



## CAD/GIS Interoperability

Rebecca Barber  
Geographic Mapping Specialist



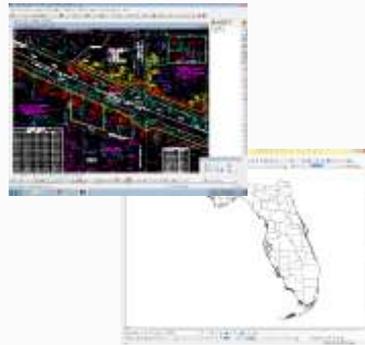
### Presentation Overview

- Background
- Research
- Interoperability
- Examples
- Drafting GIS Features in MicroStation
- Processing Parcel Line Work
- Interoperability Tools
- 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 FDOT started looking for a way to put everything Right of Way (ROW) related into the new enterprise GIS framework looking backward to historic records
- There was 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



## Research

- Texas A&M Transportation Institute (TTI) was brought in to examine FDOTs current system, practices and processes
- To develop a strategic implementation plan that would manage ROW parcels and utility data
- 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
- This research project was completed in May of 2013



## Research

- Overview
  - They conducted site visits and collected CADD Files and Documents. From this they developed
    - lists of levels, cells, and attributes
    - database tables, routines, and menus, to extract CADD information desirable to the GIS environment
- Recommendations:
  - Use of existing survey and GEOPAK data to generate parcel shapes
  - Use a database approach for managing design libraries and levels in MicroStation to be able to
    - link information
    - and add attribute data
  - Created steps for integrating existing parcel and utility data into FDOT's enterprise GIS framework



## Research

- But, there is no true “automation” available
- There is too much drafting cleanup needed on the historical data
- So getting the historical data into a GIS environment will be mostly manual, even with the tools developed by TTI
- So where do we go from here?
  - We can begin to gather new data,
  - while trying to come up with a plan for the old data



## Interoperability

- What does that mean?
  - It means that you can take line work from a CADD application, give it intelligence and export it into a GIS application
  - Or take intelligent data from a GIS application and import it into a CADD application
- Since this data has intelligence you can do queries, its not just about turning off layers/levels
  - Say you only want to see roadways that have a speed limit of 55mph.....you can do that
  - Or say you only want to see parcels over/under a certain acreage...you can do that too



# Interoperability

- FDOT anticipates that one day the ability to reference all or some amount of historical layers such as
  - Survey Control,
  - Parcels,
  - Aerials,
  - ROW,
  - Roadway,
  - Easements,
  - Utilities, and Permit Agreements
- In both CADD and GIS platforms
- FDOT sees this information as having great value in areas of informed decision making or maybe even those creating high amounts of public record requests
- Technology is moving in that direction with both the Bentley and AutoCAD platforms now supporting importing and exporting of GIS data



# Interoperability

## Requirements

- 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



# 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?



## 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
- User assessment to identify initial need and priority of GIS features
  - Start small
    - Right of Ways
    - Parcels (both right of way and excess)
    - Alignments



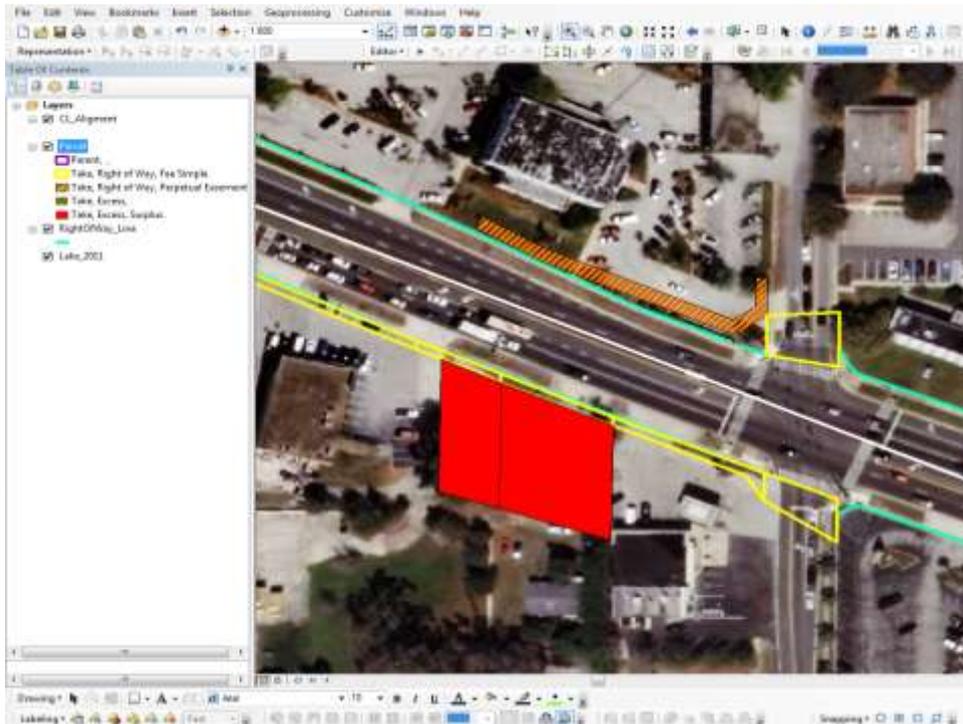
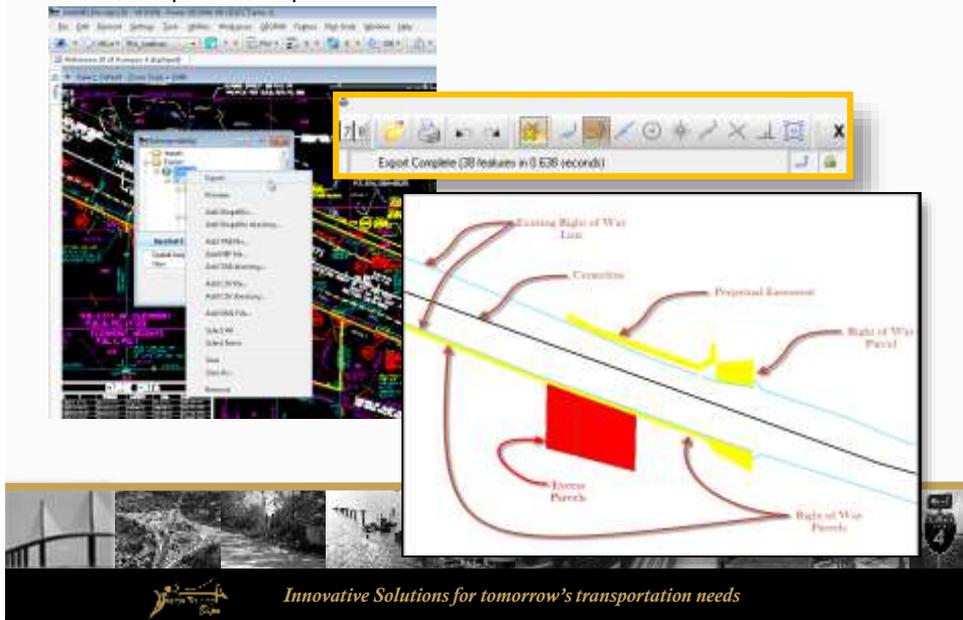
# Interoperability-Goals

- Determine workflows, and
- Build tools and workspaces in FDOT CADD platforms for creating these GIS features
- Incorporate GIS workspaces into the current FDOT workflow
- Create intelligent data is data that is both
  - Geospatially aware, and
  - Has attributes



# Example

CADD Components Exported as GIS Features



## Baby Steps

- Using Bentley Geospatial Administrator
  - A FDOT GIS workspace was created and released with FDOTSS2 MR1 (Feb 14, 2014). This workspace enables the:
    - Creation of GIS Features With Attributes (intelligent data)
      - Parcels (polygons)
      - Right Of Way Lines (line)
      - Alignment (line)



## Baby Steps

- The biggest problems are:
  - Drafting quality
    - No more sloppy drafting
      - Closed polygons
  - Data Cleanup
    - Good clean data is needed in order to Promote the line work into GIS Features
- Using the information already in the GeoPak project .gpk files and the Design & Computation Manager to visualize elements and then Promote into GIS Features
  - Polygons must be a Complex Shape
    - NOT a Complex Chain



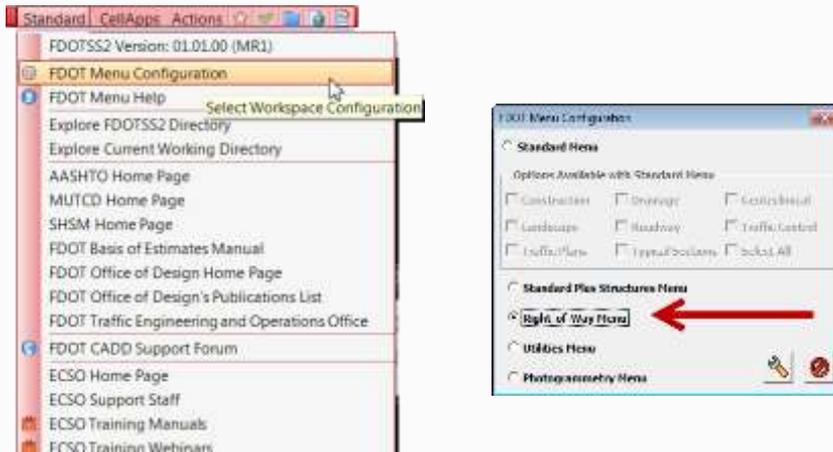
# Drafting GIS features in MicroStation



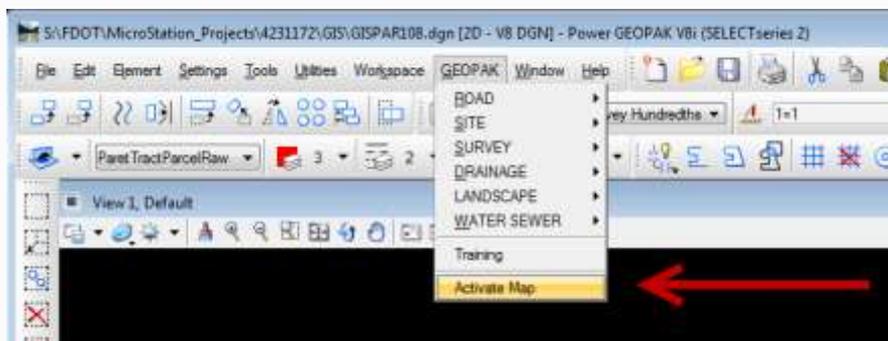
- Bentley Map
- Power GEOPAK V8i Select Series 2 with FDOTSS2 MR1 (released Feb 14, 2014)
  - Includes new geospatial tools:
    - Interoperability tools
      - Map Manager
        - Attaches files and features from any supported graphical source (such as vector maps and raster images) and manage feature display
      - Feature Menu
      - Command Manager
        - Allows for the placing, editing, promotion, analyzation2 and browsing of feature attributes

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## FDOT Workspace

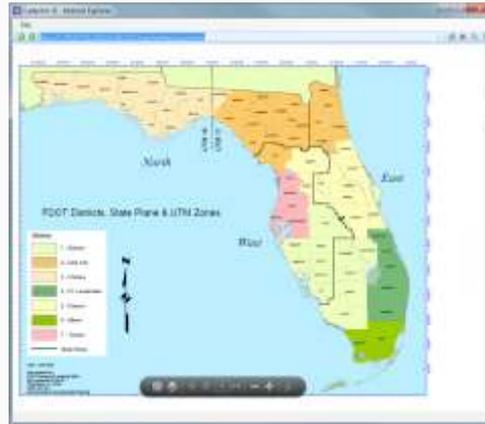


## Activate Map

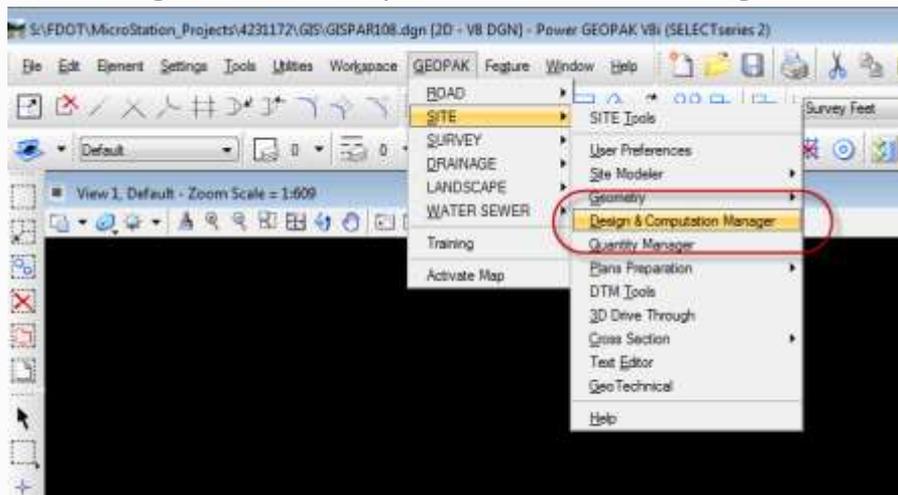




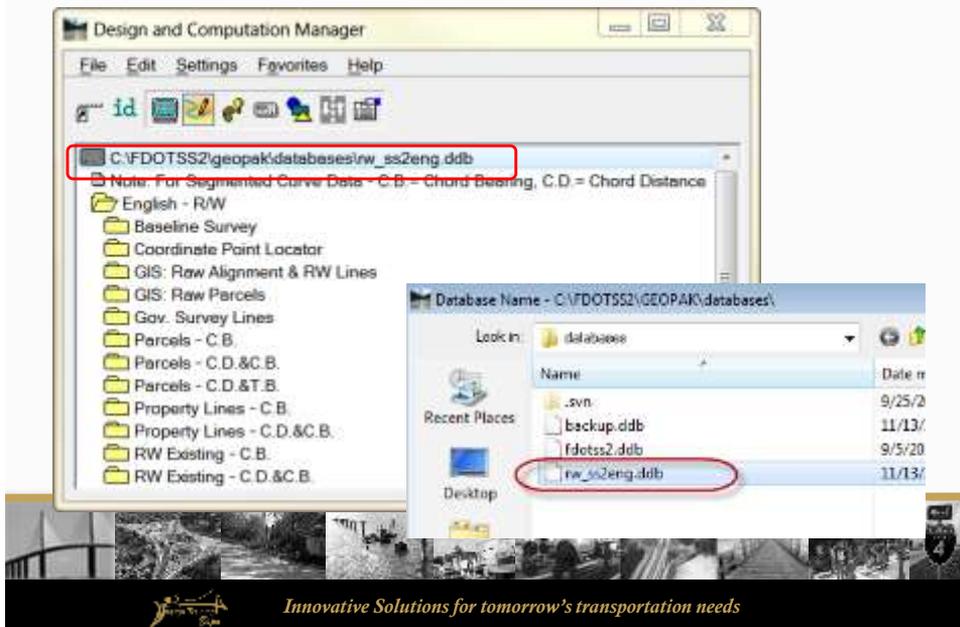
## Set Coordinate System



## Design & Computation Manager

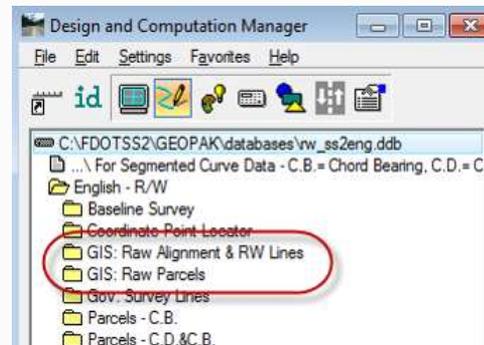


# Design & Computation Manager



## Design & Computation Manager

- Two GIS Categories have been added to the Design and Computation Manager:
- Use these GIS categories to visualize “raw” line work for promotion to Bentley Map GIS features.
- Once plotted and before being promoted to a Bentley Map GIS feature, line work like:
  - **Alignments and Right Of Way lines**
    - Need to be turned into continuous polylines.
  - **Parcels**
    - Need to be turned into polygons before being promoted.



## Design & Computation Manager

-  GIS Fee/Perp Raw Parent Tract/Fee Take/Perpetual Easement Parcels for Promotion
-  GIS Fee/Temp Raw Parent Tract/Fee Take/Temporary Easement Parcels for Promotion
-  GIS Fee/License Raw Parent Tract/Fee Take/License Agreement Parcels for Promotion

When visualizing parcels; choose the category that

best fit the type of take that will be promoted.

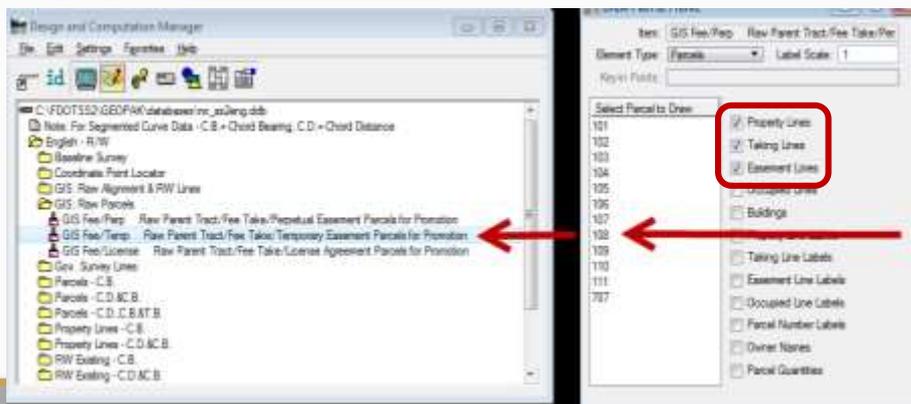
Generally choose the category based on the type of easement involved in the take.

**Note: Do not visualize labels. Labels are not necessary and will not be carried over to GIS when the lines and parcels are promoted.**



## Design & Computation Manager

As an example here is a parcel that includes a temporary easement, parcel 708, and is used to visualize the raw parent tract, fee take (108) and the temporary easement (708) all at the same time.



## GIS Levels: Raw Line Work

Name	Number	Description
AlignmentRaw	400	GIS: Raw Centerline/Baseline/Digitized Alignment
ExcessParcelRaw	403	GIS: Raw Excess Parcel
FeeSimpleParcelRaw	405	GIS: Raw Fee Simple Take Parcel (100s)
ParentTractParcelRaw	407	GIS: Raw Parent Track Parcel (Existing)
LicenseParcelRaw	409	GIS: Raw License Agreement Parcel (900s)
PerpEaseParcelRaw	411	GIS: Raw Perpetual Easement Parcel (800s)
TempEaseParcelRaw	413	GIS: Raw Temporary Easement Parcel (700s)
RightOfWayLineRaw	415	GIS: Raw Right of Way Lines (After Acquisition)
LARightOfWayLineRaw	417	GIS: Raw Limited Access Right of Way Lines (After Acquisition)
SurplusParcelRaw	419	GIS: Raw Surplus Property Parcel



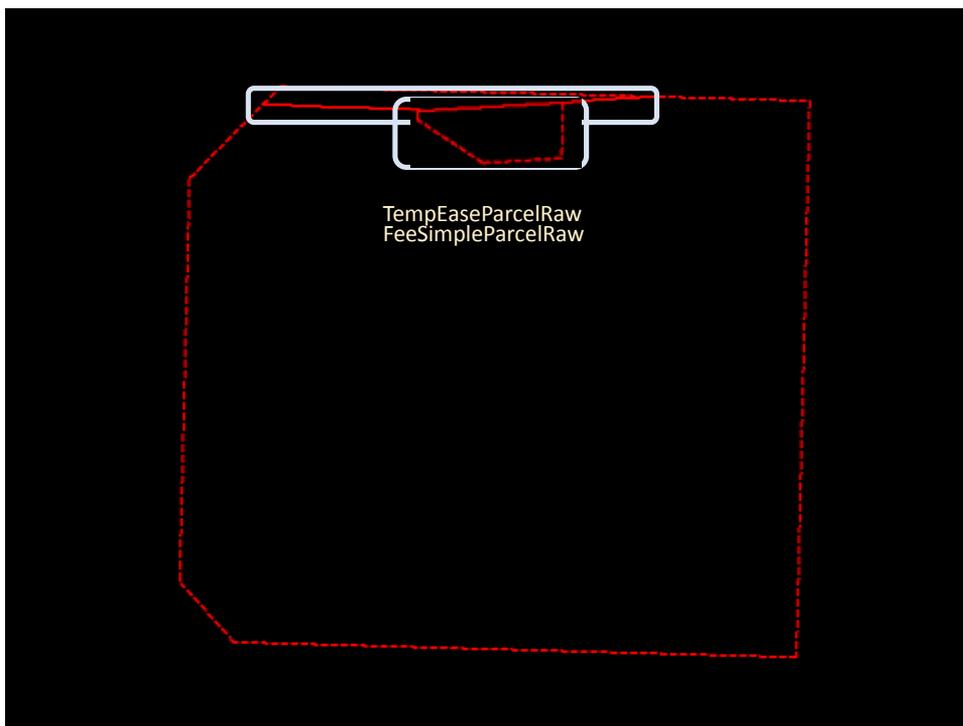
## GIS Levels: Create/Promote Features

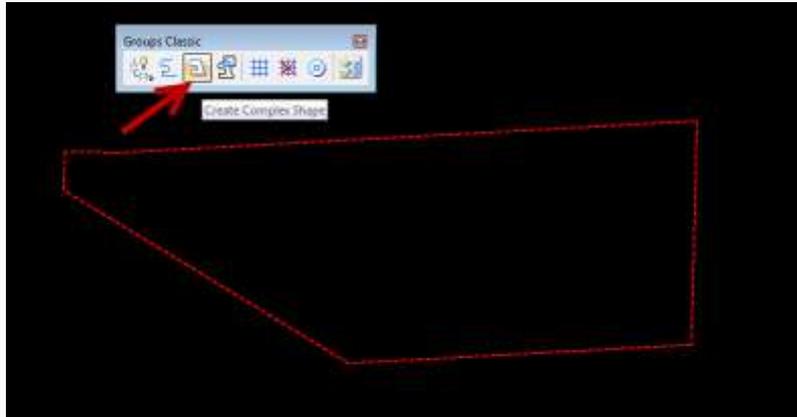
Name	Number	Description
Alignment	401	GIS: Created/Promoted Centerline/Baseline/Digitized Alignment
ExcessParcel	404	GIS: Created/Promoted Excess Parcel
FeeSimpleParcel	406	GIS: Created/Promoted Fee Simple Take Parcel (100s)
ParentTrackParcel	408	GIS: Created/Promoted Parent Track Parcel (Existing)
LicenseParcel	410	GIS: Created/Promoted License Agreement Parcel (900s)
PerpEaseParcel	412	GIS: Created/Promoted Perpetual Easement Parcel (800s)
TempEaseParcel	414	GIS: Created/Promoted Temporary Easement Parcel (700s)
RightOfWayLine	416	GIS: Created/Promoted Right of Way Lines (After Acquisition)
LARightOfWayLine	418	GIS: Created/Promoted Limited Access Right of Way Lines (After Acquisition)
SurplusParcel	420	GIS: Created/Promoted Surplus Property Parcel



# Processing Parcel Line Work

After the parcels are visualized from the D & C Manager, now what?



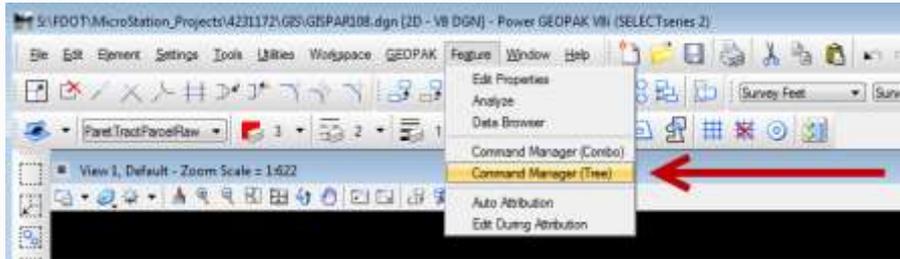


# Interoperability tools

Command Manager



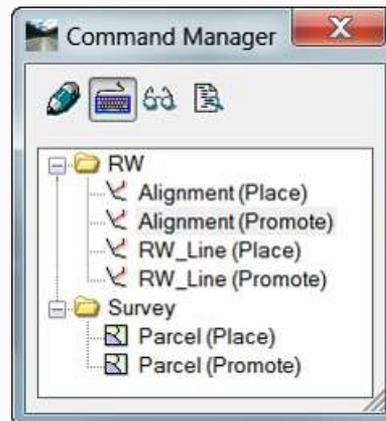
## Feature Menu



## Command Manager

### Tree

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

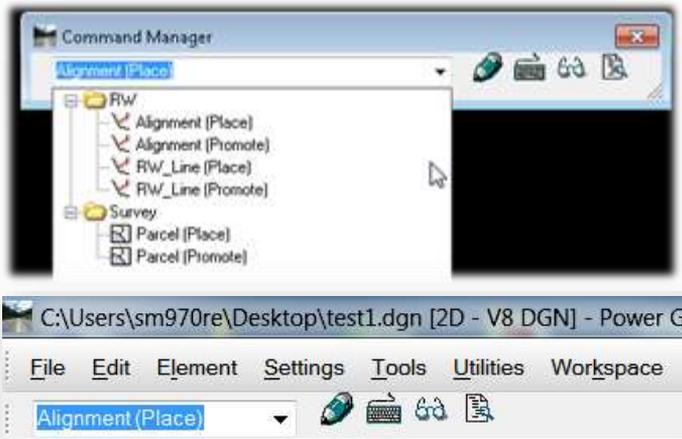


# Command Manager



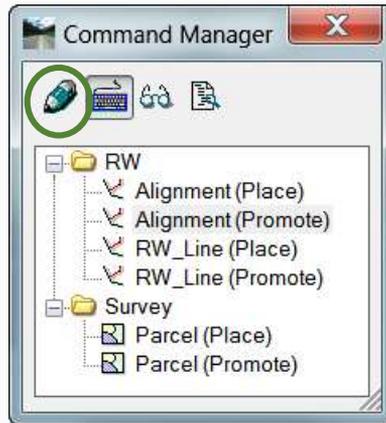
# Command Manager

Combo Box



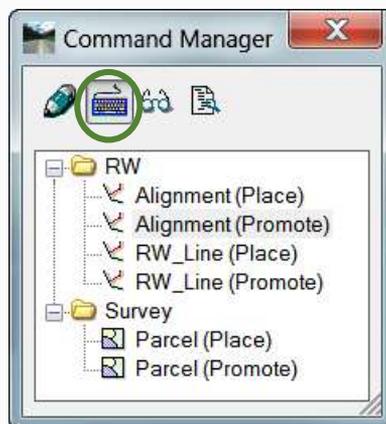
# Command Manager

Place

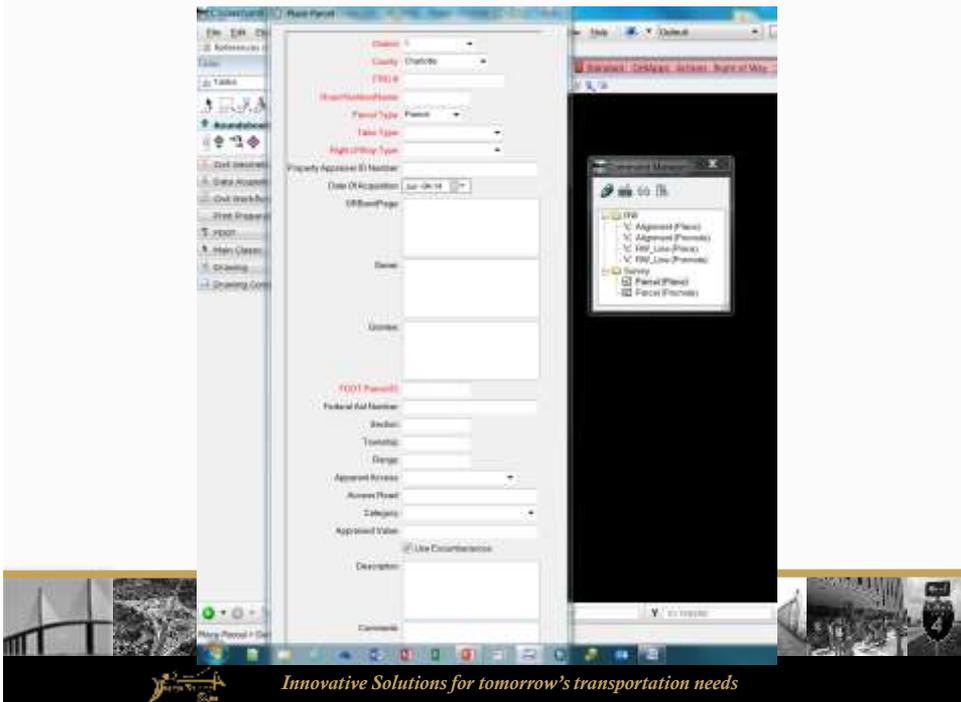
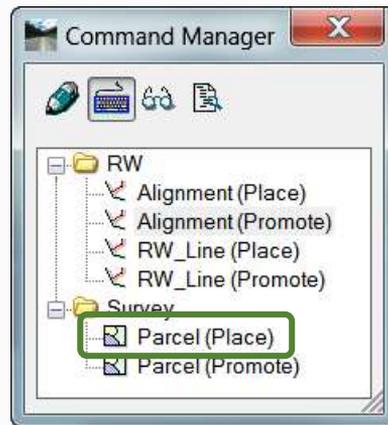


# Place

Edit



# Parcels



# Parcels Place/Create/Edit

Place Parcel

District  
County  
FPID #  
Road Number/Name  
Parcel Type: Parent  
Take Type  
Right of Way Type

Fee Simple  
Jurisdictional Transfer  
Perpetual Easement  
Temporary Easement  
License

*Innovative Solutions for tomorrow's transportation needs*

Command Manager

- RW
  - Alignment (Place)
  - Alignment (Promote)
  - RW\_Line (Place)
  - RW\_Line (Promote)
- Survey
  - Parcel (Place)
  - Parcel (Promote)

*Innovative Solutions for tomorrow's transportation needs*

# Parcels

## Promote Existing to Parcel

Promote to Parcel

Single Element  
 Fence  
 Selection Set

Delete existing element(s) after promote

District:

County:

FPID #:

State Road Number:

Parcel Type:

Take Type:

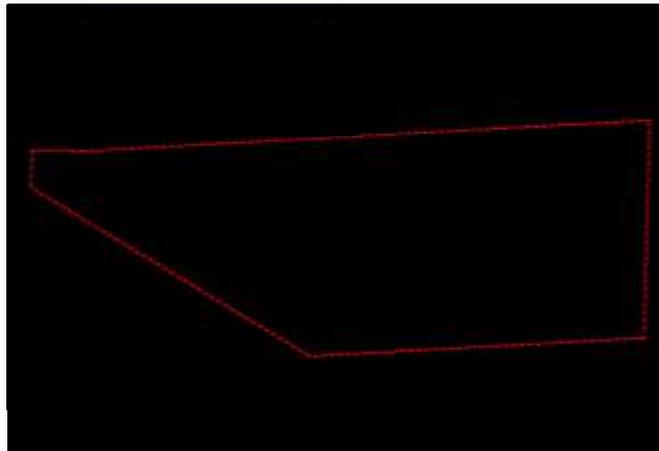
Right of Way Type:

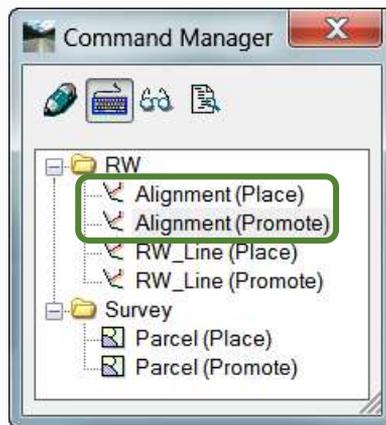
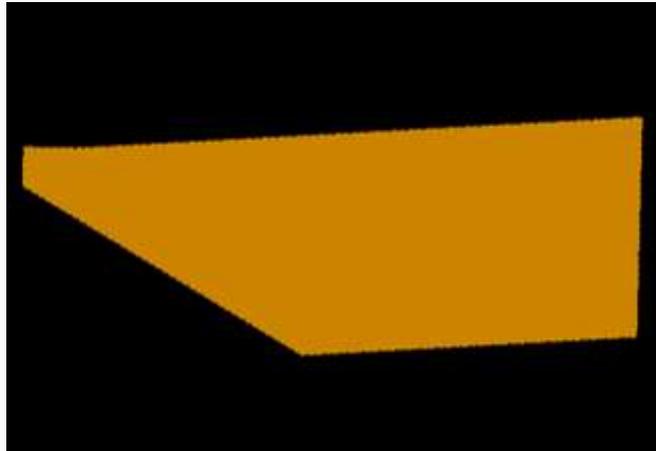
ExcessType:

Property Appraiser ID Number:

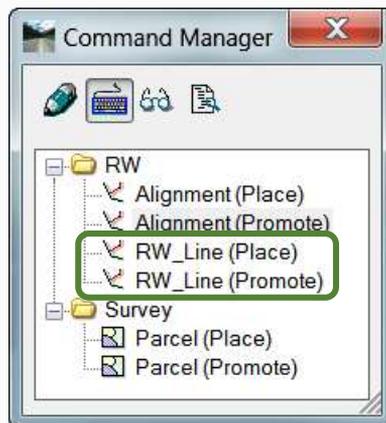
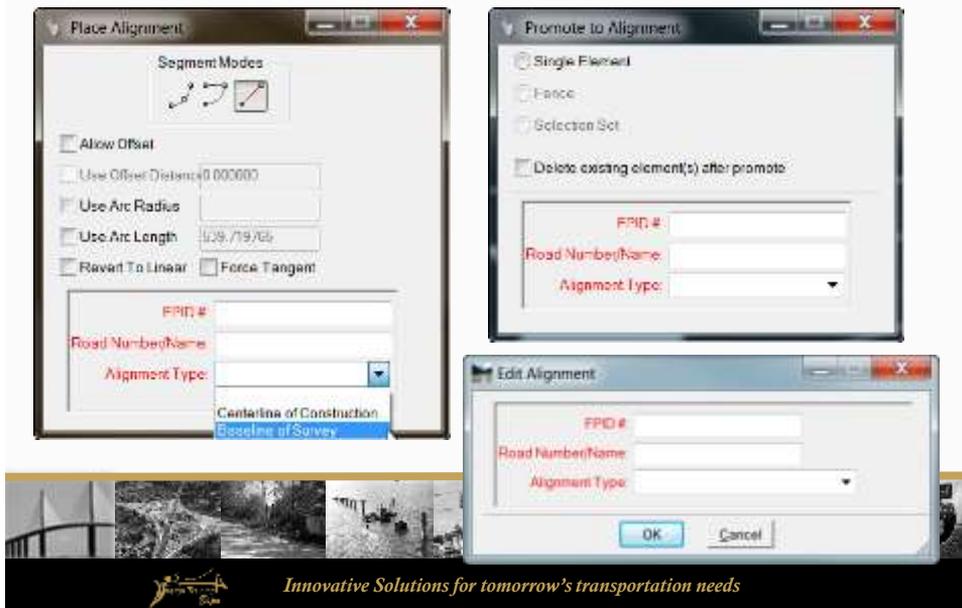
Date Of Acquisition: 3/13/2013

ORB and Page:

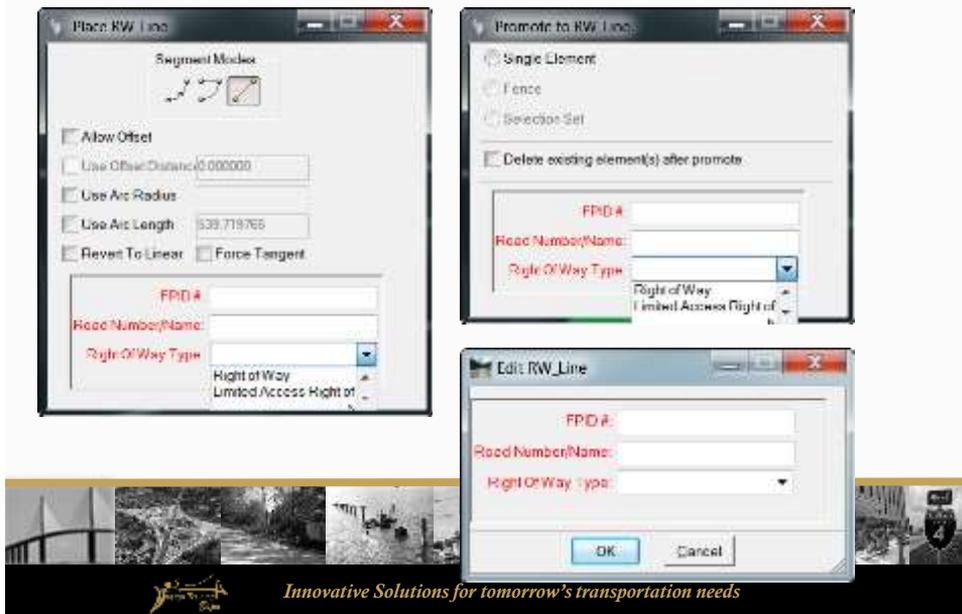




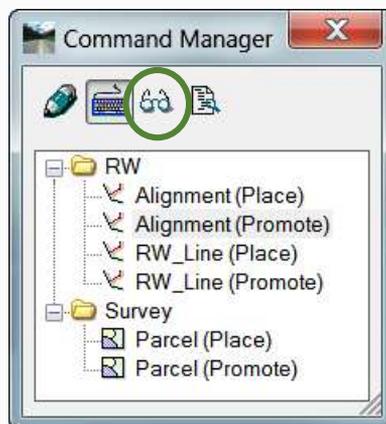
# Alignment



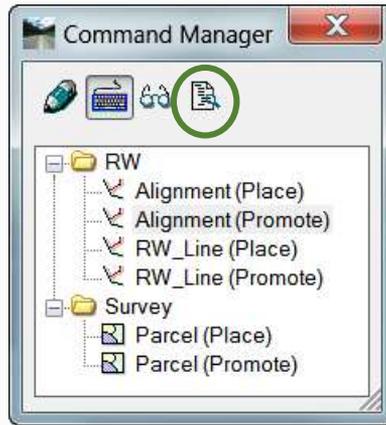
## Right Of Way Lines



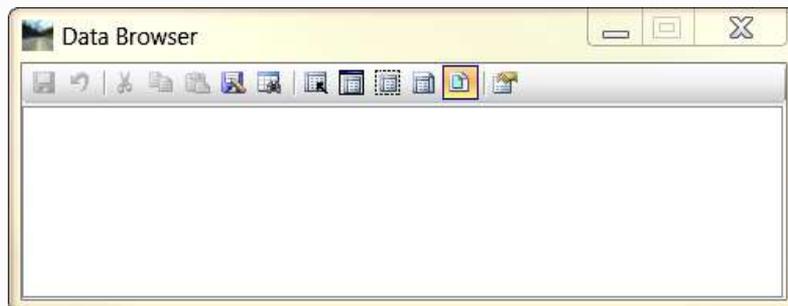
## Analyze



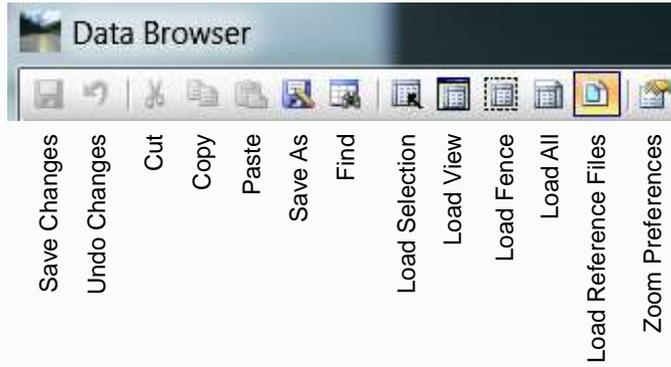
## Data Browser



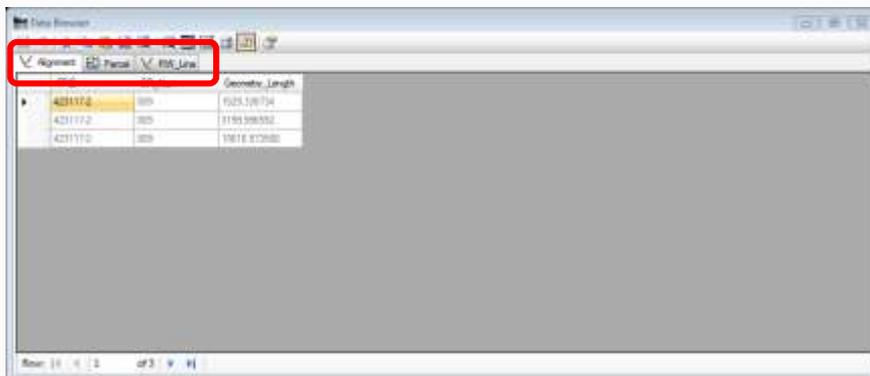
## Data Browser



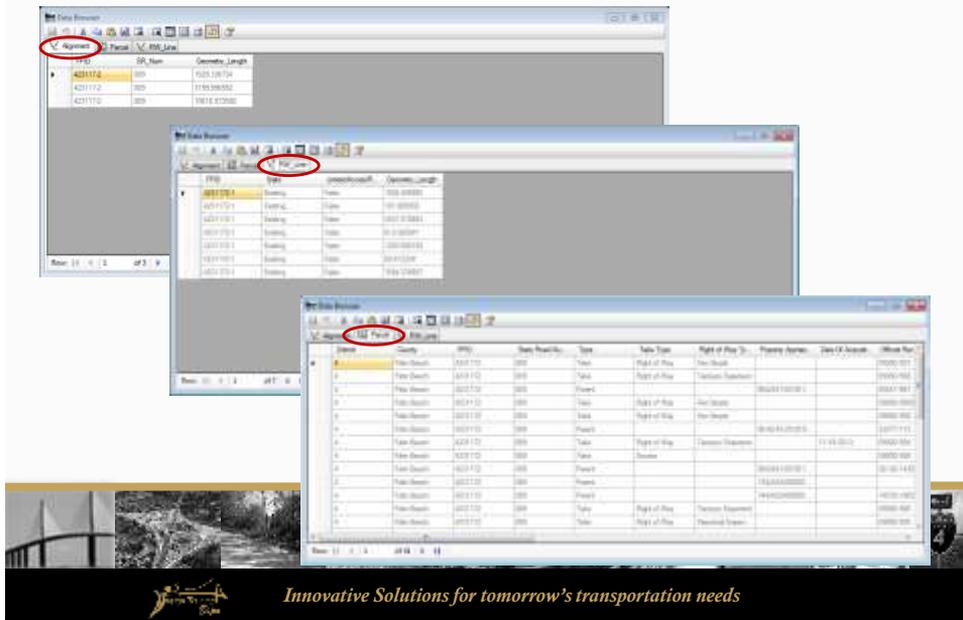
## Data Browser



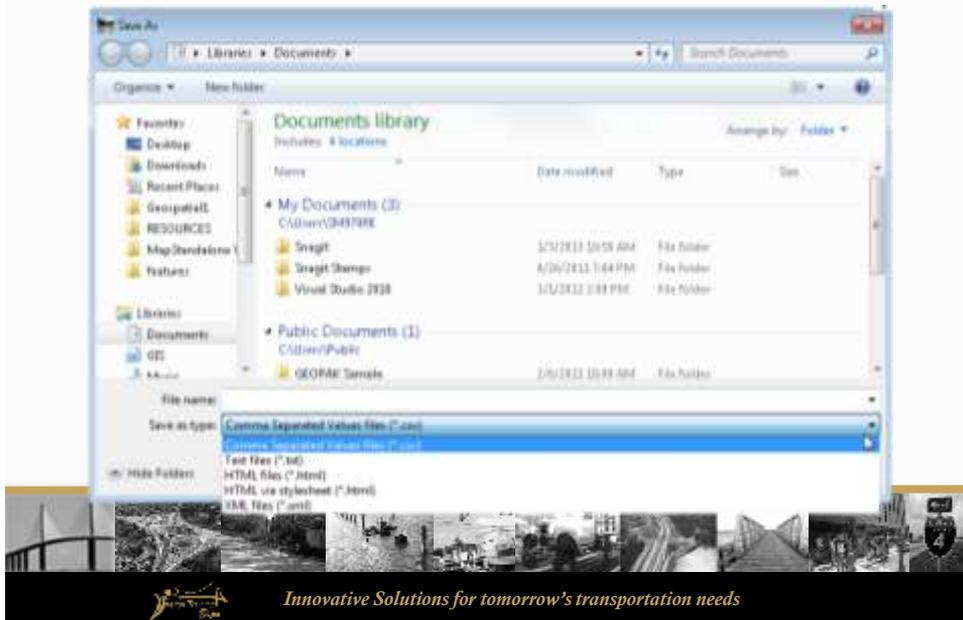
## Data Browser



# Data Browser



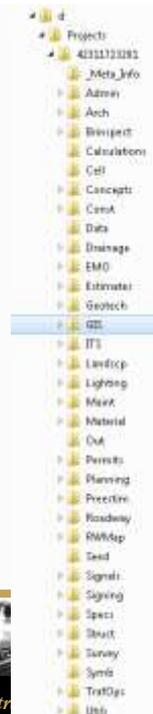
# Data Browser



# Where does this fit into my project?



- Everything GIS no matter the discipline will go into a single GIS folder that will be added to the project template.
- That way as more features are added they will all be contained in a single area.



## GIS File Names

# GISPAR###

Shows this is  
a GIS file

Shows this is  
a Parcel

The three digit  
FDOT Parcel  
Number



## GIS File Names

# GISRWDT##

Shows this is  
a GIS file

Shows this is  
a Right of  
Way Line

Sequence  
Number



## GIS File Names

# GISALG##

Shows this is  
a GIS file

Shows this is  
an Alignment

Sequence  
Number



## GIS File Names

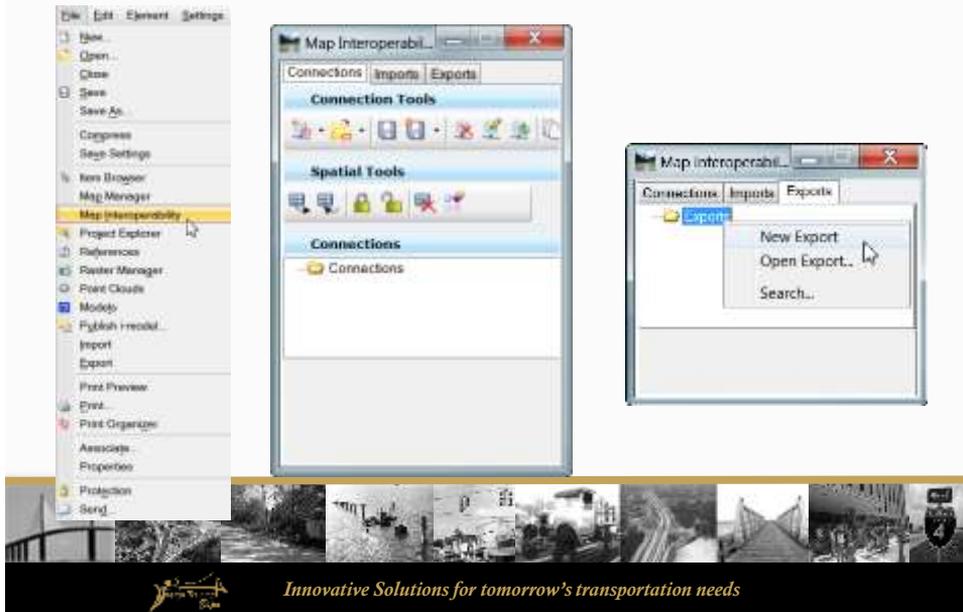
# GISMASTER

Shows this is  
a GIS file

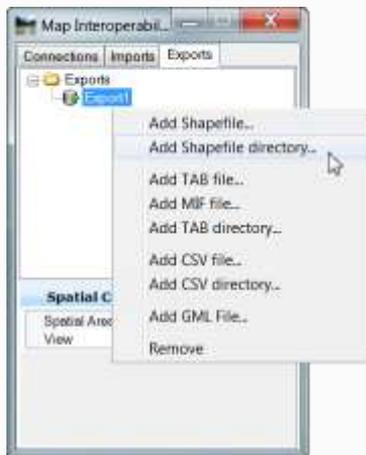
All parcels, Alignments and Right of  
Way lines referenced into a single file



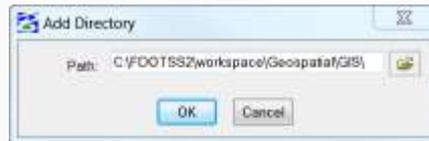
## Export to GIS



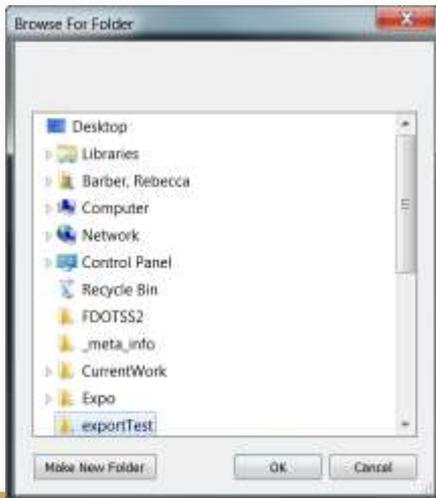
## Export to GIS



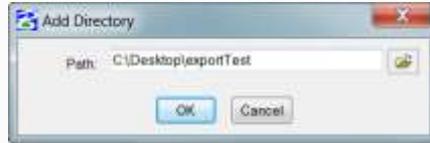
Default location:  
C:\FDOTSS2\workspace\Geospatial\GIS\



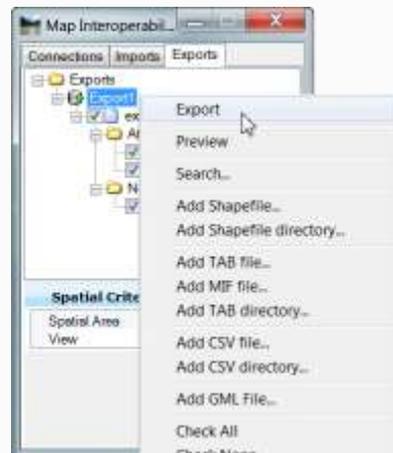
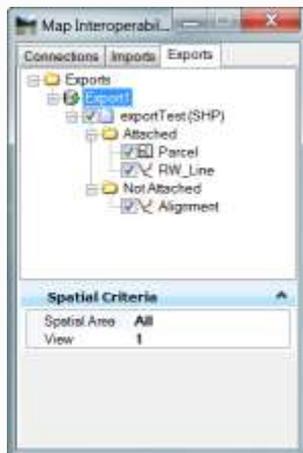
## Export to GIS



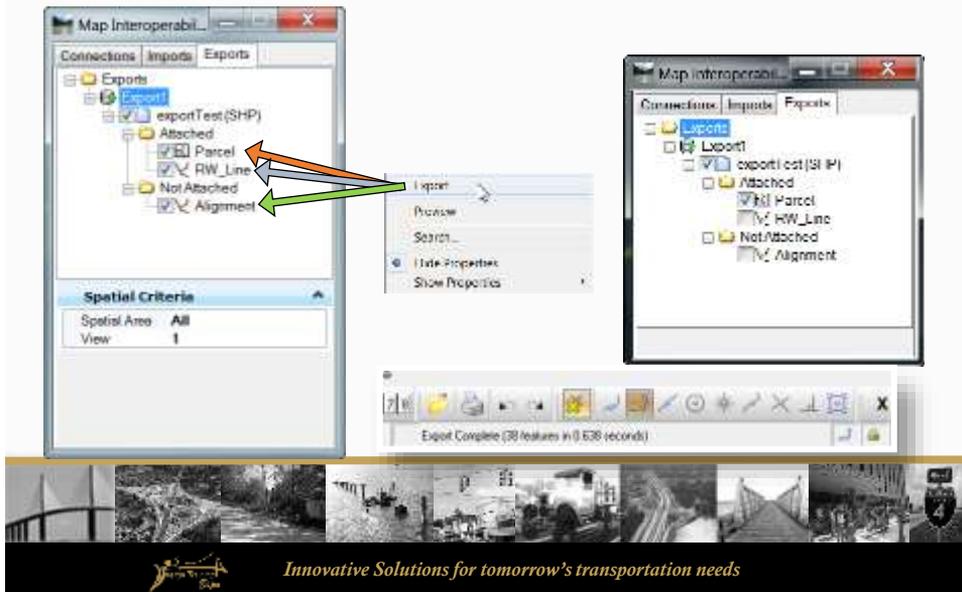
Now location is:  
Desktop\exportTest



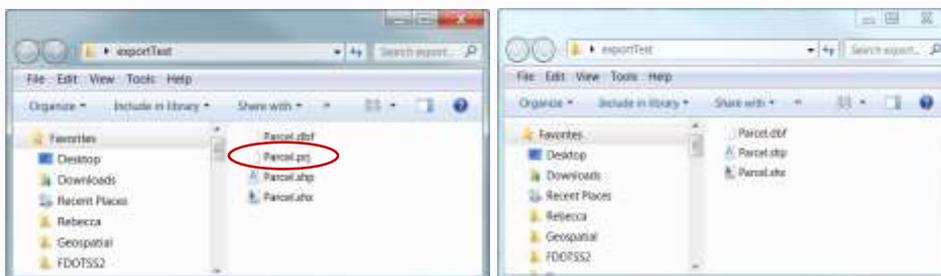
## Export to GIS



## Exporting Options



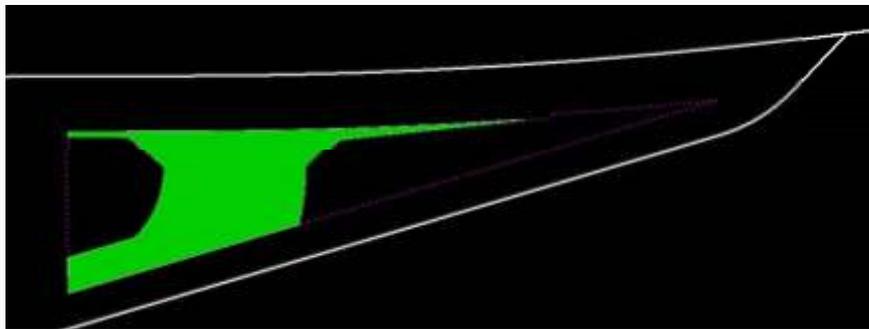
## Shapefiles



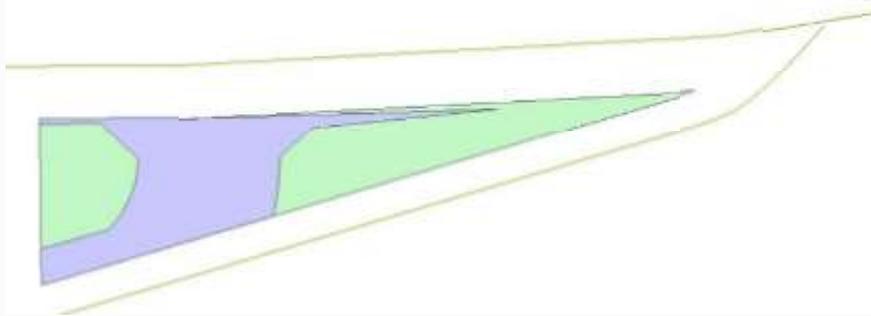
# Beta Testing



# 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.
- ESRI now supports arcs but the transfer tool (SHP) does not.
- However, in the next release of Map (Bentley release not FDOT release) and eventually the civil tools, the ESRI file geodatabase will be supported. That format does support arcs and some level of curves so this whole process should be simplified.
- (This is referring to the exportation of the line work into shape files)



## Curve Solution

- Modify the FDOT SS2 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`



## Missing Data/Null Values

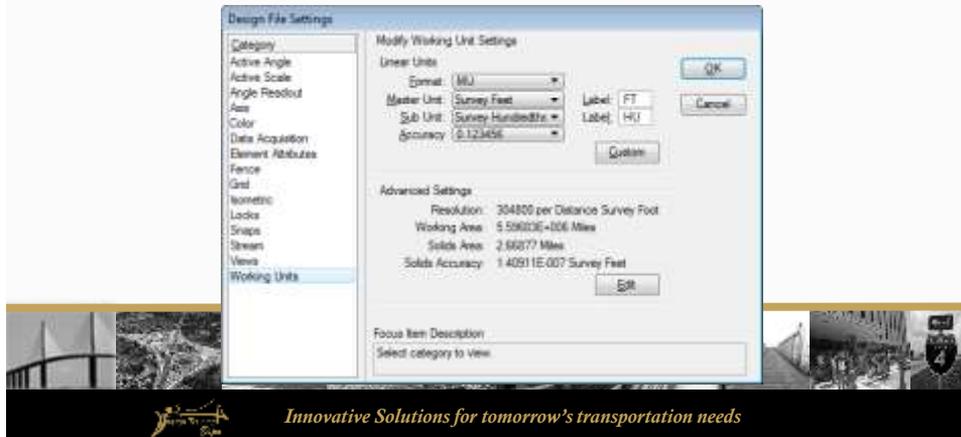
Station	County	FMSID	ARI	Name	Type	Type Code	RCD/Type	Date/Status	FDOT_Plan	ReleaseID	Section	Location	Range	SectionID	AccessID	ApprovalID	Geometry_A	Geometry_P
121	Volusia	121	SR 170	Volusia														
122	Volusia	122	SR 170	Volusia														

When ever new releases occur please let me know of any problems!



## Working Units

- Do not change the Working Units in the MicroStation file that are set to Survey Feet, because it WILL make a difference when projecting to State Plane Coordinates.



## Summary

- Process/Workflow
  - Develop a process/workflow allowing both CADD and GIS environments to interchange/share data
- This information could 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)



## Summary

- Enhanced querying activities to quickly support FDOT's consultants, partners, and customers
- Knowing what is located within the ROW by going to ONE place, with links to:
  - maps,
  - aerials,
  - documents and
  - metadata
- Resulting in cost savings in the areas of:
  - record management,
  - staff hours, and
  - informed decision making



Copy of presentation and Guidelines at:  
<http://www.dot.state.fl.us/officeofdesign/innovation/>



**CAD to GIS Process**

Create GIS features in either of our CADD environments per the FDOT CADD Manual. Export features and publish to GIS and create new layers for consumption by our GIS customers. Initial focus is on right of way lines, parcels and centerline (alignment). For more details, see the CAD/GIS Interoperability Presentation (PowerPoint, UMS) and CADD-GIS Guidelines (PDF, 11.6MB).

Supporting Content: [What's New \(2014-2015\)](#)

**Public Displays and Features**

We provide the following public displays and features:

- Public Displays
- Public Features
- Public Data
- Public Information

**Contact Information**

**Geographic Mapping Specialist**  
 Phone: (850) 414-4389  
 Email: [rebecca.barber@dot.state.fl.us](mailto:rebecca.barber@dot.state.fl.us)

July 2014 - 2015  
 2014 Surveying  
 Phone: (850) 414-4389  
 Email: [rebecca.barber@dot.state.fl.us](mailto:rebecca.barber@dot.state.fl.us)

Questions:



Contact:

Florida Department of  
 Transportation  
 Surveying and Mapping Office  
 Tallahassee, FL

Rebecca Barber  
 Geographic Mapping Specialist  
[rebecca.barber@dot.state.fl.us](mailto:rebecca.barber@dot.state.fl.us)  
 (850) 414-4389