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GGRC12 Transportation Geography

Professor Steven Farber

Assignment 2: Network Analysis in ArcGIS

Due March 20th, Beginning of class

# Introduction:

In this assignment, you will learn how to conduct network analysis tasks in ArcGIS to solve a series of transportation problems that an analyst may encounter in the workplace. The assignment consists of two parts. First, you will conduct some practice exercises drawn from a popular GIS text. These step by step instructions will teach you how to generate a network dataset in ArcGIS and use this type of data object to solve routing and service area problems. Afterward, you will use this knowledge to conduct analyses using several Toronto-based datasets.

# Reading Preparation

There is one reading that will prepare you for this assignment.

* Chang, K. T. (2006). *Introduction to geographic information systems, 7th Edition* (Chapter 17). McGraw-Hill Higher Education. [Relevant sections provided in the assignment package].

This book chapter introduces specific GIS concepts related to network analysis.

# Part 1: Textbook Applications of Network Analysis

Start by reading the provided materials from Chapter 17 of Chang’s *Introduction to Geographic Information Systems.*

Next, follow the steps on pages 385-389 to complete Tasks 3-6 from the Chang text.

Deliverables:

1. Provide answers for questions 5,6,8,9, and 10 from the Chang text.

# Part 2: Network Analysis Applications in Toronto

In this part of the assignment, you will use what you have learned to create a network dataset for the City of Toronto, and answer questions by conducting several network analyses. In this case, to make computations simpler, we are only going to be working with the pedestrian network, which includes all trails, paths, lanes, and streets in the city.

## 2A: Building a Network Dataset

Follow Task 4 from Chang to build a network dataset using the Pedestrian\_CENTRELINE\_WGS84 shapefile for the City of Toronto. Incorporate the following into your construction.

1. Call the Personal Geodatabase *TorontoNetwork.mdb* (Chang Step 3)
2. Call the FeatureDataset *TorontoNet* and choose the same coordinate system as Pedestrian\_CENTRELINE\_WGS84, WGS\_1984. (Chang Step 4)
3. When you import Pedestrian\_CENTRELINE\_WGS84 into the FeatureDataset, call the output feature class *TorontoPED*. (Chang Step 5)
4. Build the Network Dataset with the following parameters:
   1. Name the Network Dataset *TorontoPED\_ND*.
   2. Make sure to include TorontoPED in the dataset.
   3. Do not model turns.
   4. Use default connectivity.
   5. Do not model elevation.
   6. Use default attributes.
   7. Choose to establish driving directions. Click the “Directions” button and specify “LF\_NAME” in the “Name” field.
   8. Finish building the Network Dataset and add it to the map.

Deliverables: None

## 2B: Finding the Shortest Route

Using the Network Analyst “Route” tool, find the shortest pedestrian route from “College Street and University Avenue” to “Jarvis Street and Front Street East” to “Dundas Street West and Spadina Avenue”. You can use the table to find and select these streets by name. Open the Route Directions and use the Options to display distance units as kilometers.

Deliverables:

1. A map showing the shortest route.
2. How many kilometers was the total travel distance?

## 2C: School Service Areas

Next we are going to create 10- and 20-minute walking service areas to Toronto District elementary schools. The school locations are in a shapefile called ELEMENTARY\_SCHOOL\_TDSB\_WGS84.

1. Make a new map and add the ELEMENTARY\_SCHOOL\_TDSB\_WGS84 shapefile and the *TorontoPED\_ND* network dataset.
2. Use the “Service Area” tool to make 500m and 1000m service areas for schools, corresponding to 10 and 20 minute walks, respectively. This is similar to what you did in Task 6 from the Chang text with non-overlapping services areas. We are looking for polygons representing walking times *to* schools. Don’t worry about the warnings that you receive when trying to create the service areas. These are for locations where 2 schools are coincident with each other, and the software automatically drops 1 of the two locations when making non-overlapping service areas.
3. Export the Service Area polygons to a shapefile so that you can easily modify the polygon symbology.

Deliverables:

1. A map that clearly shows each school location and its 10 and 20 minute walk time service areas. You will need to adjust the symoblogies of the exported service area polygons so that all the features are clearly visible.
2. Describe the overall pattern of elementary school coverage in the City of Toronto. Where are the major gaps in coverage? You can add an Imagery Base Map by clicking the arrow next to “Add Data”, selecting “Add Base Map” and choosing the “Imagery” layer. Identify the areas that do not have good walking coverage and use the Imagery Base Map to describe the underlying land uses of the unserved areas. Can you see any residential areas that are not covered? What is the spatial pattern of these underserved areas?

## 2D: School Service Area Areas!

In this task, we are going to explore the areas of 500m service areas around the elementary schools. To do this, we are going to change the Polygon Generation properties to “Overlapping”, and the “Default Breaks” to just 500 meters. Recreate the service areas. You will need to make a new *Feature Dataset* in your Personal Geodatabase. This time, use the UTM Zone 17N coordinate system when making the new feature dataset. Export the 500m overlapping service area polygons into the newly created feature dataset. Add the new layer to the map. Change the symbology to “Graduated Colors”, using the “Shape\_Area” field, and the “Quantile” classification using 5 classes. This divides the service areas into 5 groups each with 20% of the polygons. Choose an appropriate colour ramp and visualize the results.

Deliverables:

1. A map that clearly shows each school location and the area of its 500m walking service area.
2. What is the pattern of service area size across the city? How is this related to the street network pattern around each school?

# Formatting

Your report must be written using a word processor. Answer all questions in order, and organize the report by part number. All maps should have titles, legends, scale bars, and north arrows. All maps should be inserted into the appropriate locations in the document. All figures must have numbered captions and be referenced in text. Your documents should be in colour and must include a cover page with your name, student number, and assignment title. Your document should be double-spaced, 12 point font, 1 inch margins. You should use APA 6th edition for references and in-text citations.

# Grading

Part 1: 5 points. 1 point per question.

Task 2B: 4 points. 3 points for the map, 1 for getting the right answer.

Task 2C: 8 points. 3 points for the map, 5 for your description.

Task 2D: 8 points. 3 points for the map, 5 for your description.

Writing and Presentation: 10 points.