# Python-based Tool for Automatic Transit Coding using GTFS for Cube Models

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PLANNING COMMISSION

# Summary

- Methodology
- Cube App Interface
- Inputs
- Outputs
- Conclusions and Recommendations

# Methodology

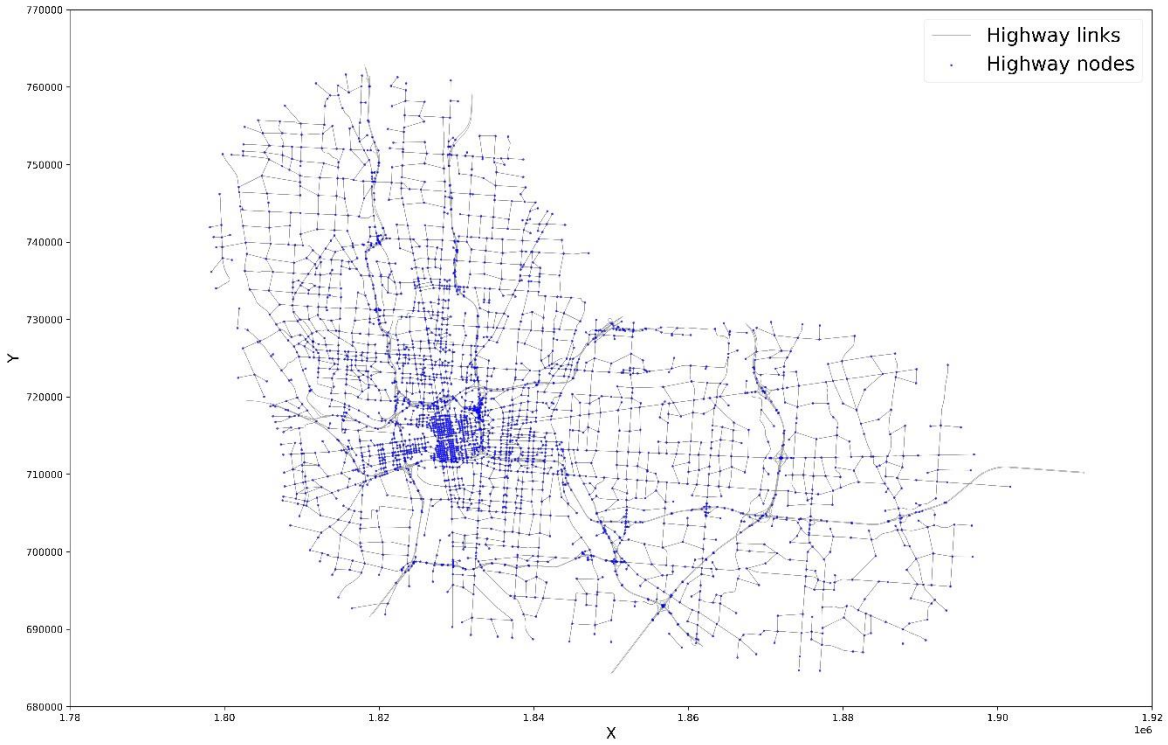


Figure 1. Highway network.

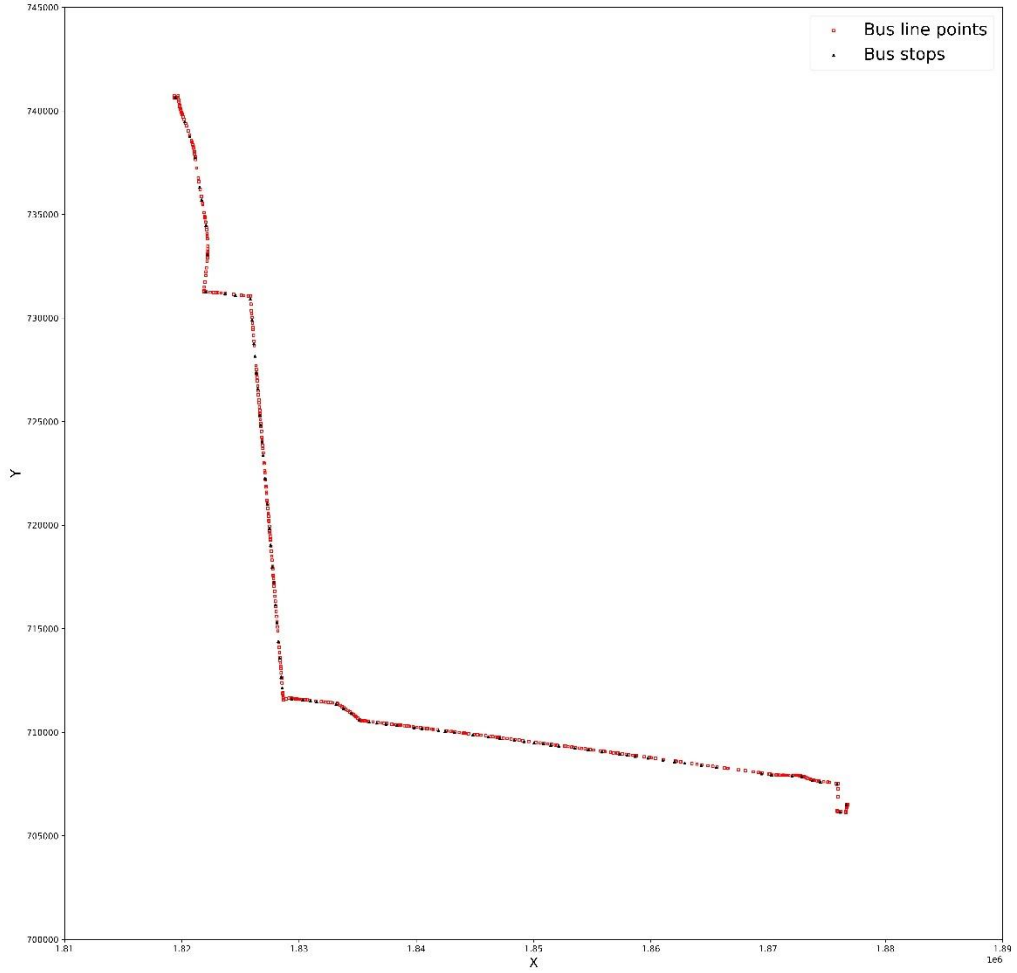


Figure 2. GTFS spatial data.

# Methodology

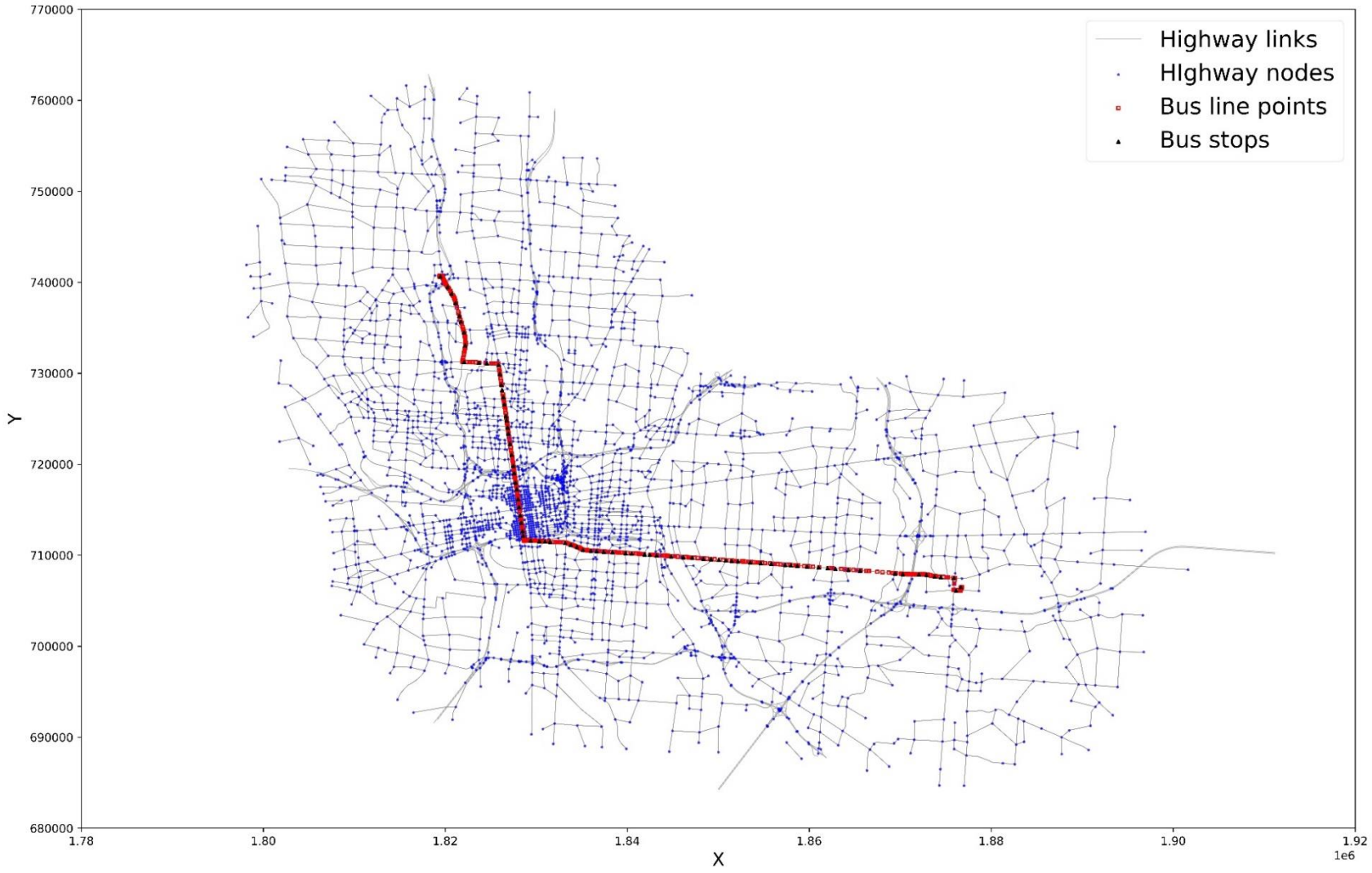


Figure 3. Highway network with the GTFS spatial data.

# Methodology

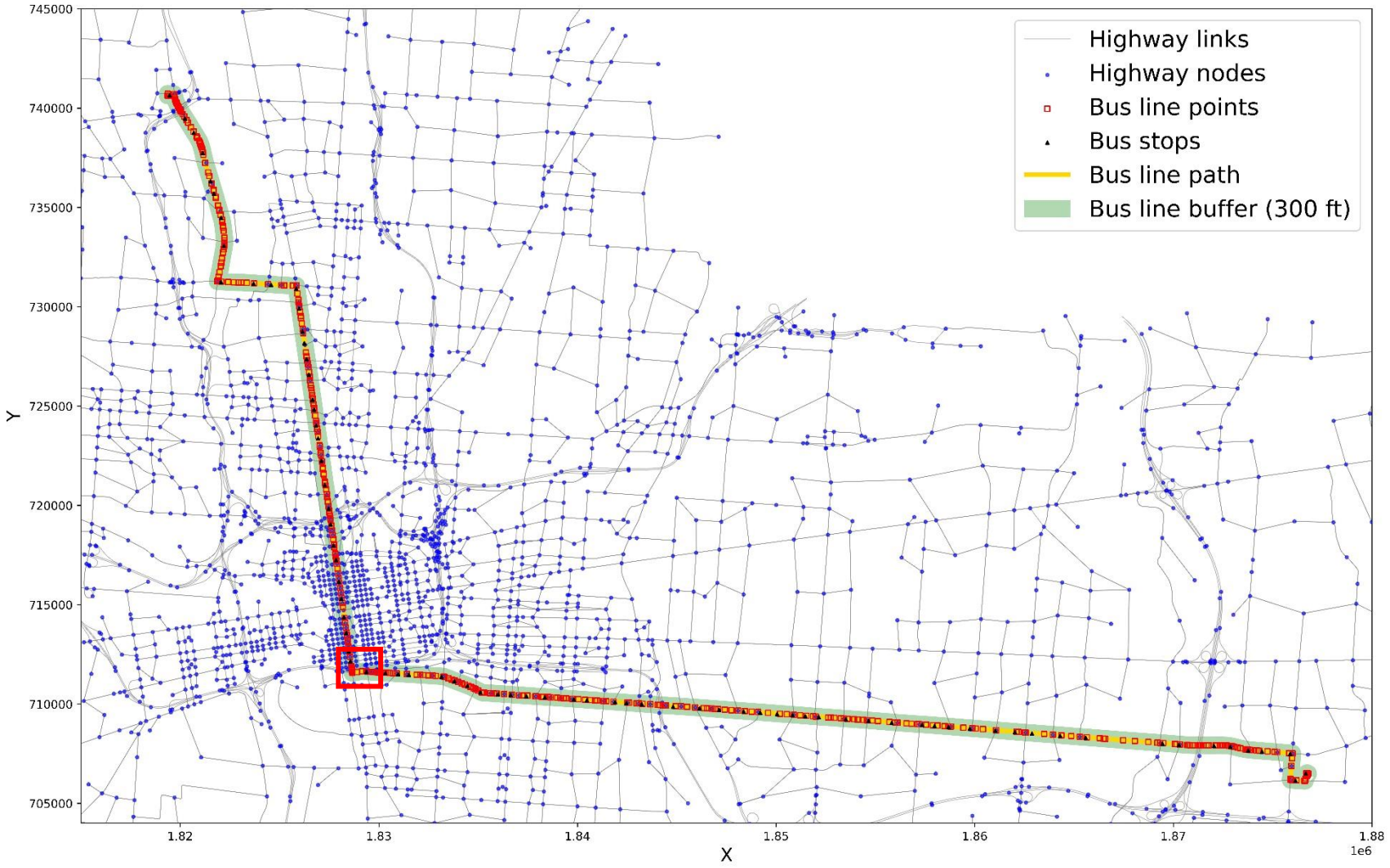


Figure 4. Highway network, GTFS spatial data, and the bus line buffer.

# Methodology

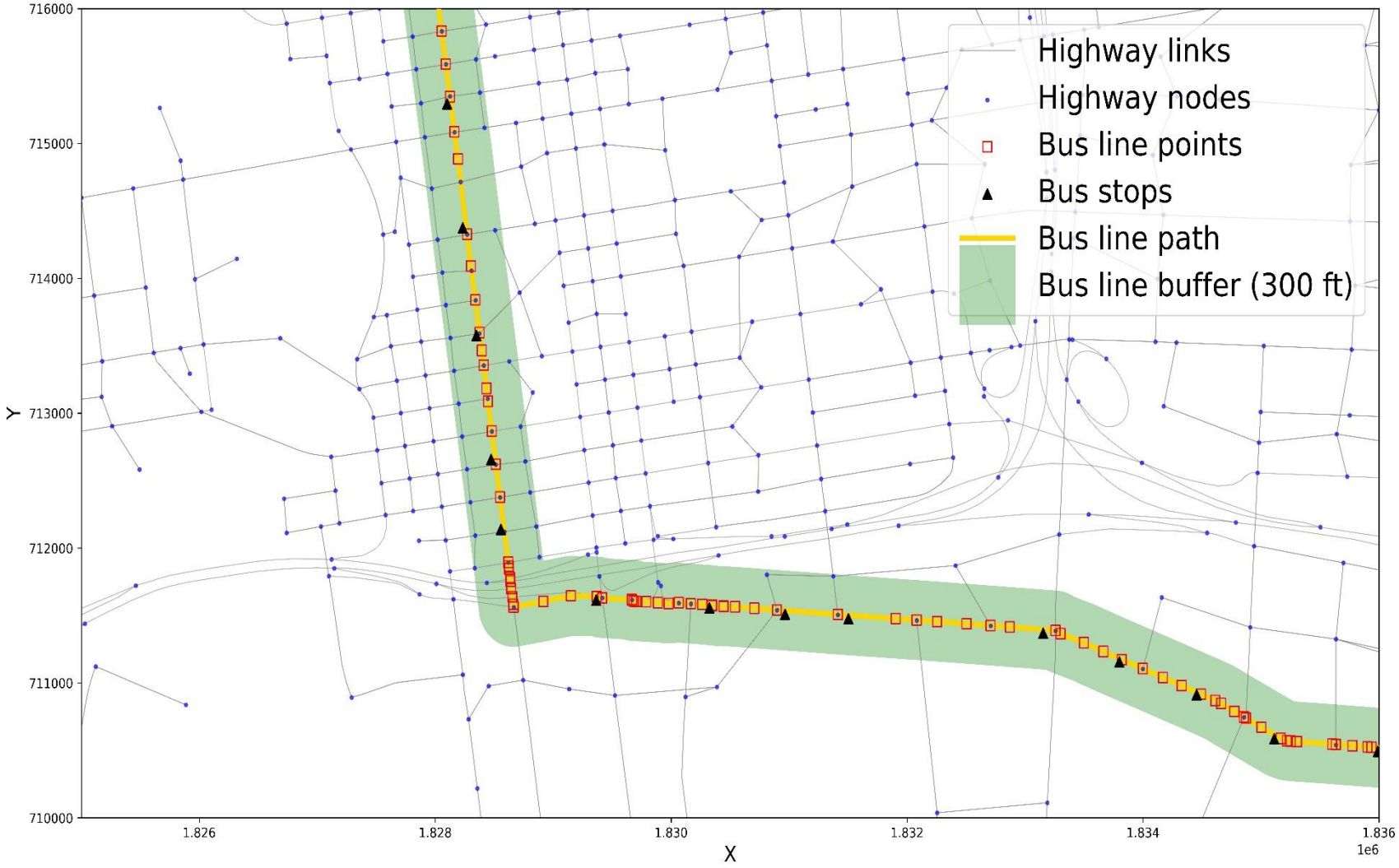


Figure 5. Bus line spatial data with more details.

# Methodology

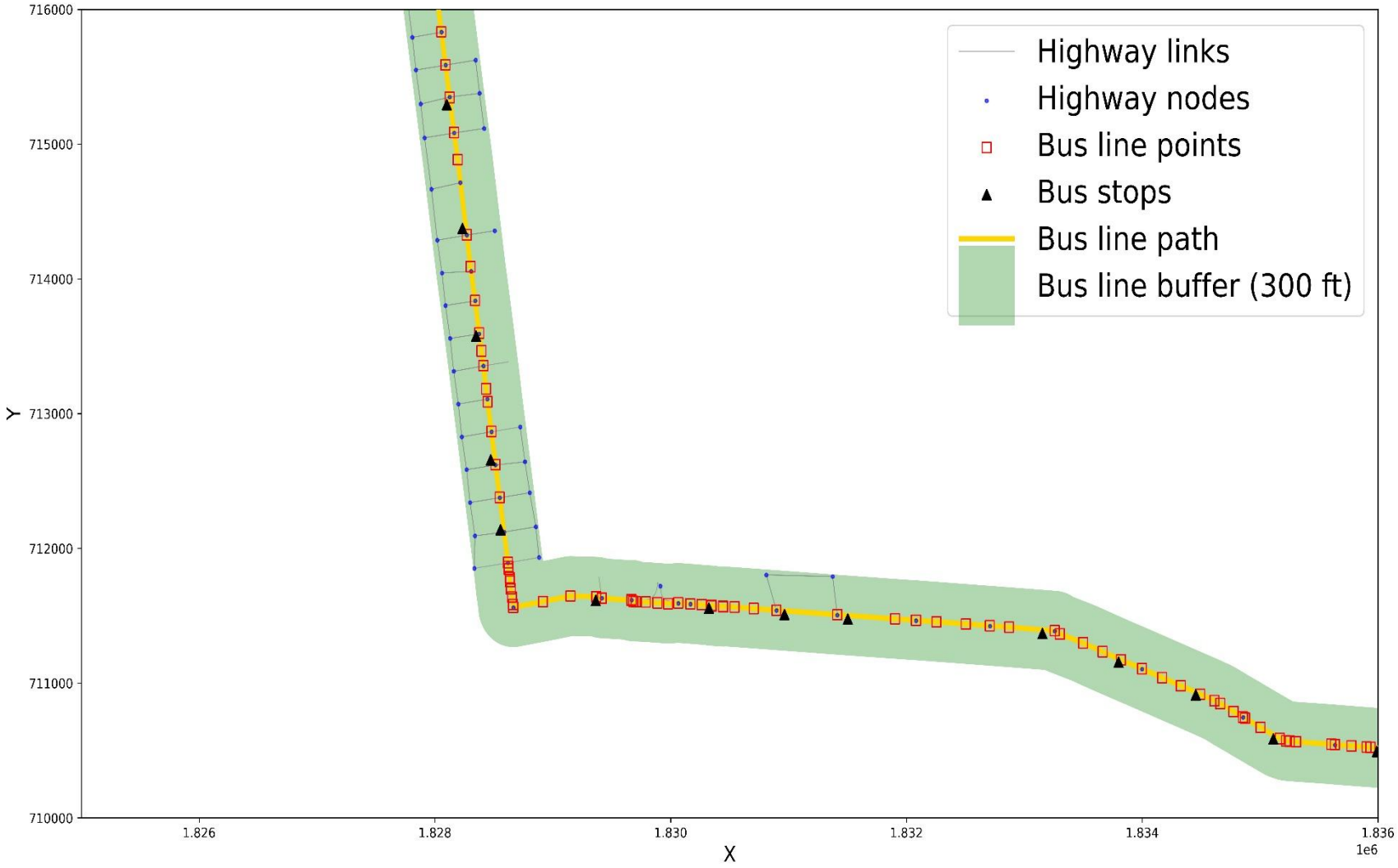


Figure 6. Only the available spatial data found within the bus line buffer.

# Methodology

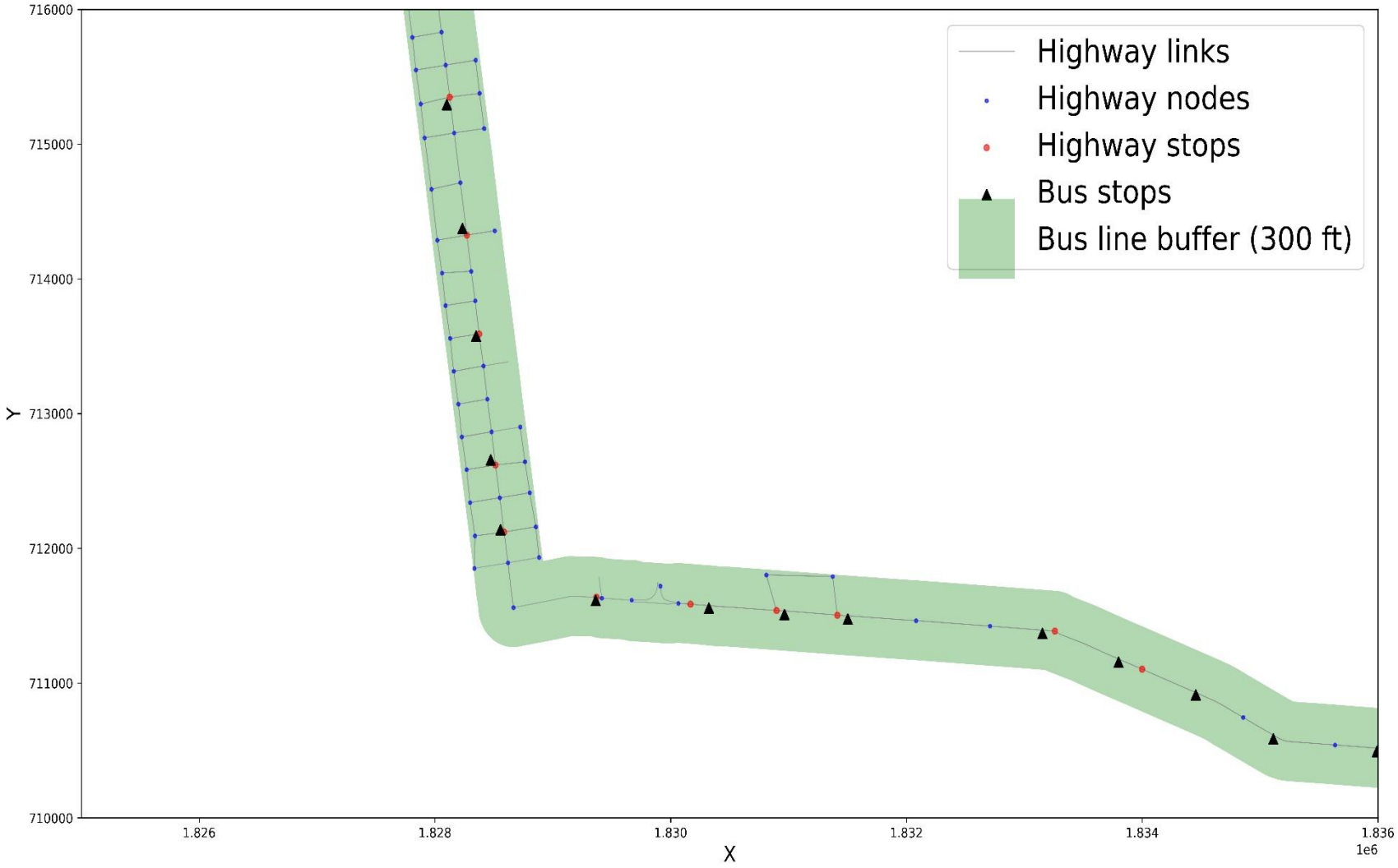


Figure 7. Closest highway nodes to bus stops according to a distance limit.

# Methodology

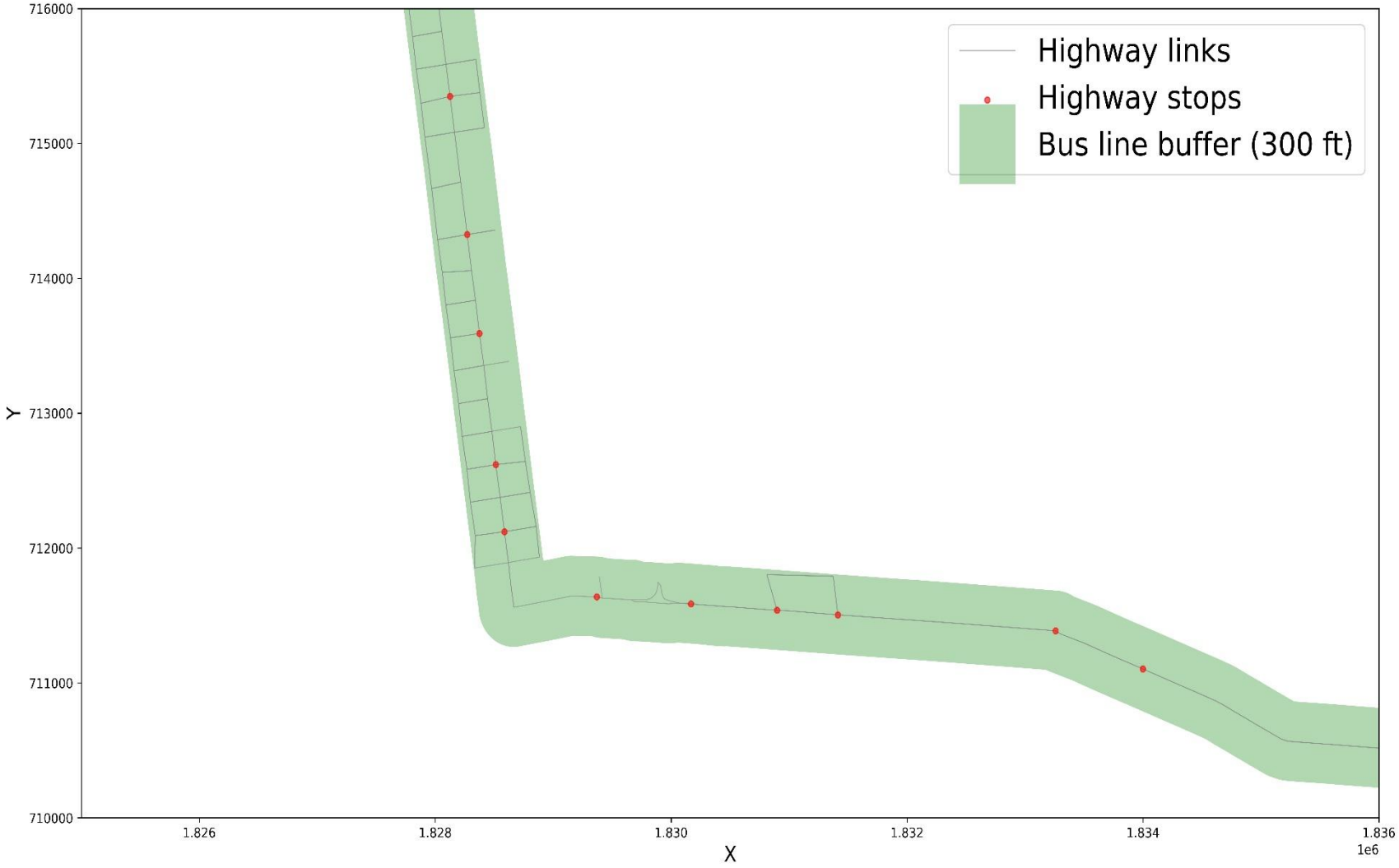


Figure 8. Highway stops and links.

# Methodology

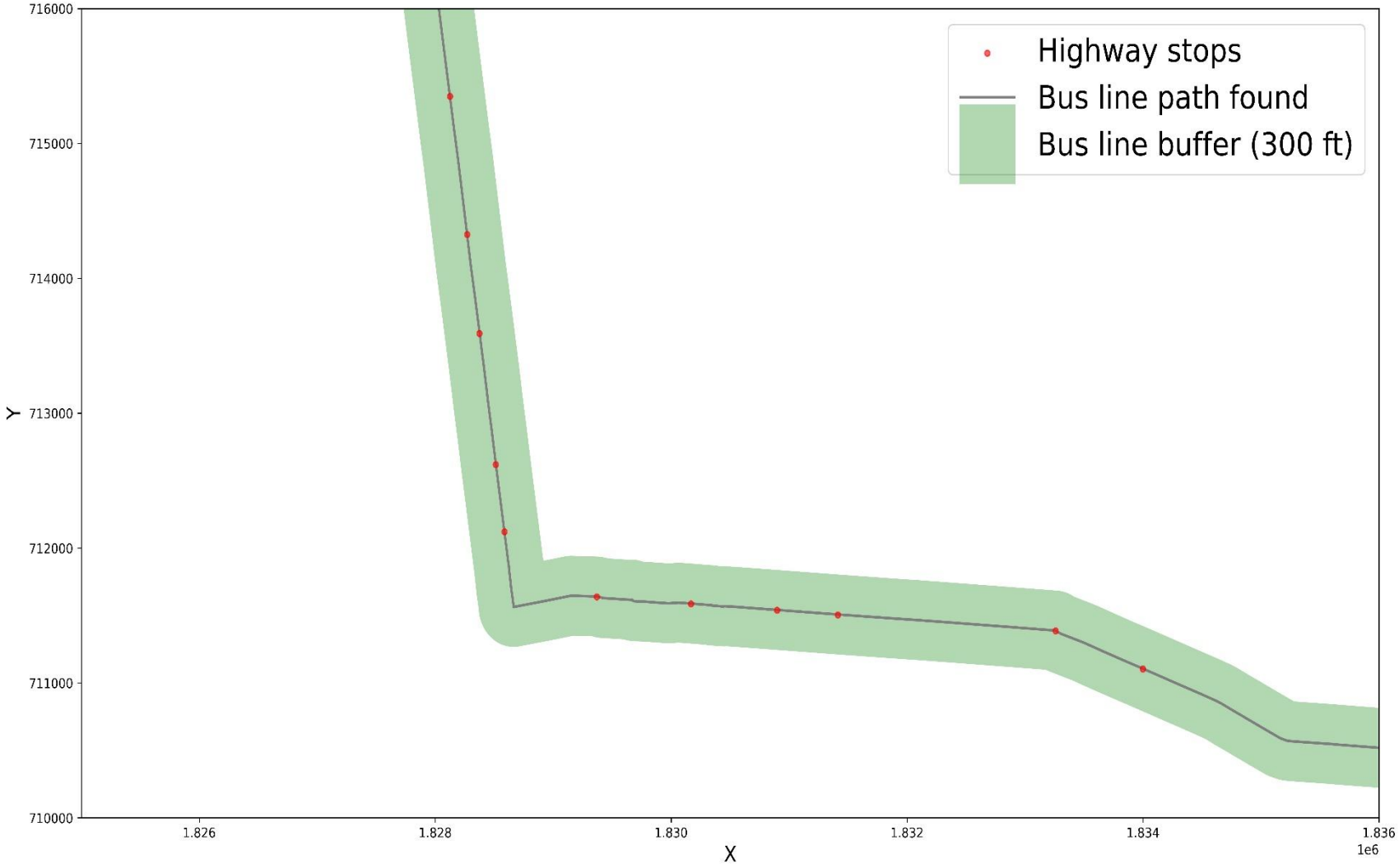


Figure 9. Bus line path found by connecting the highway stops in sequence.

# Methodology

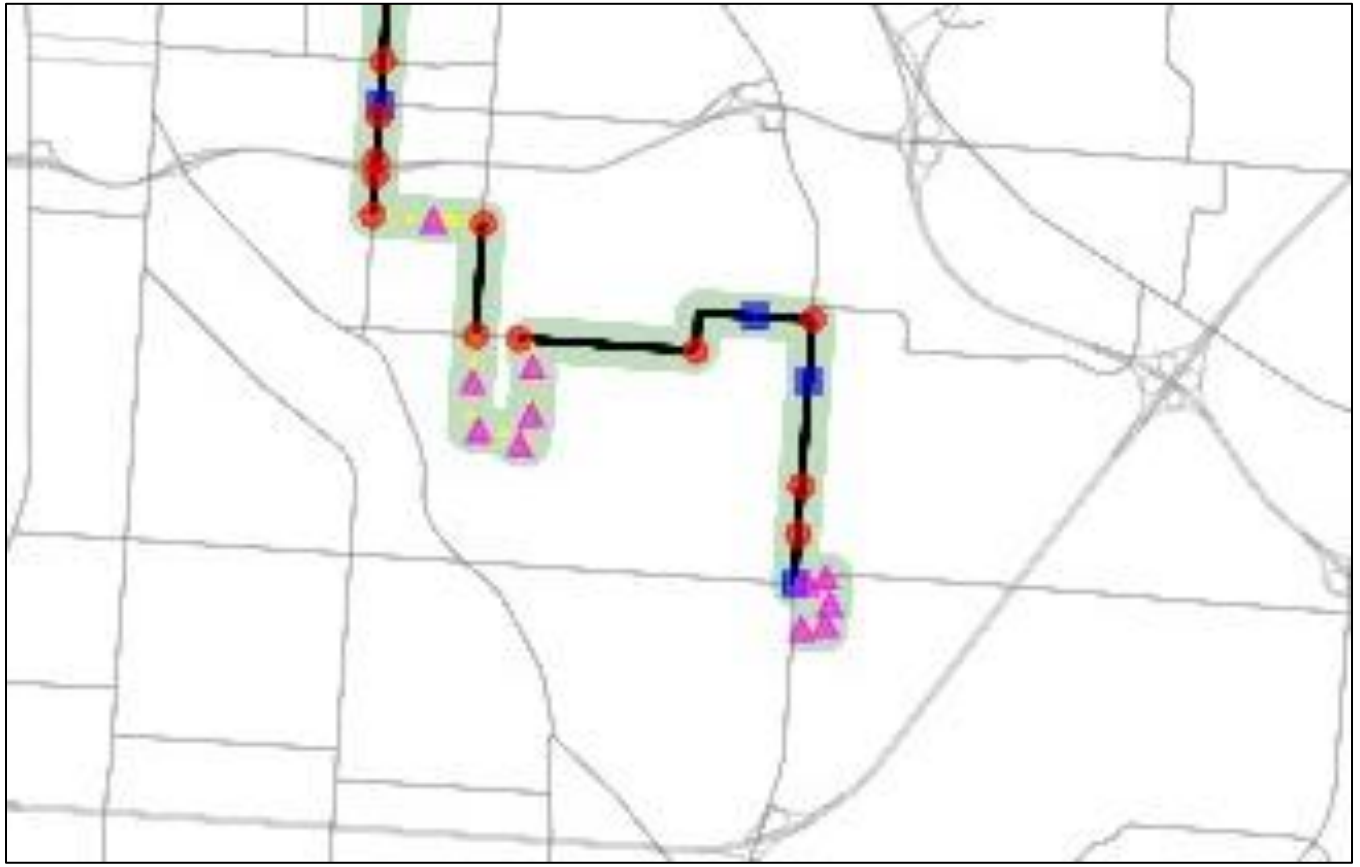

Figure 10. Transit-only nodes and links created to fill in the gaps of the network.

# Cube App

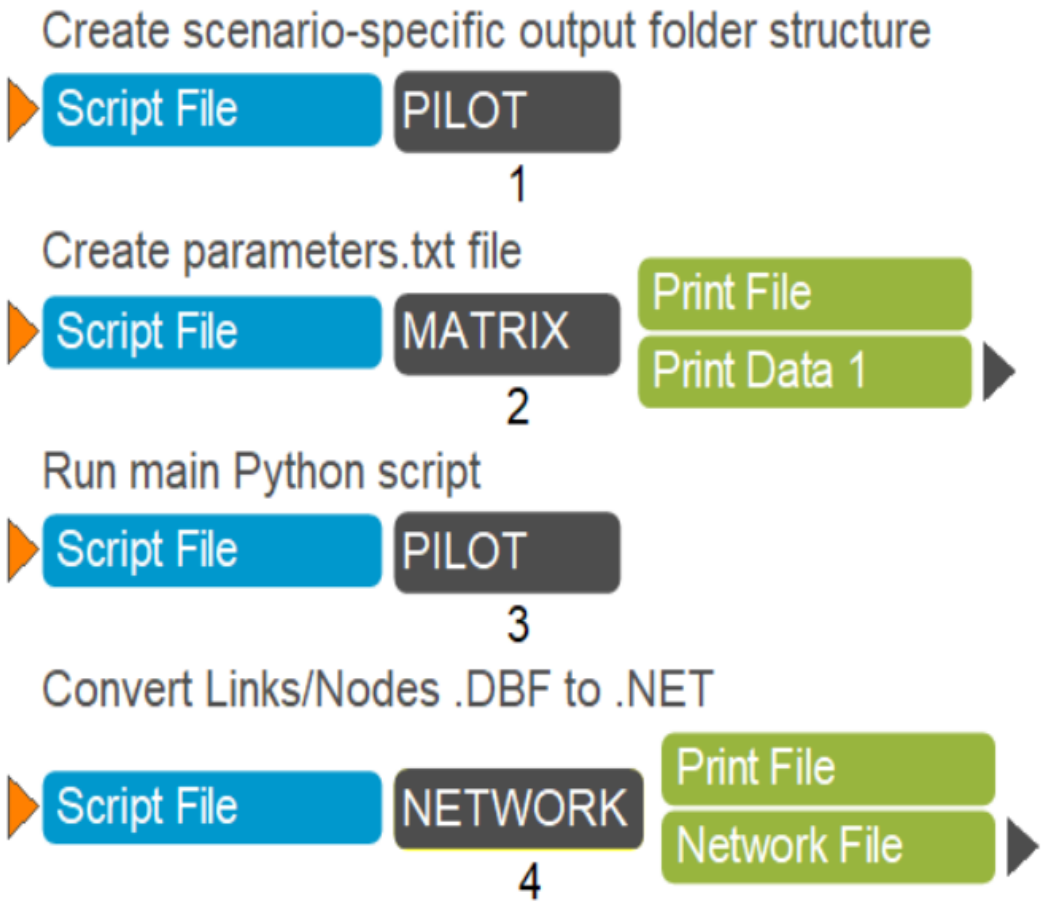


Figure 11. Cube App with 4 processes.

# Cube App

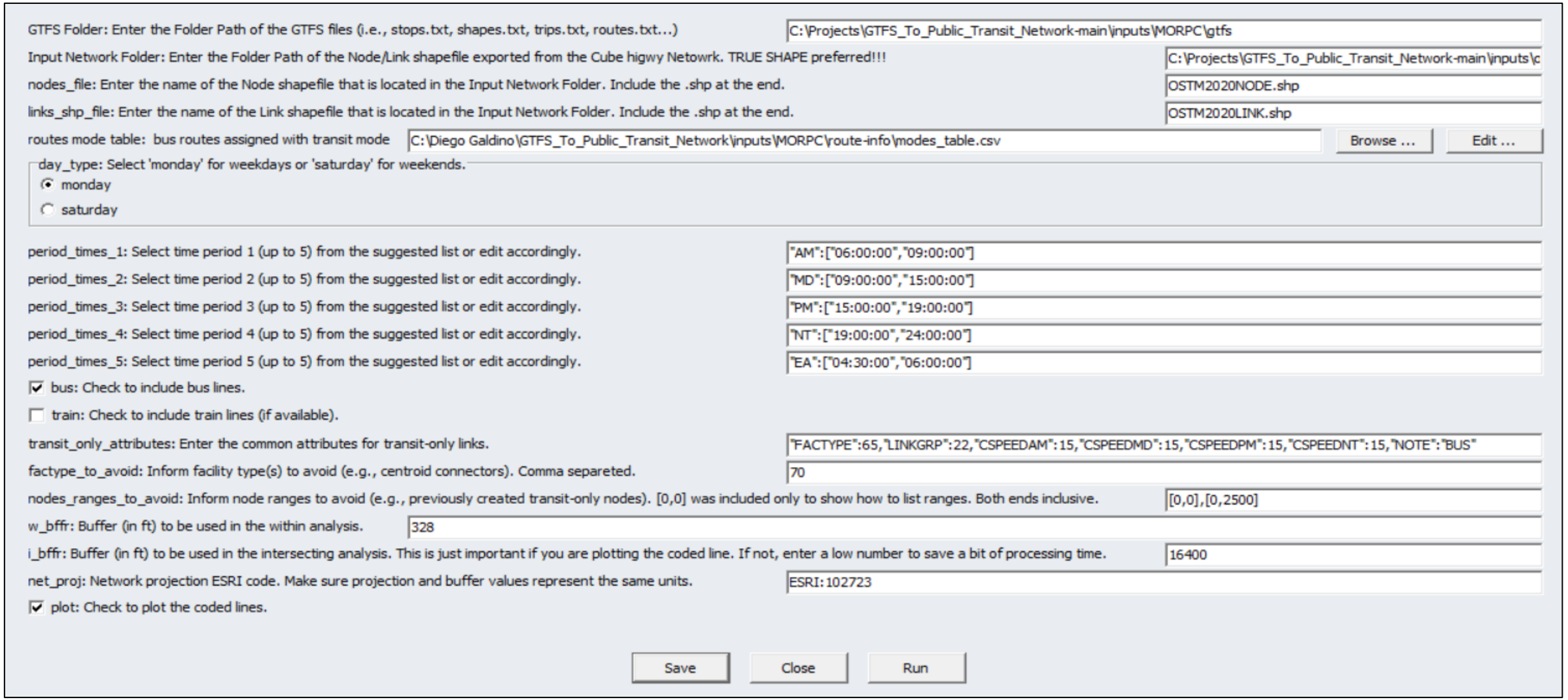


Figure 12. MORPC scenario in the Cube app.

# Inputs

- Network (True shape)
  - Open the .NET file in Cube, activate the True Shape, and export the network as Link and Node Shape Files (*.shp)

- General Transit Feed Specification (GTFS)
  - “data specification that allows public transit agencies to publish their transit data in a format that can be consumed by a wide variety of software applications” (GTFS.ORG, 2023)
  - All required information: stops, shapes, trips, routes, stop times, calendar, etc.
  - https://database.mobilitydata.org (download their CSV spreadsheet)

- Route Mode Table
  - CSV spreadsheet with columns ROUTE_ID, ROUTE_NO, LONG_NAME, and MODE.
    - ROUTE_ID, ROUTE_NO, LONG_NAME: Take this info from GTFS “routes.txt”.
    - MODE: Your own definition. This will be used in .LIN.

# Outputs

- Network
  - The Python script exports Link and Node shapefiles. The Cube app combine them back to .NET.
  - The new network contains the transit-only links and nodes.

- Transit-only
  - Transit-only links and nodes are exported as CSV spreadsheets.
  - Line file (.LIN) with transit lines basic information (name, mode, headways, oneway, allstops, vehicletype, circular) and sequence of nodes.

- Images
  - The tool can export images of the final routes like the ones in the next slides.

# Outputs

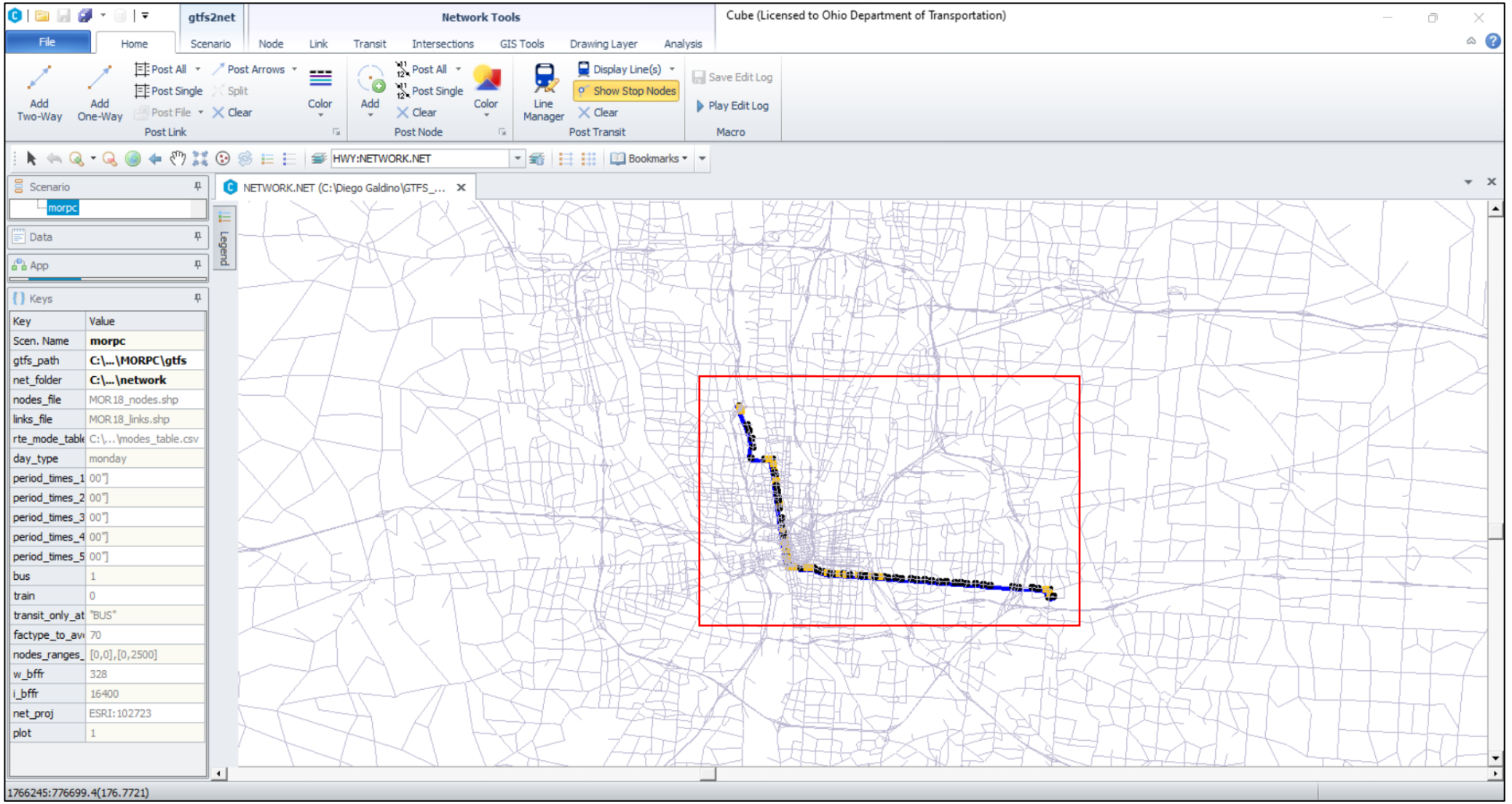


Figure 13. MORPC network with lines loaded and route 1 selected.

# Outputs

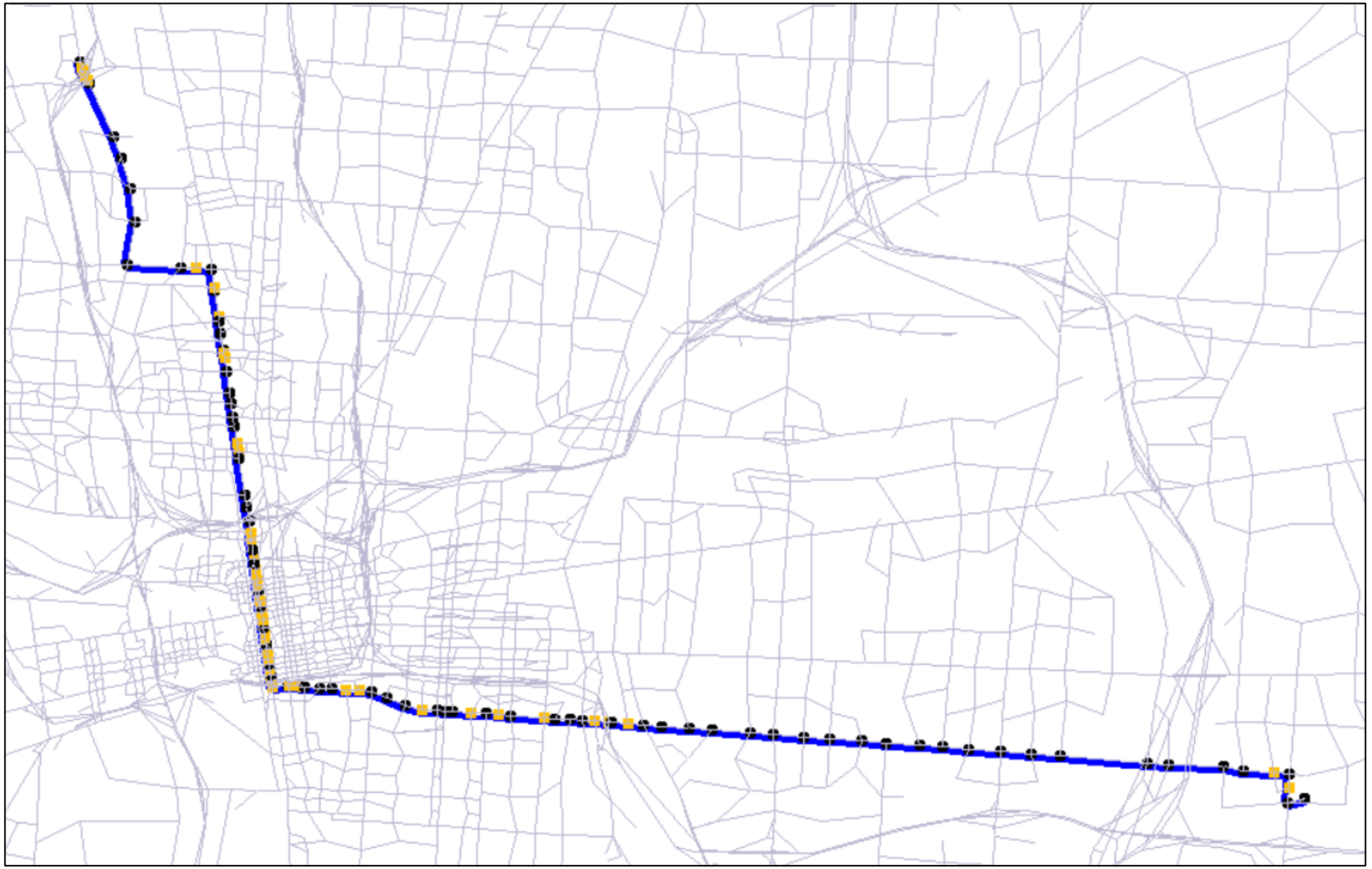

Figure 14. MORPC network with lines loaded and route 1 selected and in zoom.

# Outputs

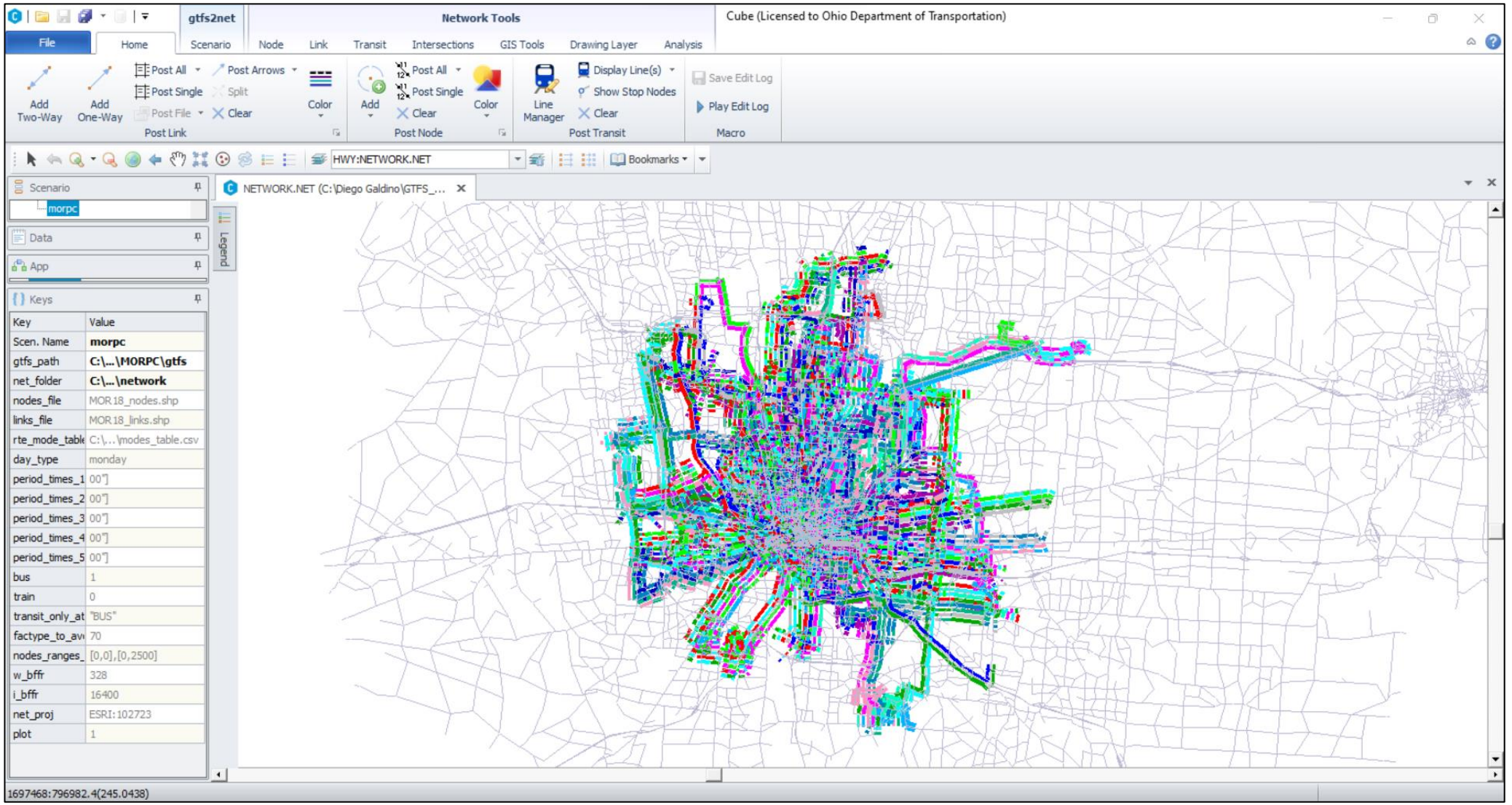


Figure 15. MORPC network with lines loaded and all routes selected.

# Outputs

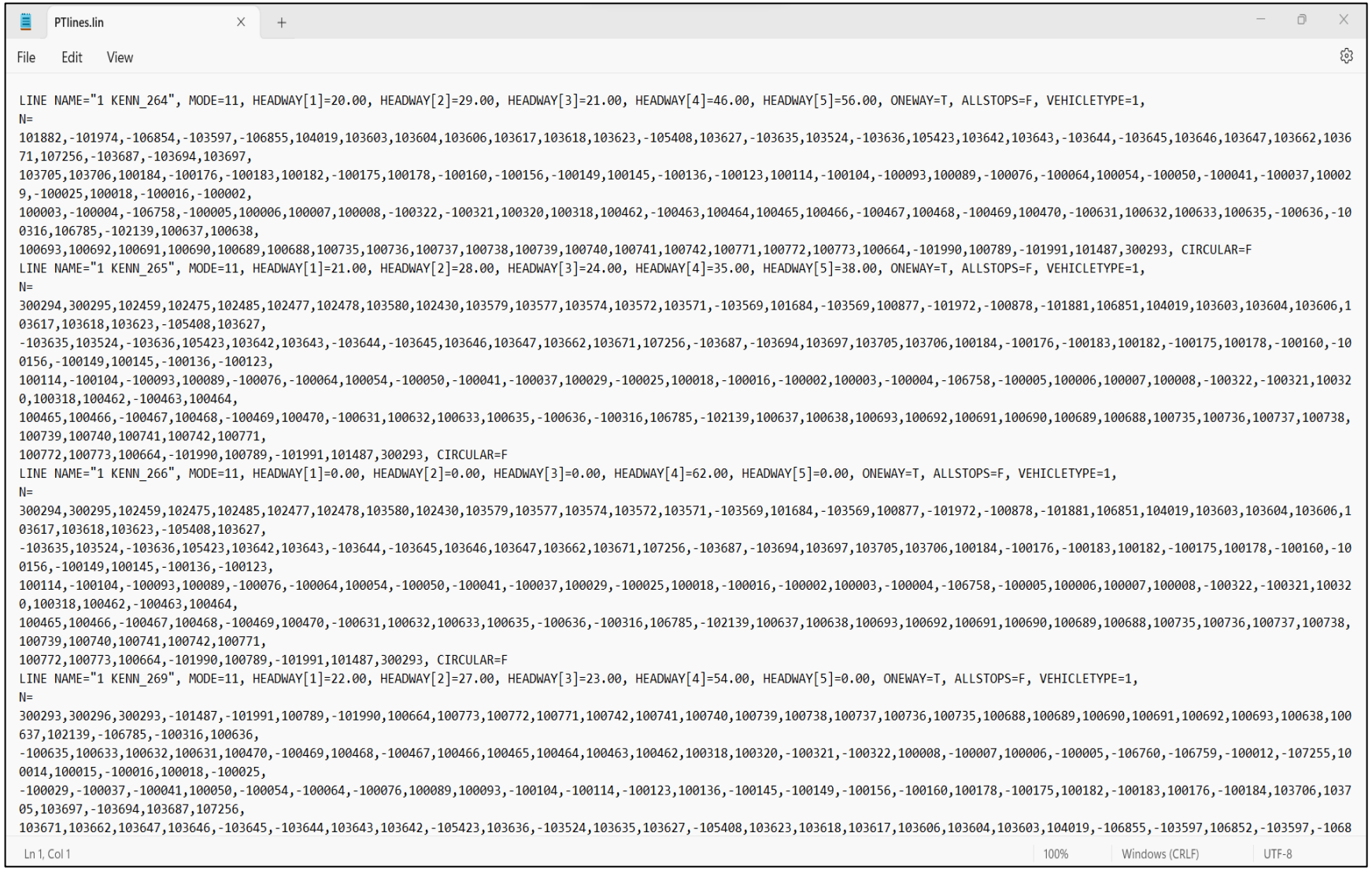


Figure 16. Line file produced by the tool.

# Outputs

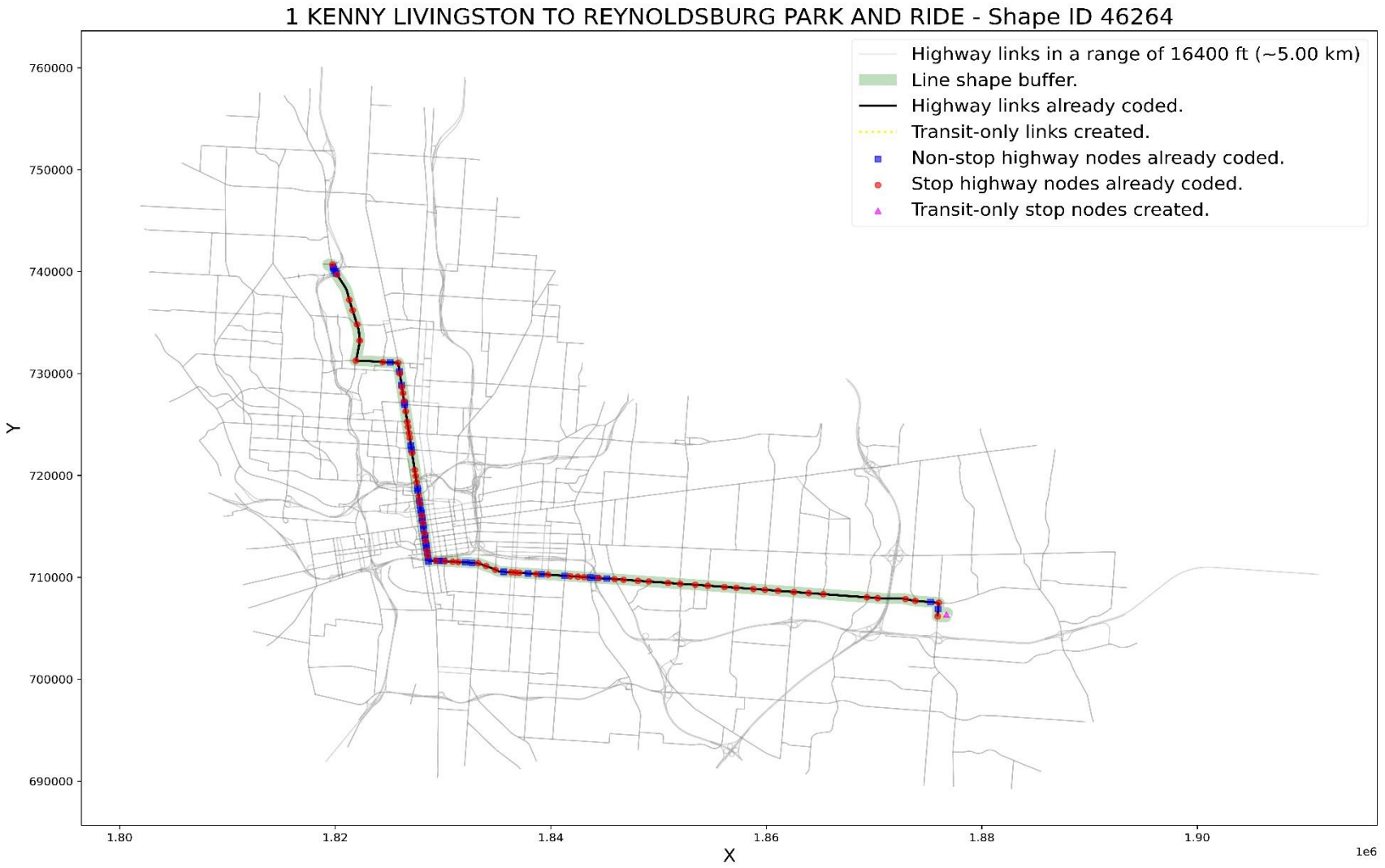


Figure 17. COTA line 1 with MORPC network.

# Conclusions and Recommendations

- The four main core functions of the Python-based tool are related to:
  - The bus line buffer.
  - The highway stops.
  - The shortest path that connects the highway stops.
  - The creation of transit-only elements (links and nodes).
- The two most important inputs are the network “trueshape” and the “within_buffer”.
- The tool does not perform well with bus lines that ride roads in both directions (e.g., circular bus lines).
- The tool was only tested with bus lines, but it should work for any mode if the right network is provided.
- Create indicators to assess the quality of the coded lines (e.g., % of transit-only elements, geometry analysis).
- Revise the selection of highway stops.
- Introduce an auto selection function for the “within_buffer”.
- Adapt Google’s or Microsoft’s “Snap to Road” tools for this application.

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GitHub: https://github.com/morpc/morpc-gtfs-to-public-transit-network

# Outputs

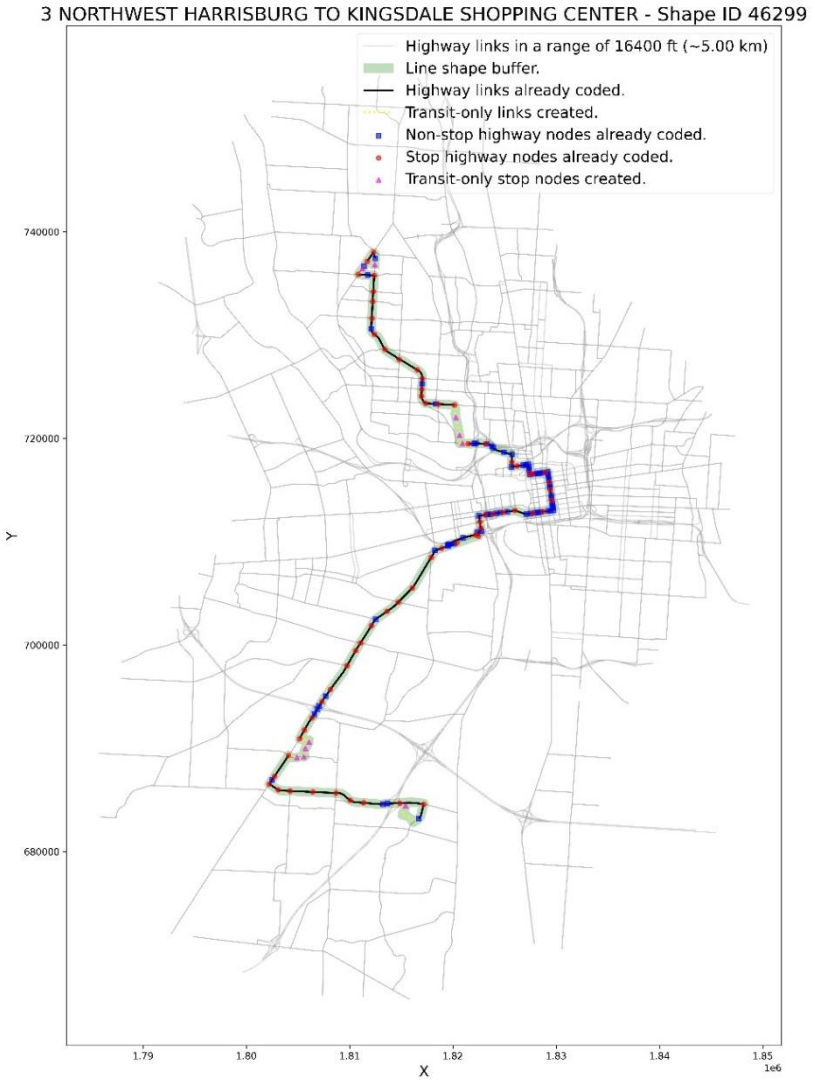


Figure 18. COTA line 3 with MORPC network.

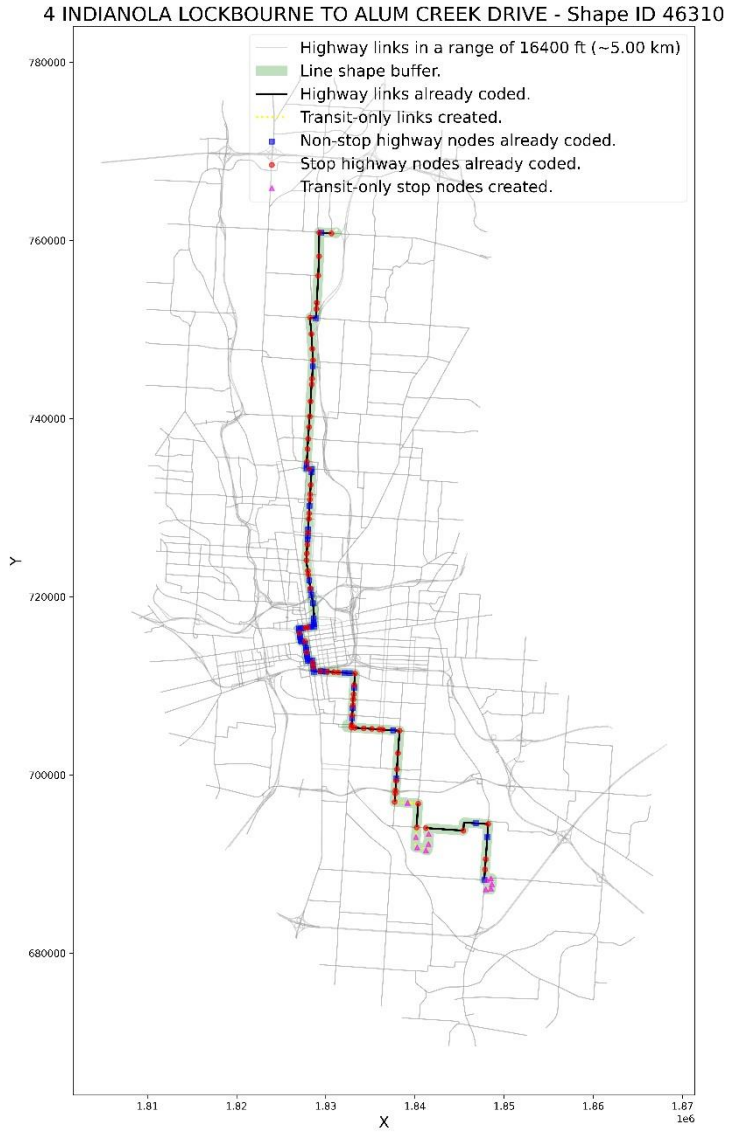


Figure 19. COTA line 4 with MORPC network.

# Outputs

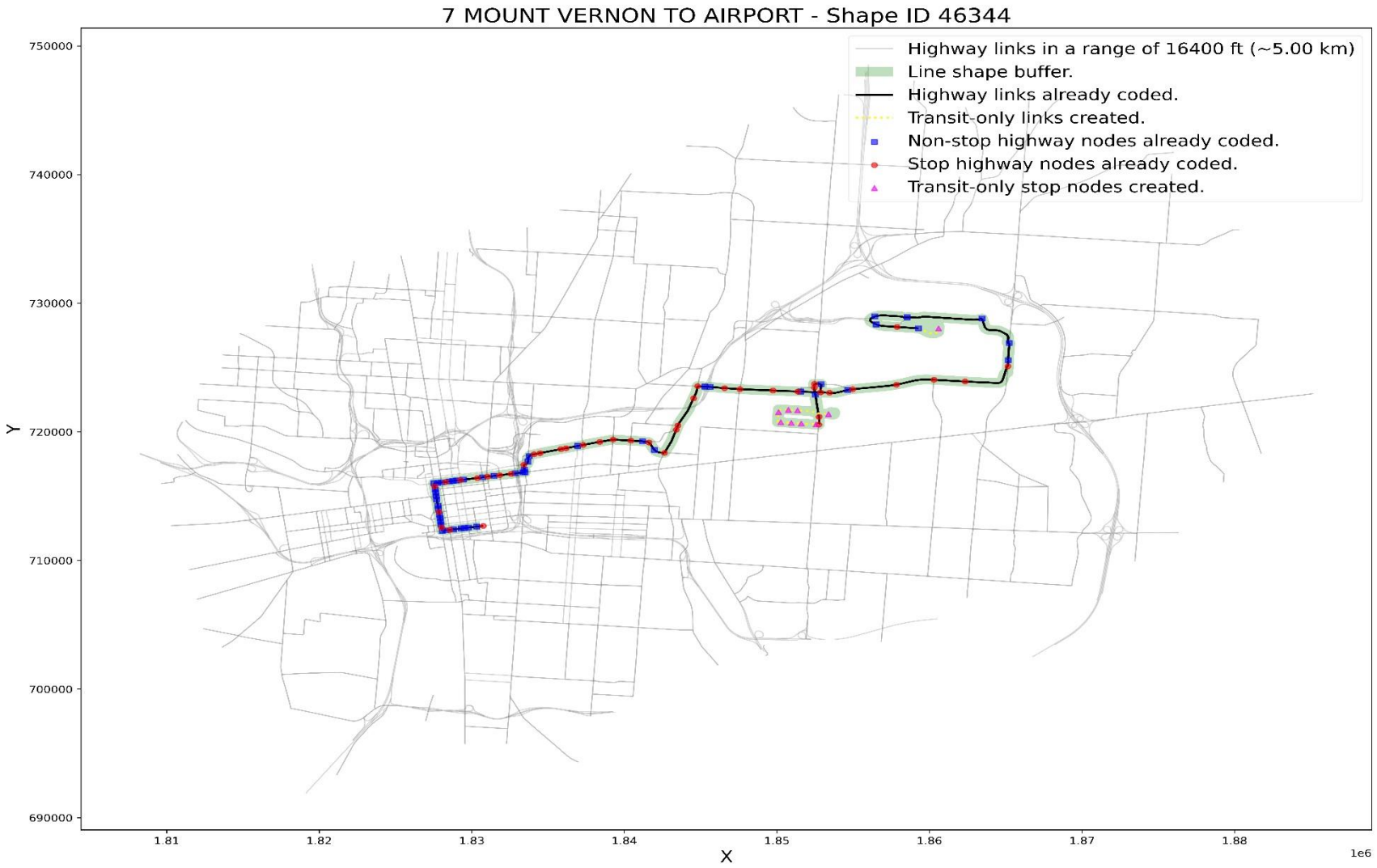


Figure 20. COTA line 7 with MORPC network.

# Outputs

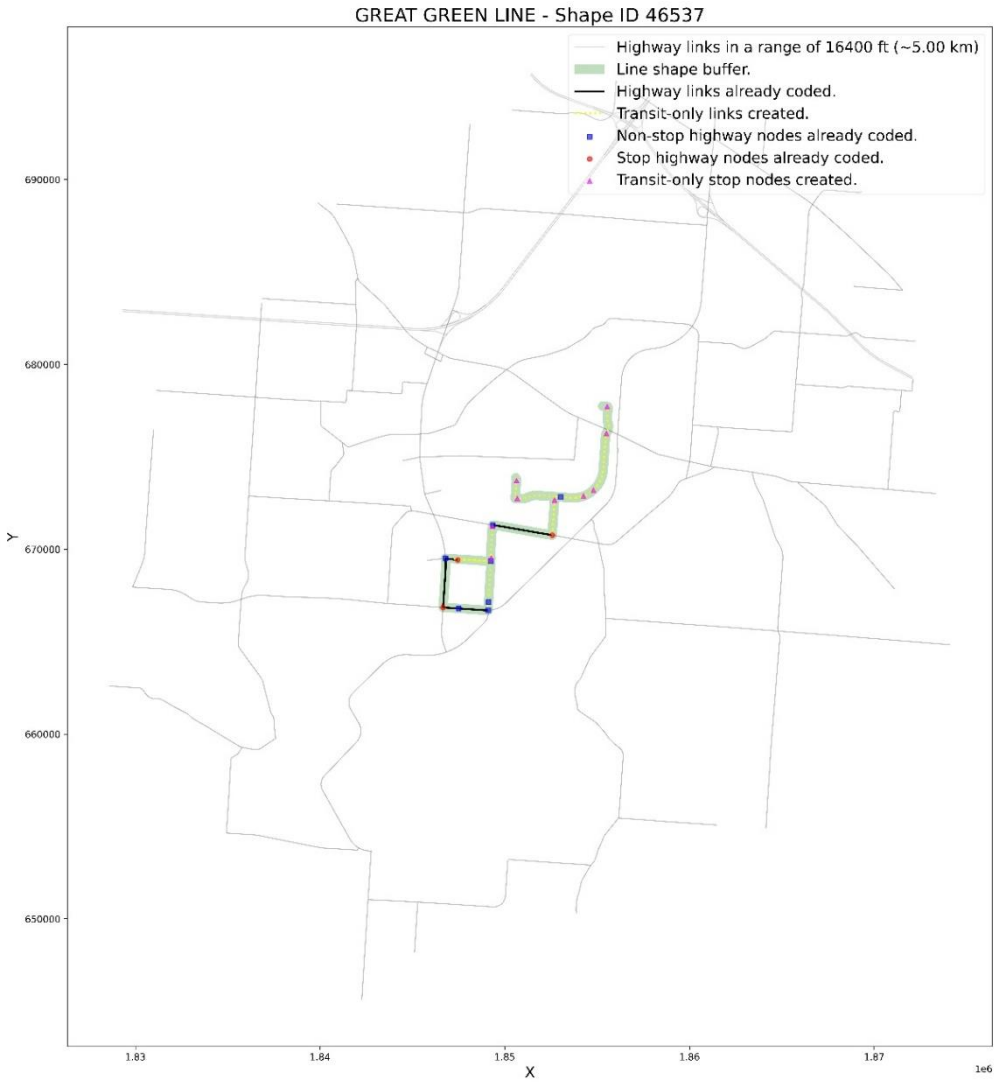


Figure 21. COTA line Great Green with MORPC network.

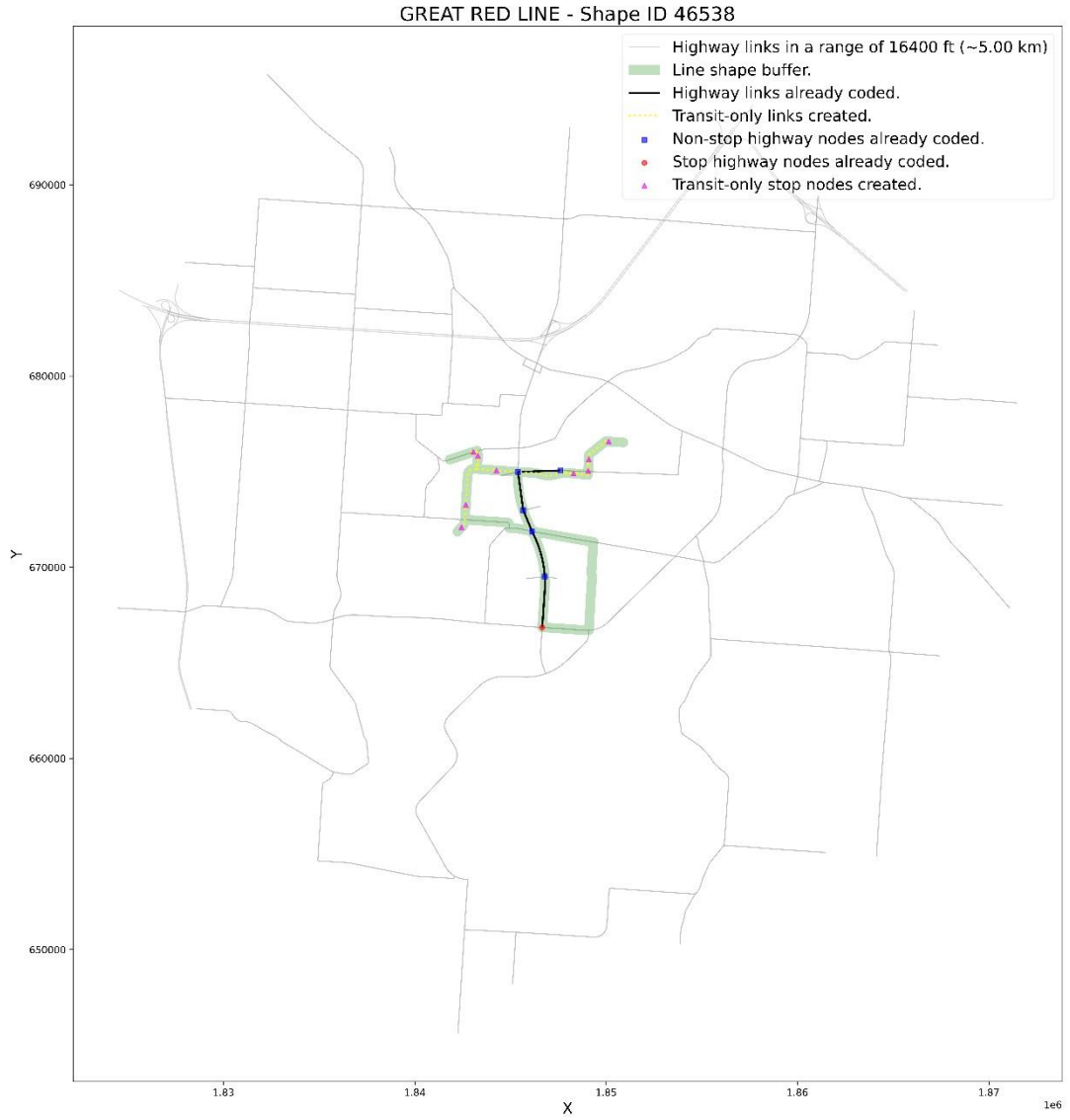


Figure 22. COTA line Great Red with MORPC network.

# Outputs

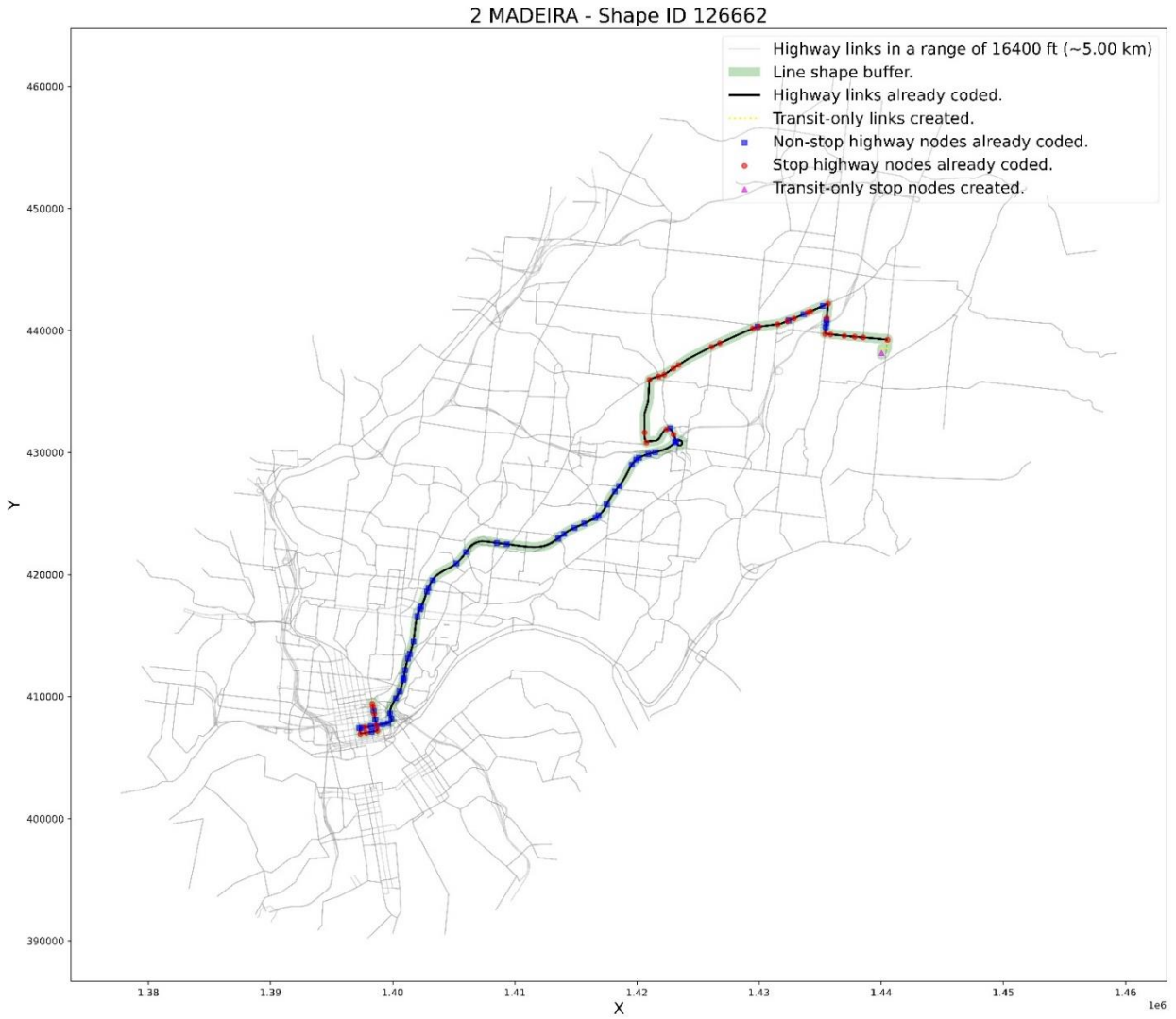


Figure 23. GOMETRO/SORTA line 2 with statewide network.

# Outputs

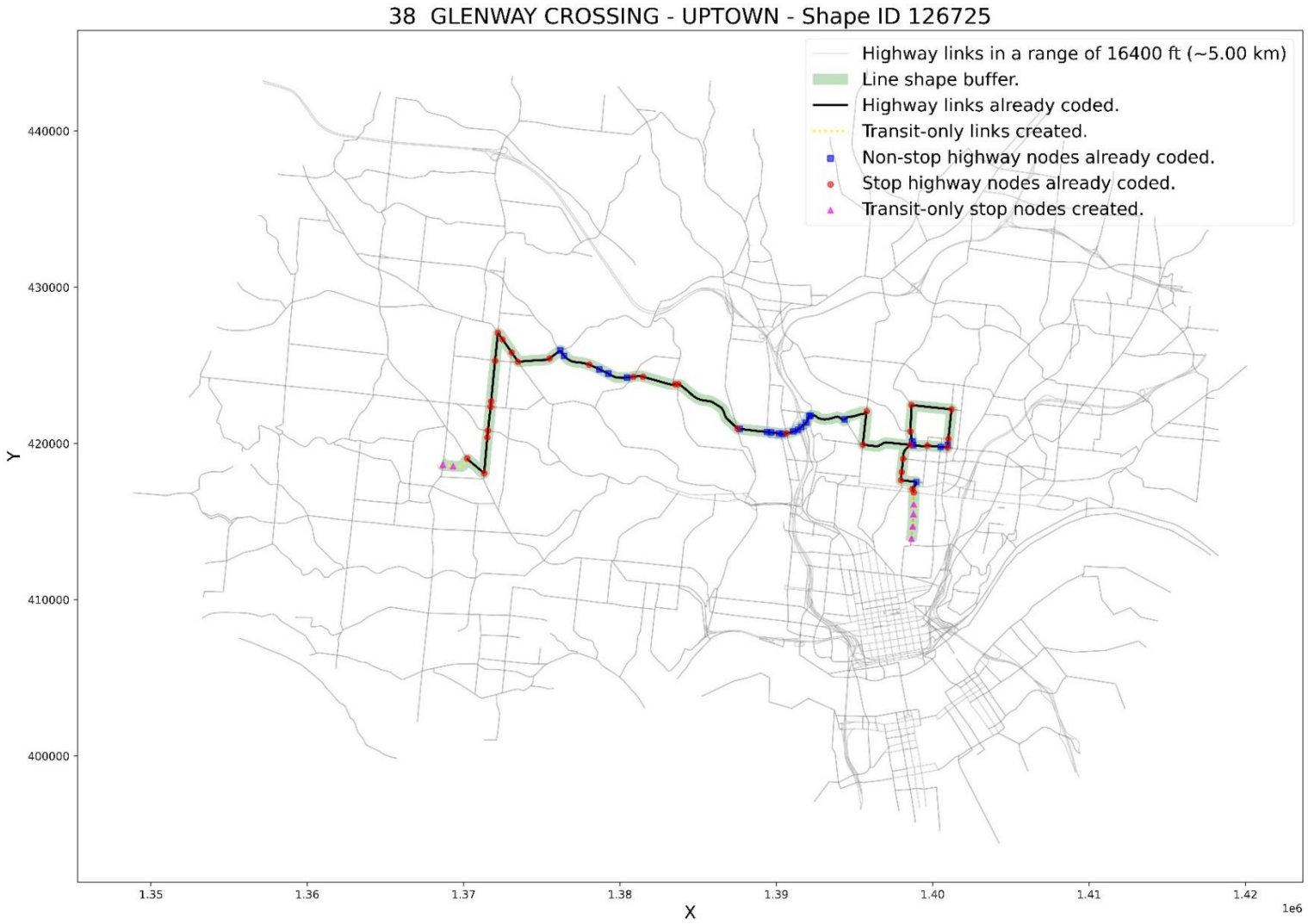


Figure 24. GOMETRO/SORTA line 38 with statewide network.