CAD/GIS Interoperability

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Since the release of the 2014 CADD software packages, options now exist to export data from CADD to GIS (with intelligence, not just lines, points and polygons), use GIS data in CADD and a whole host of other applications.

OVERVIEW
Overview

- Background
- Research
- Interoperability
- Beta Testing
- Summary
Background

- The Florida Department of Transportation (FDOT) requires standardized electronic delivery of Design Plans through CADD.
- With the advancement of the GIS Enterprise View (GEV) utilizing the FDOT Enterprise GIS Framework and the technology upgrades to CADD platforms supporting the interoperability between these environments, a path for sharing data has evolved so that users in both environments can benefit.
Background

- In 2011 started looking for a way to put everything Right of Way (ROW) related into our new enterprise GIS framework looking backward to historic records.
- We had some success in manipulating the CADD line work for ROW acquisitions into a GIS environment, but the work was tedious and time consuming.
- Utilities (a highly desired data set) would be even more tedious.
Background

- Brought in Texas A&M Transportation Institute (TTI)
- They interviewed 3 Districts to find FDOTs
  - Business processes
  - Systems
  - Information concerning management of ROW & Utility data
We wanted them to develop a strategic implementation plan to manage ROW parcels and utility data. They developed steps for integrating this existing data into FDOTs enterprise GIS framework. Including a process, workflow and a tool to hopefully “automate” bringing this historical data (CADD line work) into a GIS environment and to give it intelligence. They recommended that we take a database approach to manage our data and use existing survey and GEOPAK data. This research project is now complete.
We anticipate that we will one day want the ability to reference all or some amount of historical layers such as:

- Survey Control,
- Parcels,
- Aerials,
- ROW,
- Roadway,
- Easements,
- Utilities, and Permit Agreements
GIS to CADD

- Technology is moving in the direction of being able to deal with these types of items in a “feature” based environment.
- This information could be of great value in areas of informed decision making or those that may create high amounts of public record requests.
- Both Bentley and AutoCAD platforms now have the functionality to directly support referencing of GIS data into the CADD environment and visa versa.
CADD to GIS “Interoperability”

So…..

How can we integrate CADD Survey/Engineering data that’s symbolized specifically to create a set of design plans for construction so that elements of that design can be visualized/attributed and thereby successfully used in a Geographic Information System?
Before we can begin to answer that question we must first have an understanding of what it is that GIS requires in order to visualize and geospatially query information.

- GIS uses relational tables of records that are geospatially aware.
- Along with linked attribute data.

In short---

**Attributes    Data    Intelligence**

So that means that we must somehow create outputs in the CADD environment to meet these requirements.
CADD to GIS Interoperability Requirements

- By incorporating GIS workspaces into our current workflow
- Harnessing the tools available in our latest licensed CADD products (MicroStation Power GeoPak/Map & AutoCAD Geospatial) giving us the ability to generate GIS compliant data
  - That is data that is both
    - Geospatially aware, and
    - Has attributes
CADD to GIS Interoperability Goals

- Use existing licensed products (both CADD and GIS)
- Reach out and determine all potential stakeholders to data
  - There may be some who traditionally were not interested or didn’t have a need to mine CADD data from design plans as they were not CADD users and the data had no intelligence
CADD to GIS Interoperability Goals

- User assessment to identify initial need and priority of GIS features
  - Start small
    - Right of Ways
    - Parcels (both right of way and excess)
    - Alignments
  - Determine workflows, and
  - Build tools and workspaces in FDOT CADD platforms for creating these GIS features
CADD to GIS Interoperability Tools

- Using these tools and FDOT workspaces CADD designers can create
  - GIS compliant features (intelligent features), or
  - Promote existing CADD elements to GIS features with associated attribute data
CADD Components Exported as GIS Features
Includes new geospatial tools:

- Interoperability tools
  - Map Manager
    - Attaches files and features from any supported graphical source (such as vector maps and raster images) and manage feature display
  - Feature Menu
  - Command Manager
    - Allows for the placing, editing, promotion, analyzation and browsing of feature attributes
Bentley Geospatial Administrator
Command Manager
Tree

Note: Commands are categorized by discipline in this example, but could be categorized/organized in other ways.
Interface

Promote to Parcel

[Image of the Promote to Parcel interface with various fields and buttons for data entry]

Segment/item: [Field]
Fed Aid #: [Field]

District: [Dropdown]
County: [Dropdown]

Road: [Field]
Number: [Field]

Road Name: [Field]
Parcel Type: [Dropdown]

Take Category: [Dropdown]

Right of Way Category: [Dropdown]
Exp Date: [Date Field]

FDOT Parcel ID: [Field]

Date of Acquisition: [Date Field]
Property Appraiser ID: [Field]

Official Document Type: [Dropdown]
Book or Instrument #: [Field]
Pg #: [Field]
Owner: [Field]
Grantee: [Field]

Section: [Field]
Township: [Field]
Range: [Field]

Apparent Access: [Dropdown]
Access Road: [Field]
Description: [Field]
Comments: [Field]

Drafting Date: [Date Field]
Status Date: [Date Field]
Status: [Dropdown]
Interface

Place Parcel
Interface
Place and Promote
Alignment
Interface

Place and Promote

Right of Way Line
Export to GIS
Exporting Options
Project Template

Storage of all things GIS
Read, write, and convert data between widely used formats which include:
- DWG—Output a DWG file that is readable by any AutoCAD software client, in both visual and editable modes
- Arc/Info coverages
- SHP and E00 from ESRI
- MapInfo MIF/MID
- MapInfo TAB
- MicroStation DGN
- Generalized Markup Language
- Ordnance Survey MasterMap (DNF) (GML2, read-only)
- Oracle
- Vector Product Format (VPF, read-only)
- ASCII
- LandXML
- SDF
- Spatial Data Transfer Standard (SDTS, read-only)
ESRI Data Interoperability Tools

Requires the Data Interoperability Extension for Basic, Standard or Advanced license levels

Quick Export- Converts one or more input feature classes or feature layers into any format supported by the ArcGIS Data Interoperability extension.

Quick Import- Converts data in any format supported by the ArcGIS Data Interoperability extension into feature classes.
ESRI Data Interoperability Tools

- Used with Spatial ETL Tool
  - User-created geoprocessing tools that transforms data between different data models and different file formats

- Using the Create Translation Workspace Wizard, which assists in building the specialized tools
  - There are also third party vendors that create this FME Workbench for use both as a plug in (still must have the ESRI Extension) to ArcMap or to run as a stand alone program, they also add further functionality
Data Types

- Over 300 spatial and non-spatial data formats including:
  - Autodesk AutoCAD Civil 3D (DWF / DWG)
  - LiDar (Point Cloud)
  - Bentley Microstation Design
  - ESRI Shape
  - Raster
  - GeoTIFF
  - MapInfo TAB
  - Oracle Spatial
  - XML/GML/KML/Web
Curve Problem
Curve Problem
Curve Problem: Bentley

- Regarding the curves in GIS. This has been an issue for years and is one of the fundamental differences between CAD and GIS.

- When exporting into a shape file (SHP) curves are not supported, however with the latest version of Bentley map you can export directly to a file geodatabase where curves are supported.
Curve Solution

- Modify the FDOT SS4 Workspace
  - Add a variable to the end of the GIS.txt
- Default value is 0.0 = no stroking = Curve Problem
- A value of 1 will produce stroking but not enough to produce a curve in GIS
- Lowering the variable means that the stroking would increase but also increases file size
- Currently not worried about the files size
- So variable is set to 0.1 (No more Curve Problem)

ECSDK_GEOMETRY_STROKING_TOLERANCE=0.1
Whenever new releases occur keep an eye out for problems!
Working Units

- ArcMap is unitless until you set a projection, all state plane projections in Florida are in survey feet. The programs know the difference and automatically do the calculations so it is important that the units are set correctly.
Summary

- Process/Workflow
  - Developed a process/workflow allowing both CADD and GIS environments to interchange/share data

- So that the information can become:
  - A one stop shop for public records requests, and
  - Allow for better collaborative decision making tools with stakeholders,
    - whether through technical (data only in the form of tables or queries) or having a GIS/Thematic look (for display)
For more information and a detailed step-by-step How To document see:

www.dot.state.fl.us/surveyingandmapping/Inno-CADGIS.shtm
Questions:

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