# Transportation Network Data

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# What is Transportation Network Data?

**Transportation networks** generally refer to a set of ***links*, *nodes*, and *lines*** that represent the infrastructure or supply side of the transportation. The links have characteristics such as speed and capacity for roadways; frequency and travel time data are defined on transit links or lines for the transit system. Transportation analysis zones are represented in the network by centroids, a subset of the nodes; and centroid connectors are links that provide access and egress to the system.

Transportation Network Types:
- Highway Networks
- Transit Networks
- Other (Non-motorized modes; Freight Networks; Super Networks)

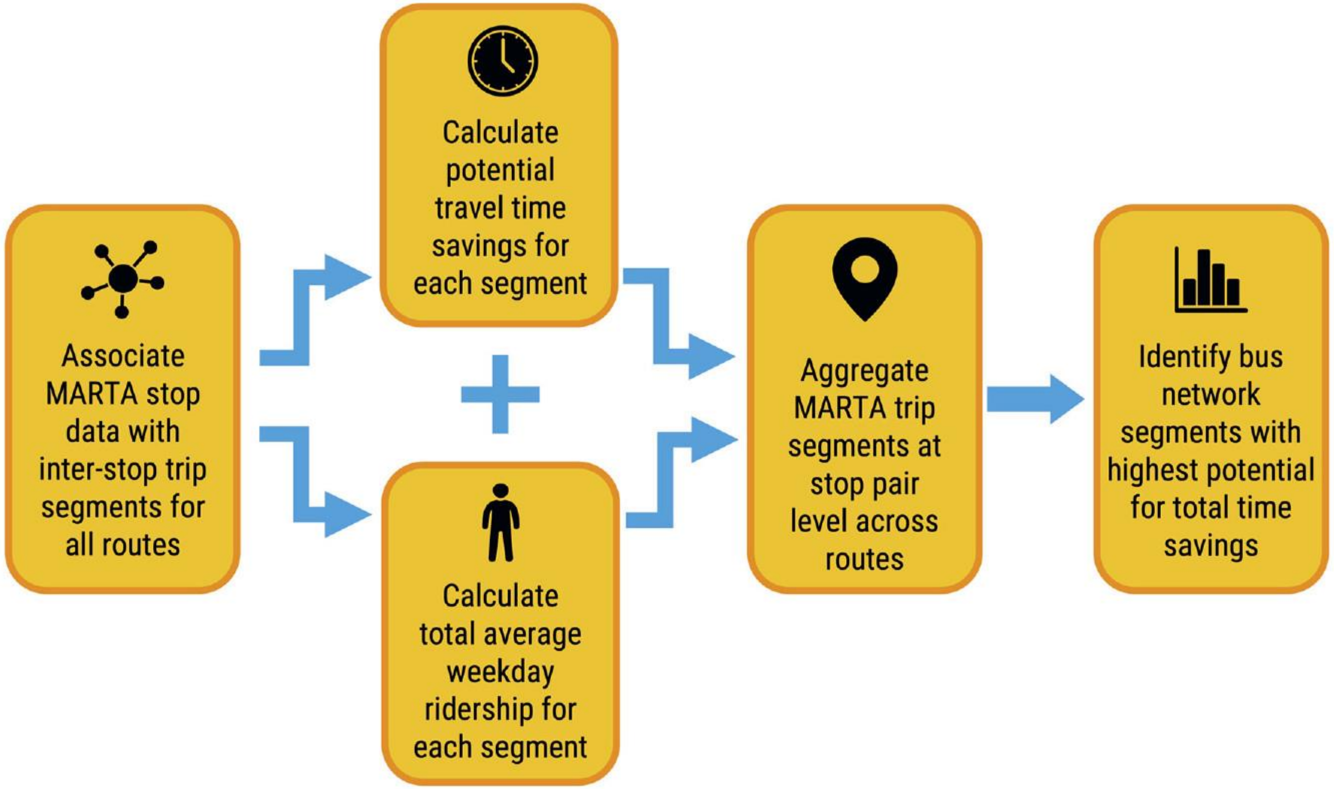
# Types of Transportation Network Data

- GTFS (General Transit Feed Specification)
- OSM (Open Street Map) -  publicly accessible map, the general public can edit it (much like Wikipedia), relies on crowdsourcing
- Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER)

# GTFS case

**Using GTFS to Calculate Travel Time Savings Potential of Bus Preferential Treatments (Arias et al. 2021)**

- Presented is a method for estimating the effects of deploying bus-dedicated lanes on a bus network
- GTFS data is one of the main inputs
- Outputs: potential total travel time saving for each segment (from a stop to another) when a bus-dedicated lane is deployed on the segment

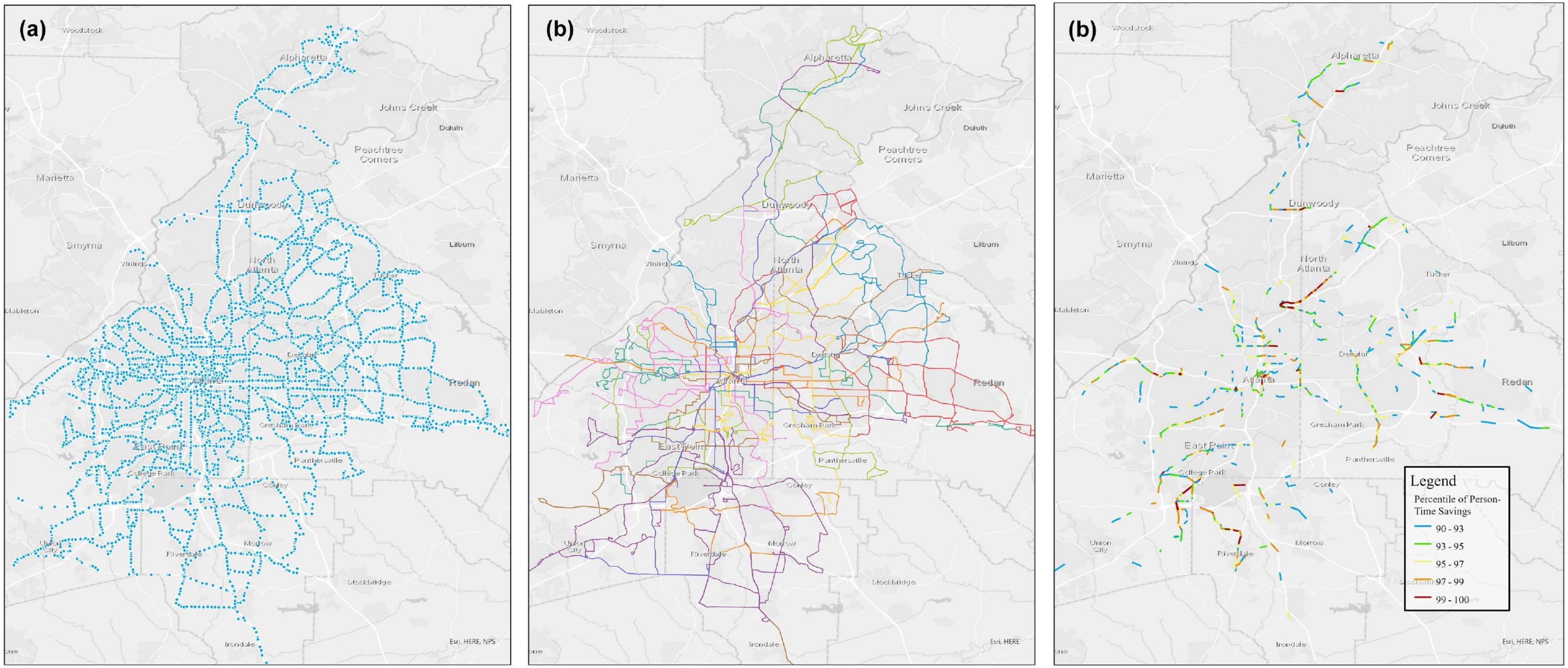



Arias, Daniel, Kara Todd, Jennifer Krieger, Spencer Maddox, Pearse Haley, Kari Edison Watkins, and Simon Berrebi. 2021. "Using GTFS to Calculate Travel Time Savings Potential of Bus Preferential Treatments." *Transportation Research Record* 2675 (9): 1643–54. https://doi.org/10.1177/03611981211009226.

# GTFS case

**Using GTFS to Calculate Travel Time Savings Potential of Bus Preferential Treatments (Arias et al. 2021)**

Example: Metropolitan Atlanta Rapid Transit Authority (MARTA) bus network

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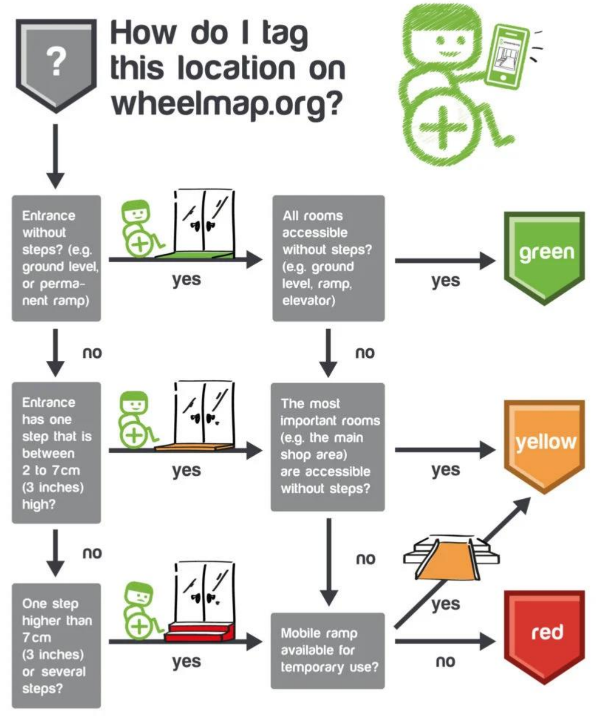
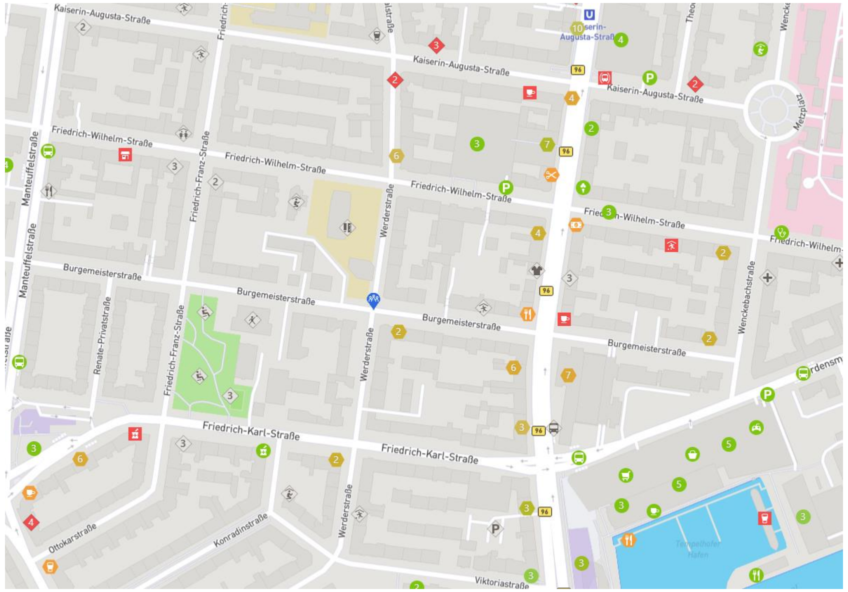
# OSM Case1 - Accessibility

- Wheelchair user map Wheelmap.org - can be used to find wheelchair accessible points of interest
  - Relies on crowdsourcing to collect data on how accessible buildings are
  - Users can add and rate new places
    - Green = accessible
    - Yellow = somewhat accessible
    - Red = not accessible
  - Currently most mapped in Germany, need to raise awareness
- OSM and crowdsourced data together can further be utilized as network data to identify wheelchair accessible *routes* for travel



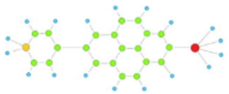
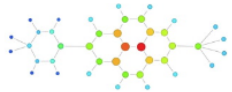
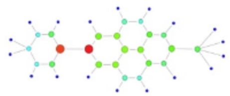
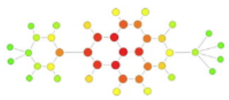



Mobasheri, A., Deister, J. & Dieterich, H. Wheelmap: the wheelchair accessibility crowdsourcing platform. *Open geospatial data, softw. stand.* **2**, 27 (2017). https://doi.org/10.1186/s40965-017-0040-5

# OSM Case2

## Modeling cyclists’ route choice using Strava and OSMnx: A case study of the City of Glasgow

- Examples of Centrality Index

| Index | Definition | Illustration[±] |
| --- | --- | --- |
| Degree Centrality [DC] | Returns the fraction of streets that it is connected to (Hagberg et al., 2018, Newman, 2006). |  |
| Eigenvector Centrality [EC] | Computes the extent of centrality of a given street based on the connectivity of the streets to which it has ties (Hagberg et al., 2018, Newman, 2006). |  |
| Betweenness Centrality [BC] | Computes how often a given street appears on the shortest path between other streets in the network (Hagberg et al., 2018, Newman, 2006). |  |
| Closeness Centrality [CC] | The reciprocal of the average shortest path from any given street segment to all other street segments in the network (Hagberg et al., 2018, Newman, 2006). |  |

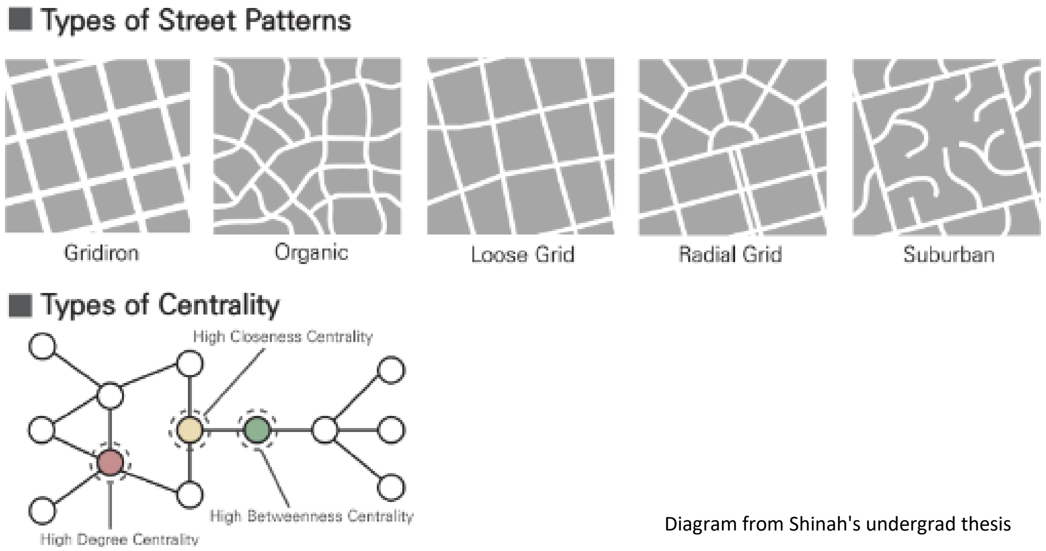


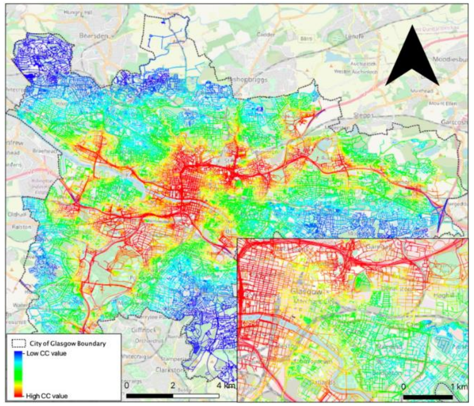

Diagram from Shinah's undergrad thesis

Alattar, M. A., Cottrill, C., & Beecroft, M. (2021). Modelling cyclists’ route choice using Strava and OSMnx: A case study of the City of Glasgow. *Transportation Research Interdisciplinary Perspectives*, *9*, 100301. https://doi.org/10.1016/j.trip.2021.100301

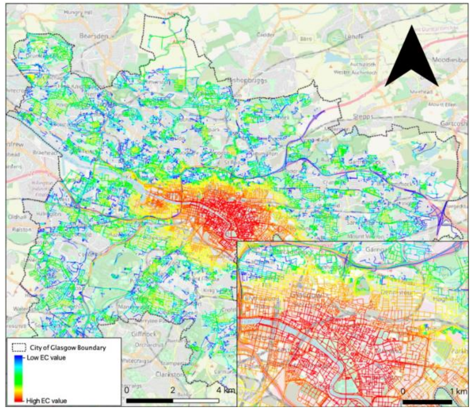
# OSM Case2

## Modeling cyclists' route choice using Strava and OSMnx:
## A case study of the City of Glasgow

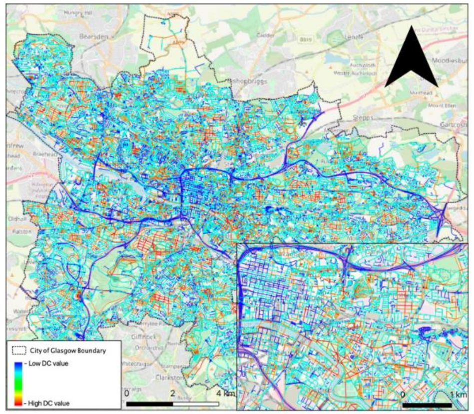
- Objective & Data Used
  - Increase the understanding of bike route choice to help decide street configuration in the future
  - Strava: a fitness app which has variables related to bike ridership
  - OSM: provided network data required for centrality indices calculation
- Methodology
  - Merged two shapefiles, one with cycling counts data by intersections obtained from Strava and one with centrality indices values calculated using OSMnx library.
  - Calculated spatial correlation
- Results
  - Ridership was found to be significantly positively correlated with streets of high CC, EC, and BC values, and negatively correlated with those of DC values.



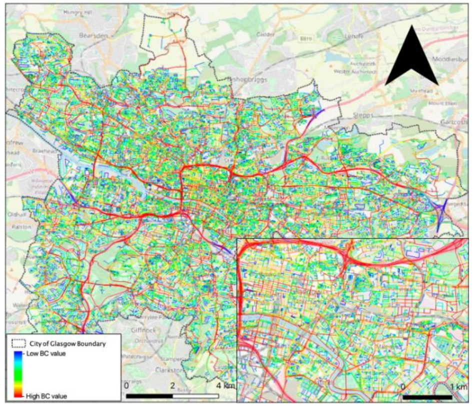
**Closeness Centrality**



**Eigenvector Centrality**



**Degree Centrality**



**Betweenness Centrality**

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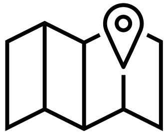
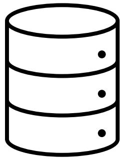
# Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER)



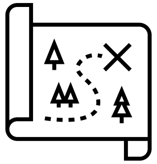


**Network Analysis Tools in ArcGIS**

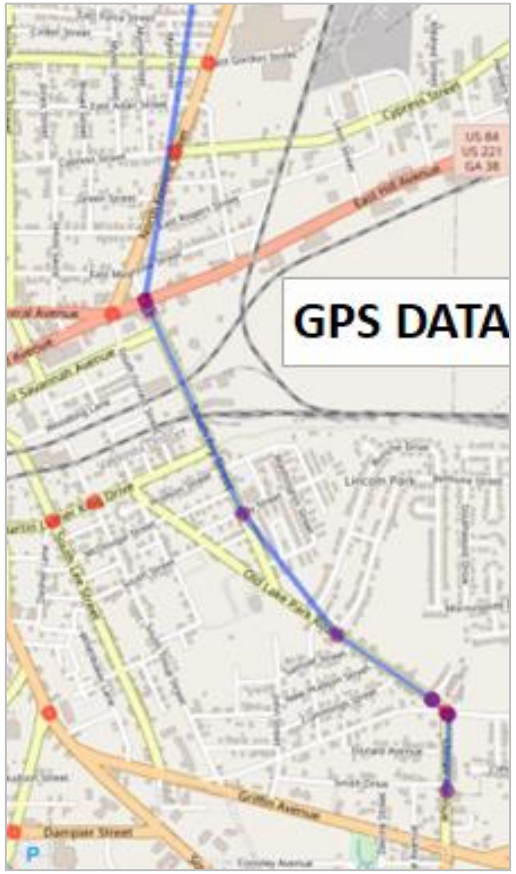
| OBJECTID_1 | NodeID | EdgeID | CENTERLINE | FROMLEFT | TOLEFT | FROMRIGHT | TORIGHT | FULLNAME |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | RD-9096 | 4011 | 4015 | 4012 | 4014 | ROOT CIR |
| 2 | 2 | 2 | RD-9096 | 4011 | 4015 | 4012 | 4014 | ROOT CIR |
| 3 | 3 | 3 | RD-9079 | 3971 | 4009 | 3970 | 4010 | ROOT CIR |
| 4 | 1 | 3 | RD-9079 | 3971 | 4009 | 3970 | 4010 | ROOT CIR |
| 5 | 4 | 4 | RD-4508 | 3901 | 3969 | 3900 | 3968 | ROOT CIR |
| 6 | 3 | 4 | RD-4508 | 3901 | 3969 | 3900 | 3968 | ROOT CIR |
| 7 | 3 | 5 | RD-9095 | 4001 | 4069 | 4000 | 4070 | COUNTRY VIEW LOOP |
| 8 | 1 | 5 | RD-9095 | 4001 | 4069 | 4000 | 4070 | COUNTRY VIEW LOOP |
| 9 | 5 | 8 | RD-9112 | 5901 | 6099 | 5900 | 6098 | PROVIDENCE PT |
| 10 | 6 | 8 | RD-9112 | 5901 | 6099 | 5900 | 6098 | PROVIDENCE PT |
| 11 | 7 | 9 | RD-269 | 5753 | 5851 | 5752 | 5850 | SKIPPER BRIDGE RD |
| 12 | 5 | 9 | RD-269 | 5753 | 5851 | 5752 | 5850 | SKIPPER BRIDGE RD |
| 13 | 8 | 10 | RD-9114 | 320 | 328 | 321 | 329 | HAMPTON ALY |
| 14 | 9 | 10 | RD-9114 | 320 | 328 | 321 | 329 | HAMPTON ALY |
| 15 | 10 | 11 | RD-924 | 5331 | 5373 | 5330 | 5372 | BETHANY RD |
| 16 | 11 | 11 | RD-924 | 5331 | 5373 | 5330 | 5372 | BETHANY RD |
| 17 | 12 | 13 | RD-9115 | 0 | 0 | 0 | 0 | |
| 18 | 13 | 13 | RD-9115 | 0 | 0 | 0 | 0 | |
| 19 | 14 | 14 | RD-9116 | 2001 | 2129 | 2000 | 2128 | TECHNOLOGY CRSG |
| 20 | 15 | 14 | RD-9116 | 2001 | 2129 | 2000 | 2128 | TECHNOLOGY CRSG |

**Information of Nodes and Edges**

*<u>Application Example</u>*



**Apply Modified Dijkstra's Algorithm in R**




**Vehicle Path Restoration**

https://catalog.data.gov/dataset/tiger-line-shapefile-2016-nation-u-s-primary-roads-national-shapefile
https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb_main.html

Thank you