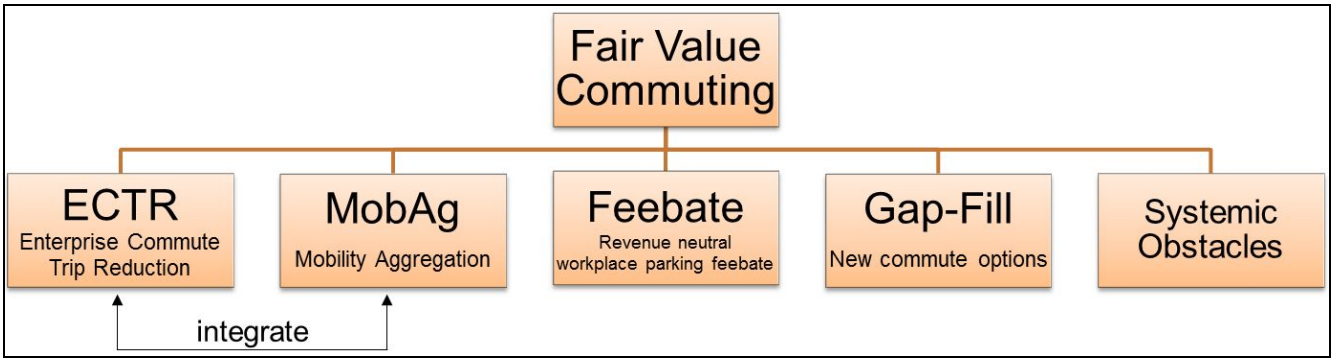
Reduce Bay Area Commuting by 25%

New product/policy design and research on "Fair Value Commuting"
Work In Progress White Paper. Version: October 13, 2016
by Steve Raney for FTA MoD Sandbox Program

Executive Summary

California state, regional, and local public policy has coalesced around the recognition that solving the dual challenges of traffic congestion and climate change hinges on reducing the demand for single-occupant vehicle (SOV) travel. Shifting commute mode choice will lower per capita vehicle miles traveled (VMT), which reduces congestion and greenhouse gas (GHG) emissions.

Our comprehensive technology/policy solution is called Fair Value Commuting and it consists of five components:



- Enterprise Commute Trip Reduction (**ECTR**) software: a) meets the needs of employers in assisting employee commuting, b) expands upon current payroll commute benefits programs, c) provides a real-time commute mode split dashboard of all employee commutes, and d) allows for fine-tuning of fees to discourage SOV travel and rebates/incentives to encourage non-SOV commutes. ECTR software vendors include Luum and RideAmigos.
- Mobility Aggregation (**MobAg**) software provides a smartphone app with a seamless combination of public/private transit/microtransit, bikeshare, rideshare, carshare, vanpool, and electric scooter/bike "loan-to-own," with smartphone e-payment. MobAg apps integrate next-generation mobility services including Lyft, Uber, Scoop, ZipCar, and Car2Go. MobAg vendors include Moovit, Transit App; Urban Engines; TripGo; Swiftly; Ventra by Cubic, Moovel, and GlobeSherpa; Xerox (GoLa) and Siemens. ECTR/MobAg integration consists of: a) ECTR provides e-cash to the MobAg app to pay for trips, and b) the MobAg app reports commute mode to the ECTR app. The MobAg app validates commute modes that use e-payment or, where necessary, automatically detects commute mode.
- A "revenue-neutral workplace parking **feebate**" charges a fee for SOV commutes, collects that revenue, and rebates that revenue to non-SOV commutes. ECTR enables feebate implementation including small, palatable initial fees. Accounting is such that: a) there is no cost to employers, and b) ECTR vendors take their fee out of the SOV revenue.

- "**Gap-Filling**" describes geographic information systems (GIS) analytics to identify commute vectors with poor alternatives and the subsequent attempts to improve options for those vectors. A commute vector is a directional line beginning at home and ending at work. As feebate shifts commute mode, innovative services become more financially viable to fill gaps. Gap-fillers include: low-income transit subsidies, e-scooter first/last mile,[1] Lyft/Uber first/last mile, increases to commuter rail capacity, bike network analysis/improvements to reduce stress, e-bikes for 5-10 mile commutes, peer-to-peer rideshare (IE Scoop, Lyft Carpool, and WAZE RideWith), public microtransit (VTA Flex[2]), private microtransit (Bridj, Chariot), private motorcoach (RidePal), telecommuting, and autonomous first/last mile public microtransit (EasyMile).
- Alleviating **systemic obstacles** such as: a) enable better public transit routes that cross county borders (The Bay Area has 24 different public transit agencies), b) better integrate public transit fares for multi-agency trips, c) modernize public transit electronic payment as fast as possible, d) develop a healthy, interoperable mobility software ecosystem, following open standards.

As of Fall 2016, Fair Value Commuting (FVC) is about 40% of the way to becoming a robust, scalable solution. Full maturation is achievable within the next two years.

Stanford University's commute trip reduction program for 30,000 daily commuters provides a scalable FVC starting point. Stanford charges SOV commuters for parking permits (equivalent to about $4/day SOV fee for the best parking spots)[3] and rebates that revenue for non-SOV modes including Caltrain commuter rail, VTA transit, bike, and carpool.[4] Stanford fills gaps with Marguerite shuttle bus, electric bikes/scooters, and ride.com on-demand rideshare. Stanford is active in electric bike/scooter and autonomous microtransit[5] research for future gap-filling. Stanford's program reduced SOV commuting from 75%[6] to 50%, eliminating the need for $107M in new parking structures.[7]

An expert process found that "similar-to-Stanford, revenue-neutral workplace parking feebate" ranked high for political viability out of eight congestion reduction policies designed to significantly reduce VMT. Six policies scoring far lower on political viability were: $5/gallon gas tax increase, $0.20/mile road user charge, $5/day cordon charge[8], $5/day workplace parking charge, $5/day workplace non-SOV incentive (often called "parking cashout"), and muscular freeway traffic control measures. As FVC deployment spreads, political viability will likely increase further. Given a series of FVC success cases, gradual performance-based FVC city ordinances (called "Sliding Commute Trip Caps") may be enacted by a group of City Councils with a simple majority votes. California's Proposition 26 requires an unattainable supermajority vote for five of the lower-scoring congestion policies.

Benefits of Bay Area-wide FVC implementation:[9]
- Over three years, gradually reduces SOV commute mode share from ~75% to ~50%.
- For 2.9M Bay Area commuters, reduces 1M car trips/day, 1.3M tons/GHG/year, 3.4B VMT/year at a "negative cost" of -$558/ton reduced.
- Creates $670M/year in new transit, biking, carpool, and smartphone mobility funding out of thin air (equivalent to a half-cent sales tax).
- Frees 3,700 acres of surface parking (worth $11B) for higher use.
- Reduces regional traffic congestion delay, improving economic competitiveness.
- Doubles transit and bike mode share.

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[1] "first/last mile" defined: The "first mile" problem addresses traveling from home to transit over a distance of zero to two miles. The "last mile" problem addresses traveling from transit to work over a distance of zero to two miles.
[2] Santa Clara Valley Transportation Authority (VTA) "Flex" on-demand van transit pilot, Jan.-June 2016. See: https://twitter.com/Cities21/status/685519454055215104
[3] "A" parking is $81/month, while the less convenient "C" is $30/month.
[4] Funding from Stanford General Use Permit assessments for development projects augments the SOV fee revenue some.
[5] Stanford Linear Accelerator pilot: http://smartamerica.org/teams/autonomous-robotics-for-installation-and-base-operations-aribo/
[6] We assume Stanford was at roughly 75% SOV in 1990. Stanford was at 72% in 2002 - per "TDM at Stanford University," Slide #19, August 2013, by Brodie Hamilton. http://bit.ly/1RCmSS2
[7] $107M per "TDM at Stanford University," Slide #24, August 2013. http://bit.ly/1RCmSS2. As of 2016, Stanford has gone away from calculating parking savings. Stanford has fewer parking spaces in 2016 than it had in 2001.
[8] "Cordon charging" or "cordon pricing" is a system in which vehicles entering a defined geographic area are assessed a fee.
[9] GHG and benefit calculations provided in Section 10F.

- Helps struggling smartphone mobility services reach critical mass. HOV lanes will fill while traffic goes down.
- Benefits lower-income workers more than higher-income workers.
- Avoids billions for auto-centered, demand-inducing projects that are misaligned with climate objectives, such as freeway expansion and new parking structures.
- Creates a large, new voting constituency in favor of new transportation funding/projects. [10]
- Data analytics: For all commutes, provides a real-time commute dashboard that shows GHG, VMT, commute mode share, feebate accounting, and parking spaces used. Data set includes accurate, current journey-to-work information enabling land use policy performance monitoring and improved transportation route/capacity planning.

Scaling from the Bay Area to the entire US provides roughly 50 times more benefit.

Compared to much-slower autonomous vehicle implementation, the state/regional/local policy coalescence may bring about the world's largest transport change over the next ten years.

Guidance for readers of this white paper

A "Credible Success Narrative" (CSN) is an evidence-based narrative that persuades expert skeptics. This report attempts to create a detailed, actionable CSN explaining how Fair Value Commuting can make substantial progress towards meeting state/regional/local policy objectives. Fair Value Commuting is one of several possibilities towards those objectives and may not be the ultimate preferred option. With this report, we attempt to set a high CSN bar that other policy/technology options should match or surpass.

There is some controversy / misunderstanding of car-loving locations. Our paper provides evidence for why it is difficult to reduce SOV commuting in car-loving locations. We reject the notion that mode shift evidence from transit-loving locations can be applied to car-loving locations. The paper debunks:

- the premise that providing luxury WiFi motorcoach bus service works for everyone
- hope that initial autonomous vehicle deployment will decrease freeway congestion
- dreams of a magical smartphone app
- efficacy of doubling the frequency of suburban bus transit
- confusion about correlation/causation regarding commuting to and from Silicon Valley transit-oriented development
- efficacy of ridematching in car-loving locations.

Joint Venture is working to mature this Fair Value Commuting software ecosystem and solution, to the point where success cases can inform public policymaking. Joint Venture does NOT participate in transportation policymaking or advocacy, as this is the domain of MTC, Air District, Bay Area Council, SVLG, VTA, SPUR,[11] etc. There are six key stakeholder groups in the commuting mobility ecosystem {cities, transit agencies, ECTR software providers, mobility service providers, large employers, small employers}. In order to transform commuting, solutions and policies must benefit all six. Of utmost importance to create viable business models, demand for SOV alternatives must be increased in car-loving places.

Rather than being a neutral academic paper, this paper follows "Silicon Valley product marketing practice," beginning with a point-of-view in favor of FVC. This paper designs a strong FVC feature set combined with a policy prescription to maximize efficacy and scalability. The paper creates an evidence-based product/policy plan. The project work plan over the next 24 months, with 11 employer pilots, will report back results.

[10] Please see Chapter 10F of this white paper. Scaling FVC to the entire Bay Area results in 465,000 new green commuters, creating a large, new voting constituency for commute alternatives..

[11] MTC (Metropolitan Transportation Commission) is the regional MPO, Air District is the Bay Area Air Quality Management District, Bay Area Council is a business-friendly policy NGO, SVLG (Silicon Valley Leadership Group) is a business-friendly policy NGO, SPUR is a research/policy NGO.

Table of Contents

	Description
Section I	**Context**
Chapter 1	Difficulties in Reducing SOV Commuting
Chapter 2	The Car-Loving Bay Area
Chapter 3	Rare Exceptions to Auto-Centricity
Chapter 4	State, Regional, and Local Mode Shift Policy
Section II	**Enterprise CTR and the Mobility Ecosystem**
Chapter 5	Mobility Ecosystem
Chapter 6	ECTR combined with MobAg
Chapter 7	Gap-Filling
Chapter 8	Autonomous Vehicle Future
Section III	**Options, Enactment, Systemic Obstacles**
Chapter 9	Ranking Congestion Pricing Policy Options
Chapter 10	Legislative Path to Enact Fair Value Commuting
Chapter 11	Systemic Obstacles to Seamless Mobility
	Acknowledgements

Appendices	
A	Suburban Ridesharing: Haystack Needle
B	Seasonal Bike Commute Reduction
C	Conflicted Commute Vector Map – Methodology
D	Impact of Work/Live by Caltrain
E	Freeway Robocars Induce Demand
F	Free-Parked CTR Leaders
G	International Mobility as a Service
H	Feebate Efficacy Details
I	Feebate FAQ
J	Partner and Support Letters
K	Draft State Bill - Reduce Commuting 25%
L	Ranking 8 Congestion Reduction Policies
M	Recommendations for Political Wrangling
N	Building Entrance Commute Mode Intercept Surveys

SECTION I: CONTEXT

Chapter 1: Difficulties in Reducing SOV Commuting

The vast majority of US regions and cities are car-loving, with high single occupant vehicle (SOV) commute mode share. 76.6% of Americans drive alone to work and 9.7% carpool, for a total of 86.3% of workers commuting by private auto.[12] For example, of the 367 US Census Bureau Metropolitan Statistical Areas (MSA), only eight have SOV commute share less than 68%:

Metropolitan Statistical Area	SOV Commute Mode Share
New York-Newark-Jersey City	50.2
San Francisco-Oakland-Hayward	59.2
Corvallis, OR	61.6
Urban Honolulu	63.3
Washington DC-Arlington-Alexandria	66.1
Boulder, CO	66.8
Boston-Cambridge-Newton	67.8
Ithaca, NY	67.8

Source[13]

Even within the eight less car-loving MSAs above, many portions of those areas are car loving. Within the San Francisco MSA, San Francisco's downtown has only 9% SOV commute mode split, leaving the majority of the rest of that MSA with high, car-loving mode share. Another indication of a car-loving area is free parking. In 1997, UCLA's Don Shoup estimated that 95% of US commuters receive free workplace parking.[14]

Whereas San Francisco has high green commuting and low SOV commute mode share, the entire Bay Area has high "suburban" SOV commute mode share: 75% SOV. The majority of commuters making rational decisions find that driving alone is their best option. The majority of the Bay Area can be considered as "car-loving" or "auto-centered" suburbia.

In the history of US car-loving suburbs, there are few examples of switching folks away from driving alone and few examples of significantly reducing traffic. As far as can be determined, there is no US example of adopting technologies and/or policies that have resulted in reducing SOV commuting from 75% to 70% over ten years. In contrast, many European and Asian countries provide examples where the price of driving is much higher ($8 per gallon gas), and per capita VMT is 33% less than US. As far as the extent of American car-loving locations, 95% of US commuters receive free workplace parking.[15]

It is difficult to launch new, successful mobility services in auto-centric locations. The chances for success of these systems will be greatly enhanced if demand for "not SOV" can be increased. Long-range California state policy (explained in Chapter 4) increases demand, so is enabling. The creativity within the smartphone mobility ecosystem is very encouraging. The availability of big transport datasets is enabling, allowing for pre-launch analysis of whether critical mass can be achieved. The lower demand for auto ownership by Millennials is enabling.

[12] Commuting in America 2013: The National Report on Commuting Patterns and Trends, Brief 10: Commute Mode Choice. For AAHSTO. October 2013. http://traveltrends.transportation.org/Documents/CA10-4.pdf

[13] Winters, P. Mode Split by MSA grouped by State. For Center for Urban Transportation Research, 9/18/15. Source data: 2014 American Community Survey 1-Year Estimates - Table S0802: Means of Transportation to Work by Selected Characteristics. http://www.bestworkplaces.org/wp-content/uploads/2015/09/ACS_14_1YR_S0801_with_ann-Mode-Split-by-MSA-grouped-by-State.pdf

[14] Shoup, D. and Breinholt, M.J. Employer-Paid Parking: A Nationwide Survey of Employers' Parking Subsidy Policies. In The Full Costs and Benefits of Transportation: Contributions to Theory, Method and Measurement. Editors David L. Greene, Donald W. Jones, and Mark A. Delucchi. Berlin: Springer Press. 1997.

[15] Shoup, D. and Breinholt, M.J. Employer-Paid Parking: A Nationwide Survey of Employers' Parking Subsidy Policies. In The Full Costs and Benefits of Transportation: Contributions to Theory, Method and Measurement. Editors David L. Greene, Donald W. Jones, and Mark A. Delucchi. Berlin: Springer Press. 1997.

Chapter 2: The Car-Loving Bay Area

There are a series of influencing factors that combine to create a very auto-centered result.

2A. Regional auto-centricity

In transit-loving Helsinki, it is easy to commute without a car. In Silicon Valley, commuting without a car is many times more difficult:

	Auto-centered Silicon Valley	Transit-centered Helsinki	Difference
SOV rate	76%	38%	½
Transit rate	3.3%	40%	12X
Bike/Walk	3.8%	18%	4X
Cars/capita	0.84	0.55	2/3
Parking cost/hr	Free	$2.25	∞
Gas price/gal	$3.50	$8.00	2X
New car fees	10%	85%	8X
Pop per sq mi	5,000	45,000	9X
Avg Commute	13 mi	8 mi	½

Sources[16]

As SPUR's analysis concluded, 75% of Bay Area jobs are located close to freeway exits - on top of various other auto-centered challenges, our sprawling human settlement pattern thwarts transit.[17]

2B. Lack of scale for mobility services

Alternatives to driving alone have a hard time succeeding in suburbia. In Silicon Valley, only 1 out of 1,000 trips is provided by Lyft/Uber.[18] There is limited scale for that great new "on-demand, smartphone-dispatched, cross-city shuttle" that suburbanites repeatedly dream up for their neighbors to ride. Alas, we cannot even point to a single successful suburban US system of this sort.

There is the dynamic rideshare "Needle in the Haystack" ridematching problem. There are many "peer-to-peer on-demand ridesharing" apps: Carma, Carzac, HOVee, NuRide, Ride.com, RideAmigos's ridematching, Scoop, TwoGo, Slice Rides, Waze Carpool, Lyft Carpool, Uber Commute, Duet, Split, and MüV. On the surface, the concept of filling empty seats in cars seems to have large potential to increase efficiency. Unfortunately, the probability of developing critical mass in car-loving areas (70%+ SOV commute mode share) is very challenging – the set of possible matches is distributed in a sparse manner. This challenge can be called the Needle in the Haystack Problem. Even making multiple optimistic assumptions, the match probability is small.

Appendix A provides calculations for commutes to downtown Palo Alto, with 10,000 downtown workers. For a zipcode with 31,550 residents, of which 500 are downtown Palo Alto workers, there are fewer than eight people to match in each 20-minute peak hour commute interval.

An additional ridesharing complexity is the "Day 1 Challenge." Even if a quantified analysis using travel demand data shows that critical mass may be obtained, there is still a "launch day" problem. Systems need to achieve system-wide critical mass on the first day of operation (Day 1), because a participant will only put up with two failed ridematching attempts before they abandon a software system.

[16] Finland car registration fees and other sources provided by Hartti Suomela, Finpro Silicon Valley
[17] From SPUR's Ratna Amin.
[18] Calculations spreadsheet - a "messy" back of the napkin spreadsheet: http://bit.ly/1HPDH6g

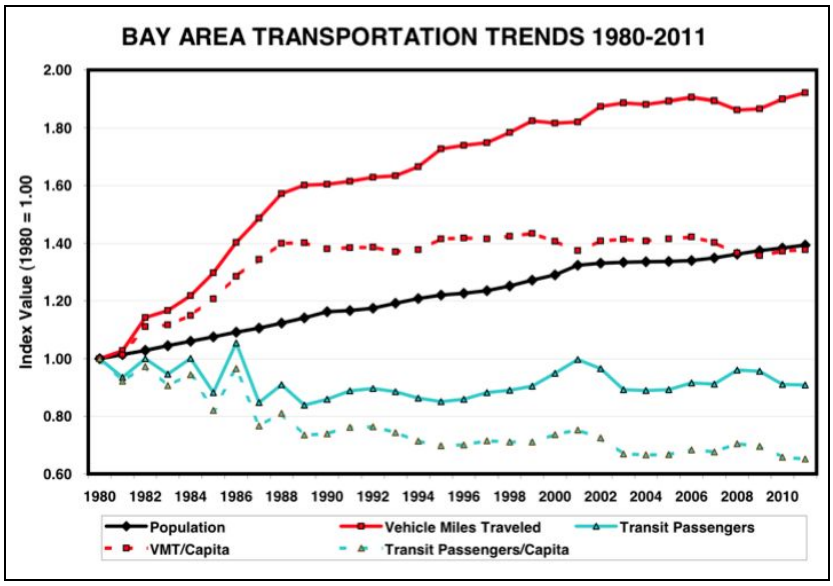
2C. Cost effectiveness

The hourly operating cost of a 50-passenger public transit bus is in the range of $135. For private transit with lower labor cost, that cost drops to about $80. Public transit requires taxpayer subsidy, whereas private transit has to generate far higher farebox revenue in order to make a profit. New commuter motorcoaches cost $500,000. Currently the economics are very difficult for both suburban public and private bus transit. As far as GHG, standard 50-passenger buses get 6 mpg (8 mpg per hybrid). A Nissan Leaf carpool filled with four people gets about 480 miles per passenger per gallon (equivalent). That is pretty hard to beat, except via bike.

Within the field of suburban transportation the following are exceptionally cost-effective (from a taxpayer standpoint): carpooling/ridesharing, biking, walking, telework, filling empty seats in existing public transit, private sector mobility services, parking price increases and driving price increases. Public transit expansion projects are sometimes cost-effective but sometimes not.

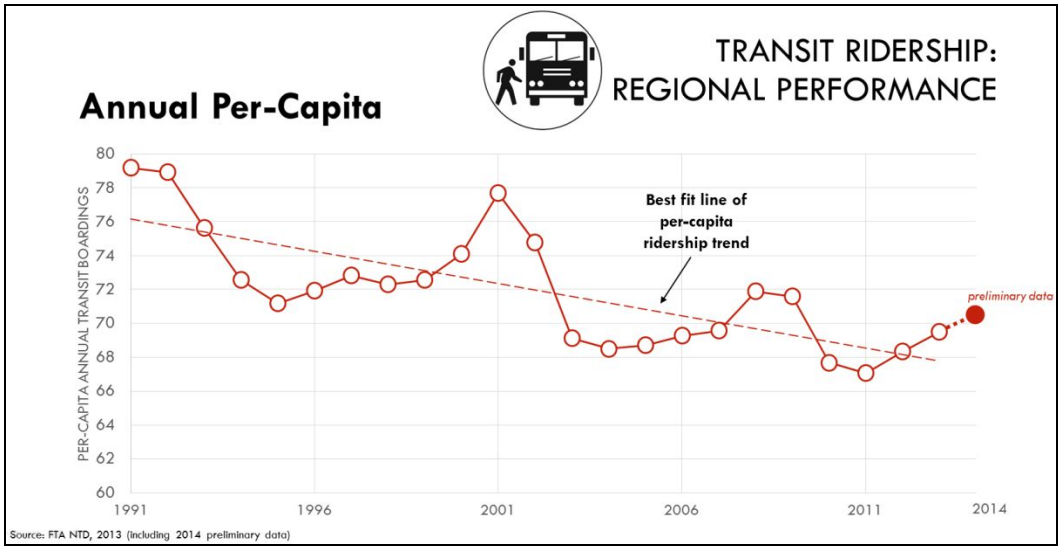
While the potential for carpooling is large, average US commuting occupancy per vehicle has disappointingly dropped from 1.3 in 1977 to 1.13 currently.

Per capita transit utilization is 31% lower from 1980 to current. Even with a 38% population increase, overall transit ridership was lower in 2011 compared to 1980 (trends analysis by Transdef): [19]



MTC provides another look at this trend, though by MTC's analysis the drop is not as large. Annual Bay Area per capita public transit trips dropped from 79 to 70 in 23 years, from 1991 to 2014 (graphic by MTC): [20]

[19] Bay Area Basics. By Transportation Solutions Defense and Education Fund. http://transdef.org/Bay_Area/Bay_Area.html
[20] From MTC presentation PPT by Ken Kirkey at Joint Venture's Mobility Ecosystem Convening #3, Sept. 24, 2015.



As Don Shoup (author, *High Cost of Free Parking*) would say, “parking is never free.” Freely provided employer surface parking provides an SOV commuter with a parking space valued at $8 per day, paid for by the employer. Bike commuters do not receive an $8/day subsidy, but SOV commuters do. This creates an unfair incentive that encourages SOV commuting. Employer-provided structured parking represents a larger $20/day SOV subsidy. [21]

Improvements to suburban US bus transit service/frequency are not guaranteed to succeed

Bus Rapid Transit (BRT) is a higher-quality replacement for conventional line haul bus transit. BRT features may include: faster trip time, higher frequency, higher comfort, WiFi, longer hours, etc.

In the urban US experience, Cleveland’s 6.8-mile, $200 million HealthLine BRT route is considered a success. [22] Since its opening in 2008, ridership has grown more than 50% and the route's travel time has been reduced from 45 minutes to 32. The HealthLine catalyzed more than $3.3B worth of real estate development. The project exploited existing urban density in an area with paid parking. This urban success example does not directly correspond to succeeding in a car-loving suburban area with free parking.

There are no recognized US suburban BRT success stories. The San Pablo Rapid (East Bay Area) system is not considered a success. Stops are 1/2 mile apart along the 14-mile route, with a 12-minute frequency, and the capital cost of the system was $3.2M in 2003. The route does not attract choice riders. In the FTA’s evaluation, bus ridership rose a small amount, but this was accounted for by an increase in service frequency and operating hours. Operational cost-effectiveness (ignoring capital cost expenditure) decreased. “The result of a large service quantity increase in comparison to a relatively modest ridership increase meant that average passengers per revenue hour on the corridor reduced from 63.4 passengers per revenue hour in May 2003 to 49.1 passengers per revenue hour in October 2004.” [23]

The 30% Commuting Time Penalty Rule

Given a choice between a 20-minute SOV commute or a 26-minute (30% slower) non-SOV commute, a high percentage chose the alternative. Thus, alternatives have to be relatively competitive, but DO NOT have to be equally speedy as SOV. Santa Clara County Valley Transit Authority's Senior Transportation Planner Chris Augenstein validates this 30 percent time dis-advantage, "In our forecasting model, if the door to door transit time is within 30 percent of driving alone, then our model forecasts high transit mode share. This share drops off rapidly once you get past 30 percent."

[21] Parking subsidy calculations: http://www.cities21.org/parking_subsidy.htm
[22] “A Look at BRT: Cleveland's HealthLine,” June 2013: http://www.metrojacksonville.com/article/2013-jun-a-look-at-brt-clevelands-healthline/page/
[23] “The San Pablo Rapid BRT Project Evaluation,” June 2006. http://www.fta.dot.gov/documents/San_Pablo_Rapid_Evaluation_Final_Report_June_2006_2.pdf

2D. Seasonal Reduction in Bike Commutes

See Appendix B for details.

State and regional policy calls for reduced SOV and expanded biking. At the state level: a) “California Transportation Plan 2040, Scenario 3” calls for doubling biking, b) “Caltrans Strategic Management Plan 2015-2020” calls for tripling of biking. At the regional level, the 2017 update to Plan Bay Area 2040 calls for doubling biking. For Silicon Valley, the current 3.8% bike commute mode share needs to reach 7.6% or better.

Bike commuting provides a compelling user experience in nice weather during Daylight Savings Time, but what happens in the winter when it’s cold, rainy, and dark? How much of a seasonal drop off is there? How does this vary by region?

Below are results from 10 US cities. The commute “Bike mode split” is given for spring months, followed by the percent of “Winter drop off” for winter months (Dec.-Feb.) from the “Bike mode split.” For example, Missoula has 6.2% springtime bike mode split. A 75% winter drop off results in 1.55% winter commute mode split:

US location	Bike mode split	Winter drop off
Los Angeles	1.0%	~5%
San Francisco	3.4%	~20%
Boston	2.1%	40%
Portland	6.1%	43%
Seattle	3.4%	44%
Austin	1.4%	61%
Boulder, CO	10.5%	62%
New York City	1.2%	70%
Missoula, MT	6.2%	75%
Chicago	1.4%	80%

There is a need to characterize and reduce the spike in SOV commuting (caused by the drop in biking) in winter. Other non-SOV modes must replace lost biking during the winter. For public policymaking efforts towards large commute mode shift, there needs to be a focus on shaving off the winter spike, as savings in commuter parking spaces can only be monetized based on the single day with the highest parking utilization (and based on the highest utilization day taken over a number of years). Enterprise Commute Trip Reduction software will generate daily commute mode reporting, to the point where winter spikes can be seen. Large winter storms that temporarily increase SOV will create the largest challenge.

In Umeå, in northern Sweden, the share of bike commuting is high, but has a significant drop off: summer 35%, winter 22%. However, transit picks up the majority of winter cyclists - most of the mode shift is between green modes, with only a 3% (nominal) overall winter SOV increase. SOV increases from 18% in summer to 21% in winter. This is an example of a relatively small winter SOV spike. (See detail in the Umeå detail section below.)

Likewise at the University of Oulu (Finland), bike commute mode is 71% in spring, dropping by 22% (nominal) to 49% in winter, but other virtuous modes pick up 17% (nominal) resulting in a modest 5% (nominal) winter SOV spike.

2E. Silicon Valley’s “Cat’s Cradle” Commute Pattern

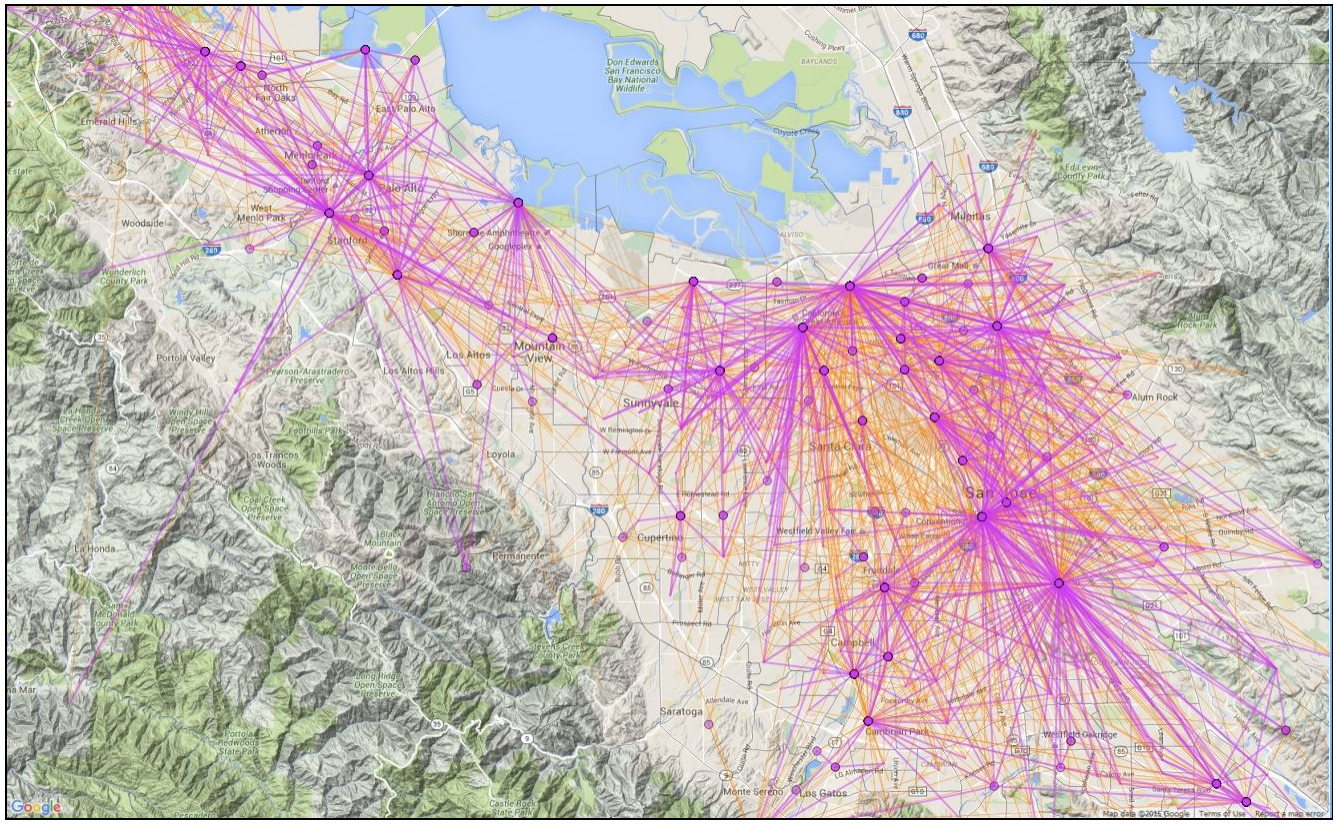
The Silicon Valley "cat’s cradle" or "string art fun" commuting pattern increases the difficulty of providing effective SOV alternatives. The commute vector map below shows how the messy suburban human settlement pattern is

well served by driving alone. Likewise, it is very difficult to create a transit system that effectively serves this pattern.

“Silicon Valley” is defined as both Santa Clara County and San Mateo County. For commutes that are “contained” in Silicon Valley (where both home and work are in the area) there are 788,000 morning commutes.

A commute vector is a directional line beginning at home and ending at work. Pink/purple commute vectors have 60-1,200 commute trips. Pink circles represent employment centers. Smaller commute vectors of 40-59 trips are represented in orange. There are 1,102 pink vectors and 1,404 orange vectors.

Please see Appendix C: “Conflicted Commute Vector Map – Methodology” for details.



Silicon Valley “Cat’s Cradle” Commute Pattern. QGIS analysis by Steve Raney[24]

2E. Ineffective Silicon Valley TOD

San Francisco TOD (transit-oriented development) provides offices and residential within ½ mile of a BART or Caltrain station, resulting in high transit ridership. SF TOD brings up the numbers for all Bay Area TOD. MTC's analysis shows very high (42%) transit commute mode share for Bay Area residents simultaneously living and working within ½ mile of Caltrain and BART. Unfortunately, the majority of this high share is caused by San Francisco's challenging SOV experience (high traffic congestion, high parking costs, and parking scarcity). For car-loving Silicon Valley, there is a much lower (7%) transit commute mode share for those simultaneously living and working within ½ mile of Silicon Valley Caltrain/BART. Please see Appendix D: “Work/Live near Silicon Valley Caltrain” for details.

[24] Image can be found on the web at: http://bit.ly/1HBgrGB

Chapter 3: Rare Exceptions to Auto-Centricity

3A. Stanford charges for parking (permits are equivalent to $4 per day)

Stanford University has reduced SOV commuting dramatically. Stanford charges SOV commuters for parking permits (equivalent to about $4/day SOV fee for the best parking spots)[25] and rebates the resulting revenue for non-SOV modes including Caltrain commuter rail (via Caltrain GoPass), VTA transit (via EcoPass), bike, and carpool.[26] Stanford fills gaps with Marguerite shuttle bus, electric bikes/scooters, and ride.com on-demand rideshare. Marguerite is one of the US's higher ridership local shuttle bus systems. [27] Stanford is active in electric bike/scooter and autonomous microtransit[28] research for future gap-filling. Stanford's program reduced SOV commuting from 75%[29] to 50%, eliminating the need for $107M in new parking structures.[30] In the best practice of Fair Value Commuting, fees and rebates are applied on a daily basis to motivate daily travel behavior decisions.

3B. Jobs for tech worker Millennials on top of high-quality transit

Where jobs for knowledge workers can be located very near Caltrain stations there is significant behavior change. Downtown Palo Alto-based Palantir does not charge for parking like Stanford, yet achieves about 38% SOV mode share. SRI International (by Menlo Park Caltrain) achieves 59% SOV.

3C. $6,000 per worker per year "expensive but effective" employer commute programs

Throughout the entire US, there are a handful of "effective and expensive" trip reduction programs that provide free workplace parking (and are not located next to Caltrain): Google Mountain View at 52% SOV, Genentech South SF at 58%, Facebook Menlo Park at 59%, and Microsoft Redmond at 62% SOV. These programs often have a Human Resources cost justification because employees work productively during their green commutes on WiFi-enabled buses. The cost of these programs is out of reach of the vast majority of US employers. Please see Appendix F: "Free-Parked CTR Leaders" for details.

Noteworthy expensive-but-effective tactics:

Tactic	Estimated cost per employee commute shifted per year
90% of Google SF residents take the Google Bus	$6,000
Genentech pays $4 to carpool drivers for each rider	$6,280 (b/c of "grandfathering")
Genentech pays $12 for each bike commute day	$2,880
Palantir: $500/mo to live w/i 1 mi of work (walk dist)	$6,000
Palantir: $300/mo to live w/i 3 mi of work (bike dist)	$3,600

Of the three exceptions above, the #3A Stanford approach is the one with the potential to scale region-wide.

[25] "A" parking is $81/month, while the less convenient "C" is $30/month.
[26] Funding from Stanford General Use Permit assessments for development projects augments the SOV fee revenue some.
[27] High ridership US local shuttle bus systems: http://www.cities21.org/tdm2.htm#Shuttle (somewhat dated)
[28] Stanford Linear Accelerator pilot: http://smartamerica.org/teams/autonomous-robotics-for-installation-and-base-operations-aribo/
[29] We assume Stanford was at roughly 75% SOV in 1990. Stanford was at 72% in 2002. Mode split is reported as: 41.9% SOV, 23.6% Caltrain commuter rail, 13.9% bike, 8.4% carpool, 7.5% bus, 3.1% walk - per"TDM at Stanford University," Slide #19, August 2013, by Brodie Hamilton. http://bit.ly/1RCmSS2
[30] $107M per "TDM at Stanford University," Slide #24, August 2013. http://bit.ly/1RCmSS2. As of 2016, Stanford has gone away from calculating parking savings. Stanford has fewer parking spaces in 2016 than it had in 2001.

Chapter 4: State, Region, and Local Mode Shift Policy

California state, regional, and local public policy is building towards large commute mode shift.

The 2009 "Moving Cooler" Report[31] (by ULI, APTA, EDF, FHWA, FTA, NRDC, and EPA)[32] has been influential in climate-focused transport planning. The "big conclusion" is that to hit aggressive GHG reduction targets, VMT must be reduced by increasing price. Transport energy efficiency increases are not sufficient. There is a direct line between Moving Cooler and CTP2040 (California Transportation Plan 2040). Within Moving Cooler, a variety of VMT reduction remedies are explored, providing a path to reduce US VMT by 28%.

4A. State Mode Shift and VMT Reduction Policy

AB 32 (Pavley and Nunez, 2006) was the landmark legislation that spurred follow-on transport GHG reduction efforts. AB 32 set goals: a) reduce 2020 emissions to 1990 levels, b) reduce 2050 emissions to 20% of 1990.

SB 375 (Steinberg, 2008) aligned transportation, housing, and land-use plans towards climate protection. It requires metropolitan planning organization (MPO) Regional Transportation Plans to adopt Sustainable Communities Strategies to reduce VMT to lower automobile and light-duty truck GHG emissions. The state's 2008 press release stated, "Spending less time on the road is the single most powerful way for California to reduce its carbon footprint." SB 375 acknowledges that MPOs have an important role to play in reducing GHG. SB 375 set the following targets for the Bay Area: 7% per-capita GHG reduction by 2020 and 15% GHG reduction by 2035.

4A1. CTP2040 Scenario 3

At the state level, CTP2040 Scenario 3 (California Transportation Plan 2040[33], Scenario 3) provides bold leadership:

- 2040 transport GHG = 20% of 1990 emissions.
- Accelerate transport electrification.
- Reduce per capita VMT (vehicle miles traveled) by 17%
- Convert HOV2 to HOV3+ – convert two-person carpool (high-occupancy vehicle) lanes to three-person
- Double transit and biking.
- "Road capacity-enhancing strategies were rejected due to concerns these would ultimately increase VMT."

When functioning efficiently, an HOV3 lane will carry the same number of people as three general-purpose lanes.

California is the only state with a transportation plan that will meet Kyoto 2040 GHG targets. Alternative 3 is pro-climate, pro-health (active transport), pro-sharing, pro-collaboration, pro-efficiency, and pro-green jobs. Pro-petrol groups tend to frame such efforts as "anti-car." The pro-petrol groups backed Proposition 23 (in 2010, to suspend AB 32) and opposed portions of this year's SB350 to cut petrol use by 50% by 2030:

[31] Moving Cooler Executive Summary: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/MovingCoolerExecSummaryULI.pdf
[32] ULI: Urban Land Institute. APTA: American Public Transit Association. EDF: Environmental Defense Fund. NRDC: Natural Resources Defense Council.
[33] California Transportation Plan 2040 http://www.dot.ca.gov/hq/tpp/californiatransportationplan2040/

At Joint Venture's Sept 2015 Mobility Ecosystem Convening, Kate White, Deputy Secretary, California State Transportation Agency, explained, "In the state's long-term GHG modeling, pricing is the game changer. The GHG benefit is actually understated because a virtuous land use cycle is created. We are suffering from lack of pricing. We need to encourage pilots." Michael Cunningham, Senior Vice President of Public Policy for the Bay Area Council, added, "People will pay for relief from the agony of Bay Area driving."

4A2. Caltrans Strategic Management Plan 2015-2020

"Caltrans Strategic Management Plan 2015-2020" has even more aggressive short-term goals:

- Reduce state VMT/GHG by 15%
- Triple biking
- Double transit and walking

Caltrans has a modernization mission for a "safe, sustainable, integrated, efficient, and performance-driven system." [34]

There was even a California Environmental Protection Agency proposal to cut petroleum use in half by 2030.[35]

4A3. SB743 CEQA Reform Preferencing VMT over LOS

SB 743 (Steinberg, 2013) creates a new paradigm favoring VMT reduction over Level of Service (LOS).[36] Under the previous California Environmental Quality Act (CEQA), LOS has been applied in ways that discourage alternatives to driving and VMT reduction. "LOS can lead to ad hoc roadway expansions." Counterproductively, LOS "focuses on driver delay, not environmental impact." Expensive road widenings induce demand and "result in adverse environmental, public health, and fiscal impacts."

4B. Regional Mode Shift and VMT Reduction Policy

The Bay Area region now has the US's second-worst traffic congestion, after Los Angeles. The "pain" of traffic has gotten to the point where "business as usual" combined with expected 2M population growth will not cut it.

At the regional level, MTC (Metropolitan Transportation Commission) will complete a regional Plan Bay Area 2040 Update in 2017. MTC cannot meet GHG reduction targets (see bullets below) without bold action:

- 7% per capita GHG reduction by 2020 (does NOT include switch to electric vehicles)
- 15% per capita by 2035 (not including EV adoption)
- Nearly double transit and biking by 2040

Quantified MTC analysis has shown that some of the largest GHG reduction potential is from mode shift (in the short term, even more so than vehicle electrification). MTC Executive Director Steve Heminger is enthusiastic

[34] Caltrans Strategic Management Plan 2015-2020 http://www.dot.ca.gov/perf/library/pdf/Caltrans_Strategic_Mgmt_Plan_033015.pdf
[35] "Cutting Petroleum Use in Half by 2030," by California Environmental Protection Agency's Air Resource Board, http://www.arb.ca.gov/newsrel/petroleum_reductions.pdf
[36] Callfornia Governor's Office of Planning and Research, "Developing Alternatives to Level of Service, Discussion of CEQA Guidelines Changes," https://www.opr.ca.gov/s_sb743.php

about exploring bold, game-changing action on parking. Pricing private parking will be one part of the discussion. MTC's Regional Parking Pricing Project has undertaken a number of analytical and project funding actions.

Important Plan Bay Area topics:

- Pricing Strategies/Climate Policy Initiatives
- Performance Target 1: reduce per capita transport GHG by 15%
- Performance Target 9: increase non-auto mode share by 10% (double it)
- Improve Bay Area transportation funding

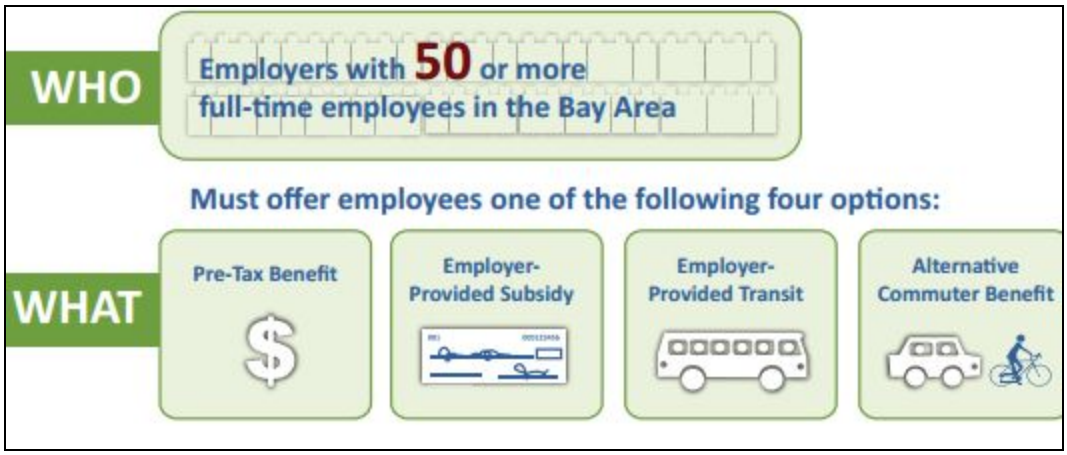
Summary table of adopted state and regional policy:

	Per capita VMT reduction	Transit goal	Bike goal
California Transportation Plan 2040	17%	Double	Double
Caltrans Strategic Management Plan 2020	15%	Double	Triple
SB 375 2030 Bay Area Target	15%		
Plan Bay Area 2040	15%	Double	Double

Bay Area Commuter Benefits Program [37]

SB 1339 (2012, Yee), the Bay Area Commuter Benefits Program, is a successful pilot program that is up for reauthorization in 2016 as SB 1128 (Glazer). Firms with 50 or more employees are required to provide one of four different commuter benefits options: pre-tax, employer subsidy, employer transit, or alternative benefit. (See figure below.) 82% of employers select the lowest-cost "Option 1." Enterprise Commute Trip Reduction (ECTR) software comprehends employer commuter benefits program requirements while providing a next-generation platform to shift mode. Hence, increased adoption of employer commuter benefits programs helps to accelerate our solution.

As of December 2015, 3,910 firms had registered for the program. Out of the Bay Area's 2.3M commuters, 1.3M are covered by a commuter benefits program, with SB 1339 responsible for 55%. An estimated 44,000 commuters (with the usual caveats about survey self-selection bias that overstates commute mode shift) have shifted mode away from SOV, for 1.8% Bay Area commute mode shift.



Four commute benefit options for employers with 50 or more employees

4C. Silicon Valley and University Trip Caps

[37] "Bay Area Commuter Benefits Program: Report to the California Legislature, Updated Feb. 2, 2016." http://www.cities21.org/dpwg/CommuterBenefitsReportToLegislature.pdf

At the city level, four cities have implemented “Trip Caps” on new office development and two cities have set aggressive TDM targets. Within the last two years, Menlo Park, Mountain View, Sunnyvale, and Cupertino implemented Trip Caps. San Mateo has a trip cap that will soon be implemented.

A “trip cap” restricts the number of commute trips into an employment site or into an employment area. For example, “Between 7AM and 9AM, Employer X may have no more than 2,600 vehicle trips. Hourly trip measurement must be provided to The City, using sensors at driveway entrances. For each trip above the cap, Employer X shall pay a penalty of $50 per day per trip. After noncompliance over 6 months, the fee increases to $100 per day per trip.”

Mountain View’s North Bayshore Trip Cap requires between 30% to 45% SOV, depending on the density of employment within buildings. One employer faces penalties of $100K for each 1% over the cap. Councilmember Kasperzak stated that “failure also requires the imposition of congestion pricing.” [38]

Sunnyvale ‘s Central & Wolfe Trip Cap is similar to Mountain View’s Cap, requiring about 50% SOV (35% reduction from ~76%). [39]

Menlo Park’s East of 101 (Facebook, etc.) Trip Cap requires about ~56% SOV (25% reduction), with a $50 penalty/trip/day. [40]

For Cupertino’s Apple Campus II, the trip cap reduces current 72% SOV down to 66%. [41]

The San Mateo Rail Corridor Transit Oriented Development Plan lays trip cap groundwork for new office entitlement to be enacted in a separate city council action:[42]

- Establishment of a corridor-wide trip reduction goal
- Required TMA membership
- A 30% commute trip reduction requirement for office within 1/4 mile of Caltrain (30% reduction from 80% SOV baseline is 56% SOV commute mode share)
- A 20% reduction for office within 1/2 mile of Caltrain (20% reduction equates to 64% SOV commute mode share)

It is expected that the council will address noncompliance in a manner similar to other Bay Area trip caps: a) initially require additional TDM measures be adopted, b) upon repeated noncompliance, penalize the occupant/owner for each trip above the cap. Trip generation is taken from the ITE Trip Generation Manual for suburban locations with ample parking, with an SOV commute mode share that is HIGHER than the US average from ACS 2009 (76.1% SOV, 10% carpool).

Trip Caps create a need for ongoing, accurate commute mode reporting and driveway car counting. Recent trip caps have not yet standardized on a preferred methodology. To address this issue, Appendix N provides a high-accuracy “one day snapshot” methodology. ECTR software is well-positioned to create daily commute mode dashboards to enable employers to view trends towards or away from trip cap penalties. In a 100%-mature FVC implementation, automated, 98%-accurate commute mode detection will provide data for ECTR commute dashboards (described in Chapter 6).

In Irvine, there is an active market “trading trips” between parcels within the greater Irvine Spectrum Center Trip Cap area.

Examples of University Trip Caps: Stanford, UW, UCLA

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[38] Mountain View 2015 North Bayshore Area trip cap: http://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=15164
[39] Sunnyvale Central & Wolfe TDM Plan: http://bit.ly/1NSV0Vd
[40] Menlo Park 2013 Facebook west campus trip cap: pgs 40-46: http://www.menlopark.org/DocumentCenter/View/2342
[41] In “Response to Comments Document: Apple Campus II EIR,” page 49. “Mitigation Measure TRANS-9b would require Apple to achieve a 34 percent alternative mode participation rate, as verified with peak trip counts at the buildout capacity of 14,200 employees.” If the peak is hit, additional TDM measures are triggered. From: https://s3.amazonaws.com/Apple-Campus2-FEIR/Apple-Campus-2-Project-RTC.pdf
[42] San Mateo Rail Corridor Transit Oriented Development Plan, Chapter 7G, Transportation Demand Management. http://www.cityofsanmateo.org/DocumentCenter/Home/View/1812

The pioneering Bay Area trip cap was the 1989 Stanford General Use Permit #1. The "GUP" allowed Stanford to grow by 2M square feet, with "no net new peak hour commute trips," plus a hard cap on total campus parking spaces. Noncompliance triggered intersection improvements. Stanford's commute program included parking charges, Marguerite shuttle bus, carpool incentives, vanpool services, bike services, and promotional activities. Stanford charged for parking permits at least as far back as 1975.[43] In 2000, GUP #1 was replaced with GUP #2, allowing a further expansion of 5M square feet with no net new peak hour commute trips.

Of note are two other University trip caps outside of the Bay Area:

For the University of Washington (UW) Seattle campus, the City of Seattle and UW agreed in 1983 to a trip cap on peak period vehicle trips and 24-hour volume. The 2003 Campus Master Plan[44] set the trip cap at 1990 levels, with noncompliance triggering additional trip reduction measures that applied until the cap is met. As of 2014, UW is about 20% below the cap. From 1989 to 2014:[45] a) Campus population grew, b) SOV mode share shrunk from 32% to 17.9%, c) Transit mode share grew from 21% to 42%, d) Carpool/vanpool mode share shrunk from 10% to 6%. In 2012, SOV commute mode for faculty, staff, and students was 45%, 34%, and 9%, respectively. 2014 campus mode split: 17.9% drive alone, 40.3% public transit, 6.5% carpool/vanpool, 6.9% bike, 26.7% walk.

An annual UCLA Cordon Count satisfies the requirements of the UCLA Long Range Development Plan (LRDP) and a 15-year Traffic Mitigation Monitoring Agreement (TMMA) that the University signed with the City of Los Angeles in 1991. The TMMA established a campus-wide trip cap[46] for average daily vehicle trips as well as AM and PM peak thresholds. At the time, the TMMA was viewed as a model for cooperative city-employer agreements, creating a balanced approach that linked the University's ability to construct new buildings on campus to maintaining an average daily vehicular trip cap under 139,500. An extensive Campus Automated Traffic Monitoring System was put in place to comply with the agreement, featuring sensors embedded at each of the multiple entrances to campus to automatically count vehicle trips. For each of the 15 years of the TMMA agreement, UCLA successfully remained below the agreed-upon daily trip cap. Although the TMMA agreement with the City of Los Angeles expired in 2006, UCLA still abides by the cap. Between 1990 and 2007, the employee drive-alone rate was reduced from 69% to 55%. The 2007 combined student/employee drive-alone rate was only 35%.[47]

The Annual Cordon Count, held during the busiest time of the year for vehicular traffic, is a week-long count of all vehicles entering and exiting the UCLA Main Campus and the UCLA Southwest Campus, including the Kinross Building, Rehab Center, and Weyburn Terrace graduate student apartments. A total of 22 vehicular access points are counted on the UCLA Main Campus and UCLA Southwest Campus, through "loop detectors" embedded within the pavement and pneumatic hoses. Vehicular traffic at the off-campus UCLA owned/occupied Wilshire Center high-rise building is counted using an agreed-upon method with the City of Los Angeles.

4E. The end of free workplace parking is inevitable

In the years 2002-2016, forward progress towards cashout,[48] transportation allowance, and eliminating free parking went almost nowhere. Most of Victoria Transport Policy Institute's (VTPI) exhaustive set of examples date from before 2002.[49]

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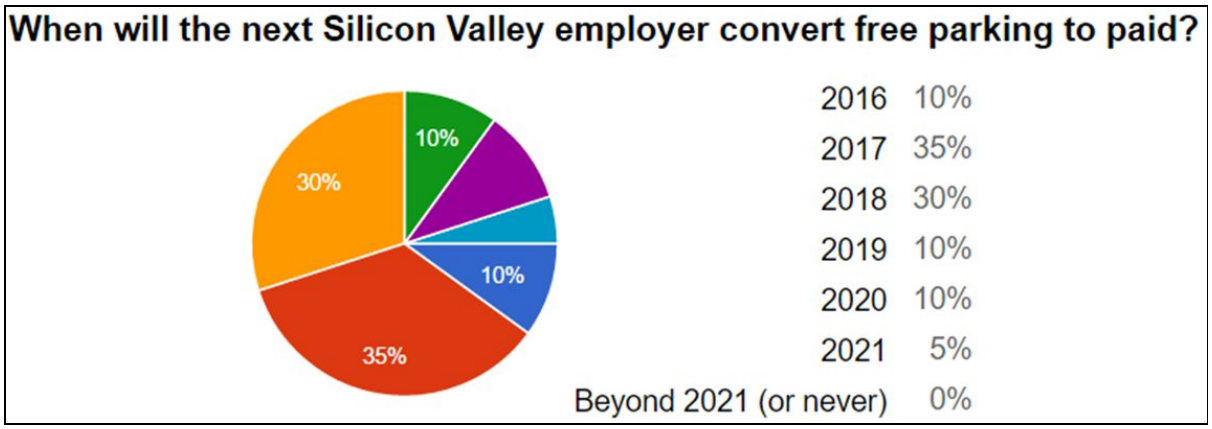
[43] From correspondence with Jeff Watchel, Senior Assistant to the President. "We have had parking charges as long as I have worked here, so that is 31 years. Also, we charged for parking when I was a student and that began in 1975."
[44] University of Washington Master Plan: Seattle Campus: Approved Compiled Plan, Jan. 2003. https://pm.uw.edu/sites/default/files/master-plan/2003_CMP/uw-2003-campus-master-plan.pdf
[45] University of Washington Master Plan: Seattle Campus: 2014 Annual Report https://pm.uw.edu/sites/default/files/master-plan/Annual_Reports/UW-Annual-Report-2014.pdf
[46] Thanks to Charles Carter, Sr. Communications Analyst, UCLA Transportation.
[47] PPT: "Long-Range Planning for a Green Transportation Program: The UCLA Experience, July 2008: http://s3.amazonaws.com/zanran_storage/www.universityofcalifornia.edu/ContentPages/13010712.pdf
[48] Parking cash out is a program that allows employees to opt out of having a parking space and instead receive compensation. The employer who leases (or owns) a space pays the employee not to park.
[49] Litman, Todd. Commuter Financial Incentives: Parking Cash Out, Travel Allowance, Transit and Rideshare Benefits. For VTPI. http://www.vtpi.org/tdm/tdm8.htm

In those past 15 years, in a car-loving US area (where "car-loving" is defined as 70% or greater SOV commute mode share), no employer converted from free employee parking to an explicit daily parking charge.[50] This would have entailed imposing a parking charge on employees that are used to free parking. Panasonic's 2013 move from free-parked New Jersey suburbs to $10/day Newark reduced SOV from 88% to 36%.[51] This virtuous move does not qualify as a conversion because Newark is not a car-loving location.

As previously mentioned, Silicon Valley is plagued by the nation's second-worst traffic. On May 24, 2016, at Palo Alto City Hall, Joint Venture convened 62 members of the commuting / mobility ecosystem representing cities (Palo Alto, Santa Clara, Cupertino, Redwood City, Fremont, San Mateo County), agencies (BAAQMD, C/CAG,[52] SamTrans, commute.org, Finland's innovation accelerator), vendors/innovators (Mercedes, GM, Ford, Luum, Xerox, vRide, Bike Leap, Scoop, Moovit, SPLT, Carma, Genze, EcoReco, BiCi), employers/developers (Intuit, Stanford, Microsoft, SAP, VMware, Moffett Park TMA, Irvine Company), consultants (AECOM, Nelson Nygaard) and NGOs (SPUR, Transform, Friends of Caltrain, Transdef, Menlo Spark).

A survey of these experts reveals that the pressure has built up to the point that free workplace parking may finally be about to come to an end:



This new finding that 75% of local experts believe "one employer will eliminate free workplace parking in the next 24 months" may serve to further accelerate this transition. i.e., if one employer will change, then more employers will consider whether to change. A tipping point away from free workplace parking could occur.

As far as eliminating free workplace parking, one mobility system expert opines, "We're getting closer, but there's still too much parking available in many of our office parks. Densification and mixed-use district development, such as planned in North Bayshore (Mountain View) and around Facebook in Menlo Park will help the change along. And we may need several of the large employers to implement paid parking at the same time so that there is no concern about employees leaving one place to go to another. Start at a low fee and link it with ECTR software so that employees can understand what's going on and what their options are."

Cupertino Councilmember Rod Sinks states, "Transportation is the number 1 or 2 issue in almost every Silicon Valley city. I have been helping to convene a unique coalition of Councilmembers and City Managers from 11 cities to work on our most pressing transportation issues. I will convene this executive group in a workshop to identify political obstacles to enacting 'four cities at once city-wide trip caps'" (a City Council ordinance to implement Fair Value Commuting and hence, to eliminate free workplace parking).

In 2012, Metropolitan Transportation Commission's Ann Flemer stated, "There is no question that the provision of free parking is a huge incentive for people to drive to work. A 2000 survey of Bay Area commuters found that while

[50] A query to CUTR's transp-tdm listserv practitioners produced zero examples of a conversion.
[51] Jaffe, Eric. How Panasonic Turned Car Commuters Into Transit Riders: It moved downtown and charged employees market rates for parking, among other things. For CityLab. Oct 27, 2015.
http://www.citylab.com/cityfixer/2015/10/how-panasonic-turned-car-commuters-into-transit-riders/412417/
[52] C/CAG: City/County Association of Governments of San Mateo County. BAAQMD: Bay Area Air Quality Management District

77% of commuters drove alone when free parking was available, only 39% drove alone when they had to pay to park. Additionally, among commuters with free parking, only 4.8% commuted by transit. By contrast, among commuters without free parking, 42% commute by transit." Transportation for America's James Corless: "Eliminating free workplace parking is the Holy Grail of trip reduction." (91% of Americans receive free workplace parking.)

4F. Local TDM and TMAs

Local TDM (transportation demand management) and TMAs (transportation management associations).

Palo Alto adopted an aggressive goal of reducing SOV by 30% in 36 months. The newly formed Palo Alto TMA "is tasked with the challenge of reducing Palo Alto's SOV traffic by 30 percent over a three-year period, by developing, managing and marketing transportation programs." [53]

San Jose's Envision 2040 General Plan prioritizes environmental leadership, increased transit use, and reduced local/regional traffic congestion. Envision 2040's TR-11 2040 VMT Reduction Goal calls for 40% reduction measured from 2009. Towards this VMT reduction, San Jose will:

- take a leadership role in working with the County, the Metropolitan Transportation Commission, Caltrans, VTA and other municipalities to establish congestion pricing for automobile travel through and within Santa Clara County. (TR 11.2)
- support a regional parking policy that levels the playing field and incentivizes local reforms. Undertake this in coordination with other regional climate/ smart growth strategies such as the Sustainable Communities Strategy. (TR 11.4)

To further reduce driving, the formation of Transportation Management Associations (TMAs) is accelerating. There are now 17 Bay Area TMA-like efforts:

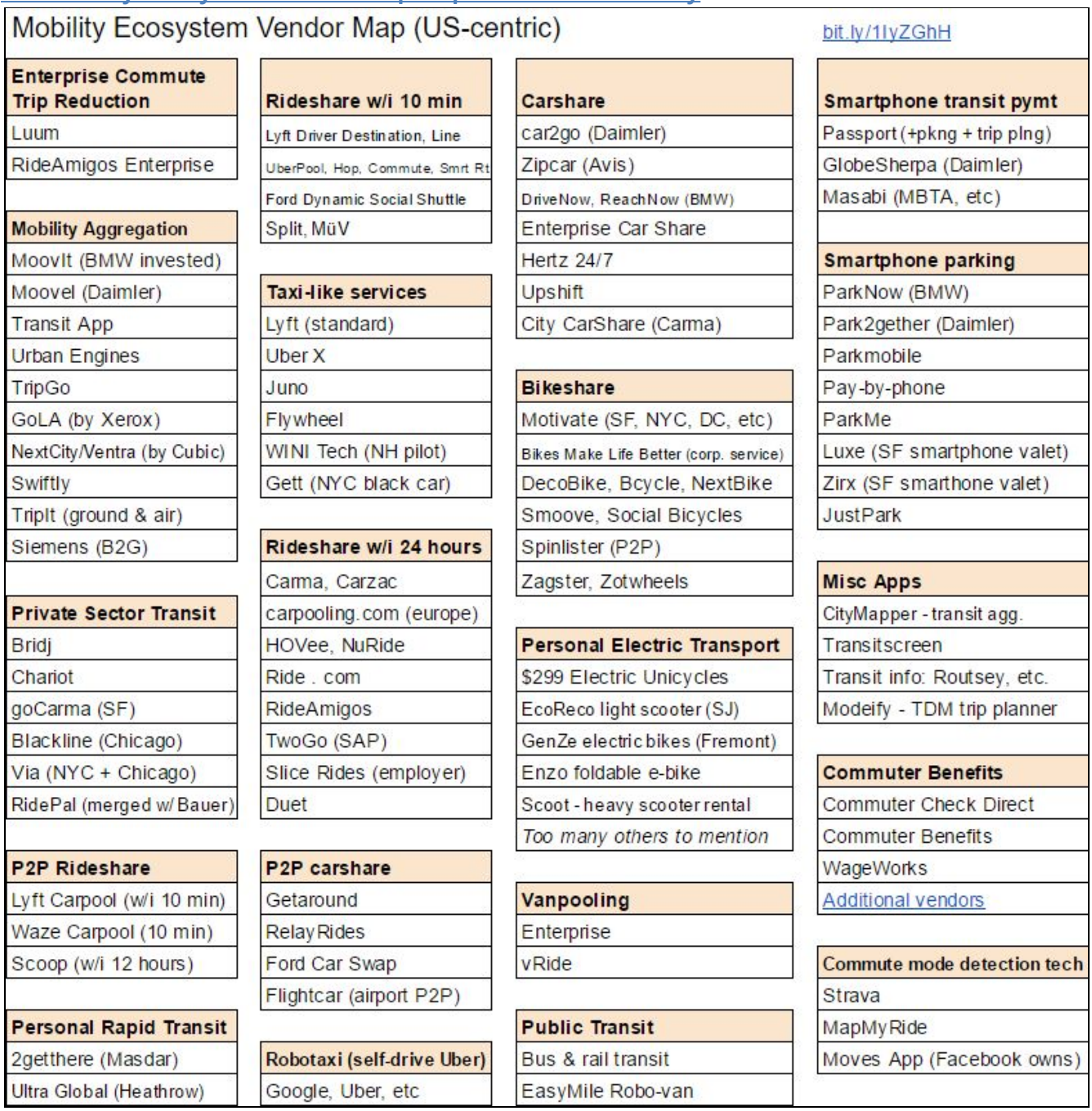
Bishop's Ranch TMA	Emeryville TMA
Mission Bay TMA	San Mateo Rail Corridor TMA
Contra Costa Centre Transit Village TMA	Hacienda (Pleasanton) TMA
Moffett Business Park TMA	TMA of San Francisco
Downtown Palo Alto TMA	Mountain View TMA
Berkeley Gateway TMA	Presidio Trust TMA
San Jose Altrans TMA	Sunnyvale Peery Park TMA
Stanford Research Park – TMA-equivalent effort	Marin County SMART – adopted TMA plan
Alameda Point – adopted plan for TMA	

SECTION II: ECTR AND THE MOBILITY ECOSYSTEM

Chapter 5: Mobility Ecosystem

[53] http://www.ourpaloalto.org/tma

5A. Mobility Ecosystem Vendor Map – spreadsheet taxonomy



Mobility Ecosystem Vendor Map (US-centric) bit.ly/1IyZGhH

Enterprise Commute Trip Reduction
Luum
RideAmigos Enterprise

Mobility Aggregation
MoovIt (BMW invested)
Moovel (Daimler)
Transit App
Urban Engines
TripGo
GoLA (by Xerox)
NextCity/Ventra (by Cubic)
Swiftly
TripIt (ground & air)
Siemens (B2G)

Private Sector Transit
Bridj
Chariot
goCarma (SF)
Blackline (Chicago)
Via (NYC + Chicago)
RidePal (merged w/ Bauer)

P2P Rideshare
Lyft Carpool (w/i 10 min)
Waze Carpool (10 min)
Scoop (w/i 12 hours)

Personal Rapid Transit
2getthere (Masdar)
Ultra Global (Heathrow)

Rideshare w/i 10 min
Lyft Driver Destination, Line
UberPool, Hop, Commute, Smrt Rt
Ford Dynamic Social Shuttle
Split, MüV

Taxi-like services
Lyft (standard)
Uber X
Juno
Flywheel
WINI Tech (NH pilot)
Gett (NYC black car)

Rideshare w/i 24 hours
Carma, Carzac
carpooling.com (europe)
HOVee, NuRide
Ride . com
RideAmigos
TwoGo (SAP)
Slice Rides (employer)
Duet

P2P carshare
Getaround
RelayRides
Ford Car Swap
Flightcar (airport P2P)

Robotaxi (self-drive Uber)
Google, Uber, etc

Carshare
car2go (Daimler)
Zipcar (Avis)
DriveNow, ReachNow (BMW)
Enterprise Car Share
Hertz 24/7
Upshift
City CarShare (Carma)

Bikeshare
Motivate (SF, NYC, DC, etc)
Bikes Make Life Better (corp. service)
DecoBike, Bcycle, NextBike
Smoove, Social Bicycles
Spinlister (P2P)
Zagster, Zotwheels

Personal Electric Transport
$299 Electric Unicycles
EcoReco light scooter (SJ)
GenZe electric bikes (Fremont)
Enzo foldable e-bike
Scoot - heavy scooter rental
Too many others to mention

Vanpooling
Enterprise
vRide

Public Transit
Bus & rail transit
EasyMile Robo-van

Smartphone transit pymt
Passport (+pkng + trip plng)
GlobeSherpa (Daimler)
Masabi (MBTA, etc)

Smartphone parking
ParkNow (BMW)
Park2gether (Daimler)
Parkmobile
Pay-by-phone
ParkMe
Luxe (SF smartphone valet)
Zirx (SF smarthone valet)
JustPark

Misc Apps
CityMapper - transit agg.
Transitscreen
Transit info: Routsey, etc.
Modeify - TDM trip planner

Commuter Benefits
Commuter Check Direct
Commuter Benefits
WageWorks
Additional vendors

Commute mode detection tech
Strava
MapMyRide
Moves App (Facebook owns)

Last updated August, 2016. Source[54]

This map will rapidly become obsolete. This map emphasizes alternatives to SOV commuting. Items left out of this map:

- Package delivery
- Niche ridematch: ZimRide, Otto, eRideShare
- SOV-focused apps: WAZE social traffic, Twist, Glympse
- Niche transport: Boost by Benz, Shuddle
- Paratransit
- Youth transport: HopSkipDrive

[54] A "live" Google Drive sheet is available on the web, with more current vendor info: http://bit.ly/1IyZGhH. Thanks to the CUTR transp-tdm listserv and other crowd-sourced contributors.

Chapter 6: ECTR Combined with MogAb

6A. European Consumer Mobility-as-a-Service (MaaS) vs. Fair Value Commuting (FVC)

Joint Venture's mobility initiative focus differs from European MaaS. The initial Silicon Valley thrust is for employer-centered next-generation CTR to meet "trip caps" and to also address climate and traffic congestion within a car-loving context. European efforts emphasize Mobility Aggregation smartphone apps with a backend supporting consumer purchase of monthly mobility plans, all within a transit-loving context where non-SOV modes thrive. FVC promises to scale up Silicon Valley mobility options, enabling pursuit of low-car European-style consumer-centered MaaS.

6B. ECTR feature set

Two of the five FVC components are:

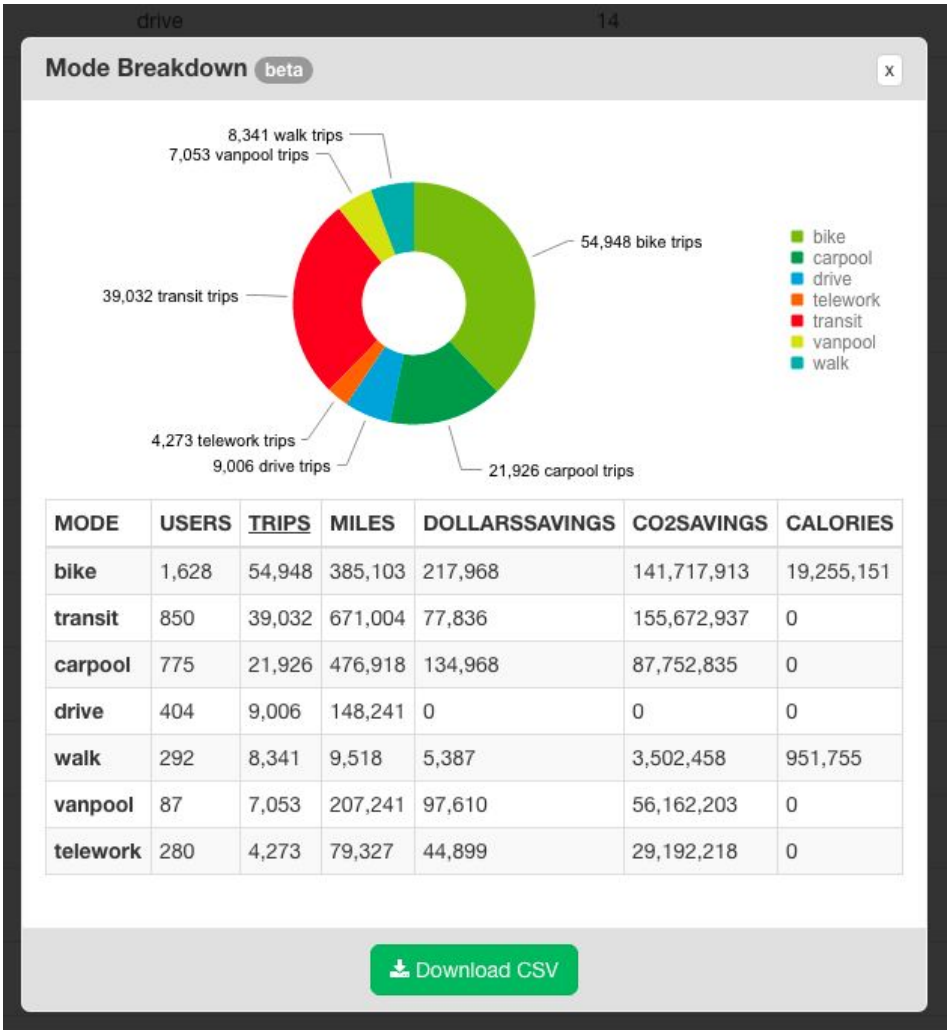
- Enterprise commute trip reduction software
- Smartphone mobility aggregation.

FVC requires integration between these two components.

ECTR software: a) meets the needs of employers in assisting employee commuting, b) expands upon current payroll commute benefits programs, c) provides a real-time commute mode split dashboard of all employee commutes, and d) allows for fine-tuning of fees to discourage single occupancy vehicle (SOV) and rebates/incentives to encourage non-SOV. ECTR software vendors include Luum and RideAmigos.

ECTR app feature set will include:

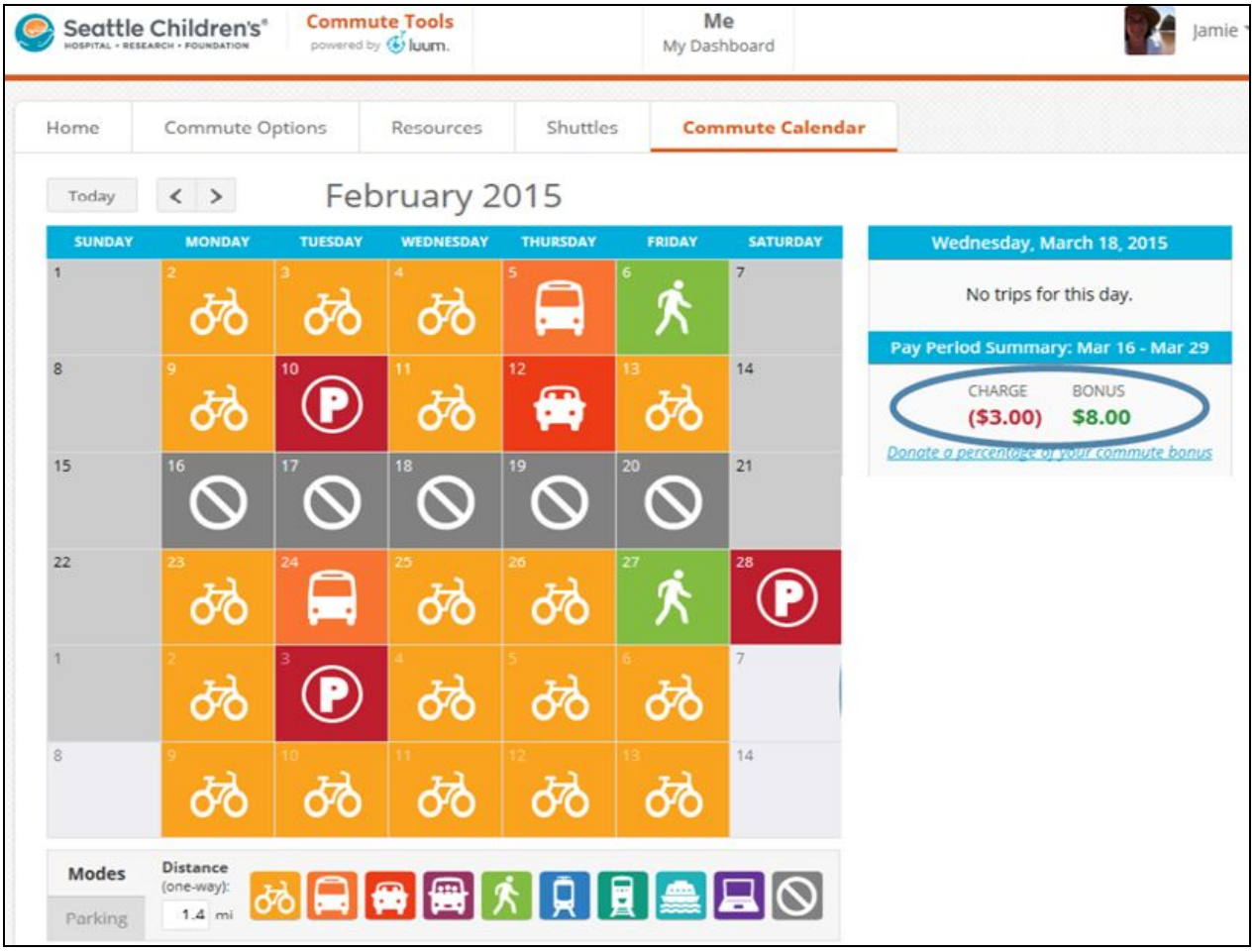
- Integration with one or more smartphone mobility aggregation apps.
- Real-time employer dashboard with commute mode split, GHG, carrot/stick accounting, and parking space utilization for all employees. Employer senior staff will not be able to access data on individual trips by individual employees. Only anonymized, aggregated data will be exposed to the employer. Strong data privacy / protection procedures will be followed.



MODE	USERS	TRIPS	MILES	DOLLARSSAVINGS	CO2SAVINGS	CALORIES
bike	1,628	54,948	385,103	217,968	141,717,913	19,255,151
transit	850	39,032	671,004	77,836	155,672,937	0
carpool	775	21,926	476,918	134,968	87,752,835	0
drive	404	9,006	148,241	0	0	0
walk	292	8,341	9,518	5,387	3,502,458	951,755
vanpool	87	7,053	207,241	97,610	56,162,203	0
telework	280	4,273	79,327	44,899	29,192,218	0

A portion of RideAmigos' daily commute mode dashboard showing all employee commutes

- Employer administration panel supporting: a) multiple benefit tiers of union/non-union employees, b) Customizable commute program intranet web portal.
- A per-employee commute calendar (and dashboard) supports daily commute mode tracking and provides an accounting of commute incentives and parking charges ("feebate") reflected in payroll processing. Informs employees of true cost of parking, subsidies, GHG, etc. Deep integration with major payroll systems such as ADP, Paychex, Workday, Oracle, SAP, and Ceridian is expected, with all payroll systems supported in a lightweight manner.



Luum's per-employee commute calendar shown for Seattle Children's. Right-hand column provides paycheck commute accounting

- Employer-centered ridematching (some ECTR apps may rely on Mobility Aggregator support for dynamic ridematching apps)
- E-bike/scooter loan-to-own, where an employee rents personal electric transport that transforms to ownership after a specified number of green commutes.
- Customer Relationship Management (CRM) combined with employee surveys, enabling geo-targeted commute program marketing within the context of each employee's obstacles.
- Employee intranet threaded commute chat boards for commuter rail, biking, major line-haul bus transit service areas, 10-20 mile ridesharing sub-regions (example: Google's internal "Carpoogler" ridematching chat board), 20+ mile ridesharing sub-regions.
- New employee on-boarding, to form green commute habits from Day 1
- Commute shed GIS (geographic information systems) mapping and commute option gap analysis (also called GIS cluster map analysis).
- Viable feebate-centered business model that scales to large and small employers at zero cost to the employer.
- Aggregated dashboards: large landowners, business parks, city-wide reporting, and region-wide reporting. ECTR apps will support open API for anonymized commute mode data export for creation of a single aggregated regional real-time dashboard. Aggregated dashboards should report on the number of employees covered versus the total number of employees. Individual commute trip origination/destination data will be anonymized by geocoding to the 1454 Bay Area traffic analysis zones (TAZ) which have an average of 5,000 residents within.
- Gamification.
- Standards-based support for top parking access hardware brands as well as custom implementations.

ECTR apps provide a wider feature set than their “commuter benefits only” cousins (Edenred, WageWorks, Commuter Check Direct, etc).

6C. Luum ECTR Case Study: From 50% to 40% SOV

In Seattle, Luum was formed by former Microsoft employees and US Olympians. Luum initially developed a corporate “good behavior challenge” gamified blood drive system.

Paulo Nunes-Ueno moved from managing King County Metro’s Commute Trip Reduction Program to Director of Transportation and Sustainability for Seattle Children’s Hospital. Working with consultancy Nelson Nygaard Associates, Paulo conceived an ECTR software concept and brought in a vendor called Parkio to develop the app. Nelson Nygaard Associates had been involved in specifying the feature set for an earlier ECTR system for Genentech’s commute program (with commute calendar and payroll integration). In 2013, Parkio was replaced by Luum. Nelson Nygaard Associates, Paulo and Luum worked closely as the software developed. Later Nunes-Ueno left to become Transit Division Director at Seattle Department of Transportation, making City of Seattle Luum’s second customer.

Nunes-Ueno was the ideal ECTR client and was instrumental in accelerating the ECTR space. He cared both about a) trip reduction for Seattle Children’s Hospital, and b) (because of his previous King County CTR role) developing a scalable software solution that could benefit all employers in King County. Nunes-Ueno participated in feature set brainstorming sessions with Luum and Nelson Nygaard, offering Luum the opportunity to undertake as much of the CTR system as desired. Nunes-Ueno also had Children’s Hospital take on part of the responsibility, focusing on a high-touch bicycling program with bike route planning, free bike tune-ups, first bike commute trip “buddy rides” to ease in new bike commuters, discounted bike accessories, and free 21-speed bikes. Children’s Hospital also created a GIS commute shed map for geo-targeted gap filling.

Luum’s Children’s Hospital implementation features: parking garage access hardware integration, tiers of commute benefits for union/non-union staff, real-time cloud-based Hospital-wide commute dashboard (parking space utilization, benefits accounting, daily commute mode split, peer-employer comparisons), automated bike commute tracking via Strava and MapMyRide, a carrot/stick feebate (integrated with payroll processing) including a phased transition away from monthly to daily parking charges, Orca transit pass card “re-filling,” an employee shuttle bus smartphone app, a one-stop employee commute tools/assistance web portal, a cloud-based employee commute calendar (with performance tracking, accurate GHG impact, and carrot/stick accounting), employer administration panel with detailed accounting by commute tool/activity, new employee onboarding (the best time to change behavior is before the first day of employment), ridematching, vanpooling, guaranteed ride home, (discounted) Zipcar integration, “carpool multi-badge garage swipe with fair apportionment of parking charge,” and gamification. The implementation shifted mode from 50% to 40% SOV between November 2013 and March 2014.[55]

Any two employees can carpool and access the parking structure. Both badges are read by the reader. Luum then distributes the parking charge, 50% to each employee.

In addition to Luum, RideAmigos has an ECTR software implementation for Southern California’s Century City TMO (transportation management organization serving the 44,000-job center) as well as some incipient Bay Area customers. The feature set includes ridematching, web portal, commuter dashboard, gamification, surveys, and GIS cluster map analysis.

6D. Smartphone Mobility Aggregation MobAg feature set.

MobAg software provides a smartphone app with a seamless combination of public/private transit/microtransit, bikeshare, rideshare, carshare, vanpool, and electric scooter/bike “loan-to-own,” with smartphone e-payment. MobAg apps integrate next-generation mobility services including Lyft, Uber, Scoop, ZipCar, and Car2Go. MobAg vendors include Moovit, Transit App, Urban Engines, TripGo, Swiftly, Ventra by Cubic / Moovel / GlobeSherpa,

[55] HHI Series - Lessons from a Leader: Transportation Planning for 21st Century Health Care Seattle Children’s “Conscious Commute”, presentations by Paulo Nunes-Ueno and Luum’s Michelle Rosenthal. Recorded On: 11/05/2014. http://bit.ly/290TgNF

Xerox (GoLa), and Siemens

MobAg apps for iPhone/Android have been around longer than ECTR, but they are not yet compelling for commuting in car-loving locations. FVC will make MobAg more compelling.

- By end of 2016, one MobAg app will likely support: public and private transit; Carma ridesharing; Motivate bike share; Lyft Line and Flywheel; Car2Go, DriveNow, and Zipcar carsharing; and smartphone e-ticketing (in some US regions).
- A second app will likely aggregate: public and private transit; Motivate bike share; UberPool; Car2Go and DriveNow; and smartphone e-ticketing (in some US regions).

Graphic depicting typical MobAg features, aggregated services, and user interface

MobAg Feature Set will include:

- Automated commute mode reporting/detection (98% accurate [56]) including differentiating between biking, SOV, and low-tech carpooling. The private sector is progressing this crucial Value Commuting technology. During travel, smartphones provide a time-stamped sensor stream with GPS, accelerometer, and gyroscope data. To illustrate the challenge, imagine Person 1 and 2 carpooling on the freeway with Person 3 tailgating behind them. 98% accurate mode detection reports Persons 1 & 2 carpooling and distinguishes that Person 3 is SOV, without running the phone battery down too far.[57] Detection will be an "opt-in" feature. Lower tech reporting options may also be deployed. For example, to validate bike commuting, Luum integrates with smartphone biking exercise tracking apps Strava and MapMyRide.
- Reporting of commute modes using e-payment. For modes where e-payment is made, the path from mobility service to MobAg to ECTR is a straightforward software integration problem (using open standard GTFS-SUM APIs). Where commute mode will be detected by the MobAg app, detected mode will be

[56] One of our partner employers has set this accuracy requirement.

[57] Three mode detection papers: 1) "Overcoming Battery Life Problems of Smartphones When Creating Automated Travel Diaries," April 2014. Jariyasunant, Sengupta, and Walker. http://uctc.net/research/papers/UCTC-FR-2014-05.pdf. 2) "Using Smartphones to Perform Transportation Mode Determination at the Trip Level," TRB 2012 Paper #12-3606. Parlak, Jariyasunant, Sengupta.3) "Quantifying transit travel experiences from the users' perspective with high-resolution smartphone and vehicle location data: Methodologies, validation, and example analyses," Transportation Research Part C, 2015. Andre Carrel.

relayed via open standard API to ECTR apps. Commute mode detection will be an employee “opt-in” feature.

- Pay for transit with smartphone (e-ticketing), especially tap and pay using near field communication (NFC).
- Better planning for three-mode trips. For a three-mode San Francisco to Mountain View commute using Lyft Line to Caltrain commuter rail to bikeshare, a) pre-book and pay for all three modes, ensuring that a bikeshare bike will be waiting, b) rather than suggesting impractically expensive San Francisco to Mountain View single mode Lyft trips (many current planners have this problem), bias the planner towards three mode trips with first mile, line haul, and last mile.
- For multi-mode trips, provide real-time "hand holding" at transfer points to ensure that the connection between modes is made without the traveler getting lost or missing the next part of the journey.
- Provide opt-in alerts so you don't miss your station/stop, to the point of waking you up if you fall asleep on the train (future phone operating systems and sensors will be able to sense if you are asleep).
- Use stored ECTR funds to pay for trips (via integration with an ECTR app).

6E. Expected ECTR/MobAg evolution

In the future, we expect three or more combinations of ECTR integrated with Mobility Aggregation. Faster-than-realtime intelligent agents {Siri, Google Now, Cortana} may further advance the customer experience, by understanding an individual’s context and accessing their calendar to plan trip-making on behalf of the individual.

Standalone mobility aggregation in car-loving locations does not appear to have a strong business case. Joint Venture is proud to have married ECTR to Mobility Aggregation, developing a scalable business model that has energized the industry.

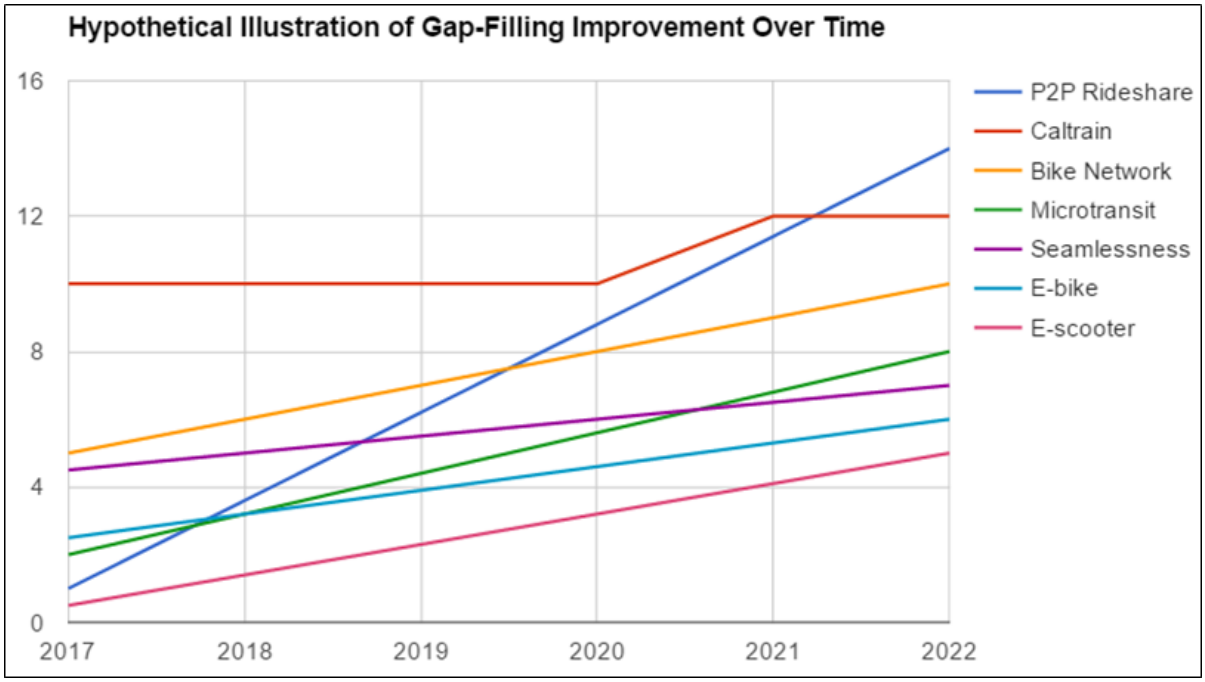
Chapter 7: Gap Filling

“Gap Filling” describes geographic information systems (GIS) analytics to identify commute vectors[58] with poor alternatives and the subsequent attempts to improve options for those vectors. As Fair Value Commuting’s (FVC) “similar-to-Stanford revenue-neutral workplace parking feebate” shifts commute mode, innovative services become more financially viable to fill gaps. Gap-fillers include: low-income transit subsidies, e-scooter first/last mile,[59] Lyft/Uber first/last mile, increases to commuter rail capacity, bike network analysis/improvements to reduce stress, e-bikes for 5-10 mile commutes, peer-to-peer rideshare (IE Scoop, Lyft Carpool, and WAZE RideWith), public microtransit (VTA Flex), private microtransit (Bridj, Chariot), private motorcoach (RidePal), telecommuting, and autonomous first/last mile public microtransit (EasyMile).

In a hypothetical FVC scenario where feebate implementation commences in 2017 and gradually shifts commute mode away from SOV over five years, the efficacy of gap-fillers increase at different rates depending on how well they scale. A conceptual (incorrect, but useful for illustrative purposes) efficacy measure is provided as the left-hand axis. “Seamlessness” denotes customer-experience improvements to public transit:

[58] “commute vector”defined: commute origination/destination pair

[59] “first/last mile” defined: The “first mile” problem addresses traveling from home to transit over a distance of zero to two miles. The “last mile” problem addresses traveling from transit to work over a distance of zero to two miles.



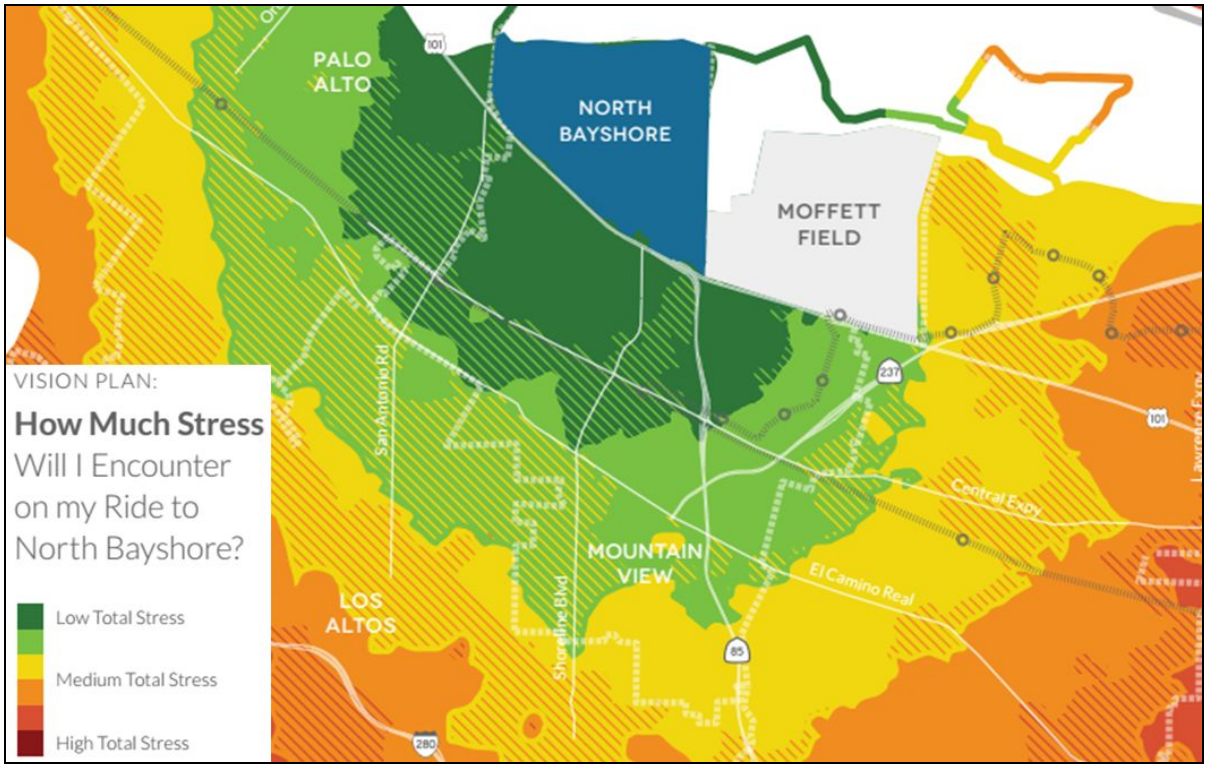
Below is an explanation of select gap-fillers:

7A. Gap-Filling: Bike route stress reduction (improve the bike network)

Google, Silicon Valley Bicycle Coalition, and Alta Planning have teamed to increase the attractiveness of bike commuting (and bike first/last mile to/from transit) with their Bike Vision Plan.[60] Joint Venture Silicon Valley has joined the team to expand the project to cover all of Silicon Valley.

The project has pioneered a map-based analytics tool, the "Bike Network Stress Test," to measure rider stress level by route:

[60] Google North Santa Clara County Bike Vision Plan, Spring 2015.
http://altaplanning.com/wp-content/uploads/Google-Bike-Vision-Plan_high_res.pdf



Output from the Bike Network Stress Tool[61]

The project has identified low-cost techniques to mitigate high stress points and Google is providing $5M matching funding for such improvement projects, with an overriding objective of making Silicon Valley as bike-friendly as Copenhagen.[62]

Key points from the Bike Vision Plan:[63]

- The reasons people chose not to ride are varied, but a key factor is the state of today's roads and bike network.
- 60% of Silicon Valley population can be classified as "Interested but Concerned" and will only bicycle on low-stress streets, having low tolerance for high-stress streets or intersections.
- The Bike Network "4Cs:" Continuity, Connectivity, Convenience and Completeness: Bike networks must be **continuous**: too many bike lanes in the United States disappear at intersections and other stressful spots. Bike networks must **connect**: a single gap in an otherwise complete bike route can discourage potential bicyclists. Bike networks must be **convenient**: people won't ride bikes to key destinations if they must go far out of their way. It is also not enough to provide a network of bicycle facilities without also considering what happens when a bike ride ends. A successful network includes sidewalks, safe intersections, and access to transit and bike parking. This design approach is sometimes called "**Complete Streets**".

To attract "Interested but Concerned," obstacles such as "high stress streets" and "unfriendly intersections" must be overcome:[64]

- High-stress streets are those with multiple lanes and speed limits of 35 mph or more. Many streets that have bike lanes are also high-stress; building traditional bike lanes on such streets simply isn't enough to get more people riding bikes. High-stress streets are often designed for driving speeds well above the posted speed limit, discouraging all but the most confident of bicyclists. High-stress streets can also act as barriers to bicycling, with easy crossings only possible at intersections with traffic lights.

[61] ibid
[62] Business Insider: "Google's bike plan aims to turn Silicon Valley into the next Copenhagen," by Chris Weller, June 26, 2015. http://www.businessinsider.com/google-wants-silicon-valley-as-bike-friendly-as-copenhagen-2015-6
[63] Google North Santa Clara County Bike Vision Plan
[64] ibid

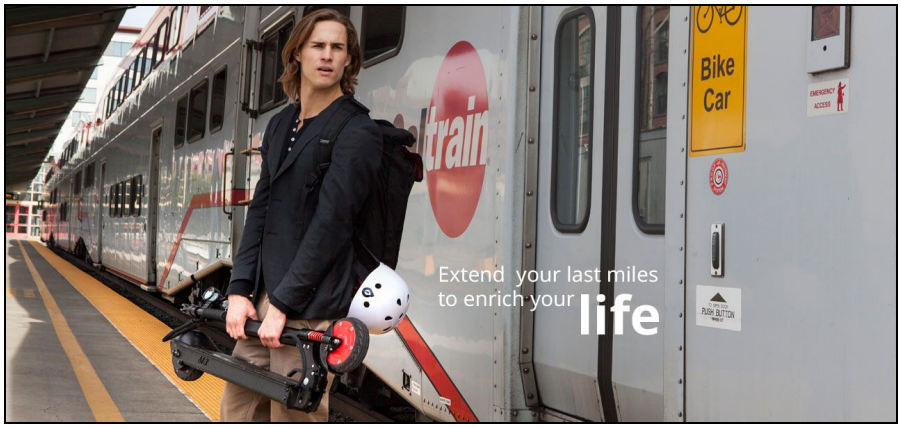
- In addition to geographical barriers and high-stress streets, the design of intersections strongly influences who chooses to ride a bicycle. There are a number of ways intersections can be unfriendly to bicyclists:
- Bike lanes end before reaching the intersection
- Bike lanes merge across lanes of traffic
- Freeway on-ramps or off-ramps
- Uncontrolled crossings of multi-lane roads
- High-speed right-turn lanes (aka slip lanes)

A bicyclist waits for the signal on Shoreline Boulevard at Middlefield Road. Despite both streets having bike lanes, only the most experienced and confident residents would feel comfortable riding a bike through this intersection.

Image courtesy Bike Vision Plan

7B. Gap-Filling: Electric bikes and electric scooters

In the Bay Area, e-scooters offer an alternative for short commutes of 0 to 3 miles as well as providing first/last mile to transit. Caltrain commuter rail's bike car is often full, whereas foldable e-scooters can fit by a rail traveler's' feet.



2,000 mpg-equivalent EcoReco Electric Scooter shown as first mile to Caltrain Commuter Rail

The e-scooter sector is experiencing rapid product enhancement combined with ongoing battery price/performance increase. In a 40-participant Silicon Valley pilot,[65] e-scooter overall trip mode share was a significant 14%, with average trip distance of 1.9 miles. Participants listed price as the top purchase concern, indicating that $900 and below was an attractive price point. FVC envisions accelerating the market further by using revenue from the $3/per day workplace parking SOV fee to allow the ECTR vendor to finance e-scooter inventory. The vendor will provide a "loan-to-own" incentive." Commuters rent scooters and, as a bonus, obtain ownership of a scooter after a specified number of e-scooter-based commutes are undertaken.

genZe Electric Bike breaks the $1,500 price point

Google and Stanford both have extensive CTR programs, but find that commuting from 5-to-10 miles away has the highest SOV mode share compared to shorter and longer distances. Both are evaluating e-biking to fill this gap to reduce SOV share. In a Silicon Valley pilot,[66] e-bike overall trip mode share was 17%, with an average trip distance of 5.4 miles. As with e-scooters, participants also listed price as the top e-bike purchase concern, setting $1,500 and below as an attractive price point. Compared to biking, participants felt e-bikes provided a speed/exertion advantage as well as an enhanced ability to commute wearing work clothes.[67] Fair Value Commuting loan-to-own applied to e-bikes should further accelerate e-bike commute mode share increase.

FVC loan-to-own envisions scaling up lower-priced, lower-performing e-bikes, as opposed to top-end models with the highest speeds. Average bike rider speed is 6.5 mph whereas average e-bike speed is 8.3 mph. The average top speed is 16.0 mph for conventional bikes and 15.8 for e-bikes. E-bikes traveling above 20 mph are encouraged (or required) to avoid bike lanes. Some top-end e-bikes can travel at 28 mph in human-assist mode, where the human is pedaling vigorously. E-bikes are heavier than conventional bikes, so are slower than conventional bikes when used for exercise with the motor turned off. [68]

7C. Gap-Filling: Autonomous, zero-emission first/last mile transit

Contra Costa Transportation Authority (CCTA) is pioneering/piloting driverless first/last mile public transit, using EasyMile[69] autonomous, zero-emission electric shuttles. This new transit mode is also called Shared Autonomous Vehicles (SAV). This technology offers an innovative, new approach to helping travelers get to transit stations, business districts and other local amenities without the hassle of driving and parking, which could be a replicable solution for many urban and suburban communities.

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[65] Association for Commuter Transportation - Northern California Chapter, "Shared Use Mobility and the Future of TDM Conference," – UC Berkeley, October 2015. Within presentations PDF, see pages 70-82, "Electric Bikes and Electric Scooters as Alternative Transportation Modes: A Pilot at Stanford, by Xin Jiang. http://bit.ly/2arwo8U

[66] ibid

[67] "Electric Bikes and Electric Scooters as Alternative Commute Vehicles, A Pilot at Stanford,"by Xin Jiang, for Stanford Precourt Institute's Energy Transform Collaborative, March 12, 2015. https://stanford.box.com/shared/static/nyccnaldqzcucn2lf9lk2bd3v0tdu2uz.pdf

[68] MacArthur, John. "Are e-bikes faster than conventional bicycles?," for Portland State TREC, 11/26/2014. http://trec.pdx.edu/blog/are-e-bikes-faster-conventional-bicycles. California e-bike laws explained in: Logemann, Alex. "New e-bike law passes in California." For People for Bikes. October 2015. http://www.peopleforbikes.org/blog/entry/new-e-bike-law-passes-in-california.

[69] http://easymile.com/

EasyMile electric, self-driving first/last mile public transit

The application of electric SAV shuttles for complementing and integrating with traditional modes of transit in Contra Costa County, including BART and fixed route transit such as Community Connect, is a natural extension of autonomous vehicle technology into the sphere of public transportation. Public transit agencies face growing public frustration with inadequate parking at major transit centers such as BART stations, and the lack of reliable connections which negatively impact ridership targets.

Contra Costa County includes a number of city centers and business parks which represent opportunities for synergistic application of SAV shuttles during peak hours, including the Bishop Ranch business park.The Bishop Ranch SAV Shuttle Program will enhance transit system ridership and contribute to modal shift and the overall optimization of the County's transportation network. Other key benefits include significant health benefits due to a reduction of GHG emissions coupled with economic benefits that will result from high paying jobs.

7D. Gap-Filling: Peer-to-peer (P2P) within-10-minute ridesharing

Chapter 2B explained the lack of scale for dynamic rideshare in car-loving locations. Fair Value Commuting promises to increase demand for these services. Peer-to-peer ridesharing lowers the cost, creating a more attractive commute option.

In March of 2016, beyond Lyft Line and Lyft Driver Destination, Lyft announced commute-focused Lyft Carpool service with initial rollout on the Bay Area's highly-congested Highway 101. Lyft Carpool taps into a completely different population of drivers (peers instead of professional drivers) by facilitating the act of picking up a complete stranger on the way to work, and getting paid to do it (similar to Avego pilots from the past). Drivers who want to participate have to share details about their daily commute with Lyft. Then, before they're ready to leave for work, they receive a push notification asking if they would like to pick up a potential passenger along the way. If they agree, they can then use the High Occupancy Vehicle lane along Highway 101, and earn up to $10 for the trip, while the passenger will pay $4-$10 for the ride. Based on the route information and Lyft's big data analytics, Lyft Carpool will never send drivers more than a few minutes out of their way to pick up riders.

Scoop peer-to-peer ridesharing is being offered to Cisco's 15,000 San Jose employees, with Cisco providing a subsidy to lower the cost farther.[70] Scoop's system matches the afternoon before the next morning's commute. As far as public ridership statements, this Scoop/Cisco implementation holds the world suburban P2P on-demand carpooling record. Ridership has grown by 100X in 8 months since Oct 2015 launch, approaching 10,000 Cisco "matched users" per month. By Scoop's definition, two or more "matched users" are required for a carpool commute trip. For Cisco's 15,000 employees, this represents about 0.6% commute mode share. In October of 2015, Scoop revealed their previous public record in Pleasanton's Hacienda Business Park, with more than 20 roundtrip carpools per day, with focus on carpool formation from Oakland residences to Pleasanton jobs. Other P2P ridematching services such as Lyft Carpool have not made public statements about ridership.

[70] https://blog.takescoop.com/2016/03/01/cisco-to-sponsor-1dollar-rides/

Google's WAZE Carpool also provides peer-to-peer ridesharing in the Bay Area.

7E. Gap-Filling: Low-income subsidy

For low-income commuters, reduced cost can make a commute option more compelling. Some examples:

- San Francisco's Muni Lifeline provides a 50% discount to low income residents[71] making less than 200% of the Federal Poverty line. Muni also provides free passes to low-income seniors and disabled residents.[72]
- Seattle Metro Transit's ORCA LIFT program[73] provides transit discounts across multiple public transit operators to low-income residents. Low income adults obtain youth fares.
- Florida's City of Altamonte Springs provides a 20% subsidy for residents who use Uber and a larger 25% subsidy to incent Uber first/last mile connection to SunRail public transit.[74]

7F. Gap-Filling: Telecommuting

Telecommuting can be a compelling commute option for some workers, especially when employers encourage it. CityLab states US telecommuting commute mode share is now 4.5%.[75] Bay Area telecommute share is 5.4%.[76]

3.7 million employees (2.8% of the workforce) now work from home at least half the time. Regular work-at-home, among the non-self-employed population, has grown by 103% since 2005. The employee population as a whole grew by 1.9% from 2013 to 2014, while employees who telecommute population grew 5.6%.[77]

Separate from telecommuting, about 22% of the self-employed population work primarily from home. That population (self-employed and home-based) declined by 3.4% since between 2005 and 2014. Sources[78]

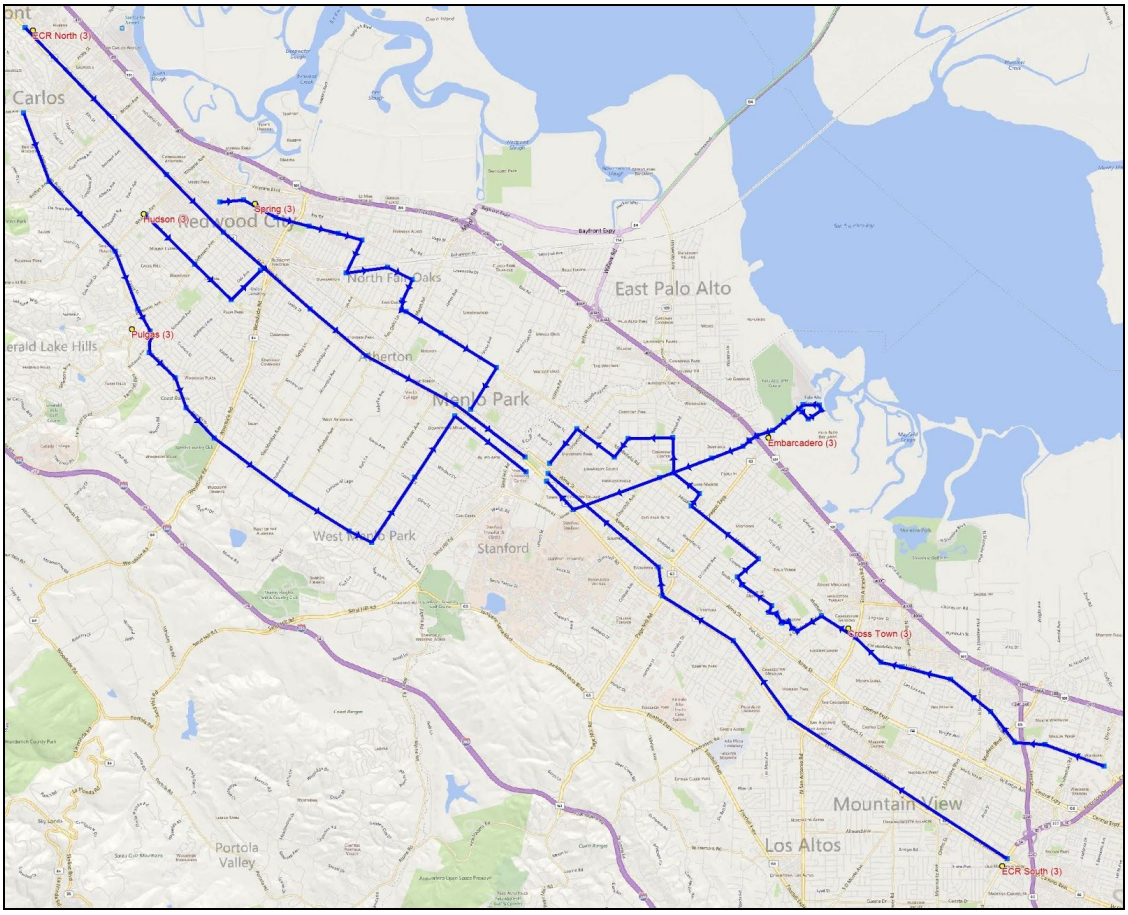
Obstacles to increased telecommuting include high-tech workplace cultural expectations, management oversight issues, and remote communication challenges.

7G. Gap-Filling: E-scooter assisted fixed-route rideshare

For car-loving areas, even with the impressive ridesharing analytics of Lyft, Uber, Waze, Scoop, etc., there is still the Needle in the Haystack Problem (Appendix A). E-scooter first mile to designated rideshare pickup points could collect multiple passengers at a single spot and reduce route deviation, improving efficiency. E-scooters also provide similar promise for the last mile. E-scooters could not only improve private auto rideshare services, but could also improve van-based services. An e-scooter can provide a two-mile catchment radius around designated pickup points, reducing the number of pickup spots on a given route.

A rough sketch of one potential application is shown below. The application targets four to eight-mile commutes via fixed arterial route where e-scooters fixed major arterial routes. Seven routes are sketch to pickup Silicon Valley residents and deliver them to Palo Alto Caltrain station, downtown Palo Alto jobs, and Marguerite-shuttle served Stanford campus jobs:

[71] Muni Lifeline: https://www.sfmta.com/getting-around/transit/fares-passes/low-income-lifeline-pass
[72] http://sanfrancisco.cbslocal.com/2015/01/20/sfmta-votes-to-give-free-muni-rides-to-disabled-low-income-seniors/
[73] http://seattletransitblog.com/2016/02/29/two-new-services-for-orca-lift-tuesday-other-fare-increases/
[74] http://fortune.com/2016/03/03/uber-subsidy-public-transportation/
[75] http://www.citylab.com/commute/2015/09/where-telecommuting-is-on-the-rise/407959/
[76] http://www.vitalsigns.mtc.ca.gov/commute-mode-choice
[77] From: http://globalworkplaceanalytics.com/telecommuting-statistics
[78] Ibid



Chapter 8: Autonomous Vehicle Future

8A. "Level 3 read-a-magazine freeway robocar"

There is significant speculation by non-planners about the impact of self-driving cars, or robocars, on different aspects of life. The major automakers have all explicitly stated a desire to sell "read-a-magazine while the car drives itself on the freeway" products (stop and go cruise control with lane keeping with regulatory approval for the car to self-drive with an inattentive human in the driver seat). Market penetration of such products is difficult to predict. One forecast foresees 5% market penetration in 2025.

States Toyota's Ken Laberteaux, "U.S. history shows that anytime you make driving easier, there seems to be this inexhaustible desire to live further from things." This means private self-driving cars on freeways will induce sprawl - building new homes with long commutes far from jobs. In transportation planning, this is a well-understood phenomenon and can be expected for early robocar market penetration (e.g. from 0 to 15%). As Stanford's Sven Beiker points out, robocars may grab market share from public transit, further increasing congestion. In a Fehr & Peers paper, 25% robocar market share is expected to induce 5 to 10% more VMT. In California Air Resources Board's paper, VMT is expected to increase because of rebound effect, sprawl, and mode capture from transit. VTPI's Todd Litman forecasts induced demand, induced sprawl, reduced social equity, and deviated focus from immediate/better transportation solutions.

The induced demand problems with robocars are likely in the the 2016-2030 time-frame. The promised benefits are more likely to begin to scale up in 2025 and beyond. Please refer to Appendix E for details.

"Level 3" refers to SAE automated vehicle classifications: SAE Level 3: "Within known, limited environments (such as freeways), the driver can safely turn their attention away from driving tasks." [79]

8B. Level 5 Robotaxi first/last mile and Robovan line-haul transit

Likely beginning around 2023, limited deployments of SAE Level 5 autonomy will arrive. SAE Level 5: "Other than setting the destination and starting the system, no human intervention is required. The automatic system can drive to any location where it is legal to drive." [80]

A Level 5 "robotaxi" is defined as "Uber with a robot driver." Geofenced robotaxi first/last mile systems will likely commence within areas encompassing less than 20 square miles (ensuring short trips). For system efficiency, higher occupancy (UberPool) is desirable.

A Level 5 "robovan" is defined as "Bridj with a robot driver." Compared to a 50 passenger bus, 10 to 16 passenger robovan transit will have ¼ the cost per passenger mile, four times the frequency, and flexibility for route deviation.

In car-loving locations, there is small demand for Uber and Bridj and hence, limited demand for robotaxi/van. At scale, FVC provides critical mass for Uber and Bridj and will likewise accelerate demand for robotaxi/van.

SECTION III: Options, Enactment, Systemic Obstacles

Chapter 9: Ranking Congestion Pricing Policy Options

(Please refer to Appendix L for details.)

Between December 8-10, 2015, an expert process ranked eight different congestion pricing policies, first on "political viability," and then on a weighted score across five dimensions (congestion reduction, GHG reduction, cost-effectiveness, equity, and implementation ease). An initial part of the process determined how much weight for each expert to apply to each of the dimensions. The process represented one of the first applications of the Delphi Method to congestion policy as well as a novel trade-off between policy dimensions.

Towards meeting state/regional/local VMT/GHG reduction objectives, there is an immediate need to compare potential Bay Area congestion reduction policies that may be implemented in the next decade. A ranking process creates a rational "frame" for policy tradeoff-making, reducing the tendency towards unproductive one-dimension-at-a-time objection-seeking.

Congestion pricing is sometimes used to help pay for new infrastructure or to help balance a budget. In contrast, the expert process examined policies with an even larger behavioral impact in order to meet state/regional/local GHG/VMT reduction objectives.

[79] https://en.wikipedia.org/wiki/Autonomous_car
[80] ibid

The expert process found that FVC's "similar-to-Stanford revenue-neutral workplace parking feebate"[81] ranked second for political viability out of eight reduction policies. Pay-as-you-drive auto insurance scored slightly ahead of feebate on viability. As more FVC deployments succeed, the viability score of feebate is expected to overtake pay-as-you-drive.

The eight congestion reduction policies that were ranked:

1. $5/gal gas tax increase with 10 year phase-in
2. $0.20/mi Road User Charge with 10 year phase-in
3. Pay As You Drive auto insurance
4. Widespread job center $5 cordon entry charge
5. $5/day workplace SOV parking charge
6. $5 per day workplace non-SOV incentive (or "cashout")
7. $3.33/day workplace SOV parking charge with non-SOV incentive (Fair Value Commuting)
8. San Mateo Highway 101 HOT3 + express bus + TDM

The first three are statewide, the last five are for the Bay Area Region.

The experts were:

- Bay Area Council: Michael Cunningham, SVP Public Policy
- MTC: Rebecca Long, Senior Legislative Analyst. Formerly Senior Fiscal and Policy Analyst, California Legislative Analyst's Office
- FHWA: Allen Greenberg, Senior Policy Analyst, Congestion Management and Pricing Team, Author of papers on PAYD, parking pricing, dynamic ridesharing, etc. Leads Value Pricing Pilot Program.
- Washington State DOT: Brian Lagerberg, Dir Public Transit with CTR leadership and expertise. Rob Fellows, Toll Planning and Policy Manager
- Joint Venture Silicon Valley: Steve Raney, Executive Director, Smart Mobility

The resultant scores, ranked first by political viability and second by weighted score are presented below. Scoring is 1 for "low" and 5 for "high." Political viability above 2.5 is promising:

viability > 2.5 is promising	Political Viability	Political reqt	Weighted Score	Congestion/GHG
3. Pay-As-You-Drive auto insurance	3.3	State ballot initiative (simple majority)	3.3	-8% VMT/GHG
7. $3.33/day SOV + non-SOV incentive (feebate)	3.0	Legislature vote (simple majority)	3.6	-28% SOV, -4% GHG
6. $5 per day non-SOV incentive (carrot only)	1.3	Legislature vote (simple majority)	3.3	-14% SOV, -2% GHG
5. $5/day workplace parking charge	1.3	Local ballot measure (2/3 vote)	2.8	-28% SOV, -4% GHG
8: San Mateo 101 HOT3 + express bus + TDM	1.3	County sales tax (2/3 vote) + project prioritization	2.6	-15% hwy 101 SOV, -0.2% GHG
1. $5/gal gas tax increase (10yr phase in)	1.0	Legislature vote (2/3 vote)	4.1	-28% VMT/GHG
2. $0.20/mi Road User Charge (10yr phase in)	1.0	Legislature vote (2/3 vote)	3.4	-28% VMT/GHG
4. Widespread job center $5 cordon entry charge	1.0	Local ballot measure (2/3 vote)	2.9	-28% SOV in cordons, -4% GHG

The five dimensions contributing to the weighted scores were weighted as shown in the table below (the sum of the weights must be 100%):

[81] For "similar-to-Stanford feebate" to be implemented, we assumed that the five component Fair Value Commuting solution would be implemented.

WEIGHTED SCORE: WEIGHTING

Congestion Reduction	GHG Reduction	Cost-Effectiveness	Equity	Implementation ease
20.6%	25.6%	15.8%	19.0%	19.0%

The summarized dimensional and weighted scores are provided below:

	Congestion Reduction	wt	GHG Reduction	wt	Cost-Effectiveness	wt	Equity	wt	Implement-ation ease	wt	Weighted Score
1. $5/gal gas tax increase (10yr phase in)	4.60	21%	5.00	26%	4.80	16%	1.20	19%	5.00	19%	4.14
2. $0.20/mi Road User Charge (10yr phase in)	4.80	21%	4.60	26%	2.80	16%	2.40	19%	2.00	19%	3.41
3. Pay-As-You-Drive auto insurance	2.20	21%	2.00	26%	4.60	16%	4.60	19%	3.80	19%	3.32
4. Widespread job center $5 cordon entry charge	3.40	21%	2.40	26%	3.20	16%	3.40	19%	2.40	19%	2.91
5. $5/day workplace parking charge	3.20	21%	2.40	26%	3.60	16%	2.60	19%	2.20	19%	2.76
6. $5 per day non-SOV incentive (carrot only)	2.80	21%	2.00	26%	4.20	16%	4.60	19%	3.80	19%	3.29
7. $3.33/day SOV + non-SOV incentive (feebate)	3.40	21%	2.80	26%	4.80	16%	4.00	19%	3.80	19%	3.64
8: San Mateo 101 HOT3 + express bus + TDM	2.80	21%	2.00	26%	3.00	16%	3.40	19%	2.20	19%	2.57

The expert process was intended to spur the organizations involved to undertake formal versions of the process with buy-in from their executives and board members. The initial results provide an informative baseline showing how the Delphi Method may be applied to ranking congestion policies. Expert comments are encapsulated within this appendix, providing further guidance for future processes. It is thought that the results from formal versions of the process will not differ substantially from this first, informal process.

For methodology, descriptions of the 8 policies, expert comments, and weighting criteria, please refer to Appendix L.

Chapter 10: Legislative Path to Enact Fair Value Commuting

Project collaborator Stefan Heck has identified a “Prisoners Dilemma” that prevents employers from eliminating free workplace parking to shift commute mode - rational employers do not cooperate even though it is in their best interest. Transportation for America’s James Corless (formerly with MTC) piles on by stating, “eliminating free workplace parking is the Holy Grail of trip reduction.” Our project offers a solution to this Prisoners Dilemma.

Fair Value Commuting Maturation

As of Summer 2016, FVC is 40% of the way towards being a 100% mature, scalable solution. Joint Venture’s 24-month project aspires to mature the solution by:

- Collaborating directly with the top vendors (ECTR, MobAg, Gap Filling) that contribute to FVC by enhancing software/hardware feature sets and interoperability
- Demonstrating FVC in a real-world setting at 11 employers with more than 27,000 employees.
- Collaboratively analyzing commute patterns to pilot new gap-fillers such as low-income subsidy and loan-to-own.

Our project consortium consists of 31 members including cities, counties, agencies, vendors, employers, and NGOs. One capstone deliverable makes a consortium-wide conclusion about FVC's maturity-level.

For employer carrots and sticks commute policy, a tipping point is approaching (See Chapter 4D). A progression may first move to "explicit SOV charge transportation allowance," a form of transportation allowance that closely resembles parking cashout:[82]

- The employer uses ECTR software to administer the transportation allowance
- Each commuter is given $3 per day commute allowance from their employer
- If they bike, walk, or "traditional carpool" they keep it the $3/day as income
- If they commute via SOV, the explicit charge is $3 per day, so the commuter is no worse off
- If they use an employer provided transit pass (Caltrain GoPass, VTA EcoPass, etc), the per day value is greater than $3. For use of this pass, the employer charges the employee $3 per day, IE the commuter is not further incentivized to use transit.
- If they use pretax commuter benefits, they accumulate employer subsidy for their next pre-tax purchase of transit pass, vanpooling, Lyft for Work, or other qualifying modes.[83]

From "explicit SOV charge transportation allowance," the next step may be to move to "small $0.25 per day stick with large carrot." Such a workplace parking feebate would not be revenue-neutral, but would be impactful in moving FVC feebate policy closer to 100% maturity. One can envision an employer negotiating a small carrot / large stick commute program with employees, where a large majority of employees favors the program.

10A. State bill to enact Fair Value Commuting

Joint Venture does NOT participate in transportation policy making or advocacy, as this is the domain of MTC, Air District, Bay Area Council, SVLG, VTA, SPUR, etc.

As part of Joint Venture public policy research, we have developed a draft state bill entitled "Downward Sliding Commute Trip Cap to Reduce Bay Area Congestion 25%."

Bill Summary:

- Within the last two years, the cities of Menlo Park, Mountain View, Sunnyvale, and Cupertino enacted "trip caps" on new development projects. These trip caps motivate employers to adopt strategies to reduce their employees' SOV commute mode share. If a trip cap is exceeded then remedies and/or penalties are triggered. This bill extends the flexible, performance-based trip cap concept city-wide, with noncompliance causing an employer to adopt Fair Value Commuting with "similar-to-Stanford revenue-neutral workplace parking feebate."
- The policy is phased in over 3 years. 1,000-employee firms first, 250-employee firms last. The SOV cap begins at 80% SOV, decreases by 2.5% every 2 months, and has a 50% SOV floor. For non-compliant employers, a "revenue-neutral workplace feebate" is triggered, requiring SOV parking charges, beginning at $0 and increases by $0.25 every 2 months, capped at $3.00.

[82] Parking cash out is a program that allows employees to opt out of having a parking space and instead receive compensation. The employer who leases (or owns) a space pays the employee not to park.

[83] https://en.wikipedia.org/wiki/Employer_transportation_benefits_in_the_United_States

Month	1000+ SOV cap	1000+ SOV fee	250-999 SOV cap	250-999 SOV fee
1	80.0%	$0.00		
3	77.5%	$0.25		
5	75.0%	$0.50	80.0%	$0.00
7	72.5%	$0.75	77.5%	$0.25
9	70.0%	$1.00	75.0%	$0.50
11	67.5%	$1.25	72.5%	$0.75
13	65.0%	$1.50	70.0%	$1.00
15	62.5%	$1.75	67.5%	$1.25
17	60.0%	$2.00	65.0%	$1.50
19	57.5%	$2.25	62.5%	$1.75
21	55.0%	$2.50	60.0%	$2.00
23	52.5%	$2.75	57.5%	$2.25
25	50.0%	$3.00	55.0%	$2.50
27			52.5%	$2.75
29			50.0%	$3.00

As the SOV cap decreases, the feebate SOV fee increases. Also shown is how the phasing commences for firms with 1,000 or more employees, with mid-sized firms (250-999 employees) following five months later

10B. Step-by-step Legislative path

Should policymakers (Joint Venture is NOT involved) choose to advance Fair Value Commuting, enactment can occur in six steps as follows:

Step 1. A few Silicon Valley City Councilmembers chat and agree to pursue this solution. A solution "hackathon" is held to delve into the policy and address concerns. Councilmembers leave the hackathon feeling comfortable with the solution.

Appendix J includes a project partner letter from City of Cupertino Councilmember Rod Sinks. "Transportation is the number 1 or 2 issue in almost every Silicon Valley city. I have been helping to convene a unique coalition of Councilmembers and City Managers from 11 cities to work on our most pressing transportation issues. I will convene this executive group in a policy research workshop to identify political obstacles to enacting 'four cities at once city-wide trip caps.'"

Step 2. The Councilmembers meet with a sympathetic State Legislator to request enabling legislation. In 1995, Federal and California policy prohibited Mandatory Employee Commute Option programs. Enabling legislation very narrowly peels back the prohibition. The Legislature is sympathetic to enabling cities to innovate to meet state-mandated SB 375 VMT/GHG reduction targets. Appendix J includes a support letter from State Assemblymember and Speaker Pro Tem Kevin Mullin.

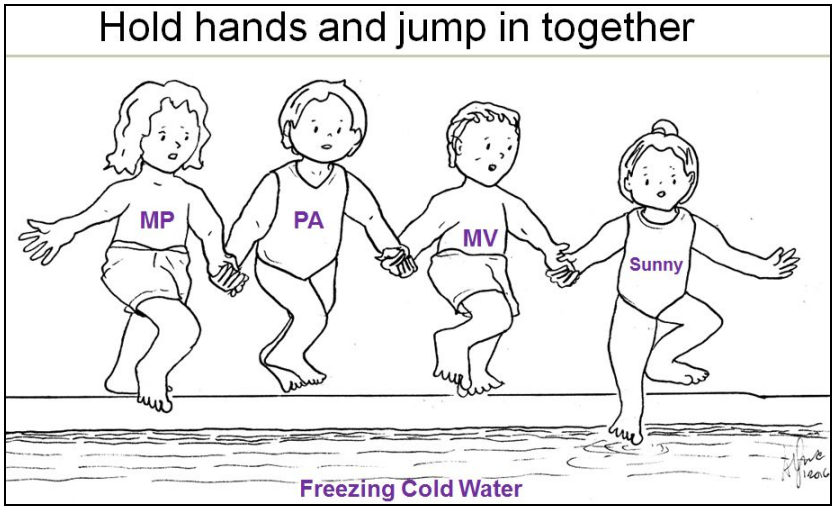
Step 3. The draft "Sliding Trip Cap" bill can be found in Appendix K. The bill has been refined by MTC, BAAQMD, and State Assembly Transport Committee. State Legislative Counsel developed an "unbacked" bill and has opined that the bill does not trigger a Proposition 26 [84] supermajority, so can be passed with simple majority votes by the two State Legislature branches. Many other congestion policies trigger Proposition 26.

The narrow state bill might face political opposition from California Chamber of Commerce, California Manufacturers & Technology Association, Chevron, Exxon, Shell, and other organizations with petrol lobby affiliation. The bill's revenue-neutral-to-employers provision should neutralize Americans for Tax Reform, California Taxpayers Association, and Howard Jarvis Taxpayers Association. Messaging about the solution's

[84] Ballotpedia: "California Proposition 26, Supermajority Vote to Pass New Taxes and Fees (2010)," https://ballotpedia.org/California_Proposition_26,_Supermajority_Vote_to_Pass_New_Taxes_and_Fees_(2010)

progressive transfer of wealth from high-income to low-income citizens should appeal to social justice organizations, but this is always a sensitive topic.

Step 4. The “gang” of Councilmembers takes the proposal public with a coordinated strategy:



A cartoon depicting coordination by councilmembers from Menlo Park, Palo Alto, Mountain View, and Sunnyvale. The political fear of congestion pricing is akin to the fear of jumping into freezing cold water.

5. Cities and employers join with Joint Venture in piloting the Fair Value Commuting solution. Pilots help staff develop hands-on experience with the solution while improving staff commutes (increasing employee retention). From hands-on experience, city staff can report Findings to Council on the viability, efficacy and scalability of the solution.

6. Multiple cities pass city-wide Sliding Trip Cap ordinances with a simple majority vote by Council. As far as the political dynamics of many Silicon Valley cities, residents are fed up with commute traffic and are enthusiastic about reducing in-commuting by non-residents.

10C. Feebate efficacy arguments

“Feebate” definition: A) A system of charges and rebates whereby energy-efficient or environmentally friendly practices are rewarded while failure to adhere to such practices is penalized. B) A self-financing system of fees and rebates that are used to shift the costs of externalities onto those market actors responsible.

An effective feebate substantially increases use of energy efficient products/services while decreasing use of less-efficient products, often creating increased consumer demand and a voting supermajority for accompanying/enabling infrastructure/services such as electric vehicle charging, bike lanes, public transit, etc. A key insight is that “feebates make things possible” whereas standalone investments in accompanying infrastructure/services may suffer from lack of demand and hence, may be less cost-effective and less politically viable.

For Frequently Asked Feebate Questions, please refer to the FAQ in Appendix I.

(Repeated from Section 4C) In 2012, MTC’s Ann Flemer wrote, "There is no question that the provision of free parking is a huge incentive for people to drive to work. A 2000 survey of Bay Area commuters found that while 77% of commuters drove alone when free parking was available, only 39% drove alone when they had to pay to park. Additionally, among commuters with free parking, only 4.8% commuted by transit. By contrast, among commuters without free parking, 42% commute by transit." When he was still an MTC employee, Transportation for America’s

James Corless said, "Eliminating free workplace parking is the Holy Grail of trip reduction." (91% of Americans receive free workplace parking.)

“Silicon Valley is insane. We charged for parking in New York City, so we should consider charging here.” - VTA Genl Mgr Nuria Fernandez (ex NY MTA COO).

"Eliminating parking subsidies has enormous potential to reduce traffic congestion and GHG. Changes to parking policy are cost-effective and can reduce traffic and GHG more than all other strategies combined.” - US Congress’s Alan Lowenthal.

Please refer to Appendix H for feebate efficacy details encompassing:

- 41 TDM Case Studies from Best Workplaces for Commuters
- Transportation Elasticities from VTPI,
- Moving Cooler report,
- Implementations by Stanford, 20th Century Corp, and CH2M Hill.

Please refer to Appendix J for Feebate supporting letters from: SVLG, MTC, VTA, SamTrans, Governor's Office of Planning & Research, Transform, and Sierra Club.

As far as employer progress towards workplace parking feebates (the key to injecting money and behavior change into the market), Panasonic implemented a combination of carrots/sticks at their New Jersey HQ, reducing SOV (single occupancy vehicle) mode from 88% to 36% while raising transit from 4% to 57%. [85] In addition, as explained in Chapter 4D, 75% of Silicon Valley experts “free workplace parking will begin to end in the next 24 months” and this knowledge may serve to further accelerate this transition.

10D. Feebate social equity

Analysis of worldwide social equity is complex. One billion affluent humans, including Californians, overproduce GHG creating future harm to six billion less-affluent, lower-emitting humans in other countries. Hence congestion pricing policies that are economically regressive on Californians may still be economically progressive for humanity on the whole. One report on worldwide GHG equity is a recent Oxfam report entitled “Extreme Carbon Inequality.” [86] The report states that the poorest 50% of humanity will bear the brunt of climate impacts. The richest 10% of the world produce 50% of GHG and poorest 50% produce only 10% of GHG.

Realpolitik Bay Area notions of equity focus on Bay Area low-income voters (as well as Central Valley in-commuters) while dismissing consideration of impacts on non-US poor.

A disproportionate percent of low-income household budget goes to transport, therefore increases in transport costs have a disproportionate impact and are economically regressive. A ranking of eight congestion reduction policies, including Feebate, on social equity can be found in Appendix L. Feebate scores high on social equity.

First, for Feebate, high-income commuters have high value of time so are more likely to have an SOV commute and pay the SOV fee, whereas low income commuters are more likely to receive the non-SOV rebate for green alternatives. Second, high-income commuters have higher current SOV mode share than low-income commuters. One US-wide analysis[87] shows 73% SOV for average commuters and 63% SOV for low-income commuters. Third, the policy envisions compassionate exceptions for low-income workers. Fourth, Feebate won’t apply to baristas and commuters who do not work “9 to 5” jobs. Fifth, even for low-income commuters living in “transit deserts,” Don Shoup’s studies have shown that congestion pricing induces carpooling, a non-SOV mode that is available in transit deserts. In short, Feebate is a progressive net wealth transfer from high-income to low-income commuters. However, within this progressive structure, there are winners and losers: some low-income commuters are made worse off.

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[85] How Panasonic Turned Car Commuters Into Transit Riders: It moved downtown and charged employees market rates for parking, among other things. By Eric Jaffe, Oct 27, 2015 (article: http://bit.ly/1icNbz3)

[86] https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/mb-extreme-carbon-inequality-021215-en.pdf

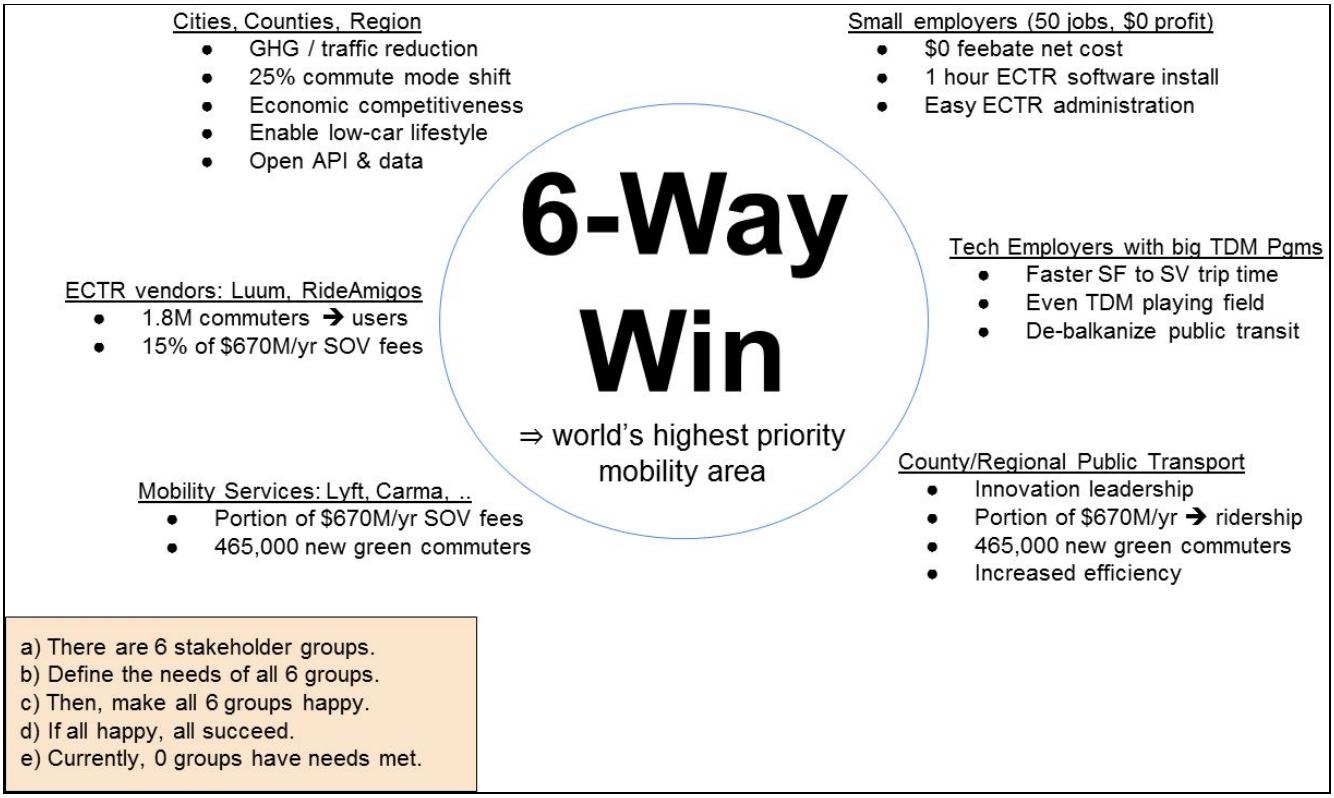
[87] “How Lower Income Citizens Commute,” Feb 2012, http://www.newgeography.com/content/002666-how-lower-income-citizens-commute

To further increase equity, congestion policies may (should) be married with low income transport/mobility subsidies. See Chapter 7E for examples (Muni Lifeline, ORCA LIFT, etc).

10E. Compelling business model & six-way win

In analyzing the very small market for private sector mobility services in car-loving locations, vendors have expressed enthusiasm for a legislative path to dramatically increase market size. Profit-motivated private sector mobility firms are not currently willing to expend significant resources on heretofore lost suburban causes.

Within the mobility ecosystem, there are six crucial stakeholder groups that all need to gain. Our solution provides a "six-way win" with significant profit motivation for the private sector to make Silicon Valley their highest priority market:



With FVC's no-cost-to-employer revenue-neutral workplace parking feebate:

- Fees are collected from SOV commuters
- The ECTR vendor takes 15% of that SOV revenue
- The remaining 85% of that SOV revenue is rebated to non-SOV commuters
- Non-SOV commuters apply their rebates to transit, ridesharing, first/last mile, e-bike/scooter, etc. Each non-SOV commuter uses the rebate in the most effective manner for their individual commuting context.[88] Non-SOV modes compete to be the best solution to receive the most rebate.
- Evidence shows that a $3/SOV/day feebate will shift SOV commute mode from 75% to 50%.

Some important considerations to create the six-way win:

- Provide large traffic/GHG reduction at no cost to cities/counties
- The majority of employers will not budget for CTR, hence FVC is constrained to be no-cost-to-employer
- FVC fills empty transit seats and creates demand for new service, without new marketing expense

[88] Commuting context encompasses origination location, destination location, come departure time, budget, opportunity cost, travel comfort preferences, etc.

- FVC creates critical mass for innovative mobility services to thrive in car-loving areas (the vast majority of the US)
- In comparison to the current ECTR business model, FVC improves the business model, motivating faster feature set build-out.

For hypothetical example calculations, WidgetCo is an employer with 185 employees, 100 SOV commuters and 85 non-SOV commuters. On a typical weekday, 100 SOV commuters are each assessed a $3 fee, resulting in $300 SOV revenue. The ECTR vendor takes 15% of $300, or $45. The remaining 85% of $300, $255, is rebated to the 85 non-SOV commuters, for a $3 per non-SOV commuter rebate. WidgetCo installed the ECTR software as a plug-in to WidgetCo's payroll processing system. WidgetCo paid nothing for ECTR installation, nor does WidgetCo accrue any ongoing ECTR cost. Of the 85 non-SOV commuters, 51 apply their rebate to public transit, 17 apply the rebate to Lyft Carpool, and 17 pocket their rebate via bicycling.

For more details on the business model, with discussion of special cases and exceptions, please refer to Appendix K, "Draft State Bill," which includes implementation guidance and feebate schedules.

10F. VMT reduction & Cost-efficacy: Negative Cost of -$558/tonne GHG reduced

Demand-reducing policies have the potential to be "cost-negative," providing more value in benefit than in the cost to implement.

Fair Value Commuting costs:
- Minimal implementation cost per employer
- Minimal government implementation cost, with counterbalancing benefits from improved transport planning data

There are multiple estimates of benefits for each VMT reduced. Allen Greenberg, FHWA's "Non-toll Driving Pricing Expert," provides an estimate of $0.211 societal benefit for each VMT reduced,[89] broken down as follows:
- $0.101 broad societal benefit from reduction of: congestion, crashes, criteria air pollutants, noise, and GHG.
- $0.11 individual driver benefit from reduced gas and auto insurance costs

At scale, Fair Value Commuting (FVC) reduces 3.4B Bay Area VMT and 1.3M GHG tonnes per year. At Greenberg's $0.211 societal benefit per VMT reduced, FVC provides societal benefit of 725M/year at a negative cost per ton of GHG removed of -$558:

[89] "Designing pay-per-mile auto insurance regulatory incentives," Allen Greenberg, Transportation Research Part D: Transport and the Environment, Volume 14D, 2009, pages 437-445. See also "Potential Changes in Emissions Due to Improvements in Travel Efficiency – Supplemental Report: Analysis of Potential Co-Benefits, US EPA Office of Transportation and Air Quality, EPA-420-R-11-014, September 2011, https://www3.epa.gov/otaq/stateresources/policy/420r11014.pdf

Greenhouse Gas Reduction

	Bay Area Scale	Sources, calculations, comments
# commuters	2,968,000	ACS'09: 130M/306M=42.4% commute. Bay Area pop: 7M
% participation	69.0%	White paper Sect K3A, 69% of jobs in firms w 50+ employees
% commuters w free parking	91.0%	9% of commuters pay to park & have already shifted mode
# participating commuters	1,863,607	
Nominal commute mode shift away from SOV	25%	See Section 10C and white paper Appendix H.
# commuters go green	465,902	

GHG/SOV commute/yr calc

Avg one-way commute dist (mi)	14	NHTS'09: 11.8mi, cities21.org/BABPC: 18.2mi. So adjust up
Avg mpg (cars, SUVs, trucks)	24	25.5 mpg 2016 new car/SUV. Existing fleet lags significantly.
Gal per 2-way SOV commute/day	1.17	
Pounds GHG/gal	20	fueleconomy.gov/feg/contentIncludes/co2_inc.htm
Pounds GHG / metric tonne	2,204	
Annual commute days/commuter	240	
Gal/SOV commute/year	280	
Pounds GHG/SOV commute/year	5,600	
Tonnes GHG/SOV commute/year	2.54	
Total tonnes GHG reduced/year	1,183,780	

VMT/SOV commute/year	6,720	commute days * one-way dist * 2
Total VMT reduced/year	3,130,860,096	

Societal benefit per VMT reduced	$0.21	Per Allen Greenberg, FHWA
Total annual benefit	$660,611,480	
Benefit per tonne/reduced	$558	

Square feet per parking space	350	Includes landscaping and travel lanes
Parking spaces freed	465,902	# of commuters go green
Acres of parking freed	3,743	SF * spaces / 43,560
Value Bay Area office land/acre	$3,000,000	
Value of free parking land	$11,230,415,289	Number could be decreased for structured parking

# participating commuters	1,863,607	
SOV fee revenue/year	$670,898,592	# commuters * 50% SOV share * 240 days * $3/day

Calculations

The GHG benefits from a nominal 25% green commute mode shift are overstated as the new modes that commuters switch to have emissions. For a first example, mode shift to existing bus transit service currently running with empty seats has almost zero addition impact, whereas once a new bus must be added to service the higher demand, then the GHG of that bus should be included. As a second example, a shift to carpooling increases commute distance slightly for first/last mile actions. Further, a two-person carpool roughly cuts GHG to 50% of previous, whereas a three-person carpool roughly cuts GHG to 33% of previous.

10G. Regional leadership roles in congestion policymaking

There may be an additional systemic need for a leading NGO (a Policy Leading NGO or "PLN") to "wrangle" the political ecosystem to enact congestion reduction. Joint Venture Silicon Valley does not undertake transportation policy leadership, so is not a candidate.

At the September 24, 2015 Joint Venture Mobility Ecosystem Convening #3, SPUR's Ratna Amin identified the "regional political wrangling gap." The cities and major employers have not coalesced around a consensus congestion reduction policy. Because every entity is pursuing their own interests, the cities/employers have minimal regional influence. Assuming that a PLN can develop a consensus, then cities/employers can exert sufficient political influence to direct regional policy analysis towards the preferred solution, leading to enactment. The regional level does not have the power to enact strong congestion policy without city/employer leadership.

Please refer to Appendix M, "Recommendations for Political Wrangling," for details.

Chapter 11: Systemic Obstacles to Seamless Mobility

Initial version May '15.
Kudos to SPUR, Stanford, SVLG, and MTC for input
Shared link to this doc: http://bit.ly/1fFsVVT

Our solution's potential for 25% mode shift has significant ramifications. Brian Shaw, Director, Stanford Parking and Transportation Services, is an advocate for a comprehensive solution that addresses a myriad of stakeholder issues. Shaw oversees the commutes of 30,000 staff and students each weekday. This chapter paper addresses these comprehensive, systemic obstacles. The region would be well-served by developing a solution that meets Shaw's needs.

Envision a multi-stakeholder partnership where stakeholders all do their part to reduce regional SOV commute mode share to 50%. Such a partnership entails remedying obstacles that hinder SOV alternatives.

Summary of obstacles and solutions

11A. Enable better public transit routes that cross county borders
11B. Public transit fare integration for multi-agency trips
11C. Modernize public transit electronic payment as fast as possible
11D. Under-utilized federal vanpool program
11E. Create a series of commute shed maps, with gap analysis/filling (progressing)
11F. Develop a healthy, interoperable smartphone mobility ecosystem (progressing)
11G. Adjust national pretax commute benefits law to favor green alternatives over SOV parking
11H. Develop PARCS (parking) API standards to facilitate software integration
11I. Accelerate support of GTFS-RT by Bay Area public transit operators.
11J. Reduce high bike-stress streets and intersections to attract "Interested but Concerned." (progressing)
11K. Next-generation, higher-throughput freeway designs are needed

11A. Enable better public transit routes that cross county borders

To close service gaps and to be more competitive with private transit operators such as Bridj and Chariot, public transit should be able to more easily create express commute service that crosses county lines.

- VTA Subscription Express may be able to provide a Pleasanton to San Jose solution, but it is far more difficult to run service from San Francisco to Silicon Valley.
- Need to state what the rules/barriers are. Sometimes OK to DROP travelers off in another county, but not pick them up. Ensures deadheading.

MTC has some authority to accelerate integration: For obstacles #1 and #2, per MTC Resolution 3866[1] and the MTC Transit Coordination Implementation Plan, MTC Commission has adopted policies that strive to:

- promote better regional fare/schedule coordination
- deliver a better regional passenger experience
- evaluate operator compliance with coordination improvements (including the regional Transit Connectivity Plan) before allocating funding. If MTC determines that the operator has not made a reasonable effort,

[1] MTC Resolution 3866

MTC shall direct the operator to correct issues within a 60-day timeframe. If the issues are not corrected, MTC shall re-program the funds.

- adopt fare/schedule coordination rules/regulations for all 24 Bay Area systems.
- require joint fare revenue sharing between all connecting systems.
- recommend consolidation of individual operator functions to improve regional efficiency

Comment: What is the ability for BART to operate cross county bus services? As most Origin and destination counties now pay into BART, could BART do this under a service agreement?
Hence, MTC has authority and multiple tools to facilitate better integration. Implementation specifics are still to-be-determined. MTC staff and the public will engage MTC Commissioners in a discussion about the recommendations in SPUR's "Seamless Transit." The timeline for this discussion is imminent.

Entities such as BAC, SVLG, and SPUR make public comment at MTC Commission meetings. The BAC/SLVG Coalitions (CalTrain Commuter Coalition and Highway 101 Coalition) could potentially decide to provide strong, supportive advocacy. Employers and cities within the Coalition could become signatories on comment letters to the Commission.

11B. Public transit fare integration (From SPUR Seamless Public Transit Report)

Single fare without penalty for switching between brands.
Allocate revenue fairly between brands.
Create a short-term fund to make operators whole.
Public transit General Managers are interested. They comment "we can integrate fares, please just avoid merging us into fewer operators."[2] MTC's Steve Heminger is in favor.
SPUR, "We need powerful stakeholders prominently behind this effort."
MTC has authority and multiple tools to facilitate better integration. See #1 above.
Comment: What is the benefit/costs of retaining current multi-agency model? Should transit agency leaders be deciding their fate and what works best for the region? Or is that best decided at MTC or in Sacramento?

Create a regional transit pass?
SR comment: Caltrain GoPass is effective and may be so popular that it is difficult to change. GoPass is beneficial to Caltrain but may be detrimental (compared to alternatives) to travelers and the region.
SR comment: It is terrific that employers subsidize transit and we need to expand this. I'm not completely comfortable with transit passes, because these distort price incentives and create sloppy accounting/analytics. Better to account for every single leg of every single trip, not have to guesstimate. If the employer's VTA EcoPass subsidy for an individual trip is $20, the commuter needs to see this. My inclination is to replace EcoPass and GoPass employer subsidies with a new system with transparent per-trip costs.
RA comment: I agree that people need pricing queues. I also think that a regional pass will be critical to helping both riders and planners realize that transit is a system and we have to become less brand-oriented. The other benefit of the regional pass (and any pass) is the opportunity to increase usage for discretionary trips because of the sunk cost. Much like monthly parking passes. Having so many separate operator passes is leaving a lot of transit usage on the table and creating a lot of administrative headaches for institutions…
SR: So RA might be enthusiastic about seamless regional electronic payment via a payment brand with optimized regional pricing across agencies. Employers provide subsidies into the regional electronic payment system, allowing employees to utilize any agency, avoiding "GoPass Caltrain lock-in." This solution fails at encouraging discretionary trips, but the IRS should NOT allow these trips to sneak through the pretax subsidy system. Policy for subsidizing discretionary trips and targeting specific members of society should not be the

[2] (Commonwealth Club event with SPUR and Eno Foundation - http://www.commonwealthclub.org/events/2015-03-31/regional-transit-governance-seminar.)

business of large employers.
RL: hey wait, any discretionary trip subsidy is great. Don't knock it. Don't be an economic purist. IRS isn't going to challenge the subsidy.

11C. Modernize public transit smartphone electronic payment as fast as possible

The SPUR Seamless Public Transit Report[3] lists "enable instantaneous smartphone payment" as a priority.

Towards that objective and in a mad rush in June, 2016, Joint Venture opportunistically created a non-binding draft project proposal for "Bay Area Ventra transit NFC[4] tap and pay." (See feature set below.) This was to be a sub-task in a larger federal grant proposal for Joint Venture's Fair Value Commuting project. Parties could not reach agreement in the short timeframe but the region should continue to consider this proposal.

Chicago Transit Authority's Ventra is a partnership between the firms Cubic and Moovel and has developed more advanced payment technology than the Bay Area. In the Bay Area, Cubic has the Clipper Card v1.0 contract through 2019, hence it is possible to bring Ventra functionality to the Bay Area using software teams that are already successfully working together, cutting and pasting existing, working lines of software code. Since 2013, Ventra has supported public transit NFC tap and pay using Apple Pay and Google Wallet (iPhone and Android). [5]

Portland TriMet offers their mobile Tickets app integrated with Cubic's back end and Moovel's RideTap SDK, providing: mobile public transit e-payment, multimodal trip planning, Lyft, Car2go, bikeshare, etc. [6]

In February 2016, American Public Transit Association and the industry lobbying group NFC Forum partnered to promote public transit NFC payment, via the NFC Forum Transport Special Interest Group (SIG). NFC Forum's high-level members/sponsors include Apple, Google, Samsung, Mastercard, and VISA. Hence there is a national priority for NFC transit payment, putting pressure on the Bay Area to close the technology gap with more advanced cities (Chicago, Portland, Phoenix, London, etc). Japan has had mobile phone transit payment for more than ten years.

In pursuit of an improved customer experience and if funding can be arranged, it may be possible to negotiate a win/win agreement between MTC and Cubic/Moovel for "Bay Area Ventra" extending the existing Clipper software platform.

One possible financing and staffing arrangement:

- $700,000 federal funding
- $500,000 funding from Cubic and partners
- MTC may be constrained on staff bandwidth and might only be able to contribute 400 person hours per year to this effort.

The desired Bay Area Ventra feature set:

- An MTC/Clipper branded consumer Mobility Aggregation (MobAg) smartphone app that is issued/owned by MTC. MobAg provides a single smartphone app to replace your car. A seamless combination of public/private transit/microtransit, bikeshare, rideshare, carshare, vanpool, and advanced mobility services. MobAg apps integrate next-generation mobility services including Lyft, Uber, Scoop, ZipCar, and Car2Go.

[3] SPUR's Seamless Transit Report, http://www.spur.org/publications/spur-report/2015-03-31/seamless-transit
[4] Near-field communication (NFC) is a set of communication protocols that enable two electronic devices, one of which is usually a portable device such as a smartphone, to establish communication by bringing them within about two inches of each other.
[5] Ventra: https://en.wikipedia.org/wiki/Ventra
[6] Trimet: https://mobileticketingtoday.com/2016/05/06/moovel-n-a-launches-ridetap-pilot-in-portland-or-offers-lyft-and-car2go-within-trimet-tickets-application/ , http://trimet.org/app/index.htm, Moovel's Rider App and RideTap SDK: http://www.moovel-transit.com/products/.

20% of Lyft/Uber trips feed public transit. MobAgs provide multimodal trip planning, presenting compelling options for travelers to choose from. Bay Area Ventra will use the Cubic/Moovel software platform.

- Mobile NFC tap and pay at any Clipper reader in the Bay Area (every rail transit station, 96%+ of public transit buses). A "virtual Clipper card" is loaded onto the traveler's phone. 50% of mobile phones currently have NFC (iPhone 6 and beyond). By October of 2018, 90% of phones will have NFC. Low-income penetration of such phones is very similar to high-income penetration.
- "Multiple group members, single phone pay." For example, enable a family of two adults and one child to tap and pay with a single smartphone.
- Since 2013, Chicago Ventra has supported NFC tap and pay using Apple Pay and Google Wallet (iPhone and Android). [7]
- A visual proof of payment and bar code ticket for legacy phones that don't support NFC.
- The ability for the smartphone NFC reader/writer function to physically update Clipper cards with value/product resulting from in-app payments.
- MTC may negotiate for open APIs that will be compatible with the upcoming Clipper 2.0 Project.
- MTC may negotiate for open APIs to better enable third party Mobility Aggregation apps such as Moovit, Transit App, Urban Engines, TripGo, Swiftly, Xerox's app (GoLA, etc), and Siemens' app to integrate easily.
- To accelerate Joint Venture's Fair Value Commuting solution, "Bay Area Ventra" may integrate with one or more enterprise commute trip reduction apps (employer commute program automation with commuter benefits payroll software). The need is for ECTR apps to track the mode and cost of public transit commutes for commuters using ECTR systems.

Third party projections for NFC tap and pay market penetration:

- Gartner Group predicts that by 2018, 50% of consumers in mature markets will use smartphones / wearables for Mobile Payments. Gartner differentiates between smartphone NFC payment (Apple Pay, Samsung Pay and Android Pay) versus branded mobile wallets from banks and credit card providers, but Gartner does not forecast how the market plays out.
- eMarketer defines "proximity mobile payments" as point-of-sale transactions that use mobile phones as a payment method, via tapping, waving and similar functionality. eMarketer projects about 40% of smartphone users will make such payments in 2019.

<u>Additional e-ticketing background</u>

Payment modernization objectives:

- In the long run, identify a preferred technology that can seamlessly, inexpensively, interoperably, and consistently be applied across 24 public transit operators with "cloud accounts." MTC's Carol Kuester (Director, Electronic Payments) is sympathetic, "but it isn't easy. There isn't currently a magic bullet. The existing Clipper 1.0 card is seamless, interoperable and consistent today. It isn't inexpensive to operate, but note that MTC and operators bear those costs and Clipper is free to users. There is always a cost to fare collection; nationwide transit agencies spend ~10% to collect fares. Even in 'the long run' it's not yet clear what one preferred technology would do all of what's desired. MTC is working with transit operators to define a next generation Clipper 2.0 system that will address some of the existing system's limitations. However, moving to a new system will require a significant investment."
- MTC's Clipper effort is made more difficult because of the 22 Clipper-participating Bay Area public transit operators. Inter-agency financial reconciliation is a very complex part of the Clipper system.
- For next generation enterprise commute trip reduction (ECTR) software, the need is to track the mode and cost of each commute. One technical possibility is for the Clipper 1.0 platform to expose an API to make trip transaction data available to trusted ECTR apps, in a somewhat timely (but not realtime) manner. The

[7] 2013 video: https://www.youtube.com/watch?v=TtgOuuLxn_Q

data is available now. As long as a vendor complies with MTC privacy policy, the data can be provided. Exposing a Clipper API requires a change order to the Clipper contract and funding for the work. Cubic is the vendor that implements MTC's Clipper 1.0 contract. The current Clipper/Cubic contract runs through 2019.

- There is no legal restriction preventing MTC from providing improved customer experience while using the Clipper brand for the user experience and using the Clipper software back end for financial transactions.[8] MTC Resolution 3866[9] also allows limited electronic payment pilots that bypass Clipper, but nothing permanent that competes directly with Clipper.

Bay Area pilots that bypass Clipper:

- The SFMTA/Moovel(GlobeSherpa) mobile ticketing pilot[10] is acceptable within the Resolution 3866 requirements, because it is only a pilot. The pilot, slated for November 2015 launch, supports all Muni modes (bus, subway, light rail, trolley, and cable car) with visually verifiable smartphone ticketing. Muni users quickly create a non-Clipper cloud account, supplying a credit card. In order to protect the Clipper brand, the pilot does not support monthly tickets, limiting the penetration potential of the pilot. Instead, the pilot targets the small market for incidental/tourist uses. Transactions are "cleared" via a paypal service. From a GlobeSherpa press release, "While the Muni mobile payment application will offer fares for Muni only, it is part of a broader effort to evaluate smartphone mobile payment options for adjoining Bay Area transit operators that participate in the Clipper card program. The next generation of Clipper card, slated for introduction by 2020, aims to provide multiple payment options to Clipper patrons." It is likely that MTC and the operators will want to wait to evaluate the Muni e-ticketing pilot before taking further action to accelerate smartphone e-ticketing.
- VTA is currently piloting EventTIK e-tickets for the limited market of 49er game transit, using the vendor Masabi. Caltrain or SamTrans may also be negotiating an electronic payment pilot.

11D. Under-utilized federal vanpool program

From Crissy Ditmore, vRide Government Account Executive: In 2007 OCTA and LA Metro both began a vanpool subsidy program. SANDAG has had a program for even longer. Since that time each of those cities have received millions of dollars in formula return for taking single occupant commuters off the road way. In the Bay Area while vanpooling is a privately provided option, there are not any air quality requirements of employers, and therefore vanpooling is not maximized as a commuter option. In addition to the absence of regulation, the Bay Area is also missing out on millions of dollars of federal return by not having a subsidy program of its own. A very conservative estimate of only the 5307 formula return would show that with 450 vanpools in service (an estimate of those already in the market), The San Francisco UZA (federal designated urbanized area) return would be ~$3.8M. With a $500 monthly subsidy the cost of running that same service for a full year is ~$2.6M. Meaning, even after paying for all costs of the program, the UZA would actually be MAKING $1.2M in 5307 funds. With all of the transportation needs in the area, not maximizing the opportunities of implementing a vanpool program leaves the Bay Area at a significant disadvantage.

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[8] Resolution 3866 requires that Clipper be the PRIMARY fare payment system for frequent transit riders, and that transit agencies should not introduce new non-Clipper fare programs without MTC's approval. [Res 3866 page 12, Section 6: Requirements for Participating Operators: A) Implement, operate and promote Clipper as the primary fare payment system for each Operator. Clipper's primary market is frequent transit riders (i.e., commuters and transit passholders). Operators shall not establish other fare payment systems or fare policies that could deter or discourage these patrons' preference to use Clipper. Operators shall set fares so that fares paid with Clipper are equivalent or lower than fares paid either with cash or other forms of payment. B) No new non-Clipper prepaid fare product, other than for promotional, special event or limited-audience—e.g., tourist—fares, shall be created by any transit operator without consulting with and receiving prior approval from MTC. C) Nothing in this provision is intended to discourage operators from providing leadership on new technologies or innovations that would offer improvement to fare collection operations or the customer experience. The expectation is that these new initiatives should leverage the attributes and assets of Clipper."]

[9] http://clipper.mtc.ca.gov/

[10] SFMTA/GlobeSherpa mobile ticketing pilot

Table 33: 30 Largest Transit Vanpool Agencies Ranked by Unlinked Passenger Trips and Passenger Miles, Report Year 2011 (Thousands)

Transit Agency	Urbanized Area (First City and State Names Only)	Unlinked Passenger Trips		Passenger Miles	
		Thousands	Rank	Thousands	Rank
King County Department of Transp.(King County Metro)	Seattle, WA	3,122.7	1	63,380.4	4
Los Angeles County Metropolitan Transp. Auth.(LACMTA)	Los Angeles, CA	2,995.2	2	131,882.5	1
Metropolitan Transit Auth. of Harris County, Texas (Metro)	Houston, TX	2,411.5	3	67,561.4	3
San Diego Association of Governments(SANDAG)	San Diego, CA	2,127.9	4	99,247.9	2
Pace - Suburban Bus Division(PACE)	Chicago, IL	1,778.6	5	40,830.5	8
Utah Transit Authority(UTA)	Salt Lake City, UT	1,417.2	6	59,336.8	5
Kings County Area Public Transit Agency(KART)	Hanford, CA	1,353.0	7	54,511.3	6
Ben Franklin Transit(BFT)	Kennewick, WA	1,293.2	8	50,633.0	7
Phoenix - VPSI, Inc.	Phoenix, AZ	1,097.7	9	28,334.7	13
Michigan Department of Transportation(MDOT)	Detroit, MI	1,026.8	10	34,282.5	10
Dallas Area Rapid Transit(DART)	Dallas, TX	985.0	11	39,072.1	9
Orange County Transportation Authority(OCTA)	Los Angeles, CA	941.8	12	33,006.8	11
Snohomish County PTBA Corp.(Community Transit)	Seattle, WA	892.9	13	23,973.9	17
New Jersey Transit Corporation(NJ TRANSIT)	New York, NY	863.8	14	30,515.2	12
Pierce County Transp. Benefit Area Auth.(Pierce Transit)	Seattle, WA	859.5	15	25,462.1	15
Marietta - VPSI, Inc.	Atlanta, GA	783.1	16	21,500.3	19
Greater Hartford Ridesharing Corporation(GHRC)	Hartford, CT	772.5	17	28,149.3	14

Source: APTA's 2013 Public Transportation Fact Book[11].

11E. Commuter Map and Gap Analysis Project (progressing)

For a series of major employment centers, map the commute shed, depict the best line-haul connections, including public and private options. Identify service gaps. These gaps need to be filled.

Enterprise Commute Trip Reduction software is being developed to support this in a robust manner.

11F. Develop a healthy, interoperable smartphone mobility ecosystem (progressing)

Increase interoperability of smartphone mobility service data, creating a healthy software ecosystem with reduced need to customize software for each integration between vendors. These two efforts provide leadership towards this solution:

- GTFS-SUM[12] (Shared Use Mobility) open data standard effort. Founding partners include: RideScout, TriMet, CUTR, Trillium Transit, IBI, Technology Association of Oregon
- RMI's Interoperable Transit Data: Enabling Mobility as a Service[13]

11G. Adjust national pretax commute benefits to favor non-SOV over SOV

Some Finland sources, including car registration fees from Haarti.
National pretax commute benefits law favors SOV parking over alternatives. This perverse incentive should be remedied. Create a standardized, fair, maximum benefit level on ALL green alternatives.

- Follow the recommendation from the DeLoitte Smart Mobility report's suggestion: "Expand tax incentives to encourage bikesharing and bike commuting. The federal Bicycle Commuting Act of 2008 allowed employers to provide up to $20 per employee monthly subsidy for bike commuting benefits. This is a useful start, but one that compares poorly to the $115 per employee deductible available for transit benefits. Extending greater pre-tax benefits to bikesharing and bike commuting programs could increase its appeal to employers." Source[14]

[11] APTA's 2013 Public Transportation Fact Book.
[12] GTFS-SUM
[13] RMI's Interoperable Transit Data: Enabling Mobility as a Service
[14] See: http://dupress.com/articles/smart-mobility-trends/

- Pre-tax commuter benefits should expand to cover innovative, virtuous non-SOV private sector alternatives. Enterprise commute trip reduction software will simplify tracking and administration of such innovative alternatives.
- The end of 2015 federal tax deal brought parity between SOV parking and transit is a step in the right direction, but does not go far enough. This TDM victory took 20 years of lobbying.[15]

11H. Develop PARCS API standards to facilitate software integration

PARCS stands for "parking access revenue control system." The PARCS industry is hampered by proprietary legacy hardware and software. A standard API will facilitate integration into enterprise commute trip reduction apps. Newer hardware is less expensive and easier to program.

11I. Accelerate support for GTFS-RT

Accelerate support of GTFS-RT by Bay Area public transit operators. One example of this need resides at SamTrans.

"GTFS-realtime is a feed specification that allows public transportation agencies to provide realtime updates about their fleet to application developers. It is an extension to GTFS (General Transit Feed Specification), an open data format for public transportation schedules and associated geographic information. GTFS-realtime was designed around ease of implementation, good GTFS interoperability and a focus on passenger information." GTFS provides improved information to customers, eliminating "waiting under conditions of uncertainty," where humans perceive time passing three times slower than reality.

11J. Reduce high bike-stress streets and intersections

As far as bicycling, 60% of US population can be classified as "Interested but Concerned" and will only bicycle on low-stress streets, having low tolerance for high-stress streets or intersections. Please see Section 7B for details on one current project.

11K. Next-generation, higher-throughput freeways are needed [16]

New research is needed on next generation freeway designs that support increased occupancy; provide faster trip times for public transit, microtransit, and carpools; and apply a higher price to single occupancy vehicle (SOV) to shift travel mode. For example:

Legacy four-lane freeways have one HOT lane and 3 mixed-flow lanes, moving about 1,800 people in each of the three mixed flow lanes and about 3,200 in the HOV lane = 8,600 people in peak hour.

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[15] See: "U.S. Transit Commuters Just Got an Early Gift for 2016: The new Congressional tax deal establishes benefits parity ($255/month) regardless of mode, but it probably won't stop people from driving to work alone." By Eric Jaffe, Dec 16, 2015. http://www.citylab.com/politics/2015/12/congress-tax-deal-commuter-benefits-parity-2016/420729/.

[16] Some throughput references for novel freeway configurations: A) Jeff Hobson and Joseph Kott. Innovation Required: Moving more people with less traffic. How to improve Highway 101 in San Mateo County, save millions, and give commuters more choices. For Transform. 2013. http://www.transformca.org/resource/innovation-required-moving-more-people-less-traffic. See also MTC's analysis of TransForm's proposal: http://www.transformca.org/transform-blog-post/mtc-analysis-confirms-optimized-hot-best-choice-highway-101. B) Testing for the Distributional Effects of National Road User Charging. Daniel J. Graham, Stephen Glaister, Mohammed Quddus, and Zia Wadud (Int'l J. of Sustainable Transportation, Vol. 3, No. 1, 2009, p. 21). Graham is at the Centre for Transport Studies, Department of Civil & Environmental Engineering, Imperial College London, London, UK. C) A Road Pricing Model for the Mexico City Metropolitan Area, by Armado Crotte, Daniel J. Graham & Robert B. Noland, typescript, late 2009 or early 2010. This paper develops a formula for translating changes in users' trip costs into changes in car-occupancies. D) Charles Komoanoff's Balanced Transportation Analyzer spreadsheet model:http://www.nnyn.org/kheelplan/BTA_1.1.xls. Go to the Travel worksheet.

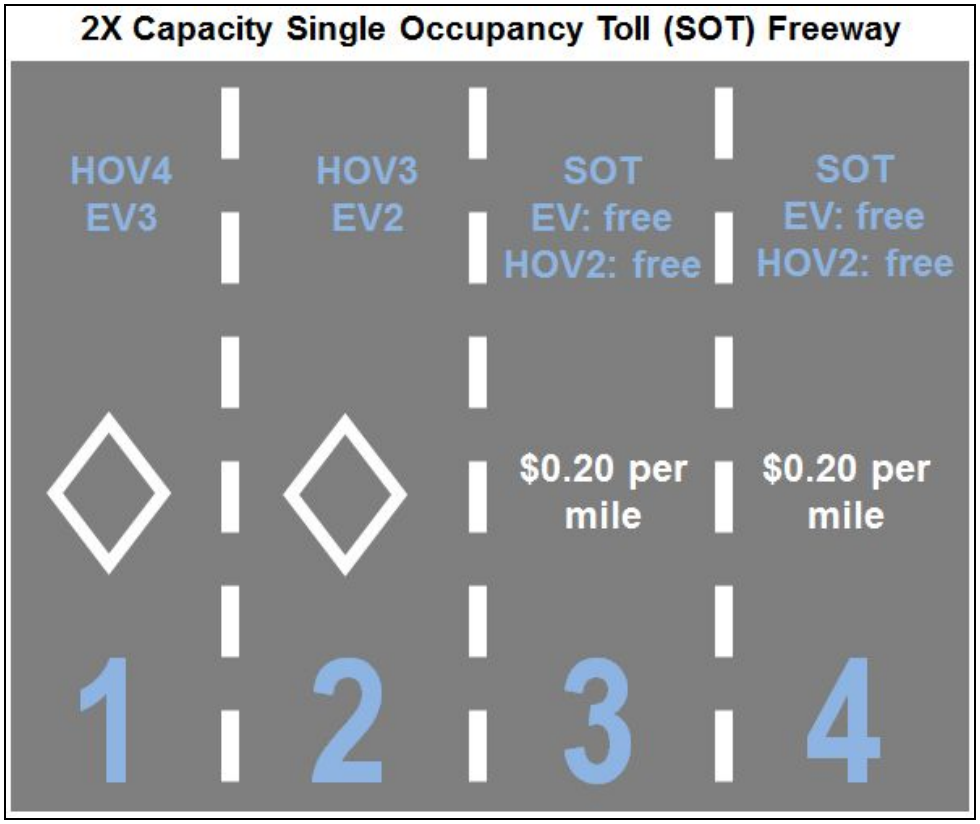
A novel four-lane freeway configuration (4 lanes from left to right):

{HOV4, HOV3, SOT, SOT}
(SOT stands for single occupancy is tolled and carpools are not)
moves 14,800 people in peak hour, doubling capacity. HOV4: 6,400, HOV3: 4,800, two SOT lanes moving 1,800 per lane.

This assumes a high demand for high-occupancy lanes - this demand is created by a sufficiently-high SOT. Presumably the mobility ecosystem evolves to provide improved high-occupancy solutions - this is already occurring with WAZE Carpool, Scoop, Bridj, Chariot, etc.

The move from legacy freeway to 2X Capacity freeway will need to occur in phases, not all at once. Intermediate configurations should be developed on the road to 2X Capacity.

Electric vehicles will likely be provided advantageous (lower-occupancy) entrance into lanes. For example, a three-person EV carpool might gain entrance into the HOV4 lane. With EV advantages included, the four lanes could be configured as follows:



Higher efficiency aligns with the California Transportation Plan (CTP) 2040 draft language recommending against any SOV-demand-inducing freeway lane additions (this was watered down in final CTP release). As background, The Moving Cooler Report states that a phased-in $5/gal gas tax increase reduces Vehicle Miles Traveled (VMT) by 28%. Depending on CAFE (average fuel economy) assumptions, a $0.20/mi Road User Charge (RUC) is similar to $5/gal tax.[17]

Normally, large freeway throughput improvements increase the number of vehicles passing through, putting pressure on off-ramps and adjacent arterials. In the case of {HOV4, HOV3, SOT, SOT}, a similar vehicle

[17] Moving Cooler Executive Summary: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/MovingCoolerExecSummaryULI.pdf

throughput increases people throughput because of higher occupancy. A system-wide study should probe impact on off-ramps and arterials.

In the San Francisco Bay Area, carpool cheating is a large issue and should be reduced. A survey by MTC found that for the morning commute, 24% of vehicles in the carpool lane violated the occupancy requirement. [18] Presumably new car models can provide enforcement information. For example, a vehicle's software might calculate vehicle occupancy based on door- open and seat-weight sensors. Then a vehicle could commutate occupancy to enforcement via vehicle-to-infrastructure communications.

Practitioner feedback on this concept:

Your suggestion has the merit of suggesting ways that our highways could move more people with the same amount of traffic as today. However, the highway cross-section you suggest is overly complicated and would be impractical to enforce and implement, in part because it would be hard for drivers to operate.

- RESPONSE: Good point that for human drivers, {HOV4, HOV3, SOT, SOT} would encourage crossing all the way over to the leftmost lane and then all the back, even for relatively short trips. Lane changes to/from Bay Area HOV lanes are less safe than desired because of speed mis-match. The advent of freeway autonomous vehicles should make lane crossing safer.

Enforcement: Your suggestion includes 7 different occupancy/vehicle-type combinations (HOV4, HOV3, HOV2, SO, EV3, EV2, EV1) that yield 4 different levels of permission to use the roadway (HOV4 + EV3 allowed free in Lane 1, HOV3 + EV2 allowed free in Lane 2, HOV2+EV1 free in Lanes3-4, SO tolled in Lanes 3-4). That would be extremely complicated for the highway patrol to enforce. And given the current violation rates you cite, we know that enforcement is already inadequate. Making it this much harder seems like a recipe for even more rampant violations.

- RESPONSE: Presumably new car models can provide enforcement information. For example, a vehicle's software might calculate vehicle occupancy based on door- open and seat-weight sensors. Then a vehicle could communicate occupancy to enforcement via vehicle-to-infrastructure communications.
- RESPONSE: For social equity, a layer of discounts for low income drivers might also be adopted, further increasing complexity.

Operations: Your suggestion presents drivers with much more complicated decision-making than they currently face. I'd guess this would reduce the actual efficiency of vehicle-movement, as there'd be less opportunity for vehicles to legally find their natural lane in the highway's speed profile. The reality is that different drivers drive at different speeds (different risk perception, ability, how long the vehicle will be traveling on this particular stretch of road, etc.). This suggestion would inhibit the highway's ability to accommodate that natural variation. If every vehicle were operated by identically-programmed automated vehicle drivers, that issue would be less important, but it still wouldn't go away (vehicles would still need to switch lanes to get off the highway, so Lanes 3-4 would often have many HOV users).

There are many other problems: restricting Lane 1-2 access via occupancy/vehicle type only means that you'd likely replicate some of the same problems we have with current carpool lanes: underuse because there aren't enough eligible vehicles (a problem which in turn opens the door to the violations).

It would be more fruitful to pursue simpler ways to get highways of the future to carry more people. On the same 4-lane highway, HOT4/HOT4/SOT/SOT (with SO toll in lanes 1-2 adjusted to keep those lanes free-flowing) would be simpler and . Let EVs get their benefit via cost of use, not lane access. Plus, by the time anyone is operating roadways with this many changes, we'll have different vehicle fuel/type challenges.

- RESPONSE: From an implementation standpoint, it would be preferable to not grant special lane access privileges to EVs. From a political viability standpoint, it may be too difficult to "take away privileges that EVs already enjoy."

[18] "Study Confirms Carpool Lane Cheating Rampant In Bay Area," for CBS SF Bay Area. May 13, 2016. http://sanfrancisco.cbslocal.com/2016/05/13/carpool-cheats-bay-area/

MTC's Highway 101 analysis acknowledged and redistributed the actual current vehicle occupancy profile. It showed that a lane distribution based solely on occupancy (HOV + 3 GP -- general purpose -- lanes) performed much less well than a lane distribution that allows an active congestion manager to manage access to a restricted lane (HOT+3 GP lanes).

- RESPONSE: Transdef has provided an interesting critique of HOT lanes: toll access for SOVs lowers vehicle occupancy in managed lanes, working in opposition to adopted state climate policy. In contrast, {HOV4, HOV3, SOT, SOT} provides a variable pricing throttle through variable SOT pricing. Given the current mainstream freeway design paradigm, the likely first thing that mainstream power stakeholders would propose for {HOV4, HOV3, SOT, SOT} would be to change to {HOT4, HOT3, SOT, SOT}. This document provides only a peak hour vision - the tolls and lane distinctions will probably "soften" in non-peak hours.

First, when thinking about the difference between occupancy in current HOV lanes and potential HOT lanes, it is important to consider how both are actually used in practice, not just what the rules are.

Current HOV lanes already have a lot of single-occupancy vehicles in them -- either clean-air vehicles or solo-driving violators. Enforcement is a very low priority for the CHP for a variety of reasons, and there's no evidence that this will change with current HOV schemes. This happens because in many places there are not enough HOVs to fill the lanes, so solo drivers see a big time advantage and take the risk of a ticket.

In an HOT environment, CHP has more of a motivation & mandate to enforce violations and the lanes have more vehicles in them (while still flowing freely). If enforcement is better with HOT (a very big IF, I recognize), it is possible that the HOT scenario will simply replace current violators with toll-paying SOVs.

Second, I think your responses to the lane-change and enforcement questions probably points to a difference in time horizon. I understand that eventually cars might be able to provide enforcement info themselves and the AV technology to change lanes. I'd guess that privacy concerns will delay the former for a long time, making automatic self-enforcement even farther away than the AV technology to ensure safe lane changes at high speed differentials.

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Appendix A: Suburban Ridematch Needle in the Haystack Problem

"Within a 20-minute interval, only four out of 31,500 can be matched"
First version Oct 9, 2015. Thanks to transp-tdm!

ACADEMIC PAPER TITLE:
Quantification of the peer-to-peer on-demand ridematching Needle in the Haystack problem.

ABSTRACT: Provided is a quantified explanation of the low ridematch probability of peer-to-peer (P2P) on-demand ridematching {Lyft Carpool, WAZE RideWith, Scoop, Carma, Carzac, HOVee, NuRide, Ride.com, TwoGo, Slice Rides, RideAmigos, Duet, Split, and MüV} in car-loving portions of United States. On the surface, the concept of filling the many empty seats in cars has large potential to increase efficiency. Unfortunately, the probability of developing critical mass in car-loving areas is very challenging - the set of possible matches is distributed in a sparse manner. This challenge can be called the Needle in the Haystack Problem. Even making multiple optimistic assumptions, the match-making probability is small. In the Palo Alto calculation provided, within a 20-minute interval, only four out of 31,500 travelers can be matched. Additional challenges reduce the probability even further: 1) matchable travelers may not use the same service so may not be aware of each other, 2) the "Day 1 Challenge," whereby new members do not all join on the same day and may quit a service before finding a match, 3) "driver backtracking shrinkage" where matches are prevented because picking up the potential rider entails a time penalty for the driver. Improvements are suggested. Scoop's achievement of 0.6% Cisco commute mode share is detailed. 17 practitioner comments are provided, adding additional opinion and insight to the difficult challenge.

Provided is a quantified explanation of the low ridematch probability of peer-to-peer (P2P) on-demand ridematching in car-loving portions of United States. "Car-loving" is defined as areas with more than 70% single-occupancy vehicle (SOV) commute mode share. High SOV share is strongly correlated with the free workplace parking that is provided to 95% of US commuters.[1] The majority of the US can be classified as "suburban with free parking," but many commuters also park free in urban central business districts. The paper's aspiration is to provide a baseline of insight so that ridematching services may innovate and increase their chances of success.

On the surface, the concept of filling the many empty seats in cars has large potential to increase efficiency. Unfortunately, the probability of developing critical mass in car-loving areas is very challenging - the set of possible matches is distributed in a sparse manner. This challenge can be called the Needle in the Haystack Problem. Even making multiple optimistic assumptions, the match-making probability is small.

US carpooling increased in the 1940s when it was encouraged by the government to save gas to help win World War II. Carpooling or "ridesharing" is when a non-professional or "peer" driver gives another peer a lift on the way to that driver's destination. Once the driver reaches their destination, the driver parks the car for a period of time. The P2P driver is "one and done." P2P on-demand ridematching often uses a mobile phone application. Some services match within ten minutes, others within 24 hours. Drivers are generally paid a modest amount for the trip

[1] Shoup, D. and Breinholt, M.J. Employer-Paid Parking: A Nationwide Survey of Employers' Parking Subsidy Policies. In *The Full Costs and Benefits of Transportation: Contributions to Theory, Method and Measurement*. Editors David L. Greene, Donald W. Jones, and Mark A. Delucchi. Berlin: Springer Press. 1997.

by the rider, often associated with partial expense reimbursement. Current P2P on-demand ridematching services include: Lyft Carpool, WAZE RideWith, Scoop, Carma, Carzac, HOVee, NuRide, Ride.com, TwoGo, Slice Rides, RideAmigos, Duet, Split, and MüV.

In contrast, transportation network company[2] (TNC) services such as Uber X, UberPool, and Lyft Line, as well as taxi services, use professional for-hire drivers providing multiple trips serving rider-selected destinations. In their attempts to coax two or more riders from different originations into a single vehicle, TNC professional driver ridesharing services such as UberPool and Lyft Line experience the same Needle in the Haystack challenge.

On account of lower cost per ride, P2P services may have significant long-term potential to scale beyond the traditional TNC market to service daily commuting.

State and region public policy calls for large mode shift and VMT reduction

In pursuit of traffic and GHG reduction, there is a new urgency for P2P on-demand ridematching to succeed.

Adopted State and Regional Policy:

	Per-capita VMT reduction
California Transportation Plan 2040	17%
Caltrans Strategic Management Plan 2020	15%
SB375 2030 Bay Area Target	15%
Plan Bay Area 2040	15%

A1. Literature Review

Over the past 20 years, there have been multiple failed attempts at P2P ridematching. Ghoseiri lists the past pilot projects, “They all suffered from a small number of requests for rides and a smaller number of matches made. This failure could be attributed to how each was designed.” [3] Chan presents ridesharing as passing through five phases from 1942 to present. [4]

A2. Quantified Palo Alto example

Palo Alto (PA) is a car-loving suburban city in Silicon Valley. To-Palo Alto and from-Palo Alto commute mode share, as calculated by the author from American Community Survey data is:

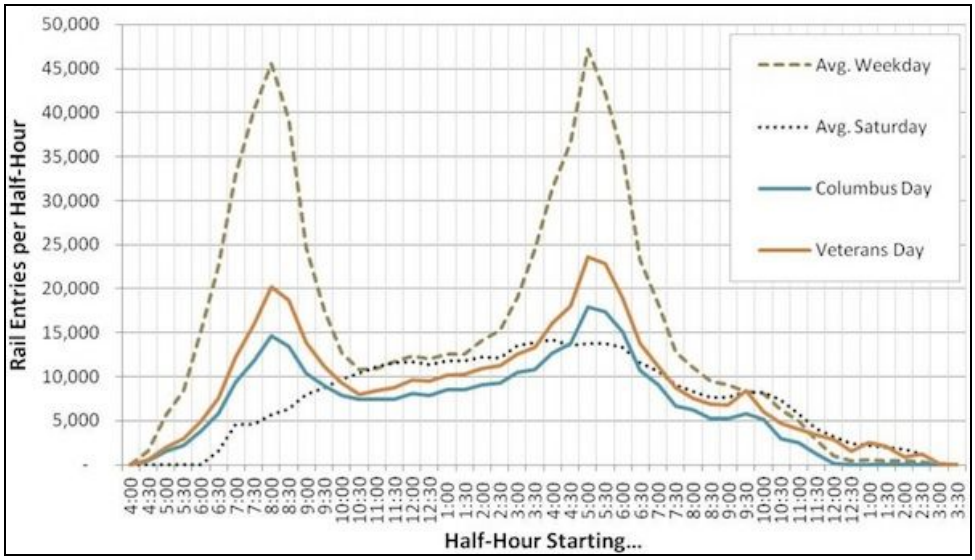
[2] Wikipedia’s Transportation Network Company page. https://en.wikipedia.org/wiki/Transportation_network_company.
[3] Ghoseiri, K., Haghani, A., and Hamedi, *M. Real-Time Rideshare Matching Problem*. US DOT UMD-2009-05. January 2011. http://www.mautc.psu.edu/docs/UMD-2009-05.pdf.
[4] Chan, N. D., and Shaheen, S.A. (2011): Ridesharing in North America: Past, Present, and Future. In Transport Reviews, DOI:10.1080/01441647.2011.621557, 2011. http://dx.doi.org/10.1080/01441647.2011.621557.

90K commute to PA		30K commute from PA	
SOV	76.3%	SOV	66.9%
Carpool	9.3%	Carpool	4.1%
Transit	5.5%	Transit	5.3%
Bike	2.3%	Bike	8.4%
Walk	2.3%	Walk	5.8%
Telework	3.3%	Telework	8.9%
Source: ACS 2009		Source: ACS 2013	

Below is a set of simplified assumptions for one representative Palo Alto ridematching example:

- There are 10,000 downtown Palo Alto workers. Downtown PA is 6 blocks long by 3 blocks wide, so all downtown destinations are accessible via walking.
- The zipcode with the most residents who commute to downtown Palo Alto is Redwood City's 94063. The zipcode has 31,500 residents with about 500 working in downtown Palo Alto. The calculation for 500 working in downtown: city staff estimates there are about 10,000 downtown workers and the Downtown Palo Alto Mode Split Survey estimates that 94063 accounts for about 5% or 500 of those workers.[5]
- Let's assume an unrealistically high 10% of commuters in this zipcode are willing to participate in a ridesharing service - current membership is far, far below this level. In the US, about 8% of total commuters "fampool," meaning carpool with members of their own household. About 2% of total US commuters carpool with people outside of their household.
- Let's unrealistically assume that all workers have eight-hour jobs, sharing a two-hour AM and two-hour PM commute time period. In truth, there are many Palo Alto retail workers with different hours and many tech workers with irregular duration work days.
- For simplification of calculations, let's assume a uniform distribution of trips within the two-hour commute period and split the commute period into 20-minute "ridematching intervals." We assume that a commuter will adjust their commute departure time by a few minutes to make a match, within a 20-minute interval. Hence 1/6 (16.66%) of the 10% are willing to adjust their schedule a bit to match within a 20-minute interval. In truth, commuting does not have a uniform distribution. The Washington DC metro map ridership distribution by half hour shows this:

[5] *Downtown Palo Alto Mode Split Survey*. By EMC Research for Palo Alto Transportation Management Association. May 2015, pp 29. http://www.paloaltotma.org/files/managed/Document/80/Downtown%20Mode%20Split%20Survey%20Report.pdf.



Non-uniform Washington DC Metro ridership distribution - by half hour[6]

- If there are multiple ridesharing services competing in the same area, and if residents have some number of those services installed, but don't run all the apps each time they try to match, then there is some loss of efficacy by having non-intersecting portions of member pools in multiple services. We will assume this is another 50% efficacy loss.

Calculations for the Palo Alto example: Within a 20-minute interval, only 4 out of 31,500 can be matched:

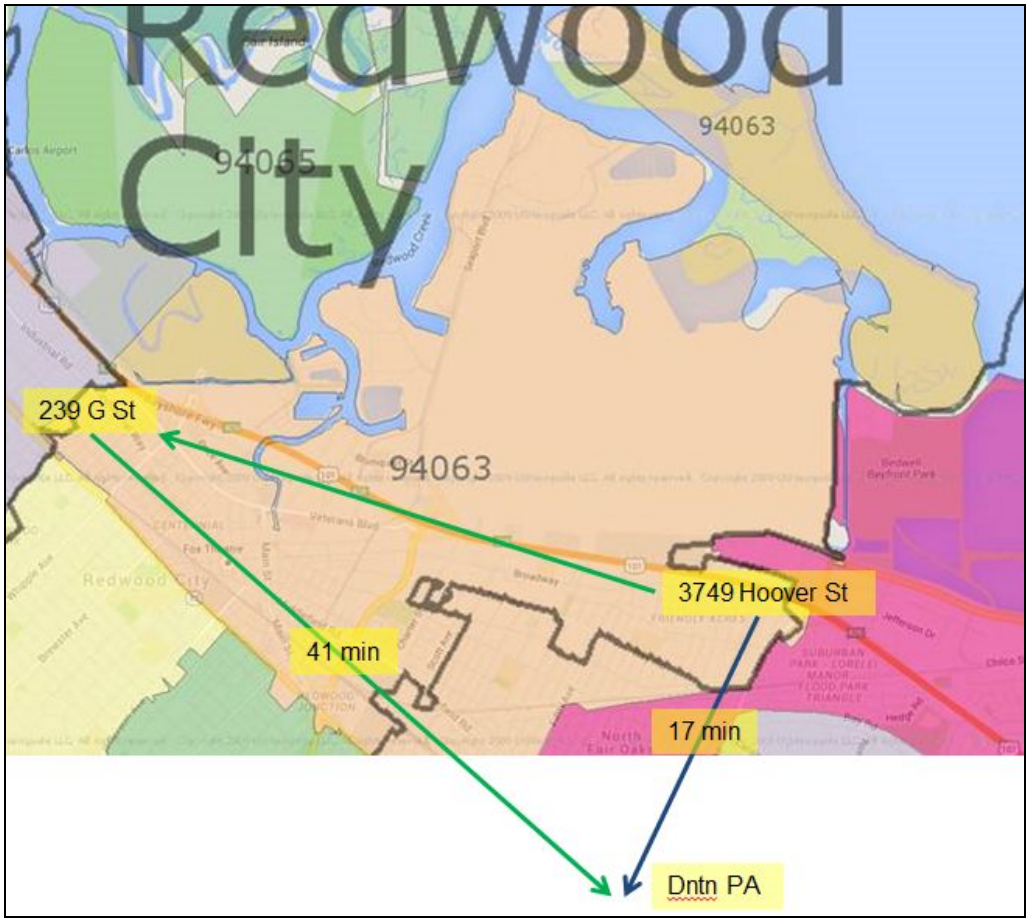
- 500 residents 94063 zipcode commute to downtown Palo Alto
- 10% participants are on-demand ridesharing members * 16.66% within a 20-minute matching period = 1.6%.
- 1.6% of 500 is 8.
- Inefficiency from having multiple competing services reduces this by 50%.
- Only 4 out of 31,500 in the Redwood City zipcode may be matched for commutes to downtown Palo Alto within a 20-minute matching interval.

An additional ridesharing complexity is the "Day 1 Challenge." Even if a quantified analysis using travel demand data shows that critical mass may be obtained, there is still a "launch day" problem. Systems need to achieve system-wide critical mass on the first day of operation (Day 1), because a participant will only put up with two failed ridematching attempts before they abandon a software system.

- In the above example, if only 25% of the on-demand rideshare market have the app installed and open the app on Day 1, then the probability of matching is only 25% of the stated probability above.

There is yet another "shrinkage factor:" The 94063 zip code in Redwood City has 31,500 residents and 500 residents who commute to downtown Palo Alto:

[6] *What Happens to Metrorail Ridership on Holidays?* By Washington Metropolitan Transportation Authority, October 25th, 2012. http://planitmetro.com/2012/10/25/what-happens-to-metrorail-ridership-on-holidays/.



Source: zipmap.net.[7]

Let's invent a ridesharing service called "CarRideGo." It is unlikely that a CarRideGo 94063 member living at 3749 Hoover Street in Redwood City with a 17 minute commute (blue vector in the image above) will a 94063 member living at 239 G Street as this will entail a 41 minute trip (two green arrows above). CarRideGo service members are willing to do good and, if there are parking hassles, then they may be motivated to go out of their way a bit more than usual. Our local transit agency, VTA, indicates that if there is only a 30% time penalty (22 minute commute with a pick up vs. 17 minutes without a pickup), then 3749 Hoover Street may be willing to pick someone up on the ride in.

A3. Simple suggestions to Increase Matching Probability

Some suggestions to increase matching probability

- Charge for workplace parking and/or provide incentives to shift mode. Raney provides evidence of commute mode shift from 75% to 50%. [8]
- Use meeting points or "hubs" to aggregate rides. For example, Park and Ride locations where commuters can meet up to carpool. (This increases the number of compatible zip codes.)
- It is reasonable to rideshare across zip codes. On the way to downtown Palo Alto, a 94063 member could drive and pick up someone in 94025 or 94027 on the way.

[7] From http://www.zipmap.net/California/San_Mateo_County/Redwood_City.htm
[8] Raney, Steve. Reduce Bay Area Commuting by 25%, white paper for City/County Association of Governments of San Mateo County, Chapter 10C. http://www.cities21.org/wp.pdf.

A4. Scoop obtains 0.6% commute mode share at Cisco

Scoop is currently being offered to facilitate ridesharing for Cisco's 15,000 North San Jose employees (Cisco is a major US technology company). As far as public ridership statements, this Scoop/Cisco implementation holds the world car-loving area P2P on-demand carpooling record. Ridership has grown by 100X in 8 months since Oct 2015 launch, approaching 10,000 Cisco "matched users" per month. By Scoop's definition, two or more "matched users" are required for a carpool commute trip. For Cisco's 15,000 employees, this represents 0.6% commute mode share. In October of 2015, Scoop revealed their previous public record in Pleasanton's Hacienda Business Park, with more than 20 roundtrip carpools per day, with focus on carpool formation from Oakland residences to Pleasanton jobs. Other P2P ridematching services such as Lyft Carpool have not made public statements about ridership.

A5. 17 Practitioner comments provide opinion and insight:

The Center for Urban Transportation Research (CUTR) at the University of South Florida hosts the transp-tdm list serv, a community of 2,000 transportation demand management practitioners who provided invaluable insight into this research. 17 of their comments are provided below.

Given the lack of success of P2P on-demand ridematching in car-loving areas, no one yet can claim to have "solved" the problem. The curated practitioner dialog below helps to further inform this topic and highlights the wide range of opinions and insights. In some instances, an author response is provided.

Practitioner comments on this research:

- This is right on. It really points out: the problem we are facing in this space, why we need a general area-wide carpooling service, that carpooling is best operated by a large group of employers in an area.
- Yep. You nailed it. If you come up with solutions to that, let me know! :)
- We think similarly. Here's how I've explained it. Odds you will carpool equals the product of: A) odds you have another member living near enough to you, B) odds that person has an inbound commute time similar to yours, C) odds that person has a work location similar to yours, D) odds that person has a departure time similar to yours. I think I left out a few factors -- I seem to remember there being six.
- QUESTION: Wouldn't it be more reasonable to use the 50 carpoolers that are the 10% you think would be potential for ride sharing. The question being, what is the likelihood that given those 50, or a subset of it, matches could be found for a morning or evening commute? AUTHOR RESPONSE: I don't believe so, because someone leaving at 7:10AM will not carpool with someone leaving at 8:50AM. So I believe there needs to be some splitting up of those AM commuters into 20 minute-intervals. This is only a general supposition as travel preferences vary widely.
- It's not quite the needle in the haystack. Still very tough to get there, don't get me wrong, but doable. It is a tough space for sure. Believe me I have been watching the space for 15 years. New efforts should learn from past efforts.
- As far as the most obvious reasons for the demise of carpooling in the USA. It's not for any technical barrier, but rather government policies that have caused carpooling to decline in America - when it's growing elsewhere: 1) Automobiles are subsidized; no increase in the gas tax for decades, resistance to tolling, Federal incentives to drive (see #2), and the FHWA performance measures placed on every DOT are tied to "vehicle" throughput and not "passenger" throughput. 2) Employers have ZERO financial incentive to encourage carpooling; Federal Commuter Tax Benefit provides corporate America with millions of tax dollar savings if you buy a transit pass (good) and TWICE as much for parking (it simply pays to drive), and most important. 3) Every city on the Peninsula (except Stanford) provides FREE parking (just like every other city and most employers in USA). We simply must stop giving away FREE

parking (everywhere) and stop requiring developers to build more parking spaces (10,000 spaces at the new Apple complex)

- I cannot argue with your logic. However, your analysis is largely assumptions and speculation. My frustration with the new generation of ridesharing services and technologies is that the vendors seem unwilling to share or collaborate in objective evaluation findings as to the actual effectiveness of programs and services offered in terms of travel and other impacts.
- Really interesting seeing it set out like that and really highlights some of the challenges! I guess you can at least go some way to reduce the size of your haystack by focussing promotion at the employment site itself, rather than just the community level.
- Although I understand the logic behind your calculations, census data shows that on average 10-12% of the commuting population carpool to work here in California and Silicon Valley. Your numbers don't support that at all. Of course, it all depends on whether you carpool with a family member or close neighbor but your analysis seems incredibly far off from an average of 10% carpooling on a typical day. AUTHOR RESPONSE: 10% commute mode share for carpooling = 8% fampools + 2% not-fampools. Of the 2% not-fampools, many are formed with work or neighborhood acquaintances outside of a household, so do not need an on-demand ridesharing app. On-demand ridesharing allows flexible carpooling with strangers, so that is currently a small portion of the 2% not-fampool - but hopefully there is a way to grow demand.
- I agree with the comments that others have provided about auto-oriented land use planning, free and ample parking, and the small likelihood of a person choosing to rideshare or not. I'm looking forward to seeing carpooling rates creeping up to 15%, then 20%, and so on with parking pricing, smarter permitting, and parking supply constraints.
- Intriguing problem, as you outline quite graphically. Your scenarios is bleak, indeed. I see some cracks that might be exploited: A) driving to work is a dreary, detested activity. Point this out, as a way to tackle the 75% of current SOV commuters your assumptions exclude. B) play up the advantages of "passengerhood" vs. "driverhood" especially now that being constantly "connected" has become so important. C) Consider a common booking app to be shared by the various companies so that they don't all compete in the same micro-markets. Also consider providing for links between parts of trips, so that a shared car can exchange riders at various rendezvous points (like park-n-ride lots, freeway exchanges) to make more matches possible. D) look at combining ridesharing with carsharing, so that you get the advantages of both, getting both better revenue numbers and providing access to a car while at work for any workers without their own car a few metres away. Your basic appeal is to save money, but that requires doing without one car that the household now owns, and that is harder to get them to agree to unless carsharing can provide a car the odd time, either/both at work and in one's residential neighborhood. See this essay to envision how it might work: http://bit.ly/1ZzEDEr
- Your analyses is very true, especially for US where suburban growth is the normal trend. I believe if we can make it really painful to drive alone (tax, toll, no car loan, etc.) and parallelly make it easy to use alternative modes including carsharing/ridesharing people will change their behavior gradually. Of course we have to change our land use policy. Question is, is there enough political will to do all these?
- You've illustrated the problems and challenges of ridesharing quite nicely. From a MPO's perspective, the question we're considering right now is how do we continue to promote and encourage ridesharing in a way that a.) is scaled to its continuing decline, but b.) recognizes that there is still great potential for the mode. I'm coming around to the belief that a public-agency ridesharing database is no longer the preferred model for assisting the public in finding rides. As you've laid out, there are plenty of third-party private apps and websites out there now, since the rapid adoption of mobile technology in the past few years. So, how does a MPO/Transit agency/other public agency provide meaningful rideshare support and information to people interested in choosing that mode, without overburdening staff and resources? Down in the Bay Area, I saw MTC's RFP to promote third-party ridesharing apps and am interested in seeing how that plays out. But the real key, it seems to me, is development of a data standard, similar to the GTFS used by

transit providers. The inherent weakness of market-based solutions for ridesharing is the diffusion of those interested in sharing rides. Currently, people need to sign up for a variety of apps and services in order to find or share a ride. But were there a data standard, no matter what your preferred app may be, a single app (like Ridescout or Transit App or MoovIt) would let people see potential rides or riders across a variety of apps. Is there an effort to develop such a standard? If there is, I'm not aware of it. But I think it's the missing link required to realize the potential of the technological opportunities we have related to ridesharing. Thoughts? AUTHOR RESPONSE: Two standards efforts: 1) GTFS-SUM (Shared Use Mobility) open data standard effort. Founding partners include: RideScout, TriMet, CUTR, Trillium Transit, IBI, Technology Association of Oregon. 2) RMI's Interoperable Transit Data: Enabling Mobility as a Service

- You're double counting here. You're benchmarking against the 8% of the actual commuters. That 2% is the result of all the discount factors that happen in all the places. It's the product of Prob(Willing to Carpool) X Prob(Matching Home/Work Locations) X Prob(Matching Home/Work times). But then you're taking that number, rounding up to 10% and saying that's the upper bound of likelihood to commute. You're feeding that back into the first parameter. But the first parameter should be, "If all other criteria matches (home/work/start time/end time), would I be willing to participate?" I'd start with a 50% estimate, and if I were to guess high I'd guess 80%. AUTHOR RESPONSE: I have attempted an evidence-based (if depressing) equation that multiplies probabilities. It is not 100% accurate. A valuable new addition will be a POTENTIAL MARKET equation that multiplies probabilities - (and most of us agree that pricing will increase this market size). From an evidence standpoint, the US has never seen 10% (or even 0.5%) combined membership for {Carma, Carzac, HOVee, etc} in an auto-centered location. Next in evidence, we have seen a series of on-demand ridesharing pilots where members joined, did not match, and quit. So, the depressing equation is 500 commuters * low recruitment probability * low match probability * non-intersecting membership pools * "Day 1 problem" shrinkage * time penalty shrinkage.
- If you had an app that showed you 8 matches, or 4? rides, every 20 minutes, wouldn't that be a good result? I am not sure why this is written this way. AUTHOR RESPONSE: 4 rides repeated over six 20-minute periods would be a good result, possibly a record. A set 24 drivers and 24 riders still may have a bit of a challenge as commute home departure distribution is wider than in the AM, potentially causing problems at the edges.
- RE: "If there are four equally strong mutually exclusive ridesharing services competing in the same area, the probability of matching is 1/4, matching 2 out of 30,000." Mutually exclusive is incorrect. People have Lyft, Sidecar, and Uber on their phones. Anyone serious about ridesharing would load 4 apps, and the pool wouldn't get diluted. Or, given the network effect, one or two players will dominate this market. Most likely one, if they were mutually exclusive, but they won't be. AUTHOR RESPONSE: Agreed I have overstated the mutex effect. However, there is some loss of efficacy by having non-intersecting portions of member pools in multiple services. The "network effect and service consolidation" should be part of a "potential market" equation. (Section above was updated to have only 50% loss.)
- For a period, I lived in Kinsale Ireland, commuting to Carma's offices in Cork. Kinsale was a town of 3,000 people, about 17 miles from Cork, a town of 250,000 people (small city, main work destination). I used Carma to get to work every day for several years. There were about 300 people of the 3,000 people in that town that were registered users with schedules on the Carma system. I mainly rode rather than drove, and I had probably about 40 or so drivers that I commuted with over the years. I'd use a lot of the same drivers, because I liked to go at a specific time of day (I'm generally an early riser, so I'd try to get in at 7 or 7:30am), which limited my choice of drivers and because people fall into habits of who they tend to commute with every week I'd generally have between 3-7 different drivers rather than the theoretical max of 10. I know some riders who would have only 2-3 drivers in a week, because of their destinations, etc. Generally, despite the large number of available registered users from the town, when I did an analysis of those who used the system every week, it was only about 60 or so of the 300 registered users from that town, and more than half of the users did not use the system every day. Several users were students who would only go to college a few days a week, etc. Carma by itself contributed to a 3-5% modal shift toward ridesharing in that commuter town. And this was without any sort of incentive, as there were no HOV lanes

and no reduced tolls in this area. In other areas that Carma has a large presence, Carma has at least that level of impact. But it took quite a sustained presence to produce that level of impact in the town. In a place the size of the USA, this would represent about 5 million to 8 million more carpoolers, but it would also require a huge amount of awareness building. I realize this is anecdotal but it is helpful to consider that ridesharing communities absolutely do work, and do thrive, but it's not easy to get them started. I know that Carma continues to innovate with its approach to the commuting challenge, and that they are not satisfied with only a 3-5% modal shift. The statistical approach you outline, highlights that the math is difficult, but it certainly is highly inaccurate to think that this implies that there is not a large overlap in travel patterns that can be taken advantage of. I am more convinced than ever that true ridesharing is a very viable option for many of us.

- From Bjørn Sandelien: In Norway and specifically in our second largest city Bergen work has been going on for quite a few years to promote ridesharing. A pilot project was started in 2010 involving nine companies with 7000 employees in a business park in the vicinity of Bergen airport, Flesland. The pilot involved testing of the Avego/Carma application. An evaluation based on a period from October 2012 to February 2014 and a survey among 1000 employees has been carried out by SINTEF and is recently documented in SINTEF report A26695 published on May 29, 2015. See link http://www.sintef.no/en/publication/?pubid=SINTEF+A26695 . Results are described in the four and a half page English summary and must be characterized at best as quite modest. Of the respondents only 21 persons (2 %) were active ridesharers. It is also of interest that only 8 % of the car trips to/from the participating companies included passengers that used the ridesharing application. During the 17 months long project period a total of 7,034 ridesharing trips were recorded. That gives 414 trips per month. It is calculated that in average each participant makes 0.8 ridesharing trips per month. Access to a carpooling lane was ranked as the most important incentive for ridesharing. The main highway to the airport (National Route 580) has since 2009 had a bus-lane in each direction open for 2+ carpools. These modest results are achieved even though considerable resources are spent. The pilot has been part of a project running since 2007 and led by my old employer the Norwegian Public Roads Administration. (I am now a pensioner). Two major products of the project have been development of a Norwegian ridesharing application www.HentMeg.no and the development of a public platform for ridesharing applications that also can facilitate public transport and taxi applications. To my knowledge the work so far constitutes only a start of an open standard public platform. What that standard technically implies I don't really know.

A6. Acknowledgements

- CUTR's transp-tdm list serv provided invaluable insight into this research.
- CityLab published an article on this research, leading to additional comment and insight.[9]

[9] Jaffe, Eric. Suburban Ride-Sharing Is Mathematically Impossible: Just about, anyway, says a sobering thought-experiment for transit start-ups. In CityLab. November 2015. http://www.citylab.com/commute/2015/11/suburban-ride-sharing-is-mathematically-impossible/415494.

Appendix B: Seasonal Reduction in Bike Commutes

Short link to this google drive shared doc: http://bit.ly/1WfNEU3
First version Oct 27, 2015. Thanks to transp-tdm!

TITLE: Seasonal Reduction in Bike Commuting

ABSTRACT: Public policy is moving towards year-round reduction in single occupancy vehicle (SOV) commuting, with a push to increase biking. Bike counters are spreading rapidly worldwide, providing the opportunity to quantify the winter reduction in bike commuting from foul weather. Substantial real-estate benefit may accrue from year-round SOV reduction, as employee parking facilities are sized for the annual peak day. Enterprise commute trip reduction software by Luum and RideAmigos is advancing to provide daily commute mode dashboards, allowing more precise tracking of winter bike decrease and SOV increase. As far as current measures of winter bike decrease and SOV increase, in Umeå, Sweden, pleasant weather bike commute mode share is 35%, dropping to 22% in winter. Most bikers switch to transit in the winter, resulting in only a 3% nominal SOV increase. Umeå provides an inspiring example of low year-round SOV commuting. Bike commuting in ten major US cities is logged, with a range of 1% to 10.5% bike commute mode share and a range of 5% to 80% winter biking reduction. Eight European cities have 6% to 48% bike commute mode share, with 0% to 80% winter biking reduction. Future research should focus on the winter SOV increase and how to eliminate it.

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Worldwide, public policy for **year-round** traffic and GHG reduction is advancing, calling for reduced single occupancy vehicle commuting with increased bike and transit. Substantial real-estate benefit may accrue from year-round SOV reduction, as employee parking facilities are sized for the annual peak day. California and the San Francisco Bay Area provide an example with the following adopted policy: [1]

TABLE 1: California and Bay Area policy:

	Per-capita VMT reduction	Transit	Bike
California Transportation Plan 2040	17%	Double	Double
Caltrans Strategic Management Plan 2020	15%	Double	Triple
SB375 2030 Bay Area Target	15%		
Plan Bay Area 2040	15%	Double	Double

This paper has the following focus: Bike commuting provides a compelling user experience in nice weather during summer Daylight Savings Time, but what happens in the winter when it's cold, rainy, and dark? How much of a seasonal drop off is there? How does this vary by region?

Bike counters are spreading rapidly worldwide, providing the opportunity to quantify the winter reduction in bike commuting from foul weather. Enterprise Commute Trip Reduction software by Luum and RideAmigos is

[1]Raney, Steve. Reduce Bay Area Commuting by 25%, white paper for City/County Association of Governments of San Mateo County, Chapter 4. http://www.cities21.org/wp.pdf.

advancing to provide daily commute mode dashboards, allowing more precise tracking of winter bike decrease and SOV increase. ECTR: a) automates employer commute programs, b) expands upon payroll commute benefits, c) enables small increments ($0.25) to daily commute fees/incentives. [2]

B1. US and European Summaries [3] [4]

B1A. US Summary

Below are results from 10 US cities. These data are far from perfect, often relying on single bike counters rather than more sophisticated measures. The commute "Bike mode split" is given for spring months, followed by the percent "Winter drop off" for winter months (Dec-Feb) from the "Bike mode split." For example, Missoula has 6.2% springtime bike mode split. A 75% winter drop off results in 1.55% winter commute mode split:

TABLE 2: US Summary:

US Location	Bike mode split	Winter drop off
Los Angeles	1.0%	~5%
San Francisco	3.4%	~20%
Boston	2.1%	40%
Portland	6.1%	43%
Seattle	3.4%	44%
Austin	1.4%	61%
Boulder, CO	10.5%	62%
New York City	1.2%	70%
Missoula, MT	6.2%	75%
Chicago	1.4%	80%

Austin has some hot and humid summers that reduce biking by 50%. Hence, some locations have heavy summer weather that also works to reduce bike commuting.

By US standards, Portland, Boulder, and Missoula have fostered high levels of biking. Davis (CA) is the US bike record-holder at 18.6% bike commute mode split. Winter drop off appears to be a function of weather severity, culture, and city effort level.

The data on winter drop off was pieced together (sources provided in detail sections below) and suffers from lack of uniform methodology. Often, a bike counter at single location, counting trips of all purposes, serves as a proxy to measure winter bike commute drop off.

B1B. European Summary

TABLE 3: European Summary

European Location	Bike mode split	Winter drop off	Snow days/year
Lund, Sweden*	48%	0%	22
Copenhagen	37%	20%	31%

[2] Raney, Steve. *Reduce Bay Area Commuting by 25%*, white paper for City/County Association of Governments of San Mateo County, Chapter 6. http://www.cities21.org/wp.pdf.
[3] Wikipedia commute mode split page. https://en.wikipedia.org/wiki/Modal_share
[4] McKenzie, B. *Modes Less Traveled—Bicycling and Walking to Work in the United States: 2008–2012. American Community Survey Reports*. For US Census Bureau. https://www.census.gov/prod/2014pubs/acs-25.pdf.

Umea, Sweden*	35%	32%	130
London	2%	33%	1
Oulu, Finland	22%	67%	122
Vienna	6%	78%	69
Helsinki	18%	80%	110
Munich	17%	80%	67

[5] [6] [7]

In explaining European bike-centricity, one expert states, “The importance of bike facilities that are separated horizontally and/or vertically from motor vehicle traffic can’t be overstated. That is the key to the bike mode share success in Copenhagen and among the Dutch cities and towns.”

Central Europe is more bike-centered than the US, but less so than Finland. For very cold European cities, Timo Perälä opines that the most influential winter cycling factors are:

- the strength of a city’s bike network (ideally made up of protected bike lanes)
- how the bike network is maintained during the cold and snowy months (ideally as a top priority).

“People who stop cycling as the winter comes mention two obstacles—no safe infrastructure, no winter maintenance—as the most important ones. Once there’s no proper cycling infrastructure nor winter maintenance, cycling through the year becomes an extreme sport.” [8]

B1C. Shaving down the winter SOV spike

A future step on this topic is to characterize and reduce the spike in SOV commuting (caused by the drop in biking) in winter. For public policy-making efforts towards large commute mode shift, there needs to be a focus on shaving off the winter SOV spike away from biking, as savings in commuter parking spaces can only be monetized based on the single day with the highest parking utilization (and based on the highest utilization day taken over a number of years). The Silicon Valley "Trip Caps" will soon generate daily commute mode reporting, to the point where winter spikes can be seen. Large winter storms that temporarily increase SOV will create the largest challenge.

In Umeå, in northern Sweden, the share of bike commuting is high, but has a significant drop off: summer 35%, winter: 22%. However, TRANSIT picks up the majority of winter cycling drop off - most of the mode shift is to green modes, with only a 3% (nominal) overall winter SOV increase. SOV increases from 18% in summer to 21% in winter. This is an example of a relatively small winter SOV spike. (See detail in the Umea detail section below.)

Likewise at University of Oulu (Finland), bike commute mode is 71% in spring, dropping by 22% (nominal) to 49% in Winter, but other virtuous modes pick up 17% (nominal) resulting in a 5% (nominal) winter SOV spike:

TABLE 4: Oulu Winter/Summer mode split: [9]

[5] Perälä, T. *Winter Cities Shake Up, Edmonton*. For the World of Winter Cycling Conference. Jan 2015, http://bit.ly/1OilCla.
[6] Perälä, T. *Oulu - the Winter Cycling Capital.* For Green Ways for Green Cities Conference. May 5, 2013. http://bit.ly/1NUckZa.
[7] Number of Snows Days per month. http://bit.ly/1TnWl9m.
[8] Jaffe, Eric. *How to Keep Cyclists Riding Even in the Frigid Snowy Winter: The two key lessons learned by Northern European cities.* In CityLab. Jan 26, 2016. http://www.citylab.com/commute/2016/01/winter-bike-riding-seasonal-cycling/426960/.
[9] Juga, Jari. Winter Cycling of University Students and Personnel: Attitudinal and Non-attitudinal Antecedents. For Oulu Business School. April 29, 2013. http://bit.ly/1RPORhz. Rough mode split calcs by the author. .

	Car	Bus	Bike	Walk
Winter	15%	15%	49%	21%
Summer	10%	4%	71%	14%

Future practice and research on the winter SOV increase should increase accuracy and sample size. Strategies to reduce winter SOV increase should be developed.

B2. Details on Selected US Cities

B2A. Los Angeles (UCLA): 5% Winter drop off

UCLA data (commute to/from school with additional trips for mid-day errands) is hard to interpret, because of large vacation breaks in the school calendar year in December and March. Feb '14 is 3,800, April '14 is 4,400. I am ignoring the large Oct '14 traffic level.

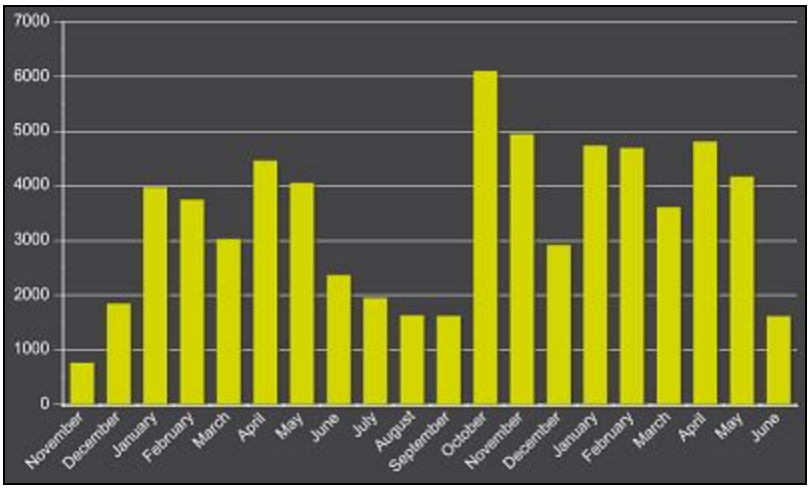


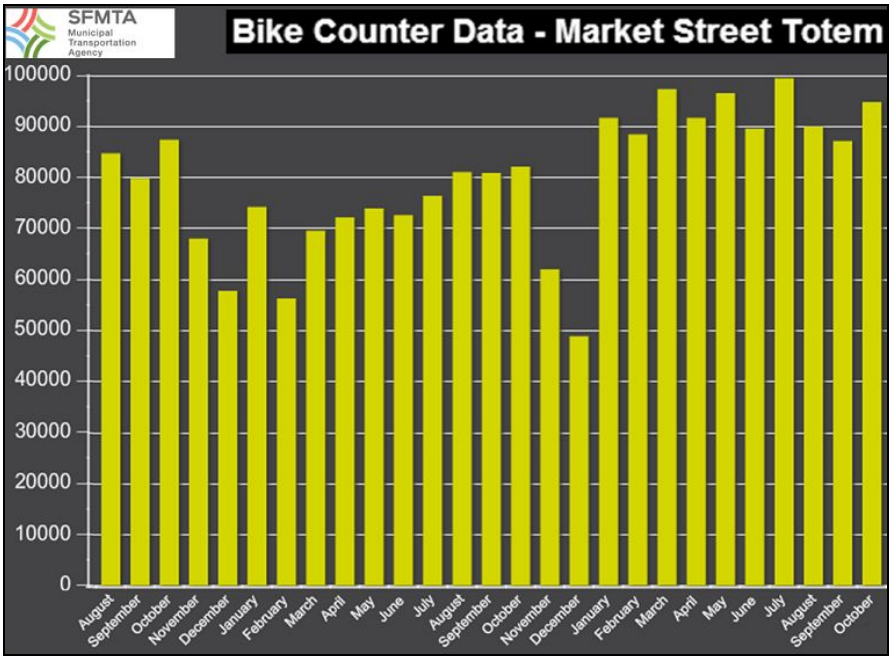
FIGURE 1: UCLA Strathmore Bike Counter [10]

B2B. San Francisco - Winter drop is typically 20%

The general purpose (not-dedicated-to-commuting) bike counter numbers are subject to interpretation but show a smaller drop off. A chart from August 2013 to October 2015 is shown below.

- February 2014 and January 2015 appear to have ZERO drop off.
- Dec '13 and Feb '14 combine for 5,700 versus 7,200 for March-June '14, a 20% drop off.
- Dec '14 (5,000) versus the same March-June '14 is a 30% drop off.

[10] UCLA Strathmore Bike Counter. http://ucla-strathmore-bike-counter.visio-tools.com/.



[11]

FIGURE 2: Bike Counter Data - Market Street Totem

B2C. Portland – winter drop is 43%

Data from the Portland Hawthorne Bridge Bike Counter shows: [12]

- April-September peak season is about 7,000 weekday trips/day
- December-February winter season (ignoring holiday periods) is about 4,000 trips/day.
- So very roughly a 43% drop from peak to low.

Hawthorne Bridge is the most popular bikeway into downtown from the central eastside.

The Tilikum Crossing, a new bridge over the Willamette River carrying bikes, peds, buses, and light rail (no cars) opened on Sept 12, 2015. Because of its location in relationship to the Hawthorne Bridge, some trips have likely been diverted.

A bike count analysis report is available.[13] Most of the report covers manual volunteer counts at 200+ locations across the city from summer 2013 and 2014. These counts are only conducted June through September each year. City of Portland Bureau of Transportation (PBOT) does not have specific weather data attached to dates, but in general it gets colder and rainy in Portland starting around October / November through April. Even the lowest winter weekday commute rate is still 40-50% of the peak summer commute.

A manual gender/helmet count on the Hawthorne Bridge was undertaken in September of 2015. From 7-9am: out of 1,509 riders, 67% were male, 33% female and 94% wore a helmet (citywide gender split is around 32% female and 81% wear a helmet).

B2D. Seattle - Winter drop is 44% [14]

[11] Bike Counter Data - Market Street Totem. http://eco-public.com/Public/?id=100007834.
[12] Portland Hawthorne Bridge Bike Counter. http://portland-hawthorne-bridge.visio-tools.com/.
[13] *Portland Bicycle Count Report 2013-2014*. For City of Portland Bureau of Transportation http://www.portlandoregon.gov/TRANSPORTATION/article/545858 .
[14] *Seattle DOT Fremont Bridge Bike Counter*. http://www.seattle.gov/transportation/bikecounter_fremont.htm.

April-September peak season is about 3,900 weekday trips/day. December-February winter season (ignoring holiday periods) is about 2,200 trips/day. Hence there is roughly a 44% drop from peak to low.

B2E. Boston - Winter drop is 40%

The Charles River TMA collected data in Cambridge on the Longfellow Bridge (summer traffic: 400 bicycles inbound per hour) and the winter traffic seems to average about 40% of that. Drop-off depends on severity of the winter. In this case, 2014 was a normal winter with snow on the ground but ploughed roads. Bike commute mode share to Cambridge is typically given as 7 to 10%, far higher than the rest of Boston.

Survey research (with a potentially skewed sample) found: [15]

- Typically, 2/3 of the riders in the survey bike every day, the other third bike less frequently.
- In a normal winter, about 25% stop cycling, and another 30-35% reduce the frequency with which they cycle.
- In an atypically cold and snowy winter (like that of 2015), about half of all cyclists stopped cycling, about 30% cycled, but not every day, and about 20% kept on going through the winter.

Boston's winter drop-off is less than Portland and Seattle, making Bostonians appear particularly hardy, given their colder winters.

B2F. Austin - "harsh winter" drop is 61%, "mild winter" drop is 29%, "harsh summer" drop is 50% [16]

A typical spring (May '13) sees 28K trips on the bike counter. In a harsh winter (Feb '12), biking drops to 11K. In a mild winter, biking drops to 20K.

A mild summer (June '15) has 28K trips and no drop off. A hot and humid summer (July '13) has a large drop off to 13K trips, a 50% drop.

In March of each year, Austin hosts the SXSW Conference and biking skyrockets.

B2G. Boulder, CO - Winter drop is 62% [17]

2000-2004 data for bike counts on Boulder Creek Path: East Side and Centennial Path. These paths have higher summer ridership than spring or fall, indicating that these numbers may be more recreational than commute.

	Apr-Sep	**Dec-Feb**
Boulder Creek East Side	900+ trips/day	300 trips/day
Centennial	400 trips/day	150 trips/day

[15] *Charles River TMA Bike Week Survey,* August 2015. http://www.charlesrivertma.org/cambridge-transportation-news/2015/8/12/bike-week-survey-results.html.
[16] Austin Bike Counter: Lance Armstrong Bikeway at Waller Creek. http://eco-public.com/Public/?id=100007648.
[17] Lewin, A. *Estimating Annual Bicycle Volumes on Multi-Use Paths in Boulder: A Longitudinal Data Analysis*. For masters thesis. March 2010, Figure 5.9, pp 30.

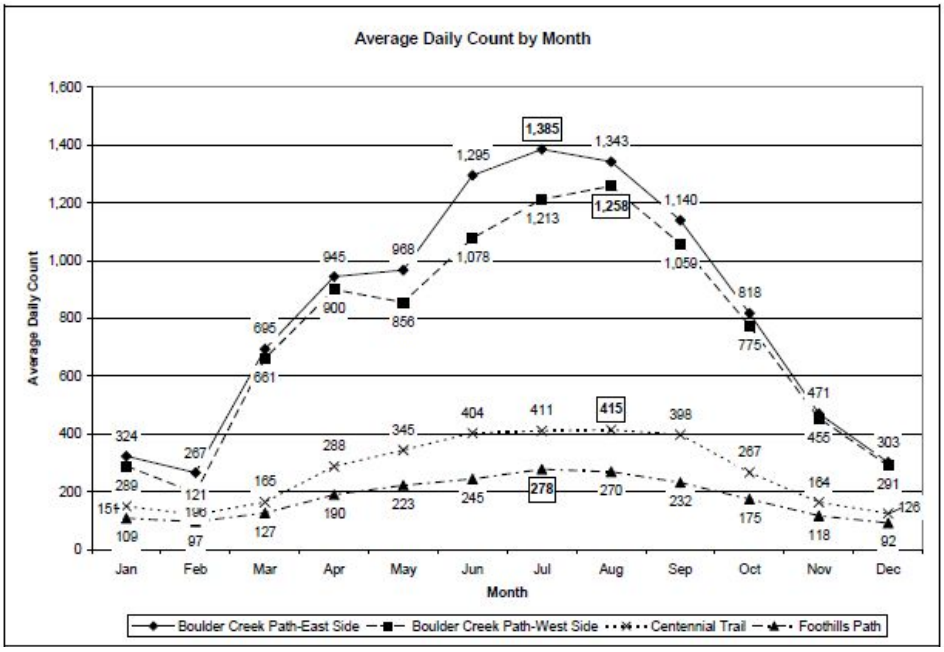


FIGURE 2: Boulder Creek Path bike count

B2H. New York City - Winter drop is 70% [18] [19]

For 2013 bike commutes at selected commuter locations (6 different locations):

- Winter monthly average: 6,312 trips/month for December - February
- In-season average: 20,372 trips/month for April - October
- Winter is 30% of in-season average: 6,312/20,372 = 30%, hence winter drop is 70%..

B2I. Missoula, MT - Winter drop is 75%

Missoula, MT provided October 2014 - September 2015 bike counter data:

[18] *New York City DOT bike counts*. www.nyc.gov/html/dot/html/bicyclists/bike-counts.shtml.
[19] *2013 All Year and Winter Cycling Indicators.* For New York City DOT. www.nyc.gov/html/dot/downloads/pdf/2013-all-year-and-winter-ci.pdf.

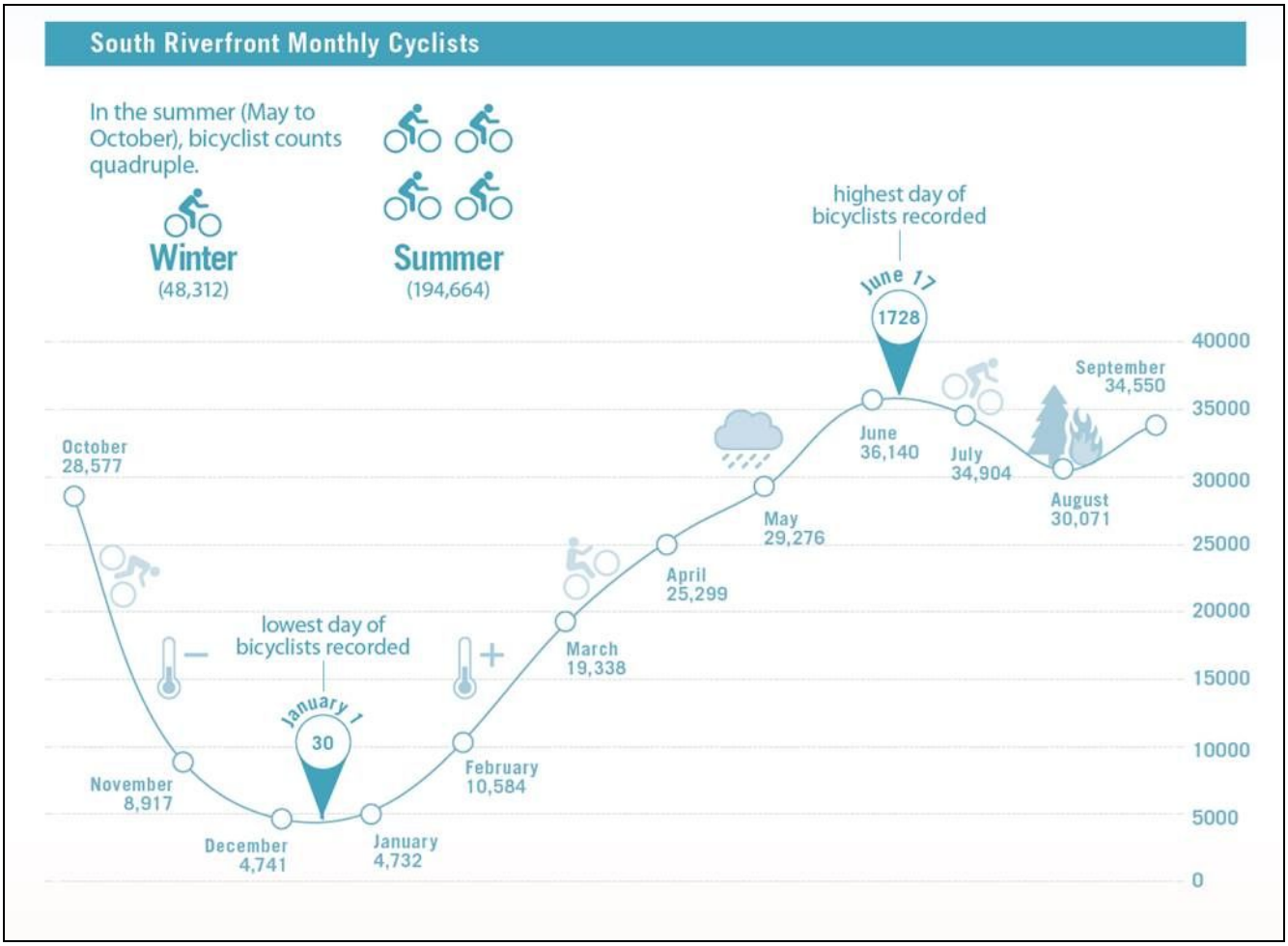


Figure 3: Missoula Bike Counter monthly data provided by Ben Weiss

B2H. Chicago winter drop is 80%+ [20]

Chicago's dataset has a "sparse" number of days. In Chicago, at the intersection of Milwaukee at Elston in the morning we have:

- 945 male riders on 7/8/14
- 193 male riders on 11/25/14
- 32 male riders on 2/8/14 (this might represent blizzard conditions)

B3. Details on Selected European Cities

B3A. Lund, Sweden: 0% Winter drop off

In Lund, in southern Sweden: 3 large companies report an INCREASE in winter biking (2015): Share of cycling of all commuter trips – summer 48%, winter: 51%. This with only 7 hours of daylight in winter, with an average temperature of freezing. [21]

[20] *Chicago DOT Bike Counts.* https://www.scribd.com/document/240207885/2014-09-BikeCount. Google spreadsheet calculations: http://bit.ly/1Xue0ia

[21] Mattisson, Pernilla Hyllenius. Green Citizens of Europe Project Evaluation Report. GREENCIT report 2014:107. http://en.greencit.se/.

B3B. Copenhagen - 20% winter drop off: heavy winter coats combined with priority snow plowing

“An important question frequently raised at conferences dealing with cycling is whether snow in the winter can influence the use of bicycles. What I learned in my study tour is that it does, but I also learned that snow should not be a big issue when policies to facilitate and encourage people to cycle in the winter are introduced. In Copenhagen, for example, cyclists do not seem to experience much of a difficulty when cycling in the winter because local planning policies ensure two important things: first, that bicycle lanes and paths are cleared from snow promptly after snow falls, and second, that snow clearance from bicycle lanes and paths has priority over snow clearance from car lanes and roads –except for car lanes on the four largest roads, which are cleared at the same time as the bicycle lanes and paths.” [22]

B3C. Umea, Sweden: 32% winter drop off

In Umeå, in northern Sweden, a 2014 commute survey found: Share of cycling of all commuter trips – summer 35%, winter: 22%, for a 32% winter drop off. Transit picks up the majority of winter cyclists - most of the mode shift is between green modes, with only a 3% overall winter SOV increase.

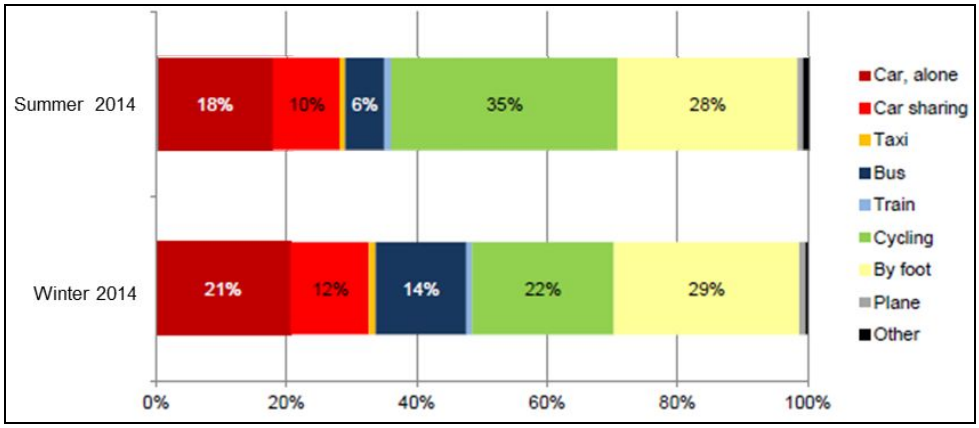


FIGURE 4: Umeå SOV increases from 18% in summer to 21% in winter

B3D. London bike share - Winter drop is 33% [23]

London Barclays Bike Share drops by 1/3 from August to January - this measure is for all kinds of bike trips including tourist trips, so may not be a strong proxy for bike commutes.

B3E. Oulu, Finland [24] [25]

Oulu has a population of 191,000 with 800 km of bike path, one of the highest ratios of path to population. Winter lasts for eight months. The first biking plan was implemented 1972-1982. Average snow coverage is 16”. Snow on paths is packed down and covered with gravel. 65% find sufficient traction with standard tires, 35% switch to studded tires. Paths are cleared before peak commute times at 7AM and 4PM.

[22] Rodriguez, L. *Making Our Communities More Liveable: Examples from Germany and Scandinavia*. For Sustainable Cities Collective. March 18, 2013. http://bit.ly/1MmZPV8.
[23] Miller, Stephen. Citi Bike Carries More Riders on Fewer Bikes Than London Bike-Share. For *Streetsblog NY*C. November 7, 2013. http://www.streetsblog.org/2013/11/07/citi-bike-carries-more-riders-on-fewer-bikes-than-bike-share-in-london/.
[24] Perälä, T. *Oulu - the Winter Cycling Capital. For Green Ways for Green Cities Conference.* May 5, 2013. http://bit.ly/1NUckZa.
[25] Juga, J. *Winter Cycling of University Students and Personnel: Attitudinal and Non-attitudinal Antecedents.* For Oulu Business School. http://bit.ly/1RPORhz. Rough mode split calcs by Steve Raney.

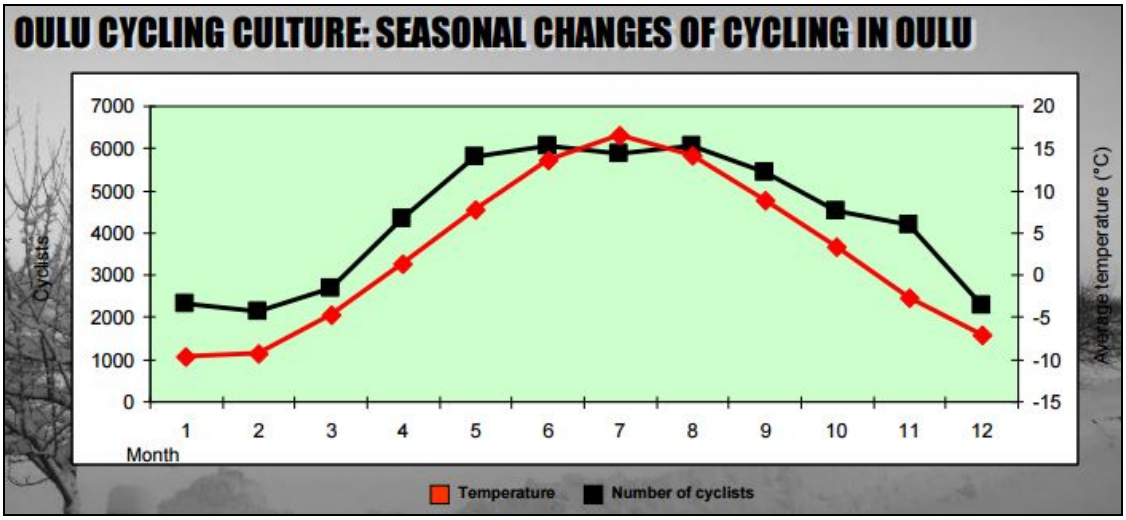


FIGURE 5: Seasonal Changes in cycling. -5C is 23F.

Timo Perälä breaks down Spring versus winter cycling propensity by age and gender:

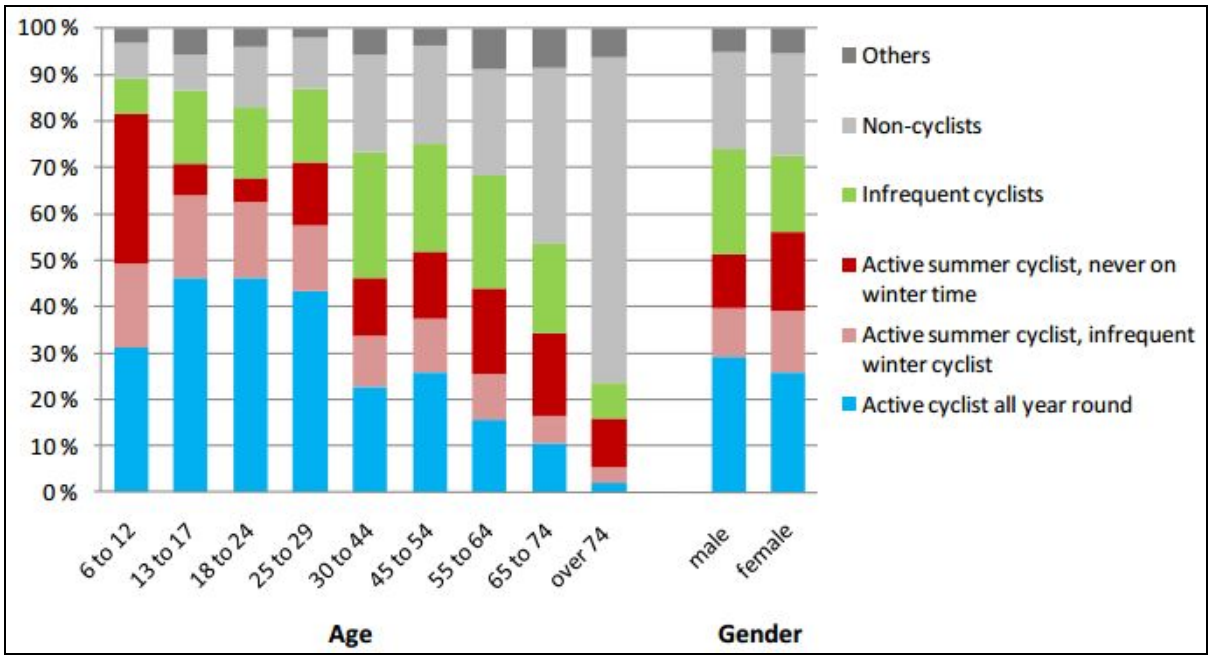


FIGURE 6: Oulu biking by age and gender.

At University of Oulu (Finland), bike commute mode is 71% in spring, dropping by 22% (nominal) to 49% in winter, but other virtuous modes pick up 17% (nominal) resulting in a 5% (nominal) winter SOV spike:

TABLE 5: Oulu commute mode split by season:

	Car	Bus	Bike	Walk
Winter	15%	15%	49%	21%
Summer	10%	4%	71%	14%

B4. Literature Review

Tin Tin found that the cycle volume on Tamaki Drive in Auckland City varied seasonally. Warm and sunny weather increased cycle volume while rainy and windy weather reduced it. [26]

Winters found that “more days of precipitation per year and more days of freezing temperatures per year were both associated with lower levels of cycling.” [27]

B5. Acknowledgements

Thanks to:

- The Center for Urban Transportation Research (CUTR) at the University of South Florida hosts the transp-tdm list serv, a community of 2,000 transportation demand management practitioners who provided invaluable insight into this research.
- Timo Perälä promotes and studies winter cycling. He organized the 2016 Winter Cycling Congress in Minneapolis. This web domain has expired, so need to find a link to: https://wintercyclingblog.org/2014/10/17/oulu-finland-winter-cycling-capital-of-the-world/
- Taylor Sutton, City of Portland Bureau of Transportation, Active Transportation Division
- Ian Stude, Director, Transportation & Parking Services, Portland State University
- Todd Merkens, Product Mgr, Luum (Seattle)
- Ann Sutphin, Travel Options Lead, Transit & Mobility Division, Seattle DOT (SDOT)
- Craig Moore, Sr. Mgmt Systems Analyst, Traffic Management, SDOT
- Ari Ofsevit, Pgm & Program and Communications Coordinator, Charles River TMA
- New York City: Kate Yu, Consultant, Steer Davies Gleave
- Missoula: Ben Weiss, Bike/Ped PM, Devt Services, Transportation Division, City of Missoula, MT
- Monique Stinson and Chandra Bhat’s TRB 2004 paper, “Frequency of Bicycle Commuting: Internet-Based Survey Analysis.” www.ce.utexas.edu/prof/bhat/ABSTRACTS/Freq_Bicycle_Commute.docB2I. They provide a US Bike Commute Regression Model by Season and Region, with the regression built using 3,500 survey responses. “The propensity to commute by bicycle in the winter season is lowest in Canada, low in the midwestern and northeastern regions of the U.S., moderate in the mideastern and southwestern U.S., and highest in the west coast.”
- More information on Swedish winter cycling is available in this Swedish-language report (page 20): http://bit.ly/1PnNxS9.

[26] Tin Tin, Woodward, Robinson, and Ameratunga. Temporal, seasonal and weather effects on cycle volume: an ecological study. In Environmental Health. March 8, 2012. https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-11-12.
[27] Winters, Friesen, Koehoorn, and Teschke. Utilitarian Bicycling: A Multilevel Analysis of Climate and Personal Influences. In American Journal of Preventive Medicine. Volume 32, Issue 1, January 2007, Pages 52–58.

Appendix C: Conflicted Commute Vector Map - Methodology

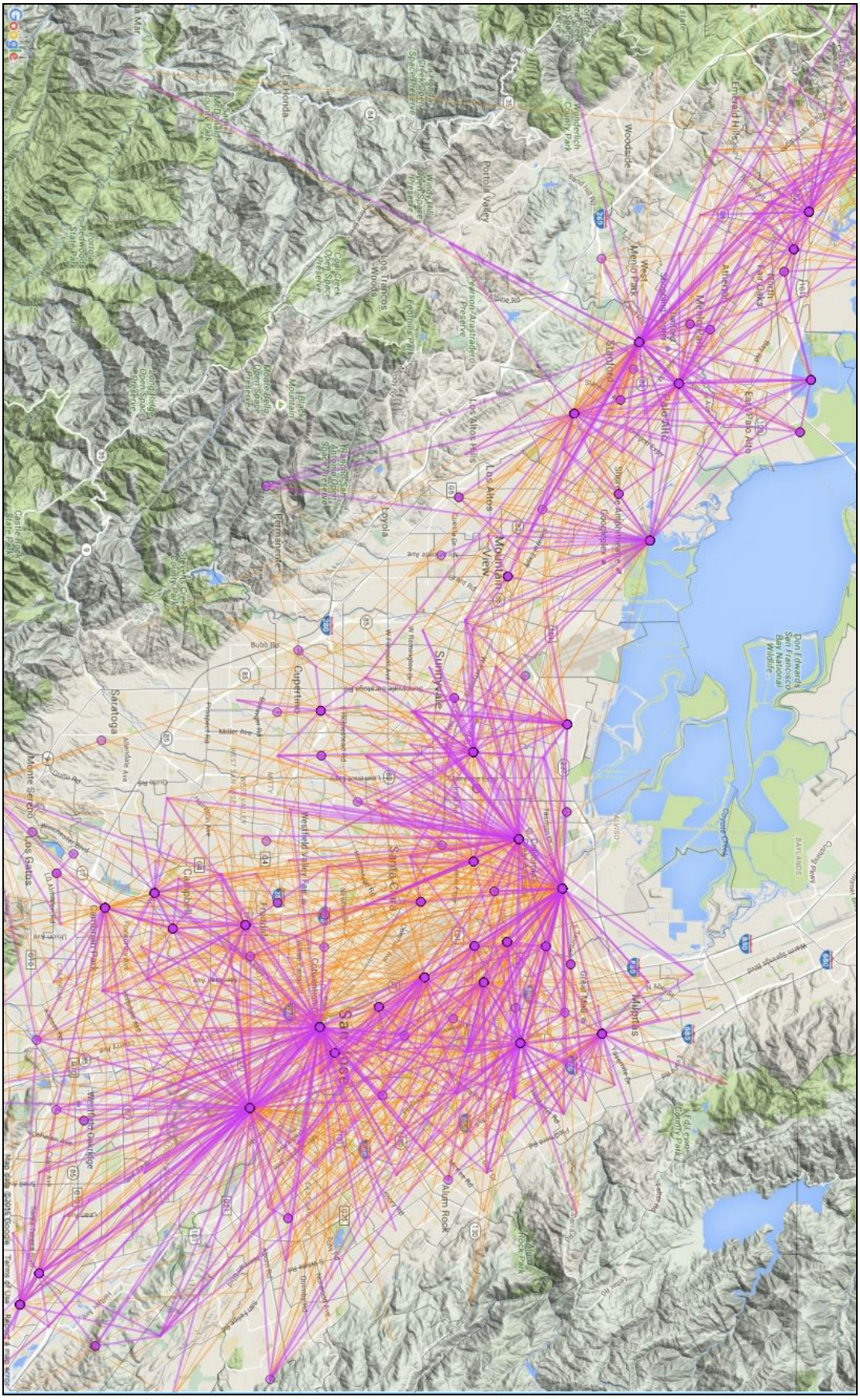
An appendix in larger white paper. Paper is undergoing review, proofreading, and formatting.

The Silicon Valley "cats cradle" or "string art fun" commuting pattern increases the difficulty of providing effective SOV alternatives. The commute vector map below shows how the messy suburban human settlement pattern is well-served by driving alone. Likewise, it is very difficult to create a transit system that effectively serves this pattern.

MTC's activity-based travel demand forecasting model predicts travel flow throughout the nine-county Bay Area. One output is a "synthetic 2015 day" of trips taken by hour, travel mode, and trip purpose. Trips are between Travel Analysis Zones (TAZ). Most TAZ are small communities containing about 5,000 residents, so are about one-sixth the size of a zip code. There are 1454 TAZ. The synthetic day contains 23.8M trips taken by 7.4M persons.

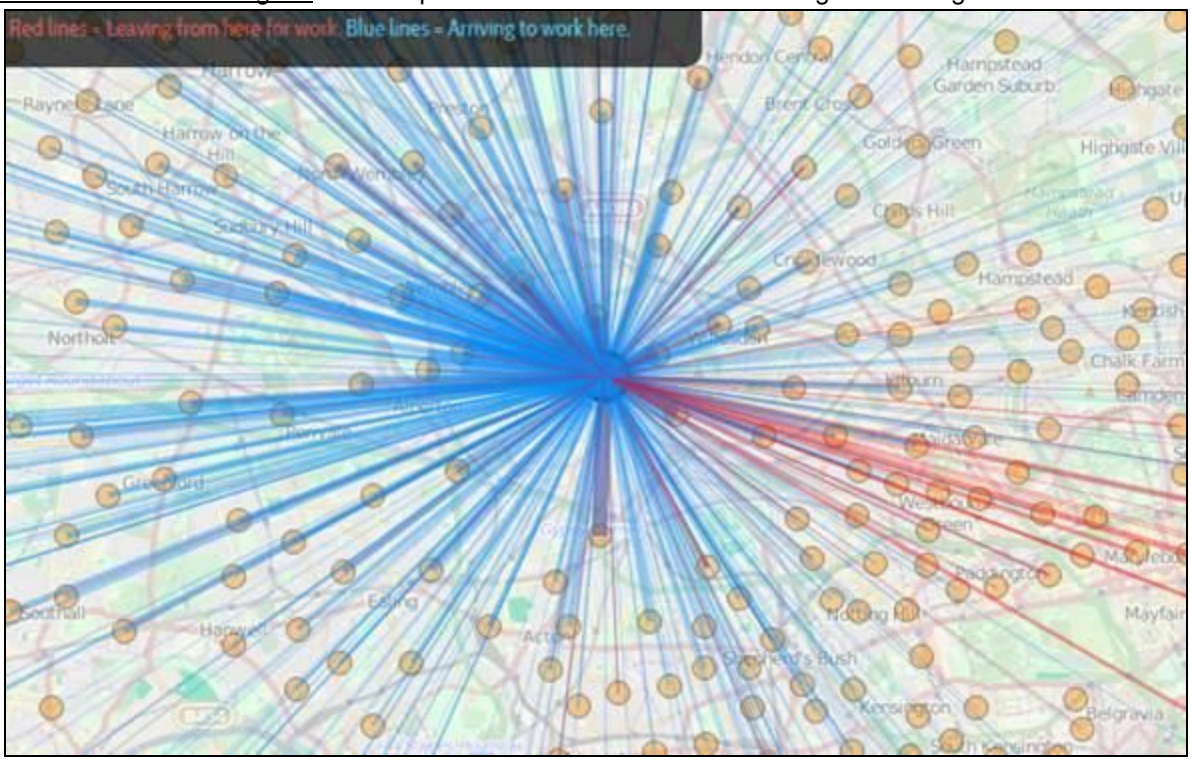
"Silicon Valley" is defined as both Santa Clara County and San Mateo County. For commutes that are "contained" in Silicon Valley (where both home and work are in the area) there are 788,000 morning commutes.

A commute vector is a directional line beginning in the middle of a residential commute origination TAZ and terminating in a work commute destination TAZ. Pink commute vectors have 60-1,200 commute trips. Pink circles represent employment centers. Smaller commute vectors of 40-59 trips are represented in orange. There are 1,102 pink vectors and 1,404 orange vectors.



Silicon Valley "Cats Cradle" Commute Pattern. QGIS analysis by Steve Raney. Image from: http://bit.ly/1HBgrGB

Within the field of commute flow graphics, and outstanding UK interactive map can be found here: http://commute.datashine.org.uk/. This map illuminates in- and out-commuting from a single TAZ-like area:



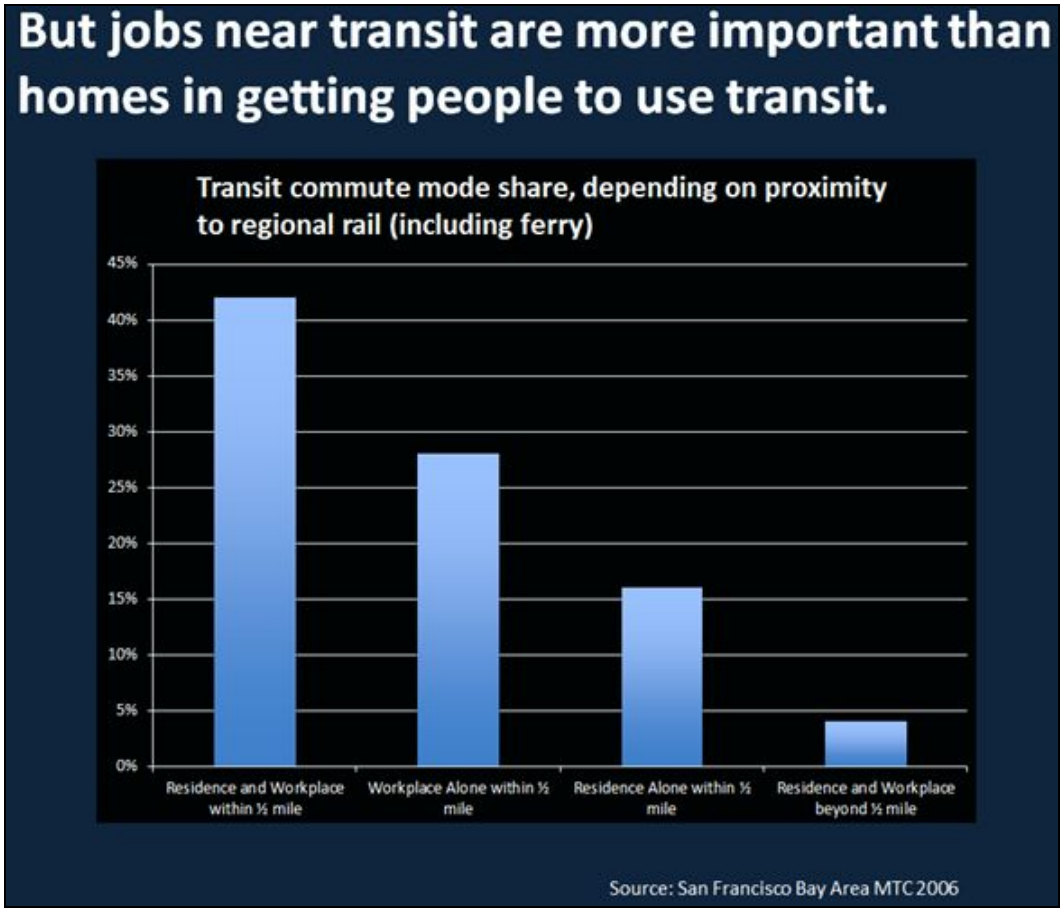
Appendix D: Work/Live near Silicon Valley Caltrain

An appendix in a larger white paper. Paper is undergoing review, proofreading, and formatting.
January 2016.

MTC's research shows very high (42%) transit commute mode share for Bay Area residents simultaneously living and working within 1/2 mile of regional rail. Does this correlation show causality?

An alternate hypothesis is that San Francisco's auto-hostility (traffic congestion, high parking cost, and parking scarcity) causes most of this 42% transit share. A look at the data favors the alternate hypothesis. For those simultaneously living and working near Caltrain in San Mateo and Santa Clara Counties, excluding San Francisco, transit commute mode share is only 7%.

D.1 MTC's Station Area research: big advantage for "live/work within ½ mile of transit"



SPUR's summary chart from MTC's Station Area Residents analysis.

The chart above is from MTC's 2006 "*Characteristics of Rail and Ferry Station Area Residents in the San Francisco Bay Area: Evidence from the 2000 Bay Area Travel Survey*," link. MTC uses "regional rail" to exclude VTA light rail, because light rail has lower impact on behavior than Caltrain or BART. The report concludes that San Francisco plays a unique role in increasing transit use in the Bay Area.

There is some debate as to whether locating jobs by regional rail is more effective than locating housing adjacent. SPUR's graph above shows jobs near train stations as more effective. PPIC's report (*Making the Most of Transit: Density, Employment Growth, and Ridership around New Stations* - link) shows greater efficacy for locating housing near transit. The paper entitled, "*The impact of transit station areas on the travel behaviors of workers in Denver, Colorado*," by Kwoka, argues that locating jobs near transit is more effective.

Paraphrased comments from MTC's Planning Principal David Ory:

- The MTC station area regional analysis does not generalize to the Caltrain corridor in San Mateo and Santa Clara counties.
- The assertion that "jobs near transit is more important than homes near transit in getting people to use transit" needs to be unpacked and picked apart a bit. Yes, with our current development pattern, that's the case, but it's likely not a universal truth. You do need density at one end. But transit can work well in moving people from dense residential areas to suburban job locations (see Caltrain southbound commuting, the commuter shuttles, etc). One reason why suburban-home-to-dense-job works better is that it's easier to store your car (or bike) at home at night and at the train station during the day. But technology / additional services can compensate, as revealed by the popular bike-Caltrain-bike commute.
- Another way to discuss all this is to say that transit is successful when it's competitive with automobile on time and cost. There are very few interchanges in San Mateo and Santa Clara Counties in which transit is competitive for residents who live and work near Caltrain.

D.2 Live/work within half-mile of San Mateo / Santa Clara County stations

We often define Silicon Valley as encompassing both San Mateo and Santa Clara Counties. If we take out the San Francisco Caltrain stations (with expensive parking), we are left with ½ mile areas around Caltrain stations in auto-centered Silicon Valley. The commuting result is much lower transit mode share for those living and working by these non-SF Caltrain stations:

	MTC Stn Area'06	Silicon Val Caltrain	PPIC Jed Kolko '11
Live & work by transit	42%	7.1%	
Work by transit	28%	7.6%	14.3%
Live by transit	16%	10.9%	20.1%

Hence it appears that auto-hostility in SF is the very large determinant of green commute behavior. SPUR's work/live analysis does apply to auto-centered portions of the Bay Area. Some Lund/Cervero research mentioned below also shows that East Bay "train work/live" differs dramatically from Silicon Valley "train work/live." My personal hunch is that price explains 2/3 of the SPUR work/live analysis. Proximity is correlated, but is not as causal as price.[1]

[1] Travel Characteristics of Transit-Oriented Development in California, by Lund, Cervero, and Willson. Jan 2004. https://www.bart.gov/sites/default/files/docs/Travel_of_TOD.pdf

Breaking down the Silicon Valley Caltrain results further:

Bay Area commute trips **TO** jobs by Silicon Valley Caltrain station areas::

Mode	Count	Mode Share
SOV	87,559	72.41%
Carpool	17,828	14.74%
Walk	4,530	3.75%
Bike	1,822	1.51%
Transit	9,184	7.59%
	120,923	100.00%

Bay Area commute trips **FROM** housing adjacent to Silicon Valley Caltrain station areas:

Mode	Count	Mode Share
SOV	39,486	68.27%
Carpool	7,316	12.65%
Walk	3,592	6.21%
Bike	1,131	1.96%
Transit	6,315	10.92%
	57,840	100.00%

Bay Area commute trips, where people **LIVE AND WORK** simultaneously near Silicon Valley Caltrain stations:

Mode	Count	Mode Share
SOV	12,667	64.17%
Carpool	2,154	10.91%
Walk	2,926	14.82%
Bike	590	2.99%
Transit	1,403	7.11%
	19,740	100.00%

With the context of overall Bay Area commuting, there are relatively few commute trips the three types.

For Silicon Valley Caltrain TAZs (travel analysis zones), many people appear to live and work in the same station TOD (transit oriented development), hence they walk. As far as someone commuting by Caltrain from something like San Bruno Caltrain TOD to Redwood City Caltrain TOD, some of these commutes are very quick via car, compared to lower frequencies of Caltrain trains that make these stops. Caltrain Baby Bullets help encourage folks to have 35 mile one-way commute distance to/from San Francisco to Silicon Valley. Baby Bullet trains help to enable unusually long commute distance via any US or worldwide standard. Hopefully future Caltrain electrification can help shorten the commute distance.

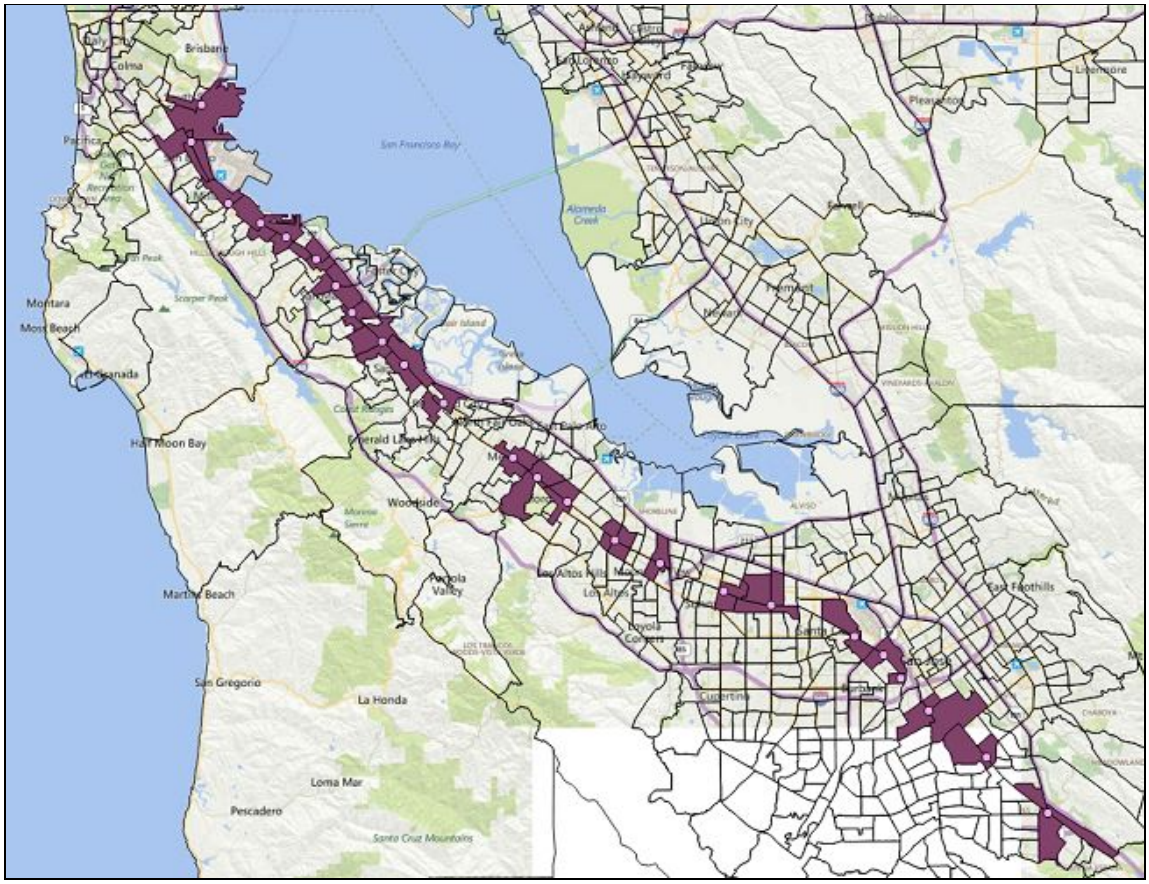
Silicon Valley Caltrain TOD outperforms non-TOD, but San Francisco and East Bay TOD outperforms Silicon Valley. *Travel Characteristics of TOD in California,* a 2004 paper by Lund, Cervero, and Willson, found East Bay TOD outperformed Silicon Valley TOD. (Residential TOD by East Bay BART stations produced 40% transit

commute mode share, whereas residential TOD by South Bay Caltrain yielded 17% transit mode share. Silicon Valley TOD far out-performed non-TOD, that had less than 5% transit mode share. [2]

D2A. Methodology

MTC's activity-based travel demand forecasting model predicts travel flow throughout the nine-county Bay Area. One output is a "synthetic 2015 day" of trips taken by hour, travel mode, and trip purpose (commute, recreation, shopping, etc). Trips are between Travel Analysis Zones (TAZ). Most TAZ are small communities containing about 5,000 residents, so have about one-sixth the number of residents in a typical zip code. Some TAZ are suburban office parks with zero residents and 30,000 jobs. There are 1454 TAZ. The synthetic 2015 day contains 23.8M trips taken by 7.4M persons (but only a 50% sample is provided, so calculations are doubled to obtain 100% results). .

The Silicon Valley TAZs with centroid (the geographic center of the TAZ area) within ½ mile of Caltrain are shown below in purple, with their Caltrain stations circled in pink. There are 61 out of 1454 TAZs by Caltrain stations in Silicon Valley:



[2] Travel Characteristics of Transit-Oriented Development in California, by Lund, Cervero, and Willson. Jan 2004. https://www.bart.gov/sites/default/files/docs/Travel_of_TOD.pdf

Appendix E: Autonomous Vehicle Induced Demand

In the short-term, Audi's aspiration increases VMT/GHG/congestion

There is significant speculation by non-planners about the impact of self-driving cars, or robocars, on different aspects of life. The major automakers have all explicitly stated a desire to sell "read-a-magazine while the car drives itself on the freeway" products (stop and go cruise control with lane keeping with permission to self-drive unattended). Market penetration of such products is difficult to predict. One forecast foresees 5% market penetration in 2025.

Toyota is the first automaker to admit to robocar negative short-term effects. States Ken Laberteaux, Toyota Senior Principal Scientist, "U.S. history shows that anytime you make driving easier, there seems to be this inexhaustible desire to live further from things[1]." This means private self-driving cars on freeways will induce sprawl - building new homes with long commutes far from jobs. In transportation planning, this is a well-understood phenomenon and can be expected for early robocar market penetration (e.g. from 0 to 15%). As Sven Beiker (Director of Center for Automotive Research at Stanford, former BMW executive, PhD), points out, robocars may grab market share from public transit, further increasing congestion.[2] In "Effects of Next-Generation Vehicles on Travel Demand" a 2014 paper by Fehr & Peers consultants[3], 25% robocar market share is expected to induce 5 to 10% more VMT. In CARB's (California Air Resources Board) "Climate and Energy Impacts of Automated Vehicles,"[4] VMT is expected to increase because of rebound effect, sprawl, and mode capture from transit. VTPI's Todd Litman forecasts induced demand, induced sprawl, reduced social equity, and deviated focus from immediate/better transportation solutions.[5]

[1] Bloomberg Business Week, July 21, 2014, http://www.bloomberg.com/bw/articles/2014-07-21/self-driving-cars-will-mean-more-traffic
[2] ibid
[3] Fehr & Peers(2014), "Effects of Next-Generation Vehicles on Travel Demand", http://orfe.princeton.edu/~alaink/Papers/FP_NextGenVehicleWhitePaper012414.pdf, http://www.fehrandpeers.com/fpthink/nextgenerationvehicles/
[4] CA Air Resource Board's "Climate and Energy Impacts of Automated Vehicles," June 2014, by Raphael Barcham, Goldman School of Public Policy, University of California Berkeley. http://www.arb.ca.gov/research/sustainable/automated_vehicles_climate_july2014_final1.pdf
[5] Autonomous Vehicle Implementation Predictions: Implications for Transport Planning, December 2015, by Todd Litman, Victoria Transport Policy Institute. http://www.vtpi.org/avip.pdf

While no major US region has run a forecast envisioning 5% private robocar penetration on freeways, transportation planning theory predicts that more robocar commuters will be willing to brave peak commute hour (while they blithely play on their smartphones or read a magazine), inducing more traffic congestion. Legacy human drivers suffer as a result.

Regions are just beginning to grapple with these "robocar induced demand impacts," which means they haven't yet proposed mitigation strategies.

E1. CARB's "Climate and Enegy Impacts of Autonomous Vehicles"

CARB is "California Air Resources Board:"
On balance, VMT seem likely to increase in the near term following introduction of autonomous vehicles. Expected effects of automation:

Effect	VMT Increase
Rebound effect	X
Sprawl	X
Substitute for transit	X

Changes in Travel Demand

"Most possible effects appear to point towards an increase in travel if AVs increase convenience. Lower Costs of Travel Automation that allows the driver to devote his or her attention to other tasks will dramatically lower the cost of travel time as it becomes more productive and enjoyable. This in turn will actually encourage higher travel demand and VMT. Congestion relief could also induce additional travel demand among both AVs and conventional vehicles.

AVs may also directly lower driving costs if insurance premiums drop thanks to safety gains or if fuel economy increases as outlined above. Modeling of travel demand impacts in the recent Eno Center report estimates possible VMT increases of between 2 and 9 percent depending on the level of adoption of AVs in the overall fleet."

Land Use Patterns

"A decrease in the perceived cost of travel could push towards greater sprawl. There are equity implications in this scenario, as wealthier drivers who can afford automated vehicles are able to live further from the urban core but increase the productivity of their commute."

E2. Fehr & Peers, Effects of Next-Generation Vehicles on Travel Demand

Induced VMT	Multi modal Regions	Auto-Oriented Regions
Freeway	0-5%	5-10%

E3. VTPI: Autonomous Vehicle Implementations

Autonomous vehicle problems:

- "Induced vehicle travel and increased external costs. By increasing travel convenience and affordability, autonomous vehicles may induce additional vehicle travel, increasing external costs of parking, crashes and pollution.
- Social equity concerns. May have unfair impacts, for example, by reducing other modes' convenience and safety.
- Misplaced planning emphasis. Focusing on autonomous vehicle solutions may discourage communities from implementing conventional but cost-effective transport projects such as pedestrian and transit improvements, pricing reforms and other demand management strategies."

Increases VMT:

- "More convenient and productive travel (passengers can rest and work) will reduce travel time costs, stimulating more vehicle travel. Provides convenient vehicle travel to non-drivers (people too young, old, disabled, impaired, or otherwise lacking a drivers' license. Sivak and Schoettle estimate that, accommodating non-drivers' latent travel demands could increase total vehicle by up to 11%. Can make sprawled, automobile-dependent locations more attractive. Reduces traffic congestion and vehicle operating costs, which induces additional vehicle travel."

E4. Recommendation: Fill the "freeway robocar induced demand" research/policy gap

Research should be funded for an activity-based or four-step regional travel demand forecast for 5% market penetration of "read-a-magazine freeway robocars" where improved commuting productivity drops the model's cost of such robocar trips to $0. If adverse impacts are foreseen, develop policy recommendations to mitigate adverse impacts.

Appendix F: Free-Parked CTR Leaders

F.1. Comparison Table of "Expensive and Effective" CTR:

Company	SOV Mode Share
Google	52%
Genentech	58%
Facebook	59% (projected, not confirmed)
Microsoft - Redmond	60%
Apple	72%
Yahoo	75%

F.2. Google, Mountain View: 52% SOV

Youtube program overview: https://www.youtube.com/watch?feature=player_embedded&v=Dt5sMxYMkGs#!

Key features of transportation alternatives program

1. 30% of Google employees take private motorcoach WiFi gBus service
   - about 4,500 commuters per day
   - 90% of Googlers living in SF take gBus
   - 25 routes, 350 daily departures
   - One cost estimate: $25 per day per employee ⇒ $6K per year (w/ scale economies)
     - Private motorcoach commute service provides a higher travel utility (benefit) than SOV
     -
   - Claims of high GHG reduction appear overstated as a 36-mile commute from SF to Mtn View is 3X longer than the median Bay Area commute distance. GHG per passenger trip might be equivalent to an average-distance SOV commute in a Prius.
     - In an SFMTA survey, 49% of tech worker respondents said they would drive alone if private, regional motorcoach was not provided. 31% said they could not make the trip without a private motorcoach (IE some would move to Silicon Valley).
     - 22% of private motorcoach riders got rid of a car
   - Well-integrated with technology for real-time tracking
   - Continual schedule/route tweaking with employees providing input
   - Subject of SF protests, but the protests are more focused on gentrification
   - Comparable comfort features to a first class airline seat

2. Other methods to de-generating SOV commutes

One estimate of the cost to Google per day per SOV commuter is $20 ($5K per year)
   - Unique real-estate constraints motivate large trip reduction

Google's visionary/green attempt to build 5,000 housing units in Mtn View
   - Rejected by City Council.

“Carpoogler” ad-hoc system

- Googlers poach bus riders at bus stops, often gaining access to Highway 85 HOV lane. Rides home are arranged on the chat board.

Self-powered commute program

- Google donates to bike commuters’ chosen charity

3. 1,000-bike campus GBike bike share system

Googler trips between buildings in Google’s large campus, there are ~700 specially colored bikeshare bikes where each bike may provide 5 bike trips per day. Google has a vast bike shop operation, with bikes being repaired and new bikes being built from kits. Bikes are collected and repositioned during the day. A guesstimate of trip types: 50% for meetings, 25% for food, 20% to connect to the regional private motorcoach system, and 5% for workouts.

4. Other campus circulation / first/last mile

- On-demand taxi-like service
- Fleet of cars to borrow during the day
- Zipcar

5. Largest corporate installation of EV charging

- over 260 level 2 EV charging stations (target: 5% of parking)

6. Additional program features

- Emergency ride home
- Public transit passes

Google bus program, from 2012 CTAA PDF

Program Description: Google offers about 170 bus runs daily across the San Francisco Bay Area, to and from its Mountain View and San Bruno California campuses. The company ferries over ~~1,500~~ employees to and from Google daily—nearly one-fourth of its local work force--aboard 50 shuttle buses equipped with leather seats and wireless Internet access. Bicycles are allowed on exterior racks, or in the baggage bins of the larger buses. There are also dedicated shuttles for those who like to bring their dog to work. Riders can sign up to receive alerts on their computers and cell phones when buses run late. The shuttles run on biodiesel and are free. Most shuttles can carry up to 37 passengers each with others carrying up to 52 passengers, running trips every day to some 45 pickup and drop-off locations in more than a dozen cities, crisscrossing six counties in the San Francisco Bay Area and logging some 4,800 miles a day. The system's routes cover in excess of 230 miles of freeways. Morning service starts on some routes as early as 5:05 a.m. The last pickup is at 10:40 a.m. Evening service runs from 3:40 p.m. to 10:05 p.m. During peak times, pickups can be as frequent as every 5 minutes. A team of transportation specialists at company headquarters monitors regional traffic patterns, maps out the residences of new hires and plots new routes to keep up with ever-surging demand. ~~Google also offers a parking subsidy for employees who choose to drive and park onsite.~~

Shuttle service incorporates stops in over a dozen cities and six counties. Shuttle hours of operation allow employees more flexible work hours.

Brendon Harrington, comments at an April 2013 SPUR presentation

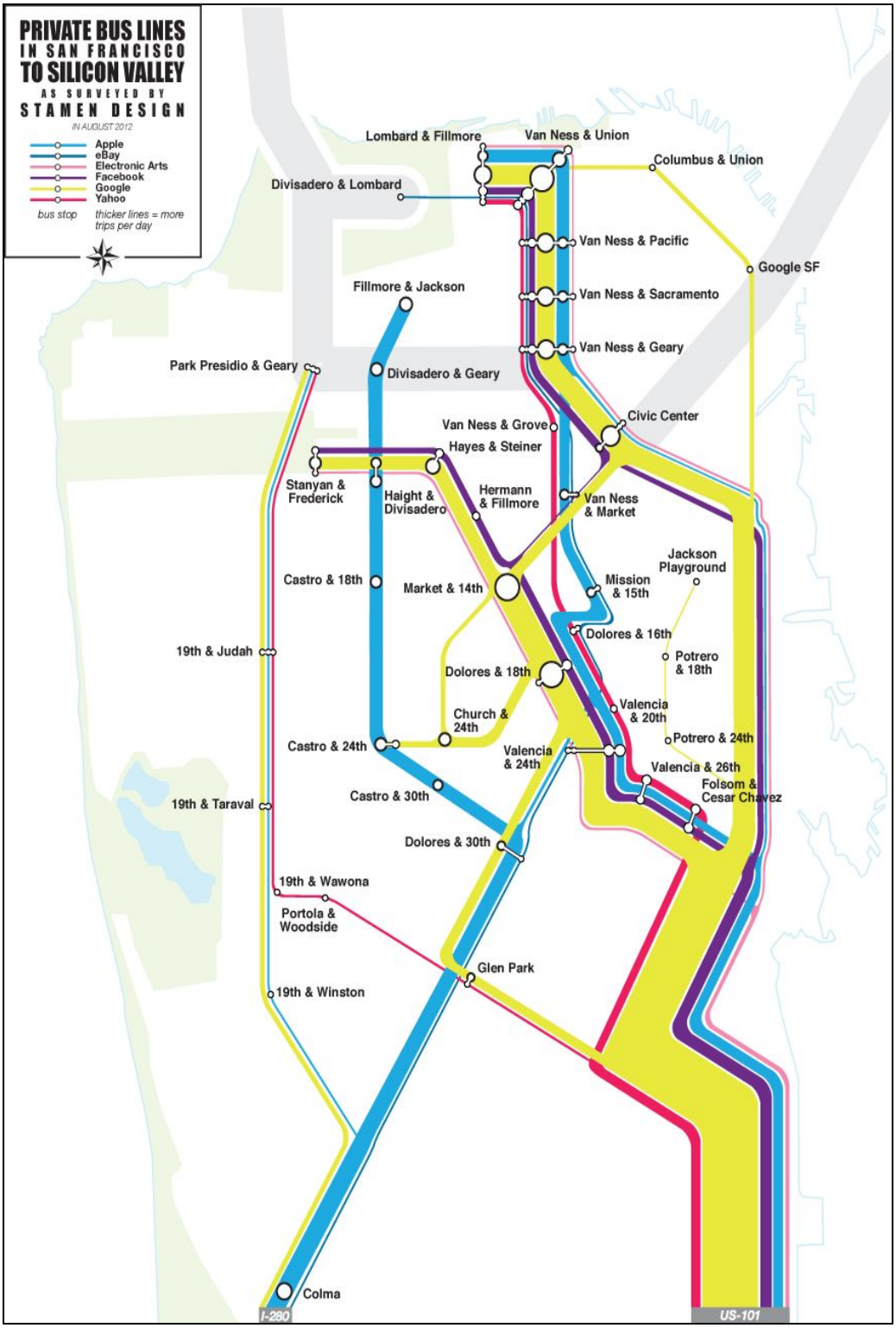
- 30% of Google employees take private motorcoach gBus service, about 4,000 or 5,000 commuters per day.
- There is also a successful internal dynamic ridematching system called “Carpooglers.”

Brendon Harrington, of the Google Transportation Team, explains Google commute options:

- https://www.youtube.com/watch?feature=player_embedded&v=Dt5sMxYMkGs#!

Google’s January 2013 TRB presentation on their commuting programs:
https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnx0ZG1jb21taXR0ZWVhYmU1MHxneDo1NjkwZTU0OWVmYmIzYjQ3.

Within the ongoing discussions over Google campus expansion and the Mountain View North Bayshore transportation study (includes LinkedIn, Intuit, and Microsoft job sites as well as Google), **Council is asking for an extraordinary 45% SOV commute mode share**. Council had previously toyed with capping trips into the area. “There was division over the idea to include **paid parking as a potential strategy** to ease congestion. Councilman McAlister was concerned about small business impact. But such a strategy may also be necessary to drop the drive-alone rate to 45% said Councilmember Kasperzak, adding that paid parking has worked elsewhere.” San Jose Mercury News, March 27, 2012. While City Council discussed paid parking, Council did not direct staff take a specific action to study/pursue paid parking.
March 22: Council considers capping trips. story. Feb 6 story.



Private bus lines from SF to Silicon Valley: http://stamen.com/zero1/. 90% of SF Google employees take the GBus.

F.3. Genentech, South San Francisco: 58% SOV

Mode	Feb-06	Nov-06	Oct-07	Oct-08	Oct-09	Oct-10	Oct-11	Oct-12
Drive Alone	77.40%	74.00%	70.80%	65.90%	65.60%	64.70%	64.40%	58.80%
gRide Modes*	22.30%	25.80%	28.90%	33.80%	33.80%	34.60%	35.10%	40.10%
Carpool								
2-Person Carpool	10.50%	9.50%	9.20%	10.40%	9.00%	8.80%	6.40%	6.50%
3-Person Carpool	1.40%	1.60%	1.10%	0.90%	0.80%	1.20%	0.70%	0.90%
4 or more Persons	0.30%	0.50%	0.60%	0.60%	0.30%	0.40%	0.10%	0.50%
Carpool Total	**12.30%**	**11.50%**	**10.80%**	**12.00%**	**10.10%**	**10.50%**	**7.20%**	**8.10%**
Transit								
BART	4.50%	6.20%	6.50%	6.80%	6.70%	4.80%	5.40%	5.70%
Caltrain	2.00%	3.40%	4.30%	5.20%	4.80%	2.70%	3.30%	2.70%
GenenBus	n/a	1.50%	3.30%	5.40%	8.60%	14.10%	15.40%	20.10%
Oyster Pt Ferry	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.30%
Transit Total	**6.50%**	**11.10%**	**14.10%**	**18.20%**	**20.40%**	**21.50%**	**24.10%**	**28.80%**
Other Modes								
Vanpool	0.90%	1.30%	1.30%	1.30%	1.10%	0.90%	1.10%	1.10%
Motorbike	0.70%	0.30%	0.50%	0.60%	0.50%	0.40%	0.20%	0.40%
Bike	0.20%	0.20%	0.30%	0.40%	0.30%	0.30%	0.20%	0.60%
Taxi	0.30%	0.20%	0.20%	0.30%	0.50%	0.60%	0.50%	1.10%
Walk[8]	1.80%	1.40%	1.90%	1.30%	1.40%	0.90%	2.30%	1.10%
Other Modes Total	**3.80%**	**3.40%**	**4.20%**	**3.90%**	**3.90%**	**3.30%**	**4.20%**	**4.30%**
Total	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*

- The nature of Genentech's business is such that there is limited telework. A majority of Genentech work and employees are lab bench based. This commute mode split does not include the small amount of telework, so SOV commute mode is overstated slightly.

More current presentation: "Parking, People and Planet: How TDM can positively impact all three at once", April 2013 APA presentation by Dan McCoy. https://www.spur.org/sites/default/files/events_pdfs/DanielMcCoy.pdf

Comments from Dan's live presentation of this PPT at SPUR in April '13:

- 50% of Genentech employees live in SF or San Mateo County.
- Part of what motivates Dan in this job is that he hears, "you've changed my life (by making my commute so much better.)"

Longer April 2012 American Planning Association Conference Presentation: "Genentech: Your Commute Just Became Easier" PDF: http://knowlton.osu.edu/ped/price.644/2012%20Webcasts/April%2020th/APA%20Webinar%20-%20Genentech%20gRide.pdf

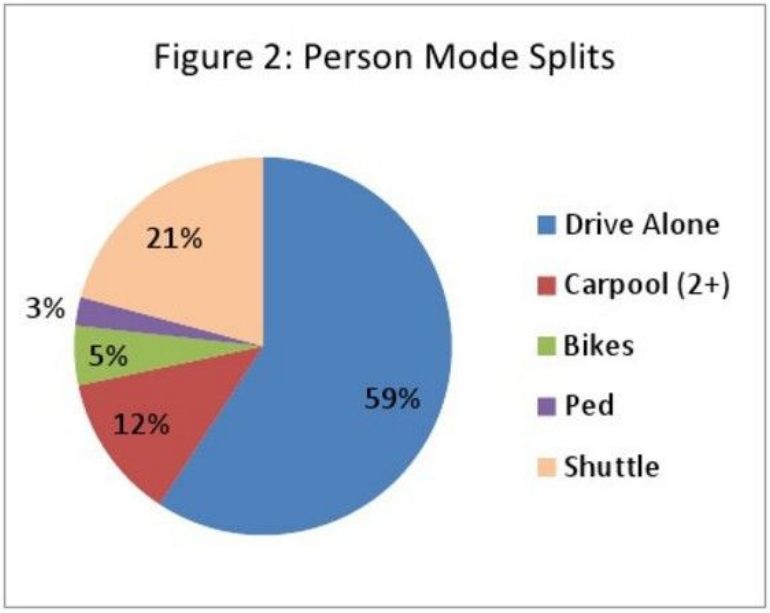
- This 2012 presentation has SOV commute mode share at 64%. SOV has been reduced further since then to 58% (see the table above).
- Slides 41-47 provide an explanation of the cordon count (an audit of the commuting habits of 100% of employees). Cost is $25-35K to the consulting firm (Nelson Nygaard) for a cordon count for 6500 employees + about $9K for security guard staff that counts commuters during AM commute hours for the three survey mornings (training of security staff is also required). Cordon counts vary highly depending on the number of entrances and the complexity of the campus. Genentech's campus needs some 15

locations monitored, which adds to the costs. This cordon count process can be justified at large companies with energetic TDM programs that provide significant parking and real-estate benefits.

- In 2006, one motivation for Genentech to choose a cordon count over a survey was because of the City of South San Francisco trip reduction ordinance. Cordon count provided 100% employee counting, whereas surveys would have resulted in fewer responses. The ordinance counted all non-responses as SOV commutes.

F.4. Facebook, Menlo Park, 59% SOV

The chart below is Facebook commute mode when they were located in Palo Alto, with more convenient Caltrain service. In the Facebook Menlo Park campus expansion plan EIR, Facebook assumes similar mode split will result. 59% in the Spring, 60% in the Winter.



March 2012 City of Menlo Park Facebook Campus Project - Environmental Impact Report Appendix 3.5G - Revised TDM Plan. link.

March 2012 revised TDM plan: http://www.menlopark.org/DocumentCenter/View/2634

F.5. Microsoft, Redmond, 60% SOV

2009 Commute Trip Reduction Report explains MS's regional bus system (The Connector):
http://wstc.wa.gov/Meetings/AgendasMinutes/agendas/2010/July13/documents/20100713_BP8_MicrosoftConnectorCommuteFactSheet.pdf

F.6. Apple, Cupertino, 72% SOV

Apple Site Mode Split (Current Apple campus, + 2 additional adjacent buildings)

- From a document on the California Governor's Office of Planning and Research.
- Commuter mode splits were calculated for the Apple campus using the person trips equivalents. Table 11 provides a summary of the AM and PM peak period mode splits and a comparison to mode splits for the City of Cupertino and Santa Clara County from the U.S. Census Journey to Work data.
- AM peak period is used as the reported mode split because the commute patterns are more concentrated

in the AM compared to the PM and thus more accurately represents the campus mode share. Approximately 72 percent of Apple employees travel in single occupant vehicles in the AM peak period. Another ten percent travel in carpools and 13 percent use public transit or Apple shuttles. The mode splits for carpools and the combined bicycle/walk were similar to the City of Cupertino and Santa Clara County statistics. SOV use was lower and transit/shuttle mode was higher than both the County and City census data.

Apple TDM Program description document.

F.7. Yahoo, Sunnyvale, 75% SOV

The information below began with CTAA's description that was then updated by Yahoo's Danielle Bricker. CTAA article: http://www.ctaa.org/webmodules/webarticles/articlefiles/ProfilesofEmployer-SupportedTransportationPrograms.pdf

Program Description:
Yahoo's Commute Alternative Program offers employees a number of on-site amenities (bicycle repair, dry cleaning, oil changes, carwash, haircuts, dental services, a cafeteria, mailing and shipping services, convenience store and gift shop and ATM access) in addition to a shuttle service to nearby transit hubs and subsidized vanpools. Among the benefits offered are free rides on Santa Clara County transit agency (VTA) vehicles and commuter tax benefits through the Federal Qualified Transportation Benefit program. Employees also receive a 25 percent discount on other transit costs. Yahoo! also provides a $115 monthly vanpool subsidy. The transit subsidy goes towards the pre-tax monthly cap, and employees can use pre-tax deductions to cover any remainder, up to $245 per month. Free shuttles, equipped with Wi-Fi from the San Francisco, Oakland and TriValley areas as well as interoffice shuttle service throughout the workday, are also provided. Carpooling is encouraged through an internal matching program as well as a regional matching program. Carpools and vanpools have access to preferred parking. The company also sponsors periodic events designed to connect employees with local transit agencies.

Results:
Currently, about 20-25 percent of Yahoo! employees routinely use alternative transportation to travel to work.

F.8. Private, Regional Motorcoach Commute Service Analyses

1. "The Role of Shuttle Services in San Francisco's Transportation System."
SF CTA Strategic Analysis Report: link.

- "62% of survey respondents indicated that their decision to live at their current residence in San Francisco was influenced by the availability of the employee shuttle service." IE shuttles are somewhat enablers of long-distance commutes.

2. April 10, 2013 SPUR (San Francisco) event, "The Story of Shuttles."
http://www.spur.org/events/calendar/story-shuttles
"Those big buses are tough to miss. As employer shuttles sprout up across the Bay Area, what do they tell us about our region, its workers and its employers? What are the benefits and challenges that accompany their increasing presence? This forum will take a closer look at how and why some employers manage worker transportation."

+ Daniel Mccoy, Genentech
http://www.spur.org/files/event-attachments/DanielMcCoy.pdf

(Please refer to previous Genentech content above)

+ Brendon Harrington, Google
(Please refer to previous Google content above)

+ Dominic Haigh, RidePal
http://www.spur.org/files/event-attachments/Dominic.pdf

+ Carli Paine, San Francisco Municipal Transportation Agency

- Presentation: http://www.spur.org/files/event-attachments/CarliPaine.pdf
- A new SFMTA study encompasses both private motorcoach commute service and local, private circulator service. There are 200 private bus stops in SF. 30K passenger trips on weekdays. Private operators do a nice job of addressing issues that come up, but the collaborative effort is ongoing.
- In an SFMTA survey, 49% of respondents said they would drive alone if private, regional motorcoach was not provided. 31% said they could not make the trip without a private motorcoach (IE some would presumably have to move to Silicon Valley).
- 22% of private motorcoach riders got rid of a car!

F.9. Commentary on free-parked CTR and private motorcoach commute service

Anonymous public university TDM staff critique of "expensive and effective CTR:"

- "Massively profitable mega-corporations are able to afford to entice workers not to drive, but Company X and Y are not demonstrating best practices. It is a bit like parents paying their children to be quiet in public: effective, but not the best parenting style. Company X and Y sink massive amounts of money into their private bus programs. How much change, after all, is required to go from driving one's self in a car (for a cost) to being driven in a private motorcoach (for free) accessing HOV lanes to go faster than a car.
- Modern sustainable transportation efforts need to be more fiscally conscious and make sure that the commuter pays the vast majority of the cost of his/her transportation. Otherwise, when business or funding falters, those amenities will disappear and SOV commuting will skyrocket. Promoting the long-term sustainable transportation needs to be born from a sustainable fiscal planning. We need to work to build a newer society who expects to pay fair market value for their transportation, not provide VIP shuttle service from doorstep to office. Otherwise, all we're doing is trading one expensive entitlement for another."

Comment from MTC regional modeling staffer. "The very large 35+ mile commute flows from SF to Silicon Valley are unusual from a regional modeling standpoint. They do not reflect typical residential/job selection dynamics. For our 2040 modeling, should we include a 'K factor' that assumes this flow still exists? Or should we assume that Silicon Valley creates housing and culture that is more appealing to twenty-something tech workers? Or will more tech jobs move to SF to be close to twenty-something residents? As of now, we assume the human settlement pattern will adjust and that the 35+ mile commute flows are just temporary. But it is not clear how this will play out."

Comment from Joint Venture: Private motorcoach commute service provides a higher travel utility (benefit) than SOV. As an example of employee preference for motorcoach over SOV, for SF to Google commuting, private motorcoach has 90% mode share. For Genentech, their GenenBus motorcoaches have grabbed substantial nominal mode share from other alternative modes: 4.2% from carpooling, 0.9% from BART, and 2.5% from Caltrain. The following statements are worth further analysis, "GenenBus riders do not require the $4 per day reward for not driving alone. Genentech's $4 per day (more for carpool drivers) rewards program is responsible for reducing SOV mode share to 78.90%. Whereas GenenBus has much, much higher impact and is responsible for reducing from 78.90% to 58.80%, a 20.10% nominal mode shift."

The world “shuttle” has two conflicting meanings. There is advantage to avoiding ambiguity by specifying “local circulator transit” or “line-haul commute WiFi motorcoach,” rather than using “shuttle.”

How green are SF to Silicon Valley private bus systems?
Answer: About as green as a Prius used in a typical American SOV commute.

Many conflicting analyses exist on the web, so it is important to state assumptions. The analysis revolves around the gallons of gas used per person per commute.

- A new hybrid WiFi motorcoach bus gets about 8 MPG for mostly highway driving. (versus 6 MPG for a traditional motorcoach).
- Assume all the morning SF to Silicon Valley bus trips from are matched by a deadhead trip back from Silicon Valley to SF. This reduces effective MPG to 4.
- Bus capacity is 50 passengers, with an assumed average occupancy of 25 passengers (packed during peak hours, lower occupancy at the tails). The SFMTA shuttle study provides employer-reported motorcoach occupancy between 20% to 70%. If occupancy was something like 30%, instead of 50%, then motorcoach green-ness would be reduced.
- Resultant “passenger miles per gallon” comes to 100.
- SF to Silicon Valley commutes (about 38 miles one-way - Lombard/Fillmore to Google) are long distance compared to the average US 16 mile one way commute. This results in relatively more gas being consumed, 0.38 gallons per employee per one-way commute.
- For the average 16-mile one way US commute, an MPG of 42 also results in 0.38 gallons being consumed. 42 MPG is similar to a 50 MPG Prius.

If the bus fuel has mix of 10% biodiesel and 90% diesel, and the biodiesel is nearly carbon neutral (meaning the amount of carbon dioxide absorbed from the atmosphere by the growing plants is nearly equal to the combined carbon dioxide released during combustion of biodiesel and the carbon dioxide emitted by vehicles transporting the fuel), then the green-ness increases proportionally. Biodiesel additionally provides particulate pollution reductions.

Conclusions:

- Attempts by Google to put thousands of homes in the North Bayshore campus area would have been game-changing in terms of reducing per-capita energy consumption. City of Mountain View Council voted against the housing based on entirely different environmental considerations: protecting dwindling bird populations. news story. One wonders if, with all the new housing, Google would have invested in additional cultural amenities to make Mountain View (already pretty attractive) more competitive with SF for twenty-somethings. Other major US suburban job centers (Tysons Corner, Denver Tech Center, Perimeter Center) have added 20-story apartments and condos to provide short-commute housing for workers.
- SF to Silicon Valley motorcoach transit provides a substantial GHG savings over typical US SOV commutes, as the typical US commuting vehicle (car or SUV / light truck) gets much less than 42 MPG. The SFMTA report reports a larger GHG savings from private motorcoaches, comparing motorcoach transit for 38 mile commutes relative to SOV 38 mile commutes, rather than to average-distance US SOV commutes.)
- Locating offices in downtown centers, such as Adobe’s San Jose tower, has a theoretical appeal as a more efficient solution, but it is doubtful that the human settlement patterns around San Jose have resulted in a low SOV commute share for Adobe.
- Filling up deadhead buses with opposite-direction commuters is more efficient. Full coach buses are more efficient than half-full buses. Shorter commute distances, such as SF to Genentech are more energy-efficient. Short Prius carpool commutes are highly efficient.

References

- How Low-Carbon Can You Go: The Green Travel Ranking. Sightline Institute.

- Which is Greener: Travel by Bus or Train? USA TODAY - link
- Do Buses Save Gas? The Truth About Cars - link.

Euro-MaaS (Content combed from the web, SlideShare, etc.)

BMW
Daimler
Siemens
Bileto.cz
Finland: national MaaS initiative
Euro MaaS initiative
Euro Mobility Aggregation (MobAg) pilots:

- Vienna Smile
- Montpellier (France) Project EMMA
- Hannovermobil

International MaaS - looming worldwide competitors:

- Toyota Hamo
- Future faster-than-realtime intelligent assistant: Siri, Google Now, Cortana

BMW EcoSystem

Moovit: Israeli MaaS app w/ SF office

- BMW iVentures + Nokia ⇒ $50M

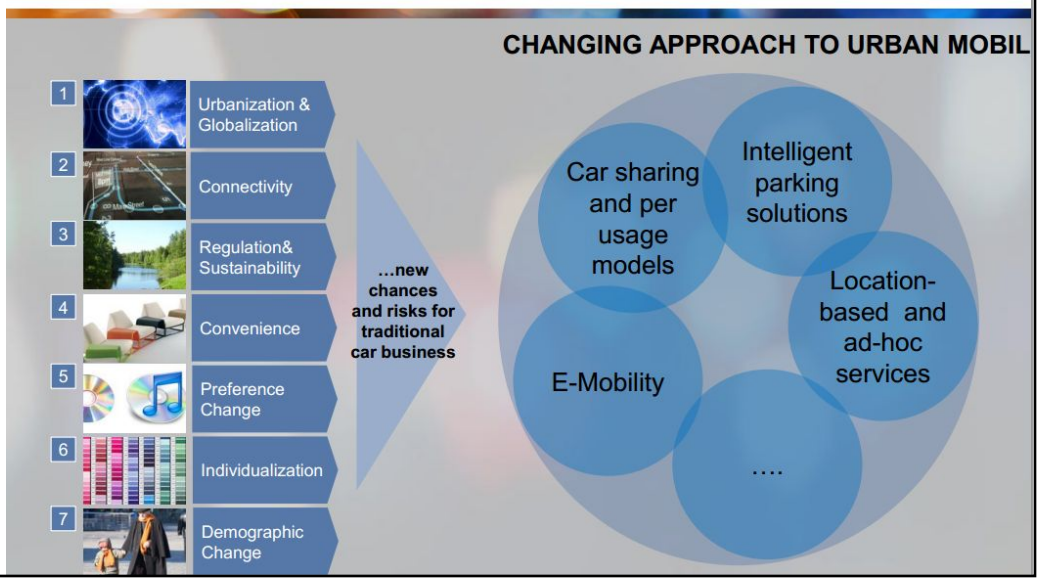
MyCityWay: intermodal routing

ParkNow: full inventory, advance reserve

DriveNow

BMW Vision

CUSTOMER CHANGE: MEGATRENDS WITH IMPACT ON MOBILITY DEMAND AND MOBILITY PATTERNS.



CAR-ENABLED AND RELATED MOBILITY SERVICES NAVIGATION AND REMOTE APPLICATIONS.

Daimler EcoSystem

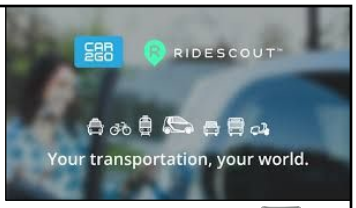
Moovel: brand umbrella + MobAg app

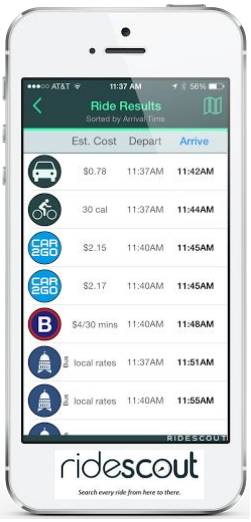
RideScout: Enterprise TDM + MobAg (acquired Sept 2014)

GlobeSherpa smartphone e-ticketing (acquired June 2015)

Park2gether: full inventory, advance reserve

myTaxi





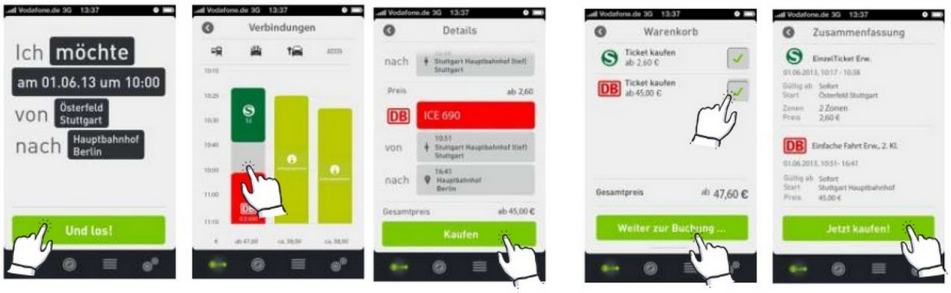
MOOVEL: INSTANT ACCESS TO A MOBILITY COSMOS

moovel connects different mobility service providers and shows the best way to get from A to B: car2go, carpooling.com, mytaxi, nextbike and public transport partners in Berlin, Stuttgart, Nurnberg and the Rhine-Ruhr area.

moovel to become the "Google of Mobility" – allowing intermodal routing, ticketing and payment

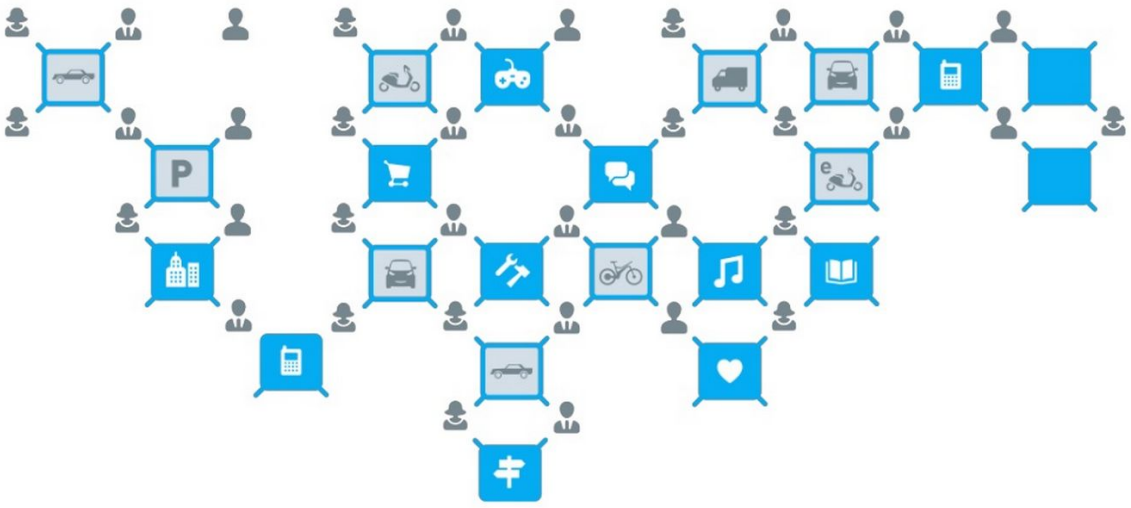
Daimler Mobility Services

Route search | Options | Route selection | Ticketing and payment



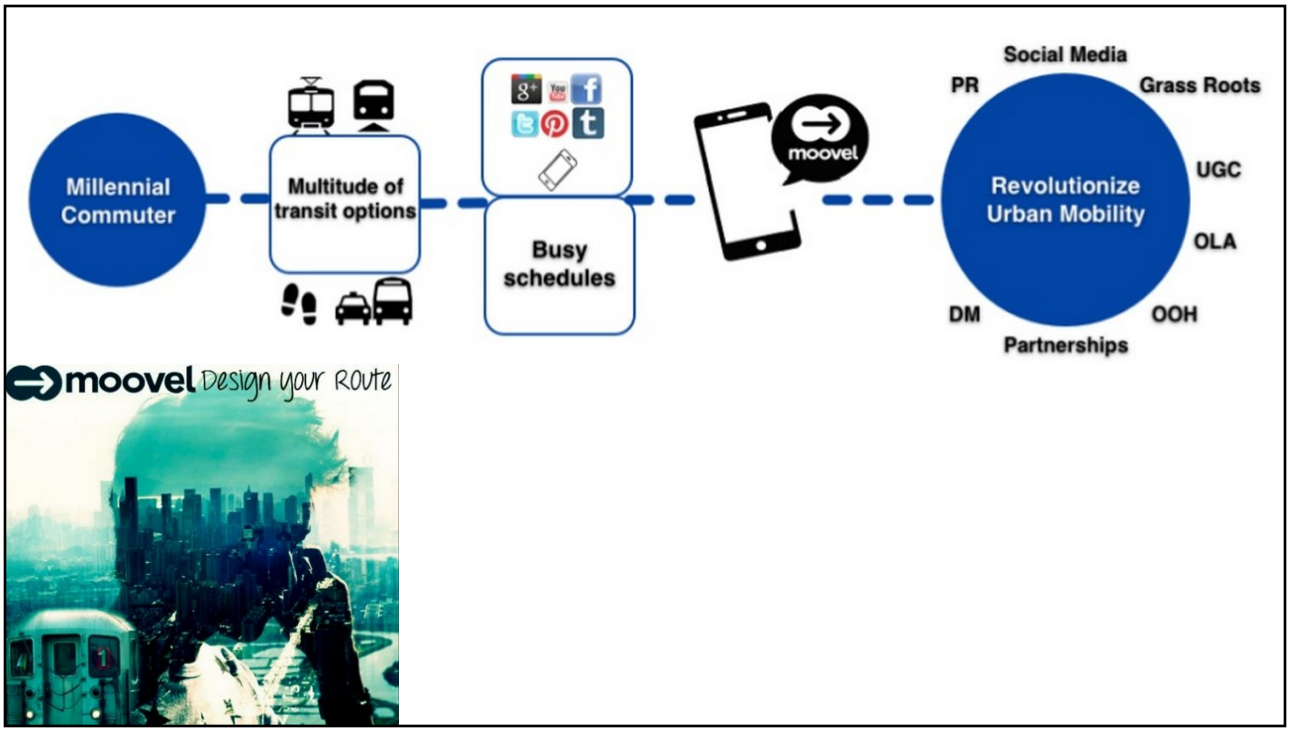
- The customer enters into moovel **when and where** he wants to go
- moovel shows the different **route options**
- **Details** can be inspected by route
- The customer **selects the preferred route** that he wants to travel
- The customer validates individual transportation means if needed and **confirms his overall travel basket**
- Finally he **buys the entire intermodal journey** and can start to travel[1]

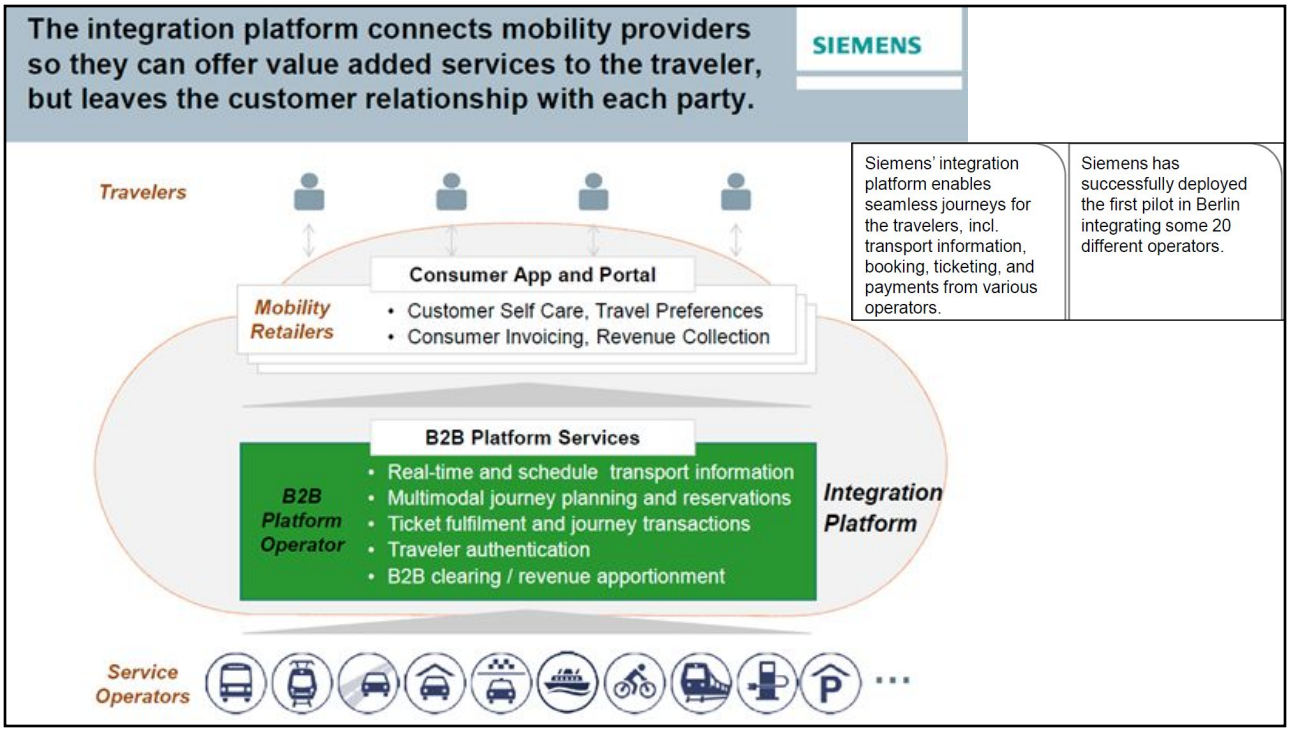
1 Booking and payment will in initial stage not be possible for all services



ACCESS TRUMPS OWNERSHIP: SHARE, TRADE, BORROW

We do not want to buy everything, but we want to have access to it.
The internet opens up intelligent means of collaborative consumption – the more intelligent things become, the easier they can be shared.


Millennial Commuter
Multitude of transit options
Busy schedules
moovel
Social Media
PR
Grass Roots
UGC
OLA
DM
OOH
Partnerships
Revolutionize Urban Mobility
moovel Design your Route

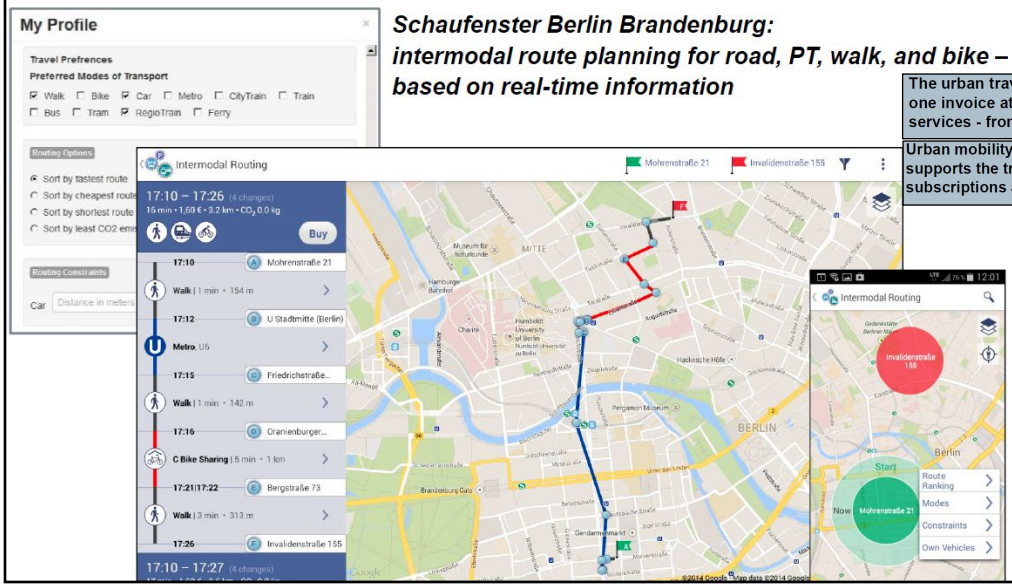

The integration platform connects mobility providers so they can offer value added services to the traveler, but leaves the customer relationship with each party.
SIEMENS
Siemens' integration platform enables seamless journeys for the travelers, incl. transport information, booking, ticketing, and payments from various operators.
Siemens has successfully deployed the first pilot in Berlin integrating some 20 different operators.
Travelers
Consumer App and Portal
Mobility Retailers
• Customer Self Care, Travel Preferences
• Consumer Invoicing, Revenue Collection
B2B Platform Services
B2B Platform Operator
• Real-time and schedule transport information
• Multimodal journey planning and reservations
• Ticket fulfilment and journey transactions
• Traveler authentication
• B2B clearing / revenue apportionment
Integration Platform
Service Operators

The urban traveler wants to plan intermodal trips optimized for travel time, cost, distance and CO2 emissions.

The urban traveler wants real time information for all mobility services - through one app or web site.

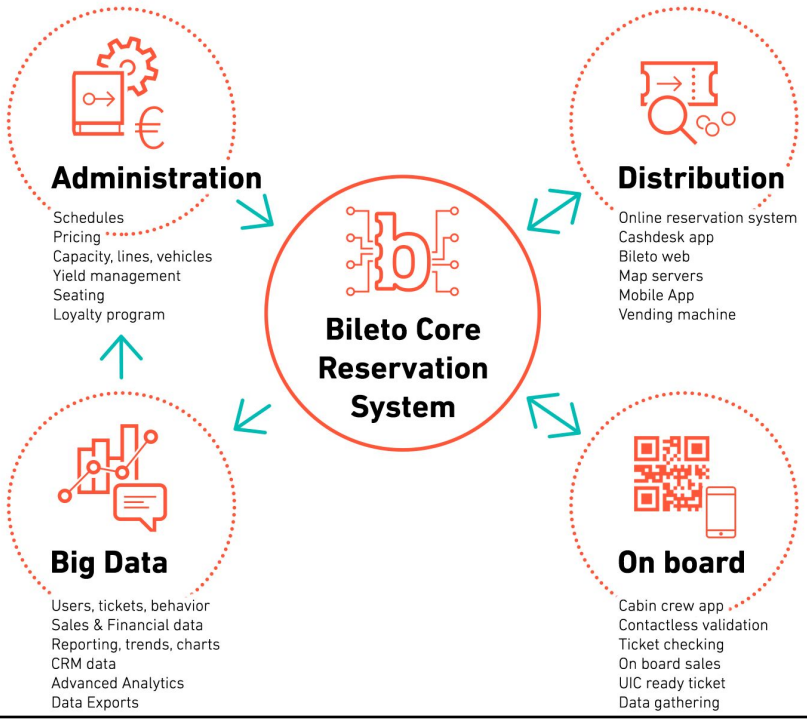
Schaufenster Berlin Brandenburg:
integration of real-time information form 12 service providers

Schaufenster Berlin Brandenburg:
intermodal route planning for road, PT, walk, and bike –
based on real-time information



The urban traveler wants cashless payments and one invoice at the end of the month for all mobility services - from his trusted mobility provider.

Urban mobility providers need a platform that supports the traveler's objectives, manages service subscriptions and supports billing and clearing.



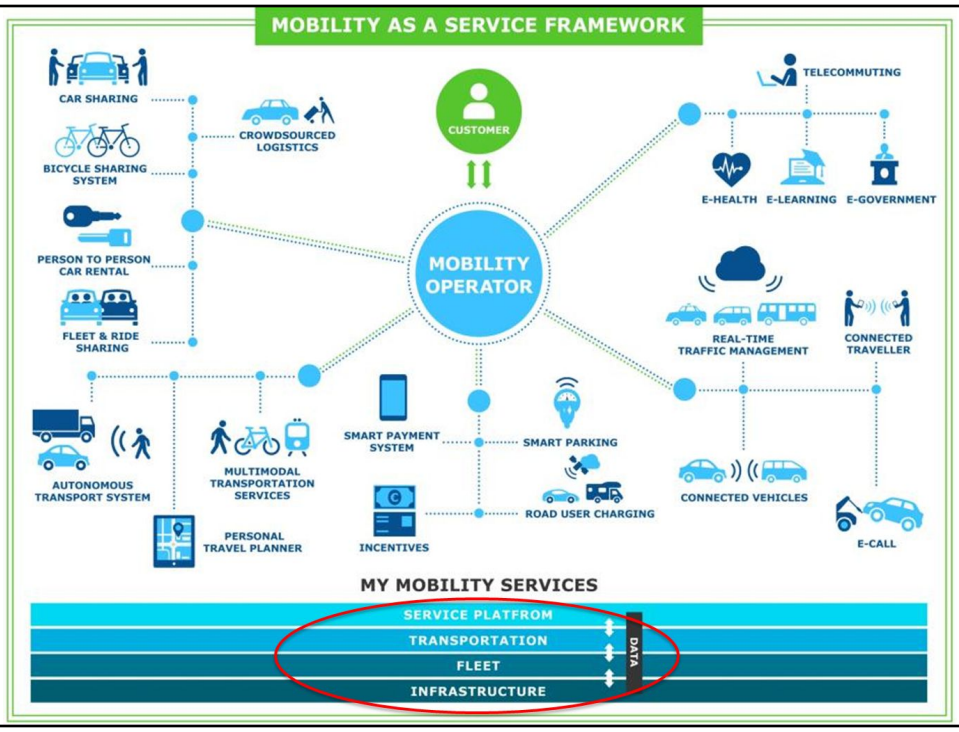
Bileto.cz

Czech MobAg
Integration: Czech transit
Uber CZ integration is expected
Open source

Finland MaaS Initiative

Significant dedicated national funding for innovation, including MaaS

- Tekes link
- Vision & funding PPT
- Finnish Transport Ministry: “MaaS and intelligent automation, Internet of Things and open data are at the core of our transport policy at the Finnish Government. The programme also has a strong emphasis on pilots and test beds as well as fully reforming our transport regulations. Mobility operators are about to start piloting their projects, including automated vehicles in arctic conditions. In Finland we believe this is a superb environment for testing, as a government we strongly support innovation and we also see it important that we do collaborate. We also feel that when we talk about MaaS we talk about giving the best possible service to our people. It is time now to make the transport sector the most advanced sector in digitalization.”



Euro MaaS Alliance

Announced Oct 2015 - 20 partners:

TfL Xerox (link to marketing schpiel) Ericsson ERTICO – ITS Europe ITS Finland, ITS Sweden, ITS Ukraine Finnish Ministry of Transport and Communications Swedish Ministry of Enterprise and Innovation Finnish Funding Agency for Innovation (Tekes) Helsinki Business Hub	Federation International de l'Automobile (FIA) IRU Connekt MOBiNET National Mobile Payment Plc. (Hungary) Vinnova Aalborg University AustriaTech University of Tampere

- "MaaS is a new approach to changing mobility markets. It relies on existing and developing transport services and has huge chance for global scaling", ITS Finland.
- "MaaS has the potential to fundamentally change the behavior of people in and beyond cities, hence it is regarded as the biggest paradigm change in transport since affordable cars came into the market". - ERTICO
- "I've been involved in ITS for a very long time and I think our biggest failing is that we fail to unlock the community-wide benefits of ITS. We have some areas of outstanding excellence in a sea of mediocrity across Europe. For me putting the user at the very heart of the services is going to be the key to making MaaS a success" - Xerox
- "It is important to team up to give consumers new products that we look on how we can utilize all the aspects of different modes of transport in a bundled solution."

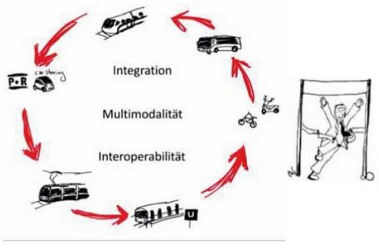
3 additional Euro MobAg pilots

Vienna : Smile project in Austria

Main goal of project **„SMILE"** is developing and evaluating a prototype of a **multimodal, integrated information-, booking and payment-system** („Integrated Mobility Platform") which connects **private and public transport** in a smart and efficient way.

Personal Mobility Assistent

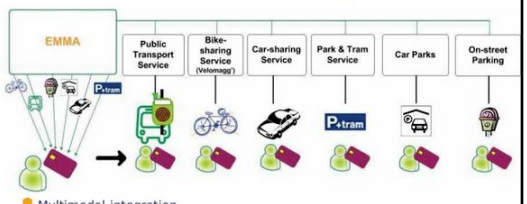
+info
+key
+entry
+ticket
+assistance
+clearing
+bill



Montpellier : PROJECT EMMA

THE OBJECTIVES , SCOPE

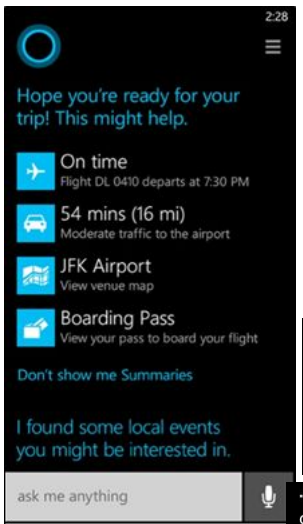
EMMA : A centralised access to all transport services



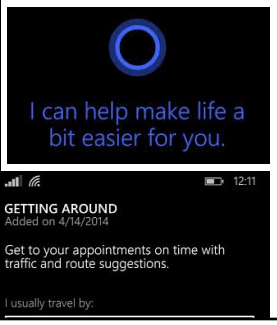
Hannover : Hannovermobil

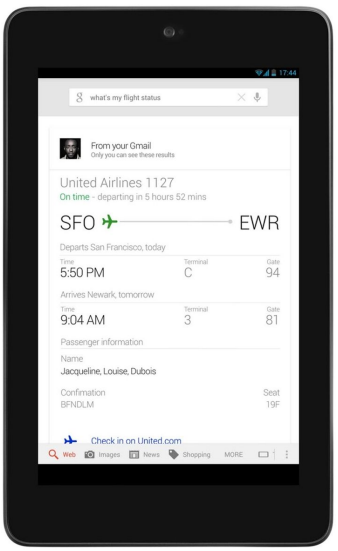
Toyota Hamo MobAg

Faster than real-time intelligent agents

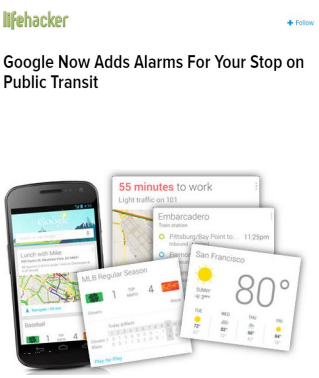


Microsoft Cortana





Google Now



Appendix H: Feebate Efficacy Details

www.bit.ly/1O9h13D

The third component of the five component Fair Value Commuting (FVC) solution is the revenue-neutral workplace parking feebate. The FVC feebate charges a fee for SOV commutes, collects that revenue, and rebates that revenue to non-SOV commutes.

Feebate efficacy evidence is excerpted below from pages 20-24 of a paper entitled, "$2 Daily Workplace Parking Charge + $3 Cashout: Cut U.S. Commute VMT 23%." [1]

H.1. Behavioral Irritants and 23% Commute Reduction

There is an intuitive psychological theory as to why cashout is not very effective. High-paid office workers ignore small-benefit programs such as $3 per day parking cashout. This "carrot" is not a sufficiently large motivator to cause commuting behavior to change. Employees will not think about the cashout on a regular basis. We believe that parking charges will "irritate" SOV commuters. These SOV commuters will think about the parking charges every day they commute. Eventually this irritant gnaws at them long enough to cause many to change behavior. Changing commuting mode choice is a significant decision because of relatively high barriers to changing away from the convenience of driving alone. This difficult decision is not a "snap decision" and may require pondering over many weeks. The same $ value of irritant/stick has a much higher impact than the same $ value of cashout/carrot. The intuitive theory is well substantiated from both field results and from "behavioral economics" research:

Stanford University has reduced SOV commuting dramatically. Stanford charges SOV commuters for parking permits (equivalent to about $4/day SOV fee for the best parking spots)[2] and rebates that revenue for non-SOV modes including Caltrain commuter rail (via Caltrain GoPass), VTA transit (via EcoPass), bike, and carpool.[3] Stanford fills gaps with Marguerite shuttle bus, electric bikes/scooters, and ride.com on-demand rideshare. Marguerite is one the the US's higher ridership local shuttle bus systems. Stanford's program reduced SOV commuting from 75%[4] to 50%, eliminating the need for $107M in new parking structures.[5] [19. Stanford]

A 1989 study found that commute carrots are less effective than sticks: "A program of transit and vanpool subsidies as well as preferential parking for carpoolers had little effect until Twentieth Century Corporation in Los Angeles raised the price of employee parking from no charge to $30 per month for solo drivers. Solo driving decreased from 90 to 65 percent after pricing." [3. Willson]

A 1990 paper found that charges changed behavior where incentives had not: "CH2M Hill in Bellevue, Washington began charging solo drivers $40 per month for parking, the amount the company pays the building owner for parking. All employees receive a $40 per month travel allowance in their paychecks. Carpoolers park for free.

---

[1] "$2 Daily Workplace Parking Charge + $3 Cashout: Cut U.S. Commute VMT 23%," August 1, 2010, Steve Raney. "Parking charge + Cashout" has the same meaning as "revenue-neutral workplace parking feebate." http://www.cities21.org/TRB_Paid_Parking2.pdf. Paper was presented three times: 1) Transportation Research Board (TRB) Conference, Transportation Demand Management Committee ABE50 Meeting, Jan 14, 2009. 2) Innovations in Pricing of Transportation Systems Conference. May 13-14, 2010, Orlando, FL. 3) Association for Commuter Transportation (ACT) International Conference, August 30, 2010.

[2] "A" parking is $81/month, while the less convenient "C" is $30/month.

[3] Funding from Stanford General Use Permit assessments for development projects augments the SOV fee revenue some.

[4] We assume Stanford was at roughly 75% SOV in 1990. Stanford was at 72% in 2002. Mode split is reported as: 41.9% SOV, 23.6% Caltrain commuter rail, 13.9% bike, 8.4% carpool, 7.5% bus, 3.1% walk - per"TDM at Stanford University," Slide #19, August 2013, by Brodie Hamilton. http://bit.ly/1RCmSS2

[5] $107M per "TDM at Stanford University," Slide #24, August 2013. http://bit.ly/1RCmSS2. As of 2016, Stanford has gone away from calculating parking savings. Stanford has fewer parking spaces in 2016 than it had in 2001.

Walkers, cyclists and drop offs keep the travel allowance. Solo driving declined from 89 percent to 64 percent after the parking policies were put into place." [4. Symposium]

Best Workplaces for Commuters compiled a spreadsheet with 41 TDM case studies. The case studies measure the “number of parking spaces freed per 1,000 workers” – the equivalent nominal mode shift would be larger than this measure, because a shift from SOV to carpooling still requires some parking spaces to be used. Some of these 41 cases are comparable to the Parking Feebate scheme: cases 10, 11, 18 and 38 (both are the CH2M Hill Bellevue example), 33, and 35 (the Twentieth Century example). The average number of parking spaces freed per 1,000 workers is 219. Summaries of these cases are provided in Table 9 at the end of this appendix. [11. BWC]

For calculations in this appendix, a nominal mode shift of 23% is assumed. The 219 spaces out of 1,000 workers would translate into a higher mode shift. The two most applicable cases, CH2M Hill and Twentieth Century, have higher shifts. For suburban tech worker commute, it is expected that more of the mode shift will occur via carpooling rather than via transit. With new GPS cellphone technology (Apple iPhone & Google Android T-Mobile phones), “instant ridesharing” is enabled, where one-time rides are arranged within minutes of the start of the trip. With instant ridesharing, a person may carpool every day, but with the flexibility of a different departure time and group of people each day. Instant ridesharing can handle schedule variations in a manner that makes transportation routine and hassle-free. Evolving solutions come from Avego, ZimRide, Goose Networks, Carticipate, Piggyback, NuRide, and Google RideFinder.

From the field of behavioral economics, there is evidence that potential losses are more motivating than potential gains. In *The Paradox of Choice,* Barry Schwartz has a discussion of this "loss aversion" phenomenon. Schwartz cites research by Kahneman and Tversky demonstrating that, "Losing $100 produces a feeling of negativity that is more intense than the feelings of elation produced by a gain of $100.” [5. Tversky]

In the book *Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing,* the author provides a discussion of positive (gain) and negative (loss) framing: Behavior change "messages which emphasize losses which occur as a result of inaction are consistently more persuasive than messages that emphasize savings as a result of taking action." [6. Message]

Janis Hom, consumer product marketing expert states, "The idea of rewards motivating behavior change is really only a wishful theory. When a sufficient pain threshold is reached, then people change. The frog being brought to a slow boil is an apt analogy. At a moderate heat/pain level, you can slow-cook a frog. If you turn the heat up high, the frog jumps out of the pot (a behavior change). $3/day is not a sufficient reward to significantly change worker commute patterns – especially high-paid workers."

Our Parking Feebate has not only a $2/day irritant that will continue to gnaw at SOV commuters over time, but the dollar benefit for green commuting versus SOV commuting is $5 per day ($1,200 per year), a significant level of financial motivation that SOV commuters will think about (rather than ignoring) during this gnawing process. The 1990 Ch2M Hill example given above achieved nominal 25% mode shift via this combined carrot/stick approach, with a daily parking charge rate that was close to $2 per work day.

H.2. VTPI Reports Support the Predicted 23% VMT reduction

VTPI’s 2009 *Transportation Elasticities* report lists three reports suggesting a greater than 23% reduction can be expected, while one report suggests a less than 23% reduction can be expected:

- Parking fees are found to have a greater effect on vehicle trips, typically by a factor of 1.5 to 2.0 (USEPA, 1998). For example a $1 per trip parking charge is likely to cause the same reduction in vehicle travel as a fuel price increase of $1.50 to $2.00. [14. VTPI, pg 18]
- $4 parking charge for suburbs yield a 36.1% reduction. [14. VTPI, pg 19, Table 15]
- Shoup found that charging reduces SOV by 20-40%. [14. VTPI, pg 21]
- Hess (2001) found $6 daily parking charge reduced SOV from 62% to 46%, only a 16% nominal reduction. [14. VTPI, pg 19]

VTPI’s *Trip Reduction Tables* provides lookup tables for combinations of commuter financial incentives and parking charges, yielding a “percent reduction in commute trips.” Using interpolation and adjusting Tables 4 and 5

for inflation between 2000 and 2009 via the US Consumer Price Index yields a relative 25% SOV commute mode share reduction for the most auto-centered locations (low density suburbs with poor transit options). For all of California, there is a mix of auto-centeredness, so the SOV reduction will be greater than 25%. Further, VTPI's financial incentive is a "rideshare/transit subsidy" that would not be quite as effective as a broader incentive program that rewards telecommuting and biking alternatives, hence Parking Feebate SOV reduction will be larger. A commuter's sensitivity to driving pricing is influenced by a number of factors, including income level. Assuming that California has higher income than the US average, the SOV reduction will be lowered from those shown by an income effect. Calculations are provided below in Table 4: [15. VTPI/Comsis, pg 2]

VTPI's *Trip Reduction Tables*			
		daily charge	daily charge
	incentive	$1.30	$2.60
Table 4	$2.60	20.80%	28.40%
Table 5	$4.00	28.30%	34.80%

Adjusted from 2000 $ to 2009 $ via CPI				
		daily charge	daily charge	daily charge
	incentive	$1.62	$2.00	$3.24
Table 4	$3.24	20.80%		28.40%
	$4.00	24.08%	**25.01%**	32.00%
Table 5	$4.98	28.30%		34.80%

Table 4: VTPI's Trip Reduction Tables yield a "percent reduction in commute trips"

H.3. Moving Cooler Report Supports the Predicted 23% VMT reduction

There are three items of interest in the Moving Cooler Report.

First, Moving Cooler provides a 0.4 price elasticity of VMT demand. [16. Moving Cooler Appendices, pg B-15]. The full U.S. cost of driving per mile is $0.55 as reflected in the 2009 US Business Mileage Reimbursement Rate [17. Reimbursement Rate] The Parking Feebate is perceived as a $6 daily change to commute costs. Assuming an average daily US roundtrip commute of 26 miles, each round-trip commute takes one gallon of gas at 26 mpg CAFE. Hence, for commuting, the policy increases the cost of driving by $6 per commute divided by 26 miles for a total of $0.23 per mile. For a price elasticity table lookup, we have a 50% price change in the cost of driving with an elasticity of 0.4. The table lookup is provided by VTPI [18. Elasticity Spreadsheet] and results in a predicted 23.3% VMT reduction.

It can be argued that using "full driving cost" price elasticity understates VMT reduction. Many believe that drivers assume many driving costs, such as car purchase/depreciation, are fixed, and these drivers change behavior based on perceived variable costs.

Second, looking to the explanation of "Employer Based Commute Strategies" in the Technical Appendices, Moving Cooler provides an alternative way to calculate the commute VMT reduction of the Parking Feebate policy. The calculation below in Table 5 is created by summing the impact of one high intensity TDM program, four one-dollar parking cashouts, and two one-dollar parking charges: [16. Moving Cooler Appendices, pg B-54]

Strategy	Description	% chg commute VMT LL - large metro	Qty	total
TDM Program	High intensity	5.20%	1	5.20%
Parking Cashout	$1/day	3.70%	4	14.80%
Parking Charges	$1/day	0.90%	2	1.80%
				21.80%

Table 5: Calcs based on Table 5.13, Commuter Measure Impacts

Commuter Measure Impact calculation assumptions and qualifications:

- California metropolitan areas average to "LL" large metropolitan areas (Over 1M population with lower per capita baseline transit use). For the proposed policy, the Moving Cooler authors might prefer some sort of a weighted average calculation using LH, LL, etc in Table 5.13. Further clarification by Moving Cooler authors would be helpful. The Parking Feebate's primary focus is on suburban office workers in large metro areas living in medium to low density housing with low transit use.
- If "MH" medium-sized metro is substituted for "LL," the resultant VMT reduction is 27%

- For “TDM Program,” the Moving Cooler authors envision employer TDM programs offering transit, ridesharing, and other TDM programs. The Parking Feebate would create a high-intensity TDM program via different means. The policy would scale TDM up to a statewide level, necessarily creating a more systematic approach to TDM, with private sector technology-laden TDM services growing faster than more traditional TDM offerings. The Parking Feebate envisions TDM spreading more thoroughly to small employers than Moving Cooler.
- Parking Feebate VMT impact is assumed to be a linear function of price/incentive.
- Moving Cooler shows a higher per-dollar impact of cashout versus charges. This is not borne out from behavioral economics theory or TDM case studies. On pg B-57, the authors state that their numbers might be improved by further validation and review.

Third, it is tantalizing to contemplate Moving Cooler’s Policy 6.2.7, a $5/day employer parking tax that must be passed on to commuters and must be “made visible” to commuters each day. Moving Cooler cautions this would be politically difficult. Moving Cooler did not provide a distinct calculation of the (large) VMT reduction this policy would induce. [16. Moving Cooler Appendices, pg B-56]

H.4. Data on “VMT as a Function of Fuel Price” Supports the Predicted 23% VMT Reduction

A price difference for green commutes versus SOV commutes of $6 has the equivalent financial motivation of $6 gallon gas tax increase. [7. Gas Calc] Per capita driving is influenced by many other factors besides gas price (such as auto-centered land use, scarcity of quality transit options, high per capita residential square footage, etc), but a comparison of developed countries with higher gas prices than the U.S. (Japan, France, Germany, and the UK) shows an interesting correlation. The non-U.S. gas prices analyzed are historically 190% to 270% of U.S. prices. As would be expected, low U.S. gas prices are correlated with high per capita vehicle miles traveled (VMT). This is a further argument that suggests that the Parking Feebate will result in a large commuting behavior change.

Once the cost of driving is permanently increased, then driving behavior changes. By a "permanent price increase," we mean that a majority of drivers believe higher prices are "here to stay" as opposed to representing only a temporary price fluctuation.

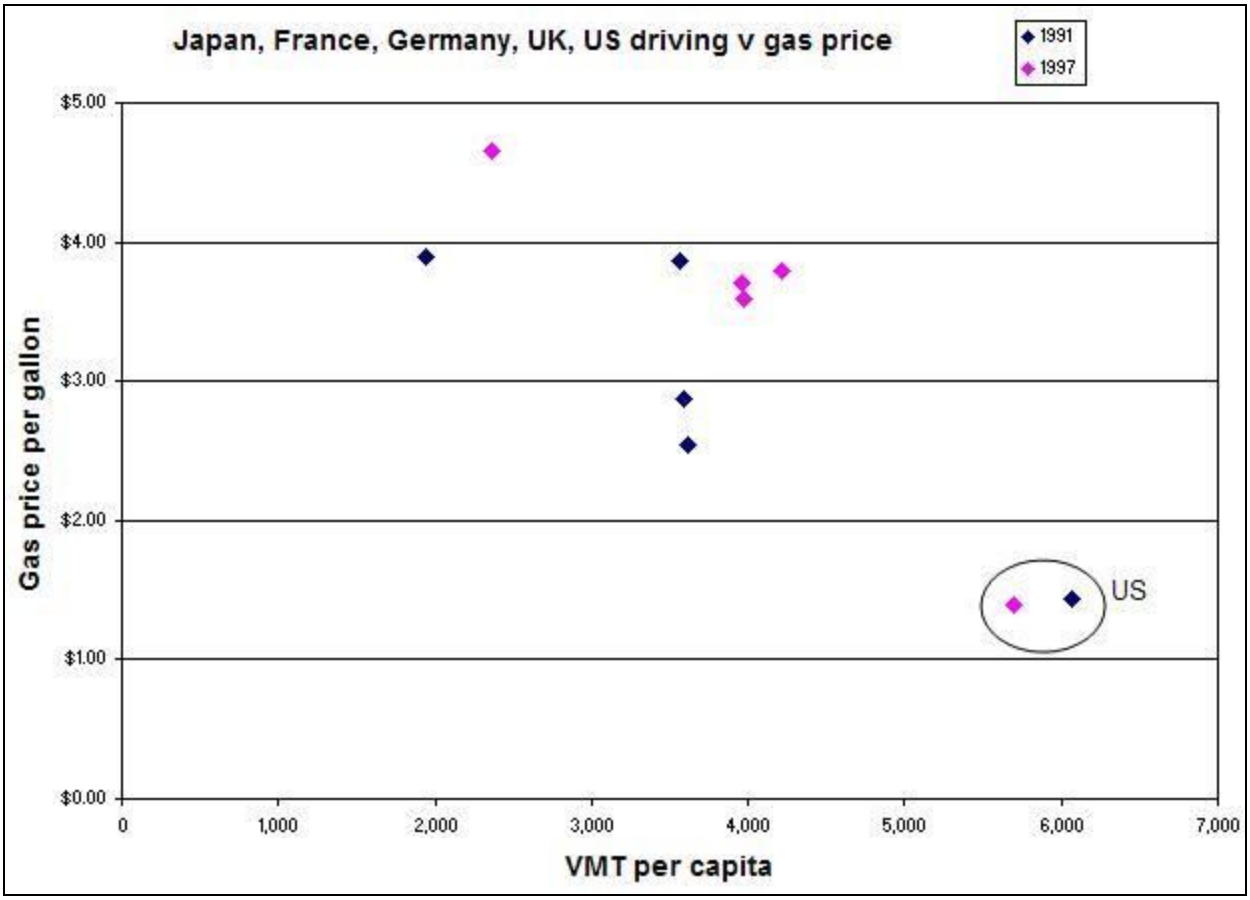


Figure 1: Gas prices are "at the pump" gas prices, including taxes [12. Gas Price]

The Moving Cooler Report states that moving to European level gas taxes, “starting at $2.40 a gallon in 2015 and increasing to $5.00 a gallon in 2050 could result in a 28% reduction in GHG emissions.” Interestingly, Moving Cooler also finds that a much smaller $1.25 increase produces a 17% GHG reduction. [13. Moving Cooler, pg 80]

H.5. REFERENCES – (Web links last updated August 2009)

1. [Subsidy] Subsidy calculation: http://www.cities21.org/parking_subsidy.htm
2. [Growing Cooler] *Growing Cooler: The Evidence on Urban Development and Climate Change.* http://www.smartgrowthamerica.org/gcindex.html.
3. [Willson] "Parking Subsidies and Commuter Mode Choice: Assessing the Evidence," by Richard Willson, Donald Shoup, and Martin Wachs, 1989.
4. [Symposium] "Proceedings--Commuter Parking Symposium" by Metro and Association for Commuter Transportation, Seattle, Washington.
5. [Tversky] See Tversky, A. & Kahneman, D. (1981). The framing of decisions and the psychology of choice. Science 185, 1124 - 1131. Kahneman, D. & Tversky, A. (1984). Choices, Values and Frames. American Psychologist, 39, 341 - 350. Kahneman, D. & Tversky, A. (eds). (2000). Choices, Values and Frames. New York: Cambridge University Press.
6. [Message] McKenzie-Mohr references J. J. Davis, "The effects of message framing on response to environmental communications," Journalism and Mass Communication Quarterly, 1995, #72, pgs 285-299.
7. [Gas Calc] Calculation: Average Bay Area daily, two-way commute distance is 32 miles. Assuming cars get 32 mpg, one gallon of gas is used per daily two-way commute.
8. [Tragedy] Tragedy of the Commons: http://en.wikipedia.org/wiki/Tragedy_of_the_commons
9. [CRIB] Car Reduction In-fill Bonus. http://www.cities21.org/CRIB.htm
10. [Working paper] Working paper from U.S. Environmental Protection Agency's "Transforming Office Parks into Transit Villages" Study. http://www.cities21.org/paidParking.htm, Survey results: http://www.cities21.org/paidParkingSrvyResults.htm.
11. [BWC] http://www.cities21.org/epaModeShiftCaseStudies.xls (See also Appendix Table 9 below)
12. [Gas Price] http://www.cities21.org/gasPriceVsVMT.htm
13. [Moving Cooler] *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions*, by Cambridge Systematics, July 2009. Published by Urban Land Institute. http://www.uli.org.
14. [VTPI] *Transportation Elasticities*, Todd Litman, VTPI, August 26, 2009, http://www.vtpi.org/elasticities.pdf.
15. [VTPI/Comsis] Trip Reduction Tables, Todd Litman, VTPI, http://www.vtpi.org/tdm/tdm41.htm. This report references *Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience*, USDOT, Institute of Transportation Engineers, and Comsis Corporation, 1993. Available at www.bts.gov/ntl/DOCS/474.html.
16. [Moving Cooler Appendices] *Technical Appendices: Moving Cooler,* by Cambridge Systematics, October 2009. Published by Urban Land Institute. http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf
17. [Reimbursement Rate] 2009 US Business Mileage Reimbursement Rate, http://en.wikipedia.org/wiki/Business_Mileage_Reimbursement_Rate
18. [Elasticity Spreadsheet] *Elasticity Spreadsheet*, Todd Litman, Victoria Transport Policy Institute, 5 June 2009. www.vtpi.org/elasticity.xls. "This spreadsheet calculates the changes in consumption predicted to result from price changes, based on various elasticity values."
19. [Stanford] "Transportation Demand Management at Stanford University, A Brief Overview," August 17, 2013, by Brodie Hamilton. http://www.greenplanningaction.org/uploads/2/1/7/4/21744182/2013.08.17_growth_without_gridlock_brodie_hamilton.pdf

H.6. Best Workplaces for Commuters: TDM Case Studies

Case #:	**10**
Author:	Tabitha Graves
Title:	Transportation Demand Management (TDM) Programs: Profiles of Selected Universities
Publication:	University of Wisconsin-Madison Environmental Management Campus Ecology Research Project No.5
Date:	December 1993
Web site:	http://www.fpm.wisc.edu/campusecology/cerp/tdm/tdm.htm
Excerpt:	See table: The percentage of drive-alone employees arriving on the UCLA campus between 6 and 9 a.m. fell from 73.7 percent in 1984 to 57.7 percent in 1992. This was a result of a variety of TDM measures, including parking pricing, carpool and vanpool programs, local bus service, late night van service, and emergency ride home
Policies:	Worksite TDM (general)
pkng spcs freed per 1,000:	160
Location:	University of California at Los Angeles
Case #:	**11**
Author:	Comsis Corporation
Title:	Implementing Effective Travel Demand Management Measures
Publicaton:	Federal Highway Administation and Federal Transit Administration
Date:	September 1993
Excerpt:	"[Pasadena's] TDM program includes a drive-alone disincentive, parking fees, but also many incentives to employees to carpool. Elements of the program that influence carpooling include: reduced parking cost..., transportation allowance..., guaranteed ride home..., on-site ridematching.... Between 1989 and 1990, SOV percentage decreased 30 percent, from 83 percent SOV to 58 percent SOV at City Hall."
Policies:	Worksite TDM (site-specific)
pkng spcs freed per 1,000:	250
Location:	Pasadena, California
Case #	**18**
Report No.	FHWA-SA-90-005
Pub Title:	Evaluation of Travel Demand Management: Measures to Relieve Congestion (Case Study 6: CH2M Hill, Bellevue, Washington)
Pub Date:	February 1990
Author:	US DOT, Federal Highway Administration
Summary:	CH2M Hill is an architectural/engineering firm of approximately 400 employees that has used a "transportation allowance" program in conjunction with restricted on-site parking. The company has achieved a mode share of 54% drive alone, 17% transit, 12% carpool, 17% other (59.4 vehicle trips per 100 employees). These figures were compared to regional control sites' mode share of 81.8% drive alone, 3.3% transit, 11.0% carpool, 0.8% vanpool, and 3.1% other (86.4 vehicle trips per 100 employees).
Policies:	Worksite TDM (site-specific)
pkng spcs freed per 1,000:	278
Location:	Bellevue, Washington
Case #	**33**
Author:	Daniel Baldwin Hess
Title:	The Effects of Free Parking on Commuter Mode Choice: Evidence from Travel Diary Data
Publication:	Ralph & Goldy Lewis Center for Regional Policy Studies at UCLA Working Paper Series #34
Date:	April 2001
Web site:	http://www.sppsr.ucla.edu/lewis
Excerpt:	"[A multinomial logit model] predicts that with free parking, 62 percent of commuters [in Portland's CBD] will drive alone, 16 percent will commute in carpools and 22 percent will ride transit; with a daily parking charge of $6, 46 percent will drive alone, 4 percent will ride in carpools and 50 percent will ride transit."
Policies:	Parking Pricing
pkng spcs freed per 1,000:	160
Location:	Portland, Oregon
Notes:	This is a modeling study based on empirical data from the Oregon and Southwestern Washington 1994 Activity and Travel Behavior Survey conducted by Cambridge Systematics.
Case #:	**35**
Author:	Richard Willson, Donald Shoup, and Martin Wachs
Title:	Parking Subsidies and Commuter Mode Choice: Assessing the Evidence
Publicaton:	University of California at Los Angeles

Date:	July 1989
Excerpt:	K.T. Analytics (FTA Parking Cash Out Web page): "A program of transit and vanpool subsidies as well as preferential parking for carpoolers had little effect until [Twentieth Century Corporation in Los Angeles] raised the price of employee parking from no charge to $30 per month for solo drivers. Solo driving decreased from 90 to 65 percent after pricing, a 49 percent decline."
Policies:	Parking Pricing
pkng spcs freed per 1,000:	250
Location:	Los Angeles, California
Notes:	Decline of 49% cited in text appears to be incorrect.
Case #:	**36**
Author:	Monica Surber, Donald Shoup, and Martin Wachs
Title:	The Effects of Ending Employer-Paid Parking for Solo Drivers
Publicaton:	University of California at Los Angeles
Date:	1984
Excerpt:	"Ending free parking for solo drivers at [the Southern California transportation services firm] Commuter Computer dramatically reduced solo driving. Solo driving decreased from 42 percent of the modal split during the last 4 months of free parking to 8 percent during the first 3 months after the parking subsidy for solo drivers was ended."
Policies:	Parking Pricing
pkng spcs freed per 1,000:	340
Location:	Los Angeles, California
Notes:	The parking subsidy at Commuter Computer was removed only for employees who did not need their car for work.
Case #:	**38**
Title:	Proceedings--Commuter Parking Symposium
Publicaton:	Metro and Association for Commuter Transportation, Seattle, Washington
Date:	December 1990
Excerpt:	K.T. Analytics (FTA Parking Cash Out Web page): "CH2M Hill in Bellevue, Washington] began charging solo drivers $40 per month for parking, the amount the company pays the building owner for parking. All employees receive a $40 per month travel allowance in their paychecks. Carpoolers park for free. Walkers, cyclists and drop offs keep the travel allowance. Solo driving declined from 89 percent to 64 percent after the parking policies were put into place, a 28 percent decline."
Policies:	Parking Pricing
pkng spcs freed per 1,000:	250
Location:	Bellevue, Washington

Table 9

Appendix I: Feebate FAQ

The third component of the five component Fair Value Commuting (FVC) solution is the revenue-neutral workplace parking feebate. The FVC feebate charges a fee for SOV commutes, collects that revenue, and rebates that revenue to non-SOV commutes.

How does this Feebate synchronize with Plan Bay Area, the region's adopted long-range transportation plan?

- This solution improves five Plan Bay Area Performance Targets: 1, 7, 9A, 9B, and 10C. http://www.cities21.org/cms/Cities21PricingPlanBayArea.pdf

How many US workers get free parking?

- 95% of the 130M US commuters are provided with free parking.[1]

Free workplace parking is my right, why are you trying to take it away?

- Free parking at work is a counterproductive $7/day subsidy for SOV commuting. See calculations for surface parking at: http://www.cities21.org/parking_subsidy.htm. The subsidy increases GHG and traffic congestion, both being negative externalities. Spaces in parking structures are 3X more expensive.

Why can't I get Google WiFi motorcoach bus service for my commute?

- Throughout the entire US, there are a handful of "effective but expensive" trip reduction programs that provide free workplace parking: Google Mountain View at 52% SOV, Genentech South SF at 58%, Facebook Menlo Park at 59%, and Microsoft Redmond at 62% SOV. These programs often have a Human Resources cost justification because employees work productively during their green commutes. The cost of these programs is out-of-reach of the vast majority of US employers. See please see Chapter 3C, "$6,000 per worker per year 'expensive but effective' employer commute programs." [2]

Out in the suburbs, public transit doesn't work. How can you expect us to get out of our cars?

- Past evidence from UCLA's Don Shoup and others has shown that, when commute alternatives are few, carpooling fills the gap.

How can Parking Feebate be enforced? What's to keep everybody from cheating on their self-reporting?

- Mobility ecosystem vendors are developing inexpensive opt-in smartphone "trip trackers" to validate that employees are taking commute alternatives. As far as this being construed as "Big Brother," for a 25% nominal commute GHG reduction, it is more like "Big Sister," a deployment of technology in the public interest (rather than being used against the public). Please refer to Chapter 6D.[3]

[1] Shoup, D. and Breinholt, M.J. Employer-Paid Parking: A Nationwide Survey of Employers' Parking Subsidy Policies. In The Full Costs and Benefits of Transportation: Contributions to Theory, Method and Measurement. Editors David L. Greene, Donald W. Jones, and Mark A. Delucchi. Berlin: Springer Press. 1997.
[2] Raney, Steve. Reduce Bay Area Commuting by 25%, white paper for City/County Association of Governments of San Mateo County, Chapter 3C. http://www.cities21.org/wp.pdf.
[3] Raney, Steve. Reduce Bay Area Commuting by 25%, white paper for City/County Association of Governments of San Mateo County, Chapter 6D. http://www.cities21.org/wp.pdf.

UCLA Professor Don Shoup, author: The High Cost of Free Parking, is my hero. Shoup helped pass CA's Parking Cashout law and, at one point, had the Clinton Administration convinced to back Cashout nationally. How is this different?

- Fair Value Commuting with Feebate is an evolution of Shoup's pioneering work. According to Shoup, "Cashout is perceived as a huge new cost to employers, so employers fight it vigorously." Adds Jeff Tumlim of Nelson Nygaard, "The cost problem with incentives-only (cashout) is that you have to grandfather in all the existing green commuters before you can entice new green commuting. Cashout is a very expensive trip reduction measure."[4] In contrast, Feebate is revenue neutral to employers. In addition, Feebate results in larger commute mode shift than Cashout. One Bay Area tech employer adopted a $4/day cashout for non-SOV commuters. SOV mode share went from 78 to 74% at a high cost per new commute de-generated of $26/day.

Can we push SOV commuting below 50%?

- There may be synergies where gap-filling mobility services become even more competitive with driving alone, grabbing mode away from SOV. In addition, commuters may be willing to increase the SOV fee at some point in the future, to apply an even larger feebate to change behavior further.

Does the feebate charge/incentive vary with SOV mode share?

- Yes, please see the WidgetCo example in Chapter 10E and also Appendix K3B for calculation details. [5]
- At a high SOV mode share such as 75%, the non-SOV feebate is almost 3X the SOV fee.

The exact details, such as the exact pricing level, seem to me to be very prescriptive

- The price structure is driven by 1) a Capitalist stakeholder constraint. It has to be revenue neutral to employers or it will not be politically viable. Under Capitalism, profit-maximizing firms are incented to minimize commute program expenditure. 2) a political viability constraint whereby FVC avoids Proposition 26's supermajority voting requirement. [6]

Another issue with this proposal is that it requires each employer to administer. This is appropriate for large employers such as Genentech, but would be a difficult burden for small employers. Perhaps a Transportation Management Association (TMA) could play this role?

- FVC can be administered easily and inexpensively through Enterprise Commute Trip Reduction (ECTR) payroll processing grabbing data from employee commute calendars. ECTR quickly plugs into payroll processing, so isn't burdensome for smaller companies.
- A first public policy implementation of FVC is envisioned to apply to employers with 250 or more employees, avoiding small businesses.
- As far as TMAs and employer Commute Staff, FVC will more than quadruple demand for such services. Association for Commuter Transportation NorCal has TMAs as members and has provided a FVC support letter.

Having a policy that would exempt smaller companies (1 to 49 employees) isn't the right fit for the employer mix in my suburban downtown.

- There are a small set of payroll apps that small companies run (Paychex, ADP, etc). These will be well-supported by FVC, creating no reason why smaller than 250-employee companies can't voluntarily

---

[4] "Policy Analysis by D Shoup, J Tumlin, CARB, SCAG, MTC: Notes on Workplace Parking Feebate (Parking Charges + Incentives)", Feb 2013, http://www.cities21.org/dpwg/parkingPolicy.htm

[5] Raney, Steve. Reduce Bay Area Commuting by 25%, white paper for City/County Association of Governments of San Mateo County, Chapter 10E and Appendix K3B. http://www.cities21.org/wp.pdf.

[6] Ballotpedia: "California Proposition 26, Supermajority Vote to Pass New Taxes and Fees (2010)," https://ballotpedia.org/California_Proposition_26,_Supermajority_Vote_to_Pass_New_Taxes_and_Fees_(2010)

implement FVC with zero budget hit. Regional political realities are different than for a specific suburban downtown situation.

A Caltrain monthly pass is $179 from San Francisco to Palo Alto. Is a small incentive such as $0.50/day expected to make a difference in behavior?

- Yes and it is a key part of a scaling/phasing strategy. The folks with the best commute options change modes first, then the SOV fee and corresponding non-SOV rebate increases and another tier changes mode, and so on. What you have to avoid is having a large chunk of employees attempt to shift 25% nominal mode in one day. That would be chaos. There is an adjustment on the demand side, and then the supply side also has to adjust (new mobility services, better bus service, etc). These adjustments will proceed in an iterative manner.
- On Day 1, an ideal employer might provide GoPass instead of $0.50 per Caltrain, while bikers and carpoolers would receive $0.50 per day. At some level of commute mode shift, employees at a firm may influence corporate decision making on volume purchase of incentives, such as GoPass. ECTR software has the flexibility to support existing employer options that go beyond the requirement for certain non-SOV modes.

I can see that self-reporting could work in a company with an attentive culture. Sampling audit systems such as transit proof of payment systems work well. However, with nontrivial amounts of money over time, lack of visibility or peer pressure, and lack of auditing, how does this system avoid cheating?

- As of summer of 2016, Fair Value Commuting's five components are about 40% of the way to being 100% mature and scalable by 2018. Part of achieving scalability is to provide 95%+ accurate automated commute mode detection.

A disproportionate percent of low-income household budget goes to transport, therefore increases in transport costs via SOV fees may have a disproportionate impact and be economically regressive.

- In a ranking of eight congestion reduction policies on social equity, FVC's Feebate is rated as economically progressive. First, for Feebate, high-income commuters have high value of time so are more likely to have an SOV commute and pay the SOV fee, whereas low income commuters are more likely to receive the non-SOV rebate for green alternatives. Second, high-income commuters have higher current SOV mode share than low-income commuters. One US-wide analysis[7] shows 73% SOV for average commuters and 63% SOV for low-income commuters. Third, the policy envisions compassionate exceptions for low-income workers. Fourth, Feebate won't apply to baristas and commuters who do not work "9 to 5" jobs. Fifth, even for low-income commuters living in "transit deserts," Don Shoup's studies have shown that congestion pricing induces carpooling, a non-SOV mode that is available in transit deserts. In short, Feebate is a progressive net wealth transfer from high-income to low-income commuters. However, within this progressive structure, there are winners and losers: some low-income commuters are made worse off.[8]
- To further increase social equity, congestion reduction pricing policies may (should) be married with low income transport/mobility subsidies, such as Muni Lifeline or ORCA LIFT.

[7] "How Lower Income Citizens Commute," Feb 2012, http://www.newgeography.com/content/002666-how-lower-income-citizens-commute

[8] Raney, Steve. Reduce Bay Area Commuting by 25%, white paper for City/County Association of Governments of San Mateo County, Chapter 10D and Appendix L. http://www.cities21.org/wp.pdf.

Appendix J: Partner and Support Letters

Consortium with 23 partners and 8 supporters (italics for supporter).

Purple denotes one of 11 employers deploying FVC

'*' denotes a legacy letter

City/County	Vendor	Employer	Agency	NGO
Redwood City	RideAmigos	Microsoft	Commute .org	Bay Area Council
Fremont	Luum	Google	C/CAG	Transp. for America
Mountain View	Moovel		samTrans	Palo Alto TMA
Palo Alto	Lyft *		VTA *	Joint Venture
San Mateo County	GenZe		*Air District*	SPUR
Cupertino - Council	EcoReco		*OPR* *	*SVLG* *
Assembly District 22			*MTC* *	*Transform* *
				Sierra Club *
				ACT Norcal *

“C/CAG” is City/County Association of Governments of San Mateo County. “VTA” is Santa Clara Valley Transportation Authority. “Air District” is Bay Area Air Quality Management District or BAAQMD, “OPR” is Governor’s Office of Planning and Research. “MTC” or Metropolitan Transportation Commission is the Bay Area MPO. “TMA” stands for Transportation Management Association. “SPUR” is an NGO name, not an acronym. “SVLG” is Silicon Valley Leadership Group. “ACT” is Association for Commuter Transportation.

The Fair Value Commuting concept has been pursued under various names since 2009, including “Silicon Valley MaaS,” “Workplace Parking Charges + Cashout” and “Workplace Parking Charges + Incentives.” Some of the old letters reference previous concept names and/or previous grant funding programs.

Community Development Department
Engineering & Transportation

1017 Middlefield Road
Redwood City, CA 94063
Tel: 650.780-.7380
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www.redwoodcity.org

April 1, 2016

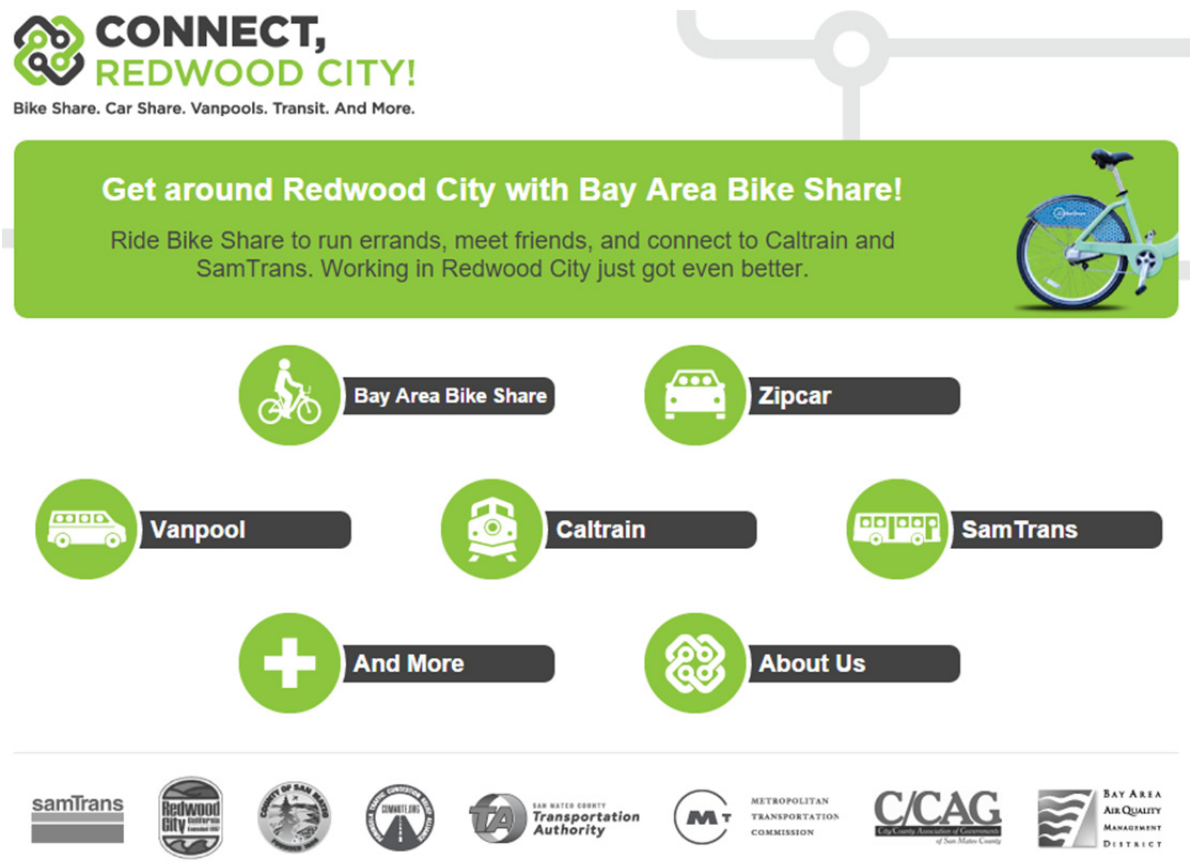
Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113

Subject: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney:

The purpose of this letter is to confirm interest from the City of Redwood City in participating in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area.

In 2011, through $1.5M FTA funding from the MTC Climate Initiatives Grant Program, Redwood City began our innovative *Making the Last Mile Count* pilot program (since renamed to *Connect, Redwood City!*). *Connect, Redwood City!* implements a suite of transportation demand management strategies to reduce single occupant vehicle trips and vehicle miles traveled. The image below is a screen shot of the program's Web page.



The Fair Value Commuting Project strongly aligns with *Connect, Redwood City!* and our sustainability goals. For example, our 2009 Community Climate Action Plan calls for 15% GHG reduction by 2020.

On behalf of the City of Redwood City, we are prepared to undertake a staff pilot of ECTR + MobAg software and to participate in other Fair Value Commuting project activities.

Sincerely,

Jessica Manzi
Senior Transportation Coordinator
City of Redwood City

CITY OF Fremont

Office of the City Manager
3300 Capitol Avenue, Building A | P.O. Box 5006, Fremont, CA 94537-5006
510 284-4000 *ph* | 510 284-4001 *fax* | www.fremont.gov

April 4, 2016

Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Dear Mr. Raney:

The purpose of this letter is to confirm interest from the City of Fremont in participating in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area.

The Fair Value Commuting Project strongly aligns with Fremont's adopted vision to "serve as a national model of how an auto-oriented suburb can evolve into a sustainable, strategically urban, modern city." Further, the mobility element of our General Plan encourages the reduction of vehicle miles traveled through the expansion of transportation choices, and making it easier to walk, bicycle, and use public transportation in the City.

Fremont is among the major cities in Silicon Valley and our Mayor and City Council encourage innovation and the use of technology to help address our modern needs and goals. The Fair Value Commuting Project as envisioned by JVSV and its project partners is a great opportunity to harness technology to support our goals for mobility, sustainability, livability and continued innovation leadership.

On behalf of the City of Fremont organization, we are prepared to have members of our staff participate in a pilot project to help with the demonstration of software applications and other activities associated with the Fair Value Commuting Project.

Sincerely,

Fred Diaz
City Manager

CITY OF MOUNTAIN VIEW

COMMUNITY DEVELOPMENT DEPARTMENT
500 Castro Street • Post Office Box 7540 • Mountain View, California 94039-7540
650-903-6306 • FAX 650-962-8502

VIA ELECTRONIC MAIL

July 16, 2015

Steve Ramey
Joint Venture Silicon Valley
100 W. San Fernando Street, Suite 310
San Jose, CA 95113

RE: SILICON VALLEY MOBILITY AS A SERVICE PILOT PROJECT

Dear Steve:

This letter will confirm the City of Mountain View's interest in participating in the Silicon Valley Mobility as a Service (MaaS) Pilot Project. Specifically, the City is pursuing a partnership with Joint Venture Silicon Valley to implement a transportation demand management (TDM) program for City employees as part of the MaaS project.

Mountain View has adopted highly progressive transportation policies to support multi-modal transportation choices for residents and workers in the City. The City is implementing a stringent trip cap and 55% trip reduction goal for our technology companies in the North Bayshore in conjunction with ambitious investments in separated bike lanes, new bike and pedestrian bridges, priority bus lanes, and a transportation management association.

The City of Mountain View is now interested in implementing a TDM program for the City organization. The MaaS Project provides an ideal opportunity to leverage the expertise and support of JVSV and its partners to create an innovative TDM pilot for our employees. We look forward to further discussions with JVSV as we scope this pilot.

Please feel free to contact me if you have any questions or need additional information. I can be reached at 650.903.6456 or at randal.tsuda@mountainview.gov.

Sincerely,

Randal R. Tsuda, AICP
Director of Community Development

OFFICE OF THE CITY MANAGER
CITY OF PALO ALTO
250 Hamilton Avenue, 7th Floor
Palo Alto, CA 94301
650.329.2392

April 5, 2016

Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Re: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney:

The purpose of this letter is to confirm interest from the City of Palo Alto in participating in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area.

The Fair Value Commuting Project strongly aligns with Palo Alto's vision to develop mobility as service as a way to reduce dependence on the automobile, reduce greenhouse gas emissions and congestion, and enhance quality of life. Our comprehensive plan encourages the reduction of vehicle miles traveled through the expansion of transportation choices, and makes it easier to walk, bicycle, and use public transportation in the City.

Palo Alto has a long standing reputation for innovation. The Fair Value Commuting Project as envisioned by JVSV and its project partners is a great opportunity to harness technology to support our goals for mobility, sustainability, livability and continued innovation leadership.

On behalf of the City of Palo Alto, we are looking forward to having members of our staff participate in a pilot project to help with the demonstration of software applications and other activities associated with the Fair Value Commuting Project.

Sincerely,

James Keene
City Manager

cc: Suzanne Mason, Assistant City Manager
Gil Friend, Chief Sustainability Officer
Hillary Gitelman, Planning Director
Joshuah Mello, Chief Transportation Officer

Printed with soy-based inks on 100% recycled paper processed without chlorine.

COUNTY OF SAN MATEO
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April 26, 2016

Mr. Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Subject: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney:
The purpose of this letter is to confirm interest from the County of San Mateo in participating in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area.

Formed in July 2014 as a part of the San Mateo County Manager's Office, the Office of Sustainability strives to improve the sustainability of the County's operations and the greater community through work in areas of renewable energy and energy efficiency; resource conservation; alternative transportation; and greenhouse gas emission reductions. We manage the Commute Alternatives Program for our more than 5,000 County employees. In addition, we have a severe parking shortage at our two largest work sites. This "parking motivation" Project is synergistic with: a) our strong commitment to active transportation and greening our commute, and b) the two County Climate Action Plans that we manage.

On behalf of the County of San Mateo, we are prepared to undertake a staff pilot project of ECTR/RideAmigos + MobAg software and to participate in other Fair Value Commuting project activities.

Sincerely,

Jim Eggemeyer
Director

County of San Mateo
Office of Sustainability
455 County Center, 4th Floor
Redwood City, CA 94063
650-363-4189 T
jeggemeyer@smcgov.org
http://green.smcgov.org/
http://peninsulacleanenergy.com/

From: Rod Sinks [mailto:rodsinks@gmail.com]
Sent: Thursday, March 31, 2016 5:02 PM

March 31, 2016

TO: Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113

Re: State/Federal Grant Partner Letter for “Fair Value Commuting” Project

Dear Mr. Raney:

The purpose of this message is to confirm my participation in the Fair Value Commuting Project. The Bay Area now has the nation’s second worst traffic congestion. Transportation is the number 1 or 2 issue in almost every Silicon Valley city. I have been helping to convene a unique coalition of Councilmembers and City Managers from 11 cities to work on our most pressing transportation issues.

In 2017, when your project is about half-complete, I will convene this executive group in policy research workshop to identify political obstacles to enacting “four cities at once city-wide trip caps.” I will expect you to participate in the workshop and create a workshop report using Chatham House Rules. Working through the Cities Association Of Santa Clara County (representing the mutual interests of the diverse fifteen cities of Santa Clara County), I will ensure that all County cities are afforded the opportunity to participate.

Sincerely,

Rod Sinks, City of Cupertino City Council

STATE CAPITOL
P.O. BOX 942849
SACRAMENTO, CA 94249-0022
(916) 319-2022
FAX (916) 319-2122

DISTRICT OFFICE
1528 S. EL CAMINO REAL, SUITE 302
SAN MATEO, CA 94402
(650) 349-2200
FAX (650) 341-4676

Assembly
California Legislature

KEVIN MULLIN
SPEAKER PRO TEMPORE
ASSEMBLYMEMBER, TWENTY-SECOND DISTRICT

COMMITTEES
BUDGET
BUSINESS AND PROFESSIONS
ELECTIONS AND REDISTRICTING
HOUSING AND COMMUNITY DEVELOPMENT
REVENUE AND TAXATION

SUBCOMMITTEES
BUDGET SUBCOMMITTEE NO. 4 ON STATE ADMINISTRATION

SELECT COMMITTEES
CHAIR: BIOTECHNOLOGY

WORKFORCE INVESTMENT BOARD

June 2, 2016

Mr. Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Dear Mr. Raney,

I write in strong support of Joint Venture Silicon Valley's (JVSV) Fair Value Commuting project application for the Federal Highway Administration's Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD).

As you know, the 48-mile Highway 101 corridor between San Francisco and San Jose is the most economically productive and important highway corridor in California. Transportation capacity in the corridor is grossly insufficient to serve the growing number of commuters, leading to heavy and growing traffic congestion and serious overcrowding on Caltrain. In order to sustain the economic engine of the Highway 101 corridor and the quality of life for local residents, swift and decisive action by transportation agencies is needed to relieve commuter congestion.

In 2015 I introduced AB 378 which prompted the dialogue with business leaders, transportation planners, and local governments, as well as the commuting public, to develop a corridor strategy to equitably alleviate congestion that we all experience on the Peninsula. I introduced AB 2126 in 2016 to address the statutory authority need to expedite transportation projects through additional CM/GC authority that will help the 101 corridor.

I commend the leadership of JVSV for facilitating the development of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area. The Fair Value Commuting project will be a valuable contribution to development of a Highway 101 corridor strategy. Additional resources for employer pilots will allow JVSV to make findings about the scalability of Fair Value Commuting as a potential technology/policy tool for Highway 101.

I enthusiastically support JVSV's grant proposal to Federal Highway Administration for the Fair Value Commuting project. I look forward to a favorable outcome. Please do not hesitate to contact me should you have any questions.

Sincerely,

Kevin Mullin

KEVIN MULLIN
Speaker Pro Tempore

Printed on Recycled Paper

rideamigos CORP.
connecting people, one way or another

April 1, 2016

TO: Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113

Re: State/Federal Grant Partner Letter for “Fair Value Commuting” Project

Dear Mr. Raney:

We confirm RideAmigos’ participation in the Fair Value Commuting Project in support of multiple Bay Area employer pilots. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in the Bay Area. The JVSV public private partnership approach allows the project to leverage our engineering investment ($4M to date) and ongoing customer project interaction capability across these pilots.

RideAmigos Unity is the next-generation Enterprise Commute Trip Reduction system with new Bay Area pilot implementations including San Mateo County-wide (Commute.org), Stanford Research Park-wide, and Google. Unity provides:

- Localized trip planners with complete access to multimodal transportation options, including public transit, ridesharing, vanpooling, walking, cycling and more
- Interactive commuter dashboards that help users track vital information in a single, easily accessible place
- Innovative trip tracking options
- Gamification and incentivization campaigns
- Complete survey management, distribution and analytics tools for administrators
- Ridesharing options
- GIS reporting tools

Our in-kind contribution to the Fair Value Commuting project will be significant. [redacted] engineering estimates for the following work scope:

- [redacted]
- [redacted]
- [redacted]

Sincerely,

Jeffrey Chernick, CEO, RideAmigos

562 1st Ave S, Suite 400, Seattle, WA

TO: Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113
steve.raney@jointventure.org, 650 329 9200

Re: State/Federal Grant Partner Letter for “Fair Value Commuting” Project

Dear Mr. Raney:

We confirm Luum’s participation in the Fair Value Commuting Project in support of multiple Bay Area employer pilots. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in the Bay Area. The JVSV public private partnership approach allows the project to leverage Luum’s significant investment in building the leading technology in this space.

In November of 2013, Luum brought the world’s first Enterprise Commute Trip Reduction system to market, working very closely with Seattle Children’s Hospital. Our solution shifted SOV commute mode significantly down within the first 12 months while improving employee satisfaction and quantifying the sustainability and wellness benefits of alternative commuting. The Luum platform’s feature set includes deep integration with enterprise IT systems to ease the commute logging and tracking process for both employees and parking administrators, parking access hardware integration, tiers of commute benefits for staff, real-time cloud-based employer-wide commute dashboard (parking space utilization, benefits accounting, daily commute mode split, peer-employer comparisons), automated bike commute tracking, a carrot/stick feebate (integrated with payroll processing) including a phased transition away from monthly to daily parking charges, transit pass fulfillment, shuttle data services, a one-stop employee commute tools/assistance web portal, a cloud-based employee commute calendar (with performance tracking, accurate GHG impact, and carrot/stick accounting), an employer administration portal with detailed accounting by commute tool/activity, new employee onboarding (the best time to change behavior is before the first day of employment), ride matching, vanpool management, guaranteed ride home, carpool parking detection with splitting parking charge, along with social and virtual commute incentives.

We are pleased to expand our Bay Area presence for our next-generation TDM platform to other Bay Area customers through the “Fair Value Commuting” Project. Throughout the project, we will continue to extend our platform to provide features our employers need most:

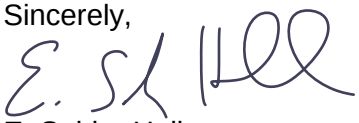
- We have significant integration with leading payroll / human resources management software and will continue to expand in that area.
- We have introduced and will continue to improve upon a new commute trip mode logging mobile app, facilitating accurate employee commute mode reporting that feeds our employer commute mode dashboard.

- We continue to expand our native features and functionalities to meet the growing needs of large employers
- Our partner network of transportation providers and incentive services continues to grow on a daily basis bringing further value to our customers and network

We anticipate being able to make significant impact on the project. We will work with stakeholders to

[redacted]

Sincerely,



04/27/2016

E. Sohier Hall,
President & CEO
sohier@luum.com
(206) 595-6938

Luum
562 1st Ave. S. #400
Seattle, WA 98104

RIDESCOUT™

200 E 6th Street #200
Austin, TX 78701

April 5, 2016

Steve Raney
Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Dear Mr. Raney:

We confirm RiceScout's participation in the Fair Value Commuting Project in support of multiple Bay Area employer pilots. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in the Bay Area. As a transportation technology working at the forefront of developing integrated solutions across transportation modes, RideScout has significant experience building user-focused mobile applications, advanced traveler information systems, and mobile payment services.

We have optimized the RideScout traveler information mobile app for over 70 U.S. cities, bringing together real-time information for walking, biking, driving, bikesharing, carsharing, and ridesharing. In 2015, we acquired GlobeSherpa, the North American leader of mobile ticketing for the transportation industry. GlobeSherpa is the current provider of transport ticketing solutions for 13 major U.S. cities, including San Francisco, Washington, D.C., and Chicago. Bringing together our core areas of expertise, we will be piloting integrated solutions for public transit and mobility-on-demand (MOD) services for several cities in 2016, and look forward to supporting JVSV through this initiative.

RideScout supports the objectives of the Fair Value Commuting project, including:

- Engaging employers and ride providers jointly in solving mobility problems.
- Increasing occupancy inside vehicles to reduce vehicle miles traveled and greenhouse gas emissions,
- Increasing transit ridership and strengthening the mobility ecosystem.
- Using advanced analytics and optimization to provide new mobility services and improve efficiency.

With the Fair Value Commuting Project, RideScout looks forward to:

- Developing mobile payment solutions for Silicon Valley transit agencies.
- Working closely with transit agencies and transportation planners to build innovative solutions for the integration of transit and mobility-on-demand (e.g., bikeshare, carshare, and other mobility services).

Sincerely,

Steve Carroll
Vice President, Strategic Development

2300 Harrison Street
San Francisco, CA 94110

Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94607

Re: Letter in support of the Silicon Valley Mobility as a Service Project

Dear MTC Climate Initiatives Team,

Lyft is committed to being part of a mobility network that works both for people and the environment. It is our vision that an ecosystem of multiple transportation modes moving people in a coordinated, efficient manner is the future of mobility. We support the VTA/Ridescout Mobility as a Service Project and hope to participate as a way to foster the growing set of alternatives to single occupant vehicle trips while decongesting our roads and reducing emissions.

Lyft has demonstrated complementary patterns to public transportation, and seeks to help grow transit ridership in the Bay Area by enabling convenient and affordable first- and last-mile connections. In the CalTrain service area, Lyft sees more than 22% of rides begin or end in close proximity to CalTrain stations. That number is slightly higher, even, when expanding to include BART stations in the East Bay Area. Through the Mobility as a Service (MaaS) pilot, we would hope to facilitate more of these multi-modal behaviors in the region.

Through our Lyft For Work program, Lyft is also already working to help employers reduce the amount of commutes that are taken in single occupant vehicles. By helping companies incentivize their employees to use Lyft in combination with transit, or to take Lyft Line and increase the occupancy of vehicle trips, we want to reduce vehicle miles traveled (VMT) and associated greenhouse gas emissions from commutes. The San Francisco to Silicon Valley corridor faces serious challenges in the form of traffic congestion,

One our more recent and most climate-friendly innovations is Driver Destination. With Driver Destination, which is currently only available in the San Francisco Bay Area, drivers who are already taking a trip can plug in their destination and accept matches with passengers seeking to travel along the same route. This breakthrough in carpooling technology is especially well-suited to address commutes of around 5 miles. In the past, single occupant vehicle trips have been exceptionally competitive for commutes of this general length, but with Driver Destination, we can match people to take a potentially significant amount of cars off the road.

Lyft is developing an open API for third party apps and expects to have it ready in time for the VTA/Ridescout MaaS pilot in early 2016. We have been in communication with Ridescout about the possibility, and are very encouraged at its potential to prove the concept of MaaS. We represent a strong addition to efficient, technology-enabled mobility and look forward to helping complete the roster of options that will give people competitive alternatives to driving alone.

Thank you for your consideration.

Sincerely,

Tommy Hayes
Transportation Policy Manager

Mahindra genZe

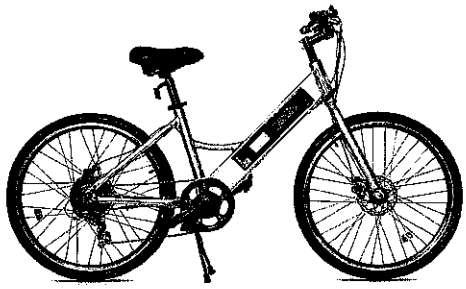
April 4, 2016

Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Re: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney:

The purpose of this letter is to confirm genZe participation in the Fair Value Commuting Project, with enthusiasm for piloting "e-bike loan-to-own" as a new financial technique to scale green commuting. Our e-bikes provide a new performance level at a mass-adoption price ($1,499 retail). In Silicon Valley, two of the major employers have highest rates of SOV commuting at 5 to 10 miles and are looking to e-bikes as the "gap-filling" solution.



Our participation:

- For up to four public sector pilots, GenZe will provide two e-bike six-month loaners, (up to 8) with steeply discounted pricing for additional units. At $1499 each, this is an estimated investment of $12,000 in retail value and includes servicing.
- [redacted]
- Piloting loan-to-own.
- Supporting the project with e-bike experiential fairs to the extent possible. These may be fairs Mahindra GenZe is participating in or those that JVSV is participating in
- Piloting IoT opt-in tracking to auto-populate ECTR commute mode dashboards with the future generation of GenZe e-bikes.

Sincerely,

Vish Palekar
CEO, Mahindra GenZe

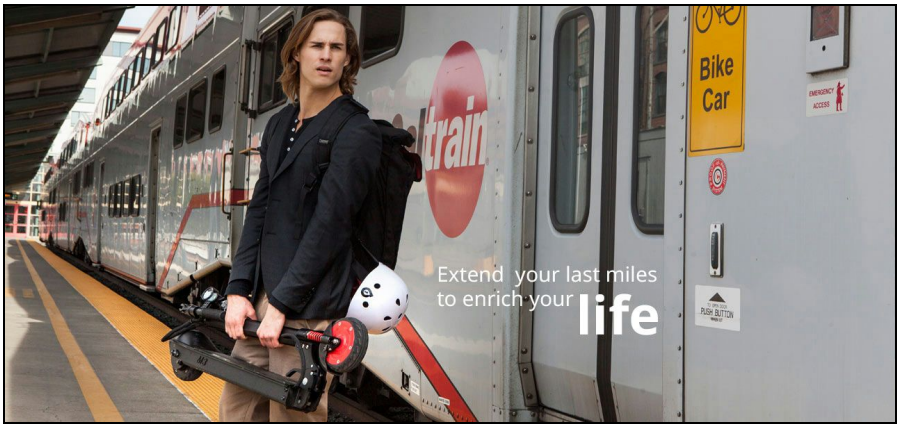
TO: Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113
steve.raney@jointventure.org, 650 329 9200

Re: State/Federal Grant Partner Letter for “Fair Value Commuting” Project

Dear Mr. Raney:

The purpose of this letter is to confirm interest from EcoReco in participating in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of a comprehensive solution to support sustainable commuting in Silicon Valley and the Bay Area.

Our mission at EcoReco is to provide eco-friendly alternatives to today’s energy-depleting, environment-threatening transport modes. Our mission aligns with the Fair Value Commuting (FCV) project’s “gap filling.” Our M5 foldable, 2,000-mpg-equivalent e-scooter provides a new option for short commutes and for first/last mile to/from transit:



M5 Air

Comfortable & Safe Ride
Rear-wheel drive and brake for max traction and stability
Full size handlebar & deck, Omni-directional tail light
Full suspension with front air wheel

Green & energy-efficient system
Zero-emissions, silent motor
2,000+ MPGe, 500+ Miles on $1
Energy Recovery Braking system (E.R.B.)

High performance integration
Top speed configurable at 20, 12, 7 mph
10-20 miles of range per charge*
Zero-drag hub motor, **heavy duty with 280 lb load**

Long battery life & steady top speed
Extended charge cycle lifetime with LFP battery*
Consistent top speed throughout operation
Charges to 70% in 2 hours

Advanced features
Safe-start throttle, 3 stage braking
LED back-lit dashboard, **top/stem gadget mounts**

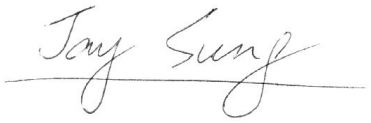
Folding size 3'x1'x1/2'
Fits in car trunks, gym lockers, and under chairs
Perfect for public transportation, RVs, and boats

We have three new scooter product lines under development for release later this year, with more compelling features: new battery technology, IoT connectivity and modified wheels.

For our FCV project participation, we look forward to:

- Providing eight M5 scooter loaners to public sector FCV pilots
- Providing additional M5 scooters to public sector pilots at a 30% discount
- Participating in employer commute options fairs
- Prototyping an e-scooter “loan-to-own” service

Sincerely,



Jay Sung
CEO & Co-founder

jay@ecorecoscooter.com
(O) 650-331-0500
(M) 310-600-6388

Microsoft Corporation
1065 La Avenida
Mountain View, CA 94043
Tel 650-693-1001
http://www.microsoft.com/

Microsoft

April 6, 2016

TO: Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113

Re: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney,

In Seattle/Redmond, Microsoft has an extensive and successful TDM program. As our Silicon Valley presence expands beyond 2,000 employees, we are also augmenting our local TDM program.

We are happy to participate in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area.

1) We will pilot a real-time commute mode dashboard from Luum software and share learnings.

2) As we have done in the past, we will make state-of-the-art Microsoft Conference facilities available for Joint Venture's regular convening of the mobility ecosystem of employers, vendors, cities, and agencies.

3) Participate in additional project activities.

Microsoft looks forward to working with Joint Venture Silicon Valley on this project. Please feel free to contact me or Terry Smith, Transportation Specialist, in the weeks and months ahead.

Sincerely,

Jonathan Noble
Director, State & Local Government
US Government Affairs

Microsoft Corporation is an equal opportunity employer.

Google Inc.
1600 Amphitheatre Parkway
Mountain View, CA 94043

Google™

July 15, 2015

To: Metropolitan Transportation Commission
Climate Initiatives Parking Management Grant Team

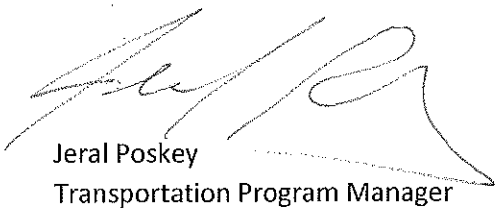
Re: VTA / Joint Venture Silicon Valley Mobility as a Service Project

Google supports the grant application for the VTA / Joint Venture Silicon Valley Mobility as a Service Project.

Google has an extensive and successful TDM program. With programs such as the Google shuttles and our GBike shared bikes, Google has been a leader in reducing single occupancy vehicle use in the suburban office park setting. Still, there is much more to be done in order for all employees in the region to be able to have good commute options.

We see e-bikes as having the potential to reach many commuters who are in the "in-between" distance -- too far for any easy bike ride, but too close to gain much advantage from using transit or carpooling. As cities adopt new policies supportive of e-bikes, such as Mountain View's planned one-year trial of allowing e-bikes on trail, we anticipate our employees being able to take advantage of this option. We support the the SV MaaS project, where we will share learnings and provide recommendations from our experiences with eletric bicycles.

Sincerely,



Jeral Poskey
Transportation Program Manager
Google Inc.

Printed on 100% post-consumer waste recycled paper

To: Davis White
Google

Date: 4 November 2015

Re: **Bicycle Metrics Study**
Draft Proposal

We are pleased to provide this proposal for a bicycle metrics study.

1. **Background**. Bicycle commuting of all types represents a fraction of all commutes in the Silicon Valley region. This is surprising, given that the local climate, geography and demographics are so well-suited to cycling. Recent American Community Survey statistics report that bicycle commuting in Silicon Valley cities ranges from 1.1 of commute trips in San Jose to 7.3 percent in Palo Alto, with many falling in the 2-4 percent range.

   This compares to a 41 percent share in Copenhagen.

   While the pool of potential bicyclists in Silicon Valley communities is large, people choose not to ride for various reasons. Google's Bike Vision Plan notes a key reason is the current state of the local road and bike network. While some high-quality bike facilities exist in the area, the broader network is limited by geographical barriers and high-stress streets.

2. **Study Objectives.** Building on the Google Bike Vision, the objectives of this bicycle metric study are to provide a detailed assessment of the state of biking in the broader Silicon Valley region, focusing on:

   - The completeness of the bicycle network from San Mateo to San Jose. Particular attention will be paid to the gaps and connectivity issues at city boundaries.

   - Bike commuting as a percentage of all commute trips in the communities between San Mateo and San Jose, inclusive.

   - A perception survey, asking people what it would take to get them out of a car and onto a bike.

   - Identifying a variety of relevant indicators that are added to the *Silicon Valley Index* and www.siliconvalleyindicators.org, which will then be curated on an ongoing basis.

2. **Production**. The paper will be produced by the Silicon Valley Institute for Regional Studies, housed within Joint Venture Silicon Valley.

3. **Personnel assigned**. Russell Hancock, Ph.D., will oversee the project. A primary investigator will be assigned or contracted to carry out the study. Other Institute personnel will be assigned as needed.

4. **Review**. As with all reports emanating from the Institute for Regional Studies, this report will be reviewed by multiple outside reader(s).

5. **Time frame and delivery.** The project is estimated to take four to six months from start date.

6. **Format.** The report will be presented as a publication of the Silicon Valley Institute for Regional Studies, acknowledging generous support from Google. It will include a letter signed by the Institute president explaining the report builds on earlier work published by Google, and broadens that work to a regional scale.

7. **Cost**. $25,000.

8. **Dissemination.** Every method available will be used to disseminate the report including: news releases, VIP briefings, public briefings, social media.

We look forward to working with Google on this worthwhile project.

Sincerely,

Russell Hancock, Ph.D.
President & Chief Executive Officer
Silicon Valley Institute for Regional Studies
Joint Venture Silicon Valley

Commute.org

400 Oyster Point Blvd, Suite 409, South San Francisco, CA 94080, (650) 588-8170

March 30, 2016

TO: Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113
steve.raney@jointventure.org, 650 329 9200

Re: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney:

Commute.org is San Mateo County's Transportation Demand Management (TDM) Agency with a mission to reduce the number of drive alone vehicles traveling to, from or through our 747,000-resident county. Commute.org receives funding from the City/County Association of Governments of San Mateo County (C/CAG), the San Mateo County Transportation Authority (TA), the Bay Area Air Quality Management District (BAAQMD) and the Metropolitan Transportation Commission (MTC). Additionally, Commute.org works with employers in the county to provide a portion of the funding for the shuttle program. Commute.org is a leader in next-generation, evidence-based TDM.

As far as Enterprise Commute Trip Reduction (ECTR) software, Commute.org has just signed a [redacted] quarter, county-wide contract with RideAmigos for an exected 24-month Fair Value Commuting project expenditure of [redacted]. RideAmigos' UNITY Platform is envisioned as the next-generation TDM platform that Commute.org will make available to public/private San Mateo County employers, providing a comprehensive, one-stop-shopping solution with comprehensive employee commute options portal (transit, ridematching, guaranteed ride home, etc), new employee on-boarding, commuter challenges, and mobile phone commute mode detection app with logging to employee calendar. Compared to our previous offering, RideAmigos' UNITY Platform iis a game-changer.

The purpose of this letter is to confirm Commute.org participation in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in the Bay Area.

The Fair Value Commuting Project strongly aligns with Commute.org's next-generation technology, congestion reduction, and sustainability focus. We are prepared to:

- Undertake a Commute.org staff ECTR pilot
- Work closely with San Mateo County employers on a series of ECTR pilots
- Participate in other Fair Value Commuting project activities.

Sincerely,

John Ford, Executive Director

C/CAG

CITY/COUNTY ASSOCIATION OF GOVERNMENTS OF SAN MATEO COUNTY

Atherton • Belmont • Brisbane • Burlingame • Colma • Daly City • East Palo Alto • Foster City • Half Moon Bay • Hillsborough • Menlo Park Millbrae • Pacifica • Portola Valley • Redwood City • San Bruno • San Carlos • San Mateo • San Mateo County • South San Francisco • Woodside

April 4, 2016

Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113

Via E-mail: steve.raney@jointventure.org

RE: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney:

The City/County Association of Governments of San Mateo County (C/CAG), a joint powers agency that includes all 20 cities and the County in San Mateo County, is the congestion management agency for San Mateo County responsible for planning, programming, and funding for transportation programs including congestion management, intelligent transportation system, shuttle services, active transportation, and climate protection.

The purpose of this letter is to confirm C/CAG participation in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in San Mateo County, Silicon Valley and the Bay Area.

C/CAG has allocated funding in the amount $25,000 over a 24-months period to contribute to JVSV for the project. We will also participate in other project activities including project review as well as assist with organizing one or more San Mateo County project events.

Sincerely,

Sandy Wong
Executive Director

samTrans

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JIM HARTNETT
GENERAL MANAGER/CEO

April 7, 2016

Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Re: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney:

The San Mateo County Transit District supports the Fair Value Commuting project and grant application. By building on previous research and exploring innovative new ways to incentivize public transit use, the Fair Value Commuting concept is consistent with the San Mateo County Transit District's adopted Strategic Plan goal to retain and attract more ridership.

The use of single occupancy vehicles continues to have a negative impact on the Bay Area's air quality, traffic congestion, goods movement and economic productivity and competitiveness. To effectively reverse this trend, we will need to explore new, creative ideas and concepts that encourage the use of a variety of alternative transportation options.

The Fair Value Commuting concept shows promise to provide reductions in vehicle miles traveled, changing perceptions about the cost and ease of driving compared to cleaner, more sustainable commute alternatives. The San Mateo County Transit District looks forward to working with project partners and other regional stakeholders to explore these potential benefits. We will participate in the project as follows:

- Review project research reports, interim and final reports
- Consider presenting any solution concept and/or final report to SamTrans Executive Staff
- Participate in quarterly project workshops/convenings
- Assist in communications / media outreach

Sincerely,

April Chan
Chief Officer, Planning, Grants, and Transportation Authority

SANTA CLARA
Valley Transportation Authority

August 11, 2015

Ms. Stephanie Hom
Project Manager
Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94607

Re: MTC Climate Initiatives Parking Management and TDM Grant Program

Dear Ms. Hom:

On behalf of Santa Clara Valley Transportation Authority (VTA), I am writing to express our support for the proposal submitted by the City of Palo Alto and Joint Venture Silicon Valley for the Mobility as a Service Software (MaaS) Ecosystem Acceleration Project. As a partner in this collaboration, VTA will play a significant role in this exciting project, which will develop innovative policies, tools and services to enhance more sustainable, multimodal mobility in our growing region.

In the spirit of innovation, VTA recently opened an Innovation Center at our administrative headquarters (http://bit.ly/1bgs1N4) in north San Jose. This facility serves as a hands-on learning lab, where we collaborate with public and private sector partners on this project as well as local universities, harnessing the creativity and latest technology to help accelerate mobility solutions. Together, we are working on a variety of projects to improve the safety and efficiency of our transit system, as well as to improve all commuters' travel experience. In recent months, VTA has hosted a number of meetings with partners in our Innovation Center to begin work on technology tools to help employees access transit services and employer sponsored commute incentives. This is an integral part of the MAAS pilot project and VTA staff have contributed significant time to support the project.

This is an exciting time for public transportation and a great opportunity for VTA to participate in the first MaaS pilot project. Our employees will contribute their vast and diverse understanding and experiences with commuting challenges, customer needs and existing system operations. Furthermore, the proposed Mobility Aggregation software program will advance MTC's objectives - and our overall project partnership goals – of improving transit availability and reliability, enhancing safety, improving the air quality and promoting economic vitality.

We look forward to being part of this collaborative effort. Working together we will improve Santa Clara County's transportation network, the VTA's customer experience and keep Silicon Valley and the Bay Area moving forward!

Sincerely,

Nuria I. Fernandez
General Manager/CEO

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

April 4, 2016

Steve Raney, Project Manager, Fair Value Commuting
Executive Director, Smart Mobility, Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Dear Mr. Raney:

The Bay Area Air Quality Management District has long recognized that emissions from motor vehicles are a major contributor to levels of air toxics, greenhouse gases, and criteria pollutants. Thus reducing the rate of driving alone is integral to our mission of protecting and improving public health, air quality, and the global climate.

We support a wide variety of efforts to encourage Bay Area residents to reduce their drive-alone travel, including our Spare the Air program (Spare the Air), our Commuter Benefits Program (Commuter Benefits Program), and innovative ridesharing and trip reduction efforts. We recognize that free workplace parking has a profound influence on how people choose to commute. One survey of Bay Area commuters found that while 77 percent of commuters drove alone when free parking was available, only 39 percent drove alone when they had to pay to park. Additionally, among commuters with free parking, only 4.8 percent commuted by transit. By contrast, among commuters without free parking, 42 percent commute by transit.

We appreciate your efforts to develop fresh approaches to reducing drive-alone travel, and your discussion with us of your 'fair value commuting' proposals, and employee trip caps. Clearly new ideas are sorely needed, given the continuing prevalence of single-occupant vehicles in regional travel patterns, and we want to encourage your work on these concepts. We encourage the Federal Transit Administration, the Transportation Research Board, the California State Transportation Agency, and others to promote your work through the provision of grants to support it.

Sincerely,

Jean Roggenkamp
Deputy Executive Officer

JR:TA:mm

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

June 11, 2012

To Whom it May Concern:

Re: *Parking Charges + Incentives: Reduce Commuting VMT 23%* -- Valuable Study

Dear Sir or Madam:

The Governor's Office of Planning and Research believes that Cities21's recently submitted proposal, *Parking Charges + Incentives: Reduce Commuting VMT 23%*, will be a valuable addition to evaluation of the issues surrounding parking and vehicle miles traveled (VMT).

The Office of Planning and Research is California's comprehensive state planning agency and serves the Governor and his Cabinet as staff for long-range planning and research. We are currently evaluating impacts of various policies, such as those contained in the California Environmental Quality Act, on VMT, and expect the Cities21 study to benefit our understanding. In fact, we have met with Steve Raney of that organization and we have agreed to review the final report.

If we can provide additional information, please contact me.

Sincerely,

Chris Ganson
Senior Planner

METROPOLITAN
TRANSPORTATION
COMMISSION

Joseph P. Bort MetroCenter
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Adrienne J. Tissier, Chair
San Mateo County

Amy Rein Worth, Vice Chair
Cities of Contra Costa County

Tom Azumbrado
U.S. Department of Housing and Urban Development

Tom Bates
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Santa Clara County

Bill Dodd
Napa County and Cities

Dorene M. Giacopini
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Federal D. Glover
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Association of Bay Area Governments

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Jake Mackenzie
Sonoma County and Cities

Kevin Mullin
Cities of San Mateo County

Bijan Sartipi
State Business, Transportation and Housing Agency

James P. Spering
Solano County and Cities

Scott Wiener
San Francisco Mayor's Appointee

Steve Heminger
Executive Director

Ann Flemer
Deputy Executive Director, Policy

Andrew B. Fremier
Deputy Executive Director, Operations

May 30, 2012

Mr. Steve Raney
Cities21
1487 Pitman Ave.
Palo Alto, CA 94301

Re: Letter of Support for Cities21's Parking Charges Proposal

Dear Mr. Raney,

The Metropolitan Transportation Commission (MTC), the metropolitan planning organization for the nine-county San Francisco Bay Area, supports your TRB Transit IDEA proposal to test the benefits of employer-based parking charges as a means of encouraging employees to consider commute alternatives to solo driving. We believe a carefully designed parking demand reduction strategy, as outlined by Cities21, offers a cost-effective option to reduce traffic congestion, lower vehicular emissions, and increase public transit ridership.

There's no question that the provision of free parking is a huge incentive for people to drive to work. A 2000 survey of Bay Area commuters found that while 77 percent of commuters drove alone when free parking was available, only 39 percent drove alone when they had to pay to park. Additionally, among commuters *with* free parking, only 4.8 percent commuted by transit. By contrast, among commuters without free parking, 42 percent commute by transit.

MTC is very interested in improving the way in which the region manages its parking supply and would be pleased to assist with educational outreach to employers and other stakeholders as your project takes shape.

Sincerely,

Ann Flemer
Deputy Director, Policy

J:\COMMITTE\Legislation\Letters\2012\MTCSupportLetter_Cities21_Final.doc

BAYAREA COUNCIL

April 4, 2016

Steve Raney
Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Re: State/Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney:

The purpose of this letter is to confirm Bay Area Council participation in the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area.

The Bay Area Council is a business-sponsored, public policy advocacy organization for the nine-county Bay Area. The Council proactively advocates for a strong economy, a vital business environment, and a better quality of life for everyone who lives here. Today, more than 275 of the largest employers in the region support the Bay Area Council and offer their CEO or top executive as a member.

The Council has long pursued progressive transportation policy-making, with planning and advocacy work focused on sustaining a vibrant economy through smart, connected urban infill that reduces greenhouse emissions. Dating back to the 1950s, with the creation of the Bay Area Rapid Transit (BART) system, the Council has solved the region's most vexing transportation challenges. Today, the Council leads a business coalition that seeks to maintain and improve mobility in the economically critical Highway 101 technology corridor (San Francisco to San Jose), promoting a three part strategy: (1) reduce travel times and improve person-throughput on Highway 101, (2) dramatically expand Caltrain capacity and frequency, and (3) launch commuter ferry service to serve mid-Peninsula destinations. The Fair Value Commuting Project serves as a pilot test of very promising strategy for this corridor.

On behalf of the Council, we are prepared to undertake a staff pilot of ECTR + MobAg software and to participate in other Fair Value Commuting project activities.

Sincerely,

Michael Cunningham
Senior Vice President, Public Policy

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F 415.981.6408
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San Francisco, California 94111
1215 K Street, Suite 220
Sacramento, California 95814

Transportation for America

1707 L Street NW • Suite 250
Washington, DC 20036
Phone: 202-955-5543
Fax: 202-955-5543
www.t4america.org

June 20, 2016

Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Re: Federal Grant Partner Letter for "Fair Value Commuting" Project

Dear Mr. Raney,

We recommend Joint Venture Silicon Valley's (JVSV) Fair-Value Commuting Project applications to the Advanced Transportation and Congestion Management Technologies Deployment program and the Mobility on Demand Sandbox program. JVSV's project will expand the region's innovative transportation demand management practices by facilitating the development, research and transfer of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area that has national implications.

Smart, locally driven transportation solutions are the investments that hold the key to our economic prosperity. The Fair Value Commuting Project furthers creative, local practices in the Bay Area by leveraging next-generation Enterprise Commute Trip Reduction (ECTR) software and Smartphone Mobility Aggregation software (MobAg) to achieve reductions in suburban Bay Area commuting by 25 percent for single occupancy vehicles (SOVs).

The project's revenue-neutral workplace parking fee-bate structure provides a significant step in addressing the invisible subsidy of free parking. It is estimated that 91% of Americans receive free workplace parking. This project allows the Bay Area to pilot proven, successful practices that will begin to value parking and provide innovative transportation demand incentives for non-SOV commute trips through the fee-bate structure.

In alignment with T4America's vision, the Fair Value Commuting Project provides a great opportunity for Federal research dollars to be used as seed capital for next-generation infrastructure and practices, including innovative financing tools and technologies that can improve efficiency of existing networks while reducing costs.

We are enthusiastic about the benefits this project will achieve and look forward to working with JVSV and public and private participants in the project to achieve cost-effective congestion reductions.

Sincerely,

James Corless
Director

Transportation for America (T4America) is an alliance of elected, business and civic leaders from communities across the country, united to ensure that states and the federal government step up to invest in smart, homegrown, locally-driven transportation solutions — because these are the investments that hold the key to our future economic prosperity.

palo alto transportation management association

355 Alma Street, Palo Alto, CA 94301

June 16, 2016

Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310
San Jose, CA 95113

Re: Federal Grant Partner for Fair Value Commuting Project

Dear Mr. Raney,

The Palo Alto TMA supports the Fair Value Commuting Project and commends the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools and tracking mechanisms to support sustainable commuting in Silicon Valley and the Bay Area.

Palo Alto TMA is a new non-profit organization of local businesses and institutions that provide funding and management of transportation programs. The TMA's mission is to reduce SOV trips by delivering targeted transportation solutions to employers, employees, visitors and residents in the downtown area.

We want to test new commuting technologies and solutions that will reach a greater number of workers for whom traditional commute alternatives has not worked, for a variety of reasons, from the high cost of using alternatives to non-peak needs, and too many travel segments. We are currently running a successful Scoop peer-to-peer on demand carpool pilot.

As part of the Fair Value Commuting project's proposed 'gap filling' to provide better commute options, we would focus on filling the gaps between low income and Latino majority zip codes and downtown. We will build on the successes of other creative mobility approaches such as:

- San Francisco's Muni Lifeline and Seattle's Orca Lift transit discounts for low income residents
- Altamonte Springs, Florida subsidy for residents to use Uber for first/last mile access to transit

The TMA has raised $30,000 for this effort in 2016. We request $40,000 in grant program funding for program management of the proposed gap-filling program for geo-targeted low income workers. We will apply this federal funding towards project management, commute vector analysis, employee commute tracking and project evaluation. No federal funds will be used to subsidize individual commute trips.

<u>Key project contributor mini CV: Wendy Silvani, Acting TMA Executive Director:</u>
20+ years community transportation program design, implementation and management. Known for the creation of innovative programs with high customer value and satisfaction; cost-effectiveness and sustainability. Blends executive management with planning, operations and customer service. Specialties include:

- Shuttle planning, operations and management
- Formation of TMA's, special funding districts, other organizational partnerships
- Transportation-based websites and marketing
- Employer and employee outreach and special events
- TDM program design and implementation

Sincerely,

Robert George
Chairman
Palo Alto TMA

SPUR
San Francisco | San Jose | Oakland

Steve Raney, Fair Value Commuting Project Manager
Joint Venture Silicon Valley
100 West San Fernando Street, Suite 310, San Jose, CA 95113
steve.raney@jointventure.org, 650 329 9200

Re: State/Federal Grant Partner Letter for “Fair Value Commuting” Project

Dear Mr. Raney:

We support the Fair Value Commuting Project. We commend the leadership of Joint Venture Silicon Valley (JVSV) for facilitating the development of innovative technology tools to support sustainable transportation in Silicon Valley and the Bay Area.

The findings of the *Reduce Bay Area Commuting by 25%* white paper provides a strong policy direction for the Bay Area to meet its mobility and sustainability goals, and support the achievement of statewide goals.

SPUR is a non-profit focused on good planning and good government in the Bay Area region with offices in San Francisco, San Jose and Oakland. We bring people together from across the political spectrum to develop solutions to the big problems our cities face. We are recognized as a leading civic planning organization and respected for our independent and holistic approach to urban issues. We are regarded as an expert on urban policy issues with track record of publishing relevant and actionable research.

In several policy studies, SPUR has recommended the rational pricing of single occupancy autos in order to create better paces, foster the development of alternatives to single-occupancy commutes, improve access and address auto-dependency, and address our dangerously large greenhouse gas contributions to climate change. This project will add much needed data and dialogue to move these solutions forward for California. As we invest billions in transit and active transportation supply-side projects, it is essential that we also address the demand side of driving by rationalizing, and internalizing, the costs to society.

We request [redacted] grant program funding to support the advancement of the policy ideas in the *Reduce Bay Area Community by 25%* research. SPUR would perform the following:

- Public policy acceptability/scalability research. Research may build on the findings of other research projects that are part of the Fair Value Commuting pilot. Research methods will include, but not be limited to in-depth interviews of key stakeholders; survey of SPUR members or other groups; design research such as observation, user interviews and user experience maps.
- Development of a high-quality, well-designed, major policy report on pricing and mode shift, with the engagement of SPUR boards. The research would include meta-research of transportation policy; original analysis; collaboration and co-creation of

recommendations with implementing/regulatory agencies; development shared language to move policy ideas forward.

- Throughout project, SPUR public events/programming and SPUR articles on: a) Fair Value Commuting pilots and b) congestion pricing, and related topics. Ensure that research reaches key audiences included elected officials, city and regional agency staff, state transportation officials, and incorporate feedback in to study.
- Wide dissemination of report and findings through SPUR communications channels, including mail, social media, events, blog, magazine, e-newsletters.
- Review Joint Venture project research reports, interim and final reports Utilize SPUR Board, Transportation Policy Board, technical community to vet analysis and proposals and provide civic support.
- Participate in other project activities as suitable.

SPUR Staff Member	Title	Hourly Rate (fully burdened)
Ratna Amin	Transportation Policy Director	[redacted]
Egon Terplan	Regional Planning Director	
Laura Tam	Sustainable Development Policy Director	
Sarah Jo Szambelan	Research Manager	
Karen Steen	Communications Director	

Thank you for your consideration.

Sincerely,

Ratna Amin
Transportation Policy Director

SILICON VALLEY LEADERSHIP GROUP

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BILL WATKINS
BridgeLux
JED YORK
San Francisco 49ers
Working Council Chair:
STEVE BEITLER, Agilent Technolgies
Established in 1978 by
DAVID PACKARD

May 15, 2012

Steve Raney
Cities21
1487 Pitman Ave.
Palo Alto, CA 94301

Re: Letter of Support for Parking Charges + Incentives Research

The Silicon Valley Leadership Group, founded in 1978 by David Packard of Hewlett-Packard, represents more than 365 of Silicon Valley's most respected employers on issues, programs and campaigns that affect the economic health and quality of life in Silicon Valley, including transportation, energy, education, housing, health care, tax policies, economic vitality and the environment. Leadership Group members collectively provide nearly one of every three private sector jobs in Silicon Valley and have more than $3 trillion in annual revenue.

Most Silicon Valley commuters drive alone and spend an average of 37 hours per year stuck in traffic. That's a loss of $721 dollars on excess fuel consumption per commuter – more than $840 million in total every year. Long solo commutes and congestion on our roadways contribute to dramatic and rapid changes in the climate of our planet and decrease productivity and quality of life for our employees. The goal of the Leadership Group's transportation work is to improve transportation in a manner that minimizes our impact on the environment. The Leadership Group is a strong supporter of California state laws AB 32 and SB 375, where a major component to addressing the climate challenge is reducing vehicle miles traveled (VMT). The Parking Charges + Incentives idea shows promise to provide major VMT reduction, changing perceptions about the cost and ease of using and parking vehicles in the community.

Two components of the Parking Charge + Incentives idea align with adopted Leadership Group priorities particularly well:

- Increase the financial sustainability of transportation. Widespread implementation of the idea could create a dedicated new source of transportation funding ($2 per workday for each Silicon Valley single occupancy vehicle commuter or approximately $273M per year) and add revenues to local transit agencies, as new riders choose transit given the increased and more visible cost of driving.
- Create more dense development patterns in strategic locations that can be more effectively served by transit, shuttles, biking, walking and carpooling. Widespread implementation of the idea shows promise to free up approximately 345,000 Bay Area parking spaces (2,608 acres) for in-fill development and densification.

The Leadership Group's contributions will consist of the following:

1. Assist outreach to major Silicon Valley employers to obtain their feedback about piloting the idea at their work site. (approximately 5 hours)
2. Participate in interim and final review of the employer implementation plan. (approximately 5 hours)
3. Participate in interim and final review of software prototypes for web based self-reporting commute calendar/diary. (approximately 5 hours)
4. Participate in educational outreach encompassing selected media outlets and stakeholder/expert events. To meet very challenging statewide objectives, there is a need for

broad-scale stakeholder education and discussion of policy tradeoffs. (approximately 5 hours)

Our total contribution will be 20 hours at a burdened cost of $100 per employee hour, for a total in-kind contribution of $2,000.

Thank you for considering this promising project and application. Please feel free to contact me with any questions or for more information.

Sincerely,

Jessica Zenk
Senior Director, Transportation Policy
Silicon Valley Leadership Group

TRANSFORM

WORLD-CLASS PUBLIC TRANSPORTATION. WALKABLE COMMUNITIES.

October 15, 2010

The Honorable Joe Simitian
California State Senate
State Capitol, Room 2080
Sacramento, CA 95814

Re: SUPPORT for Policy Proposal – Cities 21 Daily Workplace Parking Charge Plus Cashout

Dear Senator Simitian,

Thank you for your leadership on urban planning issues. I am writing you today on behalf of TransForm to express our support for an innovative parking policy concept that deserves implementation. I would like to urge you to bring attention to this proposal via your annual "It Ought to Be a Law" contest.

TransForm is a statewide organization that works to promote world-class public transportation and walkable, equitable, healthy communities. We support robust transportation options and the highest and best use of valuable urban land. Consuming huge portions of our communities for the purpose of storing empty cars is detrimental on many levels — reducing property values; limiting tax revenues; hurting transit and transit-oriented development; exacerbating water pollution; contributing to the heat-island effect; and encouraging excessive driving which is responsible for a tremendous share of greenhouse gas emissions. The full costs of parking are currently externalized such that drivers do not pay for the real impacts. The Cities 21 Parking Charge + Cashout proposal is an ingenious and viable means to slowly internalize the externalized impacts of workplace parking and, over an extended implementation period, achieve dramatic changes in the daily behavior of commuters.

Under the Parking Charge/Cashout system, employers would charge employees who drive a nominal fee, perhaps $0.25 per day, while paying $0.50 or providing benefits such as transit passes to employees who do not drive. Over a period of several years, the values would be increased to perhaps a $2 charge and $4 cashout, ramping up the incentive and providing time for improved commute options to be made available. Reporting would be done voluntarily online by employees, minimizing program costs and oversight. The program would be designed and price points modified to be revenue neutral for employers in the short-term and revenue-enhancing over the long-run as parking lots and garages are converted to much higher value uses. Exceptions would be carved out to address equity and fairness for certain workers and employers.

The Parking Charge + Cashout proposal can be a valuable tool as we work to reduce the impacts of excessive driving and parking on our communities. TransForm urges you to help advance this proposal in the legislature and to promote it via your "It Ought to Be a Law" contest. Please do not hesitate to contact me with any questions or concerns. Thank you so much for your consideration.

Sincerely,

Graham Brownstein
State Policy Director, TransForm

cc: Steve Raney, Cities 21

717 K STREET, SUITE 330, SACRAMENTO, CA 95814 | T: 916.441.0204 | WWW.TRANSFORMCA.ORG

November 10, 2009

The Honorable Joe Simitian
California State Senate - District 11
State Capitol, Room 2080
Sacramento, CA 95814

Re: $2 Daily Workplace Parking Charge + $4 Cashout

Dear Senator Simitian,

We hope you'll give favorable consideration to the $2 Daily Workplace Parking Charge + $4 Cashout proposal by Steve Raney, Cities21, a Silicon Valley resident, in your invitational contest for constituents' ideas "There Ought to Be a Law".

California must somehow price parking to have any chance against global warming. We like the fact that this Cities21 proposal for employee parking targets reduced driving as major component of GHG reduction following the "Moving Cooler" report.

We particularly appreciate that the charges pay for the cashout and that the policy is applied in gradual increments. We believe that, from a political standpoint, it is exceedingly difficult to price driving or parking. The cheaper we can start, the better. Hence we believe the small initial price envisioned in this policy makes sense.

We also like the policy being mandatory and not voluntary. We also appreciate how it handles exemptions. Other interesting features include the low implementation cost and the negative cost to business when real estate is factored in.

It is our understanding that the trust-based web self-reporting approach can be robust to privacy concerns, especially when compared to techniques that may identify the time a person is at a particular location, such as parking access to a building.

Sincerely,

Edward A. Mainland
Co-Chair, Energy-Climate Committee (CNRCC-ECC)
Sierra Club California Nevada Regional Conservation Committee (CNRCC)

Association for Commuter Transportation
NORTHERN CALIFORNIA CHAPTER

Connie McGee
President

Linda Young
Vice President

Wendy Silvani
Secretary

Elizabeth Richards
Treasurer

Kerry Haywood
Board Member at Large

Janice Spuller
Board Member at Large

Lisa Adamos
Board Member at Large

Matt Wood
Past President

May 28, 2010

Mr. Steve Raney
Cities 21.org

Dear Steve:

Re: Letter of Support to participate in the development of parking policies

Parking management will be one of the key strategies by which California reduces Vehicle Miles Traveled (VMT) to meet statewide greenhouse gas reduction mandates over the next two decades.

Parking is an integral factor in transportation mode choice. Readily available, free or highly subsidized parking at employee centers and retail/entertainment destinations encourages SOV travel, even when there are other, high quality mode choices available.

Recognizing the importance of parking management in tomorrows "smart communities" which not only achieve environmental goals but thrive economically, are sustainable and offer a high quality of life, we support the development of sound parking management policies.

We believe parking management policy can benefit both consumers and businesses with real time and monetary savings while, at the same time, work to achieve environmental goals.

The transportation demand management and transit professionals, planners, employers and others who will be responsible for implementing policy must be included in the process of policy development to ensure widespread support and practical viability of any such legislation.

The Northern California ACT Chapter feels it essential that organizations such as ours be actively engaged in the development of responsible parking management legislation for California, since the success of new policies will require both our support and our ability to implement them.

Thank you,

Sincerely,

Connie McGee

Connie McGee
President

Appendix K: Draft State Bill

Current version: Aug 14, 2016

The original, ambitious region-wide concept has been modified into a more narrow bill:

- Very narrowly modify California Health and Safety Code Section 40717.9 to allow such pilots.
- Allow pilots by Silicon Valley cities only. Do not allow county-wide or region-wide pilots.
- Apply only to firms with 250+ employees. Compared to a previous version, this avoids smaller firms with between 100 and 249 employees.
- Shrink duration to a 36-month pilot, down from 60 months.
- Avoid conflicting with 2016 SB 1339 re-authorization (SB 1128 is the new bill), as this will a tough battle in the legislature. The introduction of a second regional bill would reduce changes of SB 1339 reauthorization.
- Follow the SB 1339 strategy. The bill (Bay Area Commuter Benefits) began with a San Francisco implementing a version and grew from there. Successful pilots / case studies will increase chances for wider adoption. Prove that implementation is not onerous (where Cal Chamber defines onerous as requiring each employer to spend a few hours per month on implementation).

K1. Draft Bill

This human-readable draft served as input for California State Legislative Counsel's transformation (see Section K4) into an actionable bill. In February of 2011, Leg Counsel's Cindy Cardullo created an anonymous bill[1] for an earlier conception of this solution. Where possible, this current draft follows SB 1339 (Yee) as a template.

Bill title: **Downward Sliding Commute Trip Cap to Reduce Bay Area Congestion 25%**

Bill nickname: "Sliding Trip Cap"

K1A. The two-page "core" of the bill

Within the last two years, the cities of Menlo Park, Mountain View, Sunnyvale, and Cupertino enacted "trip caps" on new development projects. Implementation varies slightly between each city. These trip caps set a maximum SOV (single occupancy vehicle) commute mode share anywhere from 30% to 66%. These trip caps motivate employers to adopt strategies to reduce their employees' SOV commute mode share. If a trip cap is exceeded then remedies and/or penalties are triggered. This bill extends the flexible, performance-based trip cap concept, with noncompliance causing an employer to adopt one of two evidence-based options that have been shown to reduce SOV commuting.

This bill narrowly modifies California Health and Safety Code Section 40717.9[2] to authorize a 36-month pilot program for a city or cities within Santa Clara County or San Mateo County to require employers of a certain size to implement an employee congestion reduction program.

It is the intent of the Legislature to encourage cities to work with local employers to adopt policies that encourage commuting by means other than driving alone. To encourage this, the Legislature hereby authorizes 36-month pilot programs in that regard in cities within Santa Clara and San Mateo counties. Pilot implementation may begin at any time and may not extend past 2026.

A Sliding Trip Cap would set a single occupancy vehicle (SOV) commute mode target for large and mid-sized firms. Firms that fall short of the target would be required to implement either:

[1] "Employee Parking Charge and Cash-out Program Bill," http://www.cities21.org/dpwg/2dollarPkngChrgPlus4dollarIncent.pdf - 9MB
[2] http://codes.findlaw.com/ca/health-and-safety-code/hsc-sect-40717-9.html

- Option 1 (feebate): A “feebate” is a self-financing system of fees and rebates that are used to shift the costs of externalities onto those market actors responsible. A revenue-neutral workplace parking feebate charges employees a fee for SOV commute trips, collects that fee revenue, and rebates the revenue to employees using non-SOV commute modes.
- Option 2 (incentives-only): zero SOV charge with a non-SOV incentive commensurate with Option 1. Option 2 is similar to a “parking cashout.”

Firms are encouraged to increase non-SOV rebate/incentive beyond the minimums in this bill.

An implementing city will create an Implementation Team, comprised of personnel selected from city, neighboring cities, county, CMA, MPO, and other government entities. Compliant firms may prove compliance to the Implementation Team using Implementation Team-approved, unbiased, low-cost methods to accurately measure their employee commute mode. (Appendix N provides one such methodology.) The Implementation Team shall set the required tempo of such measurements. Firms that are beneath the SOV cap are to be commended.

At no ongoing operational cost, a noncompliant firm may track/report employee commuting and implement Option 1 (feebate) via Enterprise Commute Trip Reduction (ECTR) software. The Implementation Team shall negotiate MOUs (memorandum of understanding) with ECTR vendors as part of approving/validating ECTR software for unbiased, low-cost employee commute mode measurement.

The policy is phased in over 29 months. 1,000-employee firms first, followed six months later by 250-999 employee firms. Firms with fewer than 250 employees are encouraged to voluntarily reduce SOV commuting trips in a similar manner. The SOV cap begins at 80% SOV, decreases by 2.5% every two months, and has a 50% SOV floor. For non-compliant firms, the Option 1 (feebate) required SOV fee begins as $0 and increases by $0.25 every two months, capped at $3.00. Some firms are already at or below 50% SOV. These firms will likely always be compliant.

For Option 1 (feebate) the ECTR vendor reimbursal rate is 15% of SOV fee revenue. ECTR vendors do not directly charge firms a fee for their service; instead, vendors take a percent of revenue from SOV fee collection before distributing the non-SOV rebate. The daily non-SOV rebate amount is calculated so that the combination of SOV fee revenue and expense is zero (revenue neutral) to firms.

For Option 2 (non-SOV incentive-only) the ECTR vendor reimbursal rate is an additional charge to the employer of 5% of non-SOV incentive payout.

Firms/landowners that reduce SOV commuting shall be granted commensurate carbon credits to be applied to California’s Cap and Trade program.

Employee non-SOV rebate/incentive payments shall be excluded from gross income under Section 17148 of the Revenue and Taxation Code and Section 13006 of the Unemployment Insurance Code and shall be paid on a pretax basis to the extent permitted under federal law.

Public and private sector firms (employers) are covered. If this bill is in conflict with an existing collective bargaining agreement, the agreement shall be controlling for the remaining term of the agreement.

If a city implements a congestion reduction program as provided under this bill, then after each year of pilot program operation, the Implementation Team shall submit a report to the transportation policy committees of each house of the Legislature that includes, but is not limited to, the following elements:

- A description of the program, including enforcement procedures and any sanctions imposed.
- Number of employees who stopped driving alone to work as a result of the trip reduction program.
- Number of single-occupant vehicle trips reduced per month, week, or day as a result of the trip reduction program.
- Vehicle miles traveled (VMT) and greenhouse gas emission reductions associated with implementation of the trip reduction program.
- Greenhouse gas emission reductions associated with implementation of the trip reduction program as a percentage of the region’s greenhouse gas emission target established by the State Air Resources Board.

“Covered firm” means any firm for which an average of 250 or more employees per week perform work for compensation within the area where the trip reduction program adopted pursuant to this section operates. In

determining the number of employees performing work for a firm during a given week, only employees performing work on a full-time basis shall be counted.

“Covered employee” means an employee who performed at least an average of 20 hours of work per week within the previous calendar month within the area where the trip reduction program adopted pursuant to this section operates.

The bill applies to “9 to 5” jobs. “9-to-5” will be defined by the Implementation Team.

K1B. Findings

The Legislature enacted SB 375 (2008, Steinberg), setting 2020 and 2035 per capita land use and transportation GHG reduction targets for regions (7% and 15% for the Bay Area). The Legislature is sympathetic to city initiatives to achieve SB 375 targets and, where possible, will provide enabling legislation for city pilots towards those ends.

To achieve 2040 traffic congestion and GHG reduction objectives, CTP2040 Alternative 3 (California Transportation Plan 2040, Alternative 3) requires a per-capita VMT reduction of 17%.

Caltrans Strategic Management Plan 2015-2020 requires per-capita VMT reduction of 15%.

MTC’s 2017 update of Plan Bay Area 2040 calls for: a) 7% per-capita VMT reduction by 2020, b) 15% per-capita VMT by 2035.

The Bay Area region now has the US’s second worst traffic congestion, after Los Angeles. Congestion reduces economic competitiveness. The “pain” of traffic has gotten to the point where “business as usual” combined with expected 2M population growth won’t cut it.

Free parking isn’t free. “Eliminating subsidies for employee parking has enormous potential to reduce traffic congestion and GHG and other vehicle emissions by reducing VMT. If employees must pay the true cost of parking, it will affect their choices on whether or not to drive. In the short term, changes to employee parking policy can reduce traffic congestion and GHG more than all other strategies combined, and they are usually the most cost effective.” - United States Congressman Alan Lowenthal, California's 47th congressional district.

It is the intent of this act to motivate the majority of commuters to adopt greener commuting behavior, in order to bring about large-scale greenhouse gas reductions in California, in a cost-effective manner, while not disadvantaging California businesses, suburban real estate, or employees with special circumstances.

Demand-reducing policies such as this are many times more cost-effective than new, capacity-increasing infrastructure projects. Demand reducing policies avoid the cost of new infrastructure.

This congestion reduction program provides the following anticipated benefits:

- Reduces SOV commute mode share from 75% to 50%.
- Reduces commute trips, GHG, VMT.
- Creates new transit, biking, carpool, and software-driven mobility funding out of thin air (equivalent to a one-cent sales tax).
- Frees acres of valuable surface parking for higher use
- Reduces regional traffic congestion delay, improving economic competitiveness.
- Doubles transit and biking mode share.
- Enables struggling software-driven mobility services will reach critical mass.
- HOV lanes will fill while traffic goes down.
- Benefits lower income workers more than higher income workers.
- Helps avoid auto-centered, demand-inducing projects that are misaligned with climate objectives, such as freeway expansion & new parking structures.
- Data analytics: For all commutes, provides a real-time commute dashboard with GHG, VMT, commute mode share, parking spaces used. Dataset includes accurate, current journey-to-work information enabling land use policy performance monitoring and improved transportation route/capacity planning.

K2. Proposition 26 Fees/Taxes, Takings

California Proposition 26 (2010)[3] [4] requires a supermajority for passage of any fee/tax. At the state level, a legislative supermajority is required. At the local level, a voter supermajority is required.

Option 1, the revenue-neutral workplace parking feebate is not a Proposition 26 fee/tax because the SOV fee is not collected by any government entity. In the earlier, 2011 conception of this concept,[5] California Legislative Counsel found that Proposition 26 is inapplicable, resulting in a simple legislative majority vote requirement.

Option 1 is not a "taking" because there is essentially no cost for an employer to implement it.

California Health and Safety Code Section 40717.9

In 1988, the South Coast Air District implemented Regulation XV, an employer commute trip reduction program mandate. Employers of a certain size developed trip reduction plans and filed annual reports. By 1995, a backlash grew against Regulation XV. [6]

In December 1995, Congress changed the Clean Air Act Amendments to make the Employee Commute Option program voluntary (no longer mandatory). California State Law prohibits mandatory employer based trip reduction programs (SB437 - Lewis 1995 implemented in Health and Safety Code Section HSC 40717.9.) SB437 and HSC 40717.9 declare that public agencies "shall not require an employer to implement an employee trip reduction program unless the program is expressly required by federal law." "Employee trip reduction program" has a narrow interpretation. Many TDM programs are allowed. "Nothing in this section shall preclude a public agency from regulating indirect sources in any manner that is not specifically prohibited by this section." Some jurisdictions continue to implement Trip Reduction Ordinances. Burbank has an exemption from SB437. The City of Santa Monica requires new and existing non-residential development projects to adopt Emission Reduction Plans and pay transportation impact fees to reduce traffic congestion and improve air quality in the city. SB437 may not apply to California Charter Cities, such as Palo Alto.

K3. Guidance and Context for Program Implementation

K3A. Bill Summary Section - Guidance

A trip cap restricts the number of vehicle trips into an area of employment. For example, Menlo Park's policy is roughly, "Between 7AM and 9AM, Firm X may have no more than 2,600 vehicle trips. Hourly trip measurement must be provided to The City, using sensors at driveway entrances. For each trip above the cap, Firm X shall pay a penalty of $50 per day per trip. After noncompliance over 6 months, the fee increases to $100 per day per trip." Mountain View's trip cap imposes congestion pricing for non-compliant firms.

The pioneering trip cap was the 1989 Stanford General Use Permit #1. The "GUP" allowed Stanford to grow by 2M square feet, with "no net new commute trips." Stanford charges $3.60 per day to drive alone and park, applying that parking revenue to green commute alternatives and incentives. Stanford has lowered SOV commuting from over 75% down to 48%, avoiding construction of $107M worth of new parking structures.

Please refer to Chapter 4C for trip cap details and references.

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[3] Ballotpedia: "California Proposition 26, Supermajority Vote to Pass New Taxes and Fees (2010)," https://ballotpedia.org/California_Proposition_26,_Supermajority_Vote_to_Pass_New_Taxes_and_Fees_(2010)
[4] Smartvoter guide: http://www.smartvoter.org/2010/11/02/ca/state/prop/26/
[5] "Employee Parking Charge and Cash-out Program," http://www.cities21.org/dpwg/2dollarPkngChrgPlus4dollarIncent.pdf, page 3 "Vote: Majority."
[6] Marlon Boarnet, Hsin-Ping Hsu, Susan Handy. Impacts of Employer-Based Trip Reduction Programs and Vanpools on Passenger Vehicle Use and Greenhouse Gas Emissions, for CARB. September 2014. https://www.arb.ca.gov/cc/sb375/policies/ebtr/ebtr_brief.pdf

The bill applies to “9 to 5” jobs. A “9 to 5” job is defined as arriving at a primary or secondary work location between 5-11AM and working for six or more hours. A “primary” work location is used 50% or more of the time. A “secondary” work location is used 25% or more of the time.

Other policies, such as raising the gas tax $4 per gallon, are far more simple to describe but less politically viable. The Sliding Cap provides great flexibility for firms to meet the sliding SOV targets and many firms already have strong programs to assist employee commuting. Non-compliant firms are required to gradually implement either a) a feebate or b) commute incentives-only. The preferred feebate implementation combines next-generation “Enterprise Commute Trip Reduction (ECTR) software with Smartphone Mobility Aggregation” software to then implement the revenue-neutral workplace parking feebate to reduce suburban Bay Area commuting from 75% single occupancy vehicle (SOV) to 50%. A feebate is a self-financing system of fees and rebates that are used to shift the costs of externalities onto those market actors responsible.

For this bill to be viable, the six major stakeholder groups all need to “win.” This is very challenging. The groups are: large firms, medium-sized marginally-profitable firms with 250+ employees, the government hierarchy (cities, counties, region, state), transit agencies, ECTR software vendors (Luum, RideScout), and mobility service provides (Lyft, RidePal, Bridj, Carma, Scoot, Genze, EcoReco, etc).

The Implementation Team should flexibility guide the program. The Team shall establish exceptions for commuters with special circumstances. Interacting with firms, the Team shall oversee the collection of a) trip cap / commute mode compliance data, b) feebate SOV fee revenue data, c) feebate non-SOV rebate disbursal data. The Team shall impose a fine on firms that do not participate. The Team will process commute data and prepare periodic reports assessing: a) the effectiveness of GHG and congestion reduction, b) implementation status, c) recommendations for mid-course corrections that may improve the program, d) an assessment of any adverse unintended consequences.

This bill targets 9-to-5 commuting, not part-time workers working odd hours. Compassionate exemptions are envisioned.

For phasing, a forecast of Bay Area firm employment size is provided:

# jobs/firm	% of jobs	# of firms
1000+	38%	100
250-999	14%	600
50-249	19%	5,000
1-49	31%	94,000

Table extrapolated from two data sources. [7] [8]

The policy is phased in over 36 months. 1,000-employee firms first, followed five months later by 250-999 employee firms. The SOV cap begins at 80% SOV, decreases by 2.5% every two months, and has a 50% SOV floor. For non-compliant firms, the Option 1 (feebate) required SOV fee begins as $0 and increases by $0.25 every two months, capped at $3.00. This is illustrated by the table below:

[7] “The declining average size of establishments: evidence and explanations” http://www.bls.gov/opub/mlr/2012/03/art4full.pdf . There a 5M firms in the US. Bay Area has about 2% of US population. Given the density of Bay Area employment, it may be advisable to double the number of firms in the table.

[8] A partial list of firms with largest number of Bay Area employees. Of note, Google and Facebook are not included: http://sfced.org/wp-content/uploads/2013/02/LargestEmployers1.24.2013.pdf

Month	1000+ SOV cap	1000+ SOV fee	250-999 SOV cap	250-999 SOV fee
1	80.0%	$0.00		
3	77.5%	$0.25		
5	75.0%	$0.50	80.0%	$0.00
7	72.5%	$0.75	77.5%	$0.25
9	70.0%	$1.00	75.0%	$0.50
11	67.5%	$1.25	72.5%	$0.75
13	65.0%	$1.50	70.0%	$1.00
15	62.5%	$1.75	67.5%	$1.25
17	60.0%	$2.00	65.0%	$1.50
19	57.5%	$2.25	62.5%	$1.75
21	55.0%	$2.50	60.0%	$2.00
23	52.5%	$2.75	57.5%	$2.25
25	50.0%	$3.00	55.0%	$2.50
27			52.5%	$2.75
29			50.0%	$3.00

29-month phase-in, 1,000-employee firms first

This bill extends SB1339 (Yee), the Bay Area Commuter Benefits Law, that requires firms with 50 or more Bay Area firms to implement one of four different commuter benefits options. By far the most popular option is implementation of pre-tax commuter benefits integrated into firm payroll processing.

Implementation of city congestion reduction programs will:

- Allow cities to validate that implementation is not onerous, increasing the chances that the policy may be spread in the future.
- Provide a powerful market signal to accelerate the mobility ecosystem, encouraging more effective public/private investment. Without a market signal, the mobility ecosystem will not transform as rapidly as is desirable.

As far as “Implementation Team-approved, unbiased, low-cost methods to accurately measure employee commute mode,” Appendix N, Building Entrance Intercept Surveys, provides one such methodology.

- *What are best practices for a “front door,” 100% response, mandatory clipboard intercept survey (using in-house staff) at an employer to collect commute mode and home zipcode? Methodology assumes one building with two levels of underground parking, a mix of commute modes, entrances, 400 employees, with both visitors and employees entering during AM commute hours.*

Even though bike commuting varies with the weather, no special commute mode relief is provided in winter months. Bike commuters are expected to continue to take non-SOV modes during this time.

K3B. Technology/Solution Viability

ECTR software has the following minimum feature set

- Integration with one or more smartphone mobility aggregation (MobAg) apps.
- Real-time firm-wide dashboard with commute mode split, GHG, and parking space utilization.
- Firm administration panel supporting: a) multiple benefit tiers of employees, b) customizable commute program intranet web portal showing applicable non-SOV commute options.
- A per-employee commute calendar and personal dashboard supporting Options 1 and 2, with fees, rebates, and incentives reflected in payroll processing. Calendars are populated with commute modes detected by MobAg apps. Personal dashboards inform employees of the true cost of parking, subsidies, GHG, etc. Deep integration with major payroll systems encompassing 75% or more market share. Lightweight integration with all payroll systems.
- Periodically report commute mode and feebate data to the Implementation Team

Smartphone MobAg software has the following minimum feature set:

- Support for public/private transit/microtransit, on-demand ridesharing, bike sharing, and other services.

- 98% or better commute mode detection accuracy
- Trip planning
- Use stored ECTR funds to pay for trips.

The Implementation Team shall negotiate MOUs with ECTR vendors as part of approving/validating ECTR software for unbiased, low-cost employee commute mode measurement. At a minimum, these MOUs shall entail:

- Software vendors provide independent data protection/privacy audit compliance certificates meeting i) Payment Card Industry Data Security Standard (PCI DSS) and ii) ISO 27001.
- Satisfactory responses from vendors to complaints from commuters and firms that are submitted to the Team.
- Confirmation that ECTR firms do not hinder 50-249 employee companies from implementing Options 1 and 2. (This prevents ECTR firms from focusing on large firms at the expense of small firms.
- Review/renewal every 12 months.

As far as reporting back to the Legislature, the Implementation Team should make findings that the technology and policy solution is viable and is not onerous. At a minimum, the Team should find that:

- The Options 1 and 2 software solution for noncompliant firms, “ECTR combined with MobAg,” is viable.
- The software solution’s real-time commute mode dashboard is accurate,
- The software ecosystem has two or more ECTR competitors that are prepared to deliver this solution,
- The solution’s software vendors provide independent data protection/privacy audit compliance certificates meeting Team specifications
- The solution’s software vendors have deep integration with major payroll processing systems encompassing 75% or more of the California market. Deep integration means “a firm may install and configure in the solution within their payroll system in two hours or less.” There are many lesser payroll software providers. The ECTR vendors shall provide integration with minor payroll providers such that a firm’s ongoing staff time contribution shall be verified to be no more than 30 minutes per payroll period.
- User response is acceptable,
- One or more pilots have shifted an appropriate percent of commute mode.
- There are approved, unbiased, low-cost methods for firms with successful Commute Trip Reduction programs to accurately measure their employee SOV commute rate to validate compliance.
- The Team has formed a Technical Advisory Committee comprised of mobility ecosystem members (employers, vendors, cities, counties, transit agencies, and NGOs) that will guide implementation over the years.
- ECTR vendors implement the applicable open data/API standard, GTFS-SUM.
- An agreed GTFS-SUM data/API standard is followed that specifies how anonymized, aggregated firm-wide commute dashboard data percolates up to the region and state. An agreed process has been developed for cities to obtain dashboards for major development sites and for the city as a whole.

Once per year, the Implementation Team shall publish a single commute day’s worth of aggregated, anonymized commute data with a dataset record for each trip taken, similar to the MTC “synthetic day” dataset, with:

- Origin TAZ
- Destination TAZ
- Main commute mode (the longest portion mode within a multimodal commute
- Hour and minute of trip departure

Major payroll software providers may include: ADP, Paychex, Intuit, Ceridian, Paylocity, Zenefits, Oracle, and SAP.

The calculation for the Option 1 (feebate) daily non-SOV rebate is shown by example. This calculation ensures revenue neutrality. For a 1,000+ employee firm in Month 17, the SOV cap is 60%, the SOV fee is $2.00. The Option 1 ECTR firm reimbursal rate is 15% of SOV fee revenue. This results in a daily non-SOV rebate of $2.55. A check calculation for a 1,000-employee firm verifies the ECTR system accounting: $1,200 in daily SOV fee revenue is neutralized by $180 in ECTR reimbursal and $1,020 in non-SOV rebate payout:

Item	Value	Calculation
SOV cap	60.0%	
SOV fee	$2.00	
SOV revenue per employee	$1.20	=60% * $2.00
ECTR firm reimbursal rate	15%	
Remaining revenue	$1.02	=(100%-15%) * $1.20
Non-SOV rebate	$2.55	=$1.02 / (100%-60%)
Employees	1,000	
SOV employees	600	=60% * 1000
SOV fee	$2.00	
SOV revenue	$1,200.00	=600 * $2.00
ECTR reimbursal	$180.00	=$1,200 * 15%
non-SOV employees	400	=1000 * (100% - 60%)
Non-SOV rebate	$2.55	From above
non-SOV payout	$1,020.00	=400 * $2.55
Now check the results:		
SOV revenue - ECTR reimbursal - non-SOV payout: should equal 0	$0.00	=$1,200 - $180 - $1,020

Example: Calculating non-SOV rebate for revenue neutrality

Provisions to protect employees/firms from data breaches are governed by two considerations:

- electronic financial transactions will occur
- vendors will securely report up aggregated, anonymized commute data to city, region, and state government dashboards.

To achieve data protection/privacy:

- The Implementation Team shall create a group of public/private sector Technology Officers to create rigorous requirements. For example, Google and Microsoft are both ECTR customers and have put ECTR vendors through in-depth data protection vetting.
- The Implementation Team will likely require some basics: a) Dedicated servers: Geo-isolated fail-over/backup secure data centers, b) Application hosting with 99.9% up-time Service Level Agreement, c) 24/7 Server monitoring and maintenance.
- Complying with the EU Data Protection / Privacy Directive and the 2018 replacement entitled “General Data Protection Regulation,” might be a formal standard that the Implementation Team chooses to follow. [9]
- Likewise, the Payment Card Industry Data Security Standard (PCI DSS) might be selected.[10] PCI DSS is a “set of requirements designed to ensure that all companies that process, store or transmit credit card information maintain a secure environment. Essentially any merchant that has a Merchant ID (MID).”
- It seems unlikely that the Implementation Team will choose to follow the perceived-as-burdensome ISO 27001 specification for an information security management system (ISMS).[11] An ISMS is a framework of policies and procedures that includes all legal, physical and technical controls involved in an organization's information risk management processes. ISO 27001 was developed to "provide a model for establishing, implementing, operating, monitoring, reviewing, maintaining and improving an information security management system. The specification defines a six-part planning process: a) Define a security policy. B) Define the scope of the ISMS. C) Conduct a risk assessment. D) Manage identified risks. E) Select control objectives and controls to be implemented. F) Prepare a statement of applicability. The specification includes details for documentation, management responsibility, internal audits, continual improvement, and corrective and preventive action.”

K3C. Schedule 1: SOV fee, non-SOV rebate and non-SOV incentive

[9] European Commission > Justice > Data protection. http://ec.europa.eu/justice/data-protection/
[10] https://en.wikipedia.org/wiki/Payment_Card_Industry_Data_Security_Standard
[11] https://en.wikipedia.org/wiki/ISO/IEC_27001:2013

For Option 1 (feebate) the ECTR vendor reimbursal rate is 15% of SOV fee revenue. With Option 1, ECTR vendors do not directly charge firms a fee for their service, rather vendors take a percent of revenue from SOV fee collection before distributing the non-SOV rebate. The daily non-SOV rebate amount is calculated so that the combination of SOV fee revenue and expense is zero (revenue neutral) to firms. The non-SOV rebate is proportionately higher when SOV commute mode is higher.

For Option 2 (non-SOV incentive-only) the ECTR vendor reimbursal rate is an additional charge to the firm of 5% of non-SOV incentive payout.

For Option 1 (feebate), the daily non-SOV rebate amount is calculated so that the combination of SOV fee revenue and expense is zero (revenue neutral) to firms.

As Schedule 1 below illustrates, ECTR firms generate more revenue-per-employee-per-month (see the column labeled “ECTR rev/job/mo”) as SOV commute mode decreases and thus are incentivized to help firms reduce SOV mode.

An SOV fee changes commute behavior twice as much as an equivalent non-SOV incentive. Hence, the Option 2 incentive level is set to have the equivalent behavior change as Option 1 via the following equation: non-SOV incentive = 2* SOV fee + non-SOV rebate.

Month	SOV cap	SOV fee	ECTR 15% reimb	non-SOV rebate	ECTR rev/job/mo		non-SOV incentive	ECTR rev/job/mo
1	80.0%	$0.00	$0.00	$0.00	$0.00		$0.00	$0.00
3	77.5%	$0.25	$0.04	$0.73	$0.64		$1.23	$0.30
5	75.0%	$0.50	$0.08	$1.28	$1.24		$2.28	$0.63
7	72.5%	$0.75	$0.11	$1.68	$1.79		$3.18	$0.96
9	70.0%	$1.00	$0.15	$1.98	$2.31		$3.98	$1.31
11	67.5%	$1.25	$0.19	$2.21	$2.78		$4.71	$1.68
13	65.0%	$1.50	$0.23	$2.37	$3.22		$5.37	$2.07
15	62.5%	$1.75	$0.26	$2.48	$3.61		$5.98	$2.47
17	60.0%	$2.00	$0.30	$2.55	$3.96		$6.55	$2.88
19	57.5%	$2.25	$0.34	$2.59	$4.27		$7.09	$3.31
21	55.0%	$2.50	$0.38	$2.60	$4.54		$7.60	$3.76
23	52.5%	$2.75	$0.41	$2.58	$4.76		$8.08	$4.22
25	50.0%	$3.00	$0.45	$2.55	$4.95		$8.55	$4.70

Schedule 1: SOV fee, non-SOV rebate, non-SOV incentive

For Option 1 (feebate) the non-SOV rebate will be calculated using the actual SOV commute mode split from the previous period. The ECTR software shall recalculate non-SOV rebate no less frequently than one time per month. On the rebate recalculation day, ECTR software shall tally up actual SOV fee revenue against reimbursal expense and non-SOV rebate payout. The small surplus or deficit shall be applied to the calculation of the non-SOV rebate value in the ensuing period. In this manner, the small surplus/deficit is put back into the system, hence, zero ongoing program cost to firms is ensured. The firm’s surplus/deficit accounting and recalculation of the non-SOV rebate shall be transparently presented to employees in firm-wide dashboards.

Many firms already provide special benefits for certain commuting modes, such as a Caltrain Go Pass for commuter rail ridership or a vanpooling subsidy. The ECTR software shall be configurable with options:

- Continue to provide the special commute benefit while distributing the rebate to other non-SOV modes
- Account for the per-employee, per-trip cost of a special commute benefit. Deduct such per-employee costs from the non-SOV rebate before distributing the balance to employees.

ECTR software shall make all costs and subsidies transparent to employees via a firm-wide dashboard.

The bill’s intent is to minimize the Option 1 SOV fee and Option 2 non-SOV incentive while still achieving commute mode objectives. To that end, when a firm’s SOV commute mode achieves the next quarter’s target, then the SOV fee does not need to be increased. At some later point when the sliding commute mode target is not achieved, then the SOV fee is increased by a single increment, rather than stepping up all the way to the Month X SOV fee listed in Schedule 1.

K3D. Commute Modes

The Implementation Team shall work closely with ECTR firms to approve innovative new non-SOV modes. Potentially Lyft Driver Destination can progress from being a "pilot" non-SOV mode to an approved mode, based on achievement of a specified average vehicle occupancy (such as 2.0). Another potential innovative mode is "e-bike/scooter IoT loan-to-own," where an employee is loaned a trackable personal mobility device and becomes the device's owner after a specified number of commute uses.

Approved non-SOV modes. For multi-modal trips, the mode that covers the longest distance is taken as the mode.

- Public transit (Caltrain, VTA, AC Transit, BART, etc)
- Private transit (Bridj, Chariot, RidePal, employer bus service, etc)
- Ridesharing where two or more commuters travel in a vehicle (Scoop, Lyft Line, UberPool, Carma, Muv, WAZE RideWith, ECTR-provided ridesharing, etc)
- Carpool
- Vanpool
- Bike, electric bike
- Electric scooter, unicycle, or skate board weighing less than 40 pounds (Heavier electric scooters such as Vespas are classified as SOV)
- Walk
- Telework

Within an individual employee's ECTR dashboard, that employee will have "non-commute days," encompassing:

- Vacation
- Sick days
- Off-site business travel

K3E. Exceptions, spillover, reporting, outreach, fines, contractors, special cases

The Implementation Team shall establish reasonable exceptions to the requirements of the program for certain low-income workers, certain part-time workers, shift workers, and workers with other special circumstances. These exceptions shall be updated and modified by the Team, as appropriate, as additional data becomes available. The Team shall cause the list of exceptions to be made available on a government web site.

The Sliding Trip Cap implementation may create the potential for spillover parking issues where SOV commuters park in adjacent neighborhoods rather than the work site. MTC may provide technical assistance to localities in implementing best practices to remedy spillover parking. One such remedy is residential permit parking programs.

Firms shall provide a weekly employee commuting electronic report, using a standard application programming interface (API), to the Team. ECTR software shall automate this task. The Team shall use this commute data to provide regular aggregate reports on Sliding Cap performance including commute mode share, SOV fee revenue, non-SOV rebate payments, parking space utilization and savings, acres of parking no longer being used as a result of the program, and longitudinal trends.

The Team shall undertake employer education and outreach to facilitate smooth program implementation. Regional agencies may facilitate this effort. MTC and the Air District may justify this effort as furthering SB375 Sustainable Communities Strategy.

The Team shall identify firms that should but do not participate. The Team shall develop a schedule of fines such that it is less expensive for firms to participate than to be fined. The Team shall assess a daily fine on non-participating firms.

Tech companies contract to Human Resources (HR) services like Adecco for a significant number of full-time workers. These workers often have a subset of commute benefits compared to "full employees." The Team shall ensure that HR services have ECTR software to facilitate contractor mode shift. The ECTR administrator panel shall allow for the Tech companies and HR services to inject subsidies and special services like WiFi motorcoach for contractors working at Tech company offices. Of import, expeditiously getting the current work location correct

for each worker will facilitate mode shift. On-boarding at new work sites is an important time for commute behavior to change.

Special paid parking cases:

- Some employees in San Francisco and other locations must pay for third party parking. There are no known instances of firms in such circumstances that do not already achieve ultimate 50% SOV commute mode split. The Team shall require reporting for all firms, and the special case of third party parking with greater than the target SOV rate arises, then the Team shall tailor a policy for such instances to achieve the desired objectives.
- Likewise, in the unlikely event that a firm already charges for firm-controlled parking and does not achieve the target SOV rate, the Team shall develop policy to handle this special case.
- It is the intent of the Legislature that any project that is developed using development rights granted pursuant this bill shall be deemed to be a "transit priority project."

K3G. Potential additions to the Trip Reduction Program

- Specify ECTR reimbursal fees for compliant firms that track/report employee commuting via ECTR software, possibly $2 per employee per month.
- Besides Options 1 and 2, a third option, "charge for parking (SOV fee) without incentives" could be provided. At the ultimate target 50% SOV rate with $3 SOV fee and 15% ECTR firm reimbursal rate, the non-SOV rebate will be $2.55. In price elasticity of demand terms, SOV fees have roughly twice the impact on travel behavior than as non-SOV rebates. Therefore, the ultimate price motivation is equal to $3.00 + 50% * $2.55 = $4.28. Hence a third option could provide a schedule of commensurate parking charges capped at $4.28.
- For an individual employee's commute calendar, the days worked could be validated against work attendance as reported to Human Resources payroll processing.
- ECTR software firms may petition the Implementation Team to vary the specific calculations for non-SOV rebate, provided the spirit of revenue-neutrality is followed.
- Firms may petition the Team to divert a portion of SOV fee revenue away from funding non-SOV rebates and towards CTR activities and new infrastructure (last mile transit, bike lockers, etc). Multiple firms could potentially band together on a single petition. At Team discretion, such activities may be approved and the program may be modified accordingly, while still adhering to the ultimate objective of reducing SOV commute mode to 50%.

K4. "Unbacked" bill language from California State Legislative Counsel[12]

LEGISLATIVE COUNSEL'S DIGEST

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Bill No.
as introduced, _____.

General Subject: Reduction of single-occupant vehicle commute trips: pilot programs.

Existing law prohibits air pollution control districts, air quality management districts, and other public agencies from imposing any requirement on an employer to implement a trip reduction program unless the program is expressly required by federal law and the elimination of the program will result in the imposition of federal sanctions. Existing law, notwithstanding these provisions, authorizes the Metropolitan Transportation Commission and the Bay Area Air Quality Management District, until January 1, 2017, to jointly adopt a commute benefit ordinance that requires covered employers operating within the common area of the 2 agencies with a specified number of covered employees to offer those employees certain commute benefits through a pilot program. Existing law requires that the ordinance specify certain matters, including any consequences for noncompliance, and imposes a specified reporting requirement.

[12] "Downward Sliding Commute Trip Cap to Reduce Bay Area Congestion 25%," http://www.cities21.org/dpwg/Trip%20Caps%20Bill%20Drafted_Unbacked_3.4.16.pdf -2.5MB

This bill would authorize one or more cities in the Counties of San Mateo and Santa Clara to adopt, by ordinance, 36-month pilot programs requiring covered employers, as defined, to meet certain targets for the reduction of single-occupant vehicle commuting by their covered employees or to implement mitigation strategies consisting of either employer-imposed fees on single-occupant vehicle commuting employees and associated payments to commuting employees using means other than Single-occupant vehicles, or, alternatively, payment of incentives only, as specified. The bill would require participating cities to create implementation teams to administer the pilot programs, including approval of enterprise commute trip reduction software to measure commuter behavior and administer payments. The bill would exclude payments to employees under the pilot programs from gross income for state income tax and unemployment tax purposes. The bill would require the State Air Resources Board to grant covered employers that reduce commuting by single-occupant vehicle commensurate offset credits under the state's greenhouse gas reduction program.

Vote: majority. Appropriation: no. Fiscal committee: yes. State-mandated local program: no.

An act to add and repeal Section 65081.2 of the Government Code, to add and repeal Section 17148 of the Revenue and Taxation Code, and to amend Section 13006 of the Unemployment Insurance Code, relating to transportation.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. The Legislature finds and declares all of the following:

A. To achieve 2040 traffic congestion and greenhouse gas emissions reduction objectives, California Transportation Plan 2040 Alternative 3 requires a per capita vehicle-miles-traveled reduction of 17 percent.
B. The Department of Transportation's Strategic Management Plan 2015-2020 requires a per capita vehicle-miles-traveled reduction of 15 percent.
C. The Metropolitan Transportation Commission's 2017 update of Plan Bay Area 2040 calls for a per capita vehicle-miles-traveled reduction of 7 percent by 2020, and 15 percent by 2035.
D. The Bay Area region now has the second worst traffic congestion in the United States, after the Los Angeles region. Traffic congestion reduces economic competitiveness, and "business as usual" will not work, especially with expected population growth of 2,000,000 in the Bay Area.
E. "Free" parking is not free. According to Congressman Alan Lowenthal of California's 47th Congressional District, "eliminating subsidies for parking has enormous potential to reduce traffic congestion and greenhouse gas and other vehicle emissions by reducing vehicles miles traveled. If drivers must pay the true cost of parking, it will affect their choices on whether or not to drive. In the short term, changes to parking policy can reduce traffic congestion and greenhouse gas emissions more than all other strategies combined, and they are usually the most cost effective."
F. It is the intent of this act to motivate the majority of commuters to adopt greener commuting behavior, in order to bring about large-scale greenhouse gas emissions reductions in California in a cost-effective manner, while not disadvantaging California businesses, suburban real estate, or employees with special circumstances.
G. Demand-reducing policies such as those authorized by this act are many times more cost effective than new, capacity-increasing infrastructure projects. Demand reduction avoids the cost of new infrastructure.
H. It is the intent of the Legislature to encourage cities to work with local employers to adopt policies that encourage commuting by means other than driving alone.
I. NEW: The Legislature enacted SB 375 (2008, Steinberg), setting 2020 and 2035 per capita land use and transportation GHG reduction targets for regions (7% and 15% for the Bay Area). The Legislature is sympathetic to city initiatives to achieve SB375 targets and, where possible, will provide enabling legislation for city pilots towards those ends.
J. NEW: It is the intent of this act to: a) reduce single occupancy vehicle commute mode share from 75% to 50%. b) create a large new revenue source for transit, biking, carpool, and smartphone mobility. c) free acres of valuable surface parking for higher use. d) reduce traffic congestion delay, improving economic competitiveness. e) double transit and bike commute mode share. f) increase vehicle occupancy in HOV/HOT freeway lanes. g) benefit lower income workers more than higher income workers. h) provide accurate, current journey-to-work data enabling improved land use policy performance monitoring and transportation route/capacity planning.

SEC. 2. Section 65081.2 is added to the Government Code, to read:

65081.2. (a) Notwithstanding Section 40717.9 of the Health and Safety Code, one or more cities in the Counties of San Mateo and Santa Clara may each engage in a 36-month pilot program pursuant to this section to reduce vehicle-miles-traveled by encouraging commuting by means other than driving alone.

(b) As used in this section, the following terms shall be defined as follows:

1. “Covered employer” means a public or private employer with an average of 250 or more full-time employees per week in a participating city. “Covered employer” does not include an employer that would have the requisite number of full-time employees in more than one participating city, but that does not meet the threshold in any one participating city.
2. “Covered employee” means an employee of a covered employer who performs an average of 20 or more hours of work for compensation for the covered employer per week in a participating city, and who works a regular daytime schedule, as defined by the implementation team.
3. “ECTR software” means enterprise commute trip reduction software.
4. “Eligible city” means a city in the Counties of San Mateo or Santa Clara.
5. “Participating city” means an eligible city that adopts an ordinance to implement the pilot program pursuant to this section.

(c) (1) An eligible city wishing to implement a pilot program pursuant to this section shall adopt an ordinance to that effect, including enforcement procedures and sanctions for noncompliance. An eligible city may commence its pilot program at any time, but a pilot program may not extend beyond 2026.

(c) (2) The ordinance shall designate a single-occupant vehicle commute mode target for each covered employer consistent with subdivision (e), and shall require a covered employer that falls short of meeting the target to implement one of the following mitigation strategies:

A. A self-financing, revenue-neutral system of employer-imposed fees and rebates, that are used to shift the cost of externalities to the appropriate responsible market actors, pursuant to which the employer shall charge covered employees a fee for commuting to work in a single-occupant vehicle and provide for a rebate of that fee revenue, after deduction of authorized administrative costs to a vendor of approved ECTR software, to covered employees who commute to work other than in a single-occupant vehicle.
B. An incentives-only strategy that provides an incentive to covered employees who commute to work other than in a single-occupant vehicle. The amount of the incentive shall, at a minimum, be equivalent to the rebate that would be payable under a strategy implemented under subparagraph (A).

(d) (1) A participating city shall create an implementation team, comprised of personnel selected from city staff, neighboring cities, counties, congestion management agencies, the Metropolitan Transportation Commission, and other government agencies.

(d) (2) A covered employer shall demonstrate to the implementation team compliance with the applicable single-occupant vehicle commute mode target or, if noncompliant, with one of the mitigation strategies described in paragraph (2) of subdivision (c). Compliance shall be determined using low-cost, unbiased methods approved by the implementation team that accurately measure the commute mode of covered employees. The implementation team shall determine the frequency of compliance measurement and compliance reporting.

(d) (3) A noncompliant covered employer may track and report employee commuting modes and implementation of the mitigation strategy described in subparagraph (A) of paragraph (2) of subdivision (c) using ECTR software approved by the implementation team. The implementation team shall negotiate memoranda of understanding with ECTR software vendors as part of a process to validate and approve
ECTR software for unbiased, low-cost employee commute mode measurement.

(e) Each pilot program shall be phased in over 29 months. CHANGE TO: Each 36-month pilot program will phase in Options 1 and 2 over the first 29 months. Covered employers with 1,000 or more covered employees in a participating city shall implement the program at the outset, followed six months later by all other covered employers. The single-occupant vehicle target for each covered employer shall begin at 80 percent of covered employees, decrease by 2.5 percent every two months thereafter, and end at a target of 50 percent of covered

employees. Employers that are not covered employers shall be encouraged to reduce single-occupant vehicle trips in a similar manner.

(f)(1)

A. For noncompliant covered employers electing to implement the mitigation strategy described in subparagraph (A) of paragraph (2) of subdivision (c), the per-commute trip fee imposed on a covered employee shall begin at zero, increase by twenty-five cents ($0.25) every two months, and shall not exceed three dollars ($3.00).
B. The ECTR software vendor used by a noncompliant covered employer shall collect the fees, may retain 15 percent of the fee revenues for its associated costs, and shall distribute the remaining revenues as rebates to covered employees who commute to work other than in a single-occupant vehicle, in a manner that results in no direct costs to the covered employer.

(f) (2) For noncompliant covered employers electing to implement the mitigation strategy described in subparagraph (B) of paragraph (2) of subdivision (c), the ECTR software vendor shall be paid, for its associated costs, an amount equal to five percent of incentives paid to eligible covered employees.

(g) The State Air Resources Board shall grant, in commensurate amount, offset credits to covered employers that reduce single-occupant vehicle commuting. The credits may be acquired and used by covered entities to meet their compliance obligations under Division 25.5 (commencing with Section 38500) of the Health and Safety Code.

(h) To the extent the requirements of an ordinance adopted pursuant to this section are in conflict with an existing collective bargaining agreement, the agreement shall be controlling for the remaining term of the agreement.

(i) Rebate and incentive payments to covered employees shall be excluded from gross income under Section 17148 of the Revenue and Taxation Code and Section 13006 of the Unemployment Insurance Code, and shall be paid on a pretax basis to the extent permitted by federal law.

(j) A participating city shall submit an annual report, to the policy committees of each house of the Legislature with responsibility for transportation matters, that shall include, but not be limited to, the following elements:

1. A description of the pilot program, including enforcement procedures and any sanctions imposed.
2. The number of covered employees who stopped driving alone to work as a result of the pilot program.
3. The number of single-occupant trips reduced per month, week, or day as a result of the pilot program.
4. Reductions in vehicle-miles-traveled and greenhouse gas emissions associated with implementation of the pilot program.
5. Greenhouse gas emission reductions associated with implementation of the pilot program as a percentage of the region's greenhouse gas emissions reduction target established by the State Air Resources Board.

(k) This section shall become inoperative on July 1, 2027, and, as of January 1, 2028, is repealed, unless a later enacted statute, that becomes operative on or before January 1, 2028, deletes or extends the dates on which it becomes inoperative and is repealed.

SEC. 3. Section 17148 is added to the Revenue and Taxation Code, to read:

17148. (a) Gross income does not include payments received by an employee pursuant to Section 65081.2 of the Government Code.

(b) This section shall become inoperative on July 1, 2027, and, as of January 1, 2028, is repealed, unless a later enacted statute, that becomes operative on or before January 1, 2028, deletes or extends the dates on which it becomes inoperative and is repealed.

SEC. 4. Section 13006 of the Unemployment Insurance Code is amended to read:

13006. “Gross income” means all compensation for services including fees, commissions, and similar items, except as otherwise provided by this division. “Gross income” shall specifically include those items relating to

compensation specified by Article 2 (commencing with Section 17081) of, and shall specifically exclude those items relating to compensation specified by Article 3 (commencing with Section 17131)
of Chapter 3 of Part 10 of Division 2 of the Revenue and Taxation Code. “Gross income” shall also exclude payments received by an employee pursuant to Section 65081.2 of the Government Code.

Appendix L: Rank Eight Congestion Reduction Policies

First Version: Dec 2015

TITLE: Rank Eight Congestion Reduction Pricing Policies via the Delphi Method

ABSTRACT: In pursuit of congestion and GHG reduction, rank eight congestion reduction pricing policies on {political viability, GHG reduction, congestion reduction, cost-effectiveness, social equity, and ease-of-implementation}. A pilot methodology and ranking was developed, covering: A) How to quickly rank congestion reduction policies via the expert Delphi Method. B) Guidance re political viability, weighting, and price elasticity of demand. C) Description of 8 policies with impact forecast. The eight congestion policies: 1) $5/gal gas tax increase, 2) $0.20/mi Road User Charge, 3) Pay As You Drive auto insurance, 4) Widespread job center $5 cordon entry charge, 5) $5/day workplace SOV parking charge, 6) $5 per day non-SOV incentive ("cashout"), 7) $3.33/day SOV parking charge with non-SOV incentive (a "feebate"), 8) muscular freeway traffic control measures. Policies 3 and 7 scored highest on political viability.

1. Quickly ranking congestion policies via an expert process

In terms of public policy-making, there is a growing realization in California that some form of congestion reduction policy must be adopted if state/regional climate/congestion objectives are to be met. There are two adopted state policy documents and two regional policy documents: [1]

	Per-capita VMT reduction	Transit	Bike
California Transportation Plan 2040	17%	Double	Double
Caltrans Strategic Management Plan 2020	15%	Double	Triple
SB375 2030 Bay Area Target	15%		
Plan Bay Area 2040	15%	Double	Double

Towards meeting these objectives, there is an immediate need to compare potential Bay Area congestion reduction policies that may be implemented in the next decade. A ranking process creates a rational "frame" for policy tradeoff-making, reducing the tendency towards unproductive one-dimension-at-a-time objection-seeking.

Congestion pricing is sometimes used to help pay for new infrastructure or to help balance a budget. In contrast, the expert process examined policies with an even larger behavioral impact in order to meet state/regional/local GHG/VMT reduction objectives.

In 2010, Cities21 led an informal California Driving Pricing Working Group that received contributions from FHWA, California Air Resources Board TDM staff, Governor's Office of Planning and Research, State Senate Transport Committee staff, Assemblymember Nancy Skinner's staff, Metropolitan Transportation Commission (MTC), Santa Clara Valley Transportation Authority (VTA), Bay Area Council, Silicon Valley Leadership Group, Transform, Natural Resources Defense Council (NRDC), Environmental Defense Fund, CERES, SPUR, Sierra Club, Union of Concerned Scientists, Urban Land Institute, Smart Growth America, American Public Transportation Association, UCLA's Don Shoup, VTPI's Todd Litman, and major tech employers. The author's familiarity with the subject matter stemmed from this Working Group.

[1] Raney, Steve. Reduce Bay Area Commuting by 25%, white paper for City/County Association of Governments of San Mateo County, Chapter 4. http://www.cities21.org/wp.pdf.

On September 24, 2015, Joint Venture Silicon Valley convened 75 members of the mobility ecosystem (cities, agencies, vendor, employers, and NGOs) at the Mobility Ecosystem Convening #3. During the Convening, California State Transportation Agency, MTC, Bay Area Council, and SPUR participated in a "safe and supportive Silicon Valley congestion pricing discussion."

Between December 8-10, 2015, as a followup to the Convening, an expert process ranked eight different congestion pricing policies, first on "political viability," and then on a weighted score across five dimensions (congestion reduction, GHG reduction, cost-effectiveness, equity, and implementation ease). An initial part of the process determined how much weight for each expert to apply to each of the dimensions. The process represented one of the first applications of the Delphi Method to congestion reduction policy as well as a novel trade-off between policy dimensions.

The eight congestion reduction policies that were ranked:

1. $5/gal gas tax increase with 10 year phase-in
2. $0.20/mi Road User Charge with 10 year phase-in
3. Pay As You Drive auto insurance
4. Widespread job center $5 cordon entry charge
5. $5/day workplace SOV parking charge
6. $5 per day workplace non-SOV incentive (or "cashout")
7. $3.33/day workplace SOV parking charge with non-SOV incentive (a "feebate")
8. San Mateo Highway 101 HOT3 + express bus + TDM

The first three policies are statewide, the last five are for the Bay Area Region.

The experts were:

- Bay Area Council: Michael Cunningham, SVP Public Policy
- MTC: Rebecca Long, Senior Legislative Analyst. Formerly Senior Fiscal and Policy Analyst, California Legislative Analyst's Office
- FHWA: Allen Greenberg, Senior Policy Analyst, Congestion Management and Pricing Team, Author of papers on PAYD, parking pricing, dynamic ridesharing, etc. Leads Value Pricing Pilot Program.
- Washington State DOT: Brian Lagerberg, Dir Public Transit with CTR leadership and expertise. Rob Fellows, Toll Planning and Policy Manager
- Joint Venture Silicon Valley: Steve Raney, Executive Director, Smart Mobility

The resultant scores, ranked first by political viability and second by weighted score are presented below. Scoring is 1 for "low" and 5 for "high." Political viability above 2.5 is potentially worth pursuing, whereas enactment of a policy with viability score near 1.0 is highly unlikely:

TABLE 1: Congestion reduction pricing policy rankings:

viability > 2.5 is promising	Political Viability	Political reqt	Weighted Score	Congestion/GHG
3. Pay-As-You-Drive auto insurance	3.3	State ballot initiative (simple majority)	3.3	-8% VMT/GHG
7. $3.33/day SOV + non-SOV incentive (feebate)	3.0	Legislature vote (simple majority)	3.6	-28% SOV, -4% GHG
6. $5 per day non-SOV incentive (carrot only)	1.3	Legislature vote (simple majority)	3.3	-14% SOV, -2% GHG
5. $5/day workplace parking charge	1.3	Local ballot measure (2/3 vote)	2.8	-28% SOV, -4% GHG
8: San Mateo 101 HOT3 + express bus + TDM	1.3	County sales tax (2/3 vote) + project prioritization	2.6	-15% hwy 101 SOV, -0.2% GHG
1. $5/gal gas tax increase (10yr phase in)	1.0	Legislature vote (2/3 vote)	4.1	-28% VMT/GHG
2. $0.20/mi Road User Charge (10yr phase in)	1.0	Legislature vote (2/3 vote)	3.4	-28% VMT/GHG
4. Widespread job center $5 cordon entry charge	1.0	Local ballot measure (2/3 vote)	2.9	-28% SOV in cordons, -4% GHG

The five dimensions contributing to the weighted scores were weighted by the experts as shown in the table below (the sum of the weights must be 100%):
TABLE 2: Weighted Score Weighting:

WEIGHTED SCORE: WEIGHTING				
Congestion Reduction	GHG Reduction	Cost-Effectiveness	Equity	Implementation ease
20.6%	25.6%	15.8%	19.0%	19.0%

TABLE 3: summarized dimensional and weighted scores:

	Congestion Reduction	wt	GHG Reduction	wt	Cost-Effectiveness	wt	Equity	wt	Implement-ation ease	wt	Weighted Score
1. $5/gal gas tax increase (10yr phase in)	4.60	21%	5.00	26%	4.80	16%	1.20	19%	5.00	19%	4.14
2. $0.20/mi Road User Charge (10yr phase in)	4.80	21%	4.60	26%	2.80	16%	2.40	19%	2.00	19%	3.41
3. Pay-As-You-Drive auto insurance	2.20	21%	2.00	26%	4.60	16%	4.60	19%	3.80	19%	3.32
4. Widespread job center $5 cordon entry charge	3.40	21%	2.40	26%	3.20	16%	3.40	19%	2.40	19%	2.91
5. $5/day workplace parking charge	3.20	21%	2.40	26%	3.60	16%	2.60	19%	2.20	19%	2.76
6. $5 per day non-SOV incentive (carrot only)	2.80	21%	2.00	26%	4.20	16%	4.60	19%	3.80	19%	3.29
7. $3.33/day SOV + non-SOV incentive (feebate)	3.40	21%	2.80	26%	4.80	16%	4.00	19%	3.80	19%	3.64
8: San Mateo 101 HOT3 + express bus + TDM	2.80	21%	2.00	26%	3.00	16%	3.40	19%	2.20	19%	2.57

For rankings, a modified Delphi Method[2] was used. In the 1959, The RAND Corporation developed the Delphi Method as a systematic, interactive forecasting method relying on a panel of experts. The experts answer questionnaires in two or more rounds. After each round, a facilitator provides a summary of the experts' forecasts from the previous round as well as the reasons they provided for their judgments. Thus, experts are encouraged to revise their earlier answers in light of the replies of other panel members. It is believed that during this process the range of answers will decrease and the group will converge towards the "correct" answer. Delphi is based on the principle that forecasts from a structured group of individuals are more accurate than those from unstructured groups. The Method attempts to expose "highest common denominator" thinking.

Raney led the process, recruiting participants with a promise that only a three-hour contribution was required. Raney spoke with all participants by phone to explain the process, pointing participants to a shared Google Drive spreadsheet showing how the scoring process would work. [3]

For some participants there was organizational sensitivity associated with contributing to the process, necessitating Chatham House Rule: participants are free to share information from the process, but cannot attribute information to any single person. In addition, only aggregate scores are made publicly visible.

The process provided an informal introduction to the application of the Delphi Method to congestion reduction policy-making. Rather than an attempt to develop definitive results, the process was meant to spur the organizations involved to undertake formal versions of the process with buy-in from their executives and board members. The initial results provide an informative baseline showing how the Delphi Method may be applied to

[2] Wikipedia Delphi Method page. https://en.wikipedia.org/wiki/Delphi_method
[3] Raney, S. *Rank 8 congestion policies: anonymized Delphic scoring template*. For City/County Association of Governments of San Mateo County. December 5, 2015. http://bit.ly/1RQdgmj.

ranking congestion policies. Expert comments are encapsulated, providing further guidance for future processes. It is thought that the results from formal versions of the process will not differ substantially from this first, informal process.

The Dec 8-10 expert process entailed three steps:

First, Raney provided an initial, succinct description of the eight policies in a Google Drive document, iterating with some of the experts to refine details of some of the policies.

Second, each expert provided an initial score for each policy (forecasting political viability and future impact across the weighted dimensions) in the shared Google Drive spreadsheet, commenting on some scores to reveal the reasoning behind a particular score. The spreadsheet shows the responses of all experts in one location, with responses totaled to create a single weighted result for each policy. Experts can see scores and arguments provided by others within the spreadsheet, providing a baseline for their own thought process. Likewise some experts went back in and updated their original scores based on other expert scores/comments.

Third, a conference call with the experts delved into the eight policies and the scoring. The first portion of the call discussed the eight policies. Three policy descriptions were enhanced as a result of this call. Next, scores with wide variance were discussed to share insights. This tended to converge thinking and scoring.

Process insights/guidance from the December 8-10 instantiation were as follows, with quotations from some of the experts interspersed (because of Chatham House Rule, attribution is not provided):

- " 'Direct' pricing policies such as gas tax increases are less politically viable than "indirect" policies such as pay-as-you-drive insurance."
- "The weighting process is challenging. It is totally subjective, but so is life."
- "The weightings are crucial to the weighted score, so a follow-on formal process should provide very clear description and direction for collecting weighting opinions."
- In the past, for prioritizing research projects, WSDOT used an interactive process where staff collaboratively arrived at weightings. For future strategic decisions based on weighted dimensional scoring, WSDOT would seek input from community members on how best to weight different dimensions.
- To implement a similar MTC process, staff would look first to MTC Commissioners for direction on weightings, and then collect public input, with an expectation of a spirited public process.
- All policy implementation was put on a 10-year-or-less timeline. "Policies have to be actionable. Given all the change occurring now, we should avoid 20-year implementations, because 2035 will be unrecognizable."
- All eight policies were constrained to use "within-reach" technology.
- It is a challenge to maintain complete scoring consistency across eight policies with six scores per policy.
- It may be wise to research whether Bay Area price elasticity of demand is the same as the US-wide elasticity.

In the Bay Area, some citizens object to regional planning as being part of dastardly "Agenda 21" smart growth policy-making that will limit personal freedom. These citizens have incorrectly labeled consensus-fostering public workshop processes as using the RAND Delphi expert methodology. [4]

2. Guidance on dimensions to influence weighting selection

On December 8, the following guidance on weighting was provided to the experts.

"**Cost effectiveness**" highlights general taxpayer obligation, but isn't exclusive to that single obligation. Direct user fees that internalize negative externalities are considered virtuous whereas "general taxpayer obligation" draws scrutiny. Costs to be considered encompass both capital and operating costs. Effectiveness is a qualitative notion of all quantified benefits, be they from climate or congestion relief. From a climate standpoint as explained by the McKinsey GHG Abatement Curve, cost-effectiveness favors "cost negative" and "$20 per ton or less" policies on the left-hand side as opposed to $100/ton GHG reduction policies on the right-hand side:

[4] *Exposing the Delphi Technique in Public Meetings*. For Resist 21: Exposing the Beast that Threatens the Republic. http://resistagenda21.com/agenda-21/delphi-technique/.

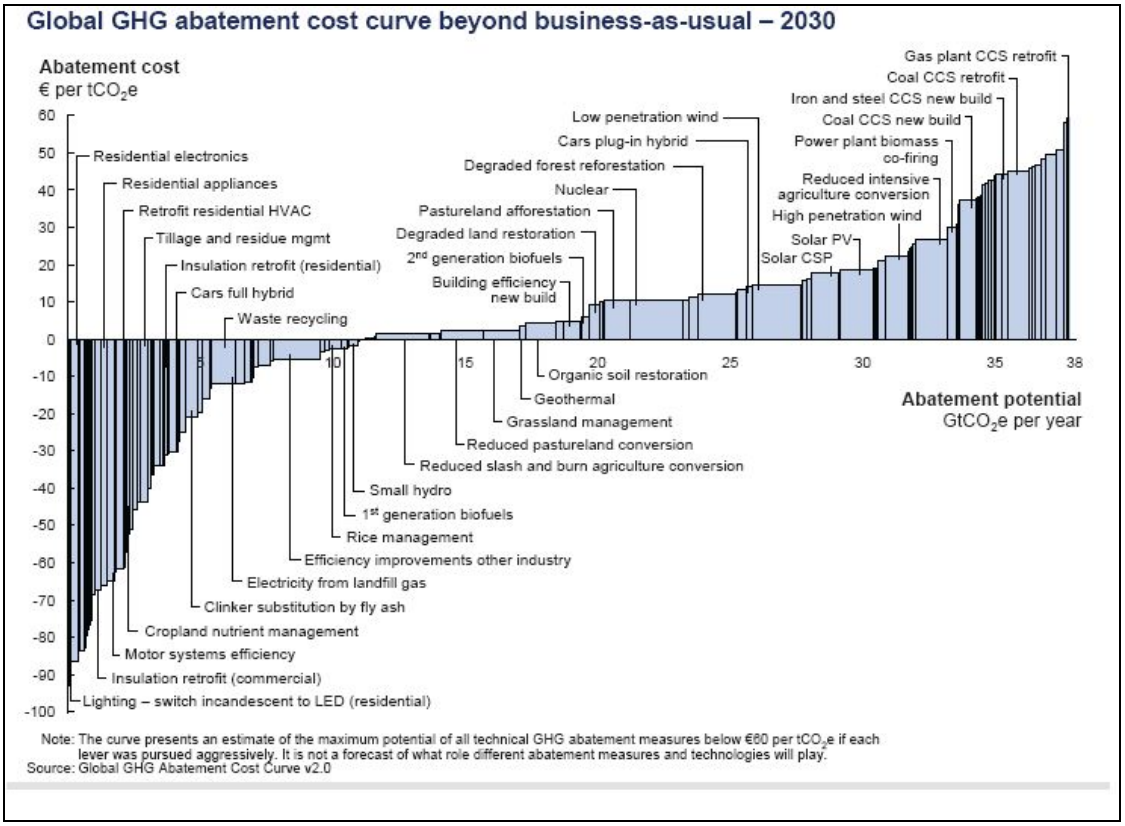


FIGURE 1: McKinsey GHG Abatement Curve [5]

In the expert process comments, large expenses to parties such as employers are called out, but do not impact the score as much as general taxpayer obligation.

Policies that reduce transportation demand are many times more cost-effective than capacity expansion projects. There are multiple estimates of benefits for each VMT reduced. FHWA's Allen Greenberg provides an estimate of $0.211 societal benefit for each VMT reduced,[6] broken down as follows:

- $0.101 broad societal benefit from reduction of: congestion, crashes, criteria air pollutants, noise, and GHG.
- $0.11 individual driver benefit from reduced gas and auto insurance costs.

Bordoff and Noel calculate $21.1B annual California social benefits from the 8% VMT reduction they forecast for adoption of pay-as-you-drive auto insurance. [7]

"**Equity**" explores social justice for low-income Bay Area commuters. This also includes equity for workers living outside of the 9-county Bay Area who commute in.

One influence on congestion pricing equity is as follows. VMT per capita is lower for low income persons and higher for high income persons (see Plan Bay Area and FHWA 2009 NHTS data below). Hence, while a gas tax increase is generally regressive, this regressivity is partially mitigated because low-income persons drive less. Table 4 and Figure 2 show low-income VMT per capita is roughly one-half that of other households.

TABLE 4: Plan Bay Area comparison of modeled scenarios - VMT per capita by income [8]

[5] *McKinsey GHG Abatement Curve*. Image courtesy: http://www.oxfamblogs.org/fp2p/wp-content/uploads/ghg-abatement-curve.png

[6] "Designing pay-per-mile auto insurance regulatory incentives," Allen Greenberg, Transportation Research Part D: Transport and the Environment, Volume 14D, 2009, pages 437-445. See also "Potential Changes in Emissions Due to Improvements in Travel Efficiency – Supplemental Report: Analysis of Potential Co-Benefits, US EPA Office of Transportation and Air Quality, EPA-420-R-11-014, September 2011, https://www3.epa.gov/otaq/stateresources/policy/420r11014.pdf

[7] Bordoff and Noel. *The Impact of Pay-As-You-Drive Auto Insurance in California.* For Brookings Institute. July 31, 2008. https://www.brookings.edu/research/the-impact-of-pay-as-you-drive-auto-insurance-in-california/.

[8] Niemeier, Karner, and Eldridge. *Technical Memorandum: Review of the Plan Bay Area DEIR*. For Public Advocates. May 16, 2013. http://www.publicadvocates.org/wp-content/uploads/ssr_technical_memorandum_5_16_13.pdf.

	VMT per capita (PDAs)		VMT per capita (other TAZs)	
	Low-income households[a]	All other households	Low-income households[a]	All other households
Base year, 2005	5.51	11.04	9.54	18.72
Initial vision	5.11	10.23	8.70	17.29
Core capacity	4.78	9.87	8.54	17.20
Focused growth	4.88	9.96	8.42	16.85
Constrained core capacity	4.94	9.89	8.40	16.82
Outward growth	5.07	10.26	8.64	17.05
	Average reduction relative to 2005 (%)			
	10.0	9.0	10.5	9.0

[a]Low-income households classified according to the US Census definition[13] based on household size and income threshold. Consistent with MTC practice, 200% of the threshold is used.

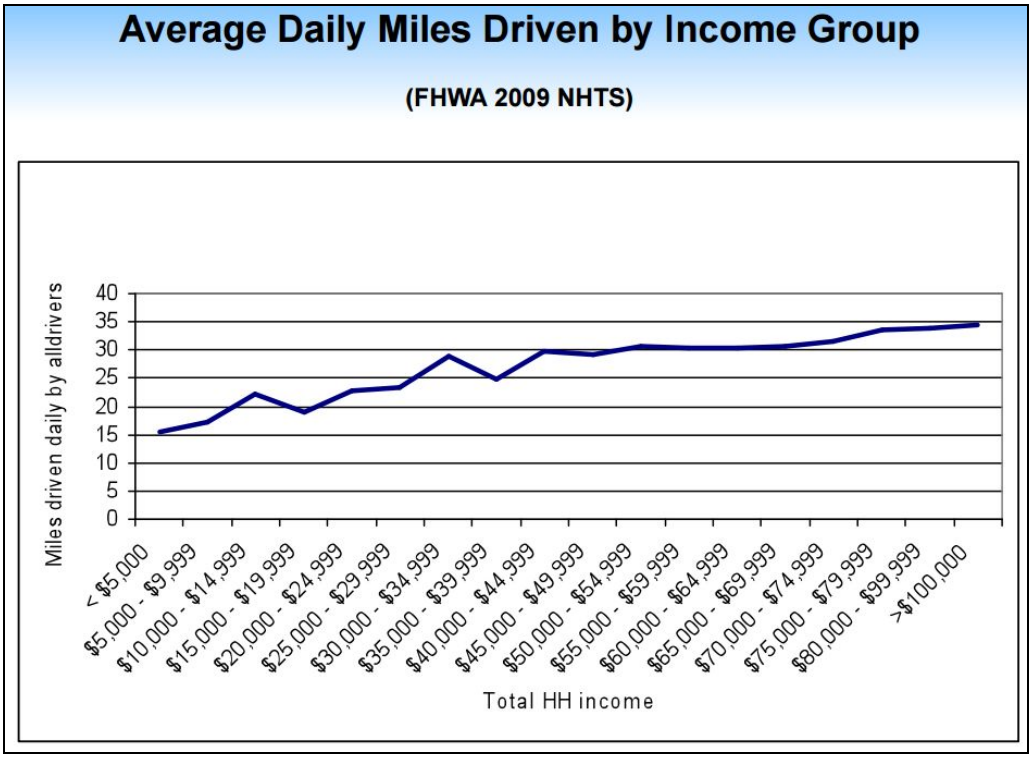


FIGURE 2: Average Daily Miles Driven by Income Group (from FHWA 2009 NHTS data): [9]

To further increase equity, congestion reduction pricing policies may be paired with low income transport/mobility subsidies such as Seattle's ORCA LIFT or San Francisco's Muni Lifeline. [10]

The "**GHG Reduction**" dimension will encompass:

- A notion of how much GHG is reduced
- Worldwide social equity issues created by climate change. Worldwide equity is included with "GHG Reduction" because realpolitik Bay Area notions of equity may focus on Bay Area low-income voters while minimizing consideration of impacts on non-US poor. One report on worldwide GHG equity is a recent Oxfam report entitled "Extreme Carbon Inequality." The report states that the poorest 50% of humanity will

[9] Kooshian, C. and Winkelman, S. Recent Trends in the Travel Intensity of the US Economy. For World Society for Transport and Land Use Research Symposium. July 27, 2011. http://wstlur.org/symposium/2011/agenda/documents/presentations/2-kooshian.pdf.
[10] Raney, Steve. Reduce Bay Area Commuting by 25%, white paper for City/County Association of Governments of San Mateo County, Chapter 7E. http://www.cities21.org/wp.pdf.

bear the brunt of climate impacts. The richest 10% of the world produce 50% of GHG and poorest 50% produce only 10% of GHG. [11]

- California often pioneers policies that spread to other states. “GHG Reduction” will NOT forecast spread of CA policies outside of CA.

One expert chose a relatively high weight of 40% for GHG reduction, “I placed a higher weight on GHG for moral reasons. This does not reflect Bay Area realpolitik.”

For “flat” policies (gas tax, etc) applied to all driving, three measures are linearly correlated: congestion, VMT, and GHG. “Congestion-focused” (cordon charge, etc) policies have a larger impact on congestion reduction than GHG reduction.

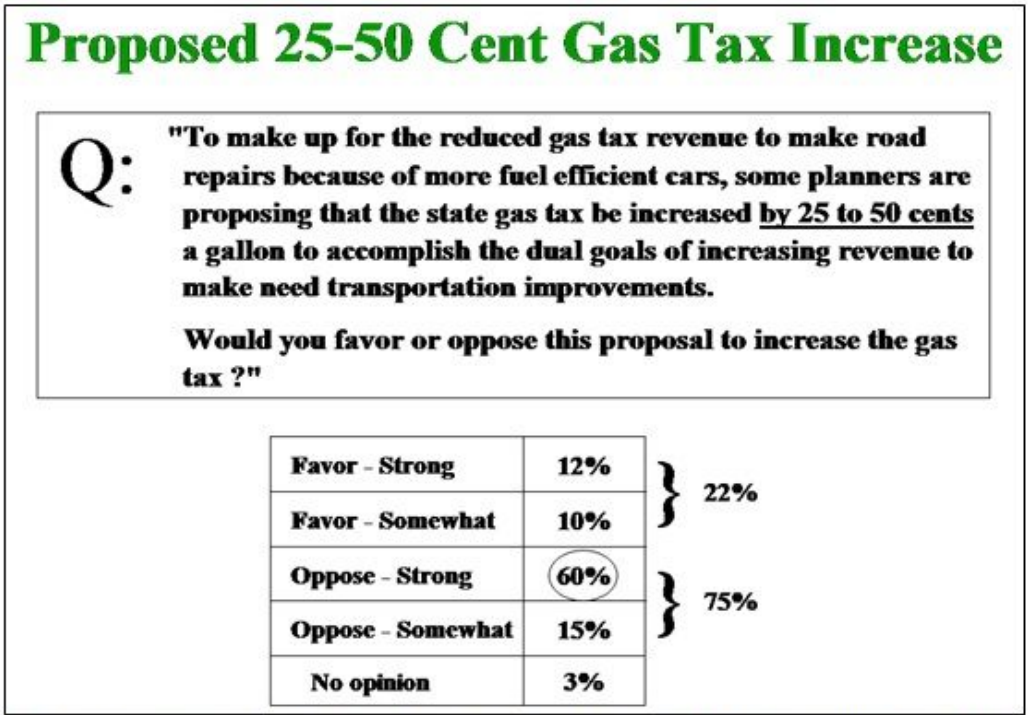
3. Guidance on Political Viability

In 2016, California has a unified pro-climate Legislature and Governor, but the voting majority is modest.

California’s Proposition 26[12] requires that certain state fees be approved by two-thirds vote of the state Legislature and certain local fees be approved by two-thirds of local voters. The state and local vote requirements make implementation of driving price increases problematic. A state supermajority does not currently exist to pass driving restrictions. State ballot initiatives provide the promise of implementing new congestion policies with a simple majority of voters, however voter congestion policy polling for policies such as gas tax increases are strongly opposed.

Laws setting climate objectives (without new fees) can pass the with simple majority Legislature votes. During negotiations over the recently passed SB350 climate law, the objective to “reduce petroleum use in cars by 50% by 2030” had to be stripped out in order for the rest of the bill to pass.

Figure 3 provides 2009 polling for a $0.25 gas increase: 75% opposed with 60% strongly opposed:



[11] *Extreme Carbon Inequality: Why the Paris climate deal must put the poorest, lowest emitting and most vulnerable people*. For Oxfam. December 2, 2015. https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/mb-extreme-carbon-inequality-021215-en.pdf.
[12] *California Proposition 26: Supermajority Vote to Pass News Taxes and Fees*. For Ballotpedia. 2010. https://ballotpedia.org/California_Proposition_26,_Supermajority_Vote_to_Pass_New_Taxes_and_Fees_(2010).

FIGURE 3: California Transportation Funding - 600 interviews. JMM Research. Aug 21-29, 2009 [13]

4. Description and impact of eight policies to be compared

On December 8, an initial preamble was provided to the experts, followed by descriptions of the eight policies. During the process, expert comments were added to the shared Google Drive spreadsheet to provide insights into particular scores. Those comments have been interspersed in the preamble below, preceded by the label "Expert."

PREAMBLE:

This exercise is inexact.

- In respect for time constraints of our experts, the eight policies have been simplified.
- Studies of the US price elasticity of demand vary widely, so forecasted congestion reduction is inexact. The price elasticity of demand is a "point" elasticity and may not hold once behavior has changed significantly. As far as achieving significant regional per-capita VMT reduction, there is no US evidence that we can lean upon. Further, Bay Area price elasticity may differ from national elasticity.

Moving Cooler[14] forecasts a 28% per capita VMT reduction for a $5/gallon gas tax increase. A linear extrapolation of this forecast to other pricing policies generally holds. Behavioral literature concludes carrots are less effective than sticks. In this exercise, we will discount carrots (incentives) by 50% before applying price elasticity - IE a $5 carrot is as effective as a $2.50 stick. For simplicity, we will ignore pre-tax payroll commute benefits implications. VTPI's Todd Litman states that parking charges are significantly more effective than other charges – we will ignore this expert finding. When driving pricing increases are perceived as permanent, these shift behavior more than fluctuating gas prices - our policies shall be perceived as permanent. For ease of calculations, we freeze CAFE (national Corporate Average Fuel Economy) at 24 mpg – this is too low in future years.

Where possible, policy price levels were chosen to be comparable between policies.

Should Metropolitan Transportation Commission (MTC) undertake a Delphi Method ranking, MTC should model the different policies with the regional travel demand forecasting model to more precisely forecast VMT/GHG reduction. We do not expect that the relative quantitative ranking for VMT and GHG reduction will differ from the Moving Cooler scaling used on the eight policies in this exercise.

5. Recommendations for formalizing this ranking process/method

- If possible, commit participants to six hours hours of time per person instead of four. Allow for more discussion and iteration on developing the eight policies.
- Be aware that project manager time commitment is larger than six hours.
- For a formalized version of this process, collect input / direction on the policies to rank and on the weighting of dimensions from transportation agency / MPO Board of Directors and the public.

6. Acknowledgements

Thanks to:

- Bay Area Council: Michael Cunningham, SVP Public Policy
- MTC: Rebecca Long, Senior Legislative Analyst. Formerly Senior Fiscal and Policy Analyst, California Legislative Analyst's Office
- FHWA: Allen Greenberg, Senior Policy Analyst, Congestion Management and Pricing Team, Author of papers on PAYD, parking pricing, dynamic ridesharing, etc. Leads Value Pricing Pilot Program.
- Washington State DOT: Brian Lagerberg, Dir Public Transit with CTR leadership and expertise. Rob Fellows, Toll Planning and Policy Manager

[13] *California Transportation Funding - 600 interviews.* JMM Research. Aug 21-29, 2009 http://www.cities21.org/dpwg/25centGasTaxIncrease.jpg

[14] Moving Cooler Executive Summary: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions. By Cambridge Systematics for Urban Land Institute. 2009. https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/MovingCoolerExecSummaryULI.pdf

- Eric Jaffe, who penned a December 2015 Citylab article based on this research.[15]

7. Detailed description of the eight congestion reduction pricing policies

On December 8, the following descriptions of the eight policies were provided to the experts. During the process, expert comments were added to the shared Google Drive spreadsheet to provide insights into particular scores. Those comments have been interspersed in the descriptions below, preceded by the label "Expert."

POLICY 1: $5/gal gas tax increase w/ 10 yr phase in (statewide, stick only)

Political viability: (requires supermajority legislative vote)

- A two-thirds legislative supermajority (per Proposition 26 requirement) does not exist to pass this tax increase. The Petroleum Lobby recently thwarted a plank in the SB350 law that would have cut petroleum use by 50% by 2030.
- 2009 polling for a $0.25 gas tax increase: 75% opposed with 60% strongly opposed
- California Manufacturers and Technology Association and the California Taxpayers Association oppose any new costs on drivers.
- Expert: No political viability at all for a phased-in $5/gallon gas tax.

Congestion/GHG reduction:

- From the Moving Cooler Report, a $5/gal gas tax increase provides 28% per-capita VMT reduction.
- Expert: The region may want to explore whether Tech Worker price elasticity of demand is the same as the US national elasticity.
- Expert: Congestion-relief benefit declines over time with higher fuel efficiency and growing share of non-gas vehicles in fleet.

Cost-effectiveness

- Direct user fee that internalizes negative externalities is very cost-effective. No general taxpayer obligation is created.
- Expert: Low administrative implementation cost, but substantial cost to motorists.

Equity:

- A high percent of low income budget goes to transport, so increased driving cost has a deleterious impact on low income people.
- Expert: Disproportionately impacts low income household budget; ultimate social equity impact depends on how new revenues are spent. But assuming California Constitution Article 19[16] (Motor Vehicle Revenues) is not changed, difficult to direct revenues towards addressing social equity impacts.
- Expert: One recent solution for a more progressive gas tax (by Senator Tom Carper D-DE) paired a gas tax increase with an increase in the federal Earned Income Tax Credit.[17]

Implementation ease

- Quick and easy to implement
- Expert: Implemented by adjusting existing mechanism, very easy. Likely to increase fraud and evasion, so additional enforcement costs are likely.

POLICY 2: $0.20/mi RUC to reduce VMT (stick only)

Policy Description: A "flat" Road User Charge (RUC) or a VMT fee

- Follows those RUCs under consideration by the Western Road usage Charge Consortium (California and Oregon are piloting as part of this Consortium program).
- Some RUCs are used to replace revenue from lower gas tax revenue, to address infrastructure maintenance deficits. Policy 2 is different - the policy objective is to increase driving price to shift mode.
- To make equivalent to Policy 1, 10 year phase in to $0.20 per mile (For Policy 1 with 24 mpg CAFE, a $5/gal gas tax is about $0.20 per mile).

Political viability should be similar to Policy 1, for the same reasons.

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[15] Jaffe, Eric. 8 Bay Area Traffic Reduction Policies, Ranked: From congestion pricing to parking fees to transit incentives. For Citylab. December, 2015. http://www.citylab.com/commute/2015/12/8-bay-area-traffic-reduction-policies-ranked/422112/.

[16] California Constitution Article 19. The Legislature shall use fuel tax revenue only for a narrow set of specified purposes. http://www.leginfo.ca.gov/.const/.article_19

[17] "Senator Carper Introduces Gas Tax Increase Paired With EITC and Child Tax Credit Expansion," August 12, 2015, by Kyle Pomerleau, http://taxfoundation.org/blog/senator-carper-introduces-gas-tax-increase-paired-eitc-and-child-tax-credit-expansion

- Proposition 26 requires a 2/3 local constituent vote (not elected officials) for this new fee. The Petroleum Lobby should be able to thwart the vote.
- Expert: In the future, a congestion-focused RUC should be considered, as it will be more politically viable than a "flat" RUC. A) For congested highways, expressways, and major arterials during peak hours, peak pricing is imposed, eventually averaging $0.20/mi. For other travel, there is lesser behavior changing pricing of $0.05/mi. B) A 10 year phase in to peak $0.20 per mile would yield 30% of VMT * 28% per capita reduction + 70% of VMT * 7% per capita reduction = 13% overall VMT reduction.
- California Manufacturers and Technology Association and the California Taxpayers Association oppose any new costs on drivers.

Congestion/GHG Reduction

- To make equivalent to Policy 1, 10 year phase in to $0.20 per mile (For Policy 1 with 24 mpg CAFE, a $5/gal gas tax is about $0.20 per mile). Hence, Policy 2 provides a 28% per capita VMT reduction.
- Gas taxes result in relatively lower costs for high mpg cars, incentivizing the purchase of fuel efficient cars, RUCs do not. Hence, RUCs should be "down-scored" a bit on overall GHG impact compared to gas taxes.
- Expert: With 10-year phase in, it is likely that differential rates would eventually be imposed on more highly congested segments, with greater congestion reduction benefits than a flat gas tax.
- Expert: Possibly even more effective than a straight gas tax, as VMT charge illuminates and simplifies the cost of driving

Cost-effectiveness

- Direct user fee that internalizes negative externalities is very cost-effective. No general taxpayer obligation is created.
- Expert: A gas tax is collected at a relatively small number of gas stations, so is inexpensive to administer. A RUC collects fees from a very large number of drivers, so revenue collection expense is higher than a gas tax. We expect revenue collection cost will decrease with time. We expect that implementation technology will improve over time, but that current technology does not gate implementation. In addition, in comparison to a gas tax, more fraud checking will be required, also resulting in increased costs.

Equity:

- Revenue will be progressively applied to driving impacts and will fund low-income-targeted transport infrastructure as well as climate protection programs. Unlike the gas tax, RUC revenue is not subject to California Constitution Article 19, so does not the same spending limitations.
- Expert: Disproportionately impacts low income household budget, but much more feasible to direct VMT fee revenue to directly benefit low income residents
- Expert: Low-income people have less fuel efficient cars, so obtain a slight benefit compared to gas tax.

Implementation Ease

- Reasonably easy to implement
- Expert: Some new administrative cost to implement and enforce odometer check. Admin cost should decline over time as VMT tracking/reporting is embedded in vehicles

POLICY 3: Pay As You Drive (PAYD) auto insurance (statewide, carrot for most drivers)

Policy description: (much more complicated than gas tax or RUC)

- 10-year market transformation from traditional to 70% usage-based PAYD auto insurance, resulting in 8% per capita VMT reduction. This policy is equivalent to a $1.40 per gallon gas tax increase. (Per the Brookings Institute report, "Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity."[18] - see also their summary for California.[19]). Low-mileage drivers save money by switching to PAYD, leaving a higher-mileage traditional insurance customer base. The average consumer who switches to PAYD will save $276 per year. This results in higher traditional insurance prices, driving more customers to PAYD, in a self-reinforcing cycle.
- The private sector is profitable and content with traditional auto insurance. In order to reduce VMT/GHG, the state undertakes a modest intervention to accelerate this market transformation. A revenue-neutral-to-insurers feebate system is implemented to incentivize 70% usage-based PAYD policies. Non-conforming policies are charged a fee and that revenue is distributed to conforming policies as a rebate. Beginning with a primarily non-conforming market, a small fee on many traditional policies

[18] "Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity," By: Jason E. Bordoff and Pascal J. Noel, July 2008. http://www.brookings.edu/research/papers/2008/07/payd-bordoffnoel

[19] "The Impact of Pay-As-You-Drive Auto Insurance in California," by Jason E. Bordoff and Pascal J. Noel, July 2008. http://www.brookings.edu/research/papers/2008/07/payd-california-bordoffnoel

generates a large rebate for compliant policies. The fees are adjusted annually to achieve desired levels of market penetration until a specified “tipping point” PAYD market share is achieved. Because a statewide ballot initiative is used, the feebate does not need to be designed to avoid Proposition 26 restrictions. One PAYD feebate paper is “Designing Pay-Per-Mile Auto Insurance Regulatory Incentives” by FHWA’s Allen Greenberg

- The state collaborates with the insurance industry to adopt a PAYD policy rating system, with bronze, silver and gold designations for small, medium, and larger per capita VMT reduction. Gold is equivalent to 70% usage-based. An example is the CERES, EDF, NRDC, VTPI “gold, silver, bronze” PAYD product rating system.[20]
- California’s Proposition 103 micro-manages insurance to prevent red-lining and other ills. This results in an expensive insurer burden to develop only-for-California products. This new PAYD policy will supersede the auto insurance restrictions of Prop 103, providing increased product development freedom to insurers while reducing product development costs.

Political viability:

- A simple majority of voters may pass a ballot initiative to enact this (a legislative supermajority could also accomplish this, but this is unattainable). Deep-pocketed political leadership must collect signatures to put this on the ballot and market the initiative. Campaign funding could come from surplus campaign funds, environmental philanthropists, “dark money,” etc.
- The average consumer will save money, so will be mildly in favor. High-mileage drivers will experience a price increase and will be more fervently opposed.
- In modifying the Prop 103 landscape, insurers will likely be enthusiastic about obtaining more product development freedom.
- Without careful campaign outreach, consumer advocates that passed Prop 103 (Consumer Watchdog and other consumer group allies) may be strongly opposed. However, Prop 103 passed with only a slight majority, so support for the status quo is not that deep.

Congestion/GHG reduction

- Expert: As far as -8% per capita VMT, Brookings assumed 100% variability (usage based), so the impact of 70% variability (which I think may be more realistic) would yield somewhat reduced the results. Brookings, though, used a pretty low (too low, in my mind) elasticity value (-0.15), which would mean that they’re under-projecting benefits, so perhaps it would be a wash when considering these two things in tandem.
- Expert: Policy doesn't focus effect on gas powered vehicles, it “penalizes” electric vehicle driving as well.
- Note on resultant expert scoring: An 8% PAYD GHG reduction would be the third highest out of the 8 policies, but low expert scoring revealed skepticism about the ability to transform the entire auto insurance market.

Cost-effectiveness

- Direct user fee that internalizes negative externalities is very cost-effective. No general taxpayer obligation is created.
- The feebate to shift the auto insurance market from traditional to PAYD is self-financing.
- Expert: expect modest administrative cost to implement at Department of Insurance.

Equity:

- Improves low income household budget by reducing transport cost. Average consumer comes out financially better off. But high-mileage poor are made worse off - there are winners and losers.
- Expert: A well-crafted initiative can achieve some of the policy goals of Prop 103 such as preventing red-lining (discrimination against poor neighborhoods).
- Expert: Fully autonomous driving has some potential to completely change the auto insurance playing field. Some have an expectation that there will be 5% market penetration of not-fully-autonomous cars on the freeway in 2023 and that will tend to induce demand. Beyond that, it is expected to take some significant number of years to advance the technology and to turn the fleet over. In addition, the current fleet cannot be retrofitted because of the need for redundant components.

[20] Litman, Leurig, and Horner. *Pay-As-You-Drive Insurance Product Rating System.* For CERES. December 2009. http://www.ceres.org/industry-initiatives/insurance/payd-standard

- Expert: An opinionated article helps explain CA Prop 103 property/casualty insurance[21]:
- Expert: There are two 30% usage-based PAYD products in California: State Farm "Drive Safe and Save" and MetroMile. Automobile Club of Southern California has "0% usage-based PAYD," which is not really a PAYD product. There are other US PAYD auto insurance products by Allstate, Esurance, National General, Progressive, Safeco, The Hartford, and Travelers that are not currently available in California.[22]

Implementation Ease:

- Modest amount of work for government staff to manage implementation. Insurer long-range product development effort/expense is REDUCED.

Raney's follow-up dialog with State Assembly Insurance Committee Staff, 12/15/15

- Paul Riches: "This isn't going to play well. Auto insurance is already essentially a regressive tax on the poor, who have few assets to protect with property/casualty insurance but are forced to insure. Poor folks are forced to live in the Central Valley. Rich folks can afford to live near work, so they drive less than poor folks. The regional and class split will be ugly." **REBUTTAL**: The data does not support this. According to MTC, poor folks VMT is 50% that of rich folks. So PAYD is not regressive in that manner. However, there is an issue of how many low-income folks will be made worse off - there are winners and losers. We probably need an MTC analysis of VMT per capita that especially focuses on folks commuting into the Bay Area from the Central Valley. Do folks with 120 mile commutes have high annual VMT? Of these extreme commuters, how popular is carpooling?
- Paul Riches: "Clean air is a rich person's problem."
- Mark Rakich: "I think the point on low-income folks is that ANY liability insurance cost is a functional 'tax' as middle income folks have assets to protect, and most minimum limits policyholders do not, so they are already doing the 'mandated public good' by having liability insurance, whereas others have some self-interest impacting their insurance decisions."

POLICY 4: Widespread job center $5 cordon entry charge with low-income discount (stick only)

Policy description:

- There are two Bay Area cordon charging concepts that haven't advanced: a) $3 SF Doyle Drive Golden Gate Bridge cordon charge, b) North Bayshore cordon charge. Let's envision a 5-year phase-in of $5 cordon charges at well-defined major employment center boundaries, providing "surgical" commute congestion reduction – one $5 entry charge per commute day. Assume technology begins as the LPR (license plate recognition) envisioned for Doyle Drive and implemented in London. The technology may advance over time. Let's further assume that low-income commuters are provided with a discount.
- A small portion of cordon revenue funds implementation.
- Expert: see CATC cordon charging writeup.[23]

Political viability:

- Proposition 26 requires a 2/3 local constituent vote (not elected officials) for this new fee on commuters. The Petroleum Lobby should be able to thwart cordon charge votes.
- The SF Doyle Drive cordon proposal was defeated, providing evidence of significant opposition.
- "Sticks-only" policies are not popular, polling at 75% opposed. A vast constituency, commuters, will be opposed.
- California Manufacturers and Technology Association and the California Taxpayers Association oppose any new costs on drivers.
- Targeting commuting congestion rather than all travel should be relatively more popular compared to a gas tax.
- Economic competitiveness issues between cordoned and non-cordoned areas should provoke heated opposition.
- Expert: This will raise privacy objections
- Expert: The general resistance to pay more will be joined by objections to differential treatment (i.e., "penalizing people who work in downtown areas") and employers/property owners.

Congestion/GHG reduction

[21] *The troublesome legacy of Prop 103.* http://www.rstreet.org/policy-study/the-troublesome-legacy-of-prop-103/
[22] *Pay as you drive insurance discounts*. http://www.carinsurance.com/Articles/pay-as-you-drive-discounts.aspx
[23] *California Transportation Commission 2012 Needs Assessment: Cordon Pricing Analysis:* http://www.catc.ca.gov/reports/2012NeedsAssess/reports_submitted/cordon_pricing.pdf

- From Moving Cooler, we have 28% travel reduction (At 24 mpg CAFE, one gallon goes 24 miles, the daily US round trip commute distance) for impacted trips. Commuting takes 30% of Bay Area VMT. Let's assume we can lasso 50% of commuting, resulting in about 4% Bay Area per-capita VMT reduction.
- Expert: Targets most-congested areas that have better transit options, so is better for congestion than GHG reduction. For GHG, it only addresses a small segment of driving
- Expert: Where parking pricing already exists (SF, etc), cordon charging will be less effective than in suburban locales.

Cost and cost-effectiveness.

- Direct user fee that internalizes negative externalities is very cost-effective. No general taxpayer obligation is created. Cordon revenue funds implementation.
- A gas tax is collected at a relatively small number of gas stations, so is inexpensive to administer. A cordon charge collects fees from a very large number of drivers, so revenue collection cost is higher than a gas tax. We expect revenue collection cost will decrease with time. In addition, in comparison to a gas tax, more enforcement will be required, also resulting in increased costs.
- Expert: Infrastructure/administration aspects seem significant
- Expert: Not insignificant implementation costs; potentially good local benefits but probably limited large-scale benefits

Equity:

- Without mitigation, cordon charges have regressive personal budget impact. To mitigate, A) discounts will be provided to low-income drivers, B) revenues will be applied progressively (to fund transit, etc)
- Expert: Equity outcomes dependent on use of revenues. Low-income discount, enhanced transit, can ease equity impacts.

Implementation Ease

- Cordon charges will likely have to receive federal approvals – we assume these will be time-consuming to obtain.
- Expert: Federal VPPP study concludes "feasible from an economical, administrative and technical point of view." But low-income discount will present difficulties.
- Expert: Not insignificant effort to model and plan appropriate infrastructure and install equipment. Operation and enforcement may also entail substantial cost.

POLICY 5: $5/day workplace SOV parking charge (stick only)

Policy description:

- Phased in over 5 years. 1000+ employee firms first, 50+ employee firms last. SOV charge begins as $0 and increases by $0.25 every 3 months.
- Enterprise CTR (commute trip reduction) software enables low-cost implementation of small, palatable parking charges ($0.25/day). This wasn't previously possible.
- Policy created as an extension of the Bay Area Commuter Benefits law (SB1339).
- Policy applies to firms with 50 or more employees. (About 69% of jobs are with 50+ job firms – see table below.)

# jobs/firm	% of jobs	# of firms
1000+	38%	50
250-999	14%	300
50-249	19%	2,500
1-49	31%	47,150

Table calculated from "The declining average size of establishments: evidence and explanations"[24]

- Policy is applied to 9 to 5 workers, encompassing about 80% of jobs.[25]
- Proceeds from the parking charge will be kept by the employer.
- Approximately 9% of Bay Area firms do not currently provide free workplace parking. A special program is worked out for employees that currently purchase third party parking.

Political viability:

- Proposition 26 requires a two-thirds local constituent vote (not elected officials) for this new fee on commuters. The Petroleum Lobby should be able to thwart cordon charge votes.

[24] Choi, E. and Spletzer, J. *The declining average size of establishments: evidence and explanations.* For Bureau of Labor Statistics. March 2012. http://www.bls.gov/opub/mlr/2012/03/art4full.pdf

[25] chacha.com query "what percentage of americans work 9-to-5 jobs?"

- A vast constituency, commuters, will be opposed. Sticks-only policies are not popular, polling at 75% opposed. The initial $0.25/day parking charge is palatable whereas the ultimate $5/day charge is not.
- California Manufacturers and Technology Association and the California Taxpayers Association oppose any new costs on drivers.
- Targeting commuting congestion rather than all travel should be relatively more popular compared to a gas tax.

Congestion/GHG Reduction

- From Moving Cooler, we have 28% travel reduction (At 24 mpg CAFE, one gallon goes 24 miles, the daily US round trip commute distance) for impacted trips. Commuting takes 30% of Bay Area VMT. Approximately 5% of Bay Area commuters already pay for parking, 95% currently get free parking. 77% of jobs are roughly 9AM to 5PM. About 69% of jobs are in firms with 50+ employees. All this multiplied together results in about 4% Bay Area VMT reduction.

Cost-effectiveness

- Direct user fee that internalizes negative externalities is very cost-effective. No general taxpayer obligation is created.
- Implementation by firms is made inexpensive by “enterprise CTR” apps (RideScout, Luum, etc) that run through payroll processing. Expensive parking hardware is not required.

Equity

- Policy would disproportionately impact low income household budget, but low-income commuters are provided with a discount. Because the system runs through payroll processing, it is easy to provide discounts based on paycheck amount.
- Proceeds from the parking charge will be kept by the employer. Employers could voluntarily pool money to fund progressive investments, but this is unlikely.

Ease of implementation

- Easily and inexpensively implemented via Enterprise CTR software

POLICY 6: $5 per day workplace non-SOV incentive (or “cashout” - carrot only)

Policy description

- Similar to Policy 6 (the $5/day SOV charge), this extension of the Bay Area Commuter Benefits law applies to 9 to 5 jobs in firms with 50 or more employees and can be easily implemented via enterprise CTR software. This policy is often called a “parking cashout.”
- Creates $1.8B/year new transit, biking, carpool, and software-driven mobility funding out of thin air (equivalent to a one-cent sales tax).

Political viability:

- Because money flows from employer to employee without the use of a government bank account, this mandate is unhindered by Proposition 26 and can be passed with a simple majority state legislative vote.
- Will be very popular with workers, but very unpopular with employers. States UCLA’s Don Shoup: “Cashout is perceived as a huge new cost to employers, so employers fight it vigorously.” Nelson Nygaard’s Jeff Tumlin, “The cost problem with parking cashout is that you have to grandfather in all the existing green commuters before you can entice new green commuting. To employers, cashout is a very expensive TDM measure.”
- California Manufacturers and Technology Association and the California Taxpayers Association oppose any new costs on employers.
- Expert: property owners may also object.

Congestion and GHG reduction

- In recent and directly applicable suburban Bay Area experience, South San Francisco’s Genentech implemented a $4/day incentive, reducing SOV from 78% to 74%. We will ignore this “low-efficacy” example. (Genentech later implemented a private motorcoach service to expensively shift substantial mode.)
- From Greenberg’s “Pay-to-Save Transportation Pricing Strategies and Comparative Greenhouse Gas Reductions to EPA’s Final Rule for Existing Electric Utility Generating Units” (TRB 2016), cashout incentive examples are: a) 1997 SoCal: -12% commute VMT, b) 2003 downtown Seattle: -10% parking space utilization. C) A recent $7 downtown Minneapolis incentive: -18% SOV. Applying these urban examples will probably overstate impact on suburban Bay Area.
- Because of our 50% carrot elasticity discount, a $5 incentive has the same impact as a $2.50 gas tax increase, for 14% VMT reduction. We can take 50% of Policy6 to arrive at 2% overall Bay Area VMT reduction.

- Expert: I'm skeptical of the projected VMT decrease. The incentive is not sufficient to lure most people out of their cars given transit travel times, inconvenience, and access to free parking.

Cost-effectiveness

- No general taxpayer obligation is created. Large new cost to employers.

Equity:

- Policy benefits low income household budget disproportionately!

Ease of implementation

- Easily and inexpensively implemented via Enterprise CTR software

POLICY 7: $3.33/day workplace SOV parking charge with non-SOV incentive (carrot + stick)

Policy 7 is essentially the same as Fair Value Commuting, the comprehensive solution presented in this white paper.

Policy description: (much more complicated than gas tax or RUC)

- This policy is a "feebate," we charge a fee on undesirable SOV commutes and rebate that money to virtuous non-SOV commutes.
- Similar to Policies 5 and 6, Policy 7 is phased in over 5 years. 1000+ employee firms first, 50+ employee firms last. SOV charge begins as $0 and increases by $0.25 every 3 months. Applies to 9 to 5 jobs. Can be easily implemented with Enterprise CTR software.
- Creates $670M/year new transit, biking, carpool, and software-driven mobility funding out of thin air (equivalent to a one-cent sales tax).
- Enterprise CTR enables low-cost implementation of small, palatable parking charges ($0.25/day). This was not previously possible.
- Incentive is calculated to be revenue-neutral to firms. At 50% SOV and $3.33/day charge, the incentive is roughly $3.33. At higher SOV rates, the incentive is higher. This bears repeating, the financial incentive to shift mode at 80% SOV is roughly 4X the parking charge, increasing initial motivation to shift mode.

Political viability:

- The CA Legislative Counsel has opined that only a simple majority legislative vote is required. The feebate is transacted via employer payroll processing, without the government collecting the fee, so is not classified as a Proposition 26 "fee."
- A combination of carrots and sticks is more popular than stick only. Cities21 surveys have delivered a majority of commuters in favor.[26]
- A few more employers must implement Enterprise CTR to develop case studies to prove out this new solution. Without case studies, the policy appears to be too complex. Stanford, Twentieth Century, and Seattle Children's Hospital provide promising initial case studies.
- If there can arise four strong ECTR software competitors, this will make the bill more viable than just two competitors. A bill that is perceived as creating a duopoly is viewed skeptically.
- The League of CA Cities is powerful and opposed to parking changes as well as any reduction in local control. Beware.
- To increase attractiveness to employers: a) provide state cap and trade credits, b) if possible, grant lucrative new transferrable in-fill development rights to landowners/leaseholders as a reward for permanent parking reduction. However, such development rights will increase opposition from other stakeholders.

Congestion and GHG reduction

- Because of our 50% carrot/incentive discount (please see the preamble), "$3.33/day SOV charge + 50% * $3.33/day non-SOV incentive" has the same impact as a $5/day parking charge: 28% travel reduction on applicable trips. By Policy 5 calculations, this produces 4% overall VMT reduction. Case Studies back this up: a) Stanford $4/day version shifted SOV mode from 75% to 49%. b) Los Angeles-based Twentieth Century Corp's 1980's carrot/stick program with $30/mo parking charge shifted SOV from 90% to 65%.

Cost-effectiveness

- Zero general taxpayer obligation is created. Zero expense for employer implementation (revenue-neutral). A "feebate" is a self-financing system of fees and rebates that are used to shift the costs of externalities onto those market actors responsible.

Equity

- According to Steve Levy (CCSCE - Center for the Continuing Study of the California Economy), the last analysis showed high income Bay Area SOV commute mode split at 78% while low income SOV mode split was 72%. If this gap still holds, Policy 7 provides a progressive transfer of wealth from high income to

[26] Raney, Steve. *$2 Daily Workplace Parking Charge + $4 Cashout*. Invited presentation to TRB Transportation Demand Management Committee, Jan, 2009. http://www.cities21.org/TRB_Paid_Parking2.pdf

low income worker. We worry that gentrification has pushed low income folks to the edges of the Bay Area, reducing their non-SOV options. This needs to be researched.
- Expert: While the incentive is good, some low income folks won't have good transit options so still be stuck paying the SOV charge. Expert 2: Where commute options are limited, Shoup's studies show that people will carpool.

Ease of implementation
- Easily and inexpensively implemented via Enterprise CTR software

Extended political viability discussion (like PAYD, this policy is more complex than other policies):
Expert 1: Employers will be skittish about a mandate
Expert 2: Employer interviews indicated employers were happy with a state mandate that made the "state the bad guy." Employers desire a fair playing field between firms.
Expert 2: Employers are in a "prisoners dilemma" regarding unilaterally eliminating free workplace parking. Employers are unwilling to undertake internal political turmoil to debate the policy internally. The decision to charge is political within a company, so becomes an expensive use of valuable Exec Staff time that should be spent on increasing revenue.
Expert 2: Case studies / pilots will be needed to prove that this policy is effective and palatable. Such case studies will increase the political viability score.
Expert 2: The policy will be performance based, with "charge + incentive" mandated for non-compliance. It will be somewhat similar to some Silicon Valley policies (Santa Clara for example) where non-compliant mode share triggers specific TDM measures.

Expert 1: May be perceived as disproportionate for firms in poor commute locations.
Expert 2: Agreed the policy is designed to motivate greener office location choices, but ...
Expert 3: The Shoup Los Angeles studies found that mode successfully shifted to the only option, carpooling.
Expert 2: There is reason for optimism that new services (Carma, Bridge, Lyft Driver Destination, etc) increase options in poor commute locations. The pricing mechanism will scale up all mobility options, increasing the chances for new options for bad locations.
Expert 2: There will be a $3.33 ceiling on the parking charge, so a non-compliant firm with SOV higher than target will not have to undertake any further measures.

POLICY 8: San Mateo 101 HOT3 + express bus + TDM

Policy description
- Highway 101 in San Mateo County is crucial to regional economic competitiveness, hence there is significant political pressure for congestion relief. There is an agreed policy objective to provide full HOV/HOT coverage on this stretch of 101. Relieving the congestion won't have a huge regional GHG impact but the solution could potentially be scaled to other freeways.
- MTC has proposed a $390M project to be built out by 2023. HOT revenue funds significant portion of other improvements. MTC's concept:[27]
    - Voluntary carrots-only TDM program must shift mode by 15% - large new cost to employers
    - New express bus service to arise (public SamTrans and private RidePal). Infrastructure investments for park n ride lots and bus stops will increase attractiveness.
    - Bridj and dynamic ridesharing
    - There are no US examples of this concept succeeding, but something has to be done
    - No mention of aggressive ramp metering to smooth congestion (this may be part of a parallel proposal)
    - No mention of faster traffic accident clearing (may be part of a parallel proposal)
    - No mention of low income mobility discounts to increase equity (this may be part of a parallel proposal)
    - Assume a county sales tax (2/3 supermajority vote by voters) to be necessary to help fund this concept.

Political viability:
- Requires a county sales tax (2/3 supermajority vote by constituents) - this should be barely achievable as voters support congestion relief.
- Politically powerful major tech employers will support this policy. Other employers will fight expensive TDM.

[27] *MTC presentation on San Mateo County Highway 101 corridor strategies.* June 2015, http://www.slideshare.net/alevin/mtc-san-mateo-county-101-corridor-strategies-062515

- All large highway HOT projects entail extensive political battles, but the politics are less opposed than the 1976 Santa Monica revolt against converting a general purpose freeway lane.
- Expert: There is no local support in San Mateo for creating a new express lane, much less doing so by converting a general purpose lane.
- Expert: Taking a lane will be politically difficult, whereas adding a new lane will be slow and costly.

Congestion and GHG reduction

- Within a critical corridor, will provide 15% commute mode shift.
- Regional VMT/GHG reduction will be small. If the 101 segment carries 5% of regional commute traffic, we have 30% of VMT is commuting * 5% of commuting is 101 San Mateo * 15% mode shift = 0.2% VMT/GHG reduction.

Cost-effectiveness

- Assuming HOT revenue funds 50% of the $390M project, and that the economic benefits are large, then this is a relatively cost-effective use of sales tax and general obligation taxpayer funding.

Equity:

- HOT lanes have been found to be only mildly regressive, with some low-income folks paying to speed up their commute.
- Mobility discounts are not currently envisioned, but could be provided to low-income drivers - implementation will be difficult.
- Excess revenue to be used progressively for transit enhancement and other virtuous expenditures, unhindered by Title 19.

Implementation ease

- HOT lane striping and tolling is standard practice.
- Voluntary carrots-only TDM to shift 15% mode has not been achieved in the US, but there will be significant motivation to make it work.

Appendix M: Recommendations for Political Wrangling

An appendix in a larger white paper. Paper is undergoing review, proofreading, and formatting.
March 2016.
Shared link to this doc: http://bit.ly/1O5iKEQ

A brief review of terminology: a “Sliding Commute Trip Cap” is the tentative name for a bill to enact Fair Value Commuting (feebate + enterprise commute trip reduction software + mobility aggregation smartphone app). Non-compliance with Trip Cap objectives triggers the revenue-neutral workplace parking feebate.

This chapter provides a recommended work scope for how an NGO can wrangle the political ecosystem to enact congestion reduction.

There are a few candidates for the NGO that may take leadership as the “Policy Leading NGO” or “PLN.” Joint Venture Silicon Valley does not undertake transportation policy leadership, so is not a candidate.

M1. Regional Leadership Roles in Congestion Policy-Making

At the September 24, 2015 Joint Venture MaaS (Mobility as a Service) Convening #3, SPUR’s Ratna Amin characterized the “regional political wrangling gap.” The cities and major employers have not coalesced around a consensus congestion reduction policy. Because every entity is pursuing their own interests, the cities/employers have minimal regional influence. Assuming that PLN (Policy Leading NGO) can develop a consensus, then cities/employers can exert sufficient political influence to direct regional policy analysis towards the preferred solution, leading to enactment. The regional level does not have the power to enact strong congestion policy without city/employer leadership.

Leadership should concisely define this effort. For example, the remit could be: “Analyze eight or more different congestion policy options and then pursue enactment of one or more policies.”

Initial analysis showed that, by a large margin, Fair Value Commuting is the most politically viable regional congestion reduction strategy. These recommendations below encompass:

- how to pursue congestion policy evaluation
- how to advance Fair Value Commuting.

Pursuit will include identifying roles and responsibilities. For example:

- PLN wrangles a broad coalition towards adopting public policy.
- MTC vetts policy options and leads an open public process.
- In support of PLN, Joint Venture Silicon Valley progresses software pilots, implementation projects, research, and standards efforts.
- Funders of this white paper, such as CCAG, have earned a position of prominence and can help specify their role.

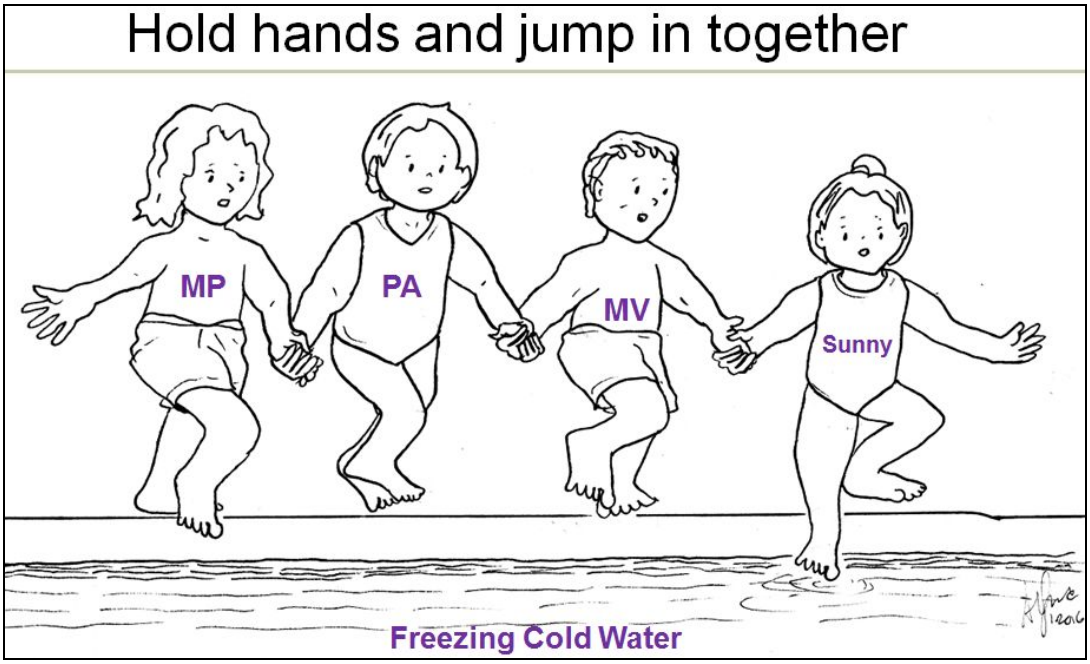
Recommended roles for PLN, MTC, cities, employers, state actors, and counties are fleshed out below.

M2. Policy Leading NGO (PLN) Role

- Make an Exec Staff decision to pursue a vision and work scope. PLN-centered arguments in favor of this project: 1) Given State and Regional objectives to reduce per-capita VMT and GHG, congestion policy is important. 2) Aligns with PLN's Commute Improvement program. 3) This project is in an "unoccupied space" without competition from other organizations.
- Name the project.
- Obtain Board approval to pursue the work scope.
- Collaborate with the Board and PLN members on an expert congestion policy ranking process.
- As part of congestion policy research of "Fair Value Commuting," implement Enterprise Commute Trip Reduction (ECTR) software for PLN staff use. Such use: a) imbues the organization with invaluable policy knowledge, b) develops empathy for the five Silicon Valley development agreement Trip Caps, c) increases the political viability of Fair Value Commuting. As far as staff pricing policy, PLN should phase in small SOV parking charges.
- Lead fundraising with an ambitious annual goal. Target energy and climate philanthropies with an energy-focused message.
- Beyond existing member entities and
- wrangle regional stakeholders and develop a policy consensus. Then present a united, powerful front in pursuing enactment of specific congestion policies. Stakeholders: {PLN member companies, cities, transit agencies, major employers, mobility service software vendors, mobility hardware vendors, NGOs}. This wrangling will include wrangling non-PLN-members, hence requires additional funding. Some of this work will entail lobbying. Wrangling tasks encompass: e-newsletters, convenings, webinars, web content, social media, and large events. Of special emphasis, PLN should wrangle:
    - The Bay Area Council / SVLG Caltrain Commuter Coalition[1] and 101 Coalition.
    - The coalition of 11 North Santa Clara County cities and County Supervisor Joe Simitian, a group that formed to influence the 2016 VTA transport sales tax.[2]
- Develop the ability to expeditiously submit policy requests with signatures from the entire united, wrangled coalition. Policy requests from this coalition should include:
    - Ask MTC Commissioners to:
        - 1) direct MTC staff to collaborate with MTC Commissioners, the public, and state-level actors (CalSTA, OPR, State Assembly, and State Senate) on an expert congestion policy ranking process.
        - 2) direct MTC to internally implement ECTR for staff commuting.
        - 3) Place priority on MTC Resolution 3866 and the MTC Transit Coordination Implementation Plan, to meet adopted MTC objectives: a) better cross-county public transit passenger experience with better routes/schedules, b) provide a single fare (without cost penalty) for two- and three-brand public transit trips.
        - 4) As Cubic and GlobeSherpa have already demonstrated in other US locations, develop a 2017 Clipper 1.5 public API to enable Clipper branded/backended smartphone "visual verify" e-ticketing. Clipper 1.5 should be made forward-compatible with 2020 Clipper 2.0.
        - 5) direct MTC staff to study autonomous vehicle induced demand. Fund an activity-based regional travel demand forecast for 5% market penetration of "read-a-magazine freeway robocars" where improved commuting productivity drops the model's cost of such robocar trips to $0. If adverse impacts are foreseen, develop policy recommendations to mitigate adverse impacts. (Please see Appendix E)
        - 6) Direct MTC staff to accelerate support of GTFS-RT by Bay Area public transit operators. One example of this need resides at SamTrans.
    - Ask a handful of cities to enact city-wide Sliding Commute Trip Caps and to internally implement ECTR for staff commuting.
    - Ask a handful of major employer CEOs to implement ECTR for employee commuting.
    - Ask state level actors (OPR, CalSTA, CARB, Governor Brown, Kevin Mullin, Jim Beall) to collaborate with regional actors on an expert congestion policy ranking process. Ask OPR, Caltrans, and CARB to internally implement ECTR for staff commuting.

[1] http://www.caltraincoalition.com/
[2] (article: http://www.mv-voice.com/news/2015/08/18/cities-challenge-vta-on-transportation-funding).

    - Ask the CEOs of {Lyft, Uber, Google, Apple, and Microsoft} to develop ECTR software. Google Now, Siri, and Cortana already advertise “seamless mobility via a faster-than-realtime intelligent agent.” If the set of ECTR software providers can expand beyond Luum and RideScout, then political viability increases, avoiding a duopoly.
    - Ask eco/energy philanthropies to contribute to the cause.
- Tech Company Exec Staff have minimal time to devote to solving congestion, yet traffic has a substantial human resources retention/productivity impact. Develop ability to communicate with one or more Exec Staffers from the top 10 companies for 10 minutes four times per year. Envision a recorded, hidden URL youtube presentation with Governor Brown, Jim Wunderman, and others presenting. Use these precious minutes to increase major employer willingness to take action each quarter. At the end of the 10-minute sessions, obtain short responses from each firm to advance the political consensus.
- In support of enacting congestion reduction, develop persuasive public messaging. Oppositional negative campaigning is relatively straightforward, but selecting the right message in favor of pricing is difficult. Working with a messaging team with a good track record, develop in-favor messaging concepts. Validate messaging efficacy on key members of the wrangled coalition. Then further validate using polling.
- When the timing is right, convene elite power stakeholders in a “pre-scripted MSP (multi-stakeholder partnership” meeting to “close the deal:”



“Menlo Park will do X if Palo Alto, Mountain View, and Sunnyvale all do Y. Palo Alto will do Y if Menlo Park, Mountain View, and Sunnyvale do Z.” etc.) An MSP is akin to “all holding hands and jumping in together even though the water is too cold.”

- Review this white paper and help strategize how to brand it and roll it out.
- Regional entities including PLN and MTC should collaborate with state actors on a public “Congestion Reduction Education and Listening” campaign with budget, staff time, workshops, webinars, media outreach, and social media outreach. Workshops/webinars should use SMS voting for real-time constituent opinion-tallying and tradeoff-making. The collaborators should also present on Congestion Reduction at professional conferences.
- Region-wide implementation of Fair Value Commuting promises to free 2,608 acres of surface parking (worth $7.8B) for higher use. PLN should lead a process to decide whether to pursue issuance of valuable transferrable in-fill residential development rights (split between employers and landowners) in exchange for quantified commute reduction. Such an effort could pit Sobrato/Arrillaga against localities. If development rights are to be pursued, the effort should be distinct from Sliding Cap pursuit.
- Pay-as-you-drive (PAYD) auto insurance is another congestion reduction policy that scores well on political viability. PAYD can reduce state VMT/GHG by 8%. PLN should consider whether to pursue a state PAYD

auto insurance ballot initiative with Governor Brown, Tom Steyer, and others. Drafting and marketing a PAYD initiative will take considerable skill.

M3. MTC / BAAQMD Role and Process

- Act on the understanding that staff is "ahead" of MTC Commissioners and Air District Board
- PLN's wrangled coalition outreaches to MTC Commissioners and Air District Board for them to direct staff to form a "congestion reduction policy evaluation program."
- Collaborate with MTC Commissioners, the public, and state-level actors (CalSTA, OPR, State Assembly, and State Senate) on an expert congestion policy ranking process.
- As part of congestion policy research of Fair Value Commuting, implement Enterprise Commute Trip Reduction (ECTR) software for MTC staff use. Such use: a) imbues the organization with invaluable policy knowledge, b) develops empathy for the five Silicon Valley development agreement Trip Caps, c) increases the political viability of Fair Value Commuting. As far as staff pricing policy, MTC should phase in small SOV parking charges.
- Place priority on MTC Resolution 3866 and the MTC Transit Coordination Implementation Plan, to meet adopted MTC objectives: a) better cross-county public transit passenger experience with better routes/schedules, b) provide a single fare (without cost penalty) for two- and three-brand public transit trips.
- As Cubic and GlobeSherpa have already demonstrated in other US locations, develop a 2017 Clipper 1.5 public API to enable Clipper branded/backended smartphone "visual verify" e-ticketing. Clipper 1.5 can be made forward-compatible with 2020 Clipper 2.0.
- Study autonomous vehicle induced demand. Collaborate with state actors on this. (Please see Appendix E.)
- Review this white paper and help strategize how to brand it and roll it out.
- Regional entities including PLN and MTC should collaborate with state actors on a public "Congestion Reduction Education and Listening" campaign with budget, staff time, workshops, webinars, media outreach, and social media outreach. Workshops/webinars should use SMS voting for real-time constituent opinion-tallying and tradeoff-making. The collaborators should also present on Congestion Reduction at professional conferences.
- For additional equity analysis, MTC should analyze VMT per capita by income, especially for extreme commuters, such as those commuting in to the Bay Area from the Central Valley. Do workers with 120-mile commutes have high annual VMT? Within these extreme commuters, how popular is carpooling? Joint Venture can do the number crunching if MTC's David Ory can provide a dataset.
- In support of MTC's interest in helping Silicon Valley expand trip caps, provide technical support to cities that adopt Sliding Cap ordinances. Such support might include assistance in handling spillover parking issues.

M4. City Role and Process

In 2016, at least two cities should enact a city-wide "Sliding Commute Trip Cap for 25% reduction," with implementation deferred until 2017. Cities should make implementation contingent on a series of conditions, including the adoption of similar Caps by at least two other neighboring cities. By entering into a public policy process to enact an ordinance, cities will increase the political viability of regional enactment.

Where possible, multi-city convenings should be exploited, including:

- meetings of the Peninsula Chapter of the League of California Cities
- meetings of the coalition of 11 Santa Clara Counties and Supervisor Joe Simitian who banded together to influence the 2016 VTA transport sales tax.

Example Introductory Memo Language for City-wide Sliding Commute Trip Cap Ordinance

- Within the last two years, the cities of Menlo Park, Mountain View, Sunnyvale, and Cupertino implemented "development agreement trip caps" on large new office development projects. Implementation varies slightly between each city. These trip caps set a maximum SOV commute mode share anywhere from 30% to 66%. These development agreements set the stage for a city ordinance capping commute trips to EXISTING offices.

- A city-wide Sliding Cap would require large and mid-sized employers to cap the percent of single occupancy vehicle (SOV) commutes to workplaces. Non-compliant employers would be required to implement a revenue-neutral workplace parking feebate ("Stanford-style" TDM), charging employees a fee for SOV commute trips, collecting that fee revenue, and rebating the revenue to employees using non-SOV commute modes. Because employers incur zero feebate cost, this is not a "taking."
- This natural extension of the SB 1339 Bay Area Commuter Benefits law[3] applies to 9 to 5 jobs in firms with 50 or more employees and can be easily implemented via "enterprise commute trip reduction" software from firms like Luum and Daimler-owned RideScout.
- The policy is phased in over 5 years. 1,000+ employee firms first, 50+ employee firms last. The SOV cap begins at 80% SOV, decreases by 2.5% every 3 months, and has a 50% SOV floor. For non-compliant employers, the feebate's required SOV parking charge begins as $0 and increases by $0.25 every 3 months, capped at $3.00.
- Because the feebate policy is zero cost to employers and money does not flow through government, Sliding Trip Cap can be passed with a simple Council majority. (In 2010, California State Legislative Counsel provided an opinion that a Proposition 26 supermajority is not triggered.)
- Enacting in 2016 with deferred implementation provides a) a vision that can trigger additional action by other stakeholders (potentially assisting Assembly Member Kevin Mullin's AB378 regional traffic relief efforts), b) time for pilot implementations to play out.
- More than 75% of residents favor significant traffic relief.
- Some supporting "findings." There is a growing realization that some form of congestion reduction policy must be adopted if state/regional climate/congestion objectives are to be met. At the state level, California Transportation Plan 2040's climate-friendly Alternative 3 calls for: 17% reduction in per-capita driving, double transit/biking, and double the number of people in carpool lanes. "Caltrans Strategic Management Plan 2015-2020" calls for a 15% reduction in per-capita VMT. At the regional level, the 2017 update to Plan Bay Area has the following recommended targets: a) 7% per-capita VMT reduction by 2020, b) 15% by 2035. San Jose's 2040 General Plan calls for "40% less VMT via regional congestion pricing policies. San Jose supports regional adoption of pricing solutions to encourage a high level of mode shift." SVLG, MTC, VTA, SamTrans, OPR, Transform, Sierra Club, and Association for Commuter Transportation have provided supporting letters for a Stanford-style feebate.
- Undertake a city process where stakeholder input is collected as to how to bring about Sliding Cap with maximum support. For example, condition Cap implementation on two other cities adopting the same policy.

As part of congestion policy-making and climate innovation, cities should internally implement Enterprise Commute Trip Reduction (ECTR) software to improve city staff commutes. Such use:

- Imbues a city with leading-edge, comprehensive, practical commute policy knowledge,
- Develops empathy for Trip Caps. Cities should "walk the walk" on congestion reduction and climate protection.
- Increases the political viability for expansion of Trip Caps beyond each city, creating a virtuous cycle to improve mobility options for all.
- Transparently exposes a real-time commute mode split and parking utilization dashboard (viewable by the public) of staff behavior, providing leadership in commuting instrumentation / analytics / Internet-of-Things.

As far as incentives and parking charges for city staff (easily implemented with ECTR software), the city should increase non-SOV incentives while also phasing in small SOV parking charges, within the context of employment/union agreements. It is assumed that $0.25 per day SOV parking charge will be palatable.

M5. Major Tech Employer Role and Process

As part of congestion policy-making and climate innovation, employers should internally implement Enterprise Commute Trip Reduction (ECTR) software to improve staff commutes and to increase overall political viability for a Sliding Cap bill. Employers should phase in $0.25 per day SOV parking charge, as this will be palatable. Each year for three years, this project should recruit four tech employers to use ECTR. It will be influential for major

[3] SB 1339 Yee - https://commuterbenefits.511.org/

employers to expose publicly-visible real-time commute dashboards. Friendly commute competition between employers should be encouraged

One major employer, as part of their Trip Capped development agreement, appears willing to adopt ECTR - first with incentives-only and then phasing in SOV parking charges.

Another major employer is moving from suburb to suburb and is expected to eliminate free workplace parking in the process.

M6. State Legislature, Department, and Governor Role & Process

OPR (State Governor's Office of Planning and Research) has offered to be the formal recipient of this white paper, raising the white paper's profile.

OPR, CalSTA, and CARB should review this white paper and help to roll it out.

Assembly Member Kevin Mullin has a 2015-16 placeholder bill to remedy Highway 101 traffic congestion, AB 378. Senator Jim Beall's State Senate Select Committee on Bay Area Transportation,[4], is also addressing traffic congestion solutions. Mullin and Beall should:

- Ask state entities (OPR, CalSTA, CARB) to collaborate with regional actors on an expert congestion policy ranking process.
- Ask OPR, Caltrans, and CARB to internally implement ECTR for staff commuting.

As part of congestion policy-making and climate innovation, Caltrans, CARB, and OPR should internally implement Enterprise Commute Trip Reduction (ECTR) software to improve staff commutes and to increase overall political viability for a Sliding Cap bill.

State entities should collaborate with regional actors on a public "Congestion Reduction Education and Listening" campaign with budget, staff time, workshops, webinars, media outreach, and social media outreach. Workshops/webinars should use SMS voting for real-time constituent opinion-tallying and tradeoff-making. The collaborators should also present on Congestion Reduction at professional conferences.

State entities should collaborate with MTC to study autonomous vehicle induced demand. (Please see Appendix E.)

CalSTA/OPR should dedicate staff time to coordinate congestion policy-making efforts with SCAG, SANDAG, and "climate leader" states such as Washington and Oregon. State staff should suggest that states should consider undertaking similar actions as are under consideration in the Bay Area.

M7. County Role: CCAG, VTA, etc.

As part of congestion policy-making and climate innovation, select county employers should internally implement Enterprise Commute Trip Reduction (ECTR) software to improve staff commutes and to increase overall political viability for a Sliding Cap bill.

Transit agencies should pursue mobility service innovations to increase the set of commuting options. VTA provides two examples: "Subscription Express" and VTA on-demand Flex circulator.

M8. Funder Role

Eco/energy philanthropies should contribute to the cause.

The "McKinsey GHG Abatement Curve" shows that preferred climate policies reduce demand and are "cost-negative. Within transportation, carpooling, biking, walking, filling empty seats in existing public transit, and

[4] http://senate.ca.gov/bayareatrans,

price increases are exceptionally cost-effective. Fair Value Commuting is one such cost-negative policy and stands out in contrast to many transportation projects that spend $1,000 for each ton of GHG reduced.

M9. Large Tech Real-estate Developer Role

The effort should recruit three large developer multi-tenant parcels to implement ECTR on all large and medium-sized tenants. An ECTR commute mode dashboard is now often required as part of large parcel development agreements.

Region-wide implementation of Fair Value Commuting promises to free 2,608 acres of surface parking (worth $7.8B) for higher use. Elite developers should contribute to a PLN process to decide whether to pursue issuance of valuable transferrable in-fill residential development rights (split between employers and landowners) in exchange for quantified commute reduction. Such an effort could pit developers against localities. If development rights are to be pursued, the effort should be distinct from Sliding Cap pursuit.

One major developer expressed willingness to charge for parking when a large mixed use project opens in Silicon Valley in 2018. Another large developer with significant TDM requirements expressed interest in hosting a mobility event.

Appendix N: Mandatory Workplace Building Entrance Commute Mode Intercept Surveys

An appendix in a larger white paper. Paper is undergoing review, proofreading, and formatting.
Short link to this google drive shared doc: http://bit.ly/1KWhHUK
October 2015. Thanks to transp-tdm!

What are best practices for a “front door,” 100% response, mandatory clipboard intercept survey (using in-house staff) at an employer to collect commute mode and home zipcode? Assume one building with two levels of underground parking, a mix of commute modes, entrances, 400 employees, both visitors and employees enter during AM commute hours. For a large corporate campus with many buildings, a “sampling of buildings with 100% response per building” can be used.

Background

- In the Bay Area, a number of cities have adopted “trip caps” on new office development where an employer is allowed a maximum number of vehicle trips across their driveways each day. Penalties accrue when the maximum is exceeded – one city charges $50/day/trip for each trip over the cap. Each trip cap agreement has an agreed formula to translate from “SOV mode share” to “trip count” and back.
- Hence, the stakes are high for accurate commute mode reporting. A past complaint about web-based commute mode surveys was that a lower percent of SOV commuters respond to such surveys, skewing results.
- Says one practitioner, “The only accurate way is a 100% clipboard count for a full AM commute.”
- With that background, what are best practices for “manual commute mode census” / “front-door intercept surveys?”
- For a building with underground parking and 6 entrances into the building, with a mix of visitors and employees entering, how do clipboard-wielding staff politely ensure that 100% of employees are rapidly processed without allowing employees to sneak through without being counted? Advice on handling part-time and/or contract employees? What can go wrong?

Some suggestions so far:

- Figure out what AM commute time period you need to intercept for. 6AM-10AM?
- Send out an “all-hands” e-mail from a senior executive the week before the intercept, indicating that an intercept survey will be taken in the next month (give a sufficiently large range so that employees don’t temporarily change commute behavior). Explain why the survey is needed and the benefits that will accrue to employees. Indicate that the survey is mandatory. Set expectations for the 20-second intercept experience and the three questions that will be asked. Explain how a three-mode commute (bike to train to shuttle bus) is characterized by the longest segment, typically the middle line-haul segment. Possibly explain away the “social desirability effect” so that employees are primed to provide an honest answer.
- With interceptor staff, undertake a 10-minute dry run the day before, with the other clipboard-wielding staff serving as interceptees. Instruct staff on how handle two- and three-mode commutes. Instruct staff to let visitors pass without collecting commute data. Instruct staff to “back off” if an employee refuses to respond, because 98% participation rate is acceptable. Explain that interceptor enthusiasm and processing brevity increase the chances for 100% response without complaint (from TCRP63, pg2). Provide FAQ answer: 1) this survey will be used to improve commute options for employees. The wording of the interceptor’s

introductions and questions affect the speed of processing and influence the mood with which each employee begins their work day. A introduction such as “Thank you for participating in our commute improvement survey. Are you full-time, part-time, a contractor, or a visitor?” Where interceptors know interceptees, “Thank you for participating in our commute improvement survey. I will put you down for full-time if that’s OK?”

- Collect data only on a Tuesday, Wednesday, or Thursday
- The objective is to quickly process employees and allow them to being their workday. One interceptor can easily process two employees per minute or 120 employees per hour, however people arrive in “clumps.,” Hence, to accommodate surges, plan as if one interceptor processes only 60 employees per hour. Estimate the percent of employees who use each entrance and the duration of the main commute arrival time period (if everyone arrives right before 9AM, plan accordingly. If arrivals are spread over primarily from 7:30-9:30AM, the number of interceptors is lower.) Create a chart of all the entrances and the expected flows of employees.
- A minimum of one interceptor is required per entrance. Where you have a busy entrance and have multiple doors, additional interceptors may be needed.
- Where an entrance has multiple doors and is not too busy, funnel employees/visitors through a single door. Attach “please use other door” signage. Temporarily secure such doors where fire regulations permit.
- Where an entrance is not too busy and may be safely closed and employees re-directed to a nearby entrance, this reduces required interceptor staff.
- Use cones or a rope line at entrances to form an orderly queue.
- Interceptors should wear distinctive clothing, such as orange vests.
- Signage: If your commute program has branding, use that branding. Sample 22x17 (or larger) eye-level foamcore signage:

20-second all-hands commute mode survey:

1. Full-time, part-time, contractor, visitor?
2. Main commute mode this morning:

Drive alone	Bike
Carpool (how many in vehicle?)	Walk
Caltrain	Vanpool
Bus	Lyft or other taxi-like service

3. Home zip code?

- For the clipboard survey instrument, 1 row per person. Circle mode (how many people in carpool, including driver), write in zipcode, circle employee type. Provide plenty of extra sheets because running out of sheets is problematic:

SOV Pool [#] Train Bus Bike Ped Van Lyft	[zipcode]	FT PT Contract

For a large corporate campus with many buildings, a “sampling of buildings with 100% response per building” can be used. For a campus with 10,000 employees it might be reasonable to sample 15% of employees in geographically dispersed locations throughout the campus. It will be advisable for the employer to develop a narrative about creating a representative sample and then having that narrative be approved by the local city or some impartial and knowledgeable third party.

Notes on high-quality employer commute mode surveys

- Methodological quality varies significantly from employer to employer, making comparisons problematic.
- Many employer commute mode share results do not include telework (Genentech and Facebook, for example), but Census Transportation Planning Package 3 does include telework, making comparisons problematic.

Washington State Department of Transportation Commute Trip Reduction Program has prepared a Guide to Employee Surveys:

- http://www.wsdot.wa.gov/NR/rdonlyres/EB29B0EF-0F5B-4F69-B3AE-962F56C7E163/0/GuidetoEmployeeSurveysfinalupdated2011.pdf
- The document's intent is to guide employers to comply with WSDOT's "paper" survey requirements. The guide includes options for reducing the cost (govt. processing of data, use of optiscan sheets to enter data (now online, too), allowing employers to sample employees instead of conducting a census). WSDOT recommends collecting one weeks' worth of data to account for some variability (e.g., part time telework, absences, etc.) and the fact that some employers can't do a cordon count (i.e., downtown location where employees arrive via various modes) without more of an intercept-type survey of employees as they enter the building(s).

Consistency and quality may be improved by:

- Standardizing survey instruments across employers. Survey questions should be unbiased. (e.g. don't call it a parking survey or a shuttle survey, etc)
- High response rates (above 50%). Low response rates are suspect.
- Employers should strive for consistency: the same surveys, forms, methodology, timing used every year (or every time) so that the data isn't skewed for other reasons (of course, there's always a risk of external factors, e.g. gas prices, transit fare changes, financial climate in general, influencing the findings)

LEED for Existing Buildings:
LEED has "Sustainable Sites Credit 4 for Alternative Commuting Transportation." For this credit, a Commute Survey process is described that penalizes survey results with low response rates. For a survey with less than 30% response, the remaining 70% of employees are assumed to be 100% SOV commuters:

Table #: Extrapolation Factor

Survey Response Rate	Extrapolation Factor
60%-100%	1.00
50%-59%	0.80
40%-49%	0.60
30%-39%	0.40
0%-29%	0.00

From: http://www.usgbc.org/ShowFile.aspx?DocumentID=8947
LEED Sustainable Sites Alternative Commuting Transportation: "SSc4." Overview

Research Needs: commute mode surveys
1. Report on employer reports of commute mode splits that have obvious errors. Such a critique may help "raise the game" in the TDM space.

2. Analyze sample bias in order to develop consistency/quality recommendations:
From a representative set of employers:

- Collect response rates. Test a hypothesis that low response rates result in understated SOV mode share.
- Collect anonymized income distributions of respondents versus full employee census. The hypothesis is that high income people respond less and high income people SOV more.
- Fund comparison cordon counts at a representative set of employers, with the hypothesis that surveyed SOV mode share is less than cordon count SOV mode share, because of sample bias.