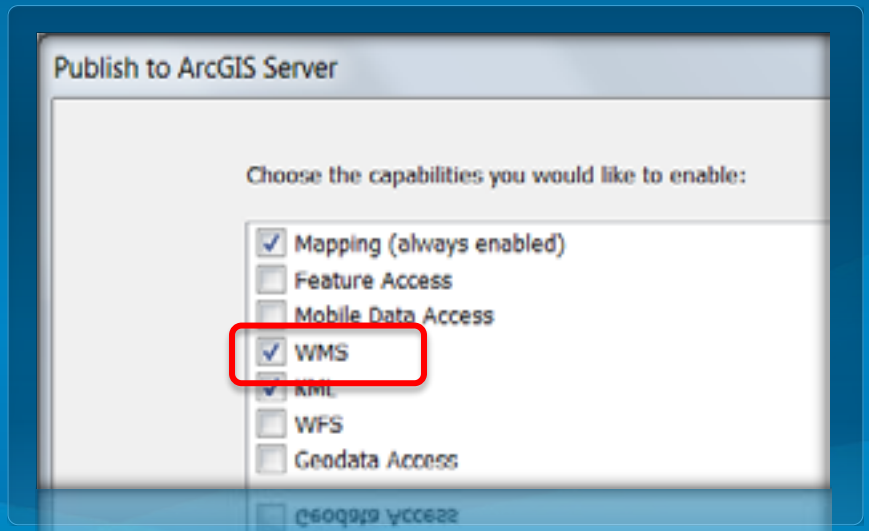
Using Map Services in CAD

ArcGIS Server & Map Services

- Share your GIS resources across an enterprise and across the Web
- A map service is the way that you publish maps to the Web using ArcGIS
- Makes maps, features, and attribute data available inside many types of client applications
  - AutoCAD through ArcGIS for AutoCAD
  - MicroStation through WMS

Accessing WMS in MicroStation

- MicroStation V8i has built-in WMS capabilities
- V8i uses Raster Manager for connection
- Enables MicroStation users to access map services for context



ArcGIS for AutoCAD

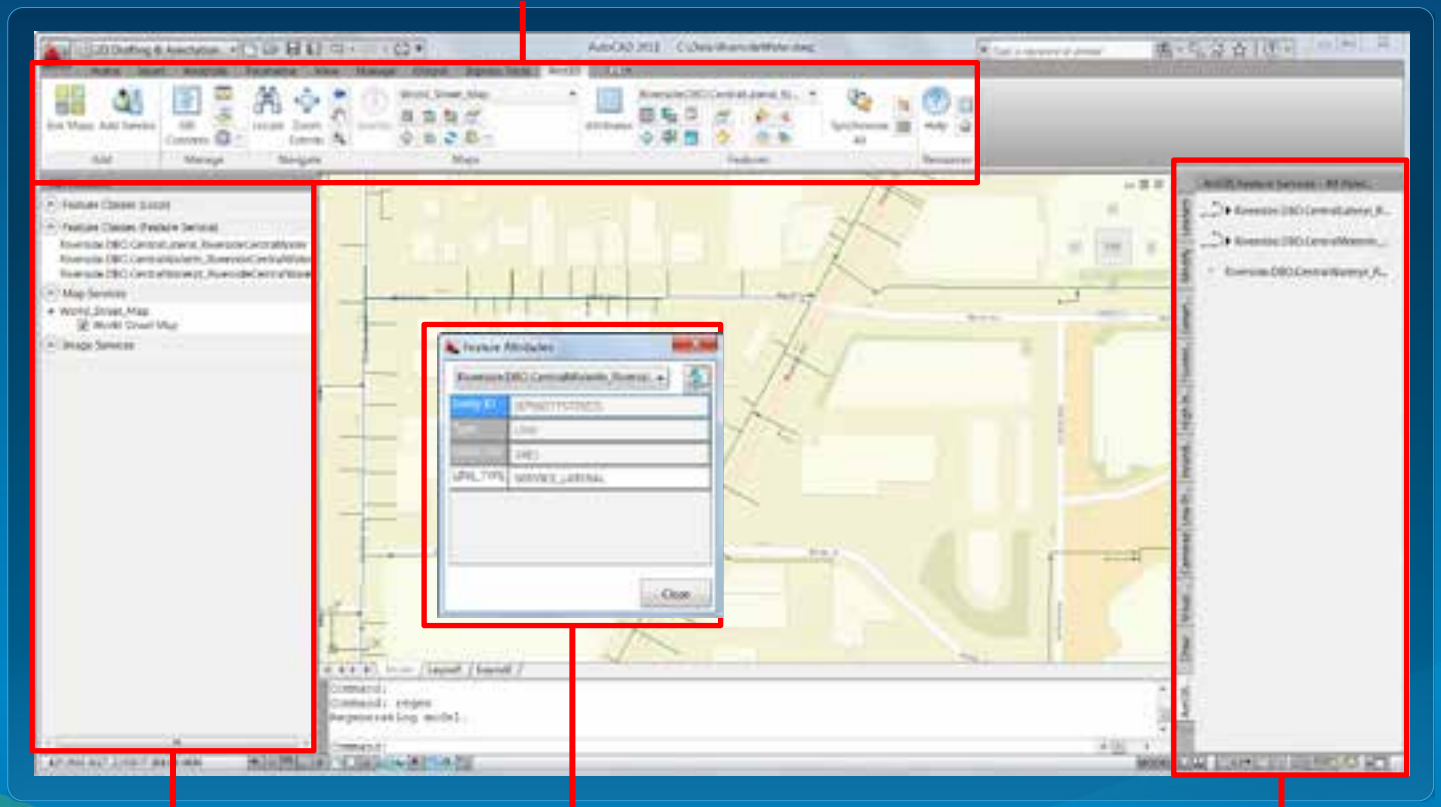
- **Free Plug-in application for AutoCAD (2010/2011/2012)**
  - **Download available at esri.com**
- **ArcGIS for AutoCAD users can access…**
  - **ArcGIS Online Basemaps**
  - **ArcGIS Server Map Services**
  - **ArcGIS Server Feature Services**
  - **ArcGIS Server Image Services**
- **New ArcGIS for AutoCAD 300 supports ArcGIS 10.1**

Demo: Using Map Services in AutoCAD

ArcGIS for AutoCAD 300

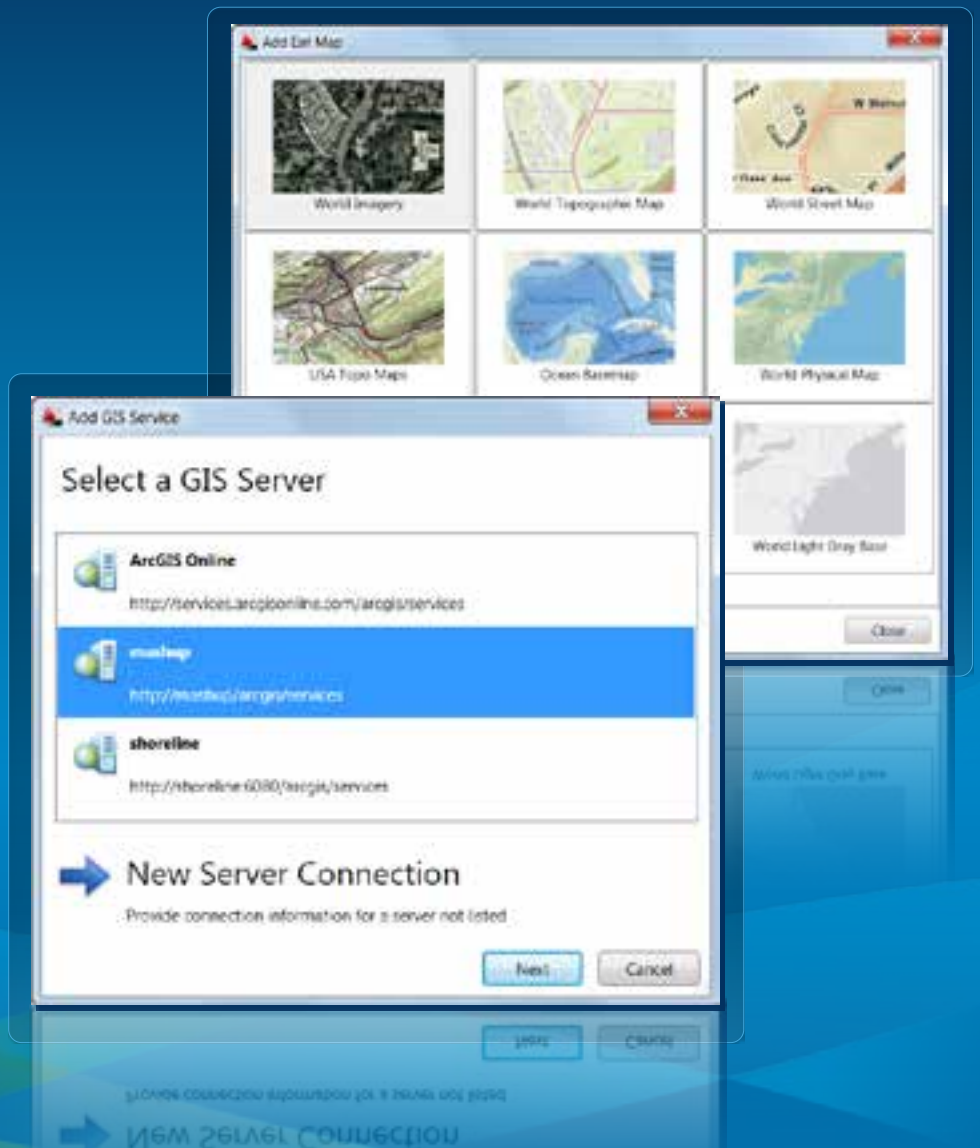
Add Maps, Features, & Imagery to AutoCAD drawings

ArcGIS for AutoCAD 300 User Interface



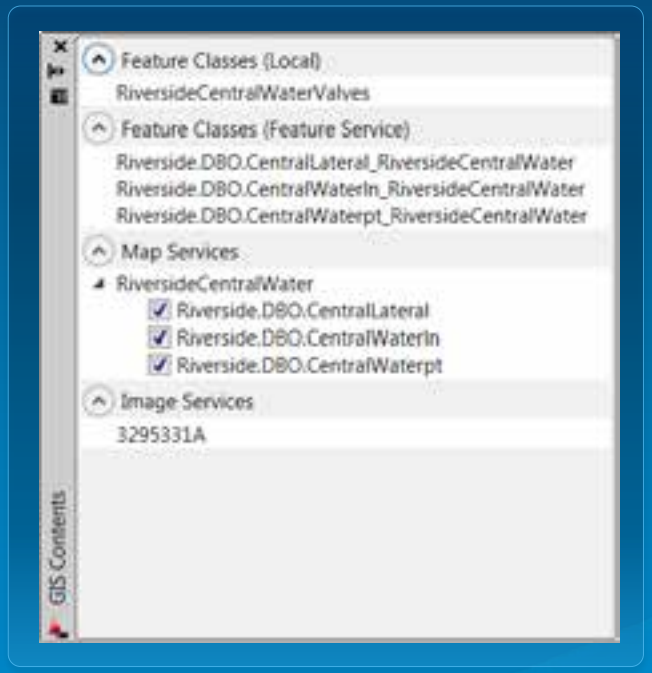
Adding Services

- Add map, feature, and image services from…
  - ArcGIS Online
  - ArcGIS for Server
- Maps and imagery are projected to coordinate system defined in drawing



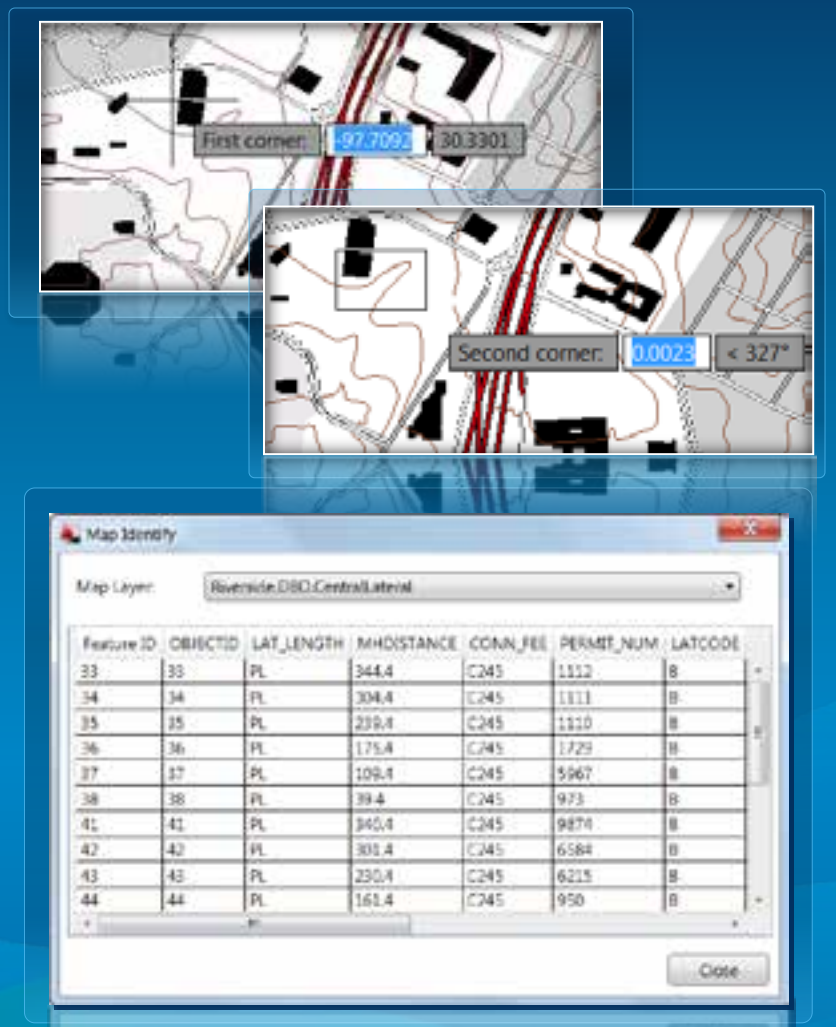
GIS Contents window

- Manage ArcGIS services display behavior
- Access commands from context menus for each item
- Open from GIS Contents button on ribbon



Identify Map Features

- Map service must support query
- Reports map service feature attributes in dialog
- Drag rectangle around features

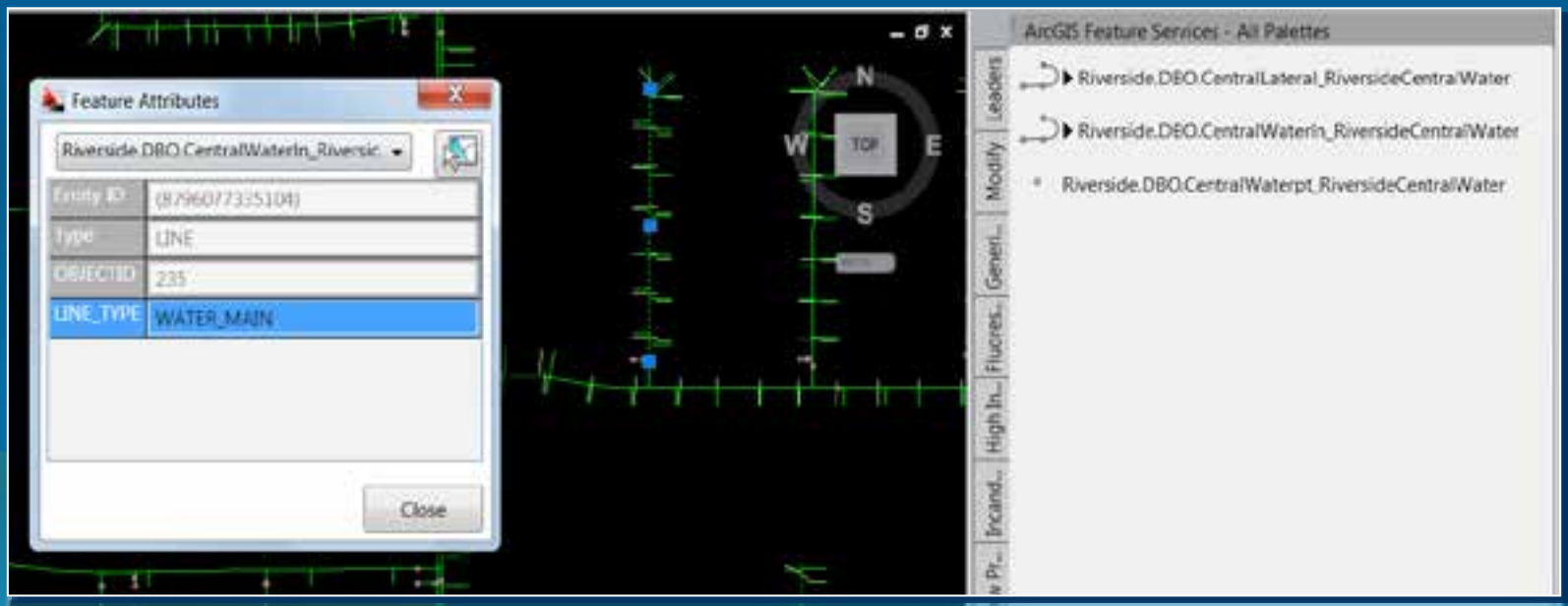


Feature Service Editing

- Edit Enterprise Geodatabases that are published in map services with feature access
- Requires editing permissions (Create, Update, Delete)
- Features are represented by:
  - CAD objects
  - On distinct AutoCAD drawing layers
  - Organized into ArcGIS for AutoCAD Feature Classes
- Can be added for query-only for snapping

Editing Feature Service layers

- **Add, modify, delete Geodatabase feature geometry and attributes**
- **Synchronize on demand to commit edits**



Demo: Using Map Services in MicroStation

WMS in MicroStation

Summary

CAD Standards for GIS

- Adopt National CAD Standards
  - Logical layer and level organization
  - Improves filtering and conversion workflows
- Create CAD objects in real-world coordinates
  - Eliminates georeferencing tasks in GIS
- Geometry connectivity
  - Closed line segments to define polygons
- Model Space versus Paper Space (AutoCAD)
  - ArcGIS only recognizes entities in model space, not paper space
  - Paper Space is graphics (e.g. title blocks, legends, notes, etc)

Resources

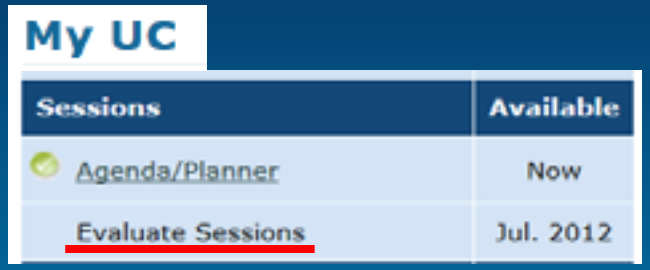
- CAD Integration Resource Center & Help System
  - http://resources.arcgis.com/en/communities/cad-integration/
  - Help, Videos, Samples, Downloads, Blogs
- Working with CAD Data - Instructor Led Course
  - http://training.esri.com/gateway/index.cfm?fa=catalog.coursedetail&courseid=50120390_10.x
- ArcGIS for AutoCAD – Live Training Seminar (Upcoming – August 2, 2012)
  - http://training.esri.com/Gateway/index.cfm?fa=seminars.viewDetails&course_id=182

Summary & Road Ahead

- Various ways to work with CAD data in ArcGIS
  - Direct read layers in ArcMap
  - Load into a Geodatabase
  - Export Geodatabases to drawings
- ArcGIS for AutoCAD 300 for AutoCAD 2013 coming soon
  - Additional language versions also coming soon
- AutoCAD DWG 2013 format support coming at ArcGIS 10.1 Service Pack 2

Steps to evaluate UC sessions

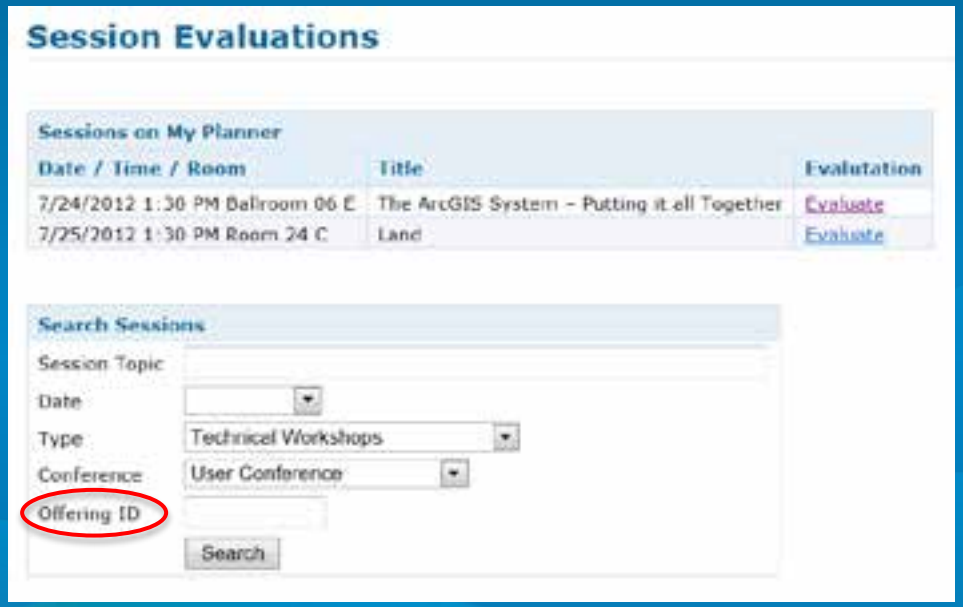
- **My UC Homepage > "Evaluate Sessions"**



- **Choose session from planner**

OR

- **Search for session**



www.esri.com/ucsessionsurveys

- Thank you for attending
- Have fun at UC2012
- Open for Questions

- Please fill out the evaluation:

www.esri.com/ucsessionsurveys

First Offering ID: 857

Second Offering ID: 1940


esri