Plug-in Electric Vehicle Charging Network

A MODEL-BASED ANALYSIS FOR NYC NEIGHBORHOODS

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September 18, 2013

WHY PLUG-IN VEHICLES?

Lower greenhouse gas emissions

- The NYS electric grid has relatively low carbon emissions due to reliance on wind, hydro, natural gas, and nuclear power
- Improved battery technology
  - Better prices, better range
- A burgeoning Plug-in Electric Vehicle (PEV) market bolstered by popular adoption of hybrid vehicles

GOALS

1. **Demonstrate a possible local area charging network**
2. **Have a justifiable methodology for allocating spaces**
3. **Present a model that could be replicable elsewhere in the NYMTC region**

QUESTIONS

Where could publically accessible chargers go?

Distribution by geography

How many do we need?

Distribution by scale

How much could it cost?

Prioritization

What does it look like?

Conceptualization

This case study provides the skeleton of a regional model where its outputs are then used in a sample community to aid in conceptualization.

PARAMETERS

- **PEV Charging should be accessible across the city via an easy walk to origins/destinations**
- **Deployment should be prioritized towards common destinations for drivers**
  - Population, employment, commercial corridors, distance from high capacity transit
  - Higher education, attractions, hospitals, car-oriented shopping
- **On-street parking is contentious – space must be utilized equitably and efficiently**

ISSUES

Unlike hybrids, PEVs need charging infrastructure

- Charging takes time:
    - 30min “fast charging” – 8 hr full charging
- Range anxiety – how far one feels comfortable traveling before worrying about battery charge
- Ability to charge in places other than a private, home garage

Urban PEV Issues

- Large reliance on street parking
- Developing incentives that don’t poach from transit
    - Moving someone from transit to a PEV is an environmental cost
- Competing demands for limited public space

ASSUMPTIONS

1. **All paid off-street parking facilities will all have some PEV charging spots**
2. **People who have the space at home for off-street charging will obtain chargers on their own**
3. **Employment & residential densities underlie trip movements**
4. **Commercial zones, colleges, hospitals, big-box shopping, entertainment areas, and areas far from the subway are particular areas that generate car trips**

MAJOR IDEA: PRICING

PRICING IS NECESSARY BECAUSE:

1. **Electricity costs money**
2. **Users value the ability to charge**
3. **It better matches supply to demand**
4. **Helps fund the system**

Hours	Marginal Cost	Total Cost
0-1	$1	$1
1-2	$2	$3
2-3	$3	$6
3-4	$4	$10
Each Additional	$5	$15+

ESCALATING PRICING IS BETTER BECAUSE:

1. **Encourages short term-use**
2. **Avoids strict time limits and enforcement**
3. **Allows customer to judge utility against cost**
4. **Ensures turn-over at a system-wide level**
5. **Utilizes information technology in charging docks**

METHODOLOGY

GIS based analysis

1. **Define accessibility**
2. **Prioritize locations by demand**
3. **Scale network extent and size**
4. **Conceptualize: Suggest proximate locations**

1. DEFINE ACCESSIBILITY

Accessibility connotes that destinations are reachable despite obstacles or demand.

¼ mile grid across the city provides cells with a 5-10 min walk shed.

At least one public PEV charger per cell.

2. PRIORITIZE LOCATIONS BY DEMAND

Each cell can be scored.

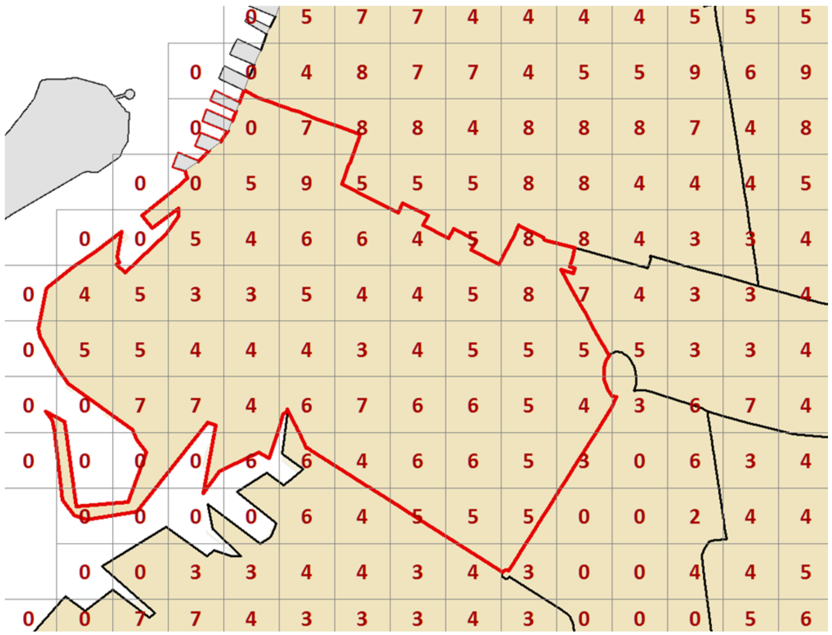
Higher is closer:
employment density (0-3)
residential density (0-3)
commercial zones (0 or 1)
special destinations (0 or 3)

Higher is farther:
subway accessibility (0-3)

If emp+res+com+dest=0 Then priority = 0

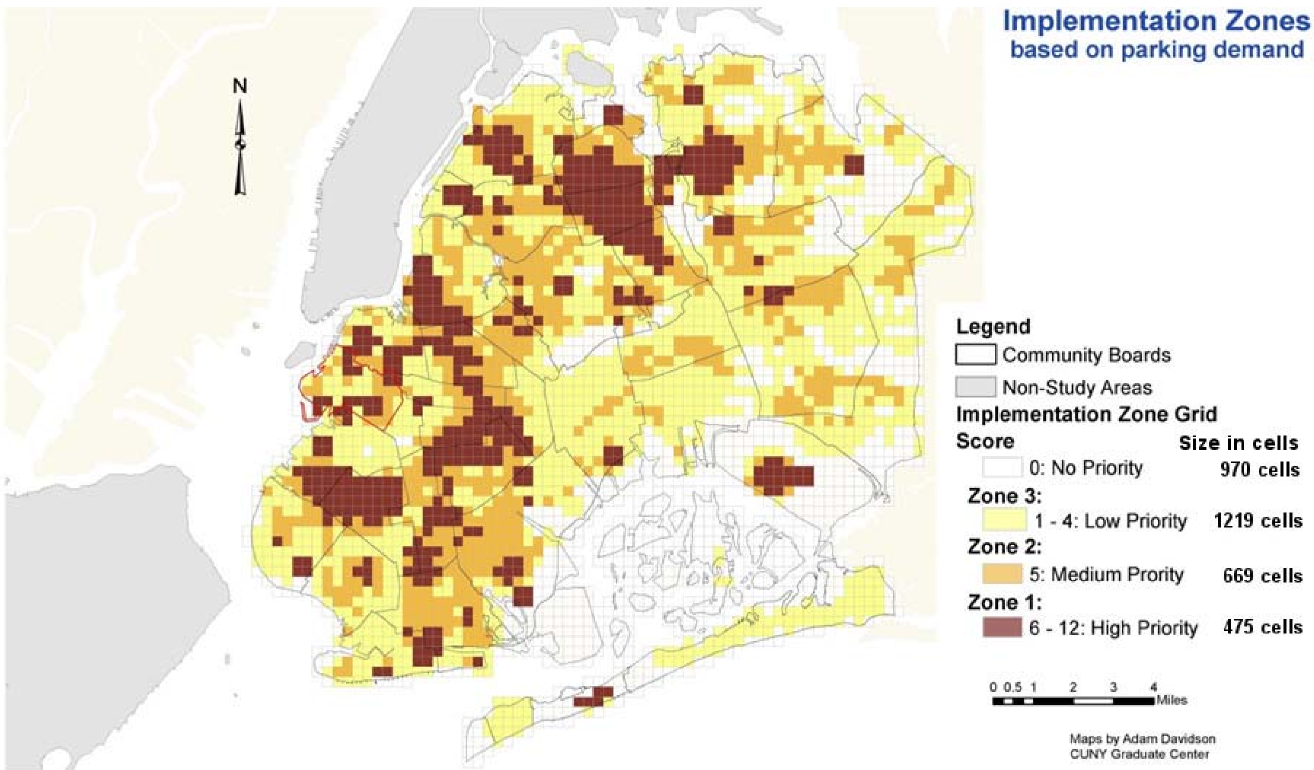
Else

priority = emp+res+com+dest+sub = 1-13



3. SCALE NETWORK EXTENT

Distribution by Geography **Grouped into 3 zones**



3. SCALE NETWORK SIZE

Distribution by Size **Grouped into 3 scales**

Proportion of known parking

On Street Parking=
(Street length/20) * # parking lanes * .65

DCA licensed off-street parking = count

Anticipate Parking Demand:

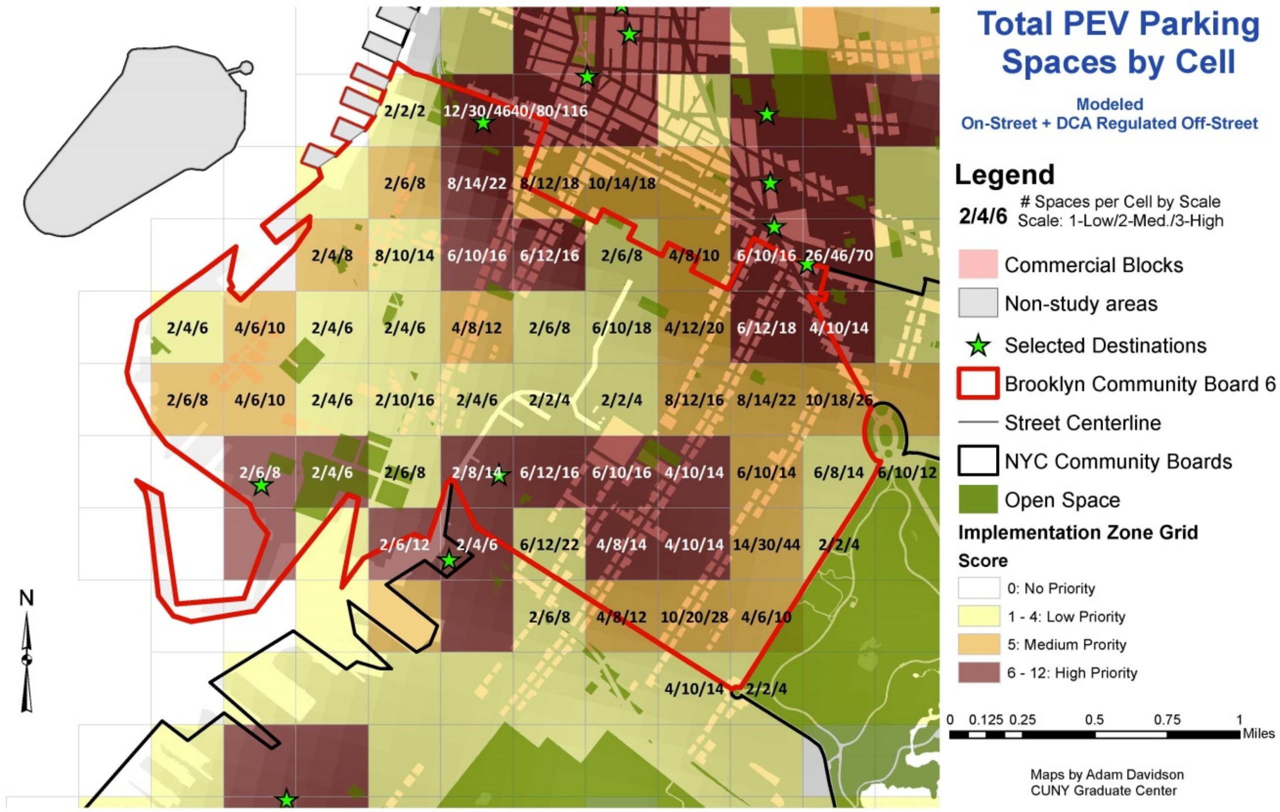
	Scale 1	Scale 2	Scale 3
On-street spaces	2/1500 spaces * priority	2x Scale 1	3x Scale 2
DCA Parking	2% of spaces	4% of spaces	6% of spaces

Minimums: 1 charger per facility, accessible to 2 spaces

4. CONCEPTUALIZE

Model Results

The number of PEV spaces specified in the model by zone and scale.



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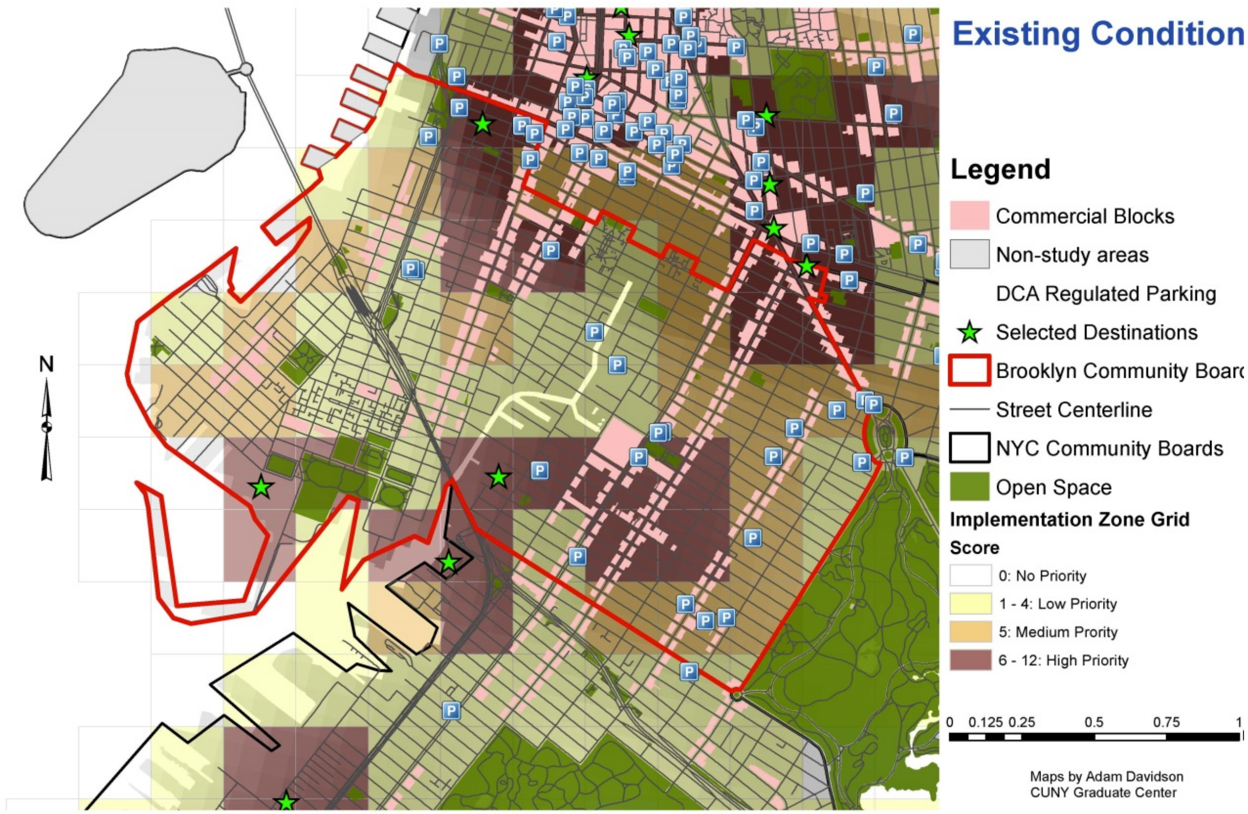
4. CONCEPTUALIZE

Streets, retail, parking garages, parks

Existing Conditions



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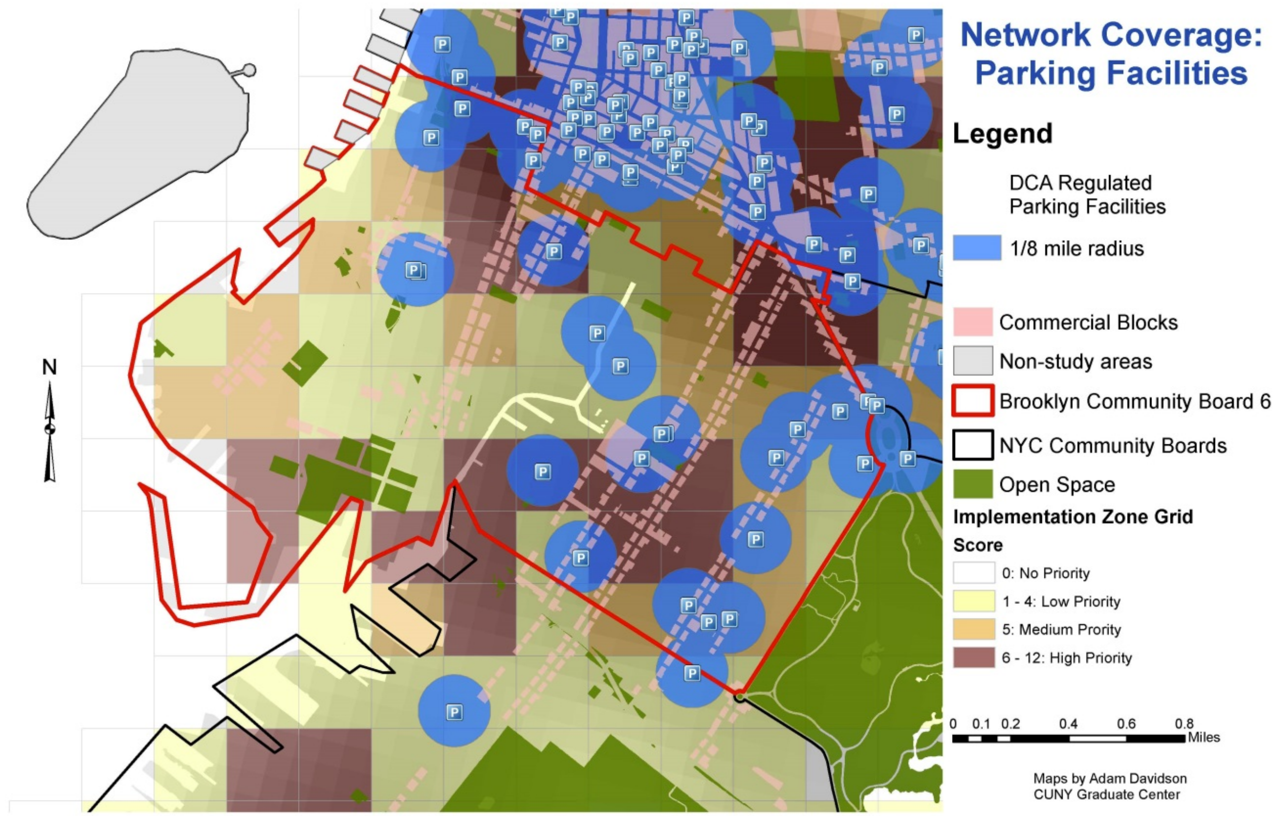
4. CONCEPTUALIZE

Parking garage walking sheds

Areas within an easy walk from a paid parking facility cover only a small portion of the district, but are easier facilities for locating PEV chargers



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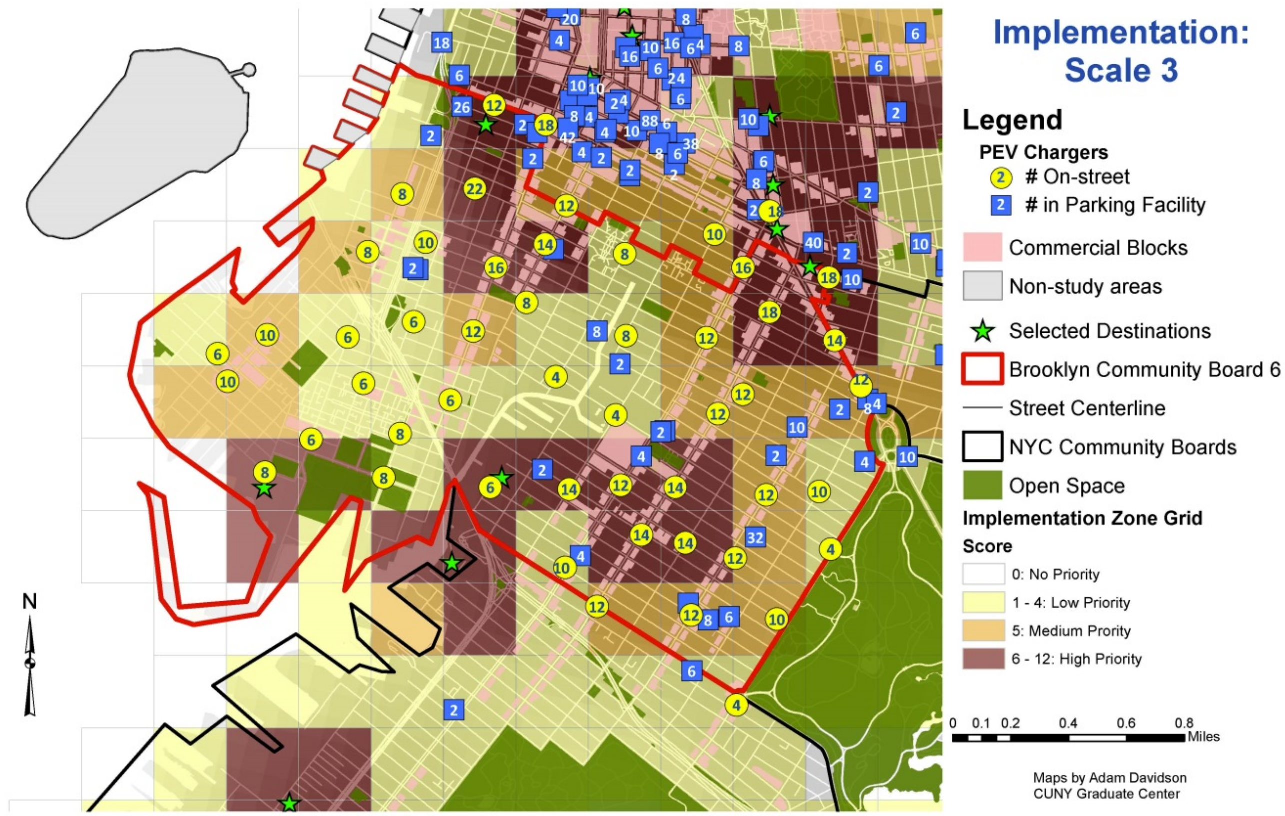
4. CONCEPTUALIZE

Placement of on-street (yellow) and off-street (blue) chargers, with the number of PEV accessible spaces at final implementation.

Assuming that each space is used by 4 cars a day, the network for this neighborhood would accommodate charging over 25,000 vehicles each week.

On-street charger locations



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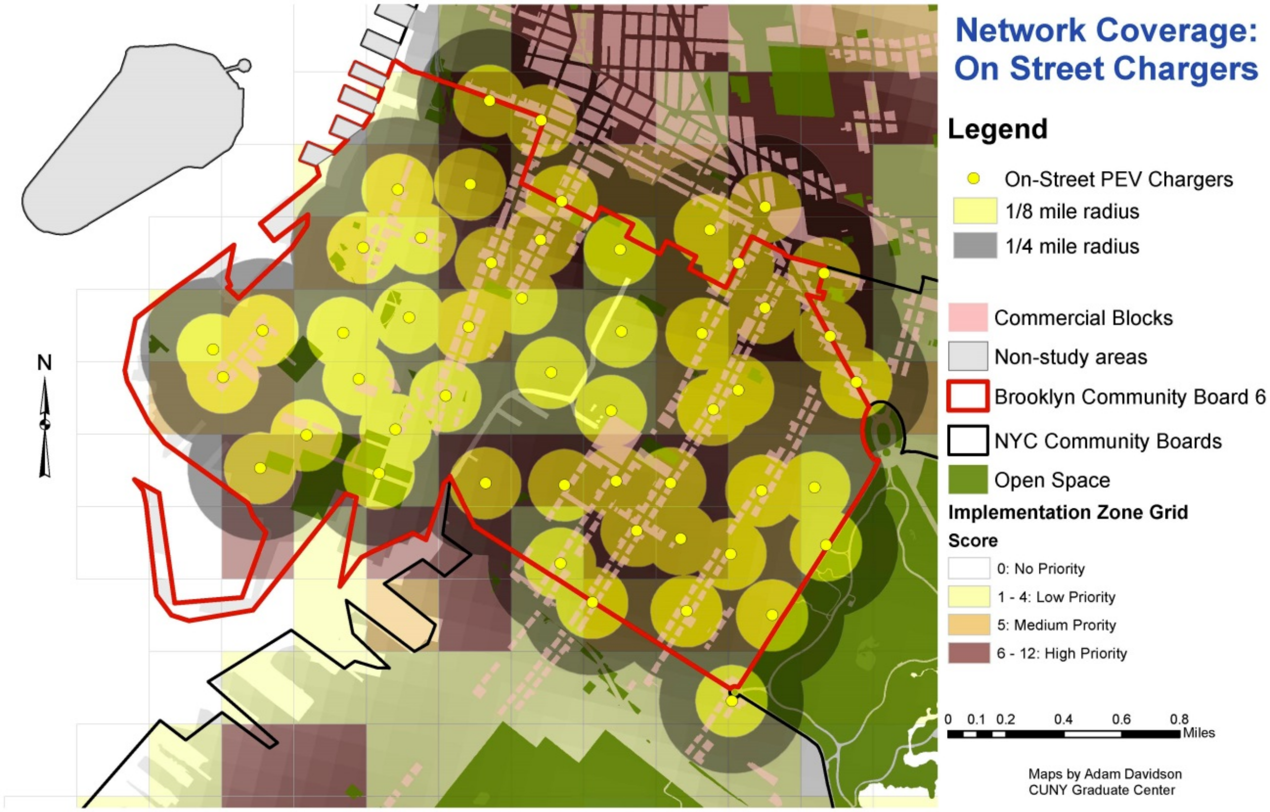
4. CONCEPTUALIZE

On-street charger walking shed

Coverage of areas that are within an easy walk from suggested on-street PEV charging clusters



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IMPLEMENTATION CHART

Network size and cost by zone and scale.

For all of Brooklyn and Queens along, and the CB6 concept.

Assumes $10k per charger

# PEV Spaces to be added		**Scale 1** : Initial Rollout # | $	**Scale 2** : Expanding System # | $	**Scale 3** : Mature # | $	**ZONE TOTALS** # | $
Zone 1 : High Priority	*Bk & Qns*	3,176 | $15,880	2,572 | $12,860	2,930 | $14,650	**8,678 | $43,390**
	CB6	148 | $740	154 | $770	152 | $760	**454 | $2,270**
Zone 2 : Med. Priority	*Bk & Qns*	2,536 | $12,680	2,416 | $12,080	2,402 | $12,010	**7,354 | $36,770**
	CB6	108 | $540	92 | $460	94 | $470	**294 | $1,470**
Zone 3 : Low Priority	*Bk & Qns*	2,920 | $14,600	2,908 | $14,540	2,880 | $14,400	**8,708 | $43,540**
	CB6	66 | $330	58 | $290	66 | $330	**190 | $950**
SCALE TOTALS	*Bk & Qns*	**8,632 | $43,160**	**7,896 | $39,480**	**8,212 | $41,060**	**24,740 | $123,700**
	CB6	**322 | $1,610**	**304 | $1,520**	**312 | $1,560**	**938 | $4,690**

OTHER PROJECTS AS A 9/11 FELLOW

- **Adapting this model to suburban locations**
  - Different set of issues
    - Off-street and home based charging can be assumed for most of the population
    - Transit facilities attract car trips, little displacement
  - Emphasis on retail corridors and off-street parking
  - Different data sets
- **Data as Infrastructure: how does interactive communication technologies effect transportation behavior?**
  - Exploratory research into the role of consumer digital communication in making trip decisions
  - Focus group study in October