This is a presentation on how the City of Edmond, Oklahoma developed its Traffic Sign Inventory database and maintains the database in an ArcGIS environment. This presentation is a case study of a project the City undertook with The CEDRA Corporation.

Topics to be Covered

- Brief Intro to CEDRA and City of Edmond
- Overview of Developing the Traffic Sign Inventory
- Traffic Sign Inventory Database Design
- Traffic Sign Inventory Collection Process
- Maintenance and Updating Process
- Summary then Q&A

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During the course of the presentation the above items will be discussed. The goal of the presentation is to illustrate how a Traffic Sign Inventory can be established and maintained in an ArcGIS environment. As we know, if a database is not maintained, it becomes useless pretty quickly. You'll also notice there are a number of signs that appear in some of the slides. You'll want to read them, some of them are very funny. Those of you interested in the link where these signs appear will want to visit this site:
https://www.bing.com/images/search?q=traffic+signs&qpvt=traffic+signs&qpvt=traffic+signs&qpvt=traffic+signs&FORM=IQFRML

Before We Begin

- How many have a Traffic Sign Database they maintain?
- How many are thinking of developing a Traffic Sign Database?

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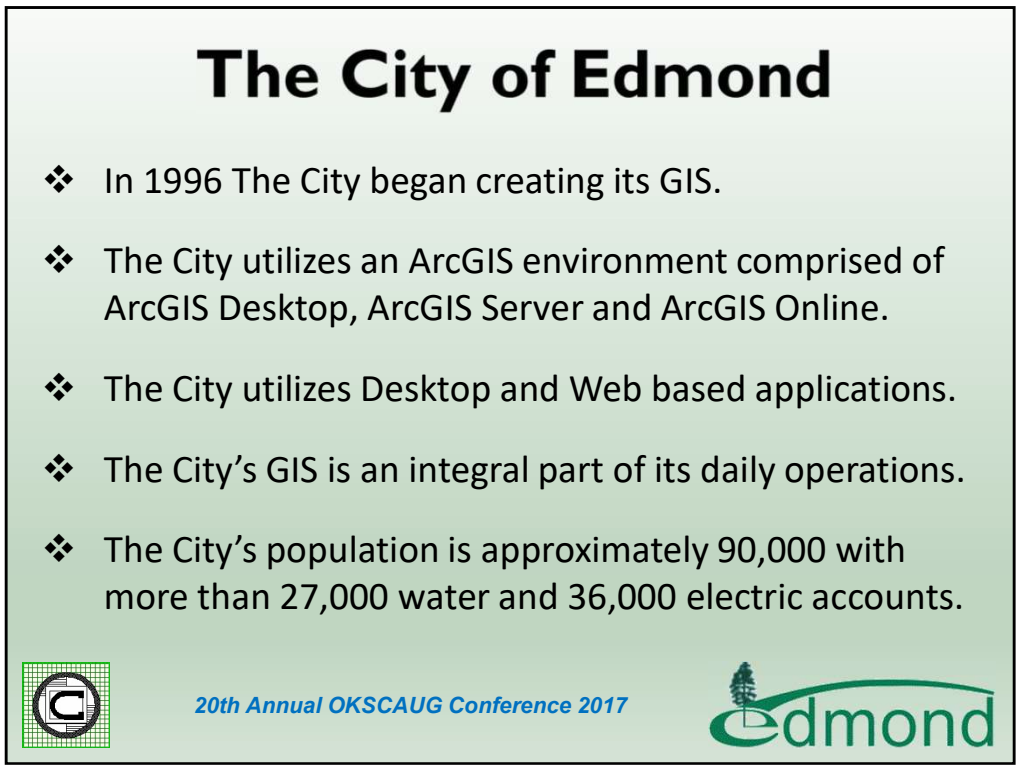
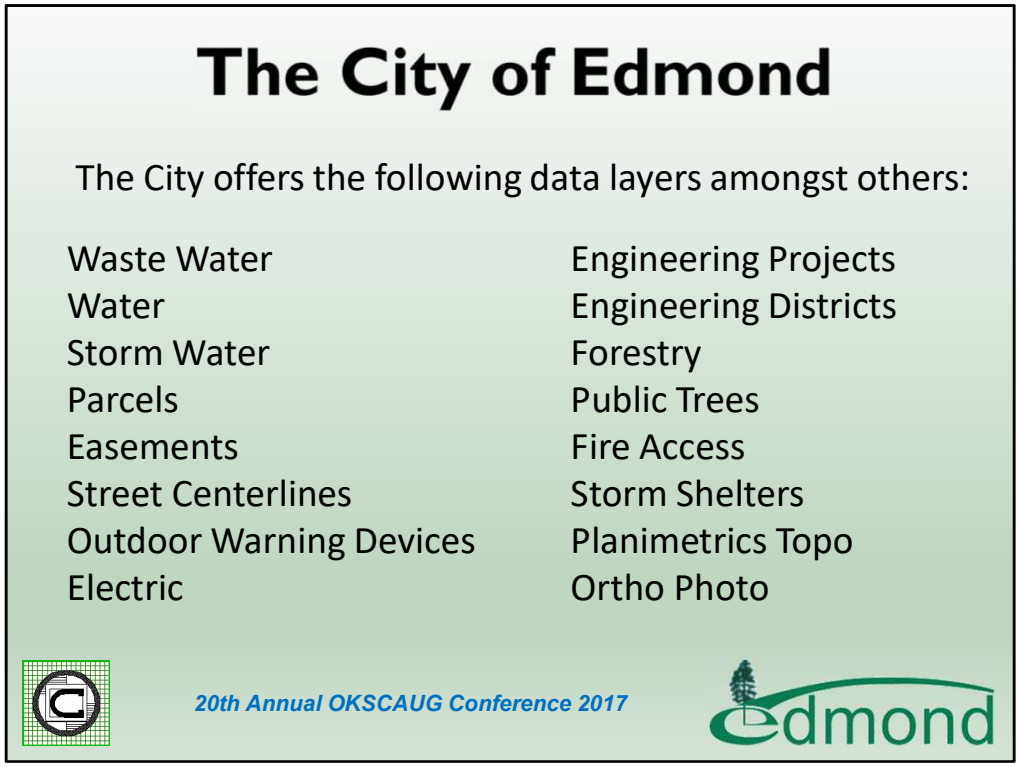
Before we start let's get a feel for the type of audience we have. How many folks currently have a Traffic Sign Inventory database? Now, how many folks are interested in developing a Traffic Sign Inventory database?

Now, how may people like puppies? Here's a little dog trivia for you. What is the most popular dog breed? The answer, Labrador Retrievers. German Shepherds, is number 2 and Golden Retrievers is number 3. The following link: **http://www.akc.org/content/news/articles/labrador-retriever-is-once-again-americas-most-popular-dog/** identifies the top breeds. For you dog lovers out there.

Here is a brief description of The CEDRA Corporation. As can be seen CEDRA has been in business for over 30 years and an Esri Business Partner for close to 25 years. CEDRA also has a great deal of experience in dealing with municipalities throughout the U.S.



Here is a brief description of The City of Edmond and how GIS is utilized throughout the City.



As you can see GIS is widely deployed throughout the City.

Reasons for Creating Inventory

- Municipal owned assets.
- Safety/Design and Manual on Uniform Traffic Control Devices (MUTCD) standards need to be met.
- Signage may be needed where it is not present.
- Prioritization for Repair/Replacement.
- FHWA mandate.

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Here are a few of the driving reasons a municipality should be interested in establishing a Traffic Sign inventory.

Developing the Inventory

- 2012 The City undertakes the establishment of a Traffic Sign Inventory database.
- The Manual on Uniform Traffic Control Devices (MUTCD) was used as a guide.
- In-house staff used to collect the data.
- Trimble GeoExplorer 6000 Series GeoXH equipment used.

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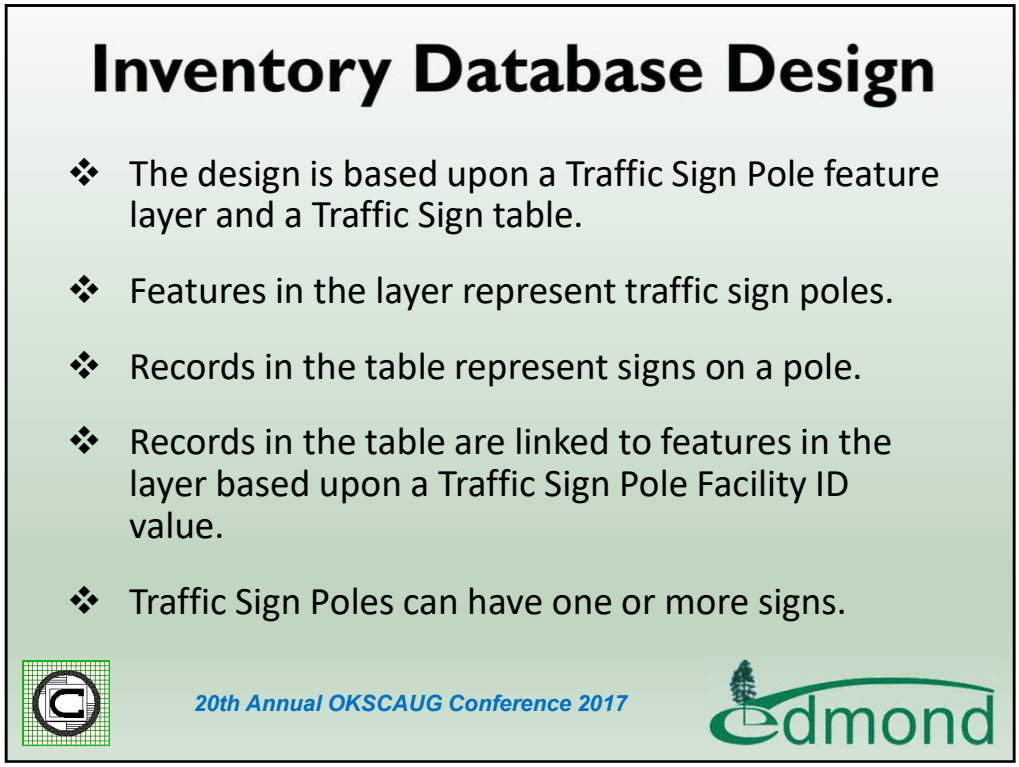
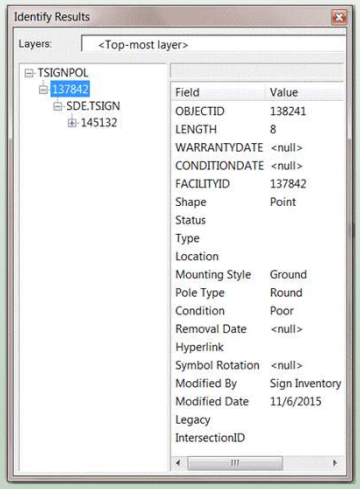
Edmond

In developing an inventory the first question that needs to be resolved is, will in-house resources be used or will the work be out-sourced. Some municipalities will use summer interns while others will use utility or line maintenance staff who have down time from their typical duties.



In designing the database, the City's approach was to have a feature layer represent the traffic sign poles and a table record represent a traffic sign. An ID assigned to the traffic sign pole would then be used to relate the records in the table to the feature in the layer.

Traffic Sign Pole Attributes



The FACILITYID attribute is the one that is used to relate the Traffic Sign to the Traffic Sign Pole

This value will appear in the Traffic Sign Table for every sign belonging to the Pole

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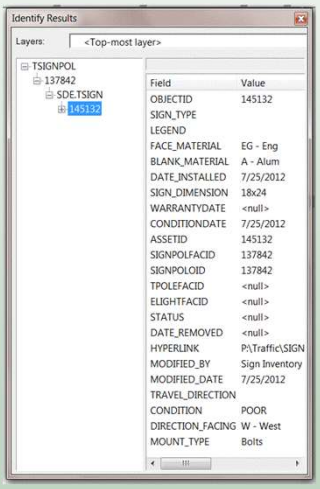
Here are a few of the attributes assigned to the Traffic Sign Pole Layer.

Traffic Sign Attributes



Pertinent Sign information such as the Sign's Face Material, Installation Date, Condition and so forth are stored in the Traffic Sign Table

This information can then be analyzed

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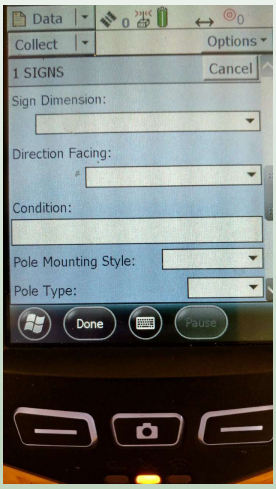
Here are a few of the attributes assigned to the Traffic Sign Table.

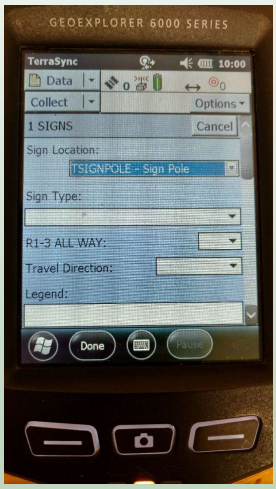
Inventory Collection Process

- A form filled template was created enabling the crews to enter the appropriate information.
- Multiple crews used to collect field data.
- 2.5 year period to collect majority of inventory.
- ~8000 Poles and >14,000 Signs collected.
- On going collection being performed.
- Digital images of signs were taken.

The collection process, as stated previously, was performed by City personnel over a multi-year period. Initially began with 3 staff members collecting data for 2.5 years which eventually dropped to 2 and now currently 1 who performs routine maintenance pick-up.

Field Collection Process





On average 1 to 2 minutes to collect data per sign, 17 attributes

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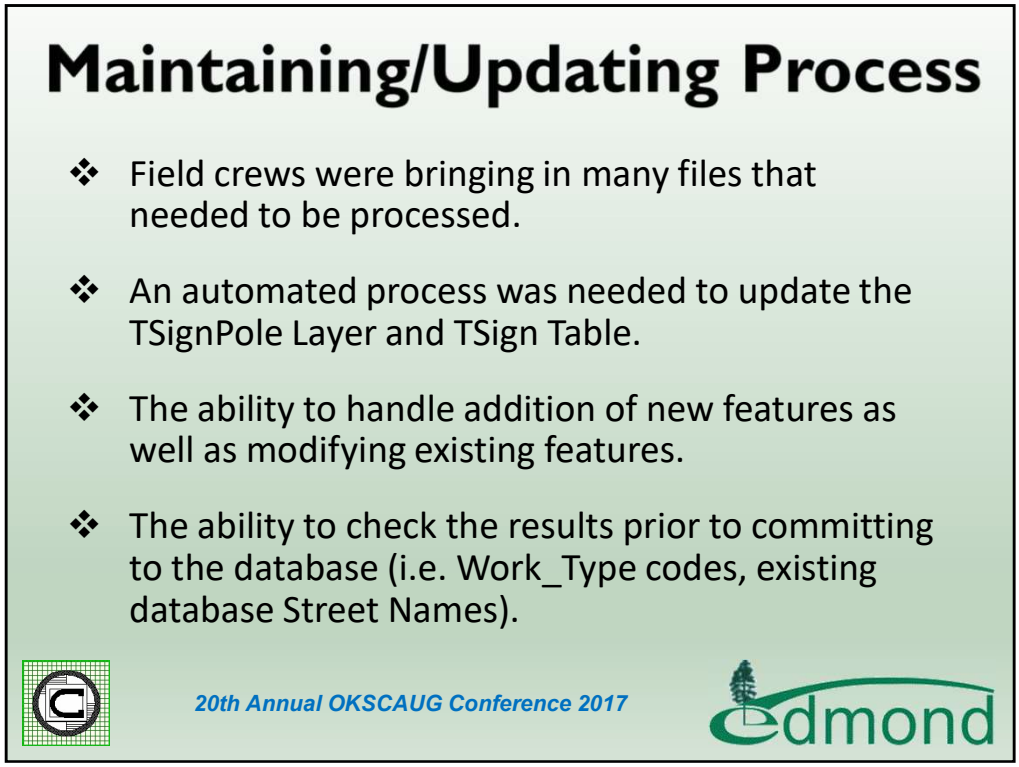
Here is an image of what the survey crews actually work with in the field. As you can see it's basically a form fill-out process that is employed. An average range of signs that was collected by a single field crew member in a day ranged between 60 and 70.

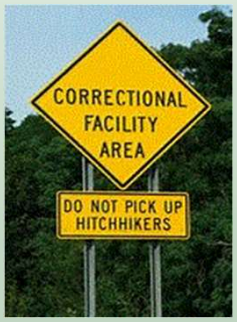


Once the field crews began to collect the data and bring it back into the office the next task was to update the database with the field information. The City initially began to manually process the information but quickly came to the realization that an automated process had to be created in order to effectively and efficiently process the survey information. In processing the data the automated process needed to handle various scenarios or cases. Specifically, 4 cases needed to be accounted for.

Case 1

New Post with One Sign

In this case, the field survey point is not close to any existing poles and there is only one field survey point at this location. Under this condition, the command adds one feature to the TSIGNPOLE layer and one record to the TSIGN table. The coordinates of the new Traffic Sign Pole feature will match those of the field survey point.



Here is the description for Case 1.

Case 2

New Post with Multiple Signs

In this case, there are field survey points that are not close to an existing pole and these points are within the proximity tolerance. Under this condition, the command will add one feature to the TSIGNPOLE layer and one record for every field survey point to the TSIGN table. The coordinates of the Traffic Sign Pole feature will be the average of the field survey points.

Here is the description for Case 2.

Case 3

Add Sign(s) to Existing Post

In this case the field survey point is close to an existing post. Additionally, the field survey point must have the WORK_TYPE attribute with the value NEW_SIGN assigned to it in order for this case to function. Under this condition, the command will add one record to the TSIGN table for every sign appearing at the existing post.

Here is the description for Case 3.

Case 4

Replace Sign(s) on Existing Post

In this case the field survey point is close to an existing post. Additionally, the field survey point has the WORK_TYPE attribute value set to "REPLACE_SIGN" or the attribute is not present. In order to determine which sign is to be replaced the SIGN_TYPE and LEGEND fields in the field survey shapefile are examined. Using the SIGN_TYPE attribute, a sign code is extracted using the space character as the delineating character.

Here is the description for Case 4.

Case 4 (cont'd)

Replace Sign(s) on Existing Post

In the TSIGN table the records associated with a post will contain the post's Facility ID. These records are then examined to make a match on the sign code. If there is only one record in the TSIGN table the existing record is modified using the TSIGN field mapping information. If there are two or more records the processing varies depending upon the sign code value.

Substantial Custom Logic Involved in this Case

As you can see Case 4 involves some custom logic that was implemented to facilitate the updating of existing signs.

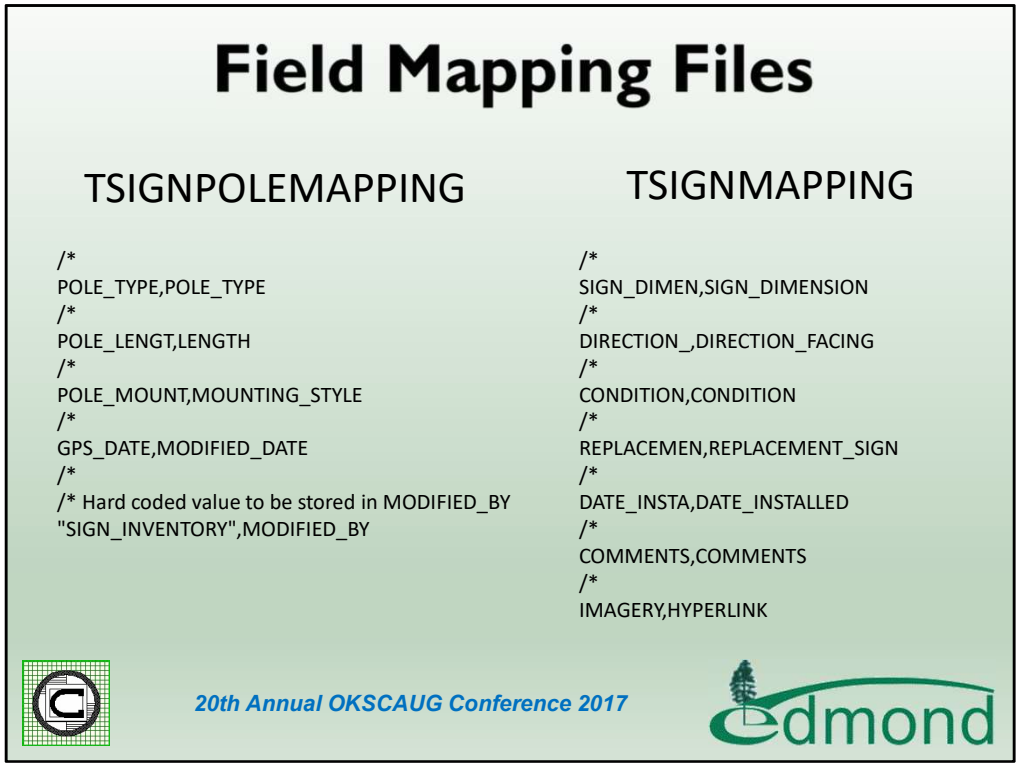
All Cases

Attribute Assignment

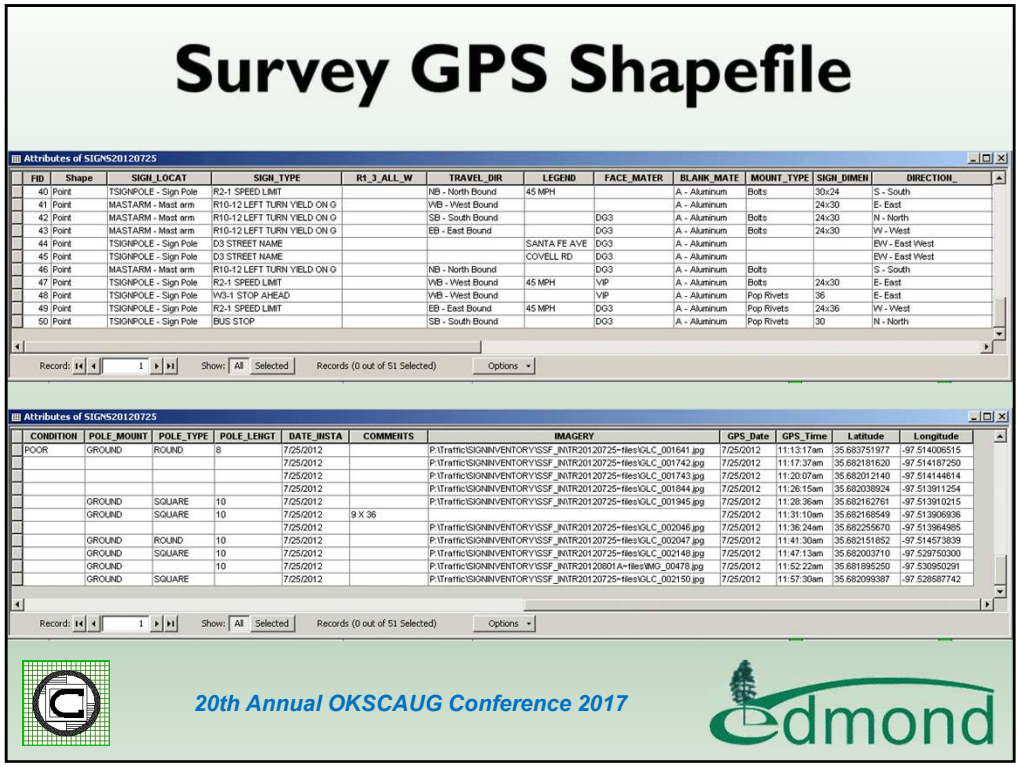
In all 4 cases previously mentioned, field survey data needed to be transferred to the appropriate fields in the Traffic Sign Pole Layer and Traffic Sign table.

Two text files called TSIGNPOLEMAPPING and TSIGNMAPPING files are used to indicate what fields the survey information is to be stored in the Traffic Sign Pole Layer and Traffic Sign table.

For all 4 cases the information collected by the survey crew had to be transferred to the feature layer point and the table records. To provide flexibility Attribute Transfer Files were employed. In so doing should the City wish to incorporate new attributes or use different field name, no programming is required.

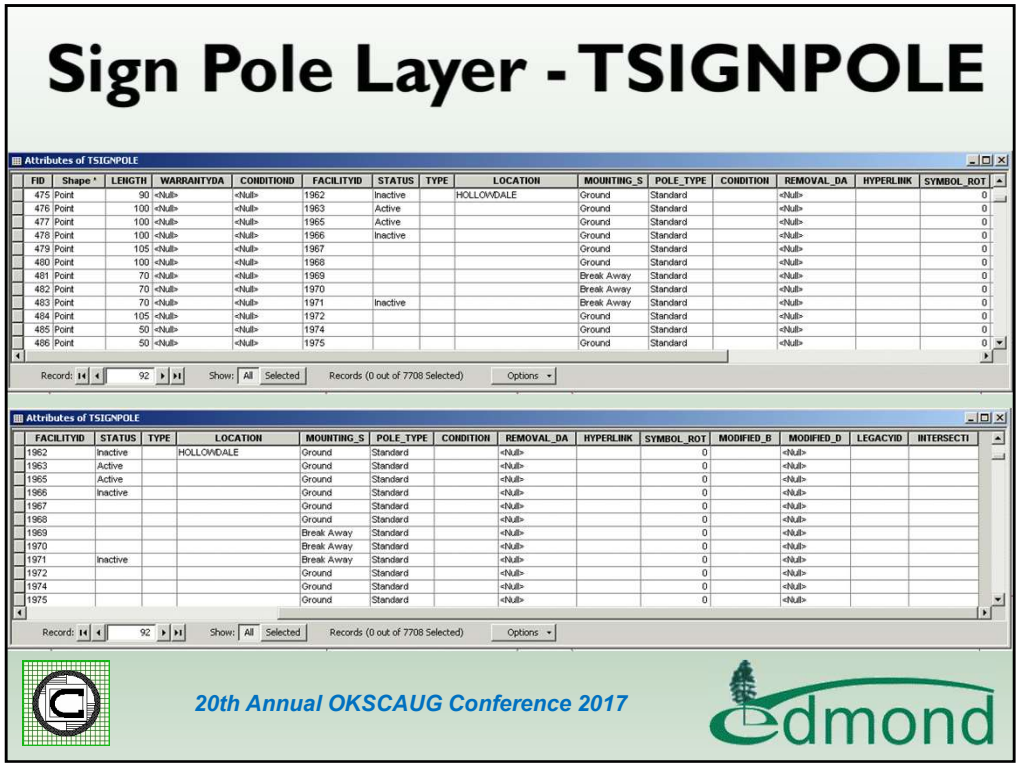


Here are excerpts of the Field Mapping files used for transferring data from the Survey shapefile to the Pole Feature Layer (TSIGNPOLE) and Sign Table (TSIGN). The /* characters denote a comment line, which is disregarded during processing. On a data line two entries are specified with the first being the attribute in the Survey shapefile and the second being the attribute in the Pole Feature Layer or Sign Table that the Survey shapefile attribute value is to be transferred to.

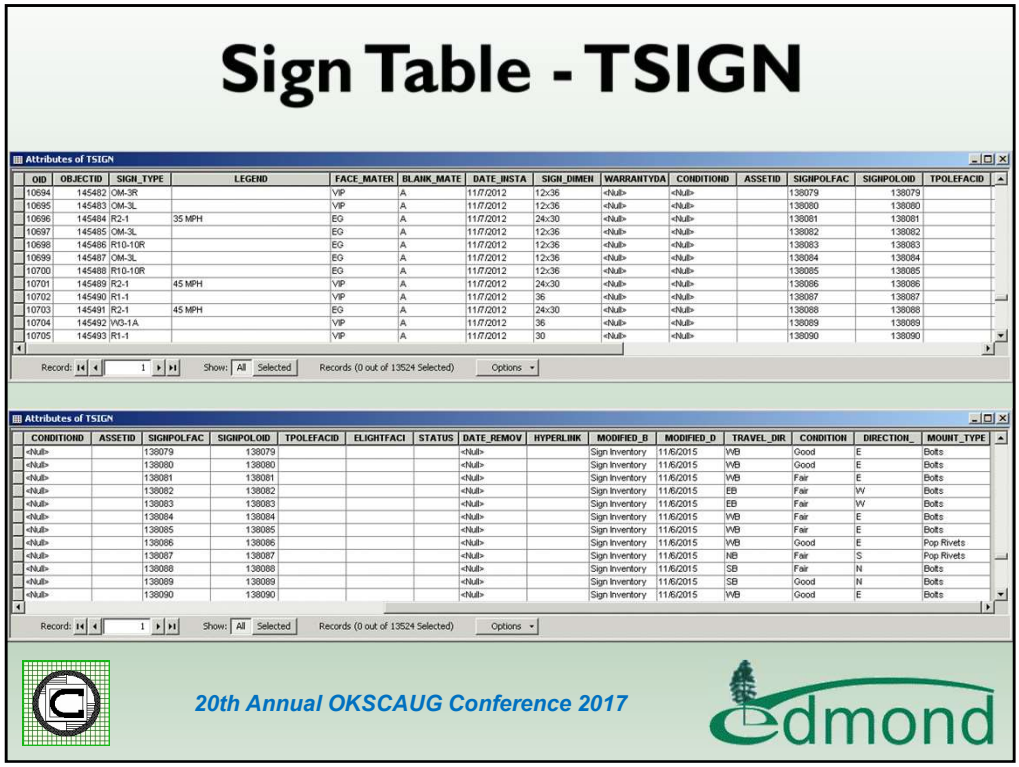


The field survey file is brought into ArcMap as a point shapefile containing the various information collected by the field crew.

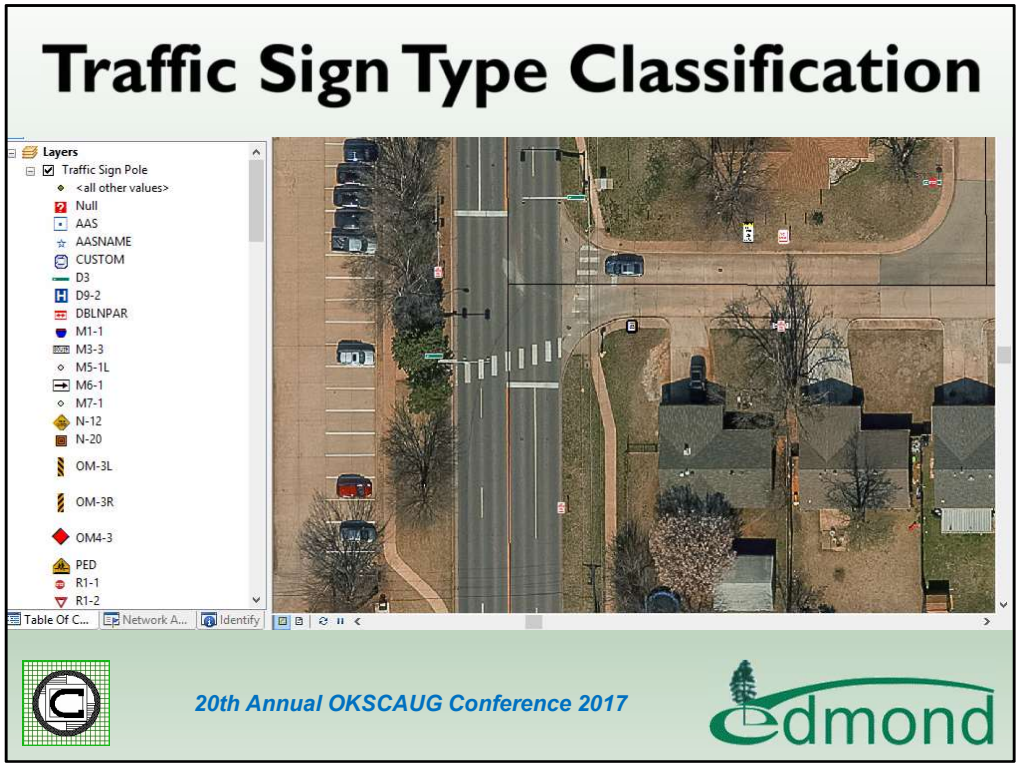
Sign Pole Layer - TSIGNPOLE



Here is the attribute table for the Traffic Sign Pole feature layer.

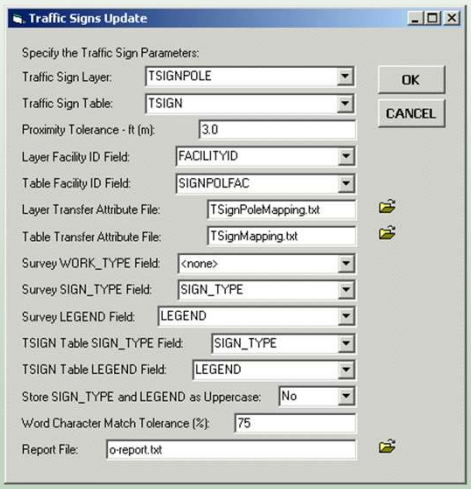


Here is the attribute table for the Traffic Sign Table. With these 3 data sources, the Survey GPS Shapefile, Sign Pole Layer and Sign Table, an ArcMap document file is created containing these data sources. As additional Survey GPS Shapefiles are generated, these can simply be added to the ArcMap document file for processing.



Here is a display of the ArcMap document illustrating the classification used to distinguish the various sign types.

Traffic Sign Update Command



Prior to executing this command the user selects the GPS Shapefile(s) to be processed in the Table of Contents

A formal report file contains the results of the processing

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Using the Traffic Sign Update Command that was created, the user is able to take a survey shapefile and update the Traffic Sign Pole feature layer and the Traffic Sign Table. As you can see there are a number of parameters that need to be specified. The user is able to save these settings and recall them prior to processing another survey shapefile. So that the user can fill out the form once and simply recall the previous values when the next survey shapefile is to be processed. In addition to updating the Traffic Sign Pole feature layer and Traffic Sign Table, a formal report file is generated which the user can review.

The Report File - Header

```
                    Traffic Sign Data Processing

Traffic Sign Layer: TSIGNPOLE
Traffic Sign Table: TSIGN
Layer Transfer Attribute File: TSignPoleMapping.txt
Table Transfer Attribute File: TSignMapping.txt
Proximity Tolerance: 3

TSIGNPOL Highest Facility ID currently assigned is: 140271
```

The formal report file is used to review the quality of the data collected by the field crew. The Header portion of the file simply contains some base information as shown above.

The Report File – Part 1

```
PART 1: Processing the active Survey Data Shapefiles


Processing SIGNS20120725 data

 1. FID 0 existing Traffic Sign
 2. FID 1 existing Traffic Sign
 3. FID 2 existing Traffic Sign
 4. FID 3 within 3 existing Traffic Signs
 5. FID 4 within 3 existing Traffic Signs
 6. FID 5 existing Traffic Sign
 7. FID 6 existing Traffic Sign
 8. FID 7 existing Traffic Sign
 9. FID 8 existing Traffic Sign
10. FID 9 existing Traffic Sign
11. FID 10 existing Traffic Sign
12. FID 11 existing Traffic Sign
13. FID 12 new Traffic Sign
14. FID 13 existing Traffic Sign
15. FID 14 existing Traffic Sign
```

Part 1 of the file contains a listing of the survey points and whether the survey point denotes a new traffic sign pole or an existing one.

The Report File – Part 1

The end of Part 1 contains a summary of the survey data that was processed

```
Total Points Processed: 51
Total Points not close to Existing Sign: 5
Total Points close to Existing Sign: 42
Total Points close to Multiple Existing Signs: 4
```

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At the end of Part 1, the report file contains a summary of the total points processed, the number of points denoting new traffic sign poles, the number of points close to existing traffic sign poles and the number of points that are close to multiple traffic sign poles. The shots close to existing traffic sign poles need to be examined and then reprocessed, perhaps using a smaller proximity tolerance value.

The Report File – Part 2

```
 PART 2: Adding New Features to TSIGNPOLE and New Records to TSIGN


1. Layer: SIGNS20120725 FID 12 added to TSIGNPOL and assigned Facility ID 140272
   Table: SIGNS20120725 FID 12 added to TSIGN and assigned Facility ID 140272

2. Layer: SIGNS20120725 FID 20 added to TSIGNPOL and assigned Facility ID 140273
   Table: SIGNS20120725 FID 20 added to TSIGN and assigned Facility ID 140273

3. Layer: SIGNS20120725 FID 24 added to TSIGNPOL and assigned Facility ID 140274
   Table: SIGNS20120725 FID 24 added to TSIGN and assigned Facility ID 140274

4. Layer: SIGNS20120725 FID 31 added to TSIGNPOL and assigned Facility ID 140275
   Table: SIGNS20120725 FID 31 added to TSIGN and assigned Facility ID 140275
   Table: SIGNS20120725 FID 32 added to TSIGN and assigned Facility ID 140275

Total New Traffic Poles Created: 4
Total New Traffic Sign Data Created: 5
```


Part 2 of the report contains a listing of the new traffic sign poles and new traffic signs. At the bottom of Part 2 is a summary of the total new poles and signs that were created.

The Report File – Part 3

```
PART 3: Modifying Existing Data in TSIGNPOLE and the Table TSIGN


 1. Layer: SIGNS20120725 FID 0 within proximity of TSIGNPOL FID 2328
           SIGN_TYPE: W3-1 STOP AHEAD LEGEND:

           Modified TSIGNPOL OID 2328

    Table: SIGNS20120725 FID 0 within proximity of TSIGN OID 4249
           SIGN_TYPE: W3-1A           LEGEND: STOP AHEAD SYMBOL

           Modified TSIGN OID 4249 SIGN_TYPE: W3-1 LEGEND:

 2. Layer: SIGNS20120725 FID 1 within proximity of TSIGNPOL FID 987
           SIGN_TYPE: R1-1 STOP LEGEND:

           Modified TSIGNPOL OID 987

    Table: SIGNS20120725 FID 1 within proximity of TSIGN OID 2157
           SIGN_TYPE: R1-1      LEGEND:
    Table: SIGNS20120725 FID 1 within proximity of TSIGN OID 3164
           SIGN_TYPE: R1-3-4    LEGEND:

           Modified TSIGN OID 2157 SIGN_TYPE: R1-1 LEGEND:
```

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Part 3 of the report contains a listing of the survey points that were close to an existing traffic sign pole and the action that was taken based upon the SIGN_TYPE value.

The Report File – Times

At the end of the report file is the date and time the report file was generated

```
Started:  02:27:11 PM 7 Mar 2017
Stopped:  02:27:31 PM 7 Mar 2017
Duration: 00:00:20
```

At the very end of the report are the processing start and end times as well as the duration. As can be seen it did not take very long to process the 51 points in this file.

Update Confirmation

- The Edits made to the TSignPole Layer and TSign Table are not committed but rather are placed in an Undo operation.
- The User can review the Report File and check if any problems exist.
- If there are problems the User can Undo the operation, make the appropriate modifications and then re-execute the command.

Once the processing has finished, no edits have been confirmed to the database. Rather, the Editor is in an edit state where the modifications can be undone using the Undo command or by stopping the Editor and not saving the edits. This approach allows the user to review the report file and determine if any modifications need to be made either to the survey shapefile or the existing database depending upon the case.

Summary

- Without the Traffic Sign Updating Tool a series of steps had to be manually performed that was time intensive and had to be repeated for every GPS file that was brought into the office.
- The Traffic Sign Updating Tool greatly reduced the time to process the GPS files and virtually eliminated user processing errors since an automated repeatable process was in place.

Series of Steps to Couple Button Clicks

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As you probably are aware more and more municipalities are establishing traffic sign inventories. Some municipalities are even mandated to have such an inventory. The thing to remember is that these databases can get very large and you need to have a mechanism for efficiently transferring the GPS information collected in the field to the database with the ability to have some sort of quality control on the transferring. The Traffic Sign Updating Tool provided this capability for the City.

Thank you!

Questions And Answers

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Thank you for viewing this presentation and if you should have any questions or comments feel free to contact Nick Tonias at 585-414-6541 or nicktonias@cedra.com.