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DC Fast Charging in the Context of Bigger Batteries

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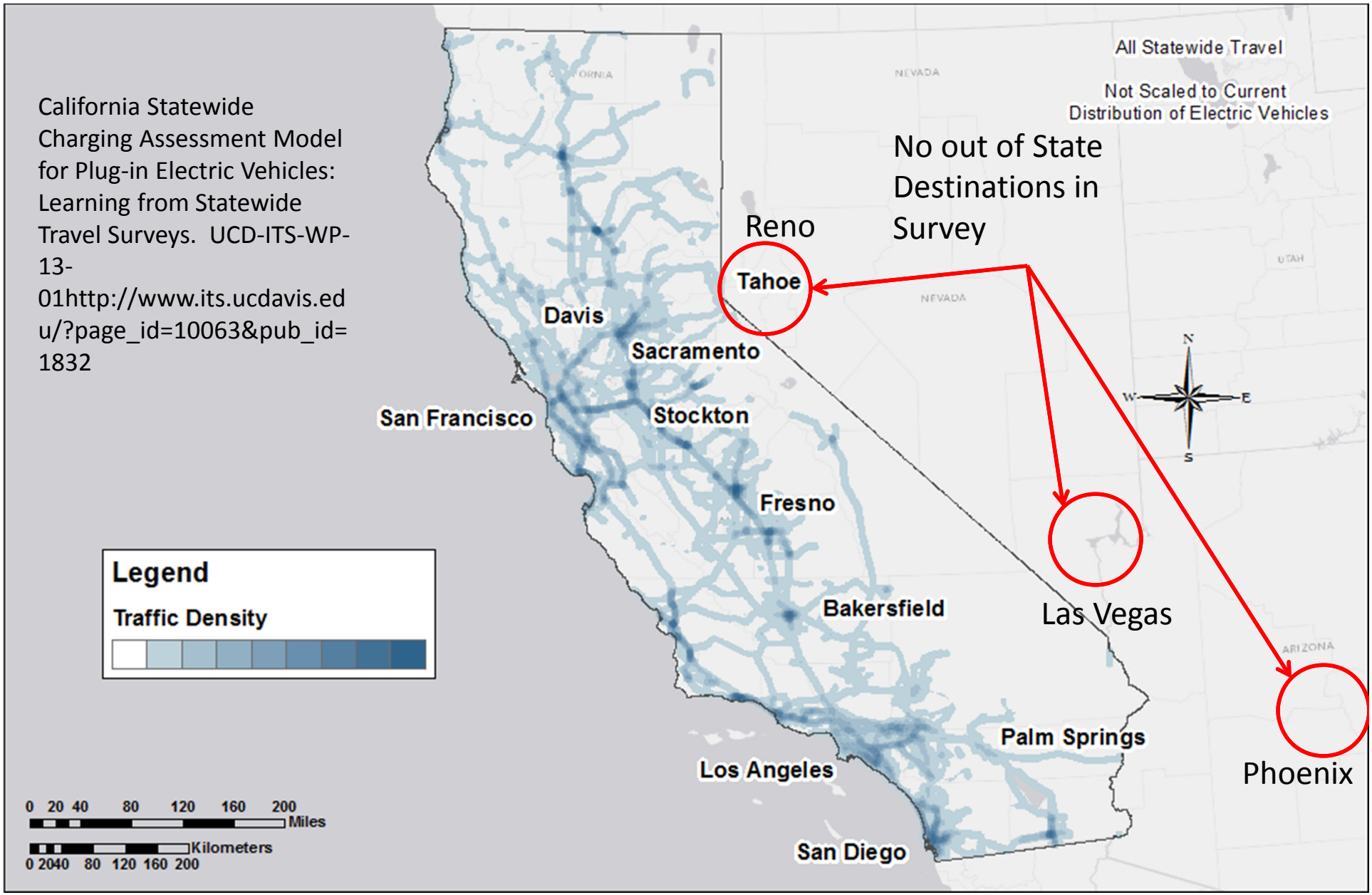
More Questions than Answers

- Questions
  - Will larger batteries obviate the need for massive numbers of fast chargers?
  - Will fast chargers' main role be to sell cars?
  - Will larger batteries enable fast charging to replace home charging? Will the paradigm be "centralized refueling" such as in the gasoline context?
  - How many fast chargers will you need in a priced vs free scenario?
  - How much long-distance induced demand is there from free?
  - How does the spatial layout of infrastructure change with increasing battery size?

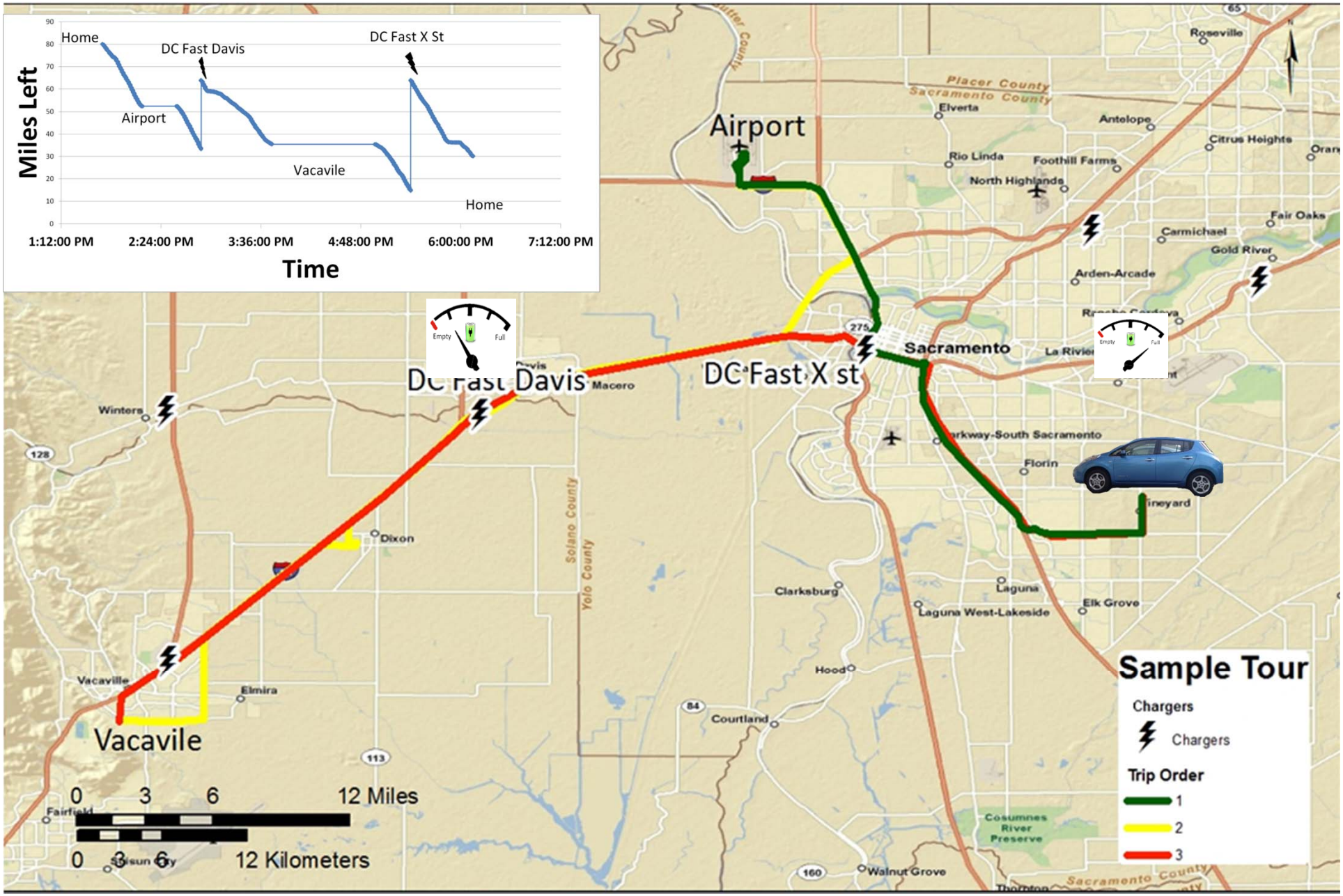
More Questions than Answers

- Answers
  - Modeling shows that 98% of miles in the State of California can be accomplished in a BEV 300 with home charging + some other L2 (20 miles reserve). Possible undercount based on state only survey data.
  - Charging location is mostly restricted to long distance corridors
  - Two fast charge events can cover the entire state in a BEV 300

Modeling - Our Data Set: Caltrans Travel Survey 2001. 31,898 Persons. Can Gasoline Travel be Done in an EV?



130 Mile Tour



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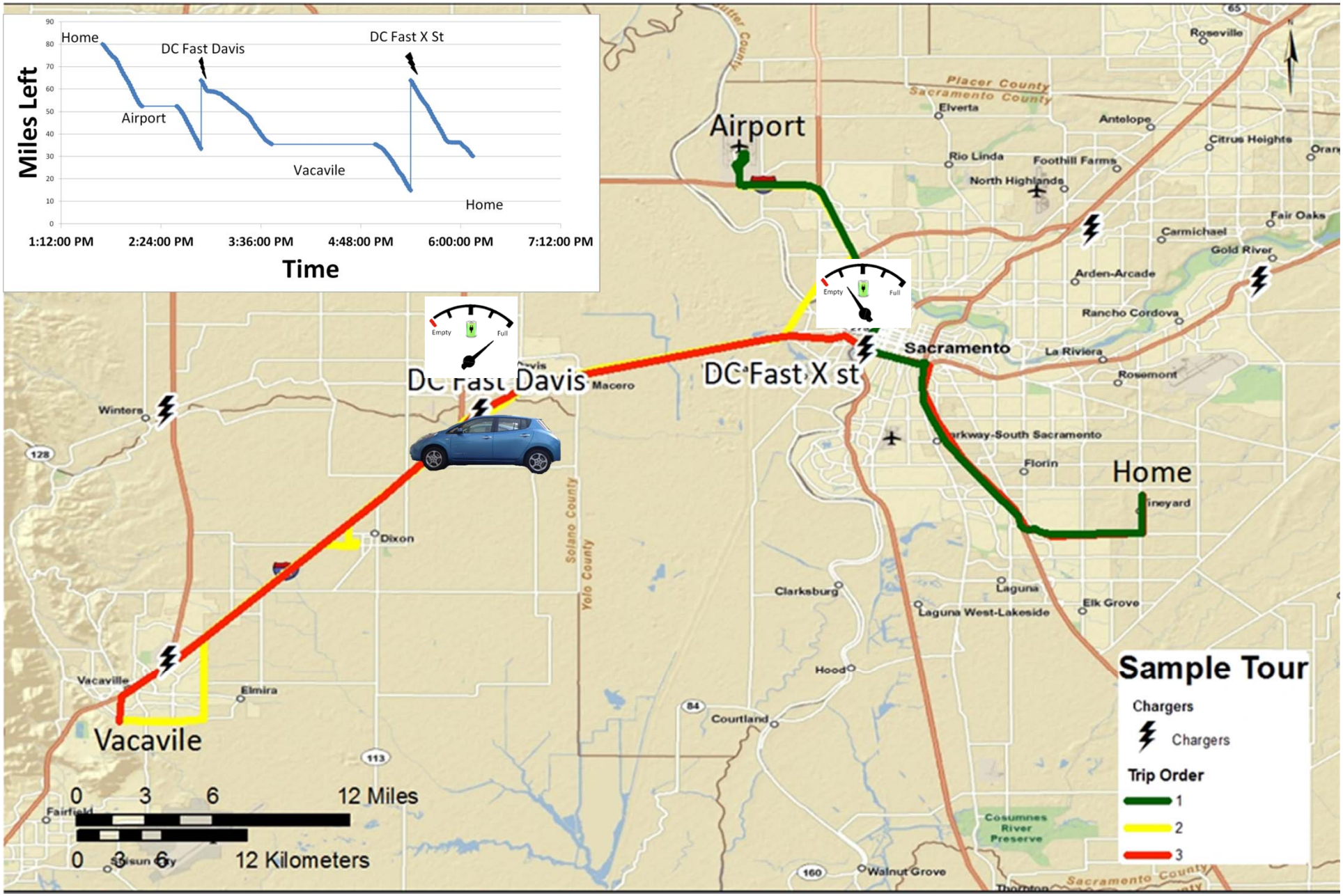

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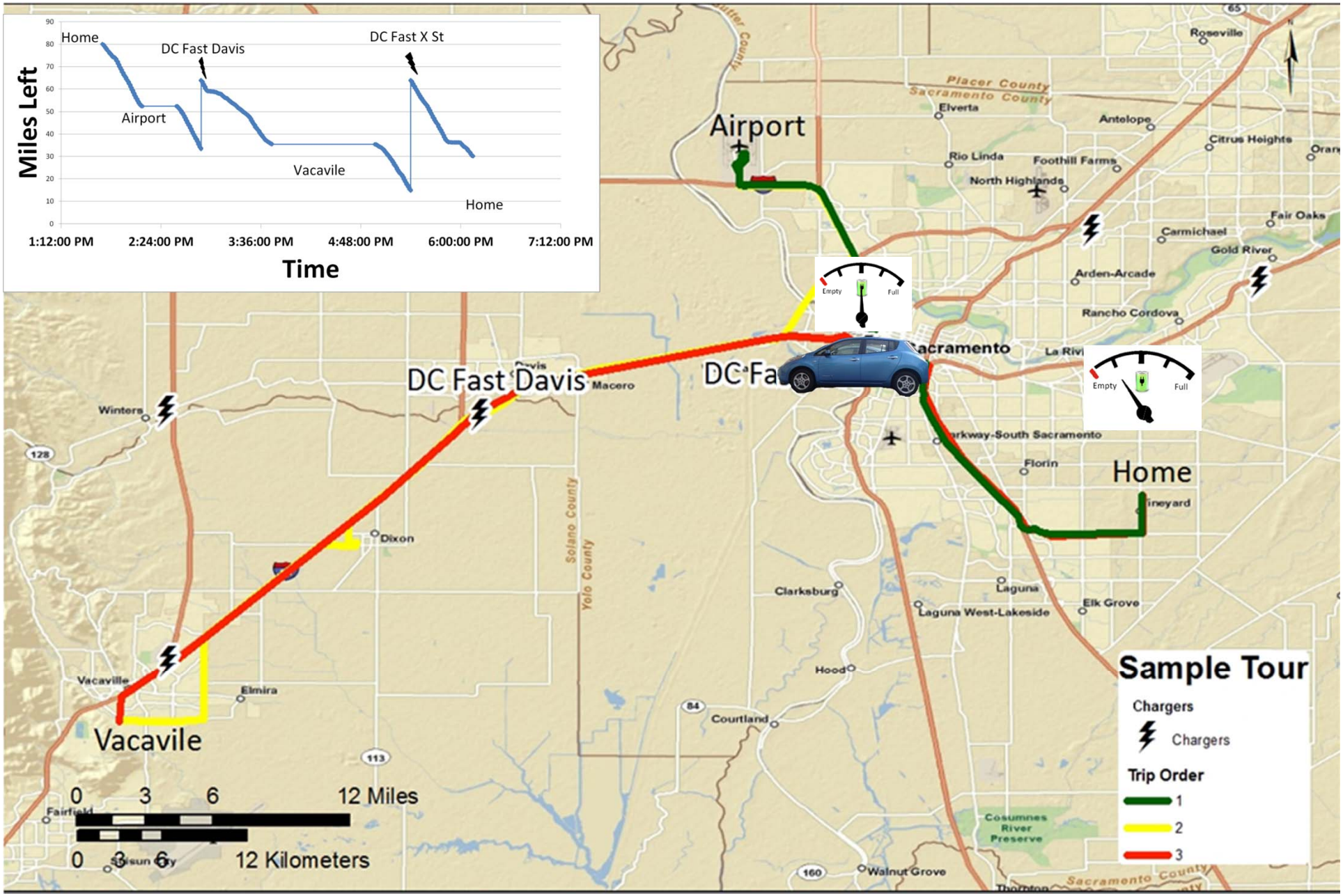
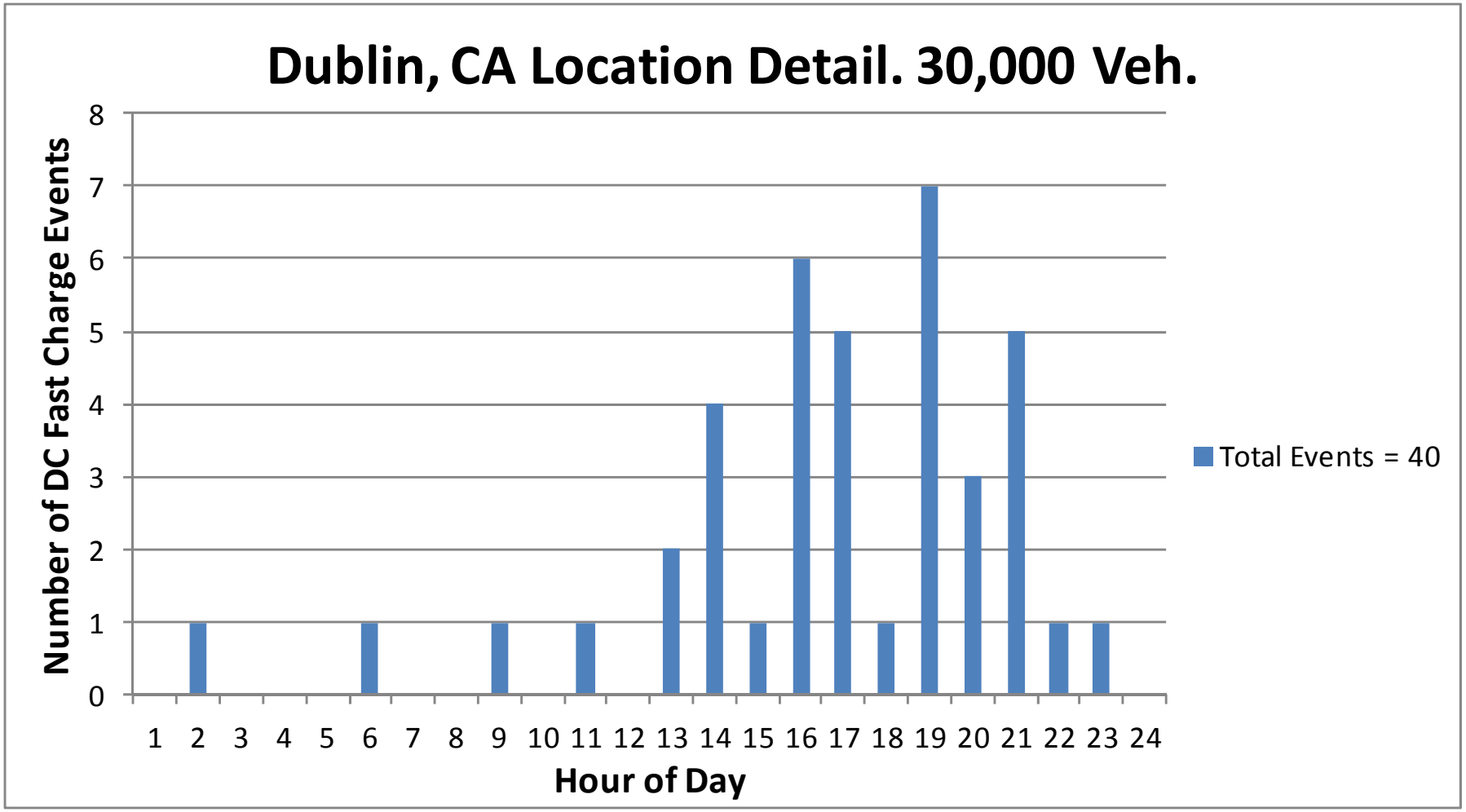
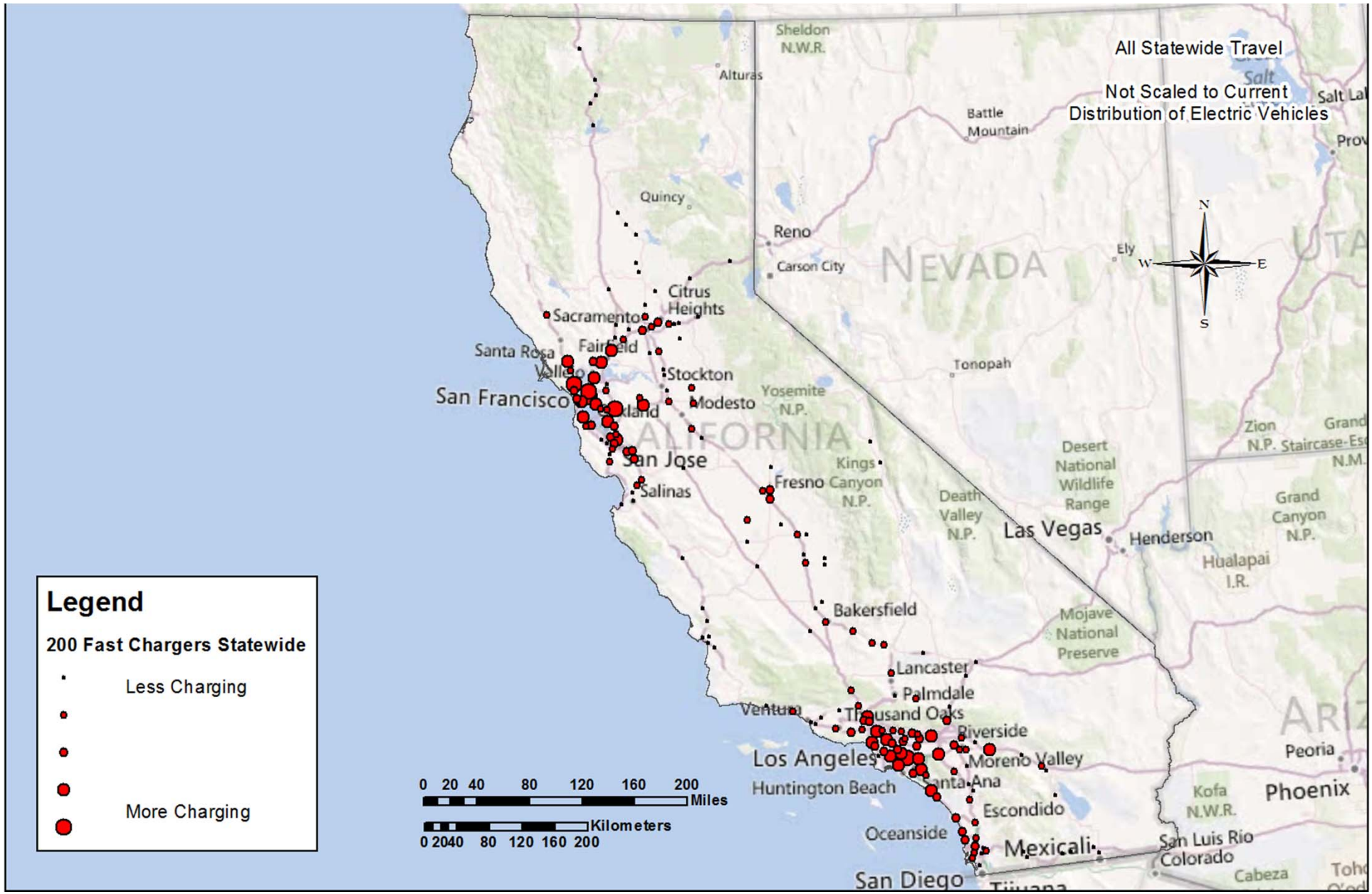


Multiple Fast Chargers in Approx. Same Location to Deal With Peak Demand



Nicholas, Michael, Gil Tal, and Justin Woodjack. 2013, January. California Statewide Charging Assessment Model for Plug-in Electric Vehciles: Learning from Statewide Travel SurveysDavis, CA: University of California, Davis. Institute of Transportation Studies, UCD-ITS-WP-13-01.

Completed Work. BEV80 State Demand Distribution: 200 Initial Locations (246 Chargers @30,000 BEV)



What Return do we Get for Infrastructure Investment? (VMT/GHG)

- Home Charging VMT
  - 60 Mile Veh. = 59%
  - 80 Mile Veh. = 71%
  - 100 Mile Veh. = 79%

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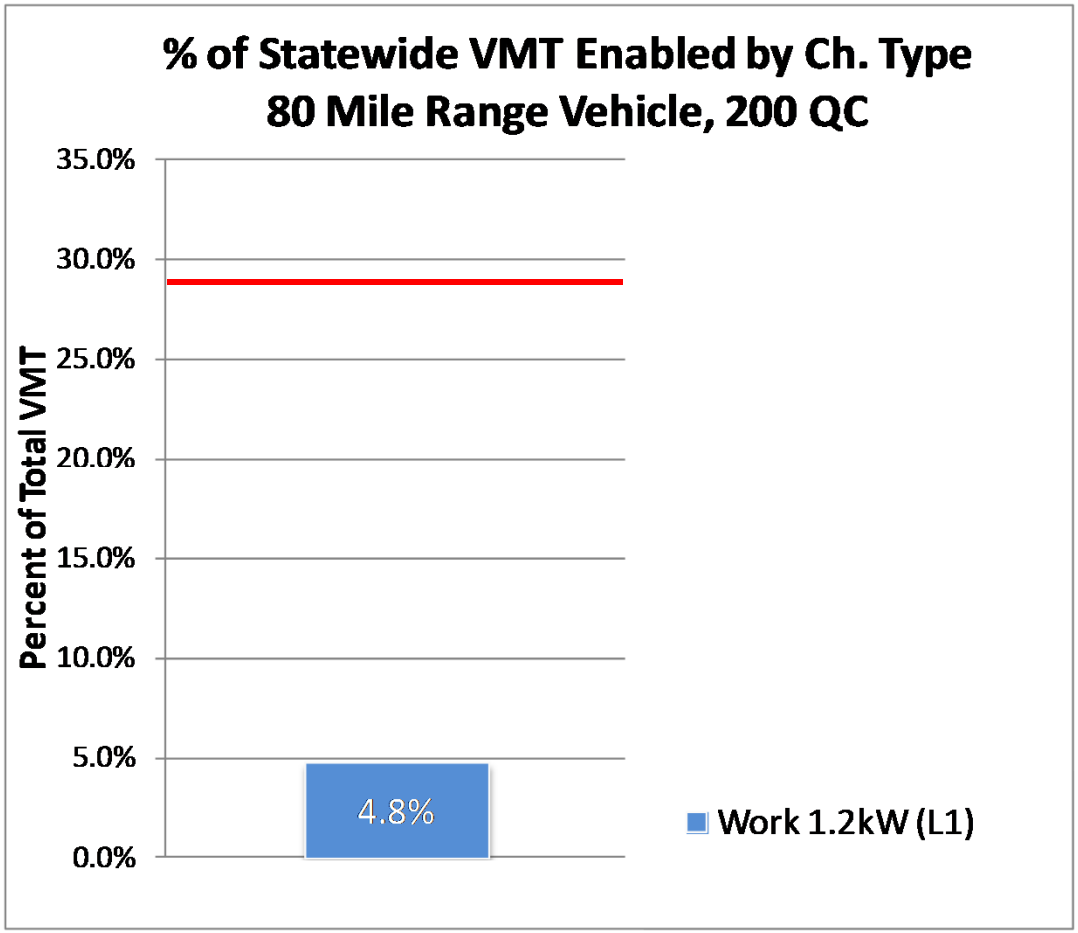

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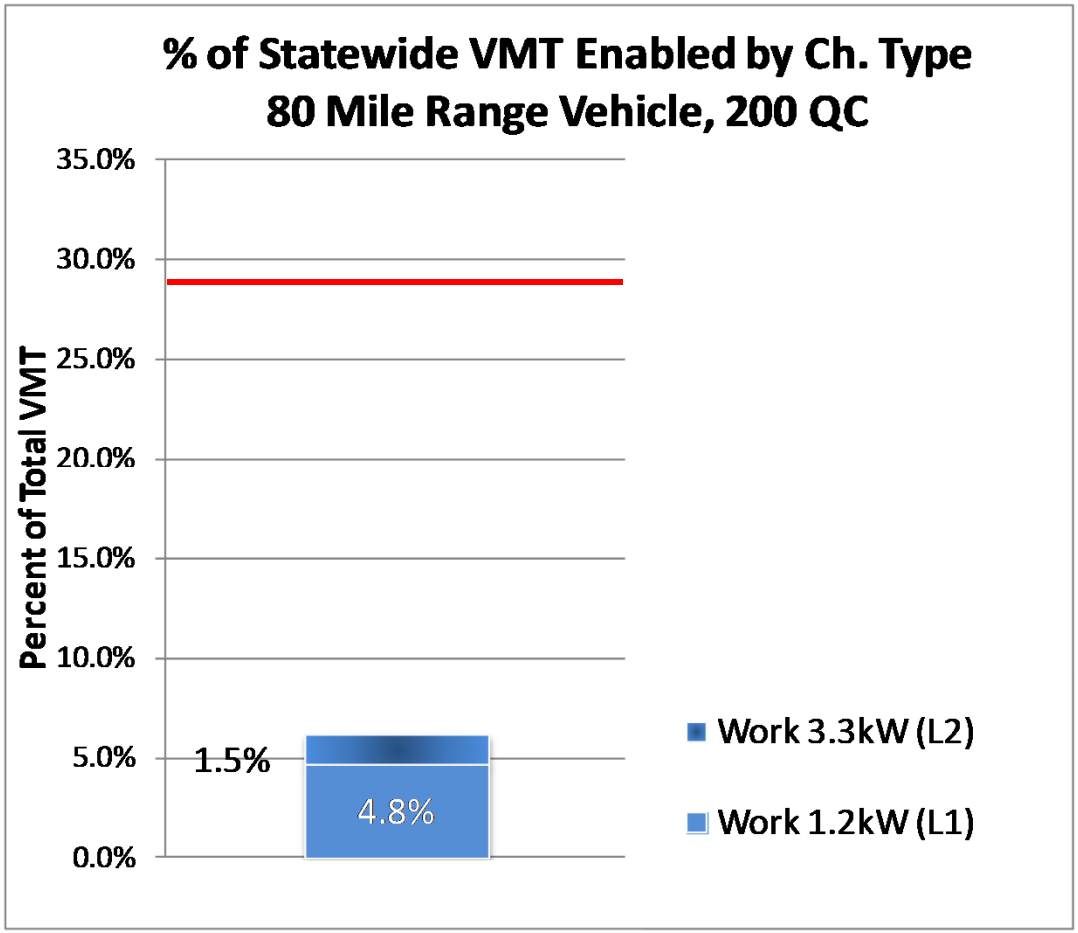

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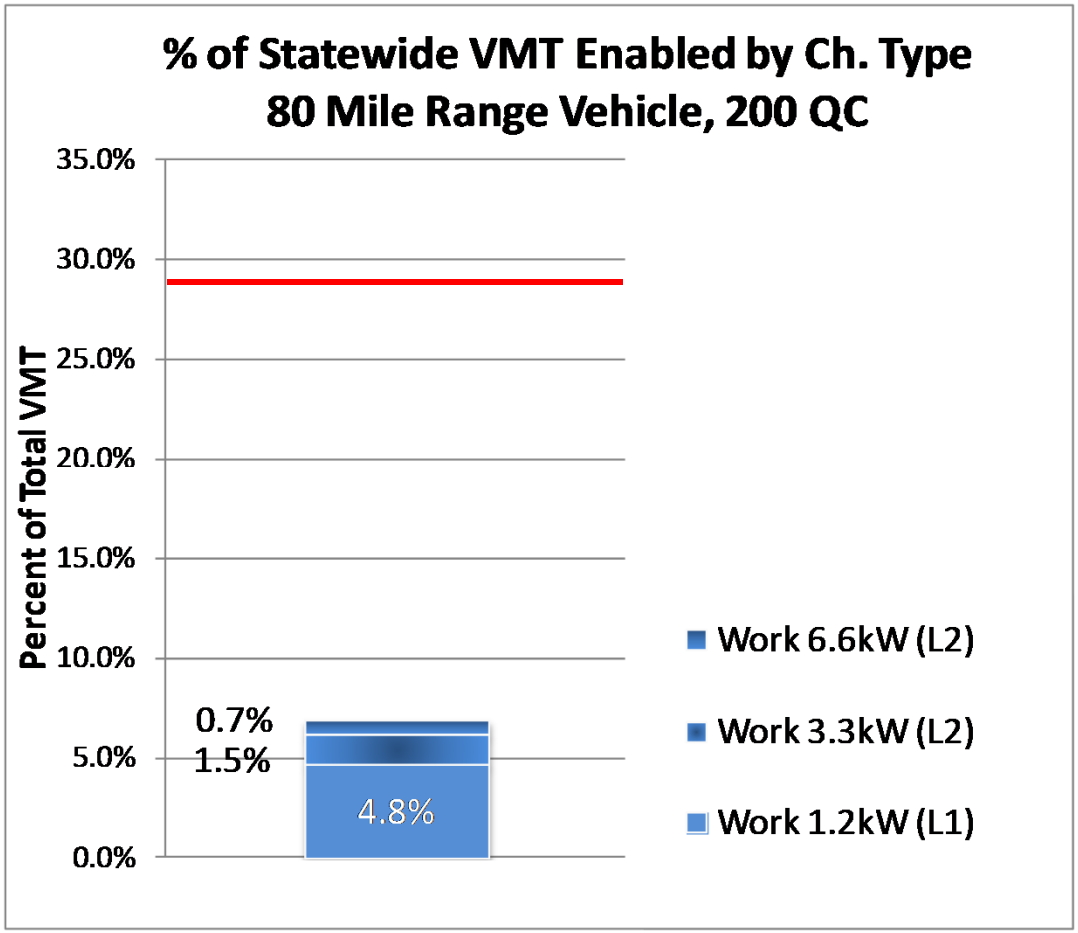

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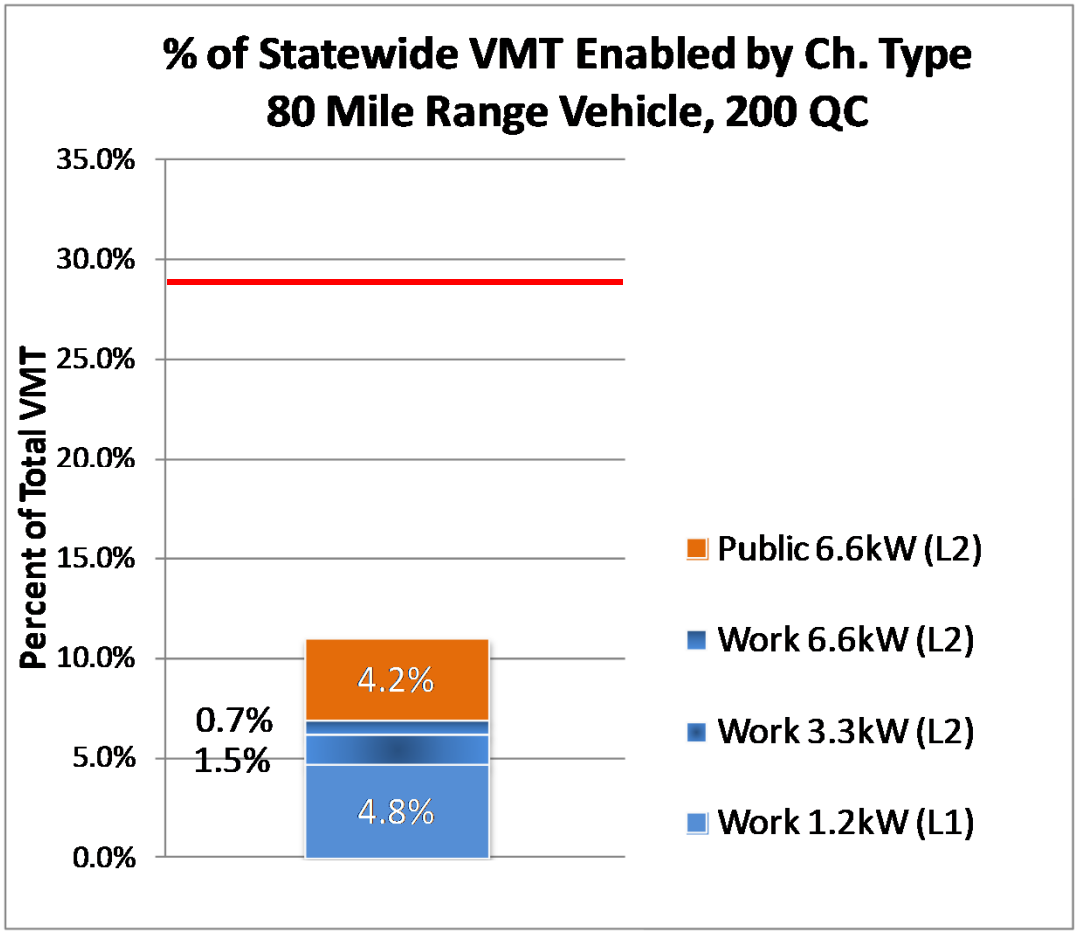

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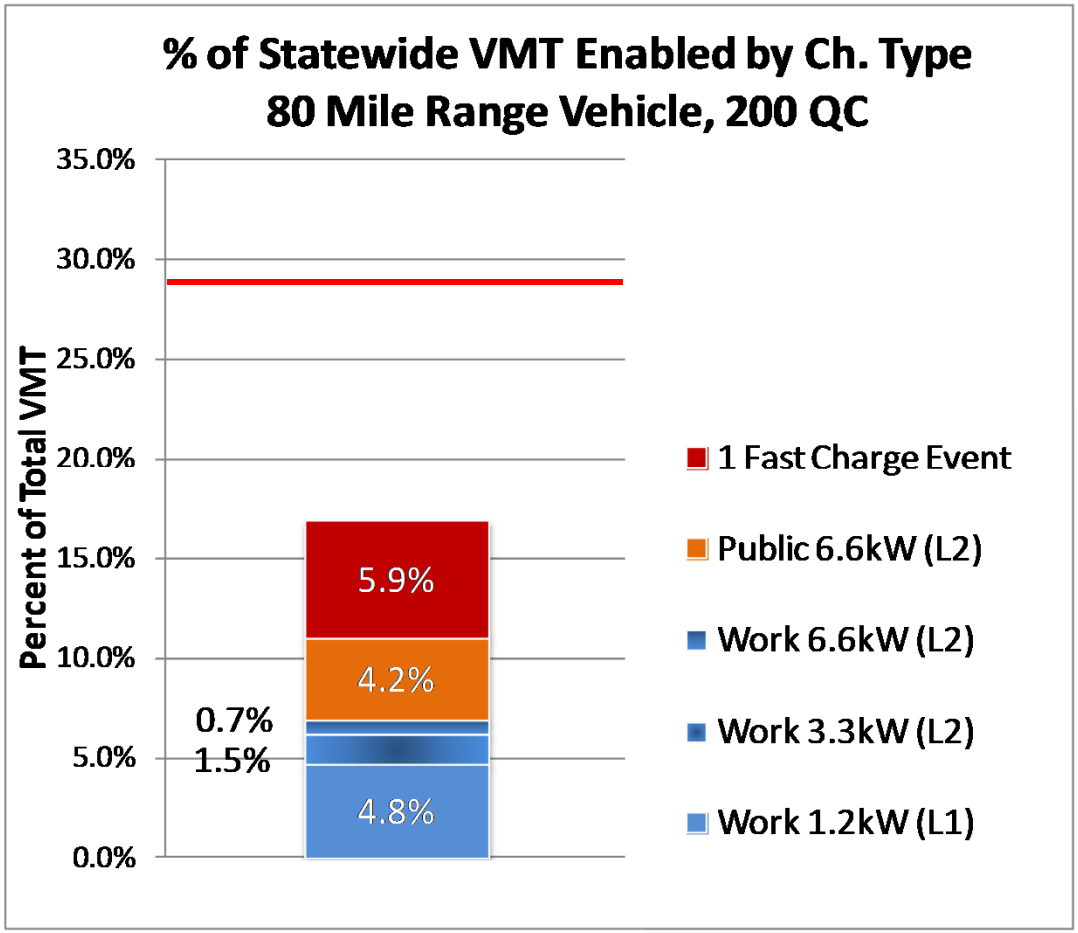

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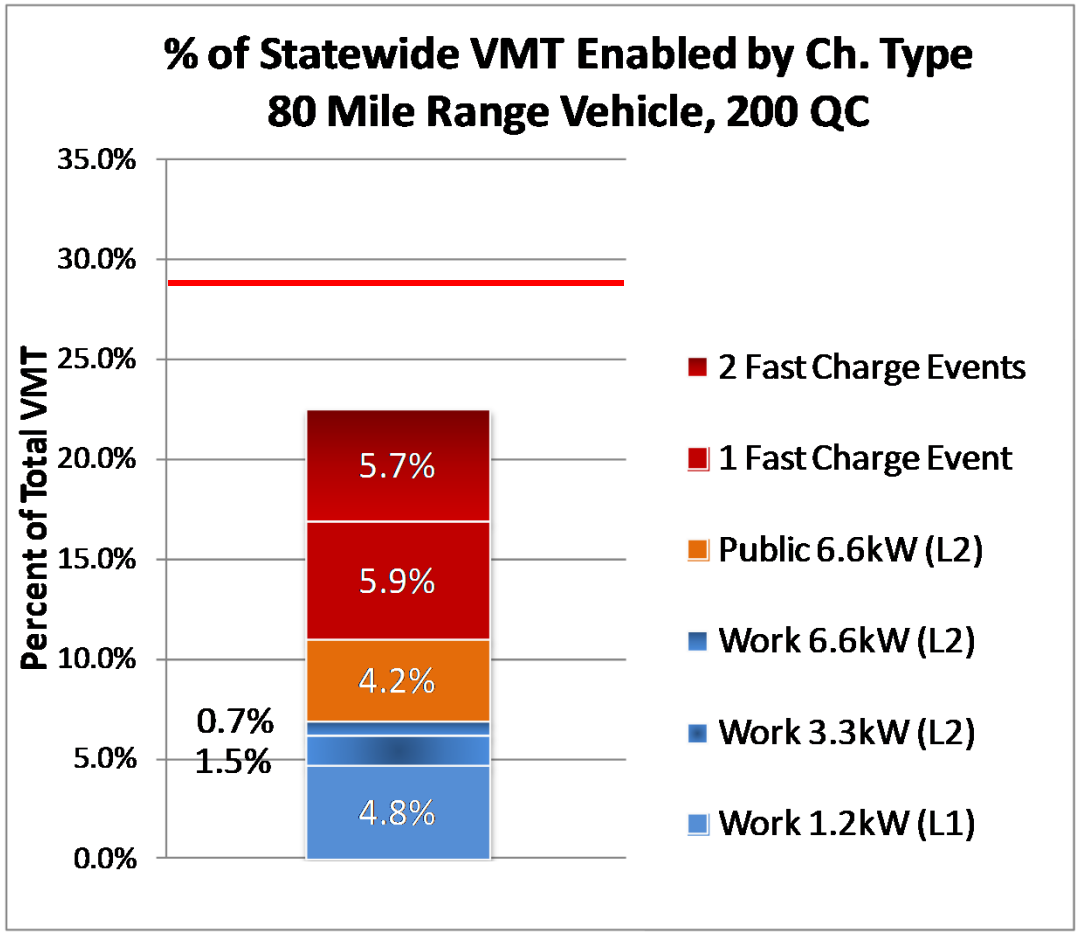

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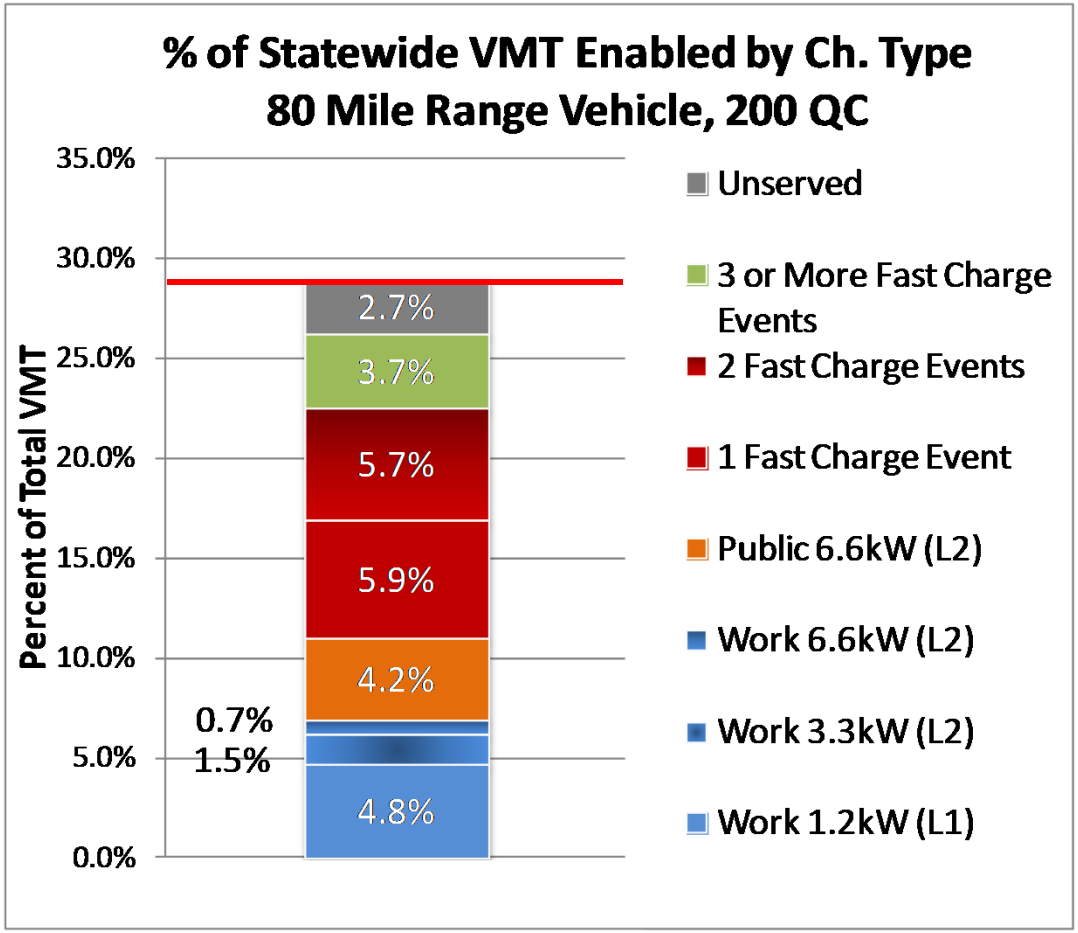
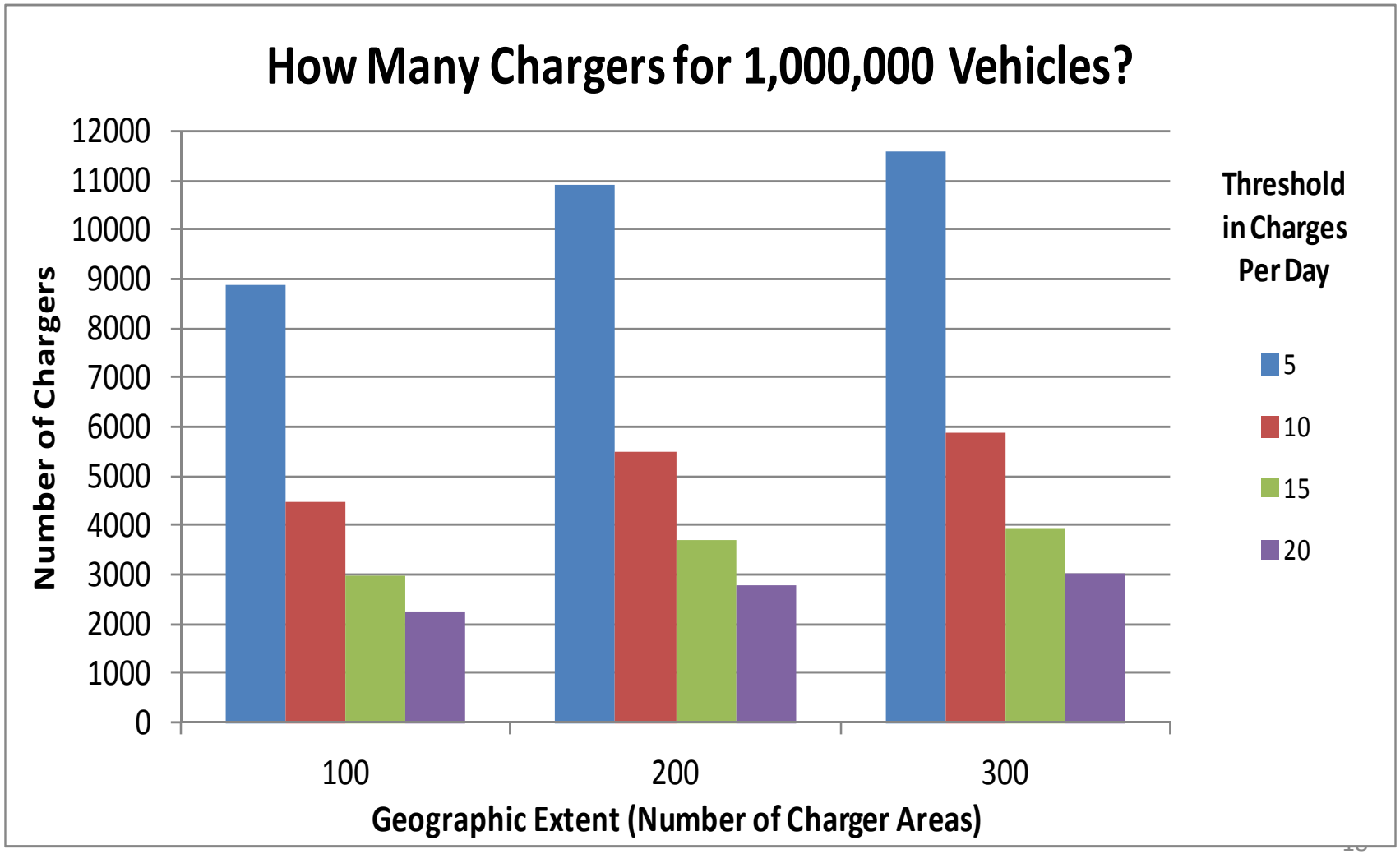
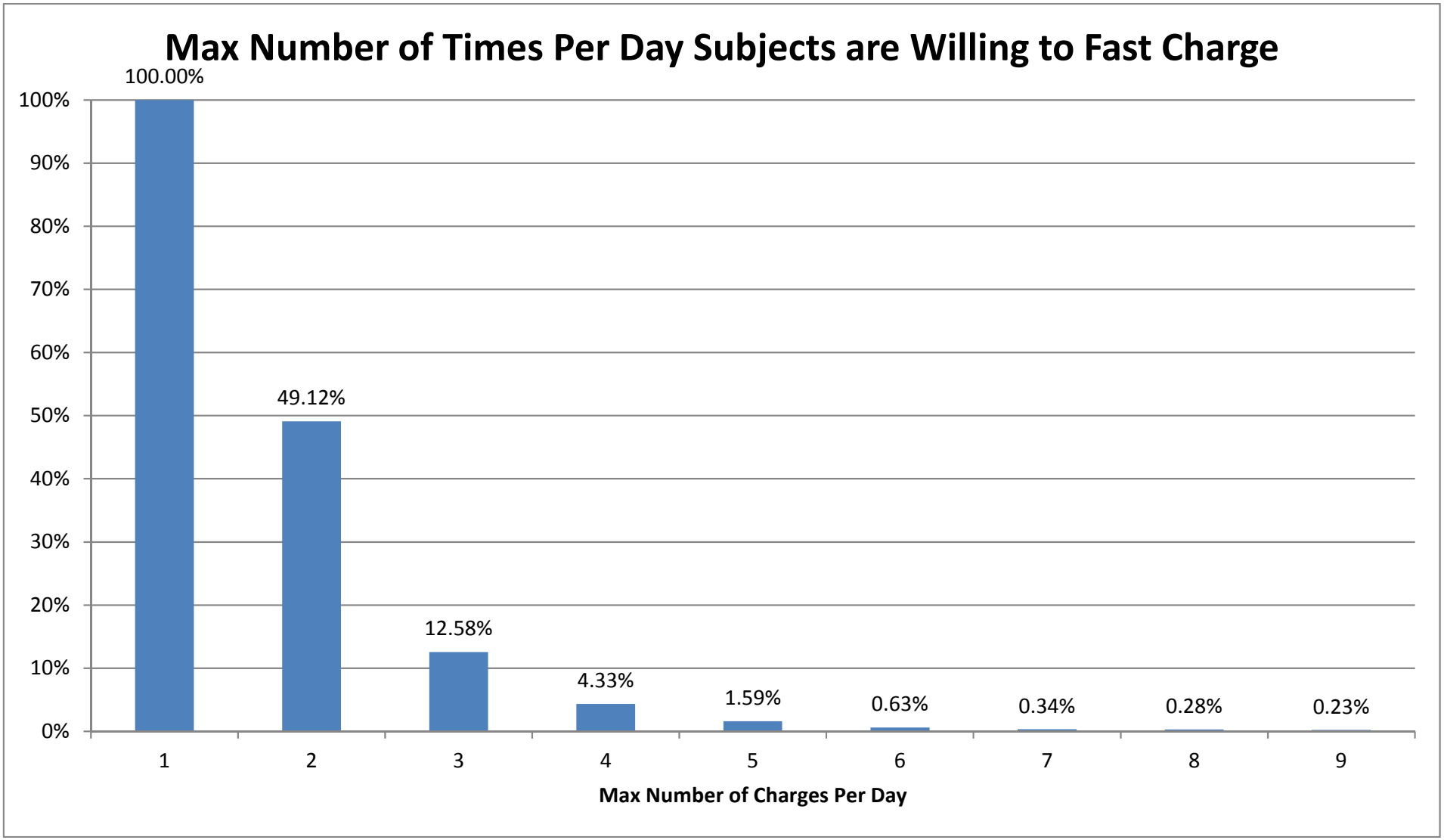


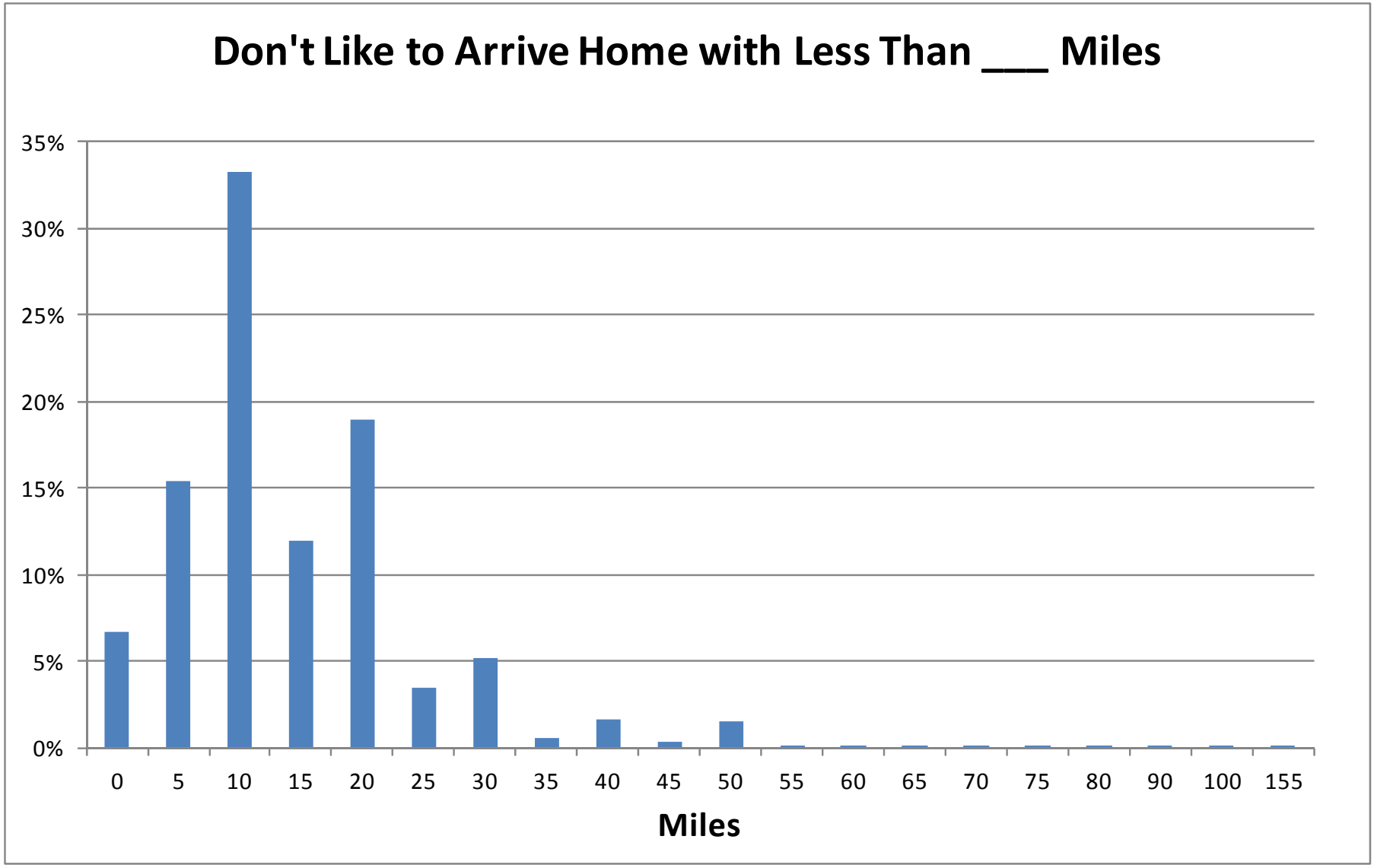
Scaling Locations to Number of Chargers in California. For an 80 Mile BEV, Approx. 1 Fast Charger/500 veh.



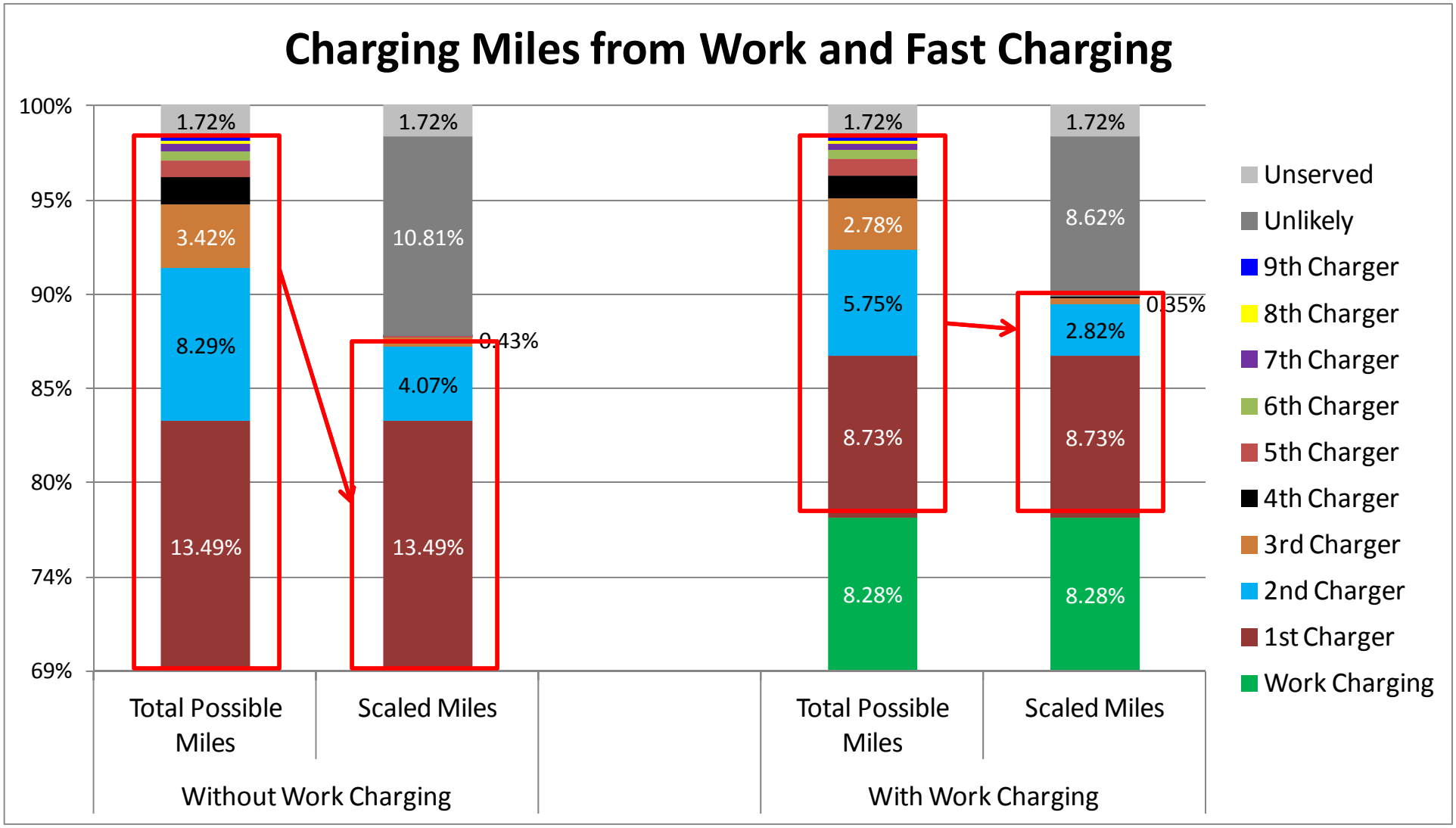
New Survey Data:
Charges Per Day on Occasional Long Tours



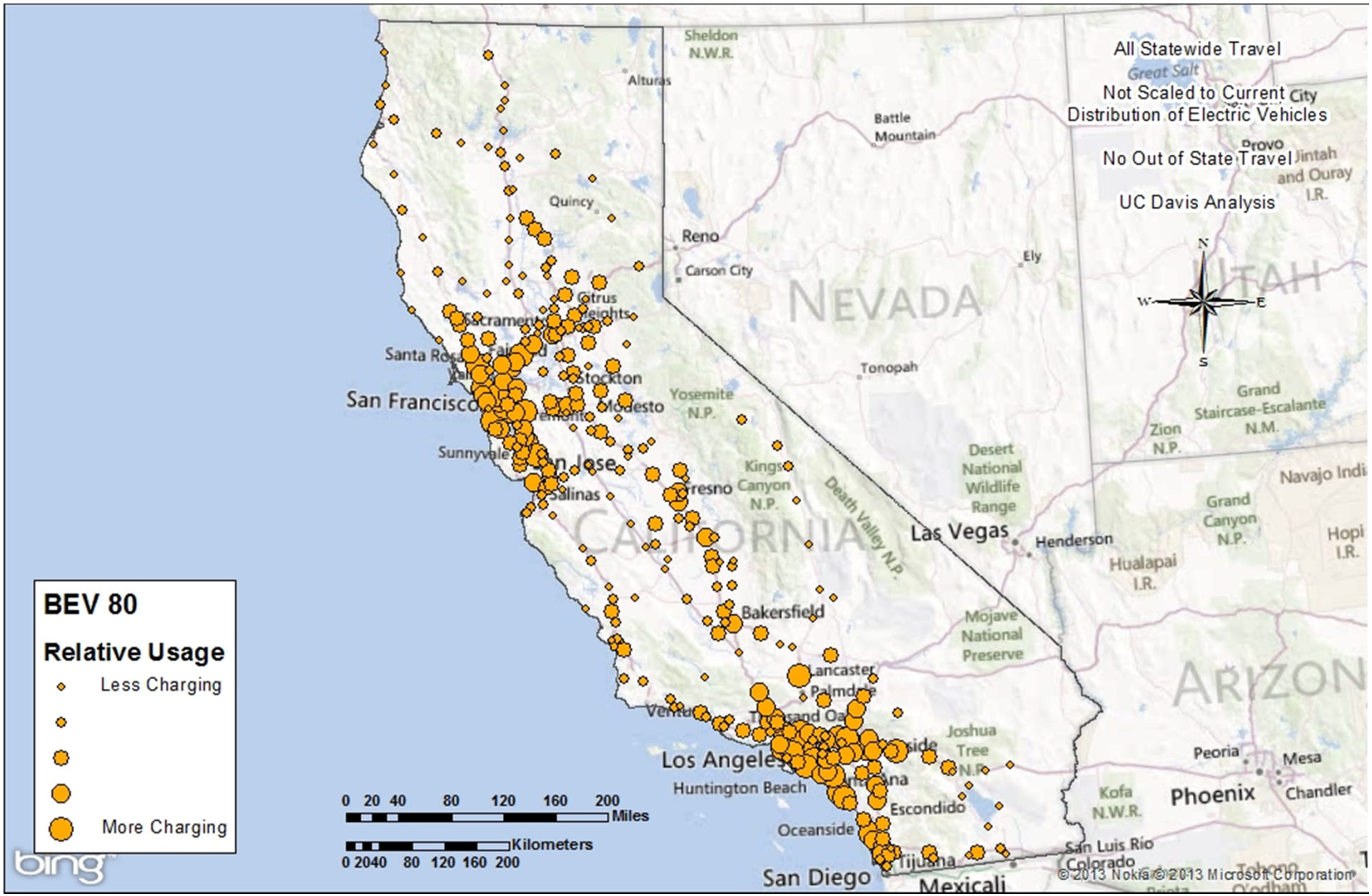
People Don’t Feel Comfortable Arriving Home With Less Than 10 Miles Left (Adjust From 5)



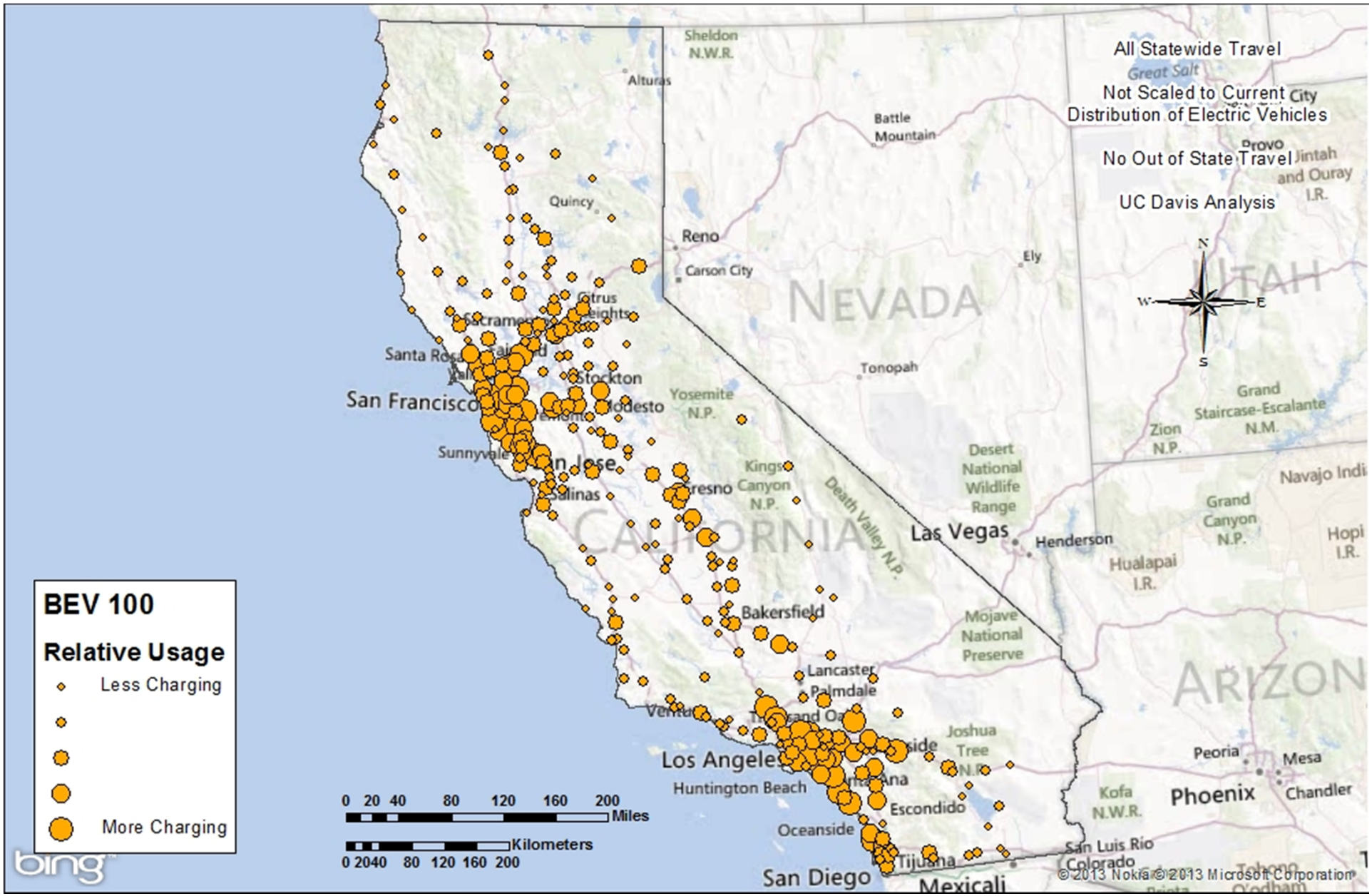
How Does Aversion to Stopping Decrease Likely VMT Benefits?



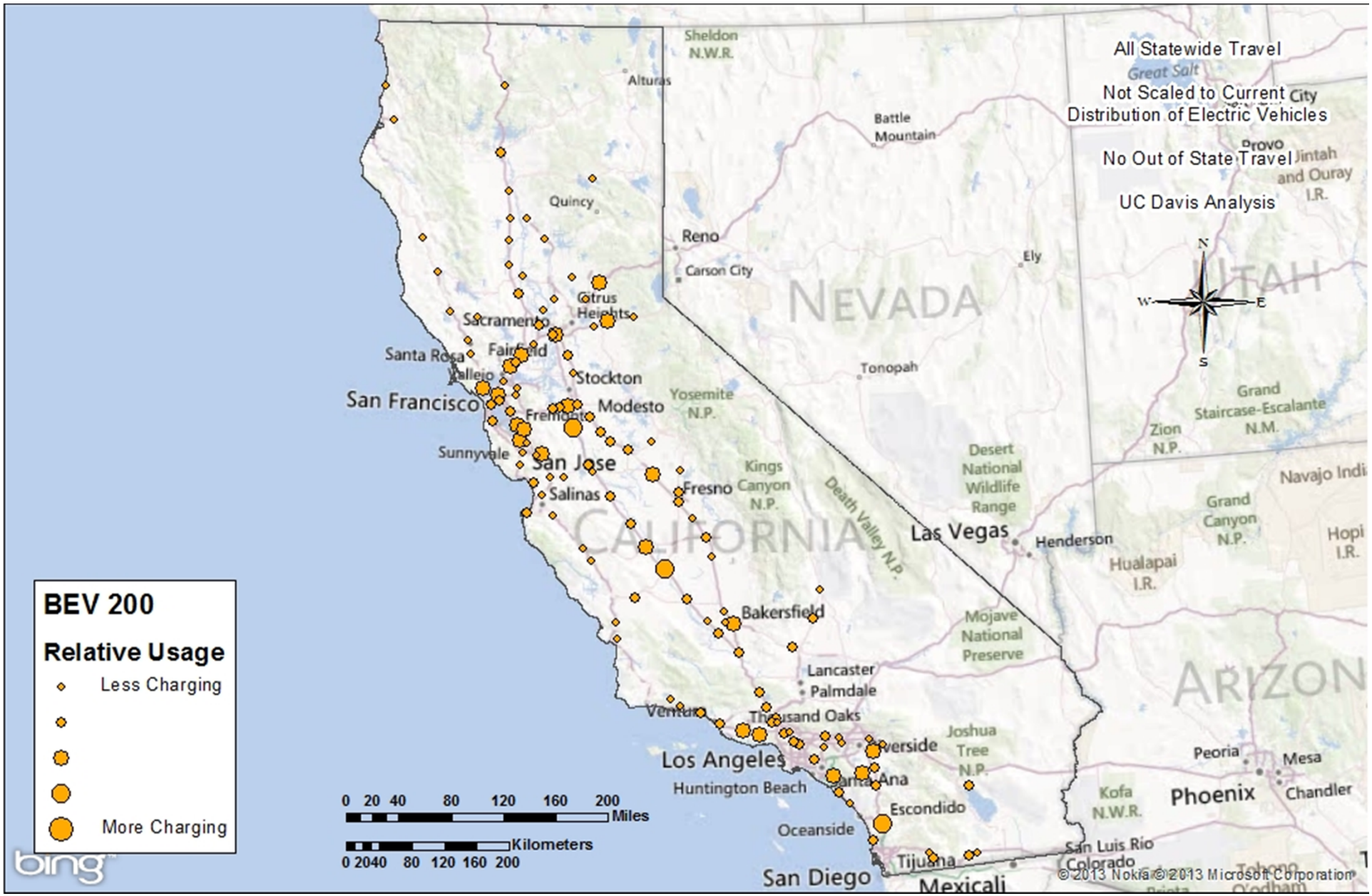
Statewide Demand Distribution: BEV 80. 334 Locations



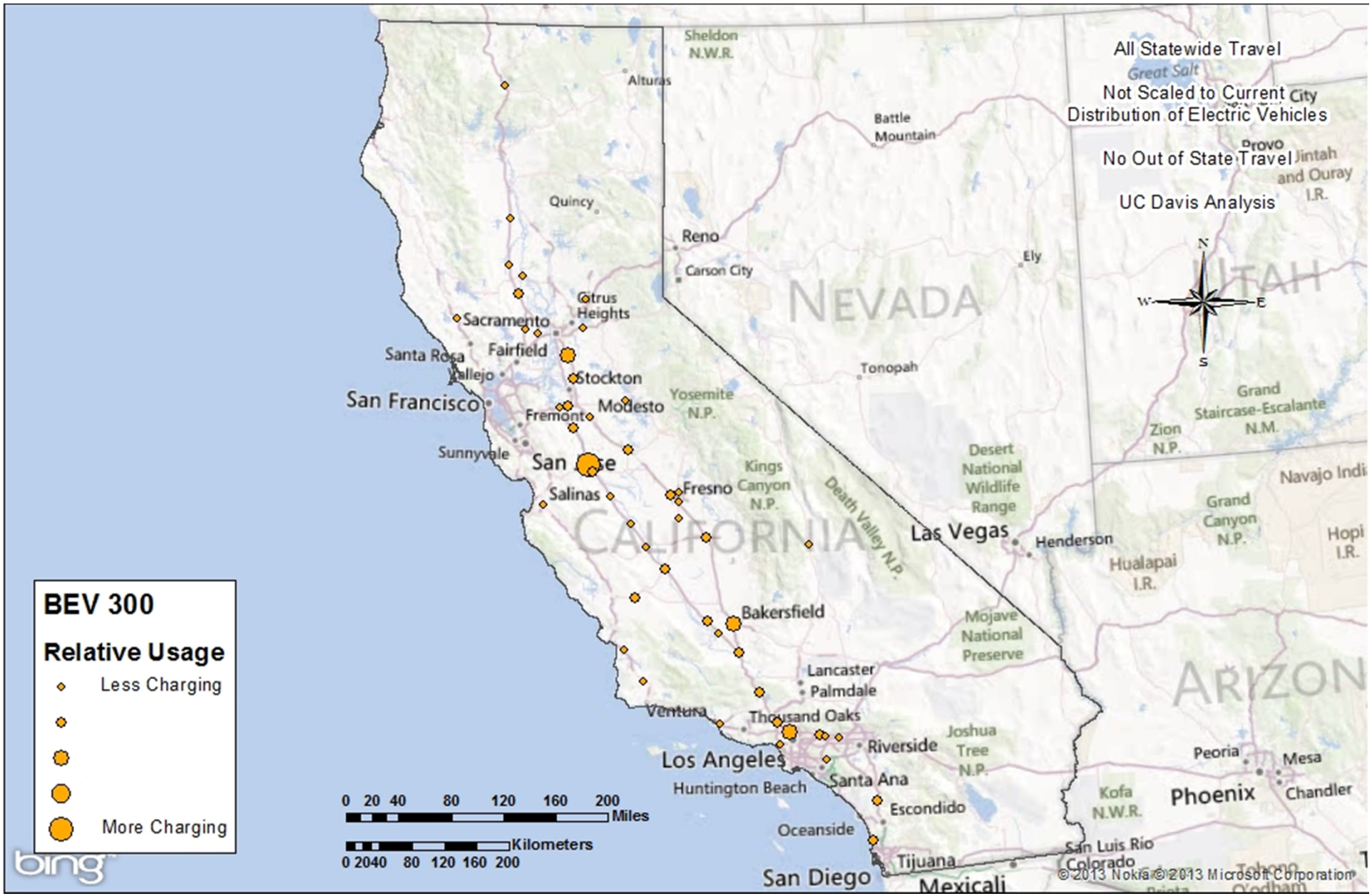
Statewide Demand Distribution: BEV 100. 334 Locations



Statewide Demand Distribution: BEV 200. 334 Locations

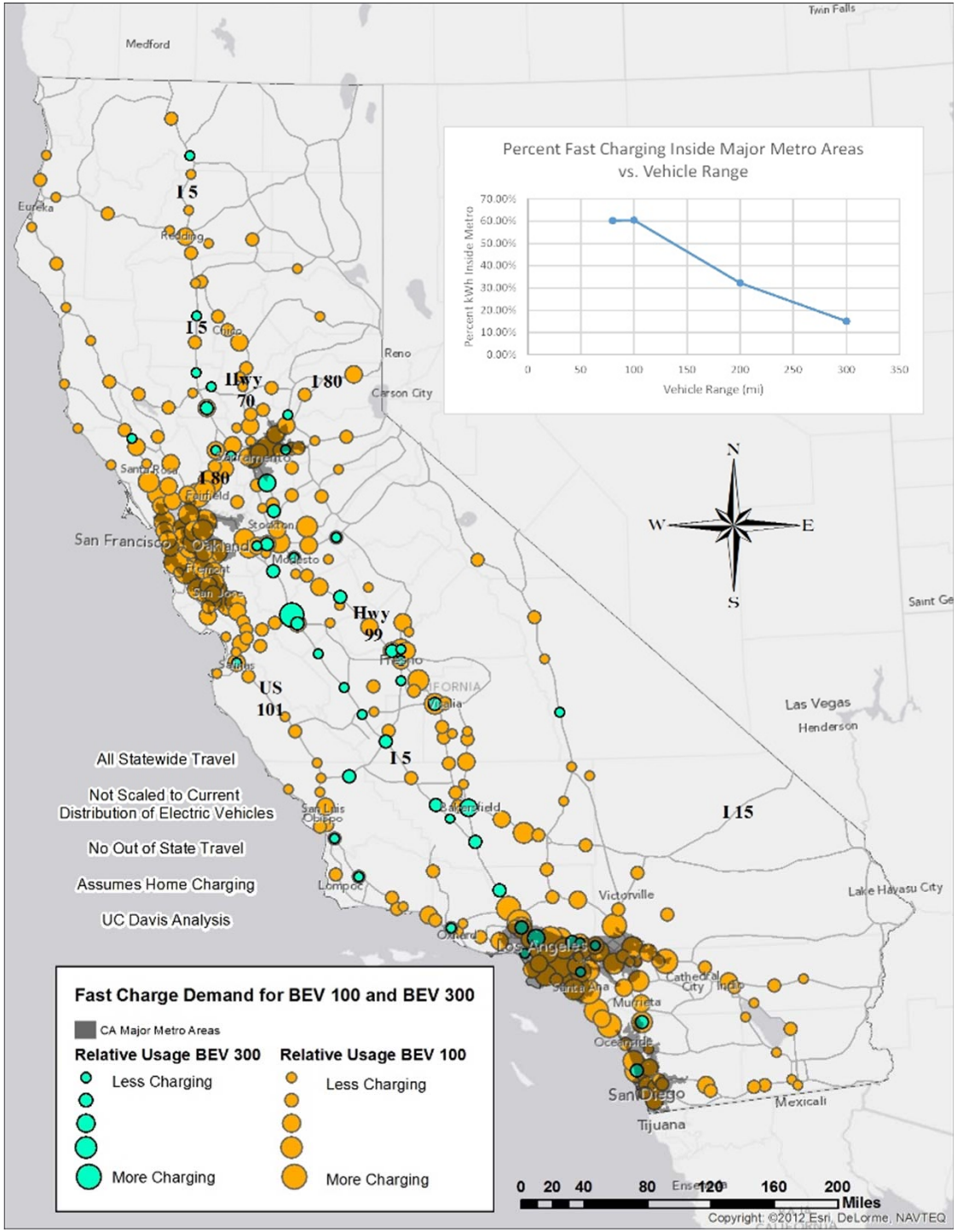


Statewide Demand Distribution: BEV 300. 334 Locations

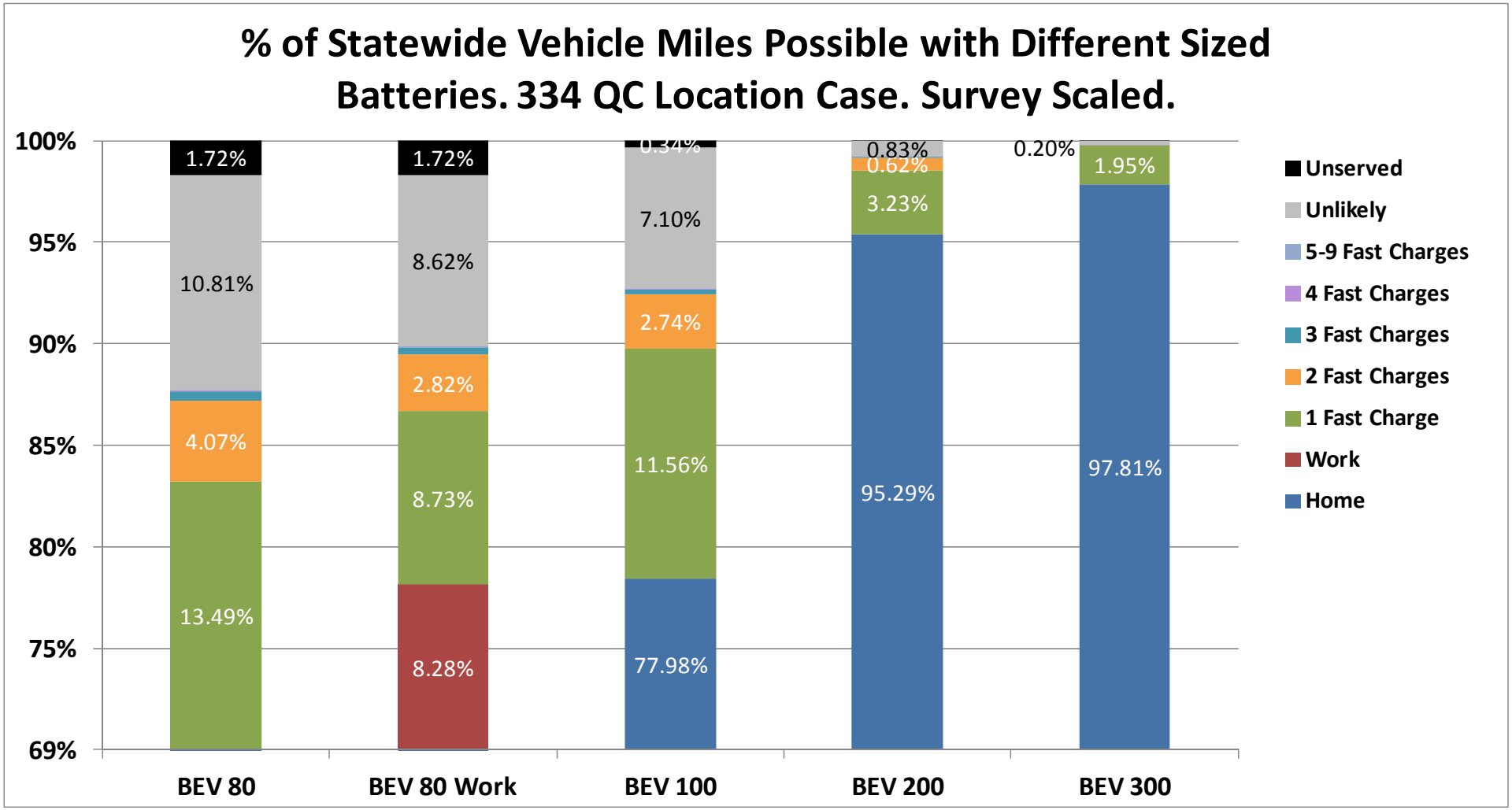


Comparison of DC Fast Charging Potential Inside Major Metro Areas for Small and Large Battery BEV

- Smaller battery BEVs show much larger need inside major metropolitan region
- 4 Metro regions included in analysis: Sacramento, Bay Area, Los Angeles and San Diego
- 4 Metro regions are based on census urbanized area and are in some cases combined areas. For example San Jose and San Francisco are both classified as "Bay area"
- 4 Metro regions as defined represent 67 percent of the California population
- For a BEV 100, 60 percent of DC fast charging is within the defined metro regions
- For a BEV 300, 15% of charging is within these regions



Declining Number of Fast Chargers Needed as Batteries Get Larger



Final Thoughts

- DC fast charging is necessary to address statewide travel needs even when level 2 is "ubiquitous".
- For 200 mile range BEVs, 95% of Statewide miles are possible with only level 2 charging
- For 200+ mile range BEVs, almost all trips can be done with 2 or fewer fast charges
- For 200+ mile BEVs, most demand occurs on Interstate 5 and CA-99. Some demand on other long distance corridors
- BEV80 networks are on adjacent-region corridors (ArCs) and BEV200+ networks are on trans-regional corridor (TReCs)