

GIS III: GIS Analysis

Module 2a: Introduction to Network Analyst

*** Files needed for exercise: *nc_cty.shp*; *target_stores_infousa.dbf*; *streets.sdc* (provided by street map usa); *NC_tracts_2000sf1.shp*

Goals: To learn how to use the Network analyst tools to perform network based analyses. Specifically, to use the Network Analyst Extension to add network locations, set your analysis properties and perform a basic service area analysis.

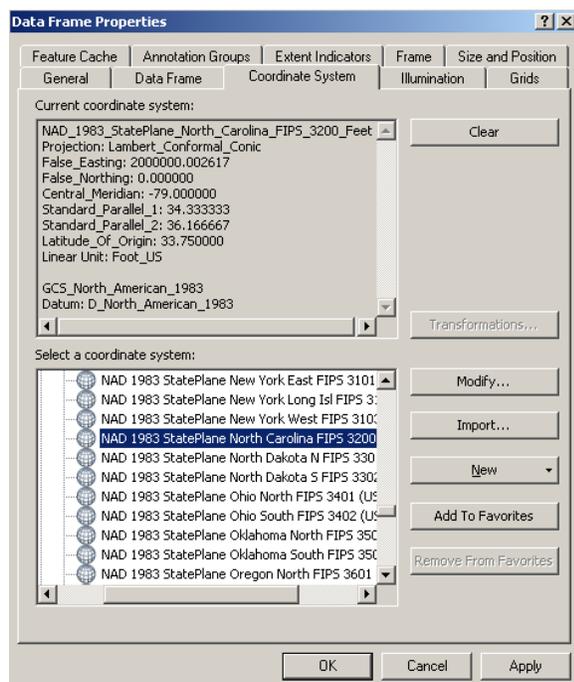
Skills: After completing this exercise, you should have a basic familiarity with Network Analyst Tools and have experience performing a service area analyses.

Service Area Problem: We are interested in finding out the percentage of North Carolina's population that is within a 30 minute drive time from any Target store. To do this we will create service area polygons representing a 30 minute drive time through a nationwide network dataset (StreetMap USA) to a Target retail store. We will use Target locations for the state of North Carolina from the InfoUSA dataset.

Prepare your node data:

1. Open ArcMap
2. Right click on your data frame and set your coordinate system to NC's standard projected coordinate system: *NAD_1983_StatePlane_North_Carolina_FIPA_3200_Feet*.

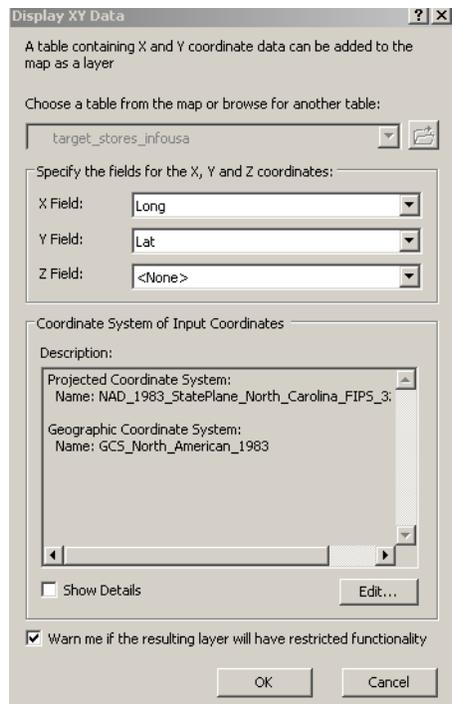
Note: All training state systems are listed in the Coordinate System standards.txt file located in the data folder.



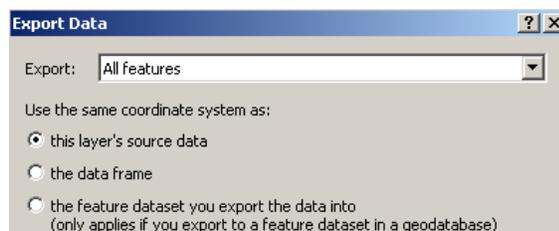
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3. Add NC County *nc_cty.shp*. This county shapefile will provide some useful geographical context for your analysis
4. Add the InfoUSA table *target_stores_infousa.dbf*. These data represent a selection made from the complete dataset ("FranchDesc" = 'TARGET').
5. Right click on your table and select **Display x|y data** - do not click OK yet!



6. Note that the raw data from the InfoUSA data is geographically defined using latitude and longitude coordinates (decimal degrees). You will need to let the software know to use a Geographic Coordinate System, NAD 1983, for proper georeferencing when displaying x|y data.
7. Click **edit > predefined > Geographic > North America > NAD1983**.
8. Right Click on your 'event' class and export to a new shapefile.
9. Using the same coordinate system as the layer's source data, name the shapefile: *Target_stores_nc.shp*.



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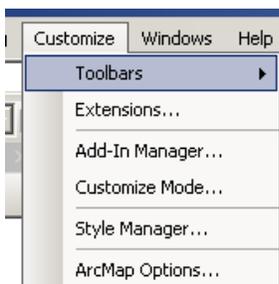
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Network Analysis:

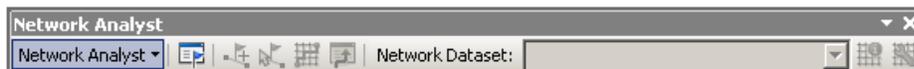
1. Turn on NA extension - **Customize > Extensions.**



2. Activate your NA toolbar - **Customize > Toolbars > Network Analyst.**



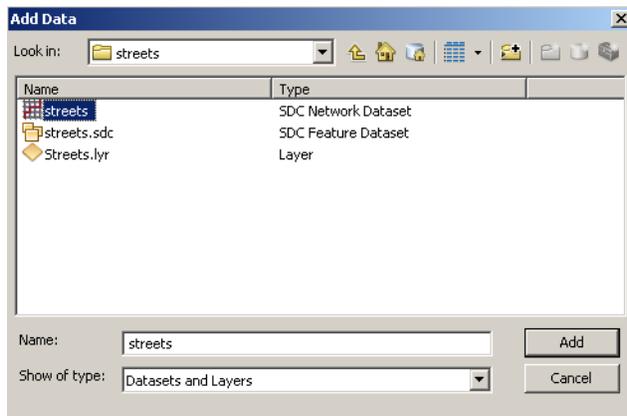
Looks like this:



3. Add your StreetmapUSA network dataset *streets*. Choose **yes** to add all feature classes that participate in the network dataset.

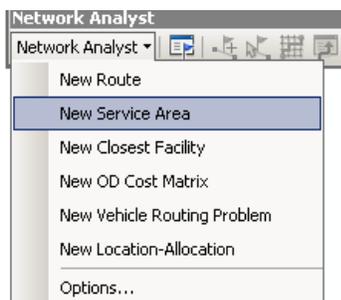
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Note: This is a nationwide dataset included on your ESRI ArcGIS Data disks; be forewarned it is large. The sdc format is un-editable, but it means you will not need to create your own network dataset. You should see a detailed road network begin to fill in. You can turn off these by un-checking them in the TOC to speed things up a bit.

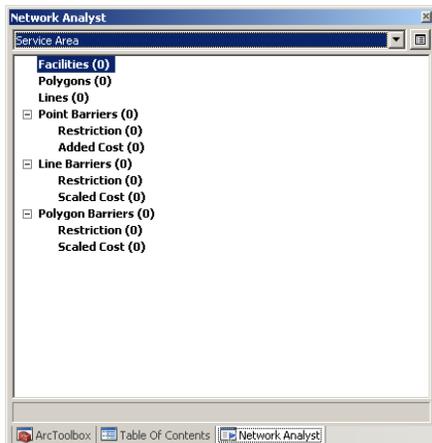
4. If your network analyst window is not visible make it visible by left clicking on  in the toolbar.
5. In the Network Analyst toolbar, click **Network Analyst > New Service Area**.



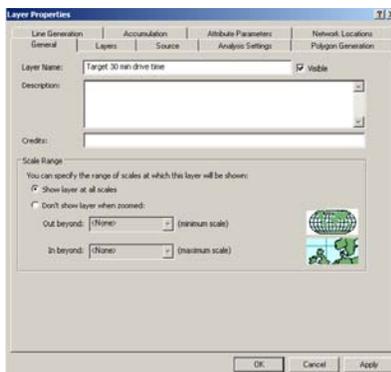
6. Adjust your service area properties and analysis settings. Left click on the **Service Area Properties** icon in the Network Analyst window (in the upper right hand side).

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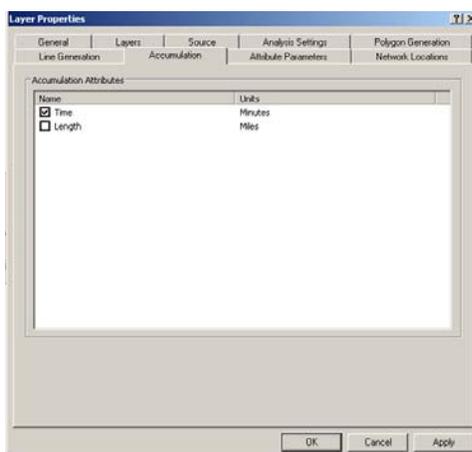
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- Under the **General** tab, name this service area layer: *Target 30 min drive time*.



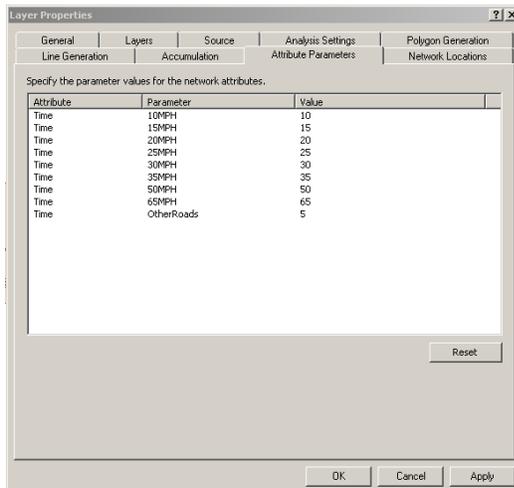
- Under the **Accumulation** tab check **Time**, this will set your impedance measurement or cost for moving through the network based on time.



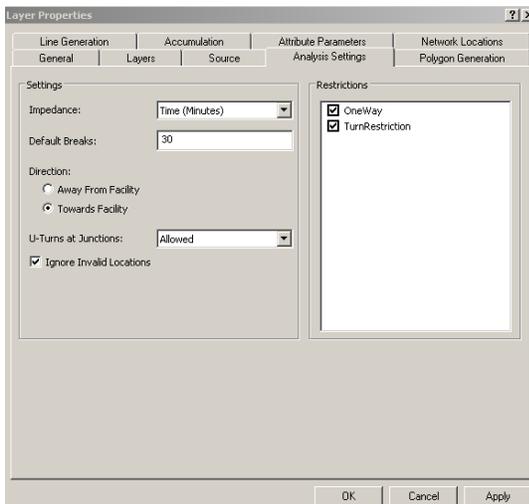
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- Take a look at your **Attribute Parameters** tab. You can see that the time attribute is informed by speed limit parameters for your network.



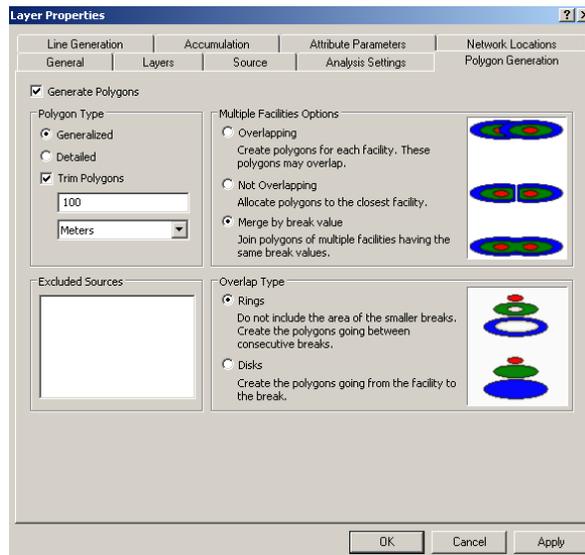
- Under the **Analysis Settings** tab you should see that your impedance or cost will be measured in time (minutes). Set your default break as **30 minutes**. Set your direction as **Towards Facility**. Go with defaults for the remaining options on this tab.



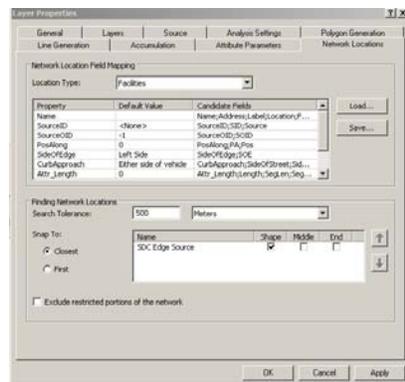
- Under the **Polygon Generation** tab, keep all the defaults with the exception of **Multiple Facilities Options**. Select **Merge by break value**.

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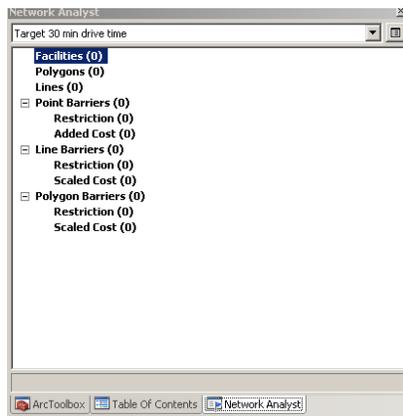
- Under the **Network Locations** tab we will set the tolerance for loading or locating the Target store locations on the network dataset. Set the **Search tolerance** for finding the Target stores on the network to **500 meters**.



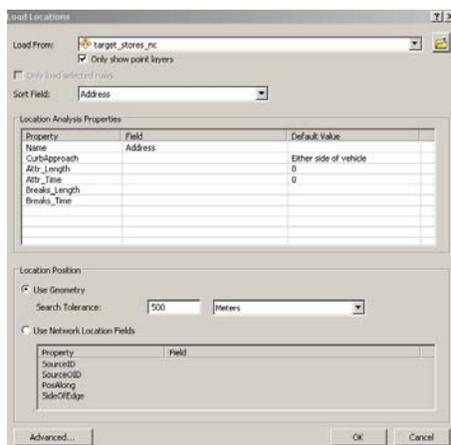
- Click **Apply** then **Ok**.
- Right click on **Facilities** in the Network Analyst window and select **Load locations**.

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- Make sure that your shapefile *target_stores_nc.shp* is the data to be loaded and select Address as your **sort field**. You can sort by any of the attributes in the table but it is a good idea to use a unique identifier. The Search Tolerance you input in the **Network Locations** tab should be reflected here.



- Click **OK**. You should see 39 facilities located in your Network Analyst window.

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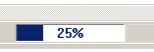
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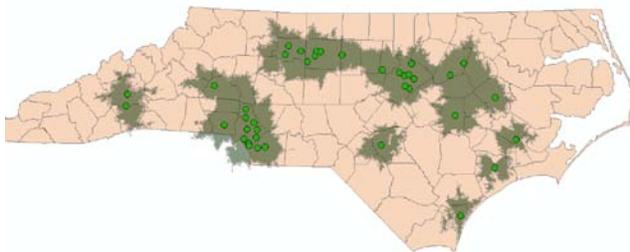


Solve the 30 min drive time service area problem:

Remember we want to create a network based area that represents a 30 minute drive time to any Target store within NC.

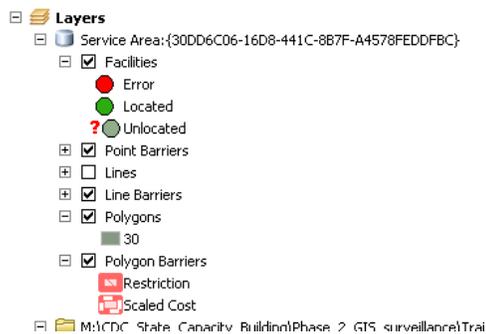
1. Right click on the solve icon  this may take a bit of time - remember we are using a very large network dataset.
2. While you wait take a look around. Take a look at the lower left hand side of your screen. If you

see this: , it's a good sign. Some indication of progress on the lower right hand side of your screen is also a good thing: . When the solving is complete you should see something that looks like this:

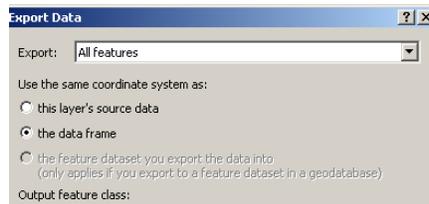


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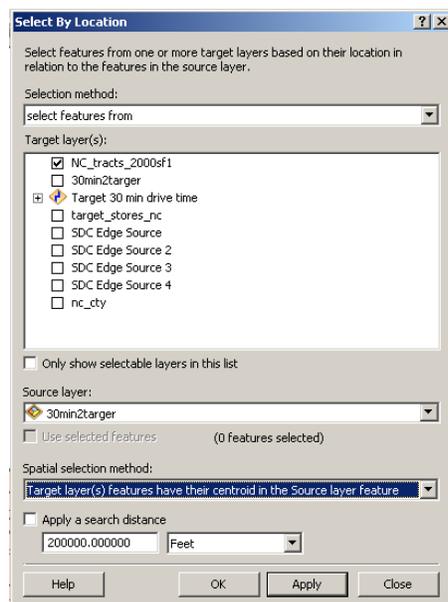
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- In your table of contents you will see the results of your analysis. Export the polygons for your analysis to a new shapefile by right clicking on them and choosing **Export Data**. This time use the projection system of **the data frame**. Name the *file 30min2target.shp*.



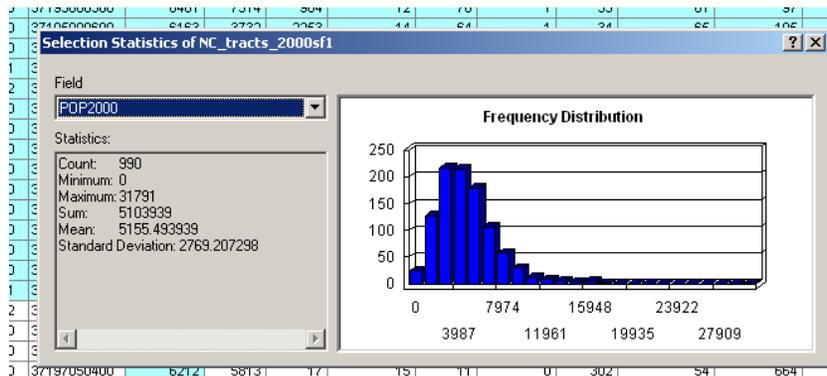
- Add the North Carolina Census tracts *NC_tracts_2000sf1.shp*
- Click **Selection > Select by Location**. Spatially select all **census tracts** that **have their centroid** (center of gravity) in the **30 minute drive time** polygon. We will make an assumption that all tracts with their centroid within the 30 minute drive time polygon have populations that are within the 30 minute window to a Target store. Click **Apply**.



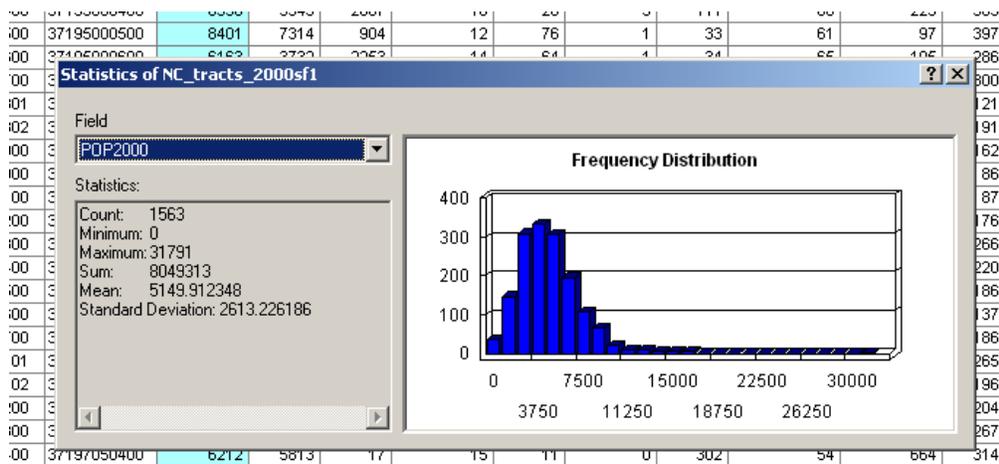
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- Right click on the POP2000 attribute field and select **statistics**. Take a look at the sum of the tract values for your selection. There are 5,036,615 people within a 30 minute drive time of a Target.



- Now **Clear selection** and take a look at the sum of the tract values for all of NC. The total North Carolina population in 2000 was 8,049,313.



Solution: It looks like ~ 63% of NC's population is within a 30 minute drive time to a Target.

Discussion:

- Do you buy this?
- What are some likely assumptions/caveats to this type of analysis?
- Do you think Target used location based intelligence when locating its stores across the state?
- How could you use a similar service area analysis in your work? What would you do differently?



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If time permits...

We can try an alternative method for inclusion in the 30 minute drive time. In this method tract centroids are weighted by underlying block group population counts-shifting centers to heavier populated areas. I have checked and the end result is not too different:

5,194,434 people within 30 minute drive time

8,049,313 total 2000 pop

~64 % of NC's population is within a 30 minute drive time to a Target