Using Car2Go to Serve the Underserved and to Solve the First & Last Mile Problem

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CAR2GO SECA

Shared Automated Electric and Connected Vehicles (SECA)

- Shared: Shared car usage. Also the ability to carpool
- Autonomous: Vehicle w/no driver.
- Electric: Electric vehicles of different makes/models. Also includes disability vehicles
- Connected: Use of algorithms and apps to optimize deployment and departure time, and vehicle route choices (socially optimum, minimized travel time)

Features of the SECA Car2Go

- Fully electric (60-80 mile range, 200 mile)
- Several vehicle models
  - 2 seater (Smart ForTwo)
  - 5 seater (lNissan Leaf, Tesla Model 3, Bolt)
  - Disability Enabled Vehicles
- Connected to Car2Go headquarters that dispatch cars

THE PROBLEM: THE 1ST AND LAST MILE

- People find it inconvenient to get to public transport hubs

Drive	Bus	Walk
Need to find parking	Not always reliable	Walking distance is ¼ mile.
Pay for parking	Bus may be full or late	People usually live outside of walking zone
Fuel Costs	May still need to walk to bus	Can be time consuming
Traffic stress	Not comfortable	

THE PROBLEM: UNDERSERVED

Disabled	• Disabled people need door to door service and have issues using public transport
Low income	• Typically high user of public transport, but getting to/from major transport hubs is time consuming
Underage	• Restricted to use of public transport or rides with parents. Limits to travel areas
Elderly	• Relies on taxi and bus. Some drive when physically unable to.

CASE STUDY: METRO NORTH – N. WHITE PLAINS

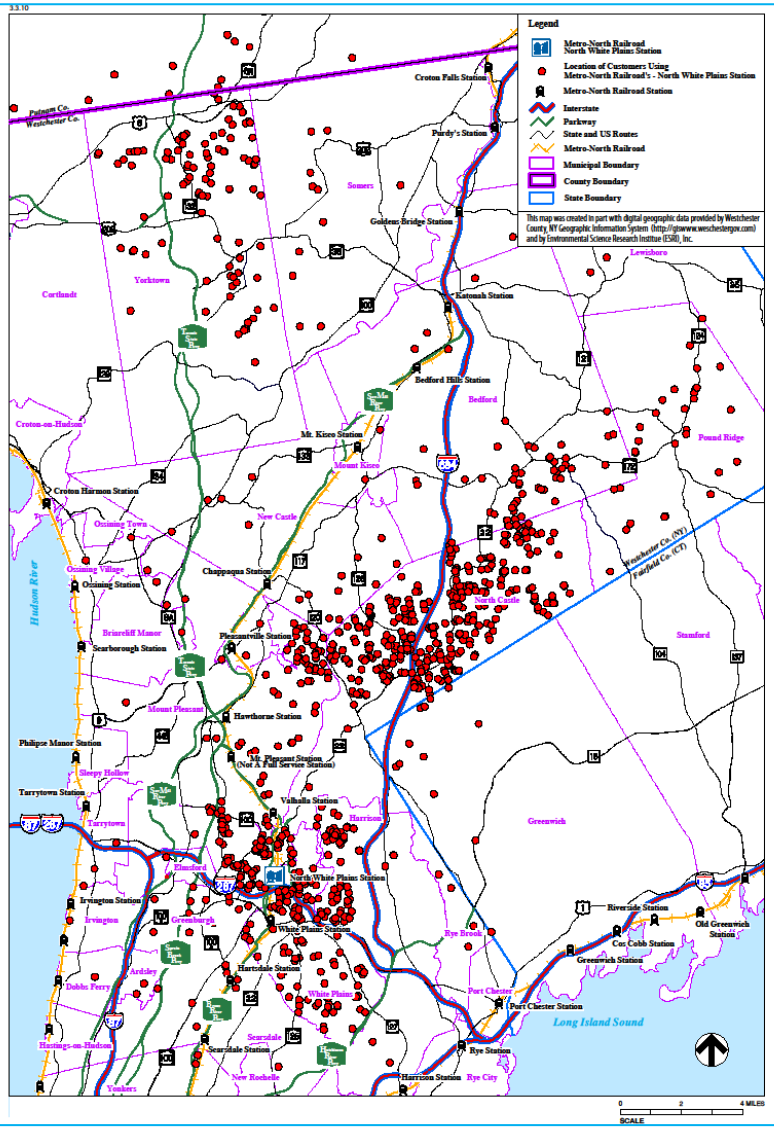


Figure A-2
North White Plains Commutershed

Metro-North Railroad North White Plains Train Stain in White Plains, NY

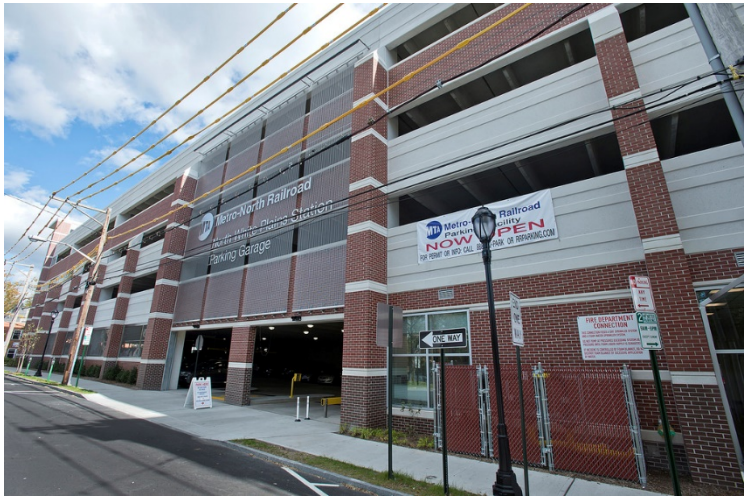
Residents served: White Plains, Greenburgh and Armonk via the Harlem Line

This station is the northernmost station in the Zone 4 Metro-North fare zone.

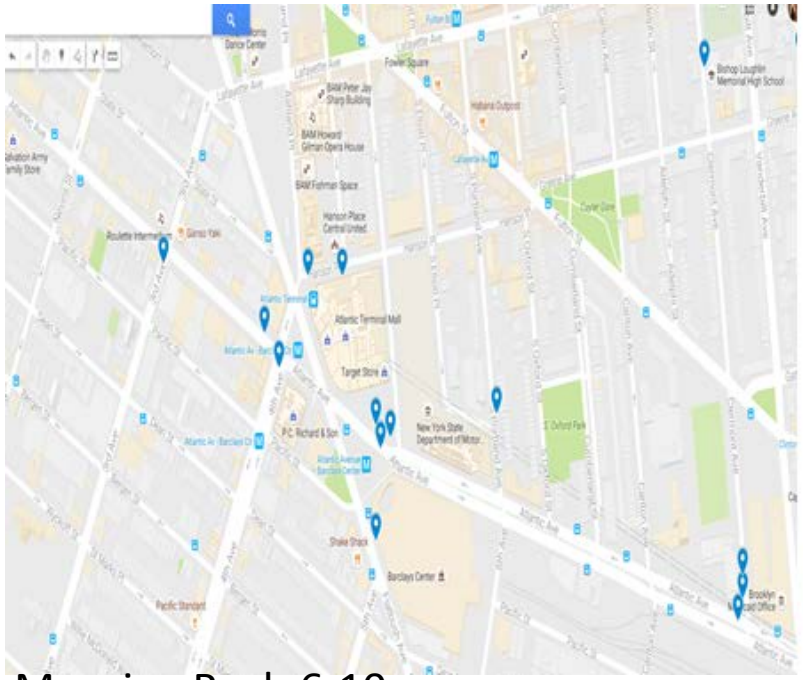
Commuter Count: 2,200 weekday, 1,300 on weekend

CASE STUDY: METRO NORTH – N. WHITE PLAINS

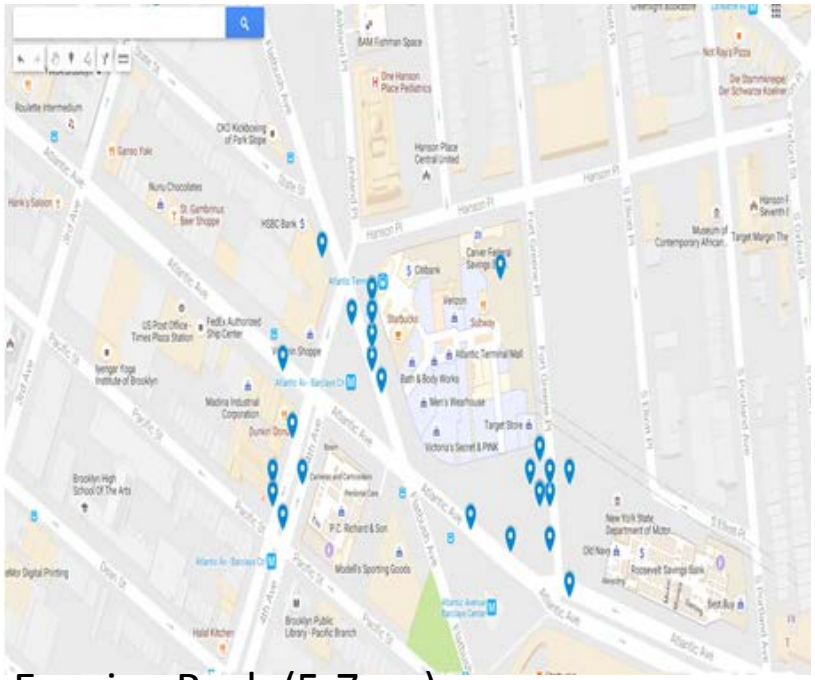
- Parking Lot at Station
  - New Parking Lot built October 2015
  - 500 parking spaces (added 391 new spaces)
  - Permit waitlist
- High usage of parking is indication that people are commuting into the train station
- 500 users, and those on wait list, are potential candidates for Car2Go service



CASE STUDY: GREEN LINE TAXIS IN NYC



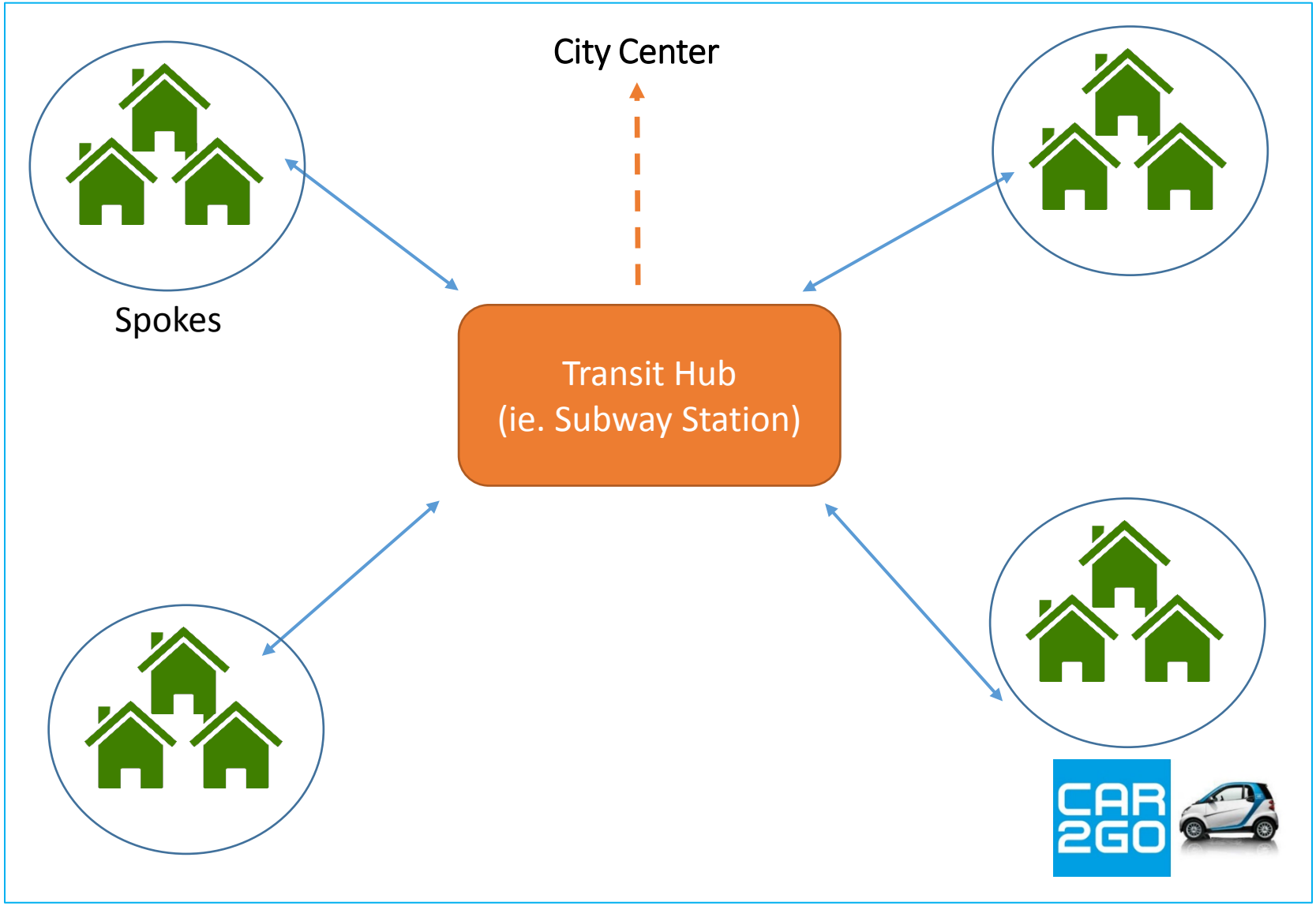
Morning Rush 6-10am



Evening Rush (5-7pm)

The Green Taxis in New York City emerged to meet the commute demand in areas considered ‘unprofitable’ by conventional taxis and was a untapped market. In the morning and evening rush, there is a higher concentration of pick ups and drop offs at Metro Stations (aka "Hubs). These taxi rides could be replaced with Car2Go

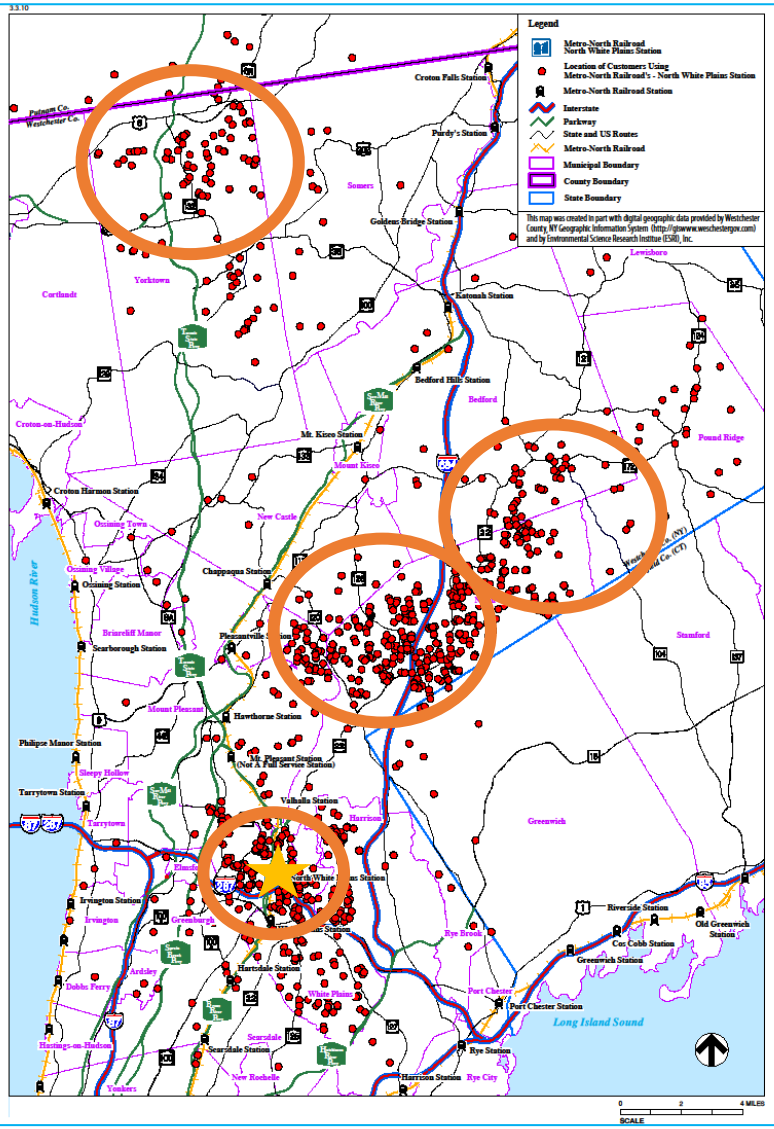
THE HUB & SPOKE MODEL



THE SOLUTION – THE 1ST AND LAST MILE

- SECA Car2Go would offer services to and from the hubs, where hubs are public transportation terminals like subway stations
- SECA Car2Go would also operate within the "spoke" areas to service users that want to travel within their suburb
- The shorter nature of trips serving local transit is an ideal application of electric vehicles, which can travel fewer miles before a charge than gasoline vehicles
- Estimated usage would peak during the rush commuting hour, providing an alternative to:
  - Driving
  - Park and Ride
  - Bus
  - Walking

THE PROBLEM: UNDERSERVED AREAS

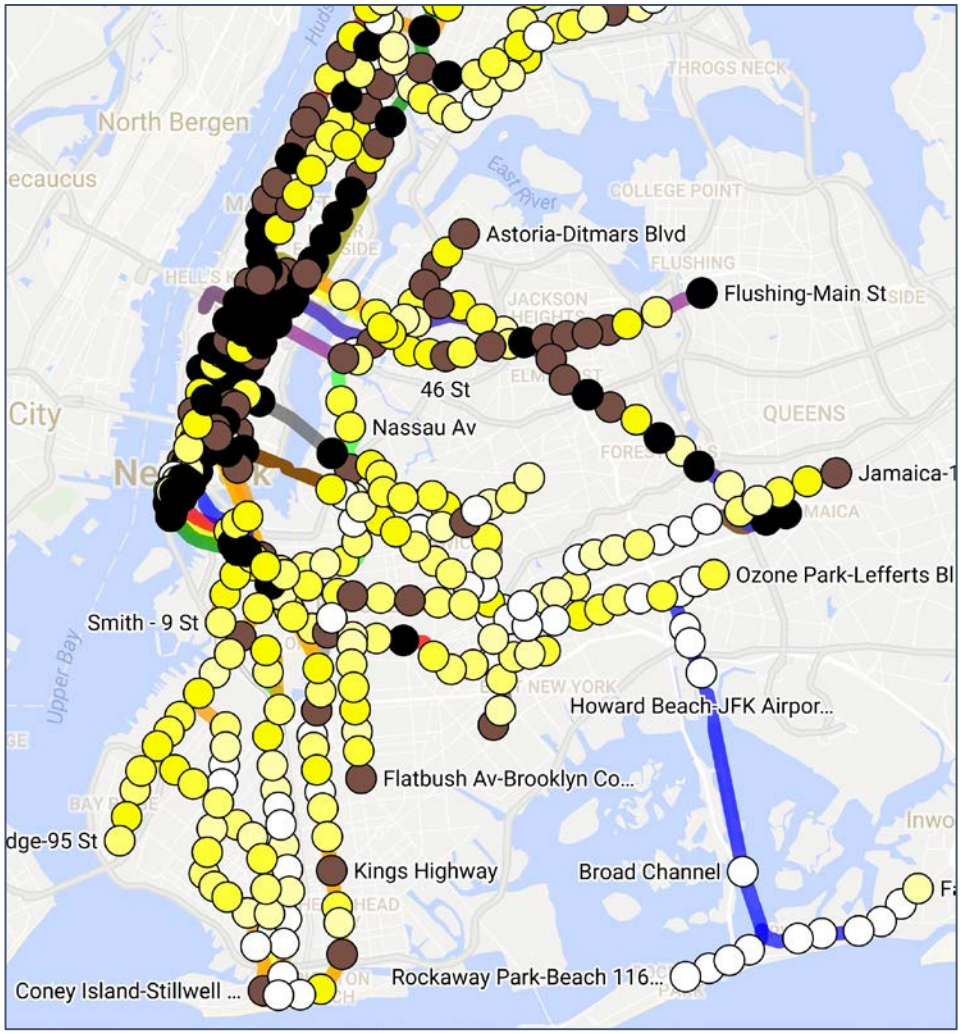


There are three key areas that attract the most commuters to the train station. These can be possible targets for Car2Go services.

METRO-NORTH RAILROAD PARKING GARAGE
50 HARLEM AVENUE, WHITE PLAINS, NY
Metro-North Railroad

Figure A-2
North White Plains Commutershed

SELECTING A STATION LOCATION

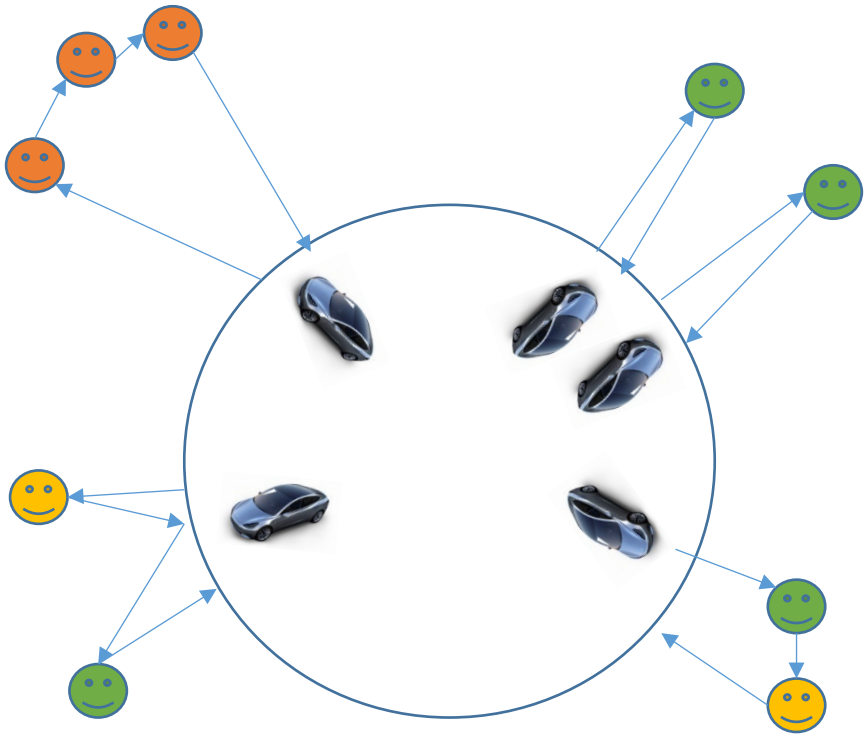


- Using NYC as a case study, several hubs can used for the model
- Focus on the areas serving high use stations and with high concentration of people outside of walking distance (¼ mile)
- Park and rides that are consistency overfilled
- Low income communities

THE ALGORITHM –ASSIGNING RIDES

Objectives:

- Prioritize elderly and disabled travelers
- Facilitate carpools for low-income travelers to lower per-person costs
- Minimize travel delay cost, subject to the above



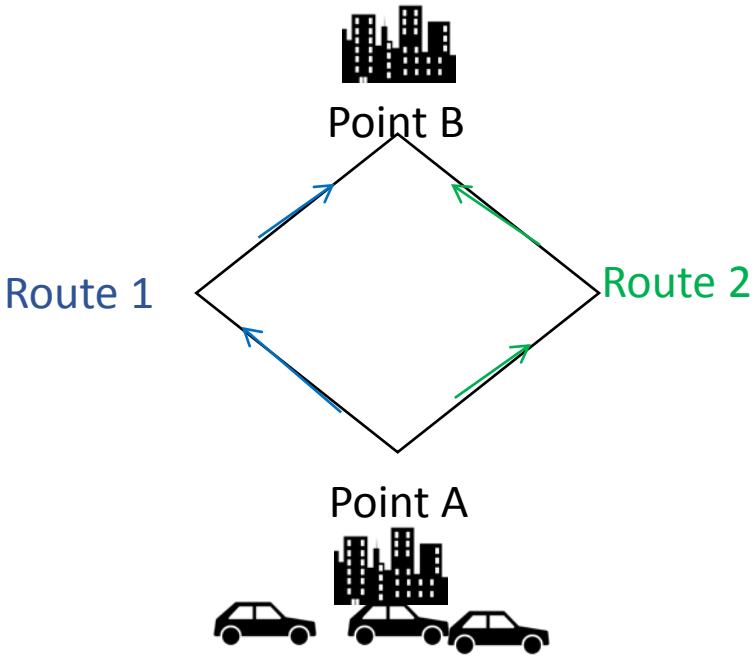
Low income users

Elderly/disabled users

Other users

ALGORITHM – MORE EFFICIENT ROUTING

- Dynamic traffic assignment that minimizes travel time for everyone (based on route and/or departure time choices)



- Autonomous – vehicles in fleet will not deviate from assignment or prescription

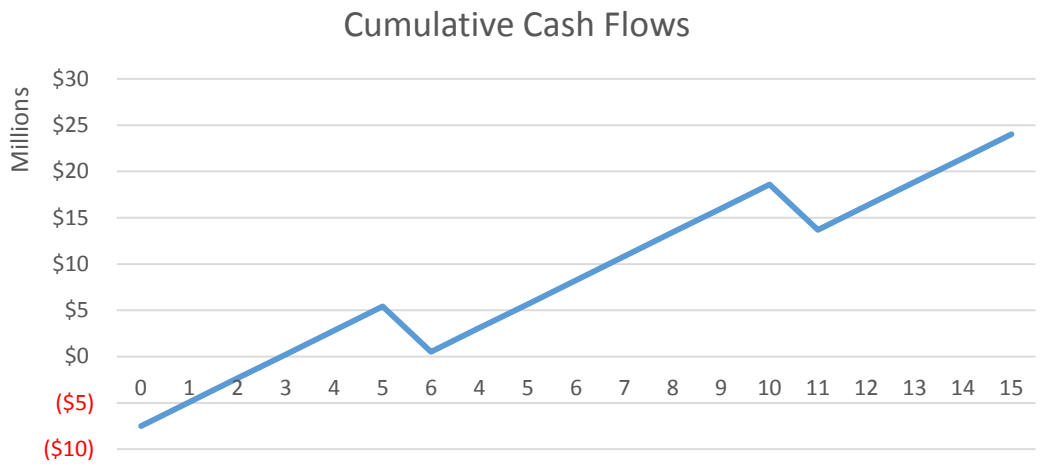
FINANCIAL ANALYSIS – 100 CAR PILOT

Assumptions

Amount of Vehicles	100	Cars
Cost of a Car and Charger	($75,000)	US Dollars
Annual Cost of Maintenance (per car)	($5,000)	US Dollars
Revenue per Trip	2.75	US Dollars
Number of trips per car per day	20	Trips per car per day
Passengers per Car	2	Passengers
Days in a year	365	Days
Tax	35%	% per Year
Cost per Mile	($0.04)	$/Mile
Miles Driven in a Single Trip	5	Miles
Insurance per car	($1,500)	$/year/car
Service Costs	($500)	$/year/car

Financial Results

NPV 10% = $6.8M
After Tax IRR = 27%
Payback Period = 2 years w/replacement every 5 years



SERVING THE UNDERSERVED: LOW INCOME

Problems w/ Current Transport	Car2Go Solution
Taxi drivers avoid low income communities	Autonomous vehicles don't discriminate
Longer Travel Time by public transportation	Cuts travel time by decreasing amount of stops and door to door
Car ownership and insurance is too costly	Car2Go shared vehicles and pools will cut down costs
Access to limited jobs because out of public transport range	Car2Go increases access to more job locations

SERVING THE UNDERSERVED: AGE

Problems w/ Current Transport	Car2Go Solution
Minors rely on buses or rides from parents, which mean restricted mobility and inconvenience	Autonomous vehicles will increase access to locations outside of bus zones and increased convenience
Elderly rely on others, buses or taxis, which mean restricted mobility and inconvenience	Autonomous vehicles will increase convenience, mobility and decrease physical stress
Some elderly drive despite physical limitations	Reduce accidents and stress to drivers

SERVING THE UNDERSERVED: DISABLED

Problems w/ Current Transport	Car2Go Solution
This subgroup may a significantly reduced ability to drive	Improve access to public transit
Travel to and from transit stops is too difficult for this group	Provides door-to-door service to and from transit stops
Limited access to jobs because out of public transport range	Car2Go increase access to more job locations

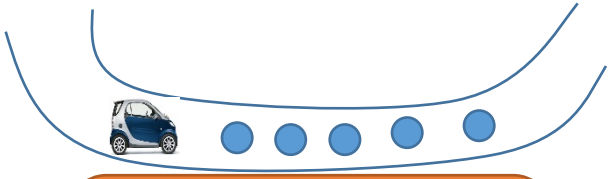
ELECTRICITY CHARGING

Nissan Leaf: 80-100 mi. on full charge. Smart Fortwo gets about 70.

100 miles per day plausible for these vehicles (NYC cabs do 180).

Daytime Charging:

PV array at transit hub used to give partial charge as needed to make it until the end of the day. PV installation reduces strain on grid during daytime peaks, and provides cleaner energy. In the more distant future, induction loops could be used to provide charge during pickup/drop-off.



Transit Hub
(ie. Subway Station)

Nighttime Charging:

Vehicles get fully charged at night via the grid. Leafs and Fortwos take 4-6 and 8 hours respectively to fully charge at 220v . Cheaper, more grid-friendly, and sometimes cleaner energy at night

CAR2GO

ADVANTAGES: ENVIRONMENT

- This service facilitates mass transit, which produces less emissions per person than private vehicles (when reasonably full).
- This service can displace single occupant, gasoline vehicle trips to transit stops
  - In most electric grids, EVs produce fewer GHGs well-to-wheel than gasoline vehicles
  - Facilitating carpooling reduces per-person VMT

REFERENCES

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