CAD: Introduction to using CAD Data in ArcGIS

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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 2014 (read only)
  - 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
Georeference
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
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

```
SELECT * FROM Polylne WHERE:
"Layer" = 'BLDG' AND "Color" = 5 AND "Linetype" = 'CONTINUOUS'
```
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
CAD Data Integration Stages

Add Geo-reference Filter Render Load
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
  - 3744
  - 3745
  - 3746

- CAD text near lines

- Line segments to polygons

- CAD to Geodatabase
  - Append to existing Geodatabase

- 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 access

- ArcGIS for AutoCAD users can access…
  - ArcGIS Online Basemaps
  - ArcGIS Server Map Services
  - ArcGIS Server Feature Services
  - ArcGIS Server Image Services

- ArcGIS for AutoCAD 300 SP1 supports ArcGIS 10.0, 10.1, 10.2
ArcGIS for AutoCAD

- Free Plug-in application for AutoCAD (2010/2011/2012 x86, x64)
- (2013/2014/ x86, x64)

- Download available at esri.com
ArcGIS for AutoCAD 300 SP1
Demo: Using Map Services in AutoCAD
ArcGIS for AutoCAD 300
Add Maps, Features, & Imagery to AutoCAD drawings

- Basemaps, Image services
- Map Services, Feature Services
- CAD Drawings

GIS content in AutoCAD
ArcGIS for AutoCAD 300 User Interface

- ArcGIS Ribbon Tab
- GIS Contents window
- Feature Attributes window
- Editing Tool Palette
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
Editing Feature Service layers

- Add, modify, delete Geodatabase feature geometry and attributes
- Synchronize on demand to commit edits
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
  - Help, Videos, Samples, Downloads, Blogs

• Working with CAD Data - Instructor Led Course

• ArcGIS for AutoCAD – Live Training Seminar
  http://training.esri.com/Gateway/index.cfm?fa=seminars.viewDetails&course_id=182
Steps to evaluate UC sessions

• My UC Homepage > “Evaluate Sessions”

• Choose session from planner

OR

• Search for session

www.esri.com/ucsessionssurveys
CAD session at User Conference

- Exhibit Hall – Geodatabase Management Island

- **TUESDAY**
  - 01:30 AM - Introduction to using CAD Data in ArcGIS (Room 04)
  - 03:15 PM - The ArcGIS for AutoCAD CAD Plug-In (Room 32 A)

- **WEDNESDAY**
  - 09:00 AM – Lining Up CAD Data in ArcGIS (Hall F, Room 1)
  - 01:30 PM - The ArcGIS for AutoCAD CAD Plug-In (Room 32 A) (2nd offering)
  - 03:15 PM – Geoprocessing Tools & Techniques for CAD (Room 05A)
  - 04:00 PM - Georeferencing CAD datasets (Hall F, Room 1)

- **THURSDAY**
  - 08:30 AM – Introduction to using CAD Data in ArcGIS (Room 04) (2nd offering)
  - 10:30 AM – Lining Up CAD Data in ArcGIS (Hall F, Room 1) (2nd offering)
  - 11:00 AM - Using ArcGIS for AutoCAD Plug-In (Demo Theater– Geodatabase Management)
• Thank you for attending
• Have fun at UC2013
• Open for Questions

• Please fill out the evaluation:

  Paper in room

  or

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  First Offering ID: 1186
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