CAD: Introduction to using CAD Data in ArcGIS

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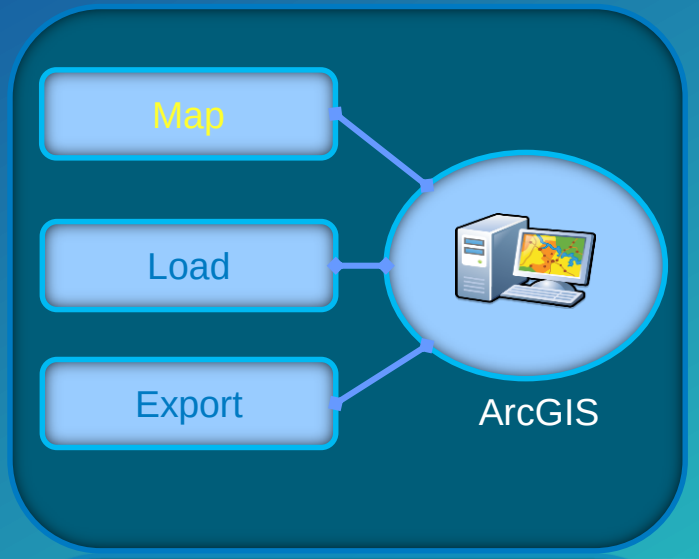
What we will accomplish today

- Overview of CAD Support in ArcGIS Desktop (ArcMap and Pro)
- Georeferencing CAD data for ArcGIS
- How Mapping Specification for CAD can help
- Loading CAD features into a Geodatabase
- Creating CAD Data (Export to CAD)
- Using ArcGIS for AutoCAD

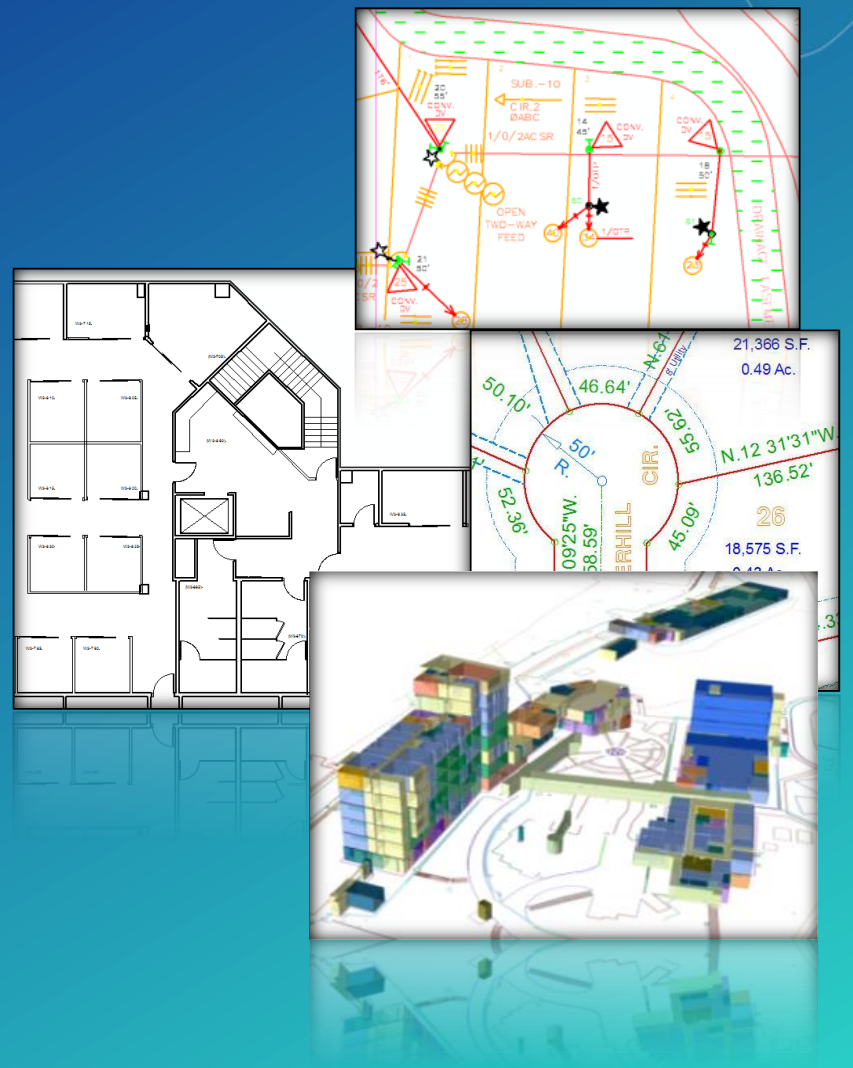
CAD/GIS Interoperability Patterns

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



CAD in the Geospatial context

- CAD drawings are a large source of GIS data
  - Surveying
  - Cadastre
  - Civil engineering
  - Architecture
  - Landscape Architecture
  - Planning
  - Geodesign



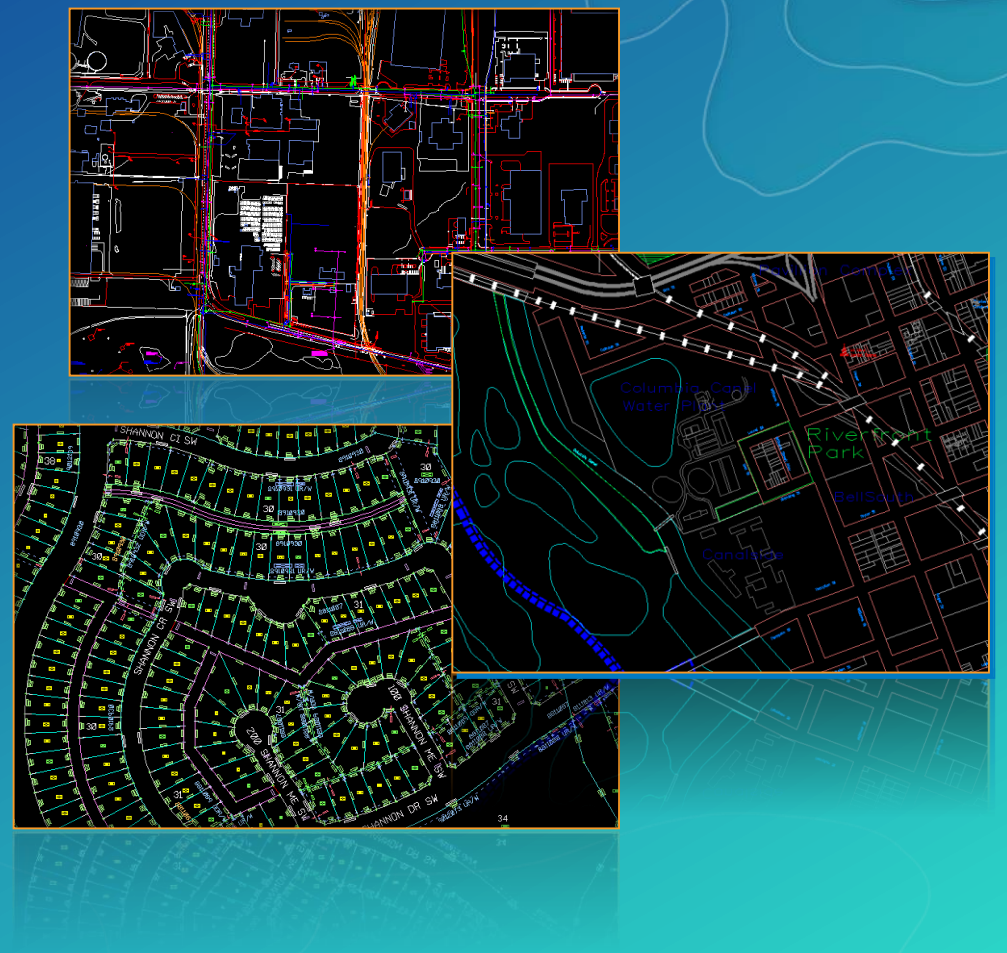
CAD Data Support in ArcGIS 10.6 and Pro 2.0

- 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 2017 (read/write)
  - MicroStation DGN: Up to V7 (read) & V8 (read/write)

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 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

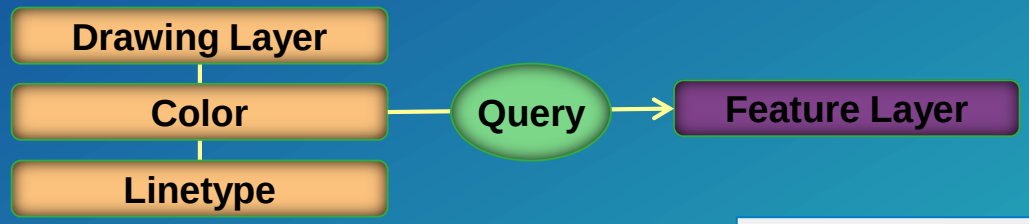
Contents of a CAD Dataset

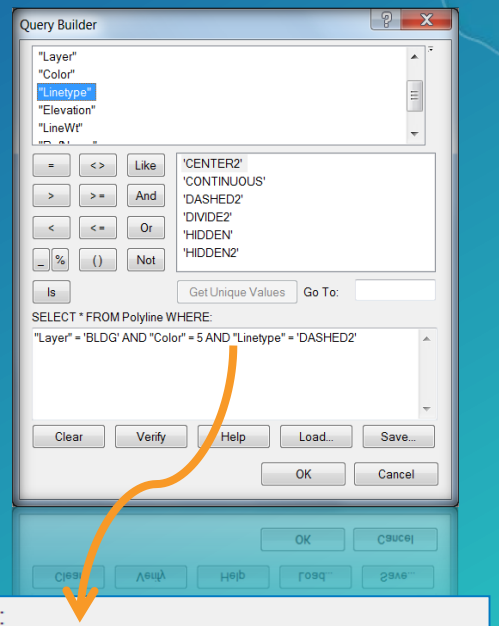
Annotation	Text, tags, and attribute definitions
Multipatch	Polygons and is useful for 3D representation
Point	Points, blocks, and cells
Polygon	Closed areas such as polygons, ellipses, and circles
Polyline	Lines, polylines, and arcs

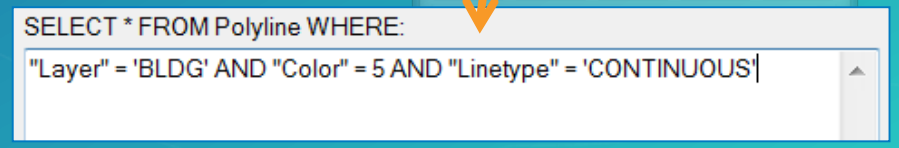
City.prj	Projection files define a coordinate system for a CAD dataset. They are recommended but not required.

Filter CAD Features in ArcMap

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







CAD data in Pro

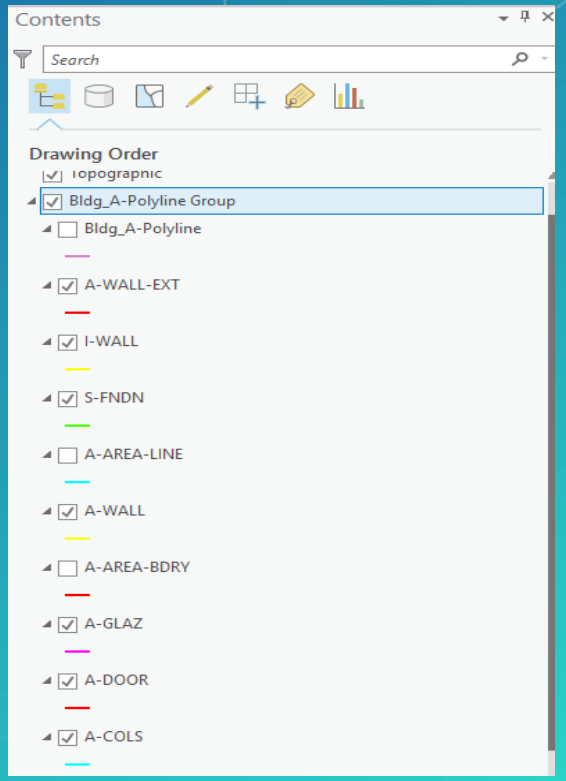
Feature Layers organized by Level/layer

- **Group layer created with the feature class name and a suffix "Group"**

- **Feature layers based on CAD layer/Level names**
  - **Feature Class will be included with layer visibility turned off**
  - **Feature Layers for each Level/layer geometric type**

- **Feature Layers can be used as input to GP tools**
  - **Maintains Layer color with conversion**
  - **Honor CAD layer level visibility**

***Removed Blocks/Shared Cells as own Group layer**

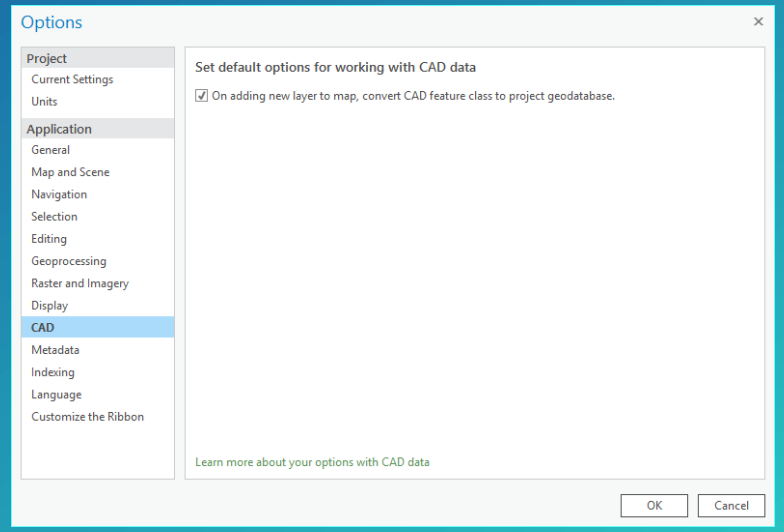


ArcGIS Pro and CAD data

Automatic Labeling of Annotation Points and Convert on Add

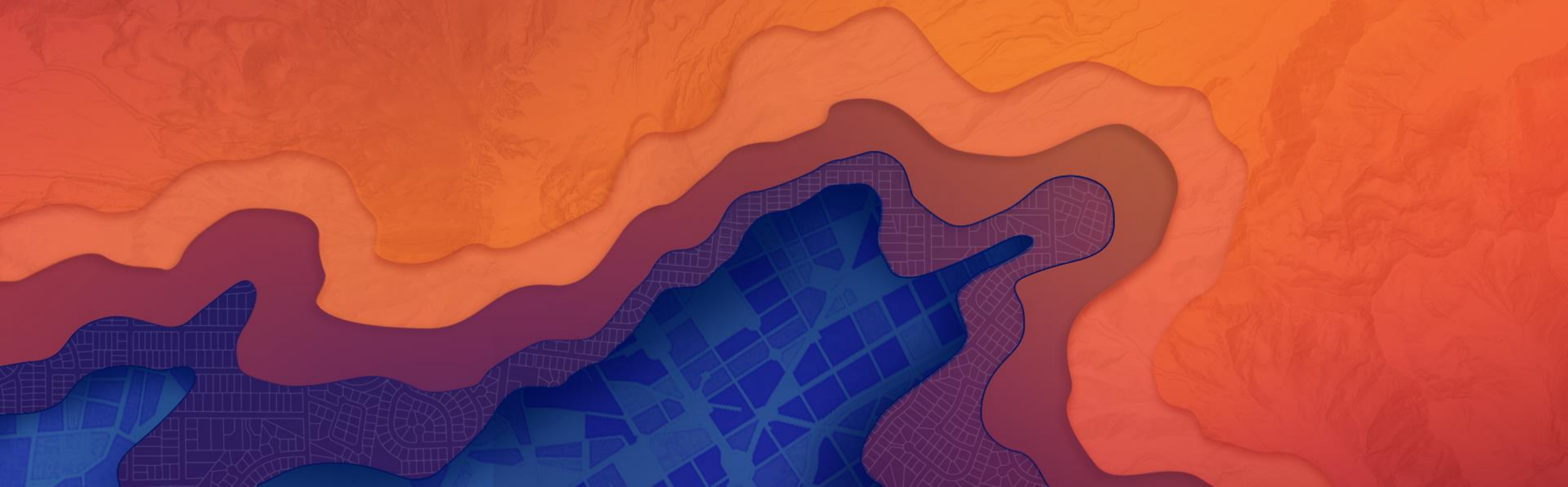
- **CAD file support is simple feature classes**
  - **ANNOTATION features are currently added as a POINTS**
  - **Labeling of CAD POINT**
  - **Standard with other data sources**

- **Convert on Add Option (off by default)**
  - **Automatically converts CAD data to GDB**
  - **Simplifies data migration of conversion**



Positioning CAD data in Pro

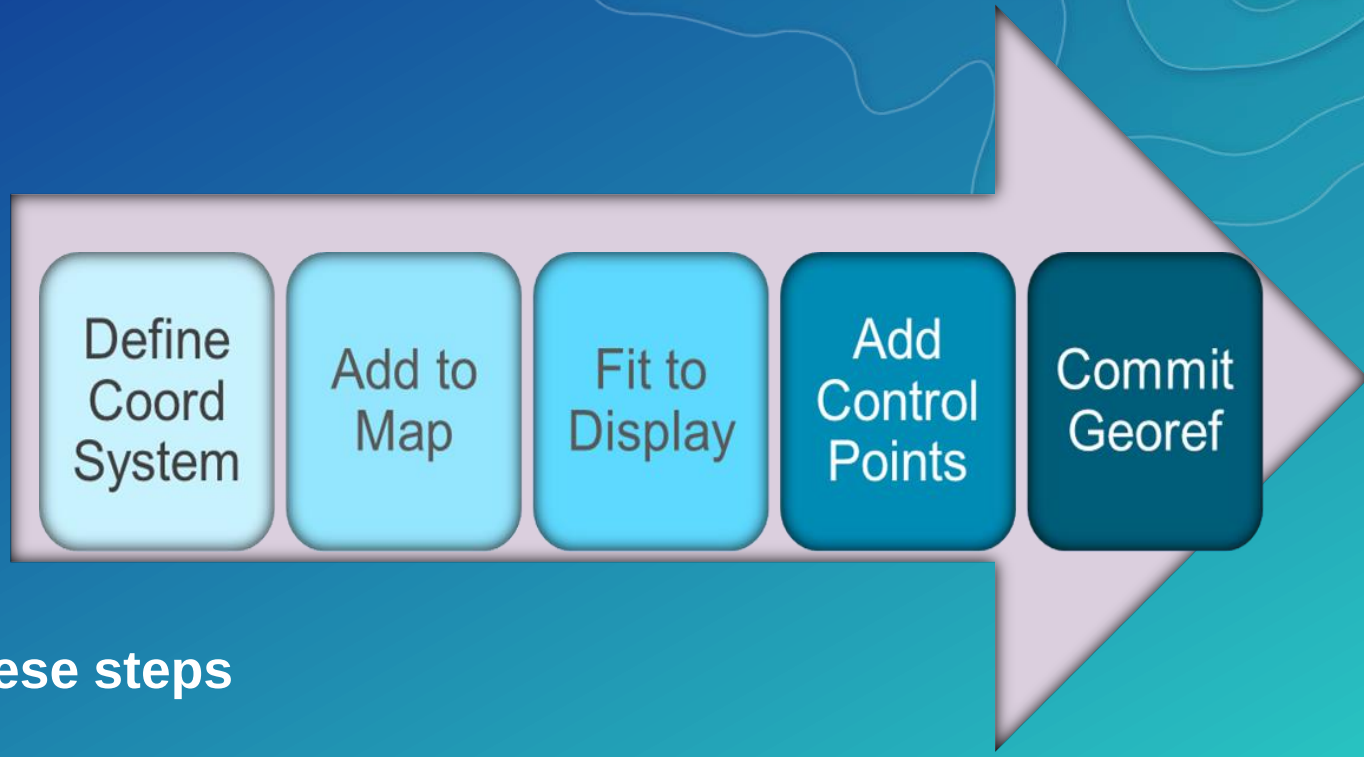
Georeferencing



Assigning coordinate systems and Georeferencing CAD in ArcGIS

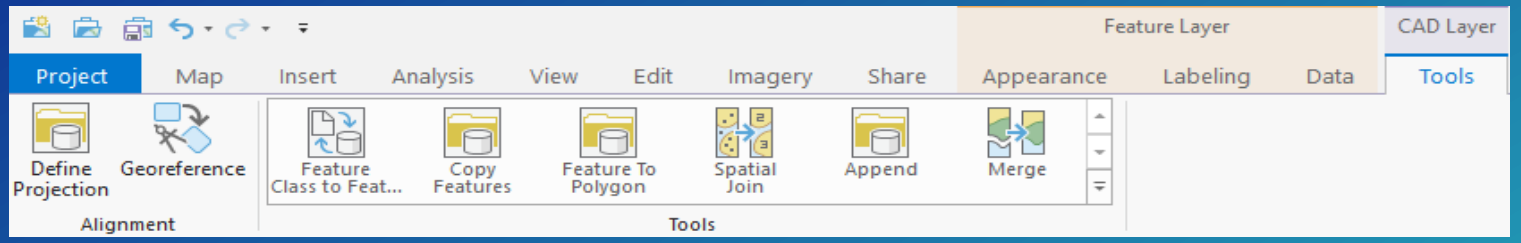
Georeferencing Process

- Assigning a coordinate system
- Applying a transformation
- Stop Tracing
- Not all CAD datasets require these steps

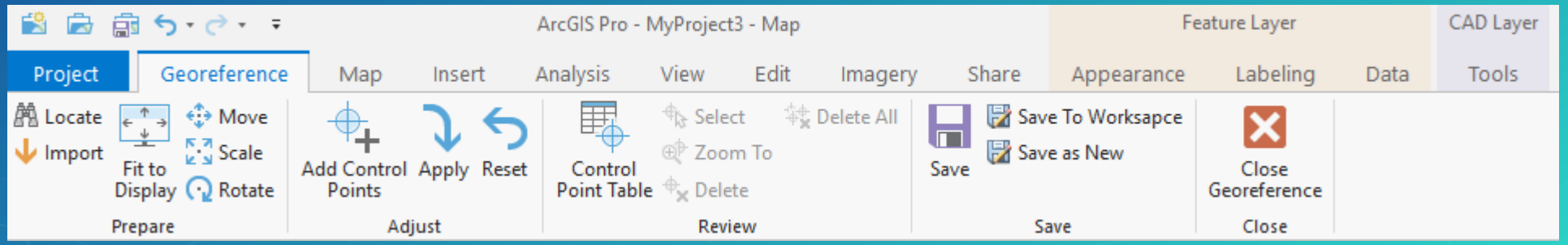


Headline Here

Select a CAD file in your TOC



Use Georeference Contextual Tab



Georeferencing

- **Two-point Similarity transformation method**
  - **Move, Rotate, and Scale**
  - **Aspect ratio always maintained**
  - **Cannot skew or ‘rubber sheet’ CAD drawing**
- **Transformation managed by World Files**
  - **ArcGIS is not modifying the CAD drawing**

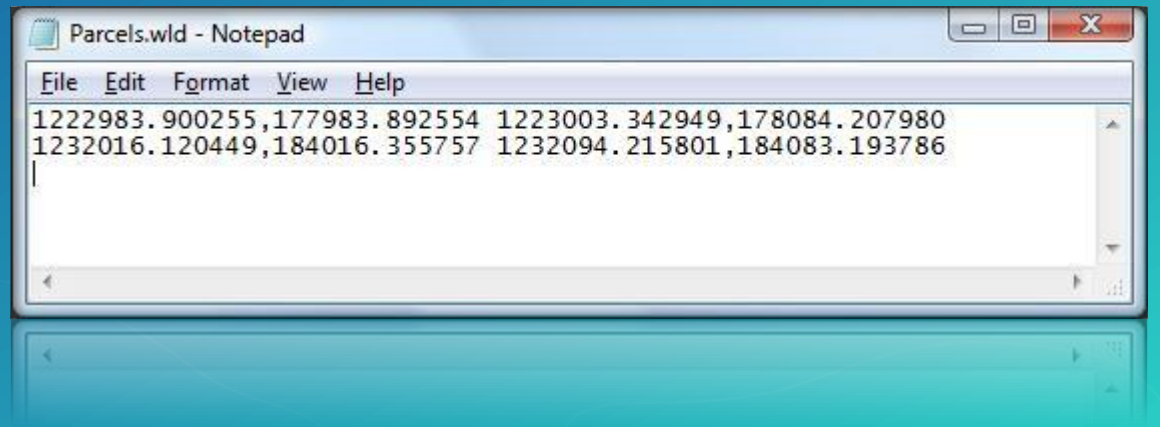
*NOT required for drawings that are drawn in real-world coordinate location.

Georeferencing: World Files

- File based, two point transformation for CAD data
- Uses the .wld file extension
- Simple text file containing two lines with two pairs of coordinate values:

  <From X1, From Y1> <To X1, To Y1>

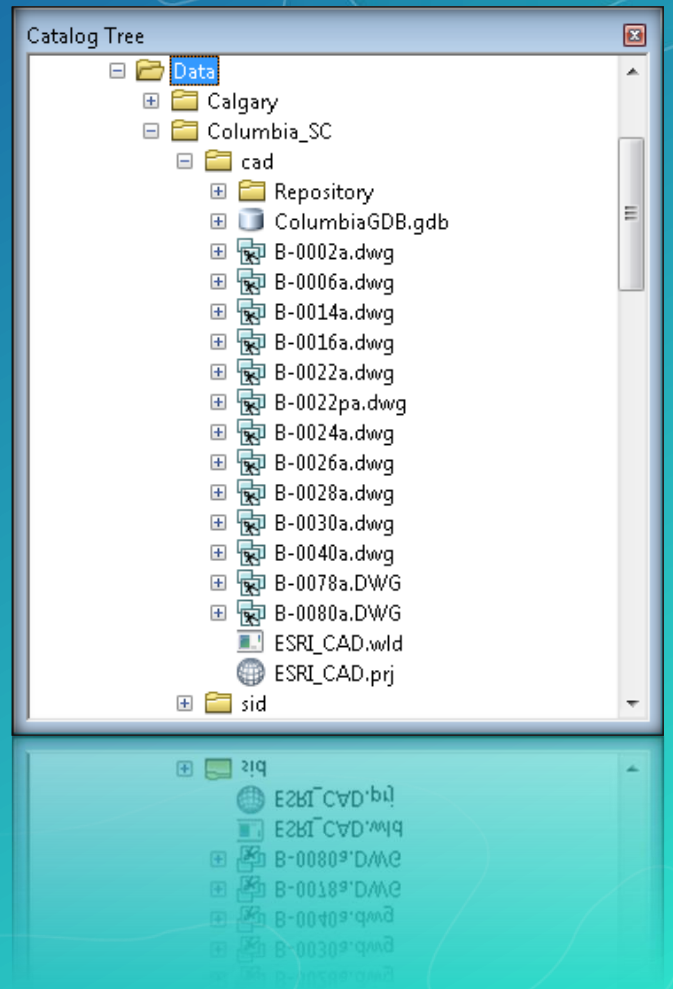
  <From X2, From Y2> <To X2, To Y2>



Universal Projection and World Files

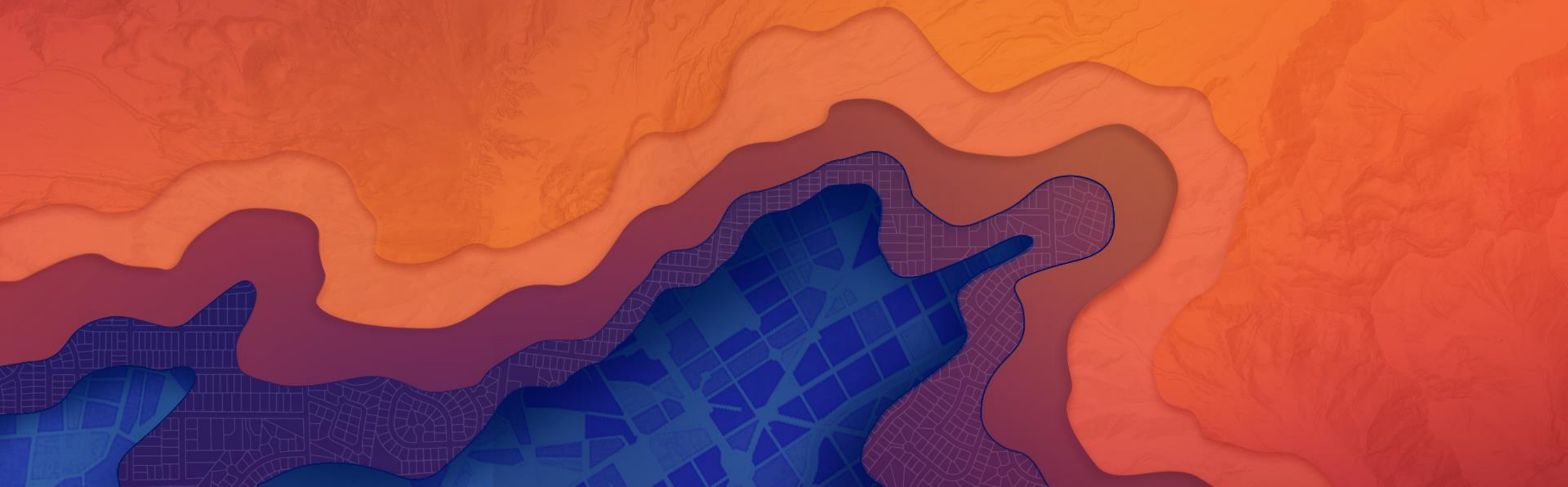
- **Universal World File**
  - ESRI_CAD.WLD
  - Applies identical transformation to all CAD files in workspace
  - Useful for set of tiled CAD drawings

- **Universal Projection File**
  - ESRI_CAD.PRJ
  - Applies same coordinate system to all CAD files in workspace



Loading CAD data into Pro

Conversion to GIS model



CAD/GIS Interoperability Patterns

- **ArcGIS user who needs to…**
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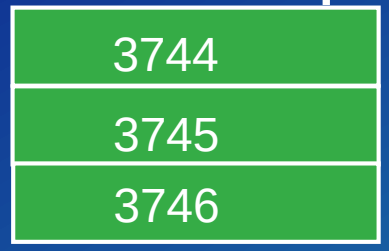
Loading CAD data Demo: Campus example

Loading CAD data in ArcGIS Pro

- 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 in ArcGIS Pro
- Can be combined with other Geoprocessing functions
  - Spatial Joins
  - Geometry manipulation

Geoprocessing Conversion Patterns

- CAD text inside polygons



- CAD text near lines

- Line segments to polygons

- CAD to Geodatabase

- Append to existing Geodatabase

- Merge with other layers

Converting to CAD data

CAD/GIS Interoperability Patterns

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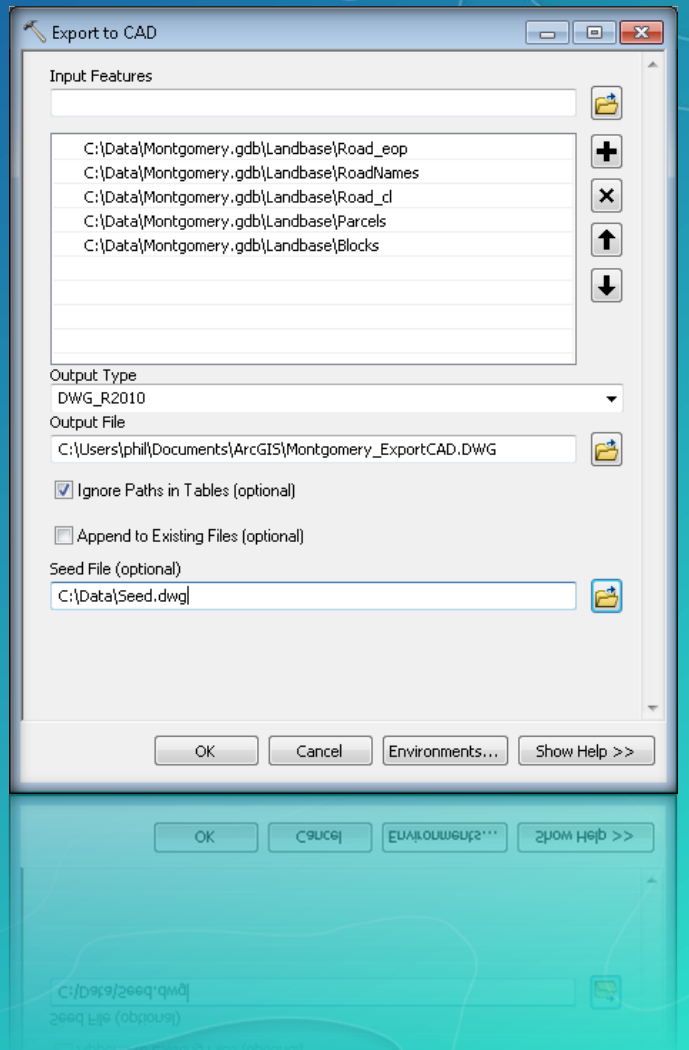
Export to CAD

- Output features to native CAD format
  - DGN V8
  - DWG/DXF Release 14 to 2017 (ArcGIS 10.4.1)
- Supports appending to existing CAD drawings
- Creates Seed files
  - CAD feature Classes (MSC)
  - Fields and default values, layers color, linestyles…

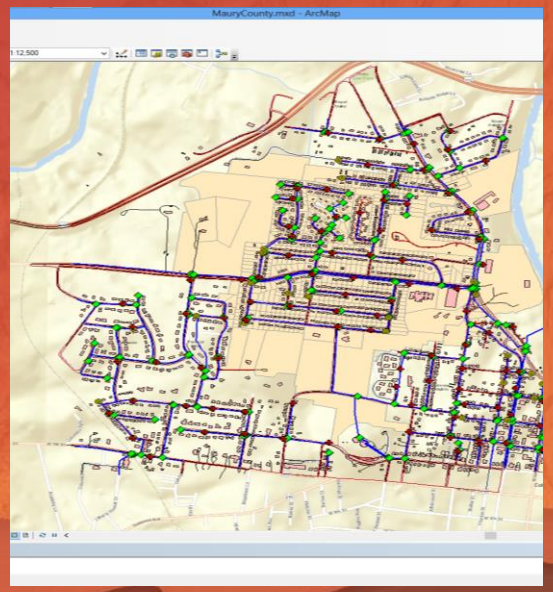
*Available at all license levels



Reserved CAD Fields

- Reserved CAD fields
  - Fields understood by Export to CAD
  - Creates shared cells, blocks, layers, colors
  - Creates MSC feature classes, fields, field values.

- Resources in help system
  - https://desktop.arcgis.com/en/desktop/latest/manage-data/cad/reserved-cad-fields-for-dwg-and-dxf-files.htm
  - https://desktop.arcgis.com/en/desktop/latest/manage-data/cad/reserved-cad-fields-for-dgn-files.htm



Data submittal Demo:

ArcGIS for AutoCAD 365 - Free Download from Esri

- **Access to GIS content**
  - **Basemaps**
  - **Image services, Map Services**
  - **Location Services**
  - **LISP API**
- **Access to Feature Services**
  - **Direct editing GIS data**
  - **Subtype, domains**
- Mapping Specification for CAD

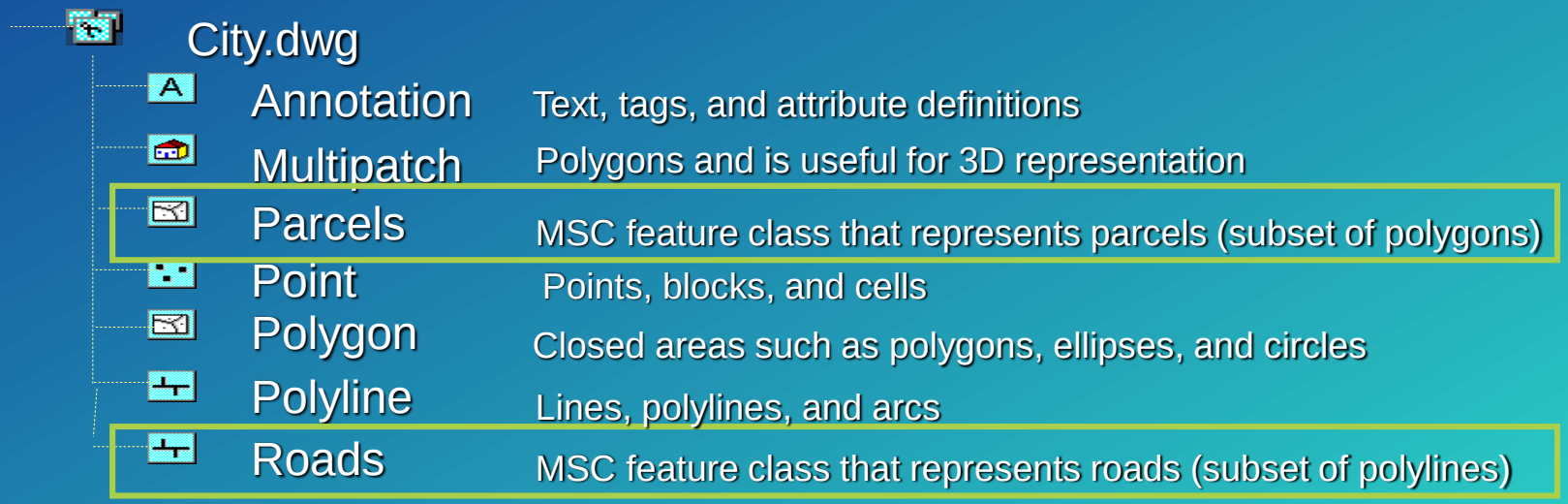
Mapping Specification for CAD (MSC)

Provides improved interoperability between CAD and GIS

- **Open source framework developed by ESRI**
  - **GIS feature classes + attributes**
  - **Coordinate systems**
- **Utilizes CAD data structures to define schema and store data**
- **Leveraged by ArcGIS Desktop CAD tools**
  - **CAD direct read/import tools**
  - **Export to CAD**

CAD data structure in ArcGIS

- **Subset feature class**
- **AutoCAD Query**
  - **Layer, color, linestyle**
  - **Etc**
- **Invisible in AutoCAD**
- **Better than a SHP file**



Export to CAD Demo: Multipatch

Best Practices

- Tips and best practices for CAD & GIS
  - Seed/template file
  - Layer standards (Plan ahead)
  - Coordinate systems
  - Drawing in proper locations
  - Only use Model Space

- Export to CAD
  - template
  - Coffee and donuts
  - ArcGIS for AutoCAD

What did we talk about

- Overview of CAD Support in ArcGIS Desktop (ArcMap and Pro)
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- Loading CAD features into a Geodatabase
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More CAD at UC2017

Session	1st Offering	Room	2nd Offering	Room
Using CAD Data in ArcGIS: An Introduction	Wednesday 01:30 PM - 02:45 PM	Rm. 08	Thursday 01:30 PM - 02:45 PM	Hilton – Sapphire ballroom A/B
CAD: The ArcGIS for AutoCAD CAD Plug in	Tuesday 01:30 PM - 02:15 PM	Rm. 31 B/C	Wednesday 10:15 PM - 11:30 PM	Rm. 14 A
CAD: An Introduction to the ArcGIS for AutoCAD Plug-in (Demo Theater)	Tuesday 11:30 PM - 12:15 PM	Geo Data Demo theater #6	N/A	N/A
CAD: Lining Up CAD Data in ArcGIS	Tuesday 11:00 AM - 11:30 AM	Tech Theater #18 Exhibit Hall A	Wednesday 02:00 PM - 02:30 PM	Tech Theater #18 Exhibit Hall A

Want to learn more?

- **Documentation**
  - http://resources.arcgis.com/en/communities/cad-integration/
- **Related Esri Training and Tutorials**
  - **CAD in ArcGIS:**
  - **http://training.esri.com/gateway/index.cfm?fa=catalog.coursedetail&courseid=50120390_10.x**

  ArcGIS FOR AUTOCAD training video's:

  http://training.esri.com/Gateway/index.cfm?fa=seminars.viewDetails&course_id=182

  http://video.arcgis.com/watch/3901/arcgis-for-autocad-350-training-series-how-to-create-gis-data-in-cad-session-3-export-from-arcmap
- **Additional Resources**
  - **Margaret Maher's book "Lining up Data in ArcGIS"**

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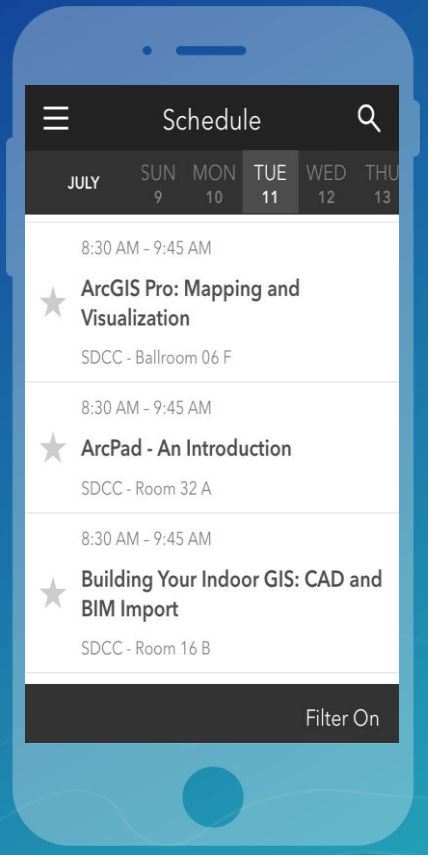
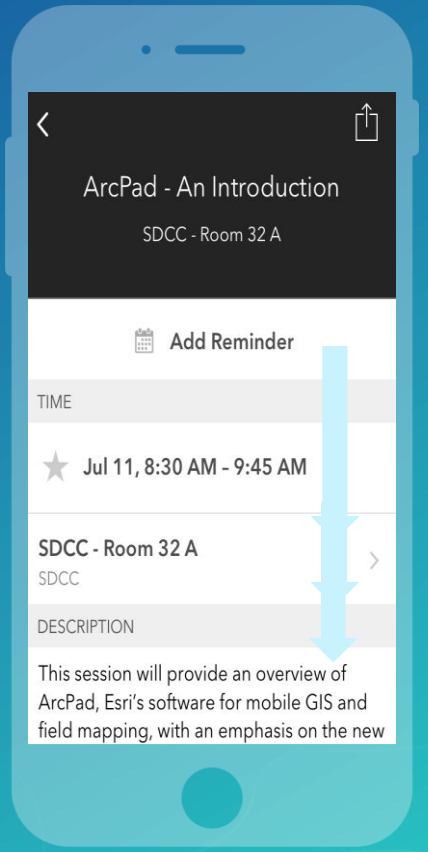
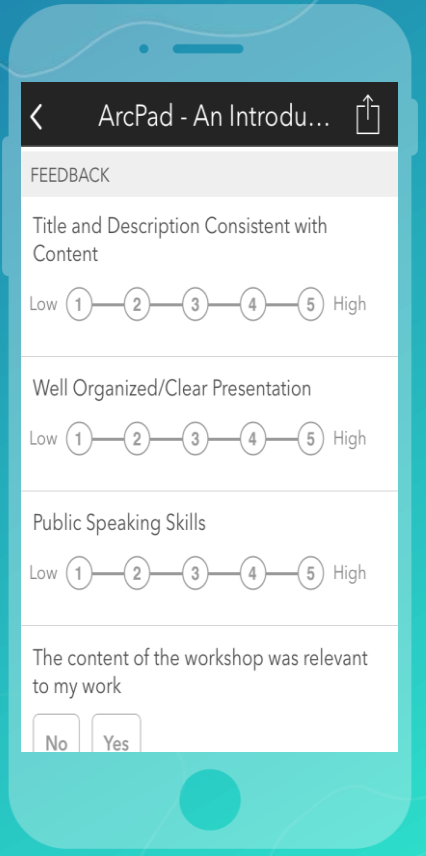
Select the session you attended



Scroll down to find the survey



Complete Answers and Select "Submit"



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