



Electric Vehicle Infrastructure

Regional Station Siting Analysis

Puget Sound Regional Council
July 2010



Regional EVi Siting Analysis

Purpose of Analysis

- Goals
 - Regional coordination
 - Inform \$20+M siting decisions with data and analysis
 - Provide broad, long-range perspective to individual station siting decisions
- Partners
 - Seattle, Bellevue, King County, Clean Cities Coalition
 - ECOtality, State, ChargeNW
- PSRC
 - Data development, analysis, mapping



Regional EVi Siting Analysis

Summary of Analysis

- Part 1. Origin-destination (O-D) analysis of likely EV market
 - Identify origin zones based on owner demographic assumptions
 - Determine auto travel patterns from origin zones
 - Compare to regional travel patterns from all zones
- Part 2. Major regional destinations
 - Work and non-work destinations
 - Trip distances
 - Dwell times
- Part 3. Supplemental siting factors



Regional EVi Siting Analysis

Key Findings

- Hybrid ownership strongest correlation with Nissan early registrants
- Travel patterns from origin zones different than regional travel
 - More concentrated in core of region
- Typical tour easily accommodated on single battery charge
 - EV owners will likely be more concerned about non-typical travel
 - Importance of “safety-net” charging sites
 - Public charging will largely involve “topping off” the battery
- Regional Destinations database and Household Travel Survey are useful for understanding non-work destinations and dwell time averages



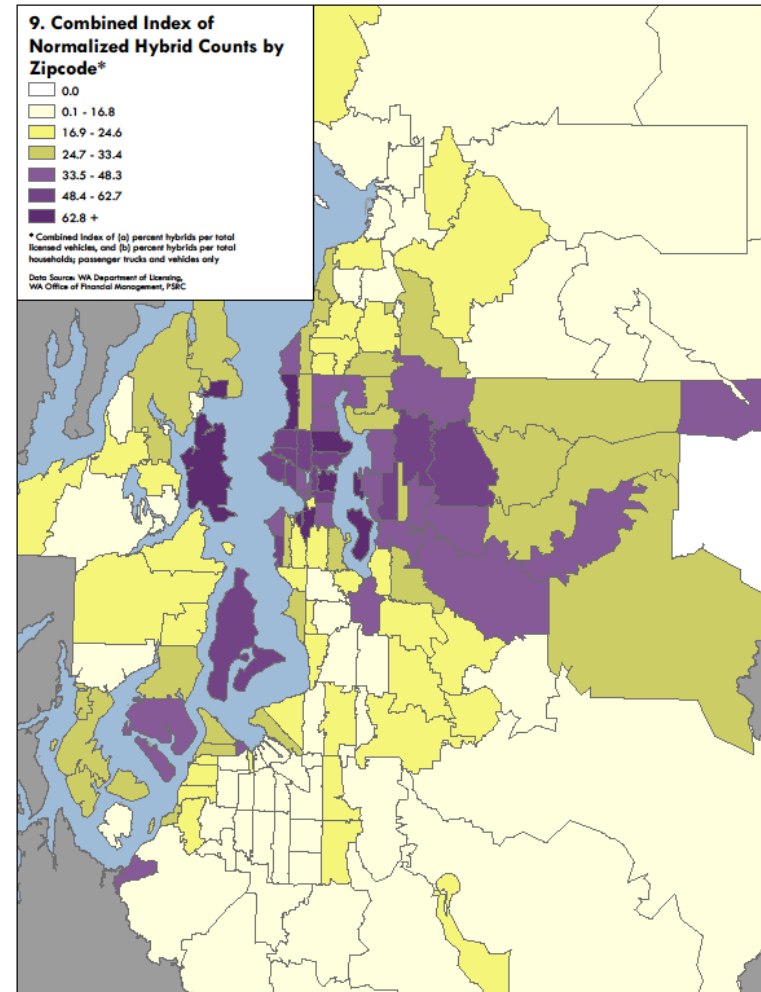
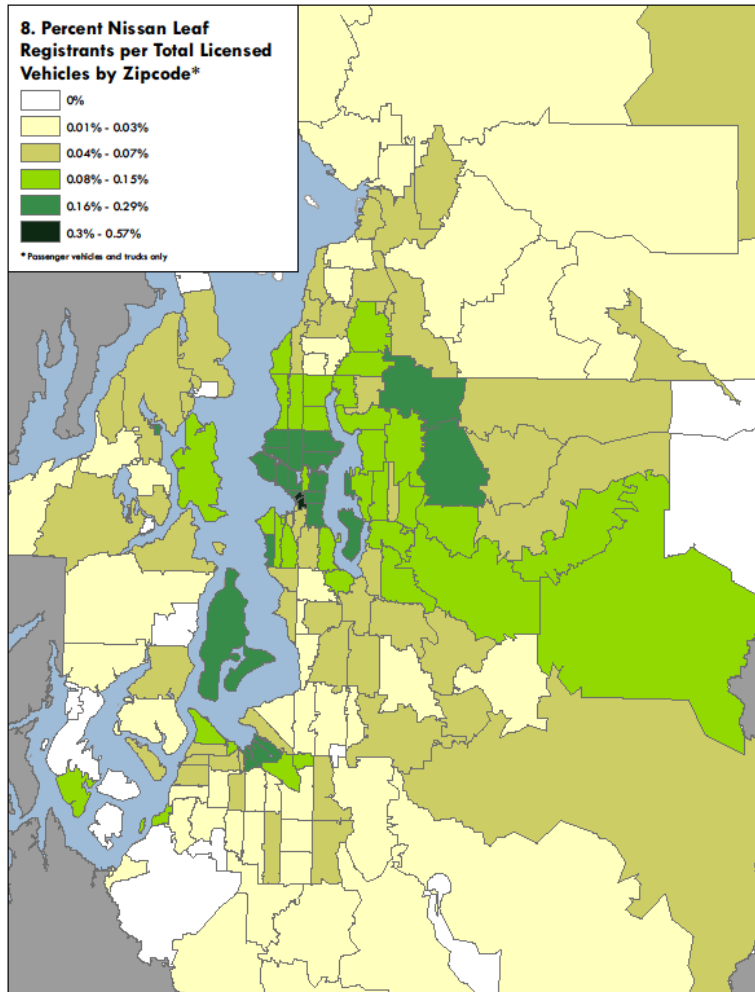
Part 1. O-D Analysis: Origin Zones

- Likely EV market
 - Nissan Leaf registrants – “early hand raisers”
- Determine origin zones
 - Hybrid vehicle ownership
 - Ratio of local-to-regional median household income
 - % SF households (i.e. predominantly SF areas)
 - % households with 2+ vehicles



O-D Analysis: Origin Zones

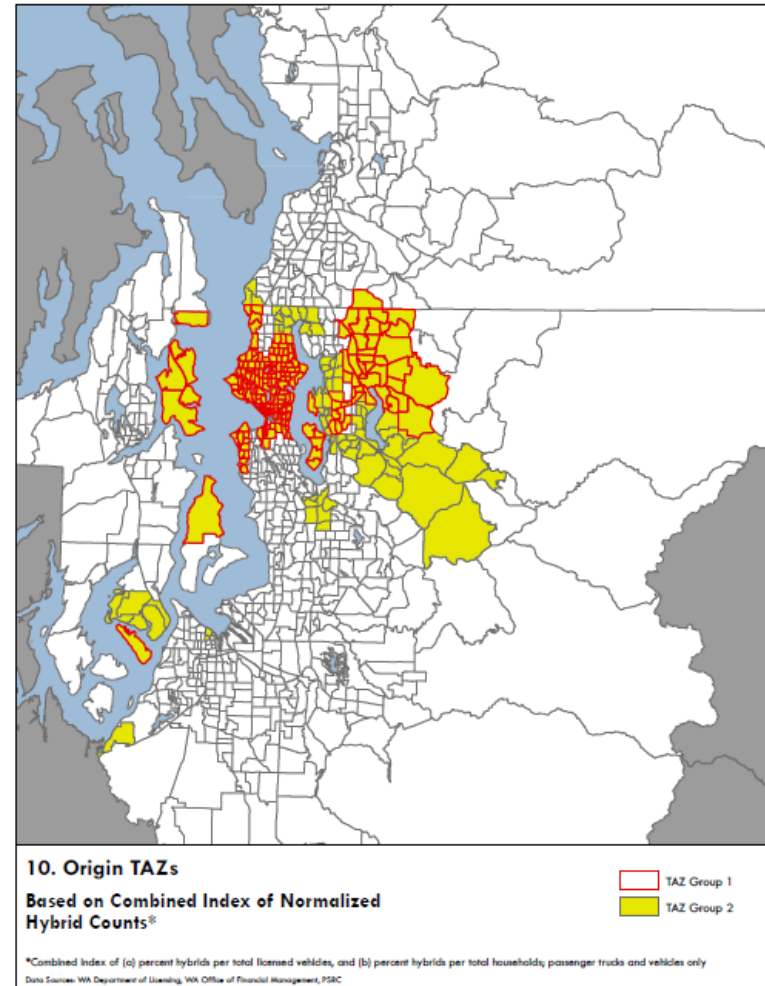
(Examples)





O-D Analysis: Origin Zones

- Findings
 - Hybrid ownership strongest correlation with Nissan Leaf registrants
 - Origin zones selected based on hybrid data (in private ownership)
 - TAZs with high percent of hybrid vehicles
 - TAZs with high percent of hhlds with hybrid vehicles
 - Approach validated by other studies and utility planning efforts





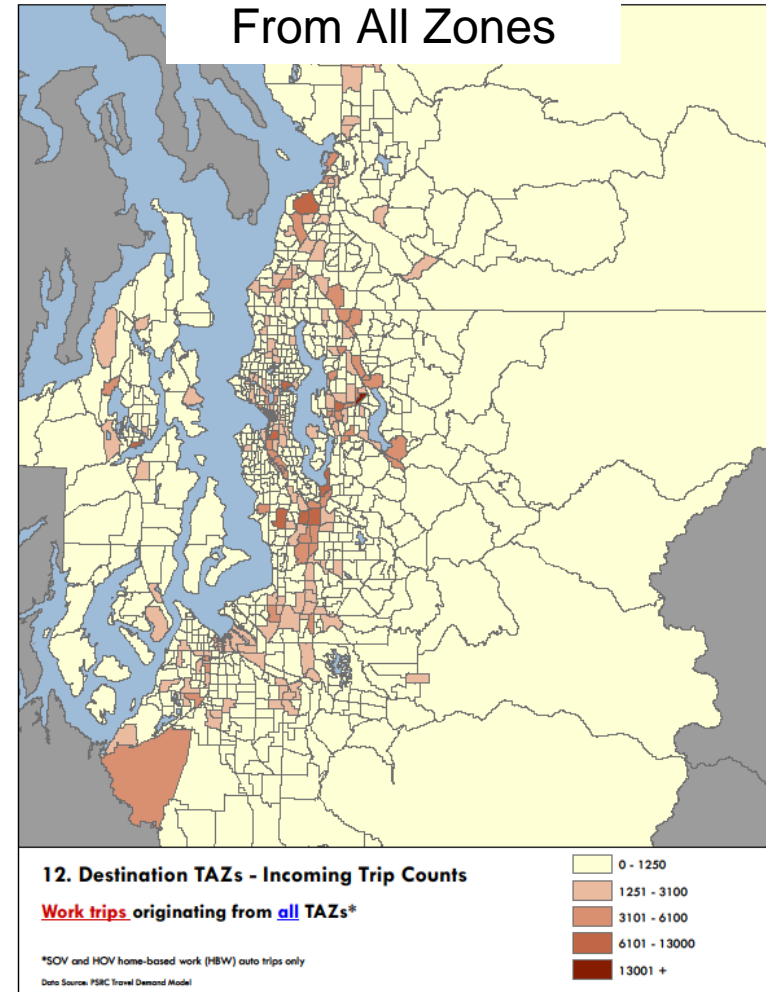
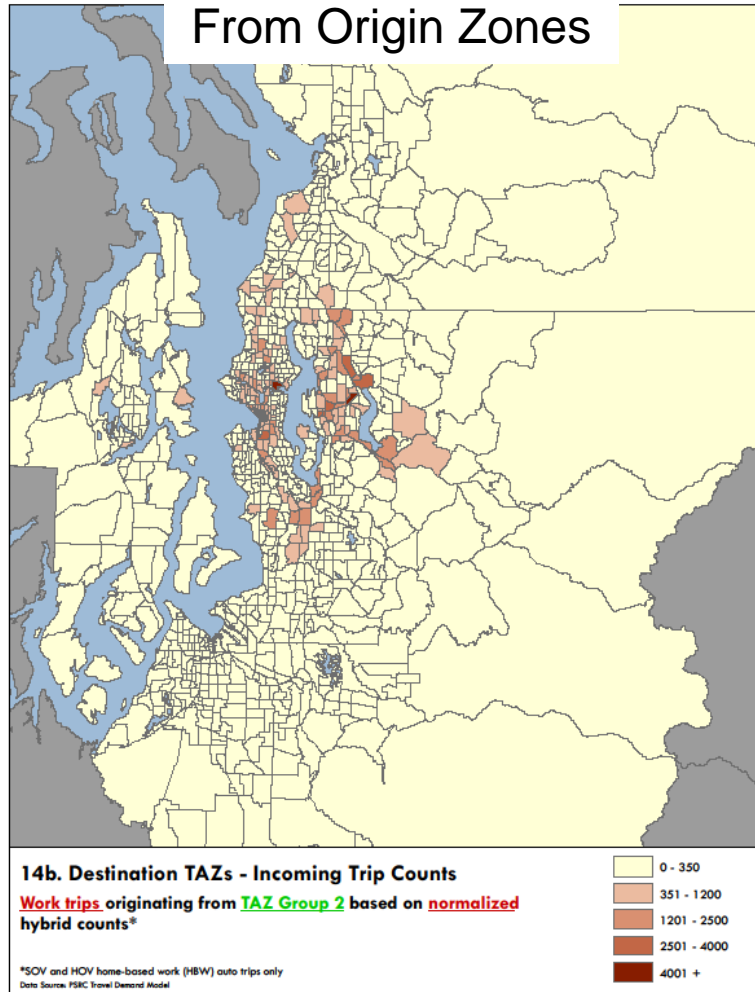
O-D Analysis: Destinations

- Identify travel patterns and characteristics of origin zone residents
 - Work and non-work auto trips
 - Trip counts
 - Trip distances
- Compare against regional travel patterns and characteristics across all zones



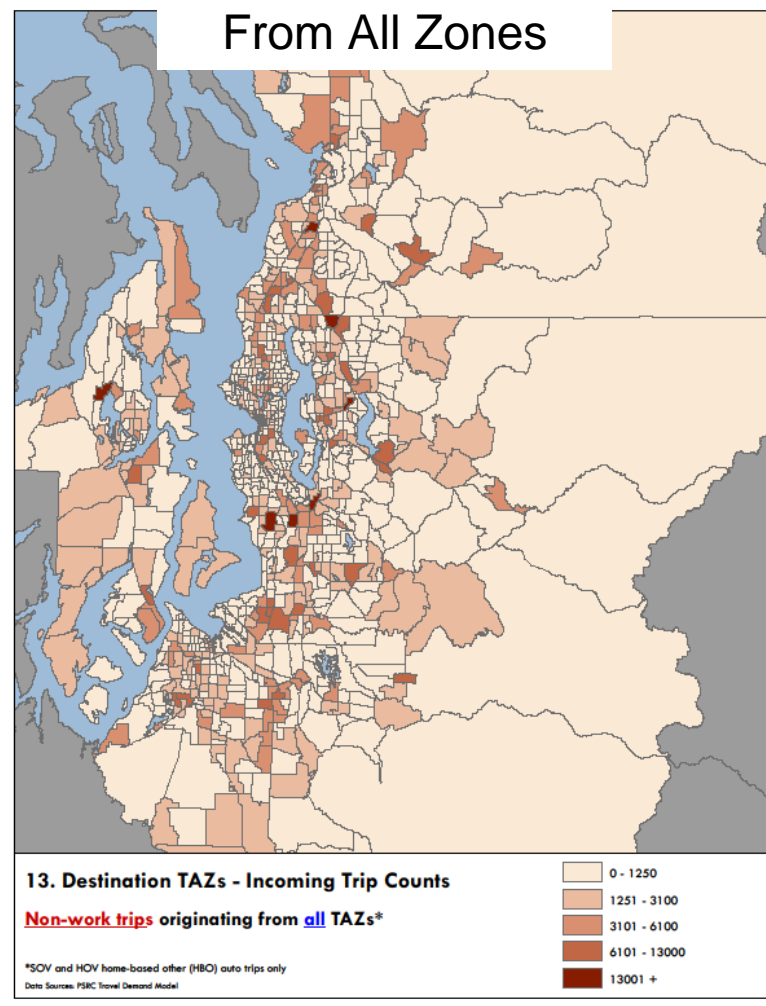
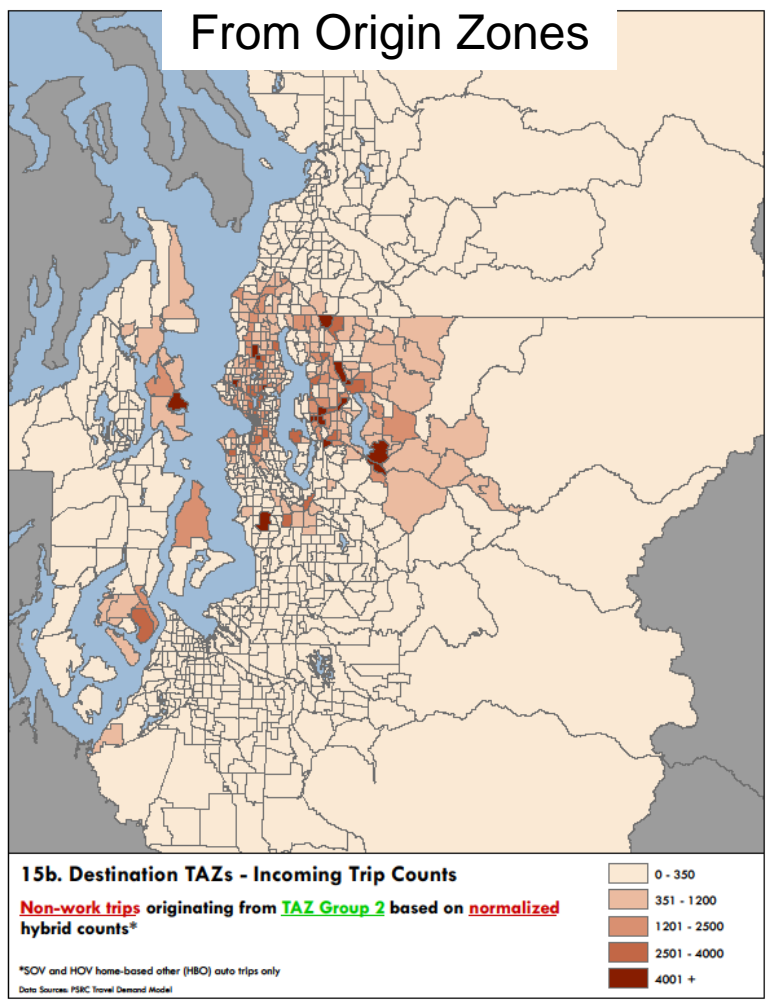
O-D Analysis: Work Trips

(Examples)





O-D Analysis: Non-Work Trips (Examples)





O-D Analysis: Destinations

- Findings
 - Travel patterns and characteristics of origin zone residents show clear differences from region as a whole
 - Typical destinations are concentrated in:
 - Seattle, East King County, SW Snohomish County, North Kitsap County, Bainbridge Island, Vashon Island, Key Peninsula
 - Work trips are longer than non-work trips
 - Non-work trips occur across a broader geographic area than work trips



Travel Tour Characteristics

- Travel tour: Series of linked trips from home to a primary destination and back home
- Regional statistics:
 - Tour type
 - Work tours comprise 37% of all tours
 - Average tour distance
 - Less than 20 miles
 - Average distance of work tours (27.9 miles) is greater than non-work tours (12.8 miles)
 - Average tour time
 - 4.6 hours
 - Average tour time of work tours (8.2 hours) and school tours (7.0 hours) is greater than other tour types



Travel Data Analysis

- Findings:
 - Assuming full charge at beginning of tour:
 - Typical auto tour (work and non-work) can be easily accommodated on a single battery charge
 - EV owners will likely be more concerned about non-typical travel
 - Importance of “safety-net” charging sites
 - Public charging will largely involve “topping off” the battery
 - Suggests Level 2 chargers may serve a purpose at sites where typical dwell time is 2+ hours



Part 2. Major Regional Destinations

- Regional Destinations
 - Work destinations
 - Derived from PSRC covered employment database
 - Non-work destinations – primary focus
 - Derived from PSRC's 2006 Household Travel Survey
 - 2-day travel diaries collected on a rolling basis during Spring 2006
 - Supplemented with other sources:
 - Rand McNally Thomas Guides
 - Kitsap County Street Atlas

Non-Work Destinations

Destination Type	# of Destinations	Non-Work Auto Trips	Average Duration (minutes)	Average Distance (miles)
AIRPORT	8	145	103	17.4
ARTS	20	67	72	4.2
BOWLING	16	33	126	6.2
CIVIC	54	190	112	6.6
COLLEGE	37	216	92	6.9
ENTERTAINMENT	22	95	191	11.7
FITNESS	220	910	76	4.8
GOLF	58	157	190	8.2
MARINA	27	86	136	7.0
MILITARY	7	152	64	7.4
MOVIE THEATER	45	135	129	5.4
MUSEUM	23	66	120	11.1
RECREATION	417	1,628	77	4.8
SHOPPING	70	601	74	6.5
STADIUM	10	92	174	9.4
TRANSPORTATION	24	96	96	5.5
ALL DESTINATIONS	1,073	4,700	90	6.2

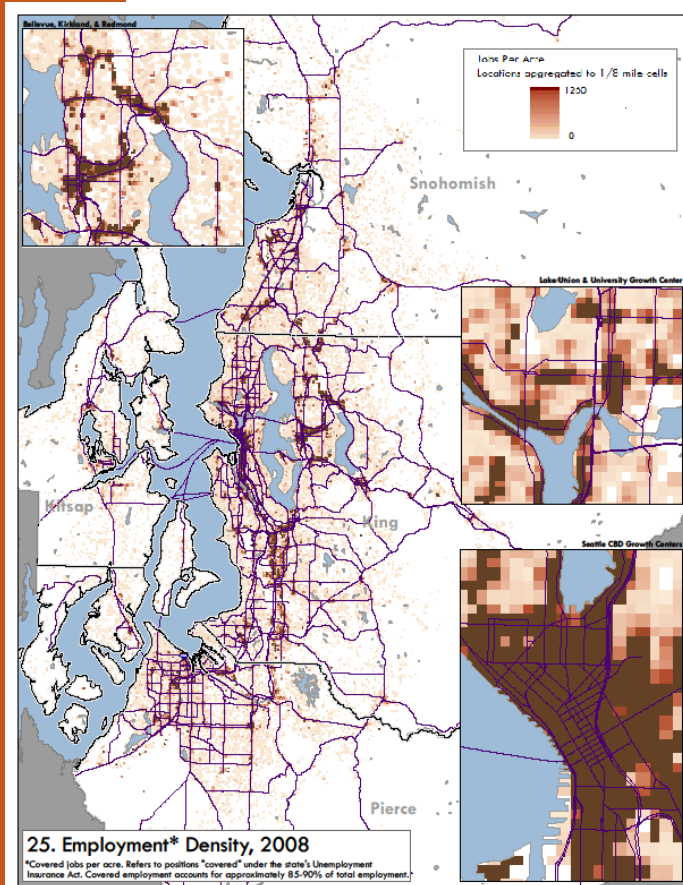
Note: Data are for auto trips to non-work destinations. Trip duration is based on driver (and not vehicle) duration at each destination.

Source: PSRC 2006 Household Travel Survey Database

Major Regional Destinations

(Examples)

Work



Non-Work

Index of Major Regional Destinations

Airport

- ★ 1. SEA-TAC AIRPORT

Civic

- ★ 2. MCCAW HALL
- ★ 3. BALLARD LOCKS
- ★ 4. WOODLAND PARK ZOO
- ★ 5. BENAROYA HALL

College

- ★ 6. HIGHLINE COMMUNITY COLLEGE
- ★ 7. SEATTLE CENTRAL COMMUNITY COLLEGE
- ★ 8. SEATTLE PACIFIC UNIVERSITY

- ★ 9. UNIVERSITY OF WASHINGTON MEDICAL CENTER
- ★ 10. UNIVERSITY OF WASHINGTON

Entertainment

- ★ 11. EMERALD QUEEN CASINO

Military

- ★ 12. NAVY COMMISSARY
- ★ 13. FORT LEWIS MILITARY BASE
- ★ 14. NAVAL BASE KITSAP/BANGOR SUBMARINE BASE
- ★ 15. MCCORD AFB
- ★ 16. PUGET SOUND NAVAL SHIPYARD

Shopping

- ★ 17. SEATTLE PREMIUM OUTLET MALL

- ★ 18. WESTLAKE CENTER
- ★ 19. FACTORIA MALL
- ★ 20. CROSSROADS MALL
- ★ 21. LAKE FOREST PARK TOWN CENTER
- ★ 22. WESTWOOD VILLAGE
- ★ 23. EVERETT MALL
- ★ 24. SOUTH HILL MALL
- ★ 25. REDMOND TOWN CENTER
- ★ 26. PACIFIC PLACE
- ★ 27. PIKE PLACE MARKET
- ★ 28. AUBURN SUPERMALL
- ★ 29. SOUTHCENTER MALL
- ★ 30. BELLEVUE SQUARE
- ★ 31. TACOMA MALL
- ★ 32. KITSAP MALL

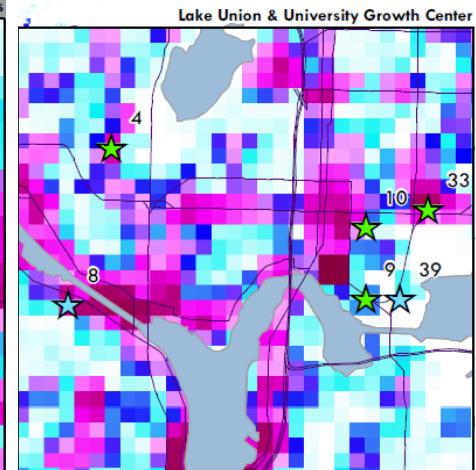
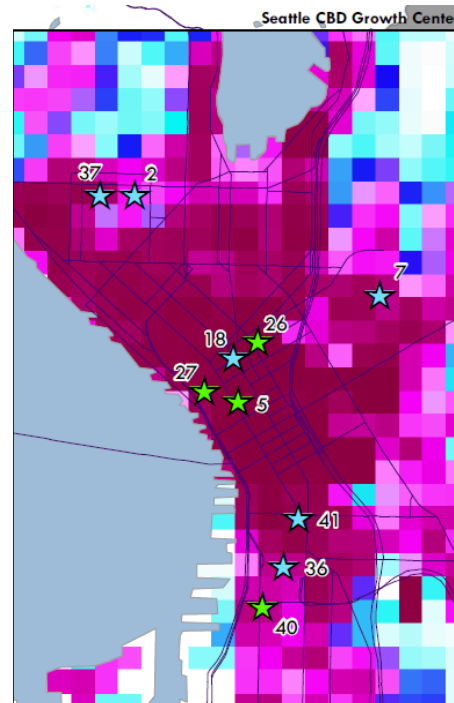
- ★ 33. UNIVERSITY VILLAGE
- ★ 34. NORTHGATE MALL
- ★ 35. ALDERWOOD MALL

Stadium

- ★ 36. QWEST FIELD
- ★ 37. KEY ARENA
- ★ 38. TACOMA DOME
- ★ 39. HUSKY STADIUM
- ★ 40. SAFECO FIELD

Transportation

- ★ 41. KING STREET STATION





Non-Work Destinations

- Findings
 - High volume destinations:
 - SeaTac Airport, University of WA and other colleges, malls, stadiums, civic attractions, parks, military bases, fitness gyms
 - Destinations with high percentage of trips >20 miles:
 - Airports, museum, stadiums, entertainment venues
 - Destinations with high average dwell times:
 - Entertainment venues, golf clubs, stadiums



Part 3. Supplemental Factors

- Supplemental siting factors
 - Priority planning districts
 - Regionally designed growth centers and manufacturing-industrial centers
 - Other subregional centers
 - Major transportation facilities
 - Park and rides, parking lots
 - Geographic equity
 - Household density
 - Employment density
 - Socioeconomic equity
 - Median household income

Regional EVi Siting Summit

- Initial meeting in June 2010
- Push pins on maps to represent preliminary station sites
- More detailed local & on-the-ground analysis needed





For more information

- **PSRC Website**
 - www.psrc.org ... search on electric vehicle infrastructure
- **Contacts**
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