

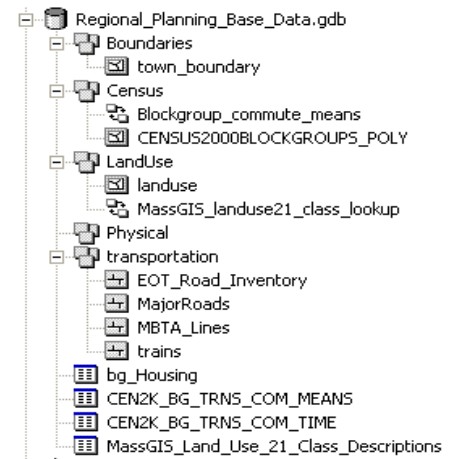
Creating a File Geodatabase

Updated by Carolyn Talmadge on January 06, 2012 for 10.6.1

This exercise demonstrates how to:

- Create a file geodatabase in ArcGIS 10.6.1;
- Import existing data into the geodatabase
- Create relationship classes

For this example, we will create a file geodatabase to support regional base mapping that would eventually be used for analysis of land use and transportation. The base data sets we will use include data from the 2010 census, land use layers, transportation layers, and physical features like floodplains.



Digital Resources

Within ArcGIS: *HUWArcGIS Desktop Help – Professional Library- Data Management-Managing Geodatabases-An Overview of the Geodatabase*

Online:





http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/What_is_a_geodatabase/003n000000100000/

and <http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/003n000000200000/>

Online Tutorial – *Geodatabases*

(http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/ArcGIS_tutorials/00v20000000t000000/-scroll down to find tutorial) – the data for this tutorial is located on the Tufts GIS Center in S:\Tutorials\ESRI\ArcMap 10\ArcTutor\BuildingaGeodatabase.

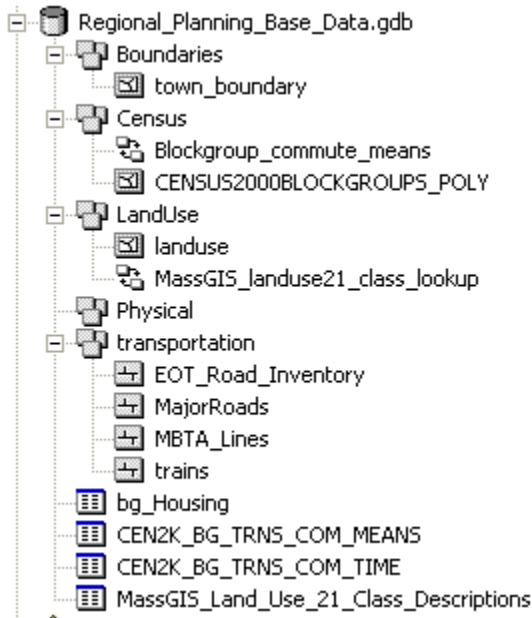
Important terms

- **Feature dataset**  – a collection of feature classes (e.g., transportation contains roads, railroads, airports) organized into a group, all of which share a common coordinate system.
- **Feature class**  – a collection of features with the same type of geometry: point, line, or polygon (e.g., roads)
- **Relationship Class**  – an item in a geodatabase that stores information about relationships between tables (e.g., a parcel polygon layer might be related to a property owner table by the parcel ID) (Symbolized by )

Later in the course we will be looking at other elements of the geodatabase like **topology** and **geometric networks**.

Geodatabase example: Regional_Planning_Base_Data.gdb

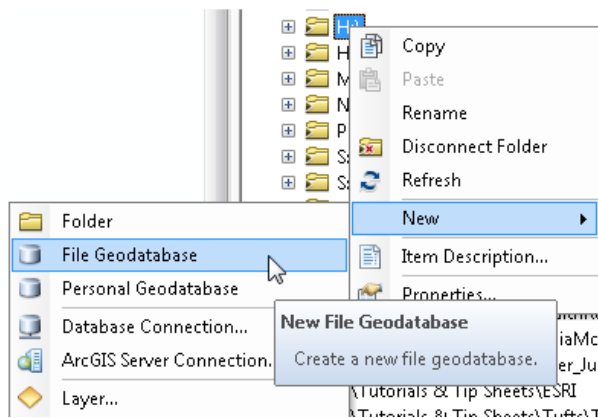
In this lab, the **Feature datasets** are Census, Land Use, Physical, and Transportation – each Feature Dataset has associated **Feature Classes**. The file geodatabase we are using contains tables of census data, and a table delineating land use code descriptions. Finally, there is a **relationship class** defining the relationship between the land use attribute table and the land use description lookup table. We will also be creating relationship classes between the census tables and census geography.



Part 1: Creating a new Geodatabase

You will create and build your geodatabase in **Catalog** within **ArcMap**.

1. Start ArcMap and expand the catalog on the right hand side. You can “pin” the Catalog in place to keep it from retracting back to the side.
2. Expand the **Folder Connections** and navigate to your H drive. Note, if you do not see your H drive, you might need to make a folder connection to it.
3. Right click on your **H Drive** and choose **New → File Geodatabase**. A new geodatabase folder will be created with the extension .gdb



4. Rename this geodatabase by right clicking on the file geodatabase and selecting **Rename**. Name it *“Regional_Planning_Base_Data.gdb”*.

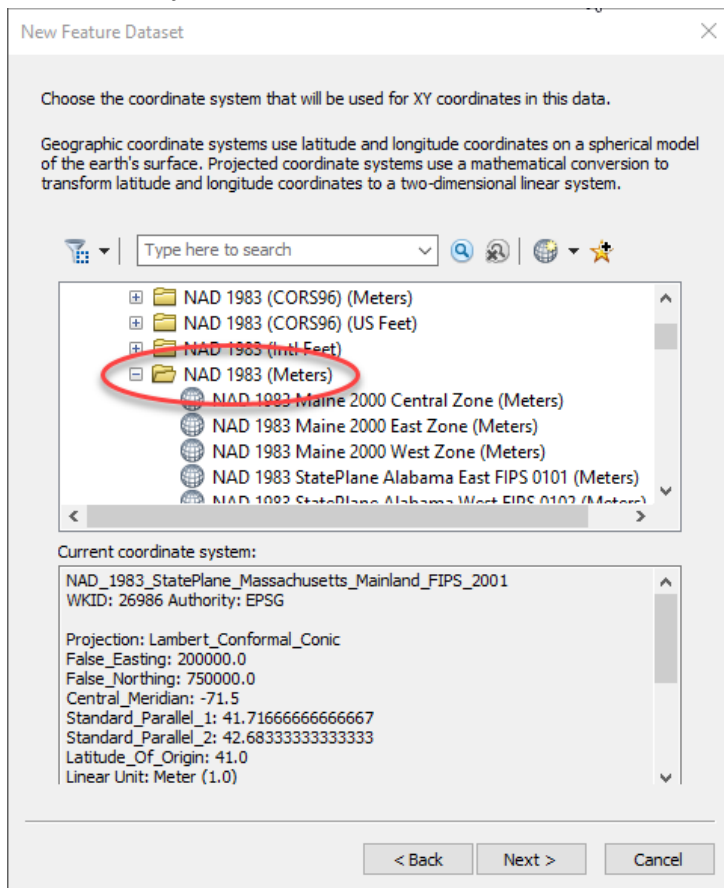
Part 2: Creating a New Feature Dataset for Transportation Layers

A feature dataset is a collection of features that have the same spatial reference (coordinate system). In this example, we might have four different feature datasets for our regional planning base data – transportation, land use, census

data, and physical (for things like floodplains). Each one of these datasets can have several feature classes – e.g., transportation could have roads, railroads, airports.

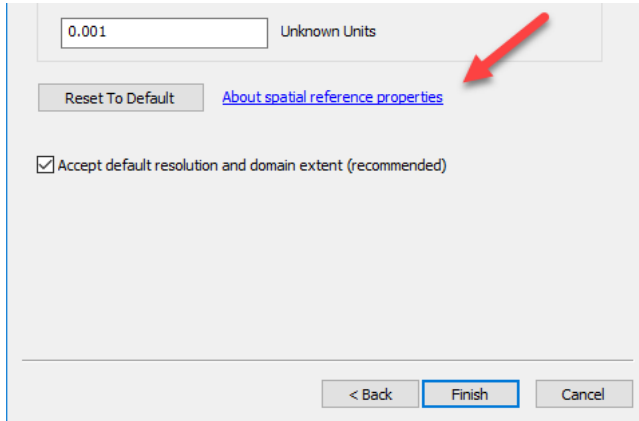
All the feature classes in a feature data set will have the same coordinates. Once you **define your coordinate system** for a feature dataset, any feature class you import into it will automatically be converted to the coordinate system of the feature dataset.

1. To create a **new feature dataset**, right-click on the geodatabase and choose **New → Feature Dataset**.
2. In the dialog box, name the feature dataset **“Transportation”**. Never include spaces in folder names! Click Next.
3. Select the coordinate system that this Feature Dataset will use, or Import it from an existing GIS file. In this example, the coordinate system will be the **Massachusetts State Plane, NAD83 Mainland (meters)**. You can import it from an existing MassGIS data layer or select it by drilling down as seen in the graphic below. (Projected Coordinate Systems → State Plane → NAD 1983 (Meters) → NAD 1983 State Plane Massachusetts Mainland FIPS 2001)
4. Select the Projection: **NAD 1983 State Plane Massachusetts Mainland FIPS 2001 (meters)**. Then click Next.




5. The transportation data set will not have a **vertical coordinate system**, so leave this **blank**. (A vertical coordinate system is important if you are modeling heights and elevations). Click Next.

- For **XY Tolerance**, accept the defaults, but read about it using the button option available. Click **Finish** to finish creating the feature dataset.



Note: As noted above, with the feature datasets’ coordinate system set, any geographic data layer that you import will automatically be converted to the feature dataset’s coordinate system during the import process, which is a very useful function. But be aware that the same does not hold true if you were simply importing a feature class into the general geodatabase (rather than into an existing **feature dataset**) – in that case the feature class maintains its original coordinate system.

Step 3: Importing Shapefiles into your Geodatabase

- In this step you will import existing GIS data layers from MassGIS that are saved in the M drive.
- Right-click on your new feature data set ( Transportation) and choose **Import** → **Feature Class (single)**. Note, you can select multiple if you have more than one layer you’d like to add into this the feature data set.
- For the **Input Features**, click on the folder icon and go to the location of the shape files you want to import (in this case, go to M:\state\MA\MassGIS\Infrastructure and select **EOTMAJROADS_Arc.shp** and click “Add”.
- Give the new layer a name in the Output Feature Class box. Call it **MajorRoads** (no spaces!). The output location should default to the **feature data set** (e.g. H:\Regional_Planning_Base_Data.gdb\Transportation).
- You can modify the attribute field names if you like. It is not necessary in this case. Click OK

For practice, import other transportation layers into this feature dataset – e.g., MBTA lines, trains, airports.

Creating other feature datasets

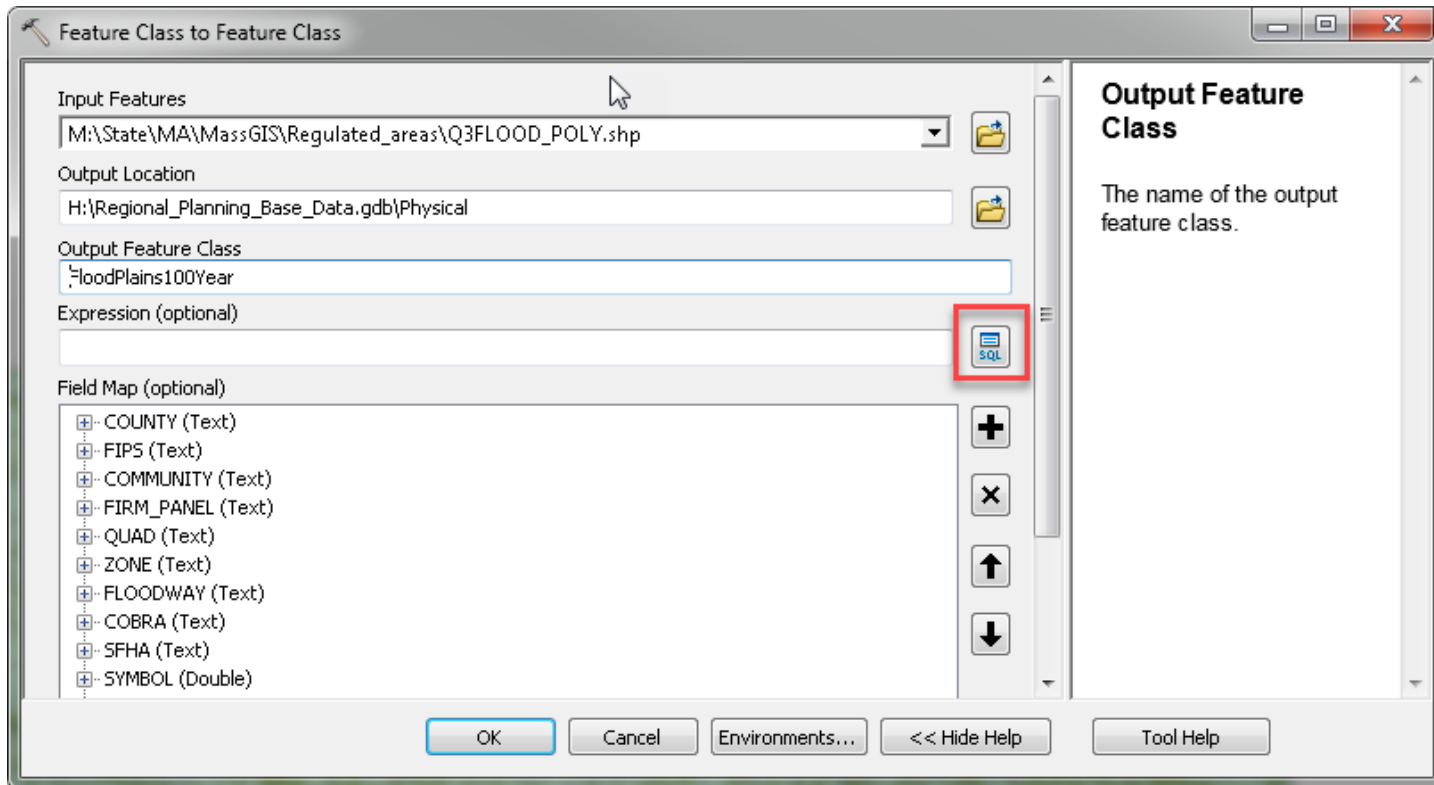
Now you will create four more **Feature Datasets** in your *geodatabase*. Create a feature dataset for each of these types of data sets listed below – and remember, you can’t have spaces in the Feature Dataset name or the individual feature class names. Refer to the earlier section if you need a reminder on how to do this. Make sure they all have the **Massachusetts State Plane NAD 83 Mainland coordinate system** (which has a horizontal unit of meters).

- Census
- LandUse
- Physical
- Boundaries

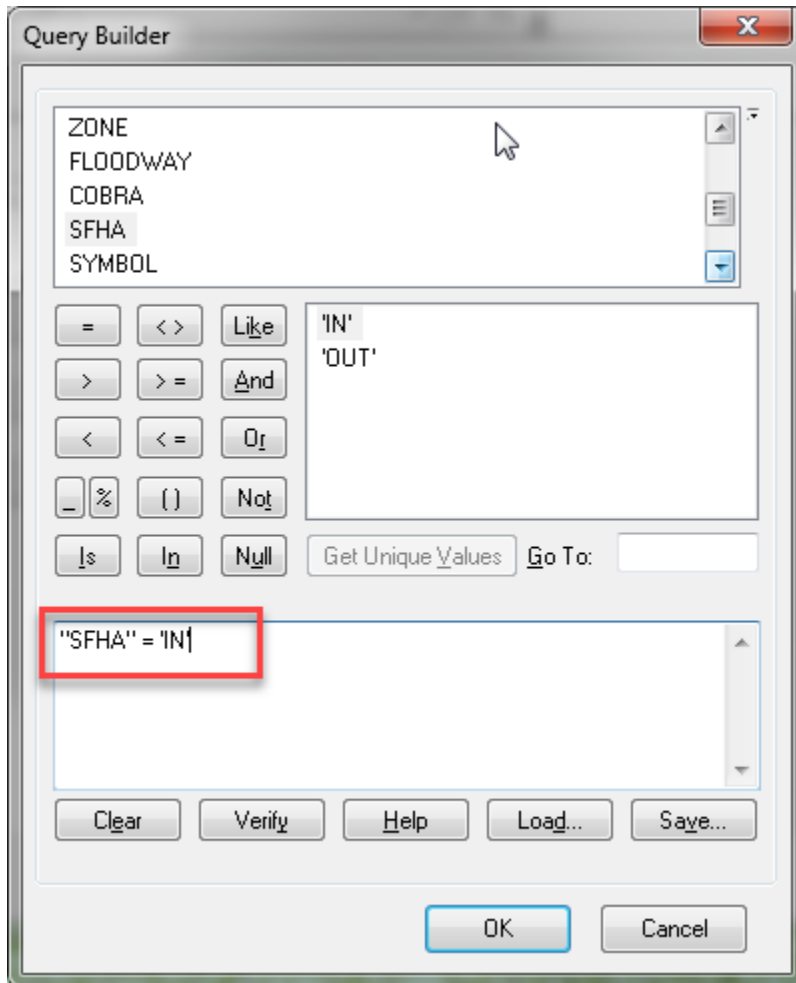
Import Shapefiles into your Feature Datasets

Follow similar steps as detailed above to import existing **shapefiles** into your **geodatabase feature datasets**.

1. For the Census Feature Dataset, import **census blockgroups** from M:\State\MA\MassGIS\Census_2000. Select the **CENSUS2000BLOCKGROUPS_POLY.shp** and name it **BlockGroups**.
2. For the LandUse Feature Dataset, import **landuse_poly.shp** from M:\State\MA\MassGIS\Physical_Resources. Name it **LandUse**.
3. For the Boundaries Feature Dataset, import **TOWNS_POLY.shp** from M:\State\MA\MassGIS\Political_Boundaries. Name it **Towns**.
4. For the **Physical** Feature Dataset, import **Q3FLOOD_POLY.shp** from M:\State\MA\MassGIS\Regulated_Areas. Name it **FloodPlains100Year**. IMPORTANT: Follow these steps for importing **only** the 100 year floodplains:
5. When you import a feature class you have the option of using an **SQL expression** to import certain *selected features*. In the Q3 flood data layer, you can select and import just the features representing **the 100-year floodplain**. Follow the steps below to do so.
6. Click on the SQL icon.



7. There is a field in the Q3 data called **SFHA** for Special Flood Hazard Zones. Double click this field in the query dialog box and set the value equal to **In**. See screen shot below and make sure to always use the buttons to get the correct syntax.

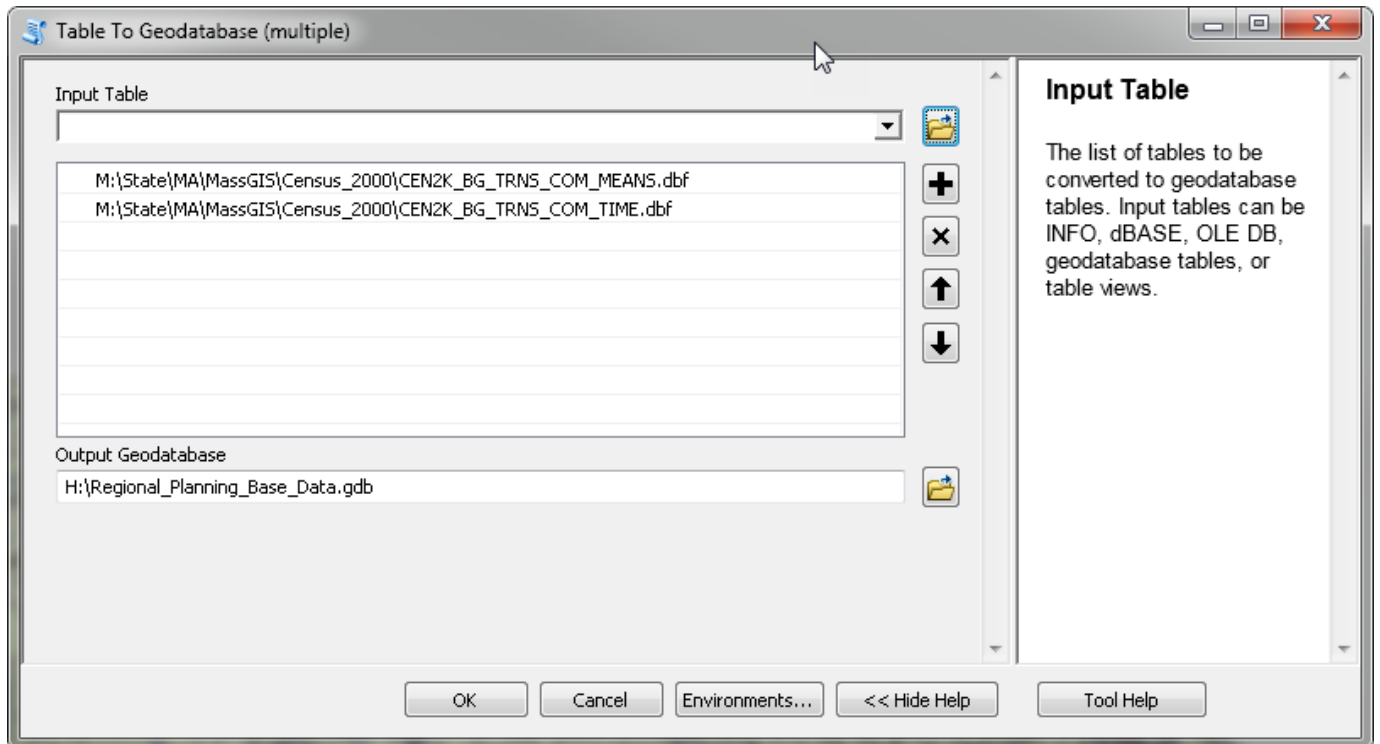


8. Click OK and then OK again on the Feature Class Import box.

Importing Tables into the Geodatabase

Tables don't go inside a feature dataset, but they can be imported to the larger geodatabase.

1. You can import tables by right-clicking on the **Regional_Planning_Base_Data.gdb** itself and choosing **Import** → **Table (Multiple)**. Import each of the following tables dealing with transportation from `M:\State\MA\MassGIS\Census_2000\`
 - a. `CEN2K_BG_TRNS_COM_MEANS.dbf`
 - b. `CEN2K_BG_TRNS_COM_TIME.dbf`
2. You will need to add both input tables and specify the **output target**, your geodatabase (which should automatically populate.)



Creating a Relationship Class

The Census **Blockgroup Polygons** contain a few basic attributes regarding each **blockgroup**. However, most of the census data from MassGIS is stored in separate tables. You added two tables that have data about transportation modes and commute times. These tables can be related to the attribute table of census blockgroup polygons via a commonly shared field called “**LOGRECNO**” (see the MassGIS Census BlockGroup web page for more information (HUhttp://www.mass.gov/mgis/cen2000_blockgroups.htmUH). You are probably familiar with creating a “join” between tables based on an attribute field in ArcMap. But inside a geodatabase, you can define this relationship more explicitly, and it will then always be available.

In the following steps, you will define a **relationship** between the Census Blockgroup polygon layer and the table with information on commute mode (CEN2K_BG_TRNS_COM_MEANS).

1. Right-click on the **Census Feature Dataset** and select **New → Relationship Class**.
2. Fill in the first dialog box as you see in the graphic below, by giving it a name and making sure that the origin table is **Census2000Blockgroups_poly**, and the destination table is **CEN2K_BG_TRNS_COM_MEANS** :

New Relationship Class ✕

Name of the relationship class:

Select the table/feature classes that will be associated by this relationship class.

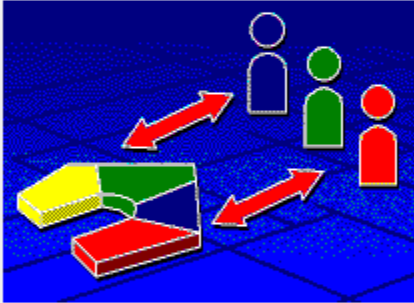
Origin table/feature class:

- [-] Boundaries
- [-] Census
 - [-] BlockGroups
- [-] LandUse
- [-] Physical
- [-] Transportation
- CEN2K_BG_TRNS_COM_MEANS

Destination table/feature class:

- [-] Census
- [-] LandUse
- [-] Physical
- [-] Transportation
- CEN2K_BG_TRNS_COM_MEANS
- CEN2K_BG_TRNS_COM_TIME

A relationship class is a collection of relationships between objects in two tables/feature classes.



Parcels are owned by owners.
Owners own parcels.

3. Click Next.
4. In the next dialog box, specify that this is a **COMPOSITE relationship** (if we delete a blockgroup, we will delete the corresponding record in the commute means table). Click Next.

5. Fill out the next dialog box as you see below:

New Relationship Class

Specify a label for the relationship as it is traversed from the origin table/feature class to the destination table/feature class.

BlockGroup_Commute_Means

Specify a label for the relationship as it is traversed from the destination table/feature class to the origin table/feature class.

BlockGroups

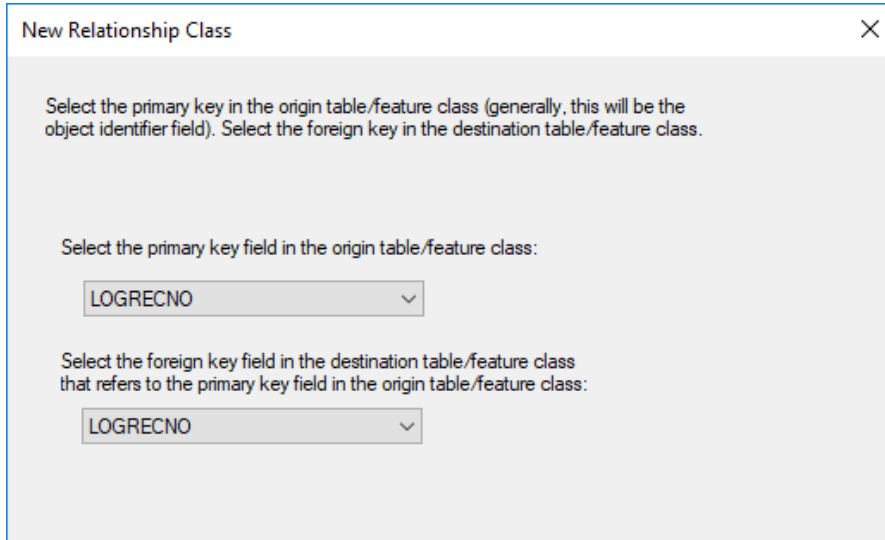
Which direction will messages be propagated between the objects related by this relationship class?

Forward (origin to destination)
 Backward (destination to origin)
 Both
 None (no messages propagated)


< Back Next > Cancel

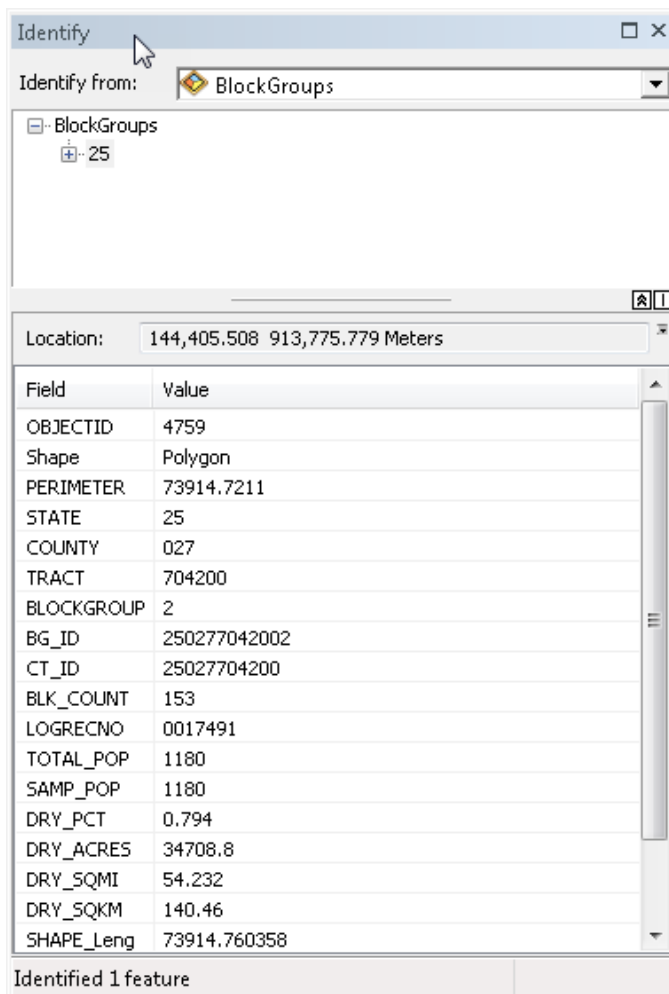
6. In the next dialog box, specify that this is a **1-1 relationship** – there is one row in the Commute Means table for each row in the Blockgroup polygon attribute table. Click “Next.”
7. In the next window, specify that you **do NOT want to add attributes to this relationship class**. Click Next.

- Fill out the next window as you see below – the **LOGRECNO** field is the common field. Click Next.

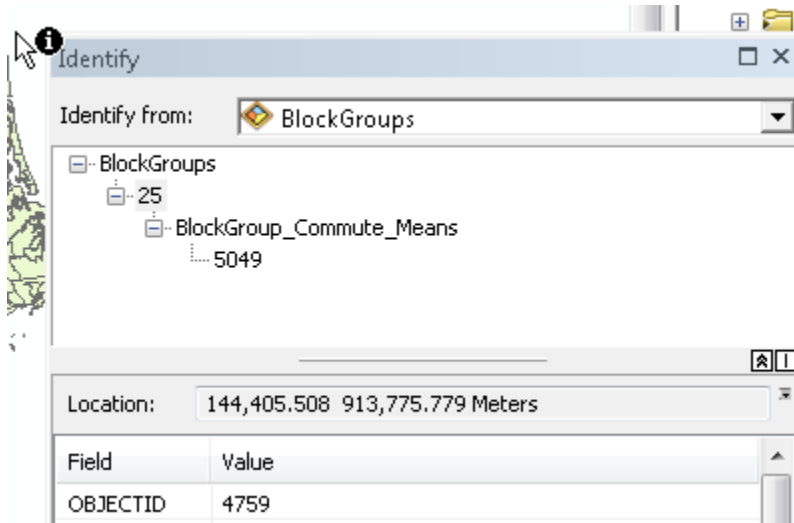


- Review the parameters, then click **Finish**. You will see your new relationship class inside the **Census Feature Dataset**.

- To see the **relationship class** in action, use the Identify tool () to click on a **blockgroup** within the map. You will see the Identify window looks like this initially – it shows the information from the blockgroup polygon attribute table:



- But drill down by clicking on the + signs and you will eventually see this – the related information for the commute modes:

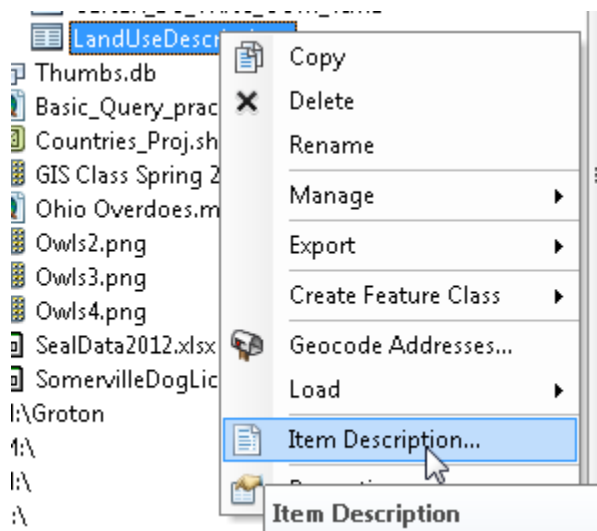


You can now easily join the census commute means table to the blockgroup polygon table by using the Join function but specifying that it is based on an existing relationship class.

- Now try this: Make another relationship class for the Commute Time table (CEN2K_BG_TRNS_COM_TIME.dbf) using the same types of parameters as above. Then try looking at it with the identify tool – you will see it is possible to see both related tables.

Create a Relationship Class to Relate Landuse Codes to their Description

- Import the **MassGIS_landuse_21_code_descriptions.dbf** table from the S:\Tutorials & Tip Sheets\Tufts\Tutorial Data\Creating a File Geodatabase\Mass GIS Landuse Code Descriptions folder into your Geodatabase. Make sure to **Import → Table (Single)** when doing so. Name it **LandUseDescriptions** and press OK.
- Let's preview this table. In the geodatabase, right click on the new table and press **Item Description**. Then click on the **Preview Tab**.



Item Description - LandUseDescriptions

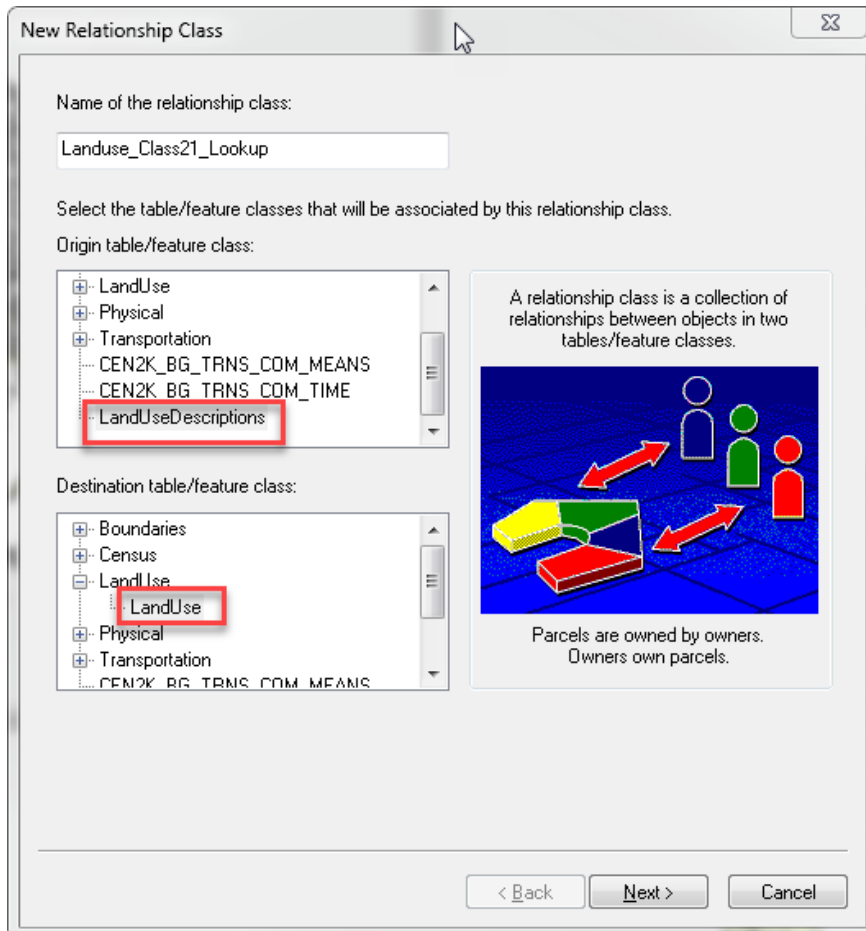
Description: Preview

Preview: Table

| OBJECTID * | CODE | ABBREV | CATEGORY | DEFINITION |
|------------|------|--------|--------------------------|---|
| 1 | 1 | AC | Cropland | Intensive agriculture |
| 2 | 2 | AP | Pasture | Extensive agriculture |
| 3 | 3 | F | Forest | Forest |
| 4 | 4 | FW | Wetland | Nonforested freshwater wetland |
| 5 | 5 | M | Mining | Sand, gravel & rock |
| 6 | 6 | O | Open Land | Abandoned agriculture; power lines; areas of no v |
| 7 | 7 | RP | Participation Recreation | Golf; tennis; Playgrounds; skiing |
| 8 | 8 | RS | Spectator Recreation | Stadiums; racetracks; Fairgrounds; drive-ins |
| 9 | 9 | RW | Water Based Recreation | Beaches; marinas; Swimming pools |
| 10 | 10 | RO | Residential | Multi-family |
| 11 | 11 | R1 | Residential | Smaller than 1/4 acre lots |
| 12 | 12 | R2 | Residential | 1/4 - 1/2 acre lots |
| 13 | 13 | R3 | Residential | Larger than 1/2 acre lots |
| 14 | 14 | SW | Salt Wetland | Salt marsh |
| 15 | 15 | UC | Commercial | General urban; shopping center |
| 16 | 16 | UI | Industrial | Light & heavy industry |
| 17 | 17 | UO | Urban Open | Parks; cemeteries; public & institutional greensp |
| 18 | 18 | UT | Transportation | Airports; docks; divided highway; freight; storag |
| 19 | 19 | LW | Waste Disposal | Landfills; sewage lagoons |
| 20 | 20 | W | Water | Fresh water; coastal embayment |
| 21 | 21 | WP | Woody Perennial | Orchard; nursery; cranberry bog |

This table can be **related** to the **landuse** GIS layer to provide descriptions for the numeric codes in that layer. There is a **1-Many relationship** between the lookup table and the landuse GIS layer – that is, there is one record in the lookup table (e.g., code 3 - forest) that relates to many records in the landuse GIS layer (all the polygons of the type “forest”).

3. Create a **new relationship class** in the **Landuse** Feature Dataset. Fill in the first window as follows – the code descriptions table must be the ORIGIN table. Click Next.



4. Specify that it will be a **SIMPLE (peer to peer) relationship** – the two tables can exist independently of each other, and deleting a record in one will not affect the other.
5. Fill out the labels as follows:

New Relationship Class ✕

Specify a label for the relationship as it is traversed from the origin table/feature class to the destination table/feature class.

Specify a label for the relationship as it is traversed from the destination table/feature class to the origin table/feature class.

Which direction will messages be propagated between the objects related by this relationship class?

Forward (origin to destination)
 Backward (destination to origin)
 Both
 None (no messages propagated)

6. Specify that it is a **1-M (one to many) relationship**. Click Next.

New Relationship Class ✕

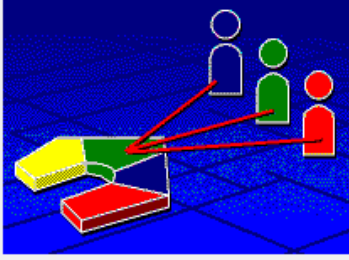
Select the cardinality for this relationship class (origin - destination).

1 - 1 (one to one)
 1 - M (one to many)
 M - N (many to many)

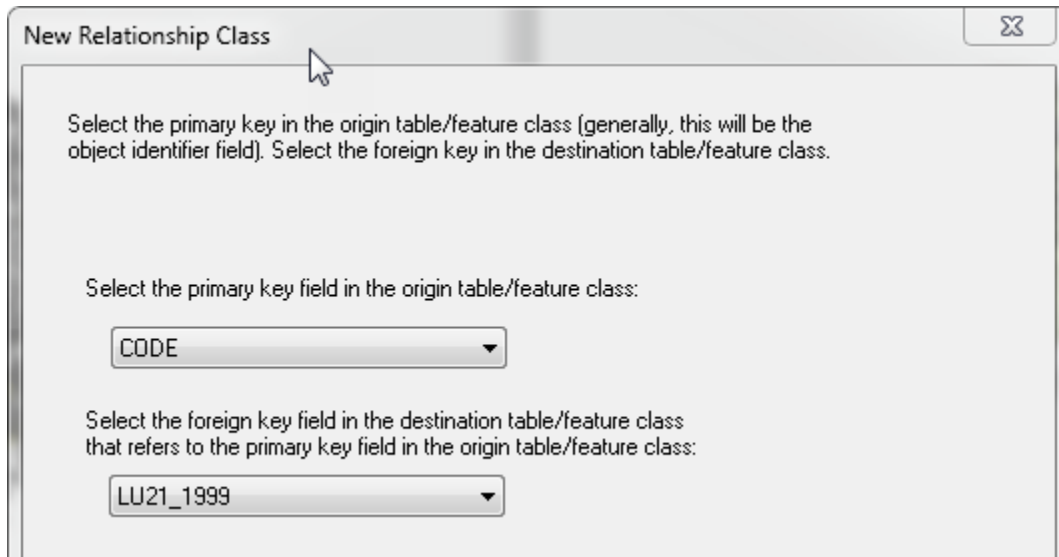
Note: If this is a composite relationship class, then the cardinality must be 1-1 (one-to-one) or 1-M (one-to-many)

In a 1-M (one to many) relationship, each object in the origin table/feature class can be related to multiple objects in the destination table/feature class.

| | |
|-----------------------------------|----------------------------------|
| Parcels Table/Feature Class | Owners Table/Feature Class |
|-----------------------------------|----------------------------------|



7. You will NOT be adding attributes. Click Next.
8. Fill out the attribute field links as follows:



9. Click Next and then **Finish** when done.
10. Use the Identify icon to see the related data in the Land Use preview tab.

You're done with creating a File Geodatabase!

Now you can open the geodatabase in ArcMap. If you want to see the joined data via the relationship class, you will still need to create the join (right click on the data layer and choose Joins and Relates → Join...). But now you can specify that the join will be based on one of your relationship classes.

Other Options for Geodatabases

We've just done some simple imports in this tutorial. But be aware that you can create new toolboxes and models as part of your geodatabase, and you can create planar and geometric topologies. In addition, the geodatabase file format gives you more sophisticated database design options which we will explore.