



GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst

*** Files needed for exercise are *UT_mcdonalds.shp*; *SaltLake_tracts_2000sf1cent.shp*; *streets.sd* (provided by street map usa); and *UT_tracts_2000sf1.shp*

Goals: Our goal for this activity is to use Network Analyst to generate an origin-destination (O-D) matrix or table. The tables and graphics provided by this practical network analysis method provide a great deal of information.

Skills: After completing this activity you will know how to complete an O-D analysis using Network Analyst and develop some ideas for how to apply this useful tool in your own work. At the application level, this tool will allow you to calculate distances between points through a network with accumulation or cost variables (distance or time).

Origin-Destination Matrix Problem: Salt Lake County UT – Fast food restaurants and neighborhoods
We will create an O-D matrix to understand restaurant accessibility for census tracts in Salt Lake County, UT. We will measure the drive time from the center of each census tract to all the McDonald's restaurants within a defined time frame. For the purposes of this exercise let's say within a 15 minute drive time.

Comparing tract level demographic data related to risk factors for heart disease and stroke alongside accessibility to fast food restaurants could prove useful for tailoring neighborhood level outreach and treatment efforts. Our O-D matrix could be used to evaluate network-based accessibility to McDonald's fast food restaurants by census tract. Which Salt Lake County census tracts have the most convenient driving accessibility?

Prepare your data:

1. Open ArcMap
2. Add the McDonald's restaurants for Salt Lake County, UT *UT_mcdonalds.shp*. This statewide dataset for the point locations of McDonald's restaurants will serve as destinations in your analysis.
3. Add the point representation of UT census tracts *SaltLake_tracts_2000sf1cent.shp*. These points will serve as origins in your analysis; we need a point representation to serve as the starting point for the Origin to Destination calculation.
4. Add UT census tracts to your project *UT_tracts_2000sf1.shp*. This statewide shapefile will provide some useful geographical context for your analysis.

Establish your Network:

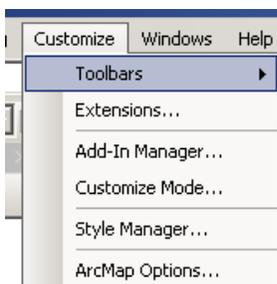
1. Turn on your NA extension by clicking **Customize > Extensions**.

GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst



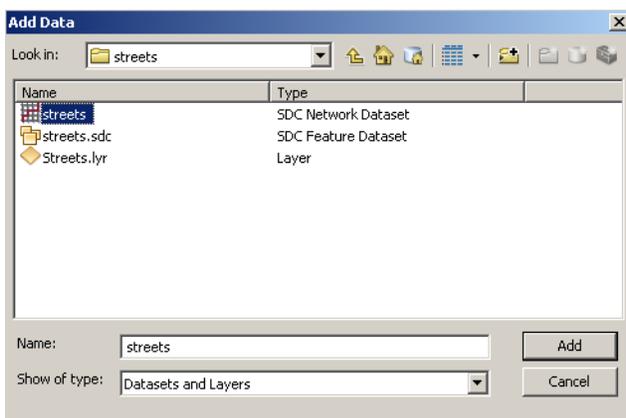
2. Activate your NA toolbar by clicking **Customize > Toolbars** and checking **Network Analyst**.



Looks like this:



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

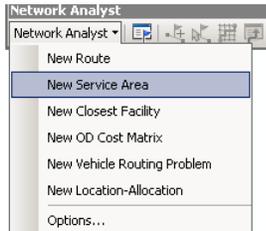


Note: This is a nationwide dataset included in your ArcGIS Data disks. Be forewarned it is large. The sdc format is un-editable, but using this means you will not need to create your own network dataset. You should see a detailed road network begin to fill in. You can turn off these by un-checking them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

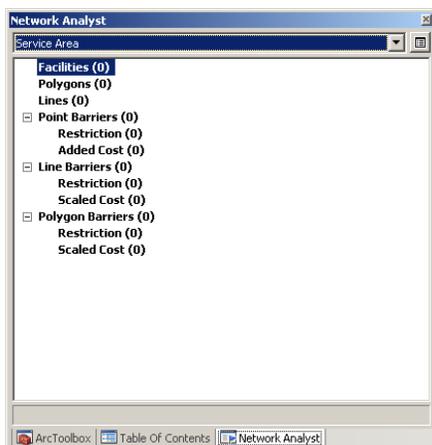
GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst

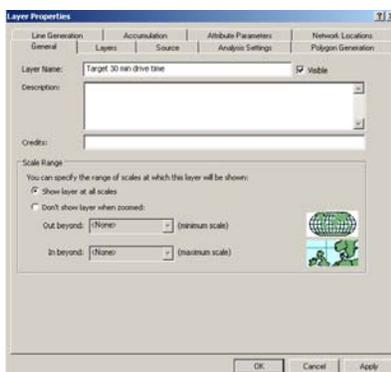
- If your network analyst window is not visible make it visible by left clicking on  in the toolbar.
- In the Network Analyst toolbar, click **Network Analyst > New Service Area**



- 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).



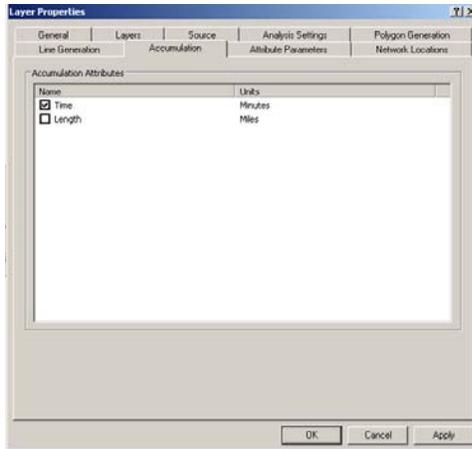
- Under the **General** tab you can name this service area layer: *Salt Lake McDonald's tract OD*.



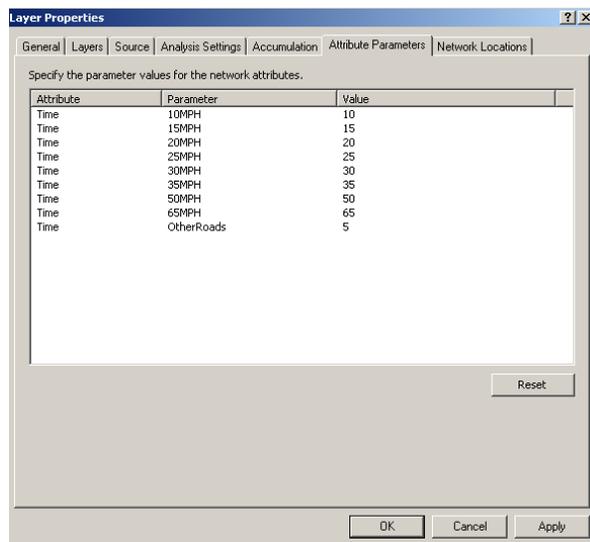
- Under the **Accumulation** tab check **Time**, this will set your impedance measurement or cost for moving through the network based on time.

GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst



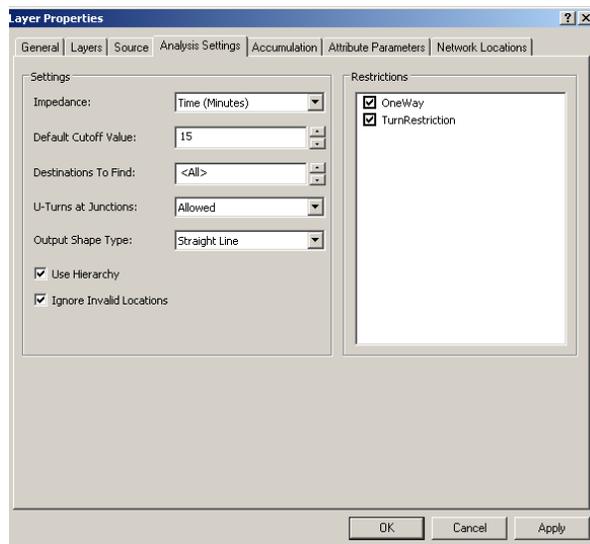
9. Take a look at your **Attribute Parameters** tab. You can see that the time attribute is informed by speed limit parameters for your network.



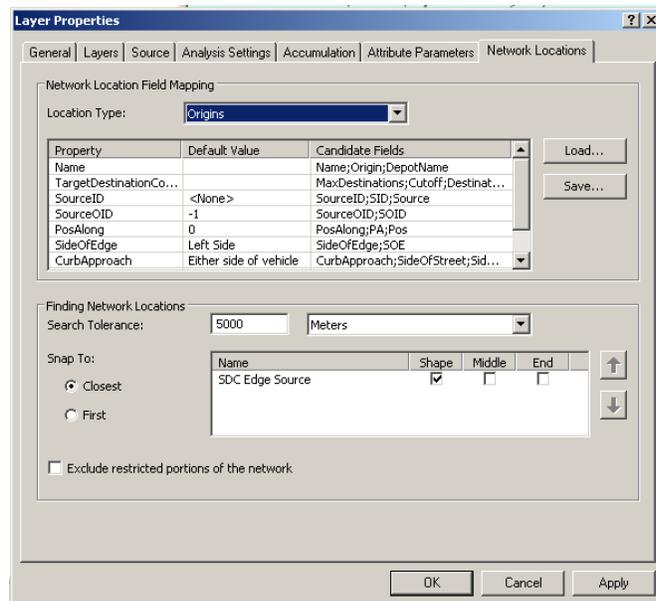
10. Under the **Analysis Settings** tab you should see that your impedance or cost will be measured in time (minutes). Change the default cutoff value to 15 minutes; remember that we only want to know those McDonald's that are within a 15 minute drive time. Go with defaults for the remaining options on this tab.

GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst

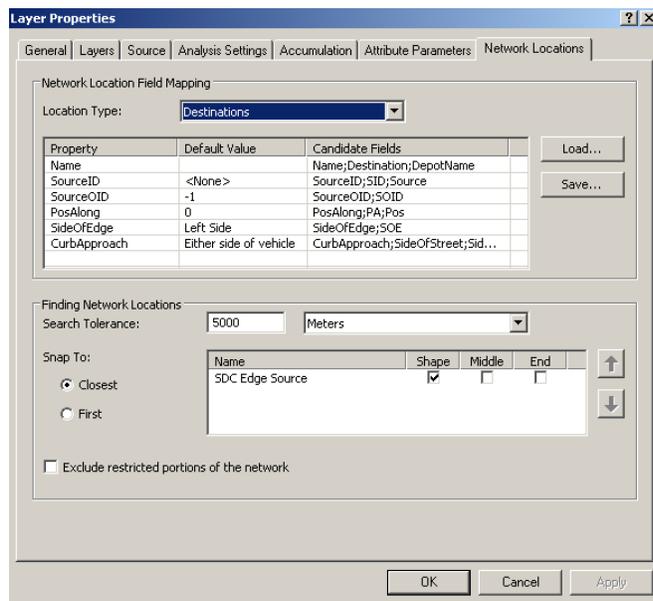


- Under the **Network Locations** tab you can set the tolerance for loading or locating the **origins** (census tracts) and **destinations** (McDonald's) on the network dataset. Toggle back and forth by selecting either origins or destinations in location type. We will stick with the 5000 meter search tolerance for both.



GIS III: GIS Analysis

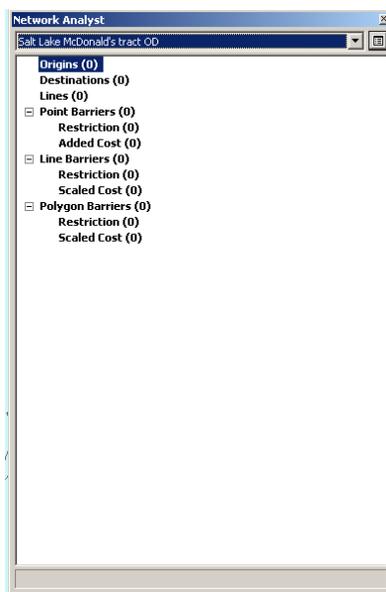
Module 2b: Introduction to Network Analyst



12. Once you have taken a look you can click **Apply** and **OK**.

Load data into your Network Dataset:

1. Right click on **Origins** in the Network Analyst window and select **load locations**.
2. Choose the shapefile *SaltLake_tracts_2000sf1cent.shp* as the data to be loaded. This means our starting point for measuring drive time will be the center of gravity for each census tract.

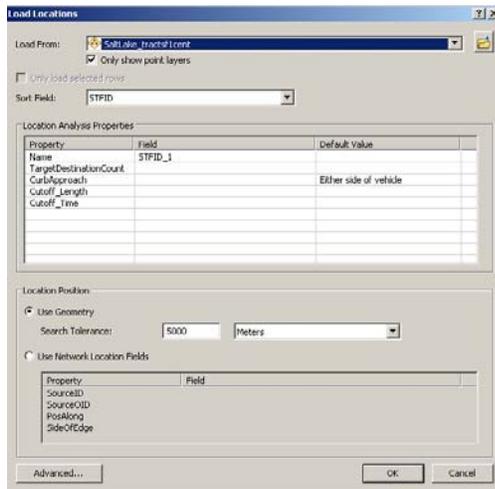


3. Select *stfid* as your **sort field** from the **sort field** dropdown. You can sort by any of the attributes in the table but it is a good idea to use a unique ID.

GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst

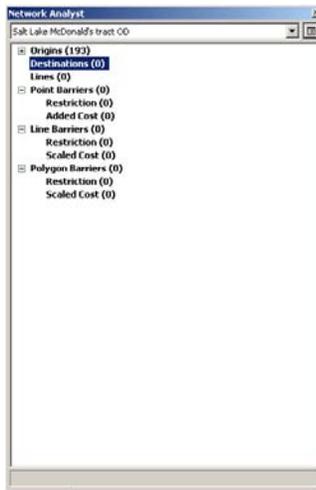
4. You can also specify a **Name Property Field** here, which is handy when looking at the results. Select *STFID_1*. Again, a unique field is probably best. Finally, the default **search tolerance** we saw under the **Network Locations** tab should be reflected here.
5. Click **OK**. All 193 of your tract centroid points should load.



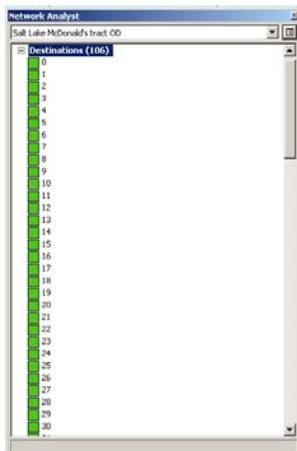
6. Load destinations into the Network Dataset. Right click on **Destinations** in the Network Analyst window and select **load locations**.

GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst



7. Choose the shapefile *Utah_mcdonalds.shp* as the data to be loaded.
8. Select *fid* as your **sort field** from the dropdown.
9. Specify FID as **Name** property **Field** here.
10. Click **OK**. All 106 of your McDonald's points should load.



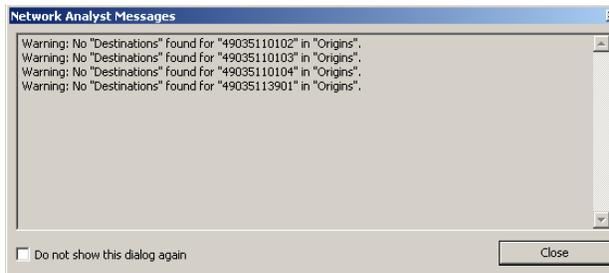
Solve the O-D Cost Matrix problem

Remember: we want to create an O-D matrix that shows the drive times from the center of each Salt Lake County census tract to all McDonald's restaurants within a 15 minute drive time through the road network.

1. Click on the solve icon .
2. You may see something like this:

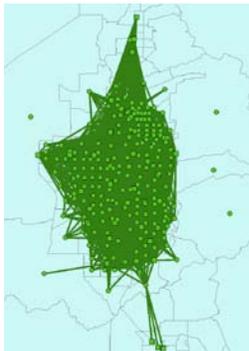
GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst

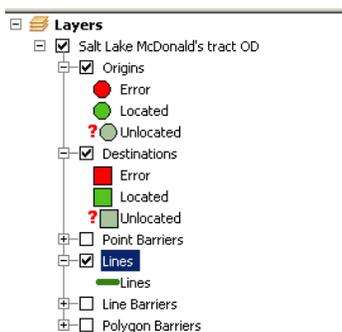


What do you think this means? *For these 4 tract centers there are no McDonald's within a 15 minute drive time. Note these are the biggest tracts and so also the least densely populated.*

- When the solving is complete you should have something that looks like this:



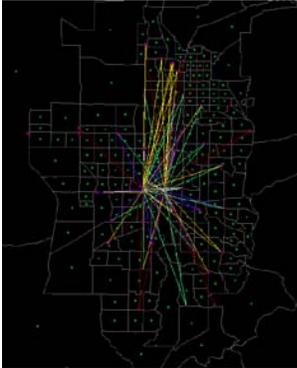
- In your table of contents you will see the results of your analysis; we are interested in the table associated with the lines that connect your origins and destinations. Right click on the lines feature in the TOC and open the table.



This table contains the pairs of all origins and destinations that meet the 15 minute drive time limit. The **Name** field contains the name fields you specified for tract centroid and McDonalds restaurants.

GIS III: GIS Analysis

Module 2b: Introduction to Network Analyst



Discussion:

1. Do you buy this?
2. Why do you think we used a statewide destination dataset and a tract specific origin dataset?
3. What are some likely assumptions/caveats to this type of analysis?
4. How could you use a similar O-D analysis in your work?
5. What would you do differently?