

Deadhead Minimization with a Flexible Facility Locator Tool

Freyja Brandel-Tanis

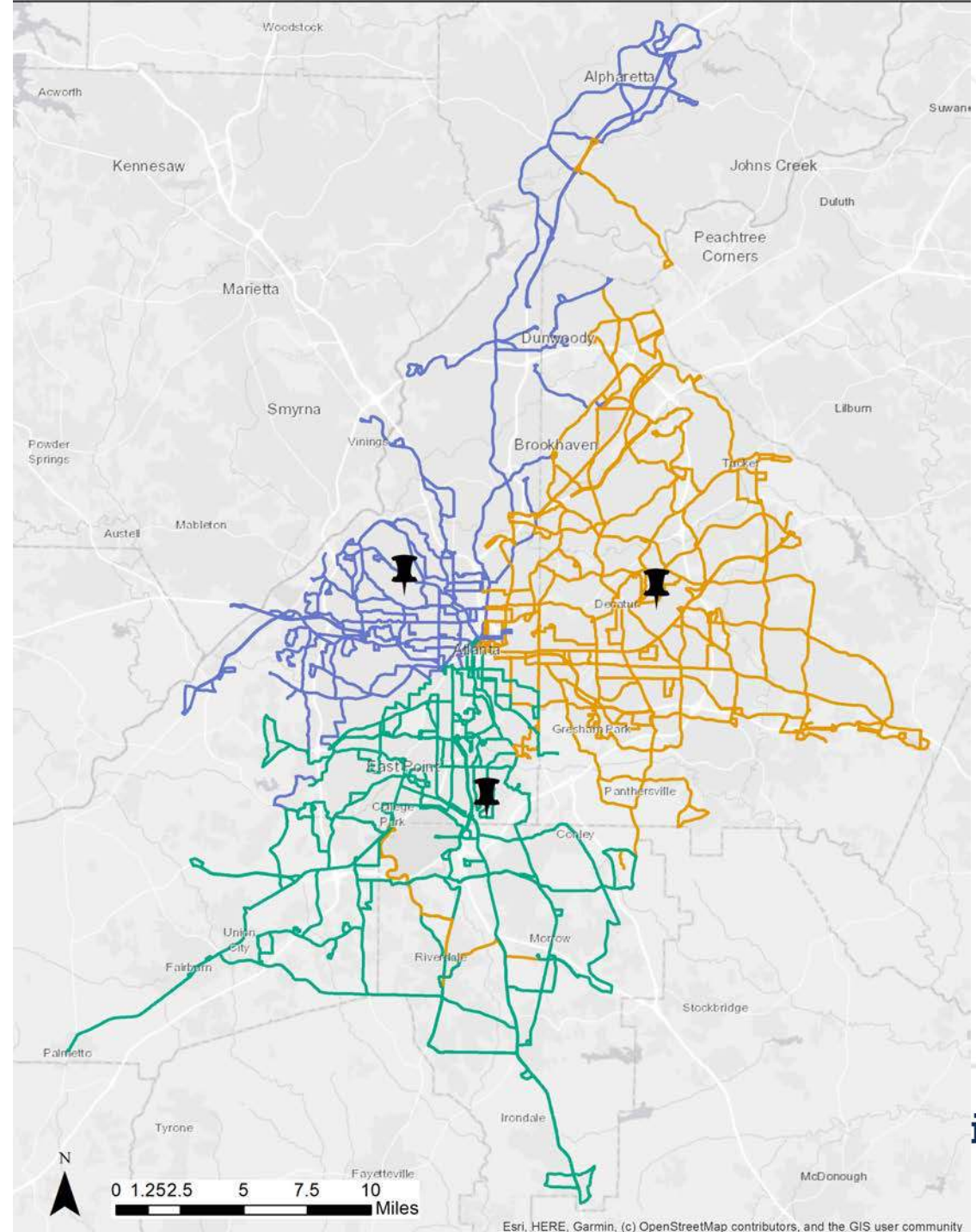
GPA/TAPA Joint Conference Fall 2021

Overview

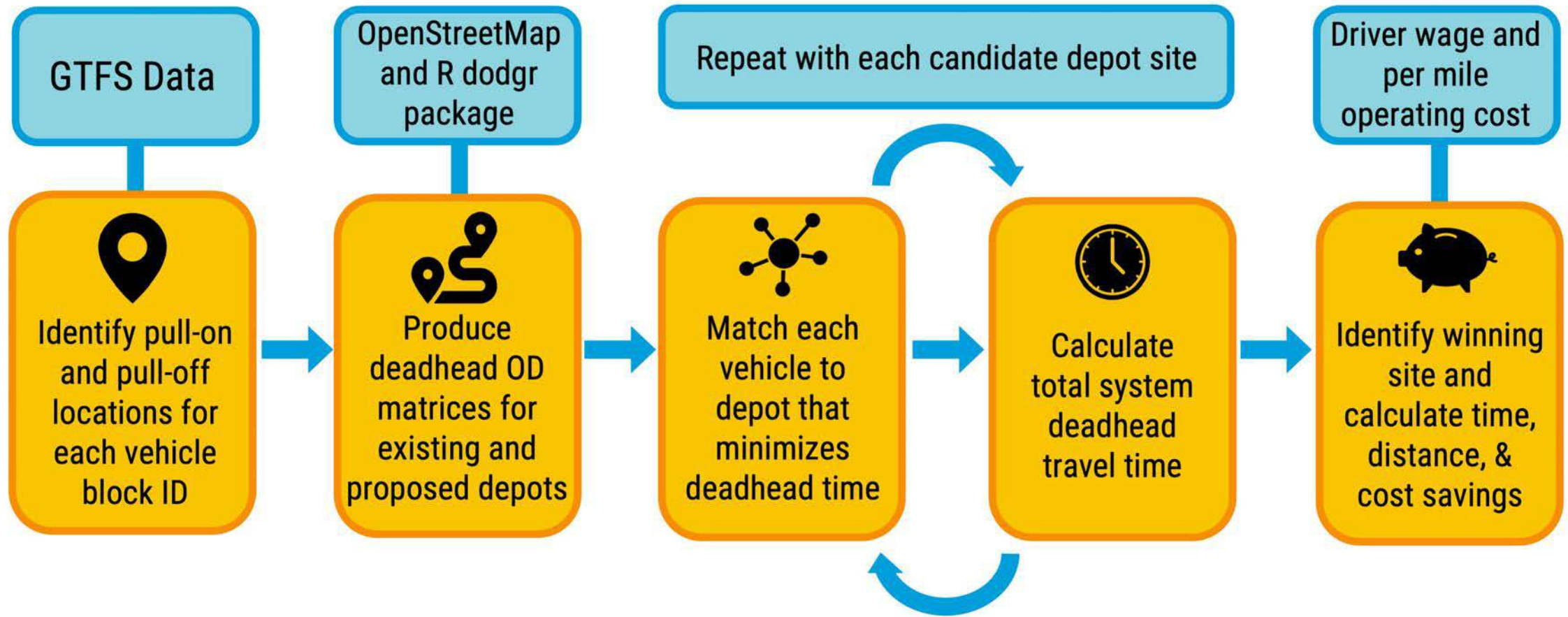
1. Background
2. Process and methods
3. Case study results
4. Implications
5. Future work

Background

- For MARTA
 - Buses currently stored in 3 depots
 - Many routes start and end service north of these depots
 - Increased deadhead time and costs
- At large
 - Capability limited to certain commercial software
 - Giro's HASTUS and Minibus
 - Skill barrier to enact solutions seen in literature



Analysis Process



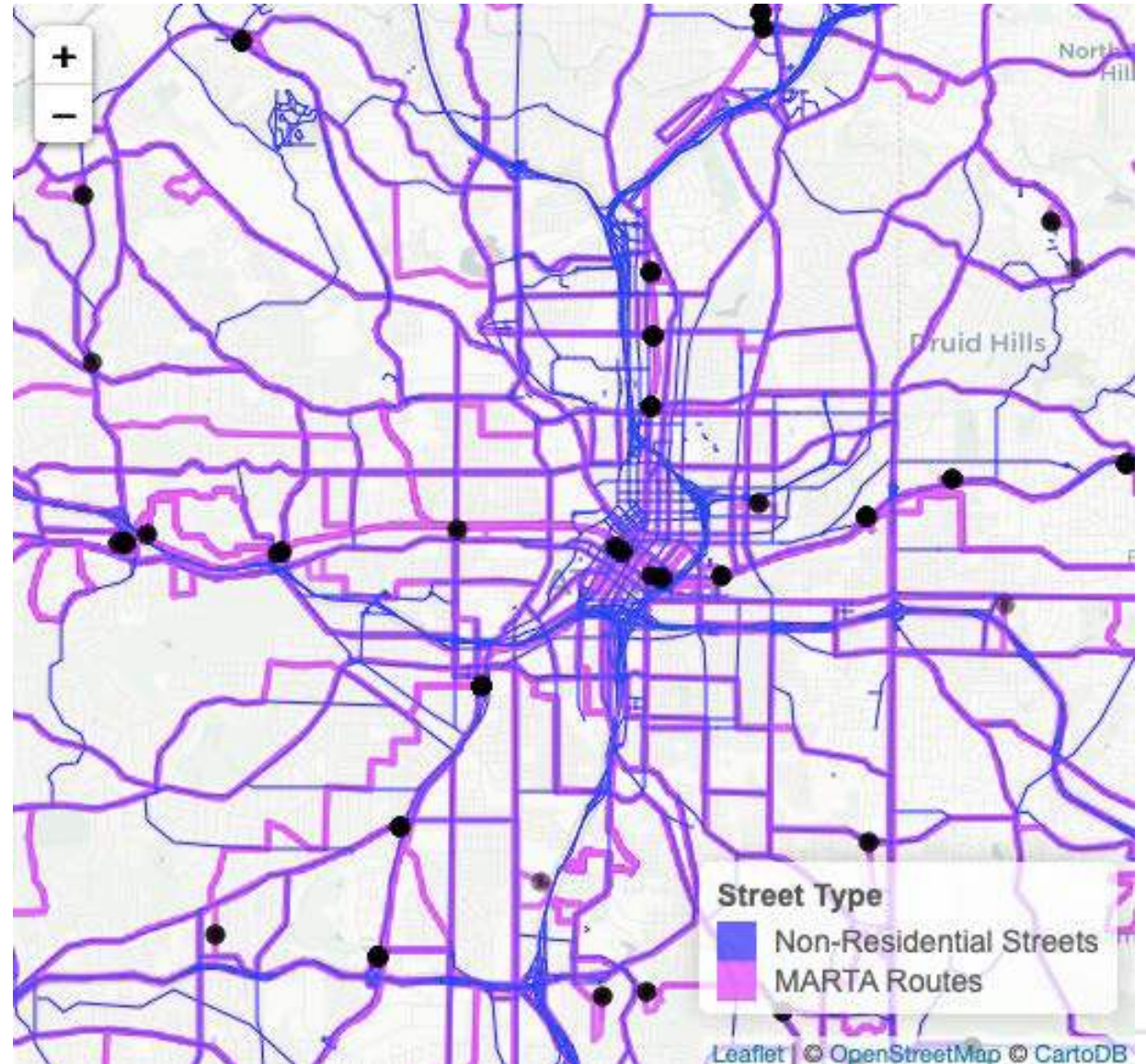
Data

Data

- GTFS
- OpenStreetMap
- Current facility locations

Assumptions

- Candidate sites
- Hourly costs
- Per mile operating cost
- Street network reduction



Leaflet | © OpenStreetMap © CartoDB

User Interface

Upload GTFS routes.txt file:

Browse... routes.txt
Upload complete

Upload GTFS times.txt file:

Browse... stop_times.txt
Upload complete

Upload GTFS stops.txt file:

Browse... stops.txt
Upload complete

Finally, upload the .csv files with the coordinates of your existing depots and the vacant properties you want to consider.

Each file should have a column titled 'lat' with latitude coordinates and a column titled 'lon' with longitude coordinates.

Upload a .csv file with the coordinates of your existing depot:

Browse... MARTA_garages.csv
Upload complete

Upload a .csv file with the coordinates of the vacant properties you're considering:

Browse... fulton_vac_prop_data.csv
Upload complete

Submit

Building street network This may take a while...

Upload GTFS stops.txt file:

Browse... stops.txt
Upload complete

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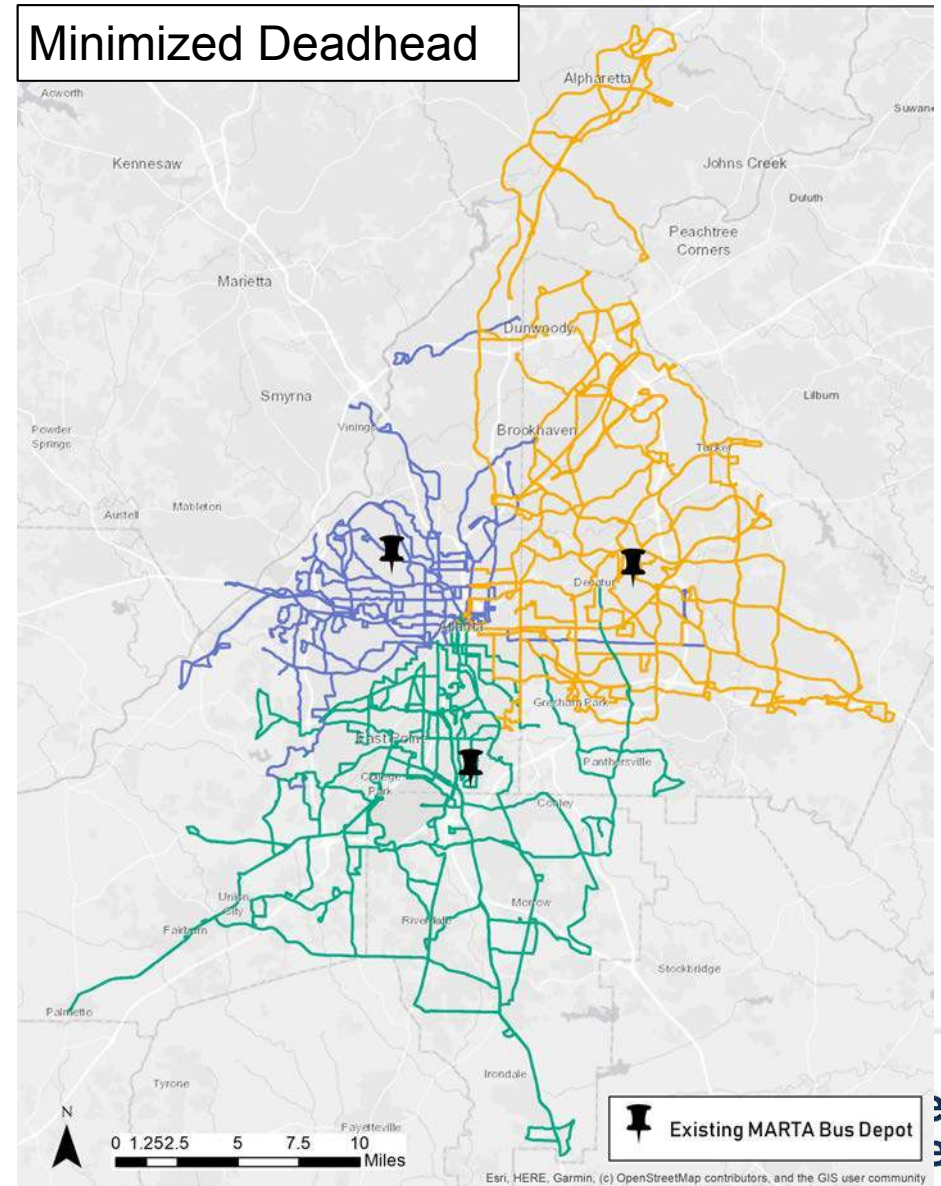
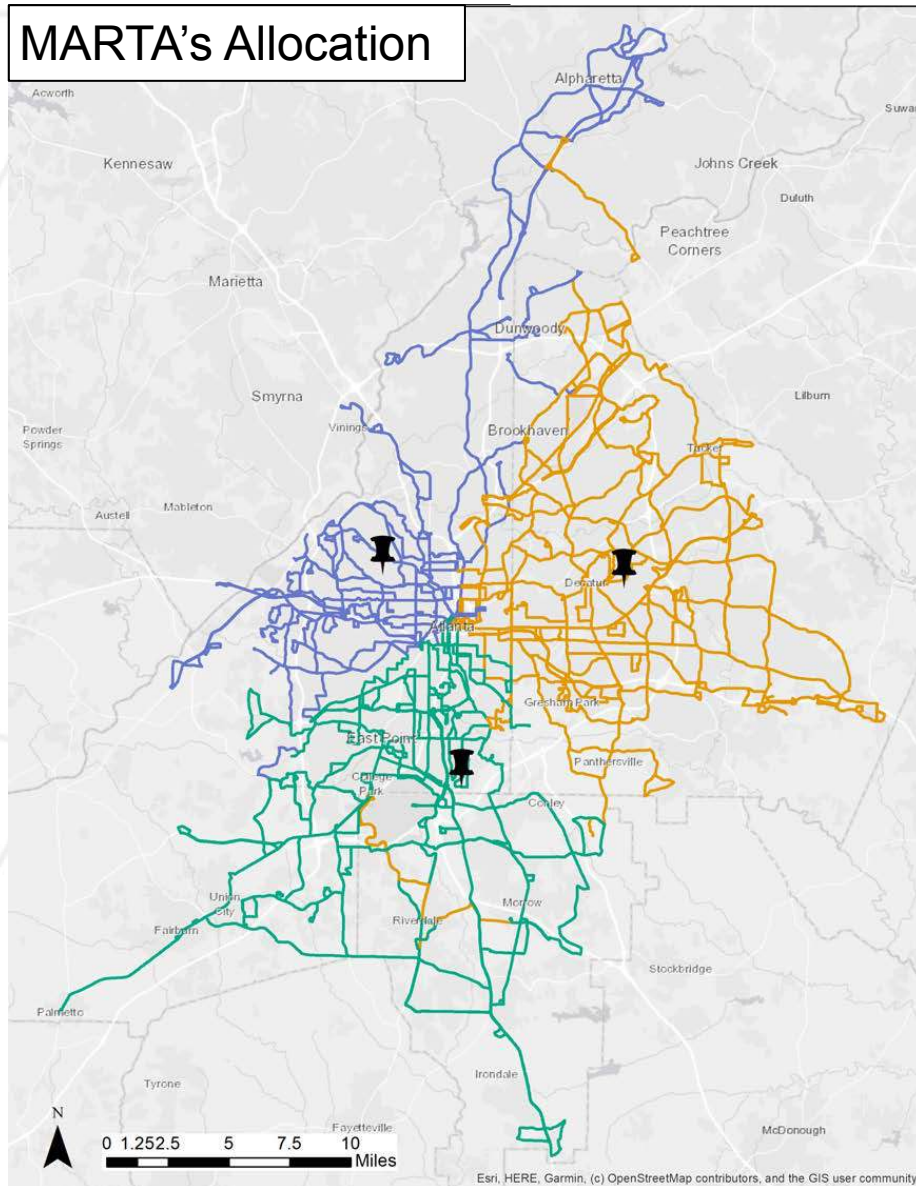
Browse... fulton_vac_prop_data.csv
Upload complete

Submit

The new depot should be located at: Windward Parkway
This would save ~29.82 hours or 1422.98 miles of deadhead travel per weekday.
This translates to saving about \$488.45 in wage costs and \$12024.18 in operating costs per weekday.

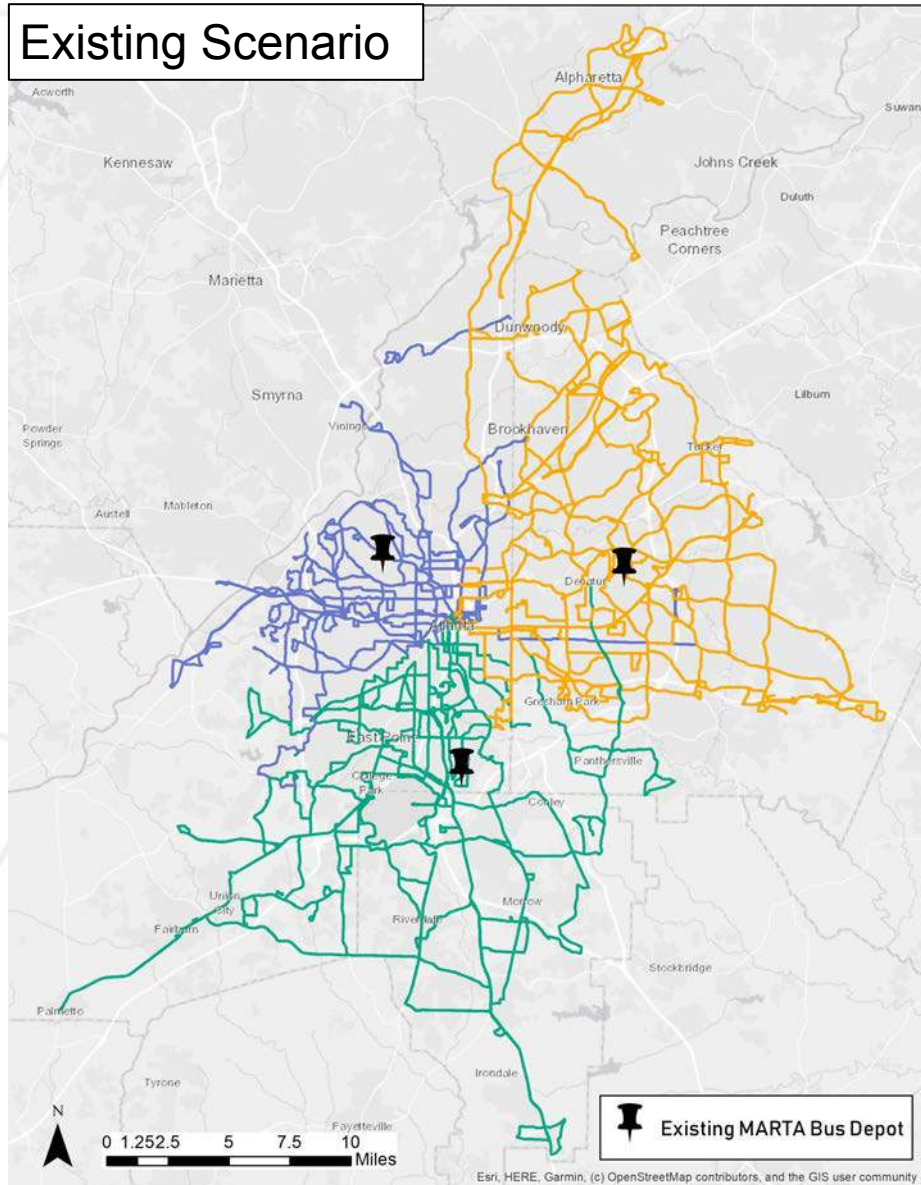
Download

Model Assumptions: Current Depots

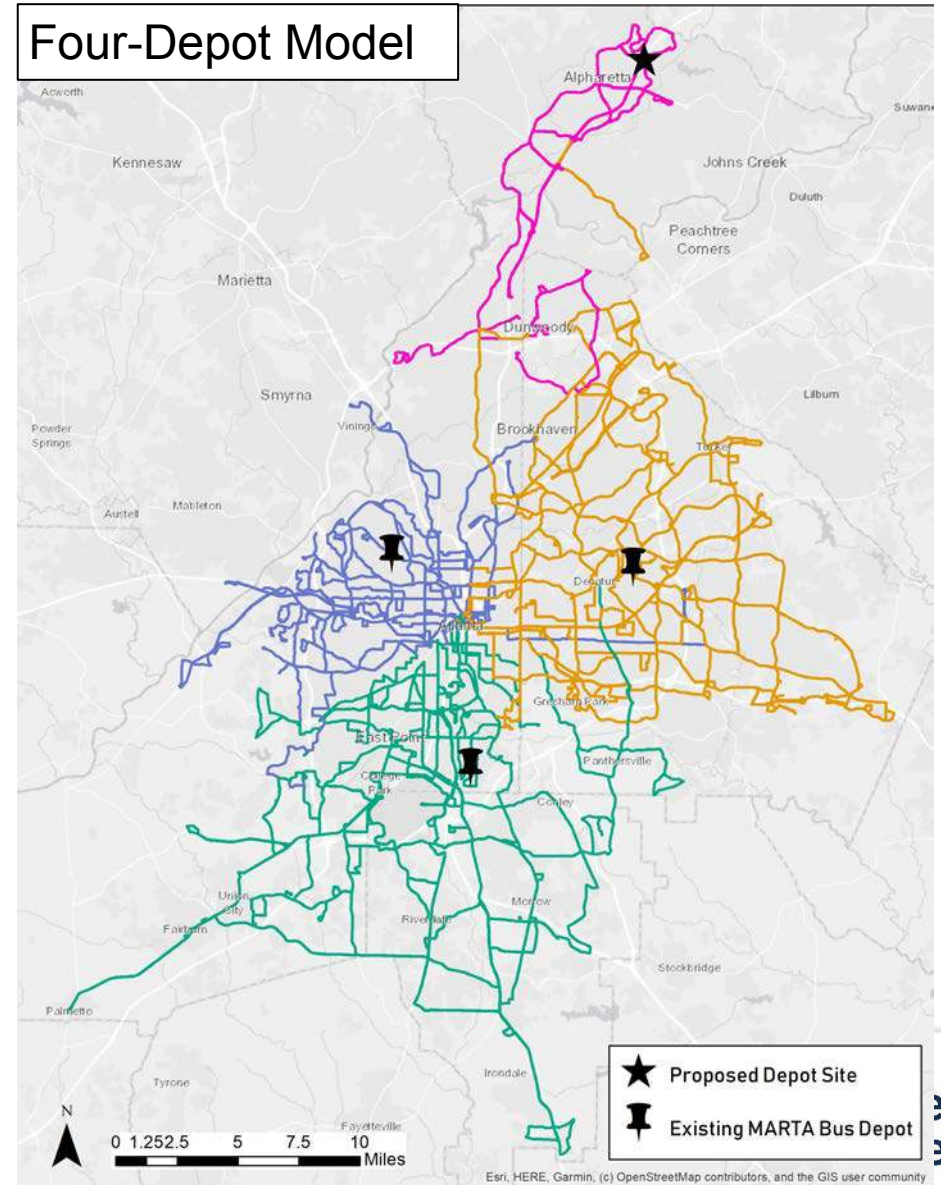


Results

Existing Scenario



Four-Depot Model



Results

Without Residential Roads

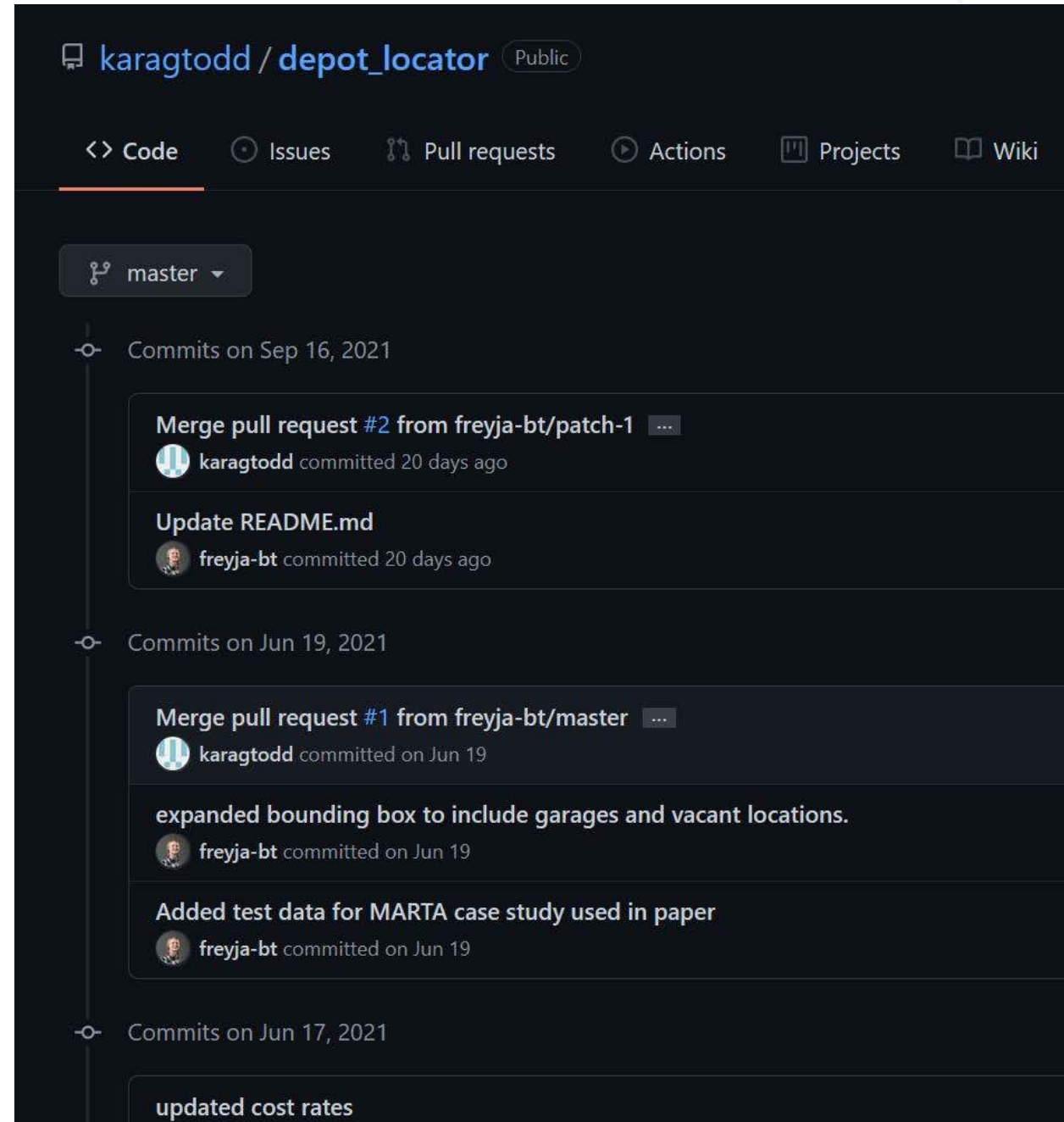
- Winward Park & Ride
 - 67 vehicles reassigned
 - 29.74 deadhead hours saved
 - Saves ~\$12,000/day based on assumptions

With Residential Roads

- 11343 Alpharetta Hwy
 - 68 vehicles reassigned
 - 29.34 deadhead hours saved
 - Saves ~\$12,000/day based on assumptions

Implications

- Successes:
 - Open-source and adaptable
 - Inputs can be updated over time
 - No coding knowledge required from the user
- Collaboration through GitHub
- Potential for transit agencies
- Potential for researchers



The screenshot displays the GitHub interface for the repository 'karagtodd / depot_locator', which is public. The navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, and Wiki. The current branch is 'master'. The commit history is shown with three entries:

- Commits on Sep 16, 2021**
 - Merge pull request #2 from freyja-bt/patch-1 (karagtodd committed 20 days ago)
 - Update README.md (freyja-bt committed 20 days ago)
- Commits on Jun 19, 2021**
 - Merge pull request #1 from freyja-bt/master (karagtodd committed on Jun 19)
 - expanded bounding box to include garages and vacant locations. (freyja-bt committed on Jun 19)
 - Added test data for MARTA case study used in paper (freyja-bt committed on Jun 19)
- Commits on Jun 17, 2021**
 - updated cost rates

Future work

- Facility vehicle capacity
- Emissions and environmental considerations
- Connect different fuel types and maintenance needs
- Consider battery range and charging station locations
- Turn penalties
- Integrated address geocoding



Photo: Kristain Baty, <https://flic.kr/p/hTKGrr>

More information

- Todd, Kara, Freyja Brandel-Tanis, Daniel Arias, and Kari Edison Watkins. “Deadhead Minimization with a Flexible Facility Locator Tool.” Transportation Research Record, (September 2021). <https://doi.org/10.1177/03611981211044455>.
- https://github.com/karagtodd/depot_locator
- <https://freyjabt.me>