

*** Files needed for exercise: NY_county10_prj_carto.shp ,BA_Pharm_NY.dbf, , NY_PWC_tract_2010_prj.shp, and streets (network dataset provided by StreetMap USA)

Goals: The goal of this exercise is to learn how to use the Network Analyst tools to perform networkbased analyses. Specifically, you will learn 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 analysis.

Service Area Problem: You are interested in finding the percentage of New York's population that is within a 15 minute drive time to a RITE AID Pharmacy. To do this, you will create a service area polygon representing a 15 minute drive time through a network dataset (StreetMap USA) to any RITE AID pharmacy. You will select RITE AID locations for your area of interest from a business dataset.

Preparing your Node Data

- 1. Open a new blank map in ArcMap.
- Right click on the data frame and set your coordinate system to New York's standard projected coordinate system: Projected Coordinate Systems > UTM > NAD 1983>NAD_1983_UTM_Zone_18N. Click OK.





- 3. Add the New York shapefile: *NY_county10_prj_carto.shp*. This state shapefile will provide some useful geographical context for your analysis.
- 4. Add the business data table: *BA_Pharm_NY.dbf,* . These data represent pharmacies in and around New York from the 2014 Esri Business Analyst dataset.
- 5. You will make a selection from the *BA_Pharm_NY.dbf*, table to select only those records representing RITE AID stores.
 - a. Right click on the table in your table of contents (TOC) and select **Open** to view the table.
 - b. Click on the dropdown arrow on the Table Options icon and go to Select By Attributes.



c. Create a new selection WHERE: "CONAME" ='RITE AID' and click Apply.

Method :	Create a ne	w selection			
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< <	= Or				
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ls I	n Null	Get Unique	Values G	o To:	
SELECT * F	ROM BA_Phi	arm_WV WHE	RE:		
"CONAME"	' ='RITE AID'				
	Varify	Help		ad	Save

You should note that 634 out of 5,024 records have been selected in the lower left hand side of your table.

OID	OBJECTID	DUNSNUM	CONAME
0	11762089	145130279	LOUCASSARA
1	11782920	837895384	RITE AD
2	11763128	187386018	RITEAD
3	11763282	849514218	BARTHS PHARMACY
4	11703009	054325843	GENOVESE DRUG STORES
5	11763826	057714511	THE MEDICINE SHOPPE
8	11764011	027679824	CVS
7	11764090	024230827	PHARMACY
8	11764105	176614477	CVS
9	11764119	078323563	CVS
10	11764145	061377478	CVS
11	11785043	821858140	MEDICINE MAN RX
12	11766102	039305435	SHRLEY PHARMACY AND SURGICAL
13	11766117	057716953	SHRLEY DRUG & SURGICAL
14	11766580	827935433	RITE AD
15	11786922	190695895	CVS
16	11767083	016022432	CVS
17	11767187	096915749	RITE AID
18	11768482	962081063	cvs
19	11769142	860189521	RITE AD
20	11789175	026739618	GENOVESE DRUG STORES INC
21	11769429	018329876	SUNRISE RX INC.
22	11769739	620658745	WALLSTREET CHEMISTS INC
23	11770011	107033490	PRESCRIPTION CENTRE OF CORAM INC
24	11770083	092381478	MEDICINE SHOPPE EAST PATCHOGUE
25	11770092	126911999	RITE AID
26	11770215	052834307	GENOVESE DRUG STORES
27	11770304	621853220	LIFE EXTENSION
28	11770389	790876114	WALGREENS
29	11771132	032508545	PHARMACY 112
30	11771134	603415027	SHRLEY DRUG & SURDICAL
31	11771216	003996659	MEDFORD CHEMISTS INC.
32	11771299	061965711	BROOKHAVEN PHARMACY



These represent the records that meet the requirements of your query: RITE AID stores. Close the *select by attributes* dialogue.

- 6. While the table is still open click on the Table Options icon again and select Export; this will export the 634selected records to create a new table.
- 7. Save the table as *RITE AID_NY.dbf* in the Exercise_Data folder; make sure you select dBASE Table in the **Save as type** dropdown.

Saving Data	× 1
Look in: 🛅	Exercise_Data 🔹 🛧 🏠 🕼 🕅 🕶 🔛 😂 🐨 🍪
Estreets	NY.dbf
Name:	RITE AID_NY.dbf Save
Save as type:	dBASE Table Cancel

When you are asked if you would like to add the new table to the current map, click **Yes**.

You can close the *BA_Pharm_NY.dbf*, table and remove it from your TOC.

8. Right click on your *RITE AID_NY.dbf* table and select **Display X|Y data**. Do not click OK yet!

Display XY Data		23
A table containing map as a layer	X and Y coordinate data can be added to th	e
Choose a table fr	om the map or browse for another table:	
RITE_AID_N	γ 👻	e
Specify the field	s for the X, Y and Z coordinates:	
X Field:	x	•
Y Field:	у	•
Z Field:	<none></none>	•
Coordinate Syst Description: Projected Coo Name: NAD Geographic C Name: GCS	rdinate System: 1983_UTM_Zone_18N Jordinate System: North_American_1983	•
•	4	
Show Detail	s Edit	
📝 Warn me if the	resulting layer will have restricted functiona	lity
About adding XY	data OK Cance	!



Note that the raw data from Business Analyst is geographically defined using latitude and longitude coordinates (decimal degrees), Y and X respectively. The software recognizes the correct fields for X and Y coordinates. **However, the software automatically chooses the coordinate system of the input coordinates from your table based on the coordinate system for your data frame - you set this in the first step.**

9. You will need to let the software know to use a Geographic Coordinate System, WGS 1984, for proper georeferencing when displaying X|Y data. The X|Y coordinates in your table are in this system. Click on the Edit button to change the coordinate system of your input coordinates to match Geographic Coordinate Systems > World > WGS 1984.

Display XY Data		8
A table containin map as a layer	ng X and Y coordinate data can be	added to the
Choose a table f	rom the map or browse for anothe	r table:
RITE_AID_N	ΛY	
Specify the fie	lds for the X, Y and Z coordinates:	
X Field:	x	•
Y Field:	У	•
Z Field:	<none></none>	•
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		4
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🔽 Warn me if t	ne resulting layer will have restricte	d functionality
About adding XY	data ОК	Cancel

Finally, click **OK**. You have now let the software know that these are Geographic Coordinates.

- 10. Your 634 RITE AID pharmacies should now be displayed.
- 11. Right click on your 'event' class and export to a new shapefile.
- 12. Using the same coordinate system as the data frame, name the shapefile: NY_RITE AID_pharm.shp and save it in your Exercise_Data folder. Saving this exported data with the same coordinate system information as your data frame will project the data to the appropriate projected coordinate system.



Saving Data		83
Look in: 🛅 🗄	Exercise_Data 🔹 🛧 🏠 🕼 🐺 🕶 🔁 🗊	6
istreets I NY_county1 I NY_PWC_trace I NY_	10_prj_carto.shp 'act_2010_prj.shp	
, Name: Save as type:	NY_RITE AID_pharm.shp Save	

Add the new shapefile *NY_RITE AID_pharm.shp* to your project.

13. You can now remove the *RITE AID_NY Events* as well as the *RITE AID_NY.dbf*.

Setting up a Network Analysis

1. Turn on the **Network Analyst extension**. Go to **Customize > Extensions.**

Extensions	23
Select the extensions you want to use.	
3D Analyst ArcScan Geostatistical Analyst Wetwork Analyst Publisher Schematics Spatial Analyst Tracking Analyst	
Description:	
3D Analyst 10.4.1 Copyright ©1999-2016 Esri Inc. All Rights Reserved	
Provides tools for surface modeling and 3D visualization.	
	Close



 Activate your Network Analyst toolbar. Go to Customize > Toolbars > Network Analyst. Note that you need to make sure that you have activated the extension prior to adding the toolbar - the software will allow you to add the toolbar to a project even if the Network Analyst extension is not activated (it will not work though).

Cus	tomize Windows	Help
	Toolbars	• •
	Extensions	e
	Add-In Manager	D.
	Customize Mode	
	Style Manager	- H
	ArcMap Options	

The toolbar looks like this:

Network Analyst		+ ×
Network Analyst 🗸 📴 🤙 🛵 🧱 🗊	Network Dataset:	→ 盟 謎

3. Add your Streetmap USA network dataset *streets*. It is located in the streets folder. Choose **Yes** to add all feature classes that participate in the network dataset. **Note:** This is a nationwide dataset so it may take a long time to download. Be forewarned, it is large. The .sdc format is uneditable, but it means you will not need to create your own network dataset.

Add Data		F					23
Look in: 🔁 s	treets	▼ ¹	۵ 🕼	-	2	60	6
streets.sdc							
Streets.lyr	•						
					_		
Name:	streets					Add	



You should see a detailed road network begin to fill in. You can turn these off 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**.



 To adjust your service area properties and analysis settings, click on the Service Area Properties icon in the Network Analyst window (on the upper right-hand side).

Network Analyst
Service Area
Facilities (0) Polygons (0) Lines (0) Point Barriers (0) Restriction (0) Added Cost (0) Line Barriers (0) Restriction (0) Scaled Cost (0) Polygon Barriers (0) Restriction (0) Scaled Cost (0) Scaled Cost (0) Scaled Cost (0)
ArcToolbox 🖽 Table Of Contents 💽 Network Analyst



- 7. Under the **General** tab, name this service area layer: *RITE AID 15 minutes NY state.* Click **Apply** rather than OK.
- 8. Under the **Accumulation** tab, check **Time**. This will calculate time as the cost of moving through the network for your analysis. Click **Apply** rather than OK.

General	Layers	Source	Analysis Settings	Polygon Generation
Line Generation	Ac	cumulation	Attribute Parameters	Network Locations
counsulation Attr	ihutee	-		
ccumulation Attr	butes			
Name			Units	
Time			Minutes	
Length			Miles	

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.

General	Layers Source		Analysis Settings	Polygon Generation
Line Generation Acc		umulation Attribute Parameters		Network Locations
pecify the param	eter values for the	e network attribu	tes.	
Attribute	Param	eter	Value	
Time	10MPH	4	10	
Time	15MPH	ł	15	
Time	20MPH	ł	20	
Time	25MPH	4	25	
Time	30MPF	ł	30	
Time	35MPH	ł	35	
Time	50MPH	4	50	
Time	65MDH	4	65	

10. Under the Analysis Settings tab you should see that your impedance or cost will be measured in time (minutes). Set your default break as 15 minutes. Set your direction as Towards Facility. In this analysis you will Use Hierarchy and go with defaults for the remaining options on this tab.



Click **Apply** rather than OK. (NOTE: **Hierarchical analysis** is a heuristic method for solving drive time by favoring travel on larger roads (e.g. highways) over small roads (e.g. local streets). Network Analyst can compute service areas more quickly when using a hierarchical analysis, but it is less exhaustive than a non-hierarchical analysis. The <u>About network analysis with hierarchy</u> help page has more information.)

Line Generation	Accumulation	Attribute Parameters	Network Locations
General La	yers Source	Analysis Settings	Polygon Generation
Settings		Restrictions	
Impedance:	Time (Minutes)	✓ OneWay	
Default Breaks:	15	TurnRestric	tion
Use Time:			
Time of Day:	8 AM		
Day of Week:	Today	-	
Specific Date:	5/16/2017		
Direction:			
Away From Facility			
Towards Facility			
U-Turns at Junctions:	Allowed	-	
Use Hierarchy			
Ignore Invalid Locatio	Ins		
About the service area a	nalysis layer		

11. Under the **Polygon Generation** tab, keep all the defaults with the exception of **Multiple Facilities Options.** Select **Merge by break value** and click **Apply** rather than OK.



ine Generation	Accumulation Attribute Param	eters Network Location
ieneral Layers	Source Analysis Set	tings Polygon Generati
nerate Polygons olygon Type) Generalized) Detailed ? Trim Polygons: 100 Meters xduded Sources	Multiple Facilities Options Overlapping Create polygons for each fa polygons may overlap. Not Overlapping Allocate polygons to the do: Merge by break value Join polygons of multiple fa same break values. Overlap Type Rings Do not include the area of th Create the polygons going b consecutive breaks. Disks Create the polygons going b	clity. These sest facility. clities having the esmaller breaks. etween

12. Under the **Network Locations** tab, check the tolerance for locating the RITE AID stores on the network dataset. Stay with the default **Search Tolerance** of **5000 meters** (i.e. locations up to 5000 meters from a road *will be located* on the network).

General	Layers	Source	Analysis S	ettings	Po	lygon Generatio	
Line Generation	Accur	mulation	Attribute Parameters		Ne	Network Locations	
Network Location Fie	eld Mapping						
Location Type:	Facilities	Facilities					
Property	Default V	/alue	Candidate Fields		*	Load	
Name			Name;Address;Lab	el;Location	;F =	C	
SourceID	<none></none>		SourceID;SID;Sour	ce		Save	
SourceOID	-1		SourceOID;SOID				
PosAlong	0		PosAlong;PA;Pos				
SideOfEdge	Left Side		SideOfEdge;SOE		-		
Finding Network Loc	ations			0.00			
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Finding Network Loc Search Tolerance: Snap To: © Closest © First Exclude restricte	ations 500 Nan SDC d portions of th	ne C Edge Sourc	Meters	Shape 1	Viddle		



Note: You may need to adjust this since how well the locations load depends on the condition of the network dataset and the quality of your geocoded data. Stick with the defaults for the rest of the settings for now. Click Apply, then OK.

13. Right click on **Facilities** in the Network Analyst window and select **Load Locations**.

The RITE AID pharmacies are the **Facilities** that you will be creating service areas for.

RITE AID 15 minutes NY state	-
Facilities (0)	
Polygons (0)	
Lines (0)	
Point Barriers (0)	
Restriction (0)	
Added Cost (0)	
Line Barriers (0)	
Restriction (0)	
Scaled Cost (0)	
Polygon Barriers (0)	
Restriction (0)	
Scaled Cost (0)	

14. Make sure that your shapefile NY_RITE AID_pharm.shp is the data to be loaded and select ADDR 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. For the Name Property select ADDR field as well; this will identify each facility by its address information. The Search Tolerance used in Network Locations tab should be reflected here.

[The second second second second	
	 Only snow point layers 	
Only load selec	ted rows	
rt Field:	ADDR	
L.		
Location Analysis	Properties	
Property	Field	Default Value
Name	ADDR	
CurbApproach		Either side of vehicle
Attr_Length		0
Attr_Time		0
Breaks_Length		
Breaks_Time		
Ocation Position Use Geometr Search Toler	y rance: 5000	Meters
🔘 Use Network	Location Fields	
Property	Field	-
SourceID		
SourceOID		
PosAlong		



15. Click **OK**. You should see 634 facilities located in your Network Analyst window. The RITE AID pharmacies have been loaded and located when possible on the network dataset indicated by an mustard colored circle (yours will likely be a different color).



If any of your locations were not located or have errors you will see a red circle, or a lighter mustard circle with a question mark in your TOC.



Solving the Service Area Problem

1. You have set up your analysis and loaded the facilities - now you can solve. Remember, you want to create a network-based area that represents a 15 minute drive time to any RITE AID for

your area of interest. Click on the Solve icon it to run the analysis. This may take a bit of time (remember that this is 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: ^{Computing service area}, it's a good sign. Some indication of progress on the lower right-

hand side of your screen is also a good thing: **25%**. Now is also a good time to stretch out, and ask any questions you may have.



3. When the solving is complete you should see something that looks like this:



Because you used a hireachical solve trim settings are not a factor-just an FYI Here are the results of your analysis:



4. In your table of contents you will see the results of your analysis. Export the polygon for your analysis to a new shapefile by right clicking on the layer in your TOC and choosing **Export Data**.

Use the same coordinate system as the data frame. Name the file RITE AID15min.shp.

Export Data				
Export:	All features			
Use the sa	me coordinate system as:			
🔘 this lay	er's source data			
Ithe dat	a frame			
the fea (only a)	ture dataset you export the data into pplies if you export to a feature dataset in a geodatabase)			
Output fea	ature dass:			



Add *RITE AID15min.shp* to your data frame when prompted.

- 5. Add the 2010 population weighted census tract centroids for New York NY_PWC_tract_2010_prj.shp; adjust your display order so that your *RITE AID15min.shp* is below the tract centroids. If you are interested these population weighted centroids came from here: https://www.census.gov/geo/reference/centersofpop.html
- 6. Click Selection > Select by Location. Spatially select all census tract population weighted centroids (target layer) that intersect in the 15 minute drive time polygon (source layer). You will assume that all block groups with their centroid within the 15 minute drive time polygon have populations that are within the 15 minute window to a RITE AID store. Click Apply, then OK.

Select By Location
Select features from one or more target layers based on their location in relation to the features in the source layer.
Selection method:
select features from 💌
Target layer(s):
 NY_PWC_tract_2010_prj RITE_AID 15min
Source layer:
Use selected features (0 features selected)
Spatial selection method for target layer feature(s):
intersect the source layer feature
Apply a search distance
About select by location OK Apply Close



7. Open the table for NY_PWC_tract_2010_prj.shp; you should see that 4,521 of the 4,870 tracts have been selected. Right click on the *Population* attribute field and select **Statistics** for these selected block groups. Take a look at the sum of the tract values for your selection. According to the 2010 Census there are 18,112,707 people in New York within a 15 minute drive time of a RITE AID Pharmacy.





8. Now **Clear Selection** and take a look at the sum of the tract values for all of New York. The total population estimate in 2010 for New York was 19,378,102.



Solution

It looks like ~93% of population for New York is within a 15 minute drive time to a RITE AID pharmacy.

Discussion

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