

Building a GIS from the Beginning: Part 1: Gathering your data

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Building a GIS Part 1

Before you start

Determine

Type of Database

Feature Datasets

Types of Feature Classes

Projection to be used



Building a GIS Part 1

Topics of discussion

Determine type of database

Parts of a database

Data sources

Creating a database

Adding features to a database



Projections

Represents how features from a round Earth are displayed on a flat map

3611 Projections around the world

Universal Transverse Mercator

State Plane Coordinate System

Web Mercator

See Attachment 1

Map of 5 state projection



Universal Transverse Mercator

Universal Transverse Mercator

Good for long distances

North & South

Zones 01 to 19 for USA



State Plane Coordinate System

State Plane Coordinate System

Good for Smaller more contained systems

124 or 125 State Projections (NAD83)

East & West

WKID

Unique Identifier

See Attachment 2 WKID Codes



Web Mercator

Good for large areas

Web mapping standard

One projection of the world



Choosing an ArcGIS Database

Three standard types

SDE Database

File Geodatabase

Personal Geodatabase

Each appears very similar in ArcCatalog and have similar functionality



SDE Database

SDE Database

Large Enterprise system

Hardware requirements

Multiple editors

Allows links to many other systems



File Geodatabase

File Geodatabase

Small to massive Datasets

Up to 1 Terabyte

Single Editor

Read only features



Personal Geodatabase

Personal Geodatabase

Small to large datasets

Up to 1 Gigabyte

Single Editor



Parts of a database: Database

Database

Structured set of data

Features

Relationships

Tables

Grids

Photos

Tins

Etc.



Parts of a database: Feature Dataset

Feature Dataset

Groups related Feature Classes

Electric

Land base

etc...

Contains Projection information



Parts of a database: Feature Class

Groups similar types of features

Stores tabular and spatial information

Points

Transformers

Switches

Lines

OH Primary

UG Primary

Polygons

Parcels

Lakes



Parts of a database: Feature Class

Field

Column in the table of a table or feature

Allows separation of individual Attributes

Domains are assigned to Fields

(Domains define what can be entered as an attribute)

Attribute

A specific value entered in a field that helps define a feature



Parts of a database: Feature Class

Subtype

Classifies specific features in a feature class

Assigned in ArcCatalog

Example:

Transformers

Overhead

Underground

Step



Parts of a database: Tables

Tables contain tabular data

Can be linked to features

Requires a unique ID in both feature and table

One entry can be linked to multiple features

Join

Relate

Relationship Class



Join

Join performed in ArcMap in an MXD

Attribute must exist in both table and feature

Can update fields in a feature from join

Allows Search by Attribute of JOINED table

Allows Symbology based on attributes in JOINED table

Can JOIN to many tables or features



Relate

Relate performed in ArcMap in an MXD

Allow you to see structured data using identify tool

Can RELATE many tables and features

Cannot update feature attributes on a relate



Parts of a database: Domains

Domains are coded values in a database

Can be assigned to a Field in a Feature Class or Table

Controls what can be entered in as in an attribute in a field.

Example: Phase only allows

A, B, C, AB, AC, BC or ABC



Parts of a database: Geometric Network

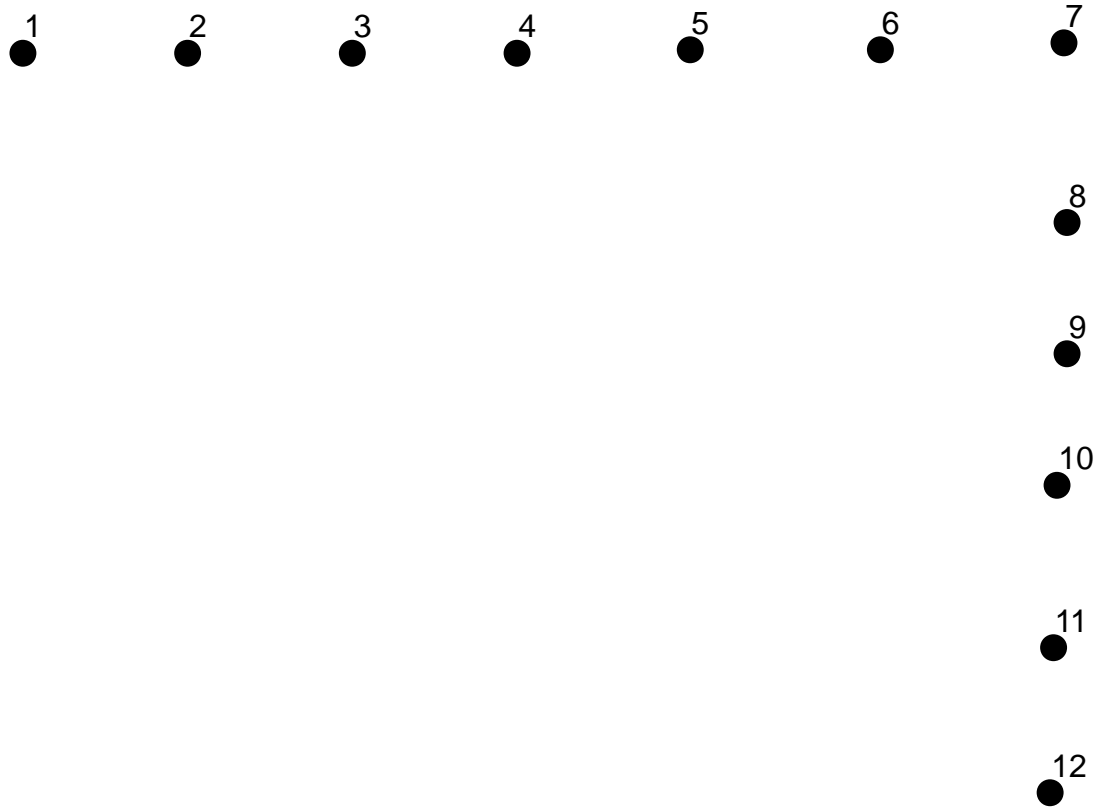
Created in ArcCatalog

Connects point and line features from a source to the end

Think of it as a DOT to DOT puzzle



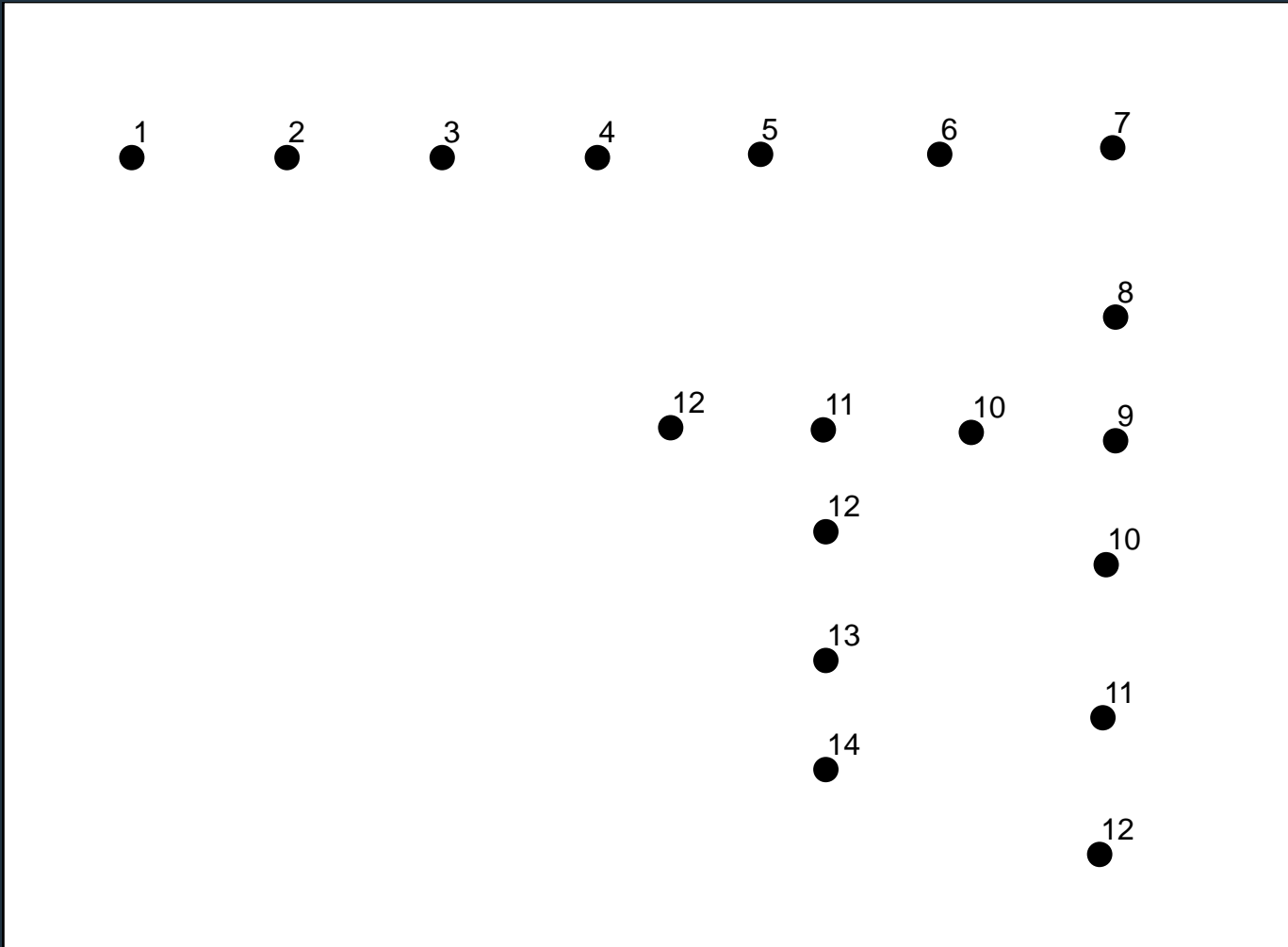
Parts of a database: Geometric Network



MID - WEST



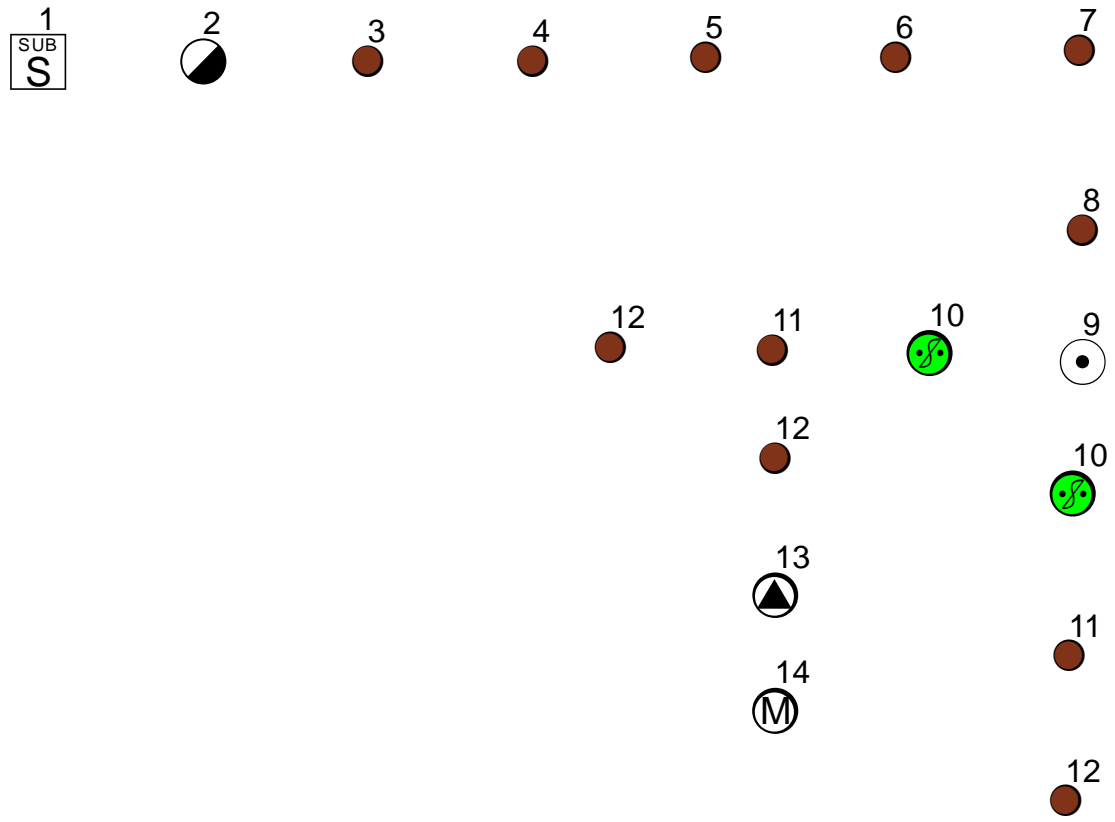
Parts of a database: Geometric Network



MID - WEST



Parts of a database: Geometric Network

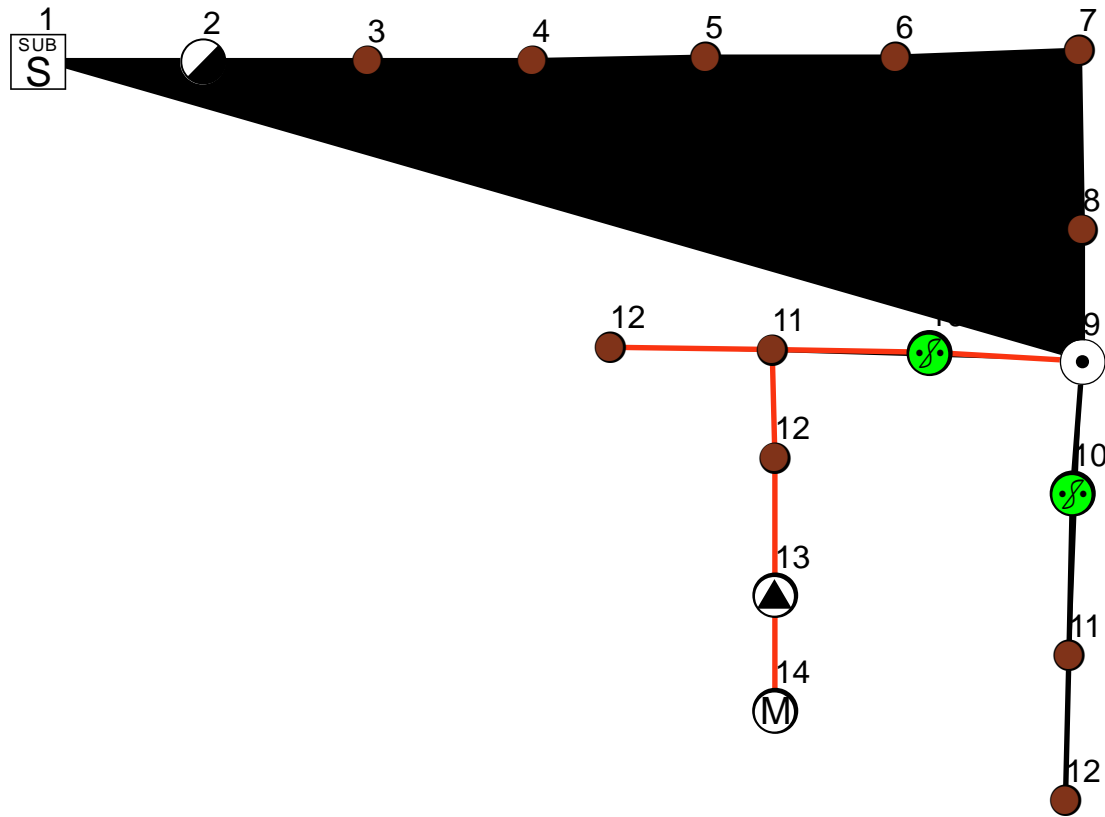


MID - WEST





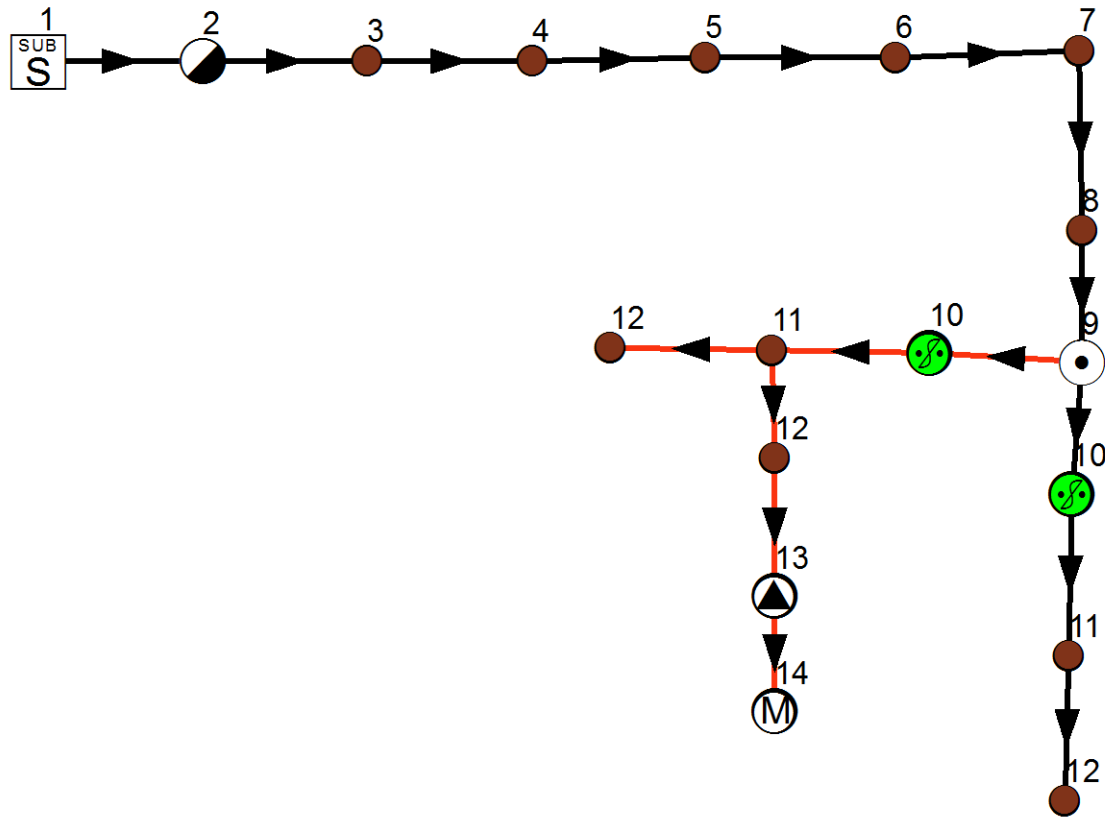
Parts of a database: Geometric Network



MID - WEST



Parts of a database: Geometric Network



MID - WEST



Data Sources

Shapefile

Note: Shapefiles are cross platform and version compatible. However they have naming restrictions for fields limited to 10 Characters

AutoCad

Geodatabases

Tables

Excel

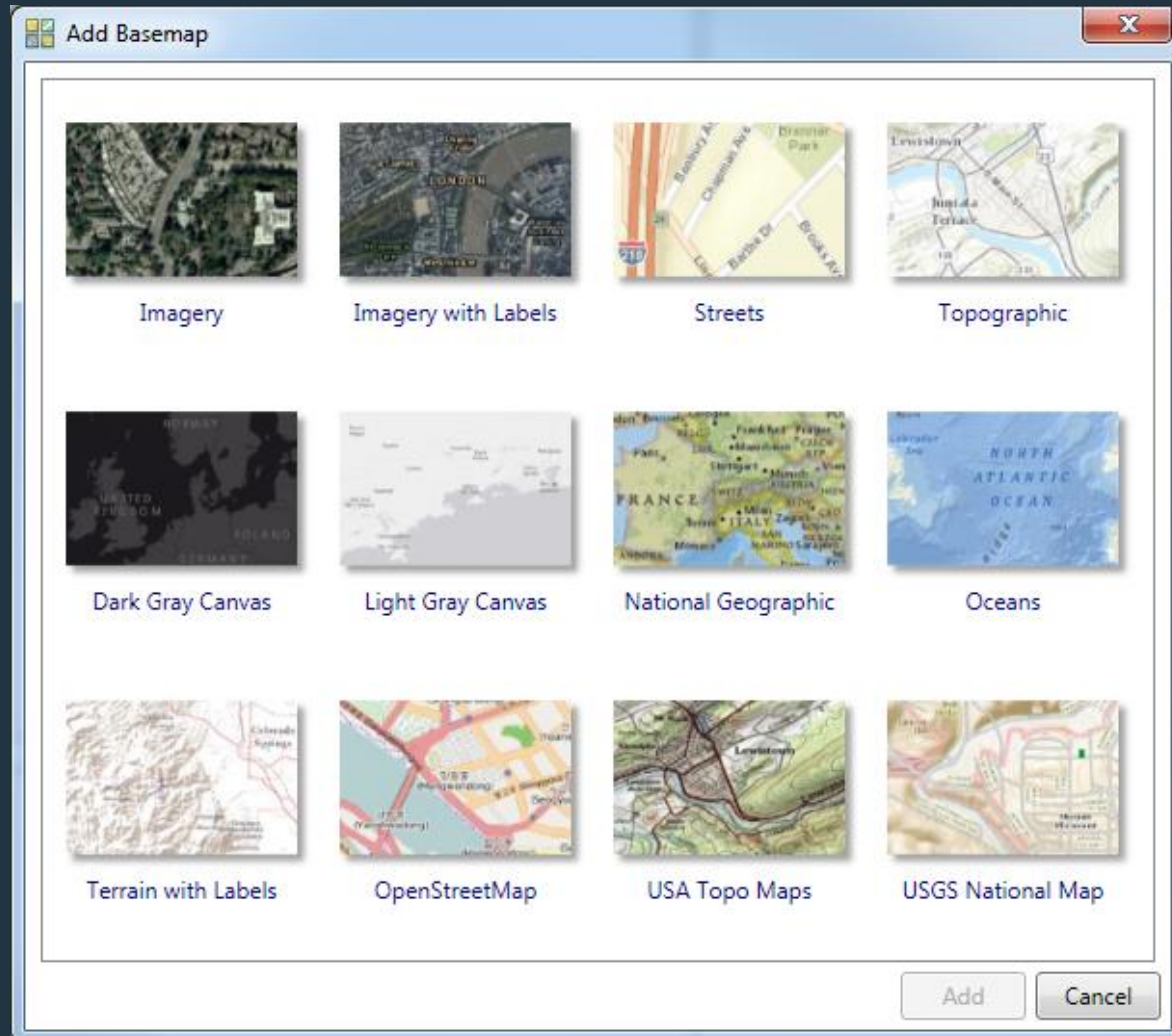
CSV or TAB delimited

MS Access

Online Sources



Data Sources: Online provided by ESRI





Online Data provided by ESRI and other GIS users

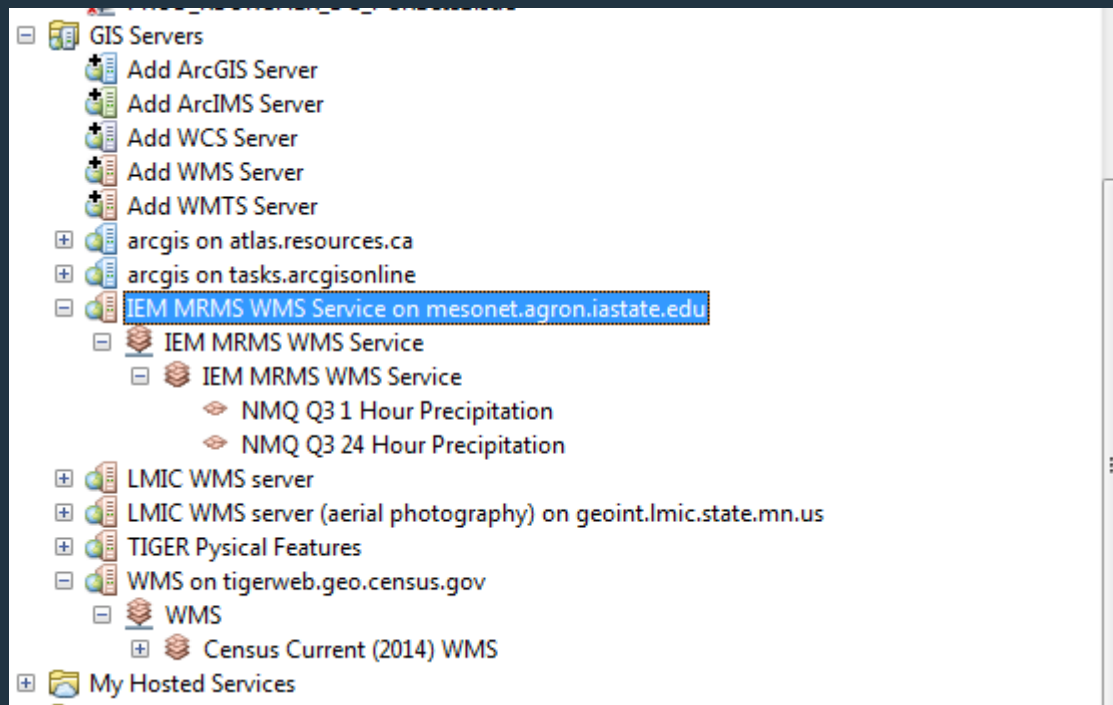
The screenshot displays the ArcGIS Online interface. At the top left is the ArcGIS Online logo. A search bar contains the text "Search ArcGIS Online...". To the right of the search bar are buttons for "Data" and "Groups", and a "Sign in" link. Below the search bar is a "Featured" section with a navigation arrow. The main content area is titled "Featured" and shows a list of map services arranged by "Title". The list includes:

- 2011 Vessel Density (map service)**: MarineCadastre.gov map service featuring density data for vessels equipped with AIS transponders during the year 2011. Map Service by ODAT_noaa, 8/23/2015. Details Add
- 2011 Vessel Traffic (AIS)**: Traffic data for vessels equipped with AIS transponders during the year 2011. Map Service by MarineCadastreAdmin, 9/24/2015. Details Add
- 2014 USA Crime Index** (ESRI): This layer shows the total crime index in the U.S. in 2014, by state, county, ZIP Code, tract, and block group. ArcGIS Online subscription required. Map Service by esri, 4/29/2015. Details Add
- 2014 USA Personal Crime** (ESRI): This layer shows the personal crime index in the U.S. in 2014, by state, county, ZIP Code, tract, and block group. ArcGIS Online subscription required. Map Service by esri, 4/29/2015. Details Add
- 2014 USA Property Crime** (ESRI): This layer shows the property crime index in the U.S. in 2014, by state, county, ZIP Code, tract, and block group. ArcGIS Online subscription required. Map Service by esri, 4/27/2015. Details Add
- 2015 USA 401(k) Retirement Plans** (ESRI): This layer shows the market potential that an adult has a 401(k) retirement plan in the U.S. in 2015, by state, county, ZIP Code, tract and block group. ArcGIS Online subscription required. Map Service by esri, 4/27/2015. Details Add

At the bottom of the list, there are navigation links: "1 2 3 4 Next".



Online Data from GIS Servers





Other data types supported

- DBMS
- Spreadsheets
- CAD
- Smallworld
- Images
- PDF



Live Demo portion 😊

Demo

- Create a database

- Create and add features

Best Practices

- Use names that make sense

- Avoid spaces or special characters

 - Other than underscore “_”

- Avoid really long names



Demo: Creating a Database

In ArcCatalog

Create the database

Create Feature Dataset(s)

Create or add Feature(s)



Demo: Adding Features to a Geodatabase

Shapefile: Road centerlines provided by the state.

<http://www.mngeo.state.mn.us/>

AutoCAD: Parcel data provided by the county

Geodatabase: Electric Dataset provided courtesy of

BENCO Electric Cooperative



Geometric Network: From Electric Dataset

Table: Comma Delimited table from contractor of Pole locations. See attachment 3

User: Manual roads created by the user



In case of DEMO failure ☹️

The following slides are the demo portion.

These slides were created in case there are issues performing a live demo or for the user to download the presentation from MWEUUG for future reference.



Create the database: ArcCatalog

In ArcCatalog

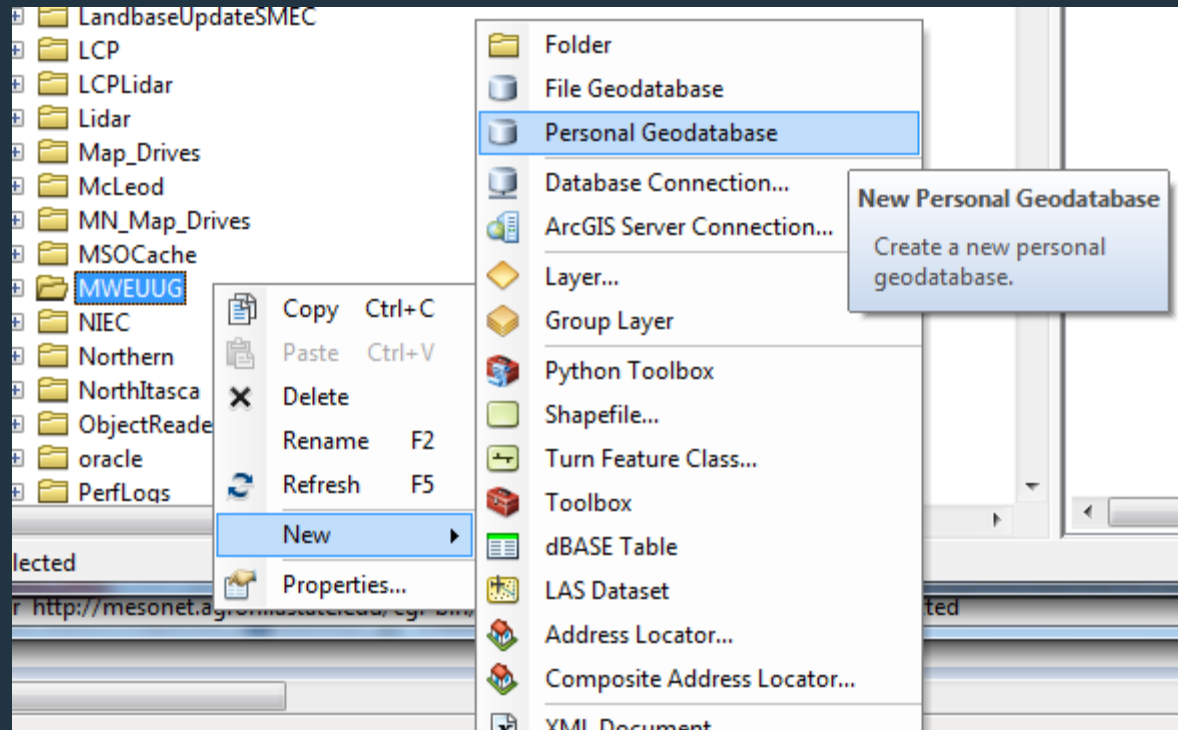
Navigate to the folder you wish to create your database

Either create a new folder or right click on the folder you wish to create your database

Select New>Personal or File Geodatabase



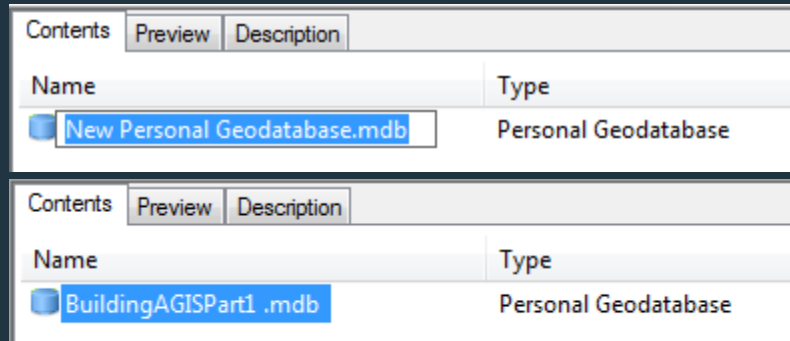
Create the database: ArcCatalog



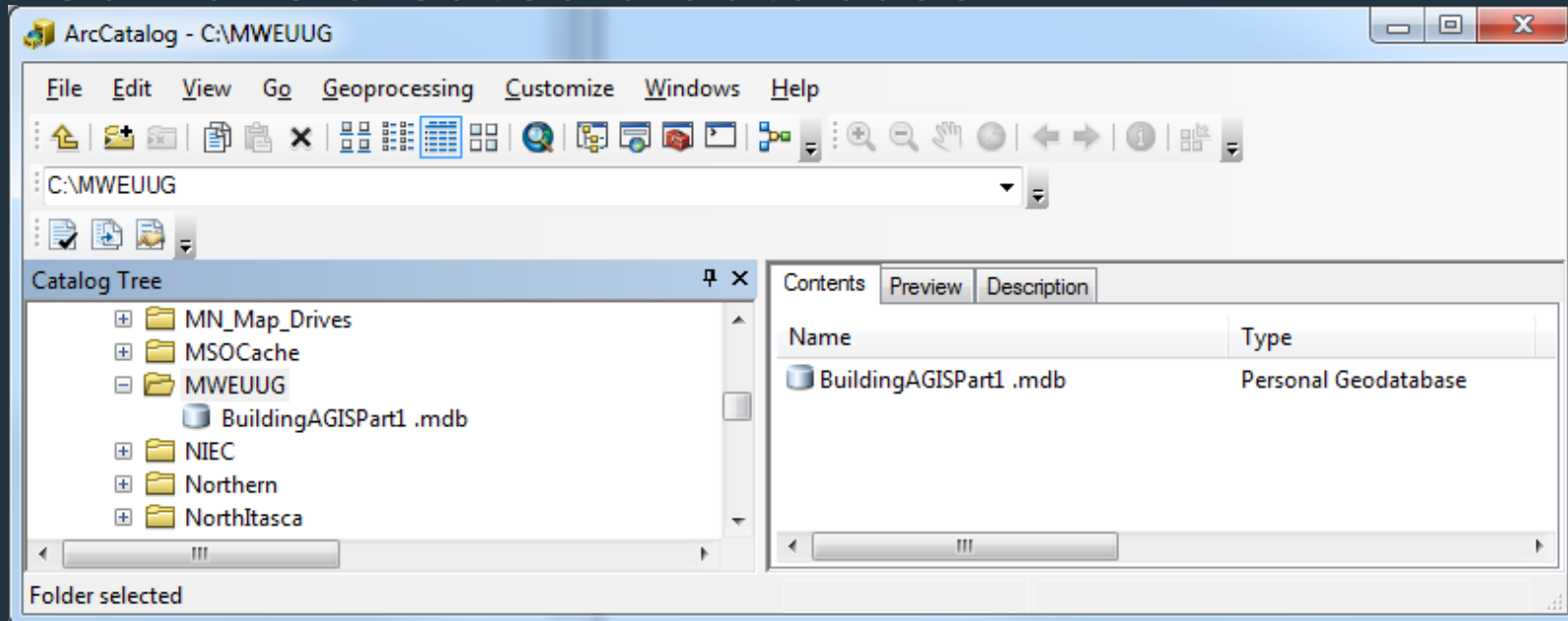


Name the Database: ArcCatalog

- Type in a name



You have created a database.





Create a Feature Dataset: ArcCatalog

Right click on your database and select

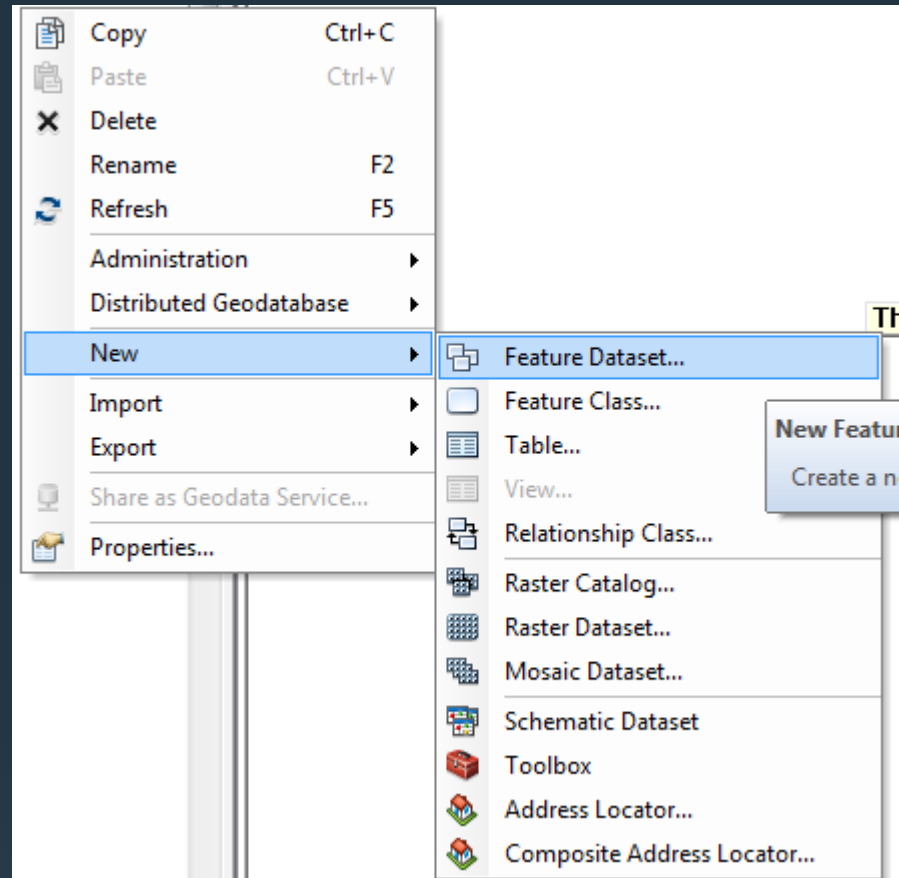
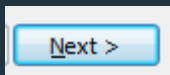
New>Feature Dataset

Give it a name

New Feature Dataset

Name:

Click Next





Feature Dataset: Select Projection

VERY IMPORTANT STEP

This needs to be correct. If your projection is the wrong one any data you add in the future may not line up where it is supposed to.



Feature Dataset: Select Projection

VERY IMPORTANT STEP

Previous projects you have used may appear in the Favorites.

You can select a favorite

You can navigate to a favorite

You can search by WKID code



Feature Dataset: Select Projection

- Select Favorite
- Select Next

Next >

New Feature Dataset

Choose the coordinate system that will be used for XY coordinates in this data.

Geographic coordinate systems use latitude and longitude coordinates on a spherical model of the earth's surface. Projected coordinate systems use a mathematical conversion to transform latitude and longitude coordinates to a two-dimensional linear system.

Type here to search

Favorites

- GCS_WGS_1984
- NAD_1983_Lambert_Conformal_Conic
- NAD_1983_StatePlane_Minnesota_South_FIPS_2203_Feet
- NAD_1983_StatePlane_South_Dakota_North_FIPS_4001_Feet**
- NAD_1983_UTM_Zone_14N
- WGS_1984_Web_Mercator_Auxiliary_Sphere

Geographic Coordinate Systems

Projected Coordinate Systems

Current coordinate system:

NAD_1983_StatePlane_South_Dakota_North_FIPS_4001_Feet
WKID: 4457 Authority: EPSG

Projection: Lambert_Conformal_Conic
False_Easting: 1968500.0
False_Northing: 0.0
Central_Meridian: -100.0
Standard_Parallel_1: 44.41666666666666
Standard_Parallel_2: 45.68333333333333
Latitude_Of_Origin: 43.83333333333334
Linear Unit: Foot US (0.3048006096012192)

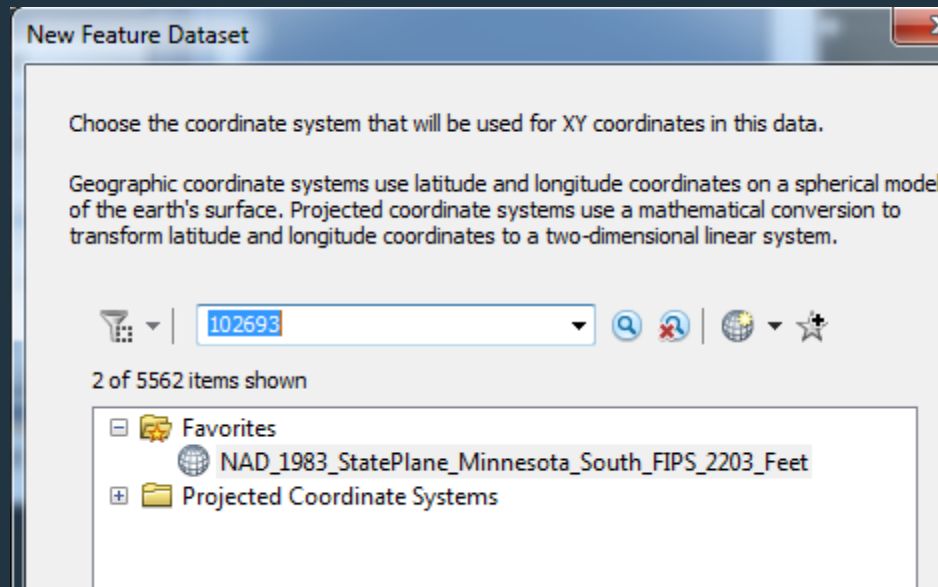
< Back Next > Cancel



Feature Dataset: Select Projection

Search by WKID code

102691	NAD_1983_StatePlane_Minnesota_North_FIPS_2201_Feet
102693	NAD_1983_StatePlane_Minnesota_South_FIPS_2203_Feet
2254	NAD_1983_StatePlane_Mississippi_East_FIPS_2301_Feet
2255	NAD_1983_StatePlane_Mississippi_West_FIPS_2302_Feet



Select the projection and select next



Feature Dataset: Select Projection

Ignore Vertical Coordinate system unless you are intending to go forward with 3D

Accept the default XY Tolerance

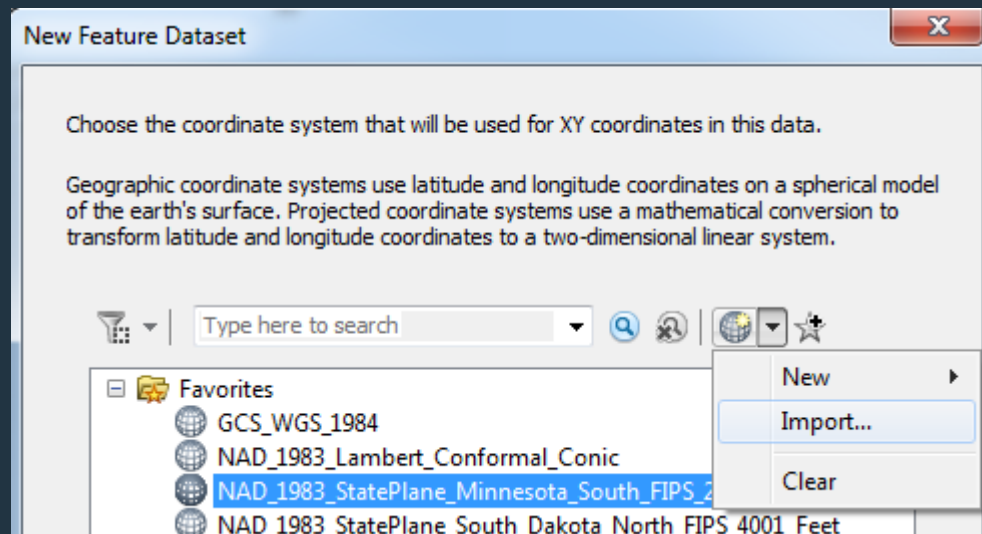
You have created a Feature Dataset



Create a Feature Dataset with parameters from another

Create a Land base Feature Dataset

When it asks for Projection select the Import option





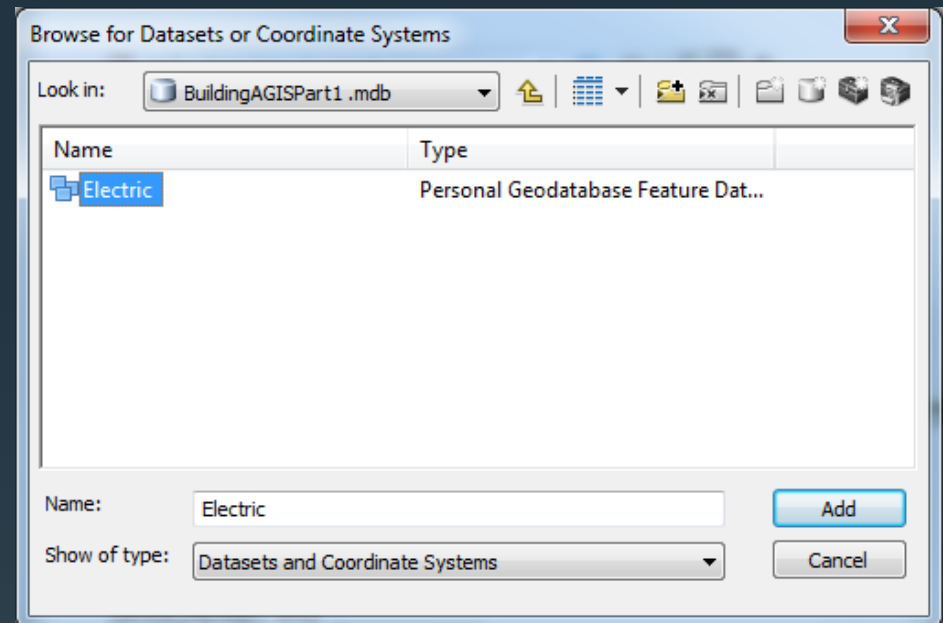
Create a Feature Dataset with parameters from another

Create a Land base Feature Dataset

When it asks for Projection select the Import option

Navigate to the first Feature Dataset and select Add

The projection from the selected Feature dataset will automatically be applied to the new





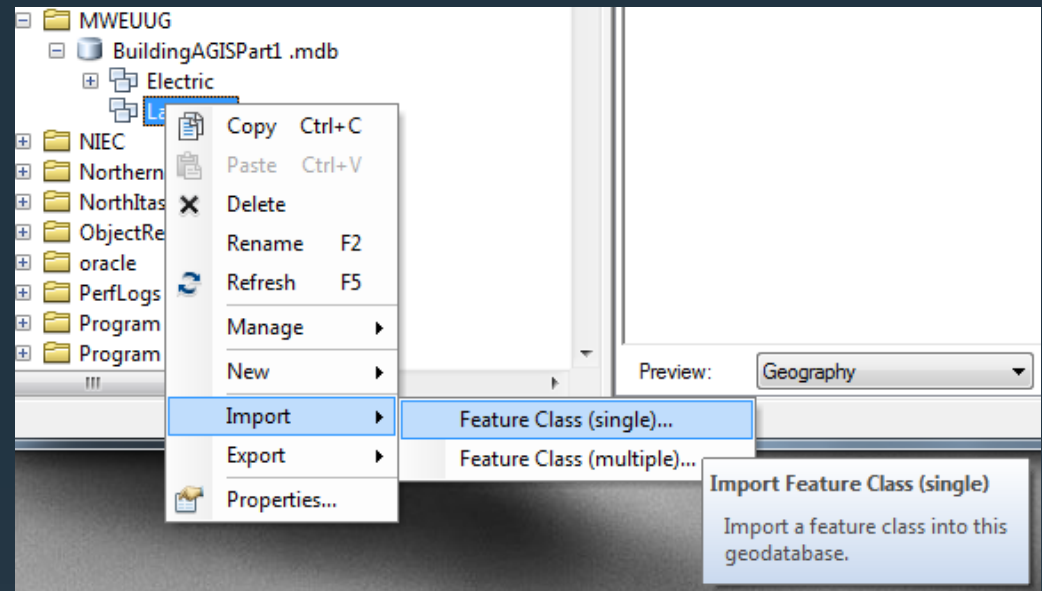
Add Shapefile: Road Centerlines

Method 1

Right click on your Land base Feature Dataset and select

Import

Feature Class(single)





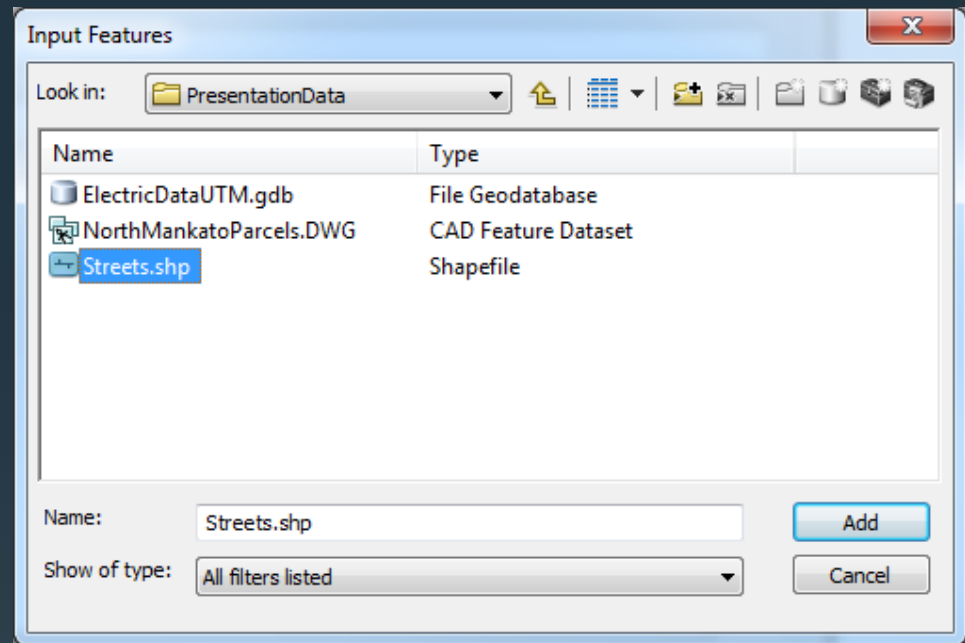
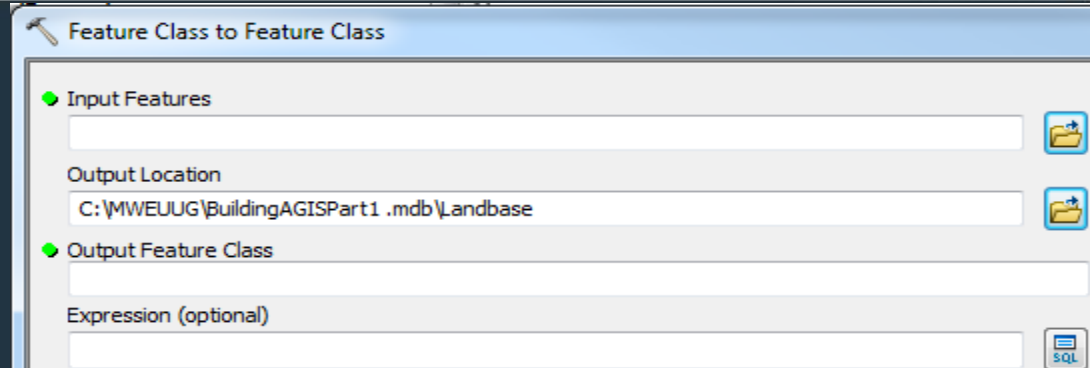
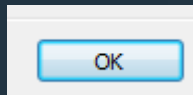
Add Shapefile: Road Centerlines

Method 1

For input features
navigate to your
shape file and select
Add

In Output Feature Class
give them a name
roads

Click OK



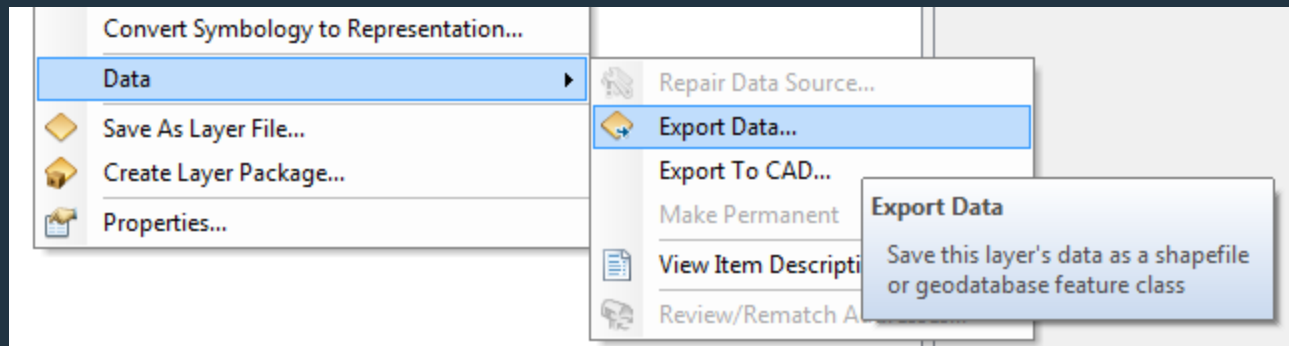


Add Shapefile: Road Centerlines

Method 2

Add your roads to ArcGIS

Right Click Data>Export Data





Add Shapefile: Road Centerlines

Method 2

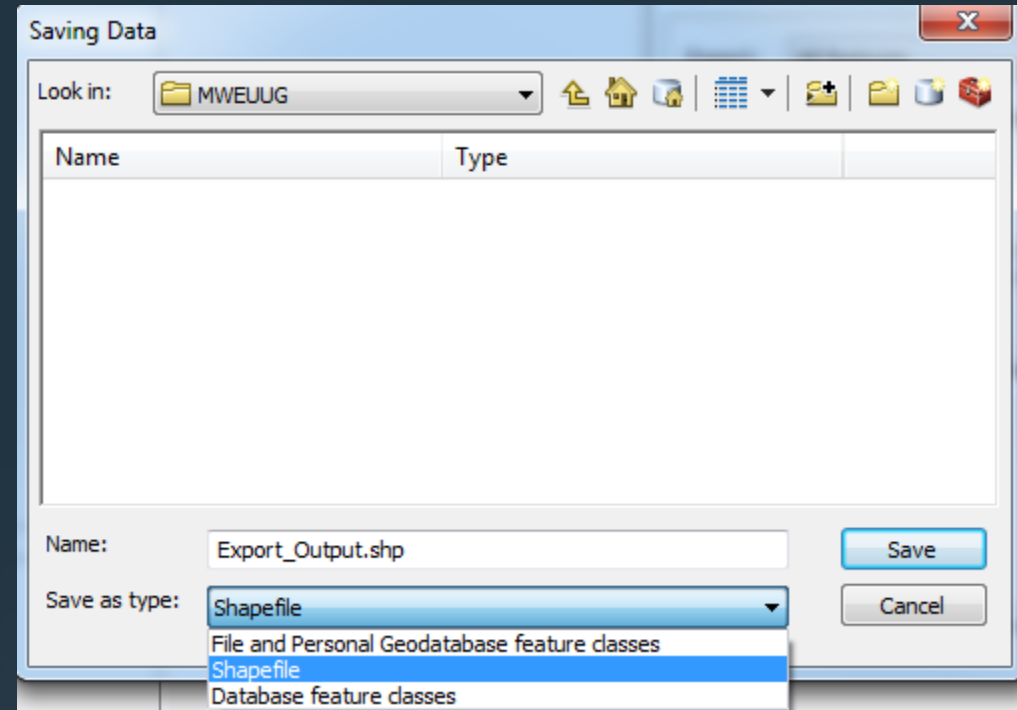
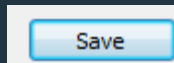
Navigate to your Feature Dataset and change the

Save as type to

File and Personal
Geodatabase feature
class

Change the Name

Click Save





Add AutoCAD: Parcel Data

Method 1 with AutoCAD

This method will preserve data if is available

Open the drawing in AutoCAD

Type

`mapexport`

The Export Location Dialog window will appear



Add AutoCAD: Parcel Data

Method 1 with AutoCAD

This method will preserve data if is available

Open the drawing in AutoCAD

Type

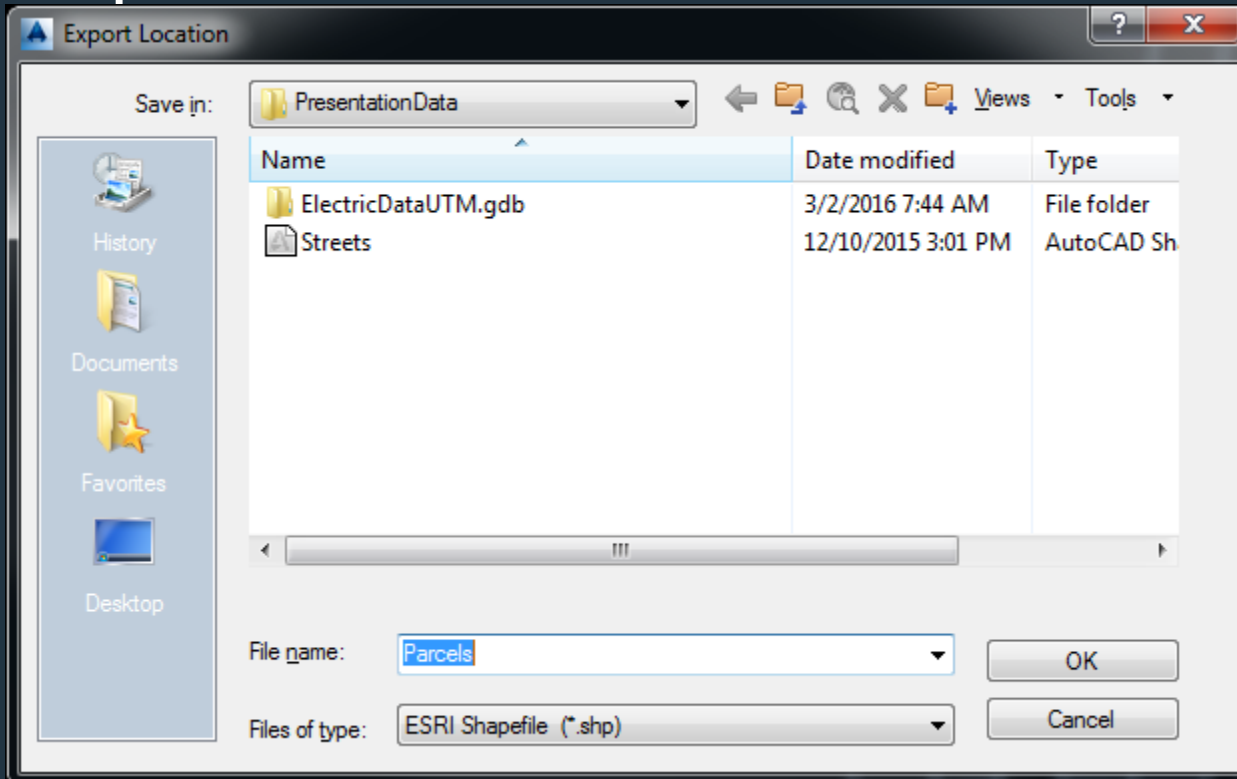
mapexport



Add AutoCAD: Parcel Data

Method 1 with AutoCAD

Navigate to where you want to store the resultant Shapefile and name it





Add AutoCAD: Parcel Data

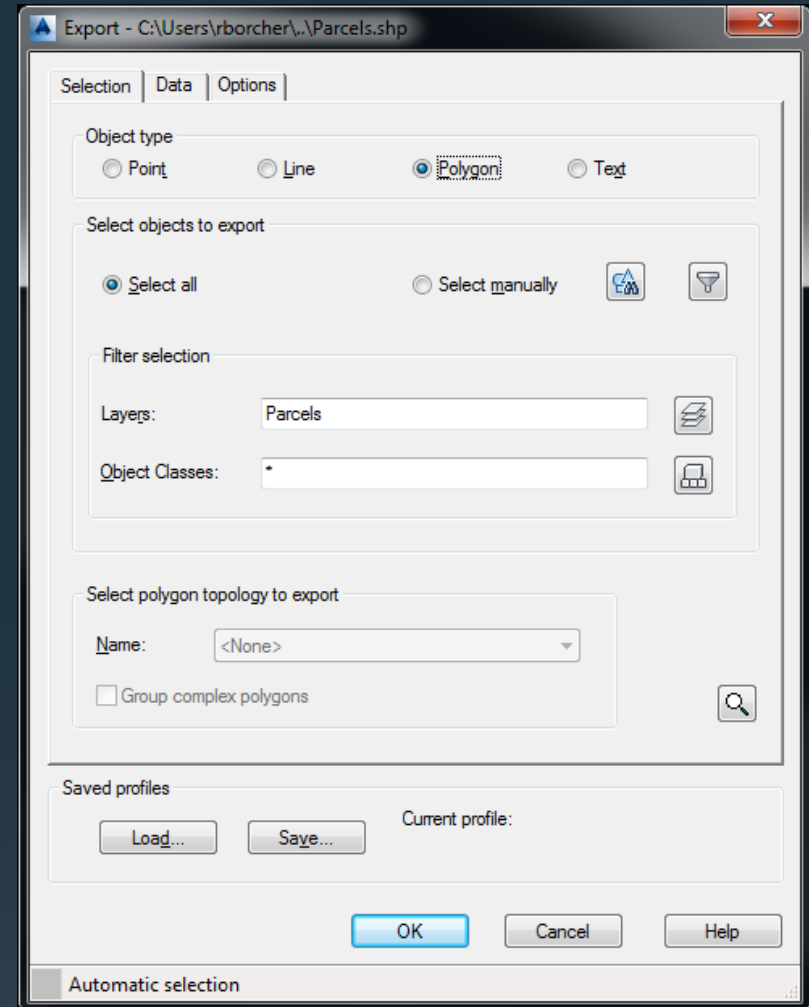
Method 1 with AutoCAD

Export Window

Select Polygons for Object Type

For layers select the AutoCAD layer in which your parcels are

Click the Data tab

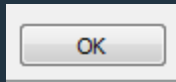




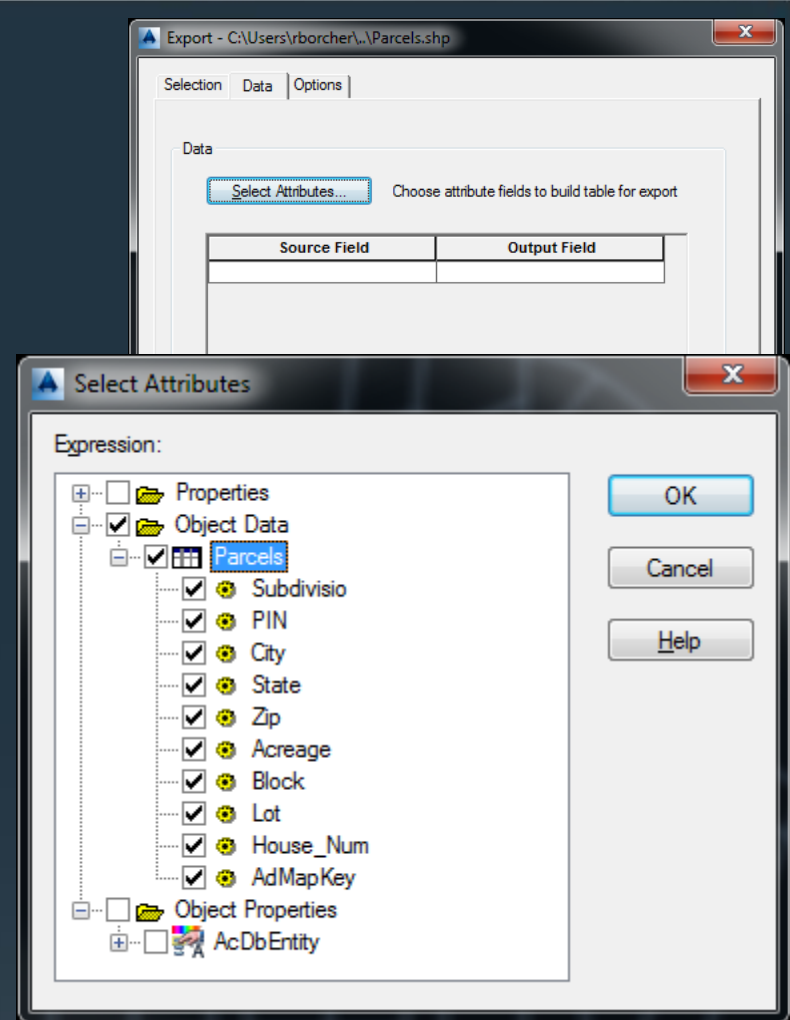
Add AutoCAD: Parcel Data

Method 1 with AutoCAD
Choose Select Attributes
Expand Object Data and
choose the Fields you
want to include.

Click OK



Click the Options tab



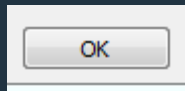


Add AutoCAD: Parcel Data

Method 1 with AutoCAD

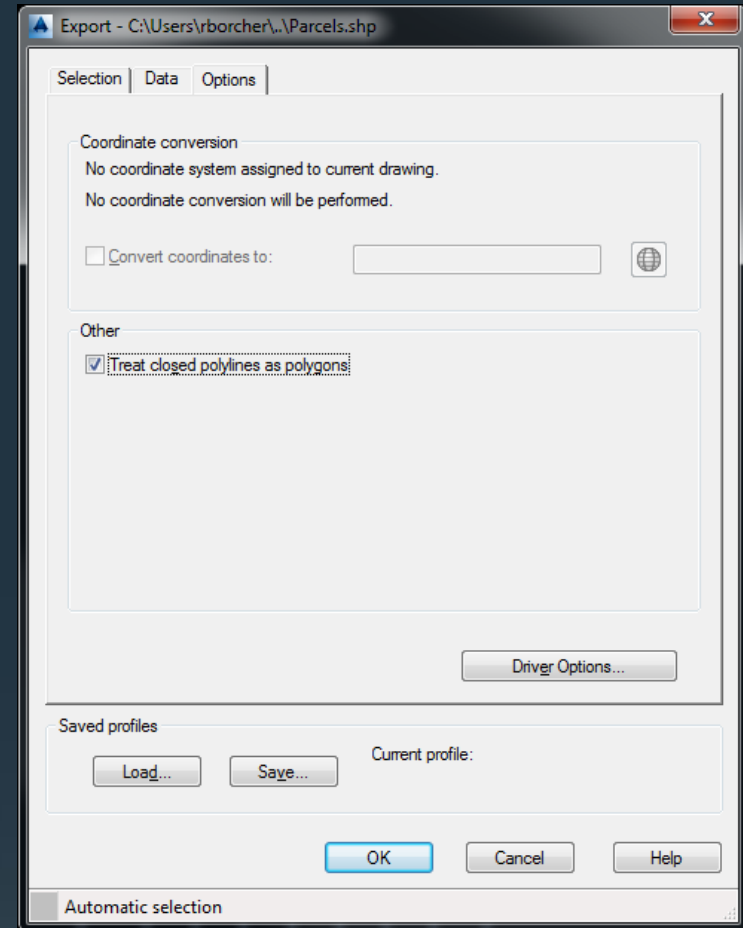
Check the box to treat
closed Polyline's as
Polygons

Click OK



AutoCAD will export your
parcels

Add the shapefile to your
database as before





Add AutoCAD: Parcel Data

Method 2 with ArcGIS

You can open your DWG in ArcGIS

Open another feature to ensure your parcels are properly located

If they are you can export the parcels to your database just as you did your road centerlines

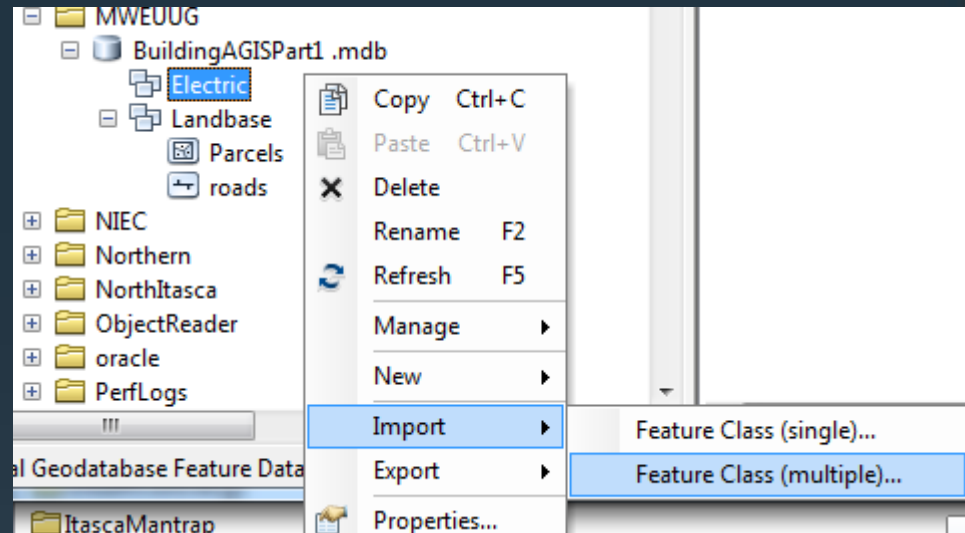
You will need to select just the parcels however

A AutoCAD drawing will have a number of features in as polygons



Add Geodatabase: Electric data from consultant

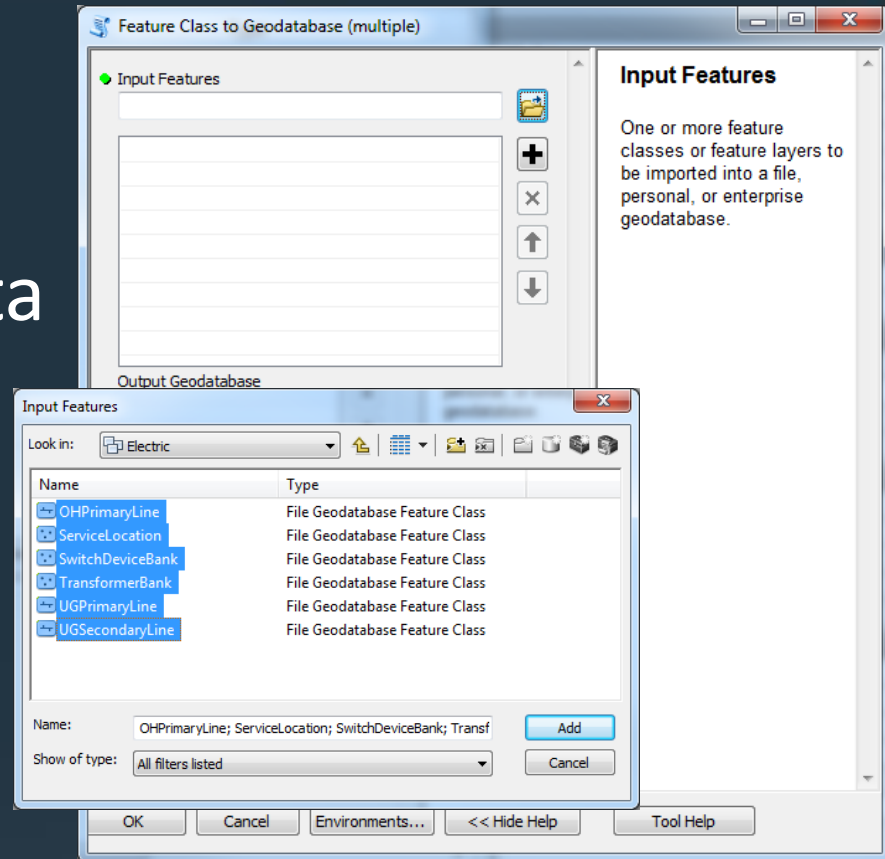
- Method 1 (preferred)
- Navigate to your database in ArcCatalog
- Right Click on the Feature Dataset you want to put your data in
- Choose Import> Feature Class (multiple)





Add Geodatabase: Electric data from consultant

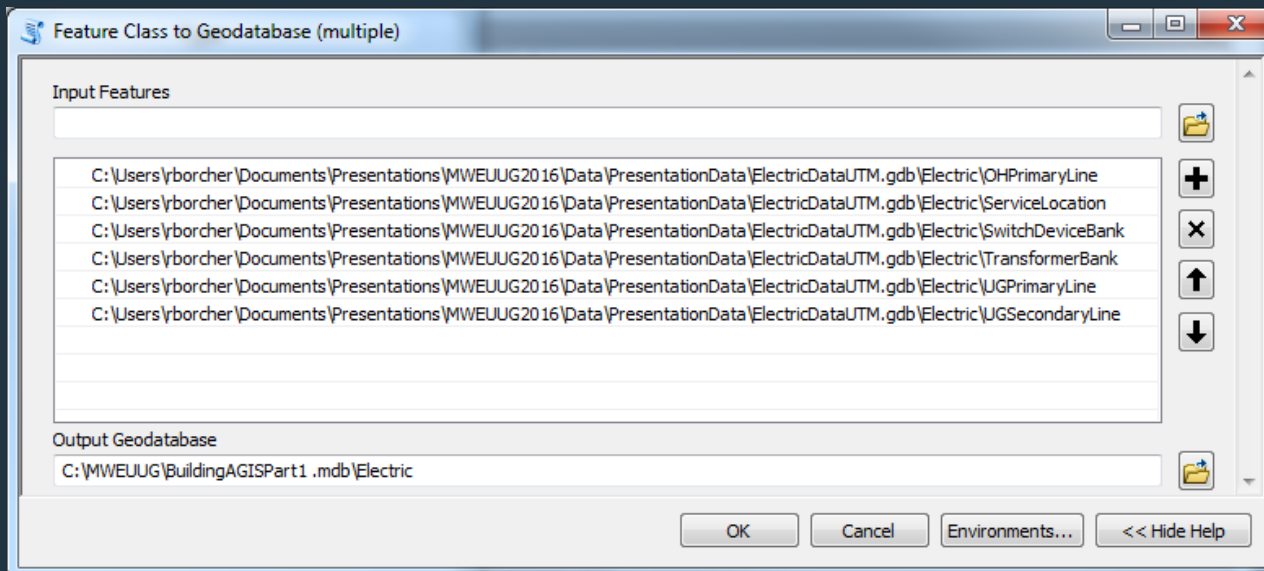
- Method 1 (preferred)
- At Input Features you navigate to your new data
- Select your features
- Click Add





Add Geodatabase: Electric data from consultant

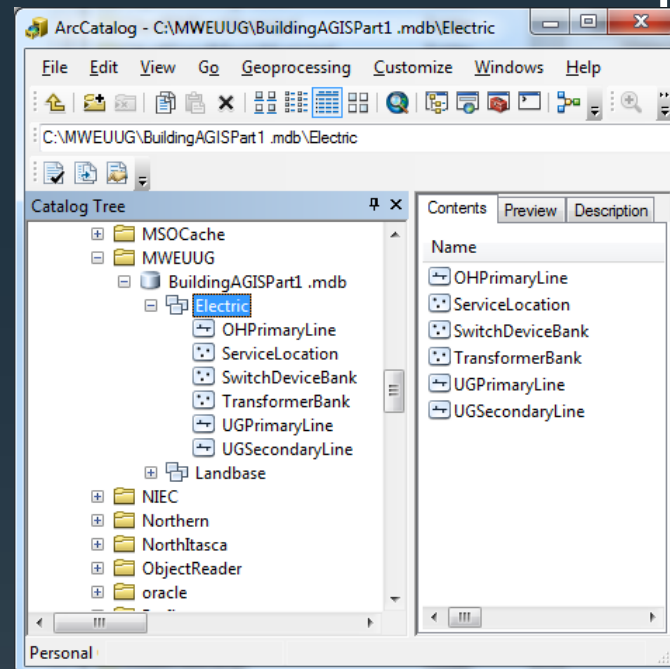
- Method 1 (preferred)
- They should appear one per line as below
- Confirm the output Geodatabase
- Click OK





Add Geodatabase: Electric data from consultant

- Method 1 (preferred)
- A little window should appear with scrolling text to indicate it is working
- For very small amounts of data this will happen very fast
- You can open your database to confirm the features have arrived





Add Geodatabase: Electric data from consultant

- Method 1 (preferred)
- This method is preferred because
- It creates/transfers new domains to the new database
- It maintains subtypes
- It automatically projects your data as it is being imported



Add Geodatabase: Electric data from consultant

- Method 2 (basic use only)
- Open your feature in ArcMAP
- Right click on it and select Data>Export Data
- Navigate to your database
- Name the feature and select OK
- This method will NOT transfer/preserve Subtypes or Domains
- Best used for new basic features that do have domains or subtypes



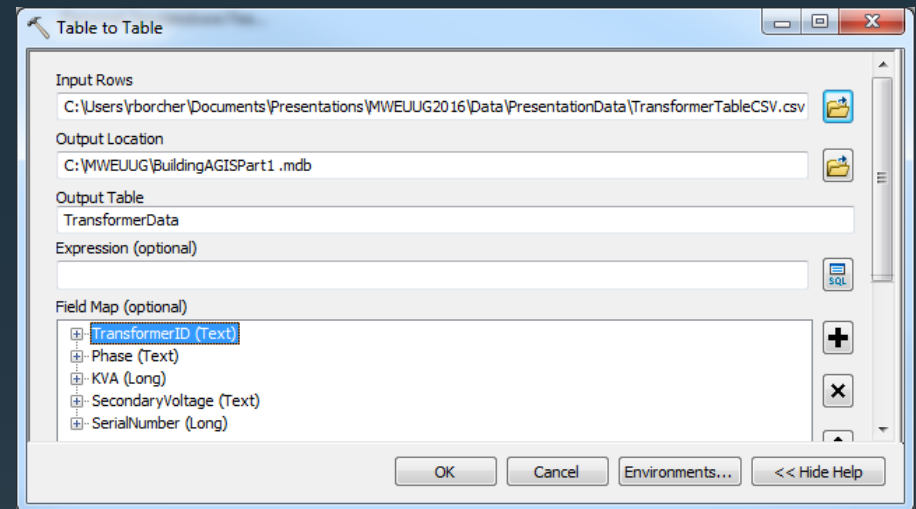
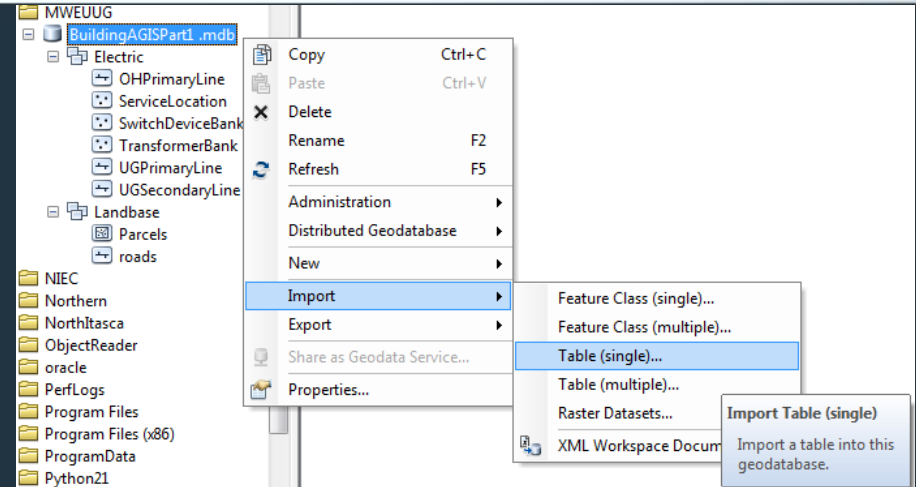
Add Geodatabase: Electric data from consultant

- Method 3 (NOT RECOMMENDED)
- Simply go to your database source and copy the features
- Paste them into your Feature Dataset
- Not recommended because it will create new Domains with a 1 after them (example Phase1)
- WILL NOT work if the projections are different
- However, if you are populating a new blank database this method is very good



Add Table: Transformer data from billing

- Method 1 in ArcCatalog
- Right click on your database and select Import>Table (Single)
- Select your Table
- Give it a name and hit OK





Build Geometric Network

- Right click on Feature Dataset and select New>Geometric Network

The screenshot shows the ArcGIS Desktop interface. In the left-hand pane, a feature dataset named 'Electric' is selected. A context menu is open over it, with the 'New' option highlighted. A sub-menu is also open, showing 'Geometric Network...' as the selected option. Other options in the sub-menu include 'Feature Class...', 'Relationship Class...', 'Terrain...', 'Network Dataset...', 'Topology...', and 'Parcel Fabric...'. A tooltip box in the bottom right corner provides additional information about the 'New Geometric Network' option.

New Geometric Network
Create a new geometric network in this feature dataset.
Requires a Standard or an Advanced license and is disabled with a Basic license.



Build Geometric Network

- Enter the name for network or use default
- Click Next
- Select features to be included and click Next

New Geometric Network

Select the feature classes you want to build your network from:

- OHPPrimaryLine
- ServiceLocation
- Substation
- SwitchDeviceBank
- TransformerBank
- UGPrimaryLine
- UGSecondaryLine

Select All

Clear All

Unavailable...

< Back Next > Cancel



Build Geometric Network

- Select Yes to Enable network Features

New Geometric Network

Do you want to preserve existing enabled values?

All network features are initially enabled unless they belong to a feature class that already has an enabled field.

No
Enable all network features.

Yes
Enable network features using the existing enabled attribute values. Any features with invalid enabled attributes will be reinitialized to enabled.

< Back Next > Cancel



Build Geometric Network

- Select Yes to Enable network Features

New Geometric Network

Do you want to preserve existing enabled values?

All network features are initially enabled unless they belong to a feature class that already has an enabled field.

No
Enable all network features.

Yes
Enable network features using the existing enabled attribute values. Any features with invalid enabled attributes will be reinitialized to enabled.

< Back Next > Cancel



Build Geometric Network

- Select Substations as the Source Yes
- Select next twice and your network is built

New Geometric Network

Select roles for the the network feature classes:

Feature Class Name	Role	Sources & Sinks
<input type="checkbox"/> OHPrimaryLine	Simple Edge	<None>
<input type="checkbox"/> ServiceLocation	Simple Junction	No
<input checked="" type="checkbox"/> Substation	Simple Junction	Yes
<input type="checkbox"/> SwitchDeviceBank	Simple Junction	No
<input type="checkbox"/> TransformerBank	Simple Junction	No
<input type="checkbox"/> UGPrimaryLine	Simple Edge	<None>
<input type="checkbox"/> UGSecondaryLine	Simple Edge	<None>

< Back Next > Cancel



Add Table: Transformer data from billing

- Method 1
- Automatically assigns a unique ObjectID
- Can now be edited in ArcMAP
- Can be used in Relationships
- Fields can be assigned Domains
- Can be SubTyped
- Can be imported from
 - ArcGIS Database
 - MS Excel or Access
 - Tab or Comma delimited text files



Add Table: Transformer data from billing

- Method 2 in ArcMap
- Add your table to ArcMap
- Right click on it and export it to your database



Create Feature: Poles from Contractor

Method 1 (preferred)

The table with your Pole locations can be any Table format

It may look something like this when opened in Excel

	A	B	C	D	E
1	PoleNumber	PoleHeight	Notes	Xing	Ying
2	Pole546	30 Foot		-94.06958398	44.17936917
3	Pole455	30 Foot		-94.06935258	44.18065823
4	Pole458	35 foot	Tap West, fuse west	-94.06958637	44.17978662
5	Pole546	30 Foot		-94.06955249	44.18024827
6	Pole628	30 Foot		-94.07080543	44.17978286
7	Pole623	30 Foot		-94.06957648	44.17805703
8	Pole624	30 Foot		-94.06957893	44.17848602
9	Pole625	30 Foot		-94.06958136	44.17891015
10	Pole626	30 Foot	Rotten	-94.07019357	44.17978251
11	Pole637	30 Foot		-94.06782113	44.18250713
12	Pole644	30 Foot		-94.06805872	44.18212101
13	Pole643	30 Foot		-94.06837194	44.18177171
14	Pole642	30 Foot		-94.068714	44.18139108
15	Pole641	30 Foot		-94.06905144	44.18101559
16	Pole636	30 Foot	Riser	-94.06775405	44.18287198



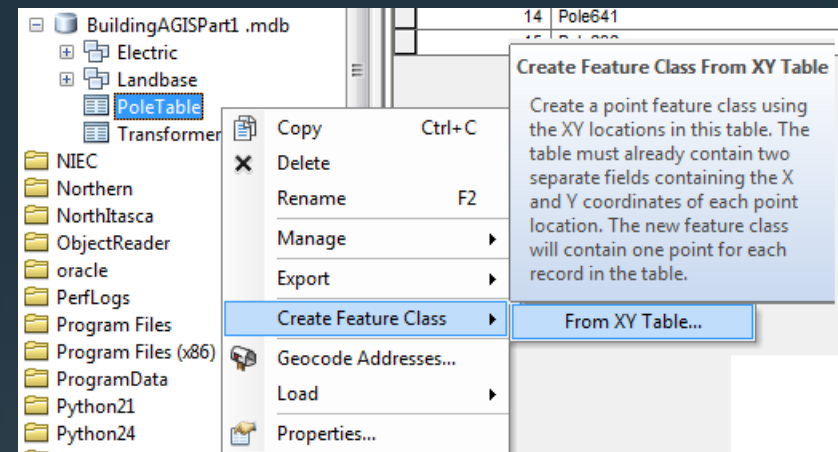
Create Feature: Poles from Contractor

Method 1 (preferred)

In ArcCatalog navigate to the location of the table

Right click on the Table and select

Create Feature Class > From XY Table





Create Feature: Poles from Contractor

Method 1 (preferred)

Choose the proper X and Y fields

Specify output shapefile or feature class. You can select to put it in your database

Press the Coordinate System of Input Coordinates button

Create Feature Class From XY Table

Input Fields

X Field: Xing

Y Field: Ying

Z Field: <None>

Coordinate System of Input Coordinates...

Output

Specify output shapefile or feature class:

C:\MWEUUG\BuildingAGISPart1.mdb\Electric\

Configuration keyword:

Advanced Geometry Options...

OK Cancel



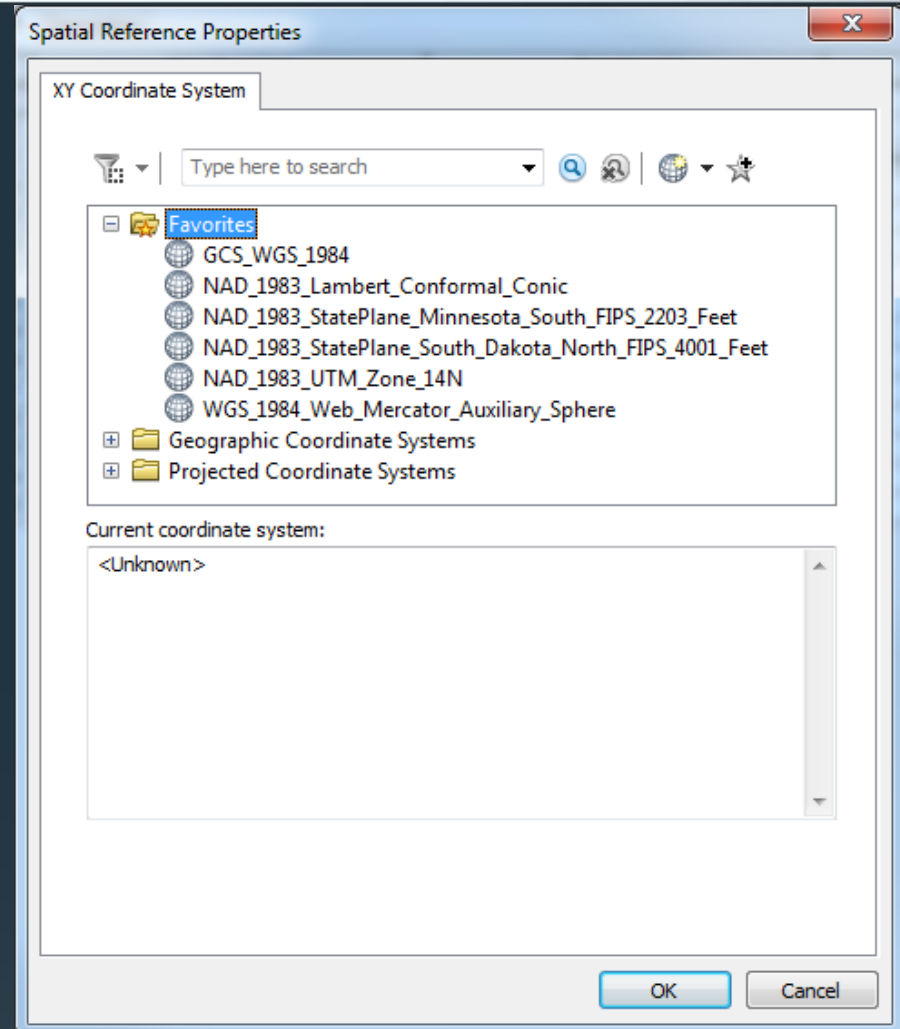
Create Feature: Poles from Contractor

Method 1 (preferred)

If the XY are in the same format as the example select GCS_WGS_1984

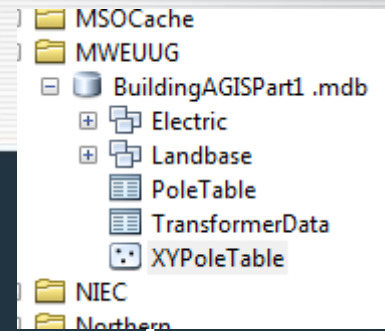
Or WKID 4326

Hit OK





Create Feature: Poles from Contractor



Method 1 (preferred)

The new Pole Feature Class was created (not in a Feature Dataset) as a point feature called XYPoleTable.

Now import it into the Feature Dataset where you want it. You will have to use a different name than the point feature it created

After verifying new feature is correct you can delete the XYPoleTable



Create Feature: Poles from Contractor

Method 1 (preferred)

Benefits of this method is that you can now use the original pole table as a data table for the poles

Field names are preserved

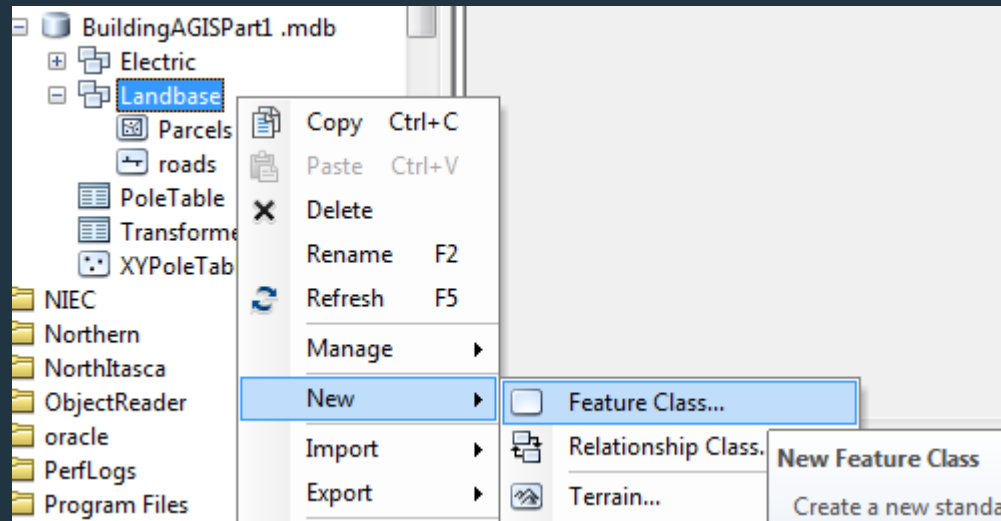


Create Feature: Manually Created Feature Class

In ArcCatalog

Right click on the Feature Dataset you want to
create your new empty feature and select

New > Feature Class





Create Feature: Manually Created Feature Class

Enter the name for your new
Feature Class

Alias will be automatically
populated with Name

Select the type of feature

Point

Line

Polygon

Click next

New Feature Class

Name: RoadsManual

Alias:

Type
Type of features stored in this feature class:
Line Features

Geometry Properties

Coordinates include M values. Used to store route data.

Coordinates include Z values. Used to store 3D data.

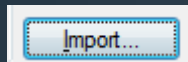
< Back Next > Cancel



Create Feature: Manually Created Feature Class

In the New Feature Class window will be OBJECTID and Shape. These are default Fields and cannot be changed.

You can enter any Field names that you want and determine a data type OR Click the Import Button



New Feature Class

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry

Click any field to see its properties.

Field Properties

Alias	OBJECTID
-------	----------

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

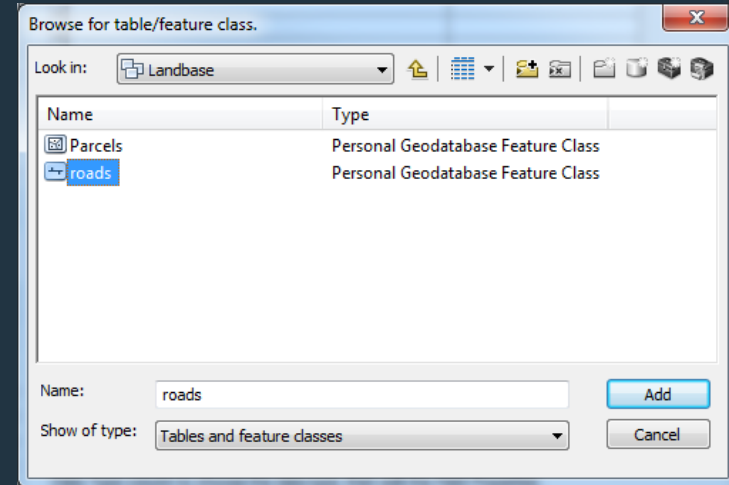
< Back Finish Cancel



Create Feature: Manually Created Feature Class

By using Import you can create a new Feature Class based on an existing Feature Class complete with SubTypes and Domains

Navigate to the Feature Class you want to emulate and click the Add button





Create Feature: Manually Created Feature Class

When you click the finish
button your new
feature class will be
ready

New Feature Class

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
STR_NAME	Text
STR_PFX	Text
BASE_NAM	Text
STR_TYPE	Text
STR_SFX	Text
E_911	Text
TIS_CODE	Text
RTE_SYST	Text
RTE_NUM	Text
DIVID	Text
TRAF_DIR	Text

Click any field to see its properties.

Field Properties

Alias	STR_SFX	
Allow NULL values	Yes	
Default Value		
Domain		
Length	2	

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel



Create Feature: Manually Created Feature Class













