Lab Report

Title: Final Project
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Project Repository: https://github.com/greg-kohler/GIS5571/tree/main/Final
Google Drive Link: N/A
Time Spent: 15

Abstract

Freeway removal is a topic in transportation that is often opposed due to fears of increasing commute times. This project will delve into the changes in service area, or how far someone can get from one point, before and after the removal of I-94 between downtown Minneapolis and downtown Saint Paul. This report will summarize the methods used to build the network dataset and service area analysis layers. It will then show the results and compare the differences in service areas before and after the removal of the freeway. Next, this report will validate the results by comparing the network to ESRI's network dataset and will discuss the results and any lessons learned.

Problem Statement

Urban freeway removal is becoming a relevant topic for transportation departments, governments, and community stakeholders. According to (*Alternatives | Rethinking I-94 — Minneapolis to St. Paul | Let's Talk Transportation - MnDOT*, 2023), in the Twin Cities, one of MnDOT's alternatives for I-94 is the removal of the freeway between the two downtowns and replacing it with an at-grade boulevard and urban development. The main argument against this is an increase in travel time and loss of convenience. In this project, I would like to explore how great this impact is.

Table 1 - Required Resources

#	Requirement	Defined As	(Spatial) Data	Attribute Data	Dataset	Preparation
1	MnGeospatial Commons	Open data used to download data	Road geometry	Speed limit, segment length, elevation	Mn GeoSpatial Commons	Calculated new fields
2	ArcGIS Pro Network Analysis	ArcGIS Pro tools used to define travel attributes of network	N/A	Time and length	Metro Road Network	Needed to adjust travel attributes
3	ArcGIS Pro Notebooks	Juypter Notebooks used to store code for analysis	N/A	N/A	N/A	N/A

Input Data

The main source of data used in this project was the Road Centerlines from the Minnesota Geospatial Commons. This is line data of all roads in the Twin Cities metro and follows the Geospatial Advisory Council's Schema. It contains several attributes needed to generate a network dataset, including elevation, speed limit, road type, and one-way. This data had to be altered slightly to calculate length in miles, and if the road is prohibited from private vehicles.

Table 2 - Input Data

#	Title	Purpose in Analysis	Link to Source
1	Road Centerlines (Geospatial Advisory Council Schema)	Raw input dataset for creating network dataset from MetroGIS	Mn GeoSpatial Commons
2	I-94 Removal	Line feature used to represent how I-94 will be removed.	Created locally

Methods

The biggest piece of this project is the actual removal of I-94 from the network. For the removal of I-94, I chose to follow MnDOT's Rethinking I-94 guidelines, which extend from I-35W in downtown Minneapolis to Marion Street near downtown Saint Paul. I also chose to remove all ramps that connect to it. See Figure 1 for an overview of the pieces of I-94 that were removed.

Figure 1 - Portion of I-94 Removed

The first step of this process was downloading the Metro Centerlines from the Minnesota Geospatial Commons. This required using requests.get() and the zipfile module to download the Shapefiles and extract them to the local disk (See Figure 2)

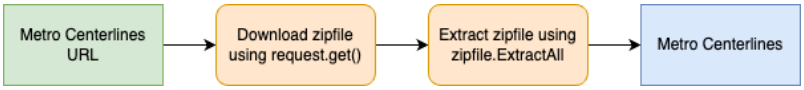

Figure 2 - Downloading Metro Centerlines

After obtaining the data, the centerlines needed to have a few fields calculated. I had to manually select roadways that banned cars. This included the University of Minnesota Transitway, Nicollet Mall, and the East Bank Transit Mall. After this, I had to calculate the length of all of the segments in Miles. I did this by dividing the length in meters by 1,609.34. I also had to calculate how far a vehicle could go on these segments in a minute. I did this by dividing the length in Miles by the Speed Limit and multiplying by 60. Once these fields were calculated, I created a feature dataset for the centerlines and added them to it. I then used this feature dataset to create a network dataset. Once this was created, I adjusted the travel attributes. I set the distance parameter to the Miles field and the time parameter to the Minutes field. I added restrictions, so cars could not go on Transitways or down the wrong side of one-ways. Additionally, I set the elevation attribute to the elevation field in the Metro Centerlines dataset, this lets the network know what was bridged over and what was connected. Once this was all completed, I created a template from this Network Dataset so I could copy these attributes when I make the network dataset for the centerlines without I-94 (See Figure 3).

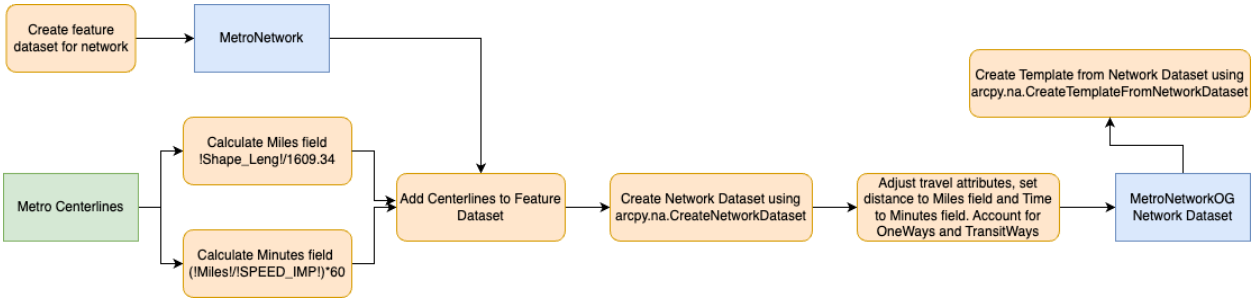

Figure 3 - Creating Network Dataset

After preparing the network dataset, I built the network using the parameters stated earlier. Once built, I made the service area analysis layer. With this, I imported the point I wanted to use for this draft analysis and solved the service area analysis layer to get 5, 10, and 20 minute service area polygons (See Figure 4).

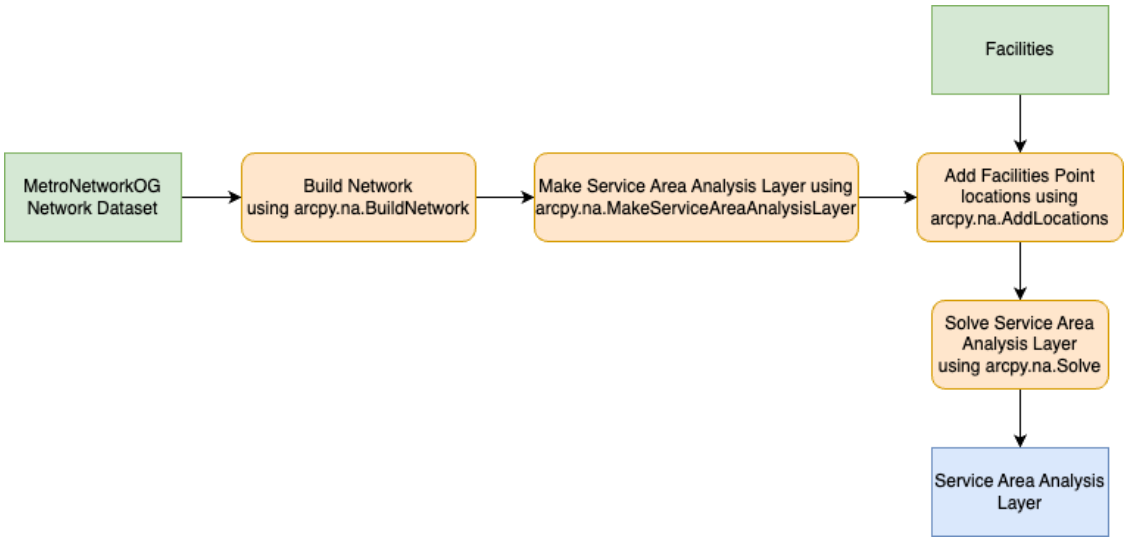

Figure 4 - Building Service Area Analysis Layer

For the creation of the network without I-94, the steps were almost identical. The main difference was the centerlines used to create the network did not have the I-94 segments outlined in Figure 1. I will expand on this process more in future drafts.

Results

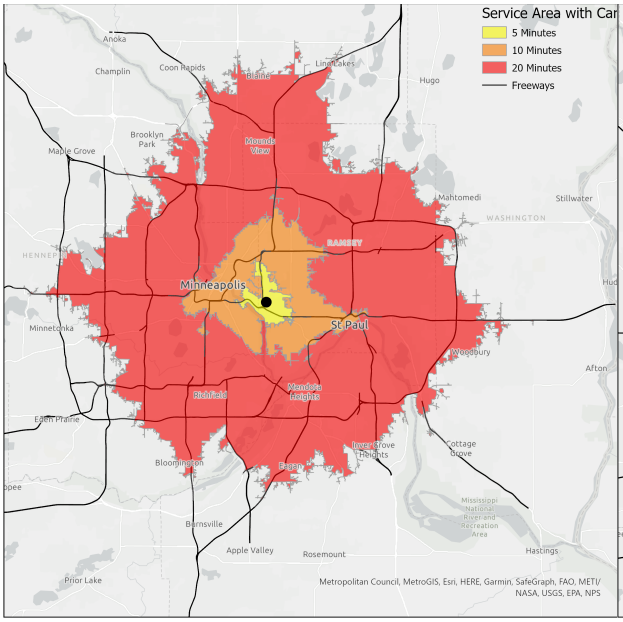

Figure 5 - Service Area With 94

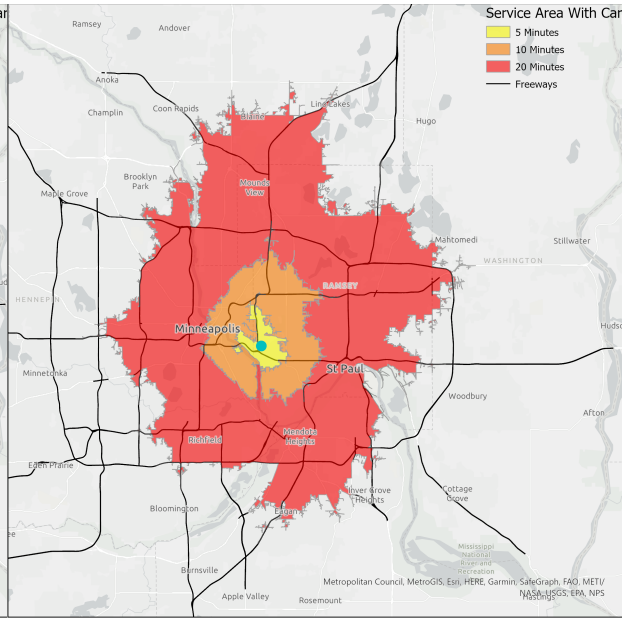

Figure 6 - Service Area Without 94

For my results, I will show several figures comparing how the service area has changed before and after the removal of I-94. For this draft, you can see two service area maps. Figure 5 shows the farthest you can go in 5, 10, and 20 minutes in a car from my neighborhood with I-94 in existence. Figure 6 shows the same but without I-94. This section will have more results with various points and travel times. It will also contain a mathematical comparison to calculate the

average decrease in service area after the removal of I-94. This will be done by running a random sample of points around 94, calculating the service area, and doing a comparison of the polygon sizes.

Results Verification

I will compare my results to an ESRI network dataset to ensure the network was built correctly. This section may also showcase the code used to build the network and verification of the math used to calculate the average decrease in service area.

Discussion and Conclusion

This section will discuss my thoughts on the impact of removing I-94 on travel time and service area. Once I gather more results I will be able to formulate a discussion.

References

Alternatives | Rethinking I-94 — Minneapolis to St. Paul | Let's Talk Transportation - MnDOT. (2023, July 18). ; Minnesota Department of Transportation. https://talk.dot.state.mn.us/rethinking-i94/news_feed/alternatives

Self-score

Category	Description	Points Possible	Score
Structural Elements	All elements of a lab report are included **(2 points each)**: Title, Notice: Dr. Bryan Runck, Author, Project Repository, Date, Abstract, Problem Statement, Input Data w/ tables, Methods w/ Data, Flow Diagrams, Results, Results Verification, Discussion and Conclusion, References in common format, Self-score	28	28
Clarity of Content	Each element above is executed at a professional level so that someone can understand the goal, data, methods, results, and their validity and implications in a 5 minute reading at a cursory-level, and in a 30 minute meeting at a deep level **(12 points)**. There is a clear connection from data to results to discussion and conclusion **(12 points)**.	24	24
Reproducibility	Results are completely reproducible by someone with basic GIS training. There is no ambiguity in data flow or rationale for data operations. Every step is documented and justified.	28	28
Verification	Results are correct in that they have been verified in comparison to some standard. The standard is clearly stated **(10 points)**, the method of comparison is clearly stated **(5 points)**, and the result of verification is clearly stated **(5 points)**.	20	20
		100	100