

# **Impacts of Employer-Based Trip Reduction Programs and Vanpools on Passenger Vehicle Use and Greenhouse Gas Emissions**

## **Policy Brief**

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**September 30, 2014**

Policy Brief: [http://www.arb.ca.gov/cc/sb375/policies/ebtr/ebtr\\_brief.pdf](http://www.arb.ca.gov/cc/sb375/policies/ebtr/ebtr_brief.pdf)

Technical Background Document:  
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## **Policy Brief on the Impacts of Employer-Based Trip Reduction Programs and Vanpools on Passenger Vehicle Use and Greenhouse Gas Emissions**

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### **Policy Description**

Employer-based trip reduction programs use various approaches to reduce single occupant car travel to work and the associated greenhouse gas (GHG) emissions. These programs are sometimes encouraged or required by State or local governments, and sometimes are pursued voluntarily by firms.

Employer-based trip reduction programs typically include some combination of the following elements, usually chosen by firms to suit their specific context:

- Employer-provided alternative mode services, such as carpool facilitation (e.g. a carpool matching service), preferential parking for carpoolers, vanpool service, carsharing programs, or a guaranteed ride home for employees who commute by transit;
- Financial incentives for carpoolers, vanpool users, cyclists, or pedestrian commuters, free or reduced public transit fares (often subsidized by the employer), or a cash transportation allowance combined with a parking fee, also called a parking cash-out;
- Worksite facilities, such as showers, lockers, or bicycle racks, for physically active commuting,
- Alternative work schedules that include flexible work hours and/or a compressed work week; and
- Information and marketing, such as a commuter information center or a transit promotion campaign.

Employer-sponsored vanpool programs first emerged in the 1970s and were soon followed by third-party vanpool programs (operated by transit agencies or transportation management associations) and owner-operated vanpools (Chan and Shaheen, 2012). In recent years, companies in the Bay Area and elsewhere have begun operating private shuttles for their employees. Google, for example, sponsors luxury buses that transport employees from San Francisco and other areas to Google's offices in Silicon Valley.

### **Impacts of Employer-based Trip Reduction**

#### *Effect Size*

While there have been several studies of the effectiveness of employer-based trip reduction programs at reducing vehicle trips and/or increasing the share of alternative

modes, only a few have estimated reductions in vehicle miles travelled (VMT) or GHG emissions, either for employees in the program or, even less commonly, for a region or metropolitan area. This brief focuses on four such studies (Table 1), but relevant insights from other studies are also discussed. Most studies examine State-mandated employer commute trip reduction programs, which typically apply to large firms in highly populated urban regions.

Overall, the evidence suggests that employer-based trip reduction programs can potentially reduce total commute VMT for employees at participating work sites by 4 percent to 6 percent, while total peak-hour reductions for an entire metropolitan region are closer to 1 percent (Table 1). One study found that employees participating in the program had 4.2 to 4.8 percent lower VMT than employees at the same worksite who did not participate, suggesting a much lower reduction in total VMT for the worksite than other studies (Herzog et al., 2006).

*Table 1: Summary of Employer-Based Trip Reduction Studies*

Study	Study Location	Study Year(s)	Results	
			Effect Type	Effect Size
<b>Lagerberg (1997)</b>	9 most populous counties in Washington State	1993-1995	VMT from commute trips at participating work sites	6% reduction
<b>Hillsman et al. (2001)</b>	Seattle metropolitan area	1999	Total VMT, a.m. peak  Freeway VMT, a.m. peak	1.33% reduction  1.07% reduction
<b>CTR Task Force 2005 Report</b>	9 most populous counties in Washington State	2005	VMT from commute trips at participating worksites	5.9% reduction
<b>Herzog et al. (2006)</b>	Denver, Houston, San Francisco, and Washington, D.C. metropolitan areas	2004	Commute VMT, participants compared to reference group at same work site	4.16% to 4.79% reduction

Washington State passed a commute trip reduction law in 1991, which requires firms with work sites of more than 100 employees to implement employer-based trip reduction programs. The evidence suggests that in Washington State commute VMT is reduced by 6 percent on average for employees at the work sites in the commute trip reduction program (see, e.g., CTR Task Force 2005 Report to the Washington State Legislature and Lagerberg, 1997).

A study of voluntary employer-based trip reduction, which includes San Francisco, (Herzog et al., 2006) found similar VMT reductions (4.16 to 4.79 percent) among employees offered an array of trip reduction benefits when comparing employees who participated in trip reduction programs with a reference group of employees at the same work site who did not participate.

At least one study of individual employers has shown changes in mode share that suggest the possibility of more substantial changes in VMT. Genentech, in South San

Francisco, has commuter drive-alone rates that are 21 percent below standard suburban rates, likely due to the company's broad menu of trip reduction incentives, some of which date to at least the early 1990s, as well as local infrastructure that enables the use of alternative modes (Nelson\Nygaard, 2008). An impact of that magnitude likely represents a high end or upper bound of what could be expected at an individual work site. In contrast, a study of employer-based programs in the Los Angeles region found that solo driving rates declined only 6.3 percent at the worksites studied (Giuliano et al., 1993).

Only two studies estimated VMT reduction for the entire region or metropolitan area. Hillsman et al. (2001) used survey data from firms on the number of commute trips eliminated by Washington State's commute trip reduction (CTR) program to estimate the declines in total VMT (1.33 percent) and freeway VMT (1.07 percent) for the four central counties in metropolitan Seattle. That is a smaller impact than other studies because the authors examined all travel during the morning peak, including commute trips to non-participating sites as well as non-commute trips. The CTR Task Force 2005 Report, using different years in the same data set analyzed by Hillsman et al. (2001), estimated a 1.6 percent reduction in total VMT.

Several studies suggest that the more effective programs offer a broader array of assistance and incentives, including financial incentives for employees (e.g. Dill and Wardell, 2007; Herzog et al., 2006). Because most programs include more than one type of assistance or incentive, it is difficult to isolate the effect of individual strategies.

No recent studies provide direct evidence of the effects of vanpool programs on VMT. A review that looked at changes in vehicle trip rates resulting from 12 trip reduction programs that, among other options, included employer-sponsored vanpools, found that the effects of the entire program ranged from no change at one company, to a reduction in vehicle trips of 34.5 percent at another (Kuzmyak et al., 2005). As noted by another review, not all vanpool riders shift from driving alone: in a demonstration program in the Bay Area in the 1970s, as much as 50 percent of riders shifted from transit and 35 percent from carpooling (Evans and Pratt, 2005). The new employer-sponsored bus services have not yet been evaluated as to their impacts on VMT, though one study suggests that such services encourage employees to live farther from work than they otherwise would (Dai and Weinzimmer, 2014).

### *Evidence Quality*

The trip reduction programs that were mandated by State governments (Washington State since 1991 and California pre-1996 in the studies reviewed here) required employers to collect data on employee commute patterns, providing opportunities for before-and-after analyses, either for individual employees or more commonly for firms or work sites (e.g. Giuliano, Hwang, and Wachs, 1991; Lagerberg, 1997; and CTR Task Force 2005 Report). Most of the studies in Table 1 estimated commute reduction by examining changes in commute mode share, combined with survey data on commute distance. With the exception of Herzog et al. (2006), the studies did not use control

groups. As Higgens (1996) discusses, control groups are preferable to simple before-and-after comparisons of program participants because before-after comparisons cannot control for changes in the overall environment (e.g. gas prices or transit fares) that might influence commuting behavior during the study period. The evidence from both mandated trip reduction programs (e.g. Lagerberg, 1997; CTR Task Force 2005 Report; Hillsman, Reeves, and Blaine, 2001) and voluntary programs (Herzog et al. 2006) gives consistent estimates.

### *Caveats*

With the exception of the most recent evaluation of Washington State's program in 2005, there is little evidence on the effectiveness of mandated trip reduction programs in an era of high gasoline costs, such as the \$3 to \$4 per gallon prices of the past few years. There is no evidence on the effect of mandated employee trip reduction for work sites smaller than 100 employees. There is, however, some evidence showing that employees at smaller worksites are less likely to use vanpools, presumably because vanpooling and other shared rides are easier to implement when the program can draw from a large employee pool (Concas et al., 2005). Transit access and bicycle/pedestrian amenities have been shown to influence the effect of trip reduction programs on vehicle trips (Dill and Wardell, 2007): sites with high transit access had double the reduction in vehicle trips of sites with low transit access in one study (Kuzmyak et al., 2005).

Another complicating factor is induced travel (Lagerberg, 1997). As some commute trips are removed from the street and highway network, the associated reduction in traffic congestion might encourage other people to take trips during peak hours that would have otherwise been shifted to different times of day, non-car modes, and alternate routes. Therefore, VMT reduction for a region overall might be lower than the reduction in commuting VMT at participating work sites.

### **Greenhouse Gas Emissions**

The CTR Task Force 2005 Report estimated that Washington State's employer-based trip reduction (ETR) program reduced statewide carbon dioxide equivalent emissions from motor vehicles by 0.2 percent to 0.6 percent, even though the ETR program was required in only nine of the State's 39 counties. Using a simulation model, Herzog et al. (2006) found carbon dioxide emissions declined by 4.11 percent to 4.74 percent for participants of employer-based trip reduction programs compared to a reference group at the same work site. Any induced travel effects would at least partially offset these reductions. Note that for vanpool programs, reductions in emissions are likely to be less than reductions in VMT, as vans generally have higher emissions rates than cars.

### **Co-Benefits**

The purpose of employer-based trip reduction programs is to provide incentives for employees to switch from solo driving to other commuting modes. Co-benefits of this

switch typically include reduced parking requirements and cost, increased use of transit, bicycle, and walking commuting, and (due to reductions in solo driving) reductions in traffic congestion, automobile emissions, and air pollution. Mode shifts and reductions in commute vehicles arriving at the work site have been documented by many studies, for example, Dill and Wardell (2007) in Portland, Oregon as of 2006, Concas et al. (2005) for Seattle, Washington, and the studies cited in Table 1. When employees shift to non-motorized commute modes, co-benefits could also include improvements in health resulting from increases in physical activity. Co-benefits can also include reductions in criteria pollutants, as documented by Georggi et al. (2007).

## Examples

In California, the South Coast Air Quality Management District implemented a commute trip reduction program, Regulation XV, in 1988 requiring employers with work sites of more than 100 employees to develop employee trip reduction plans. Firms could choose elements of the plans, but were required to file reports detailing the plan and, after the initial reporting period, to report on employee commuting patterns annually. In 1995, State legislation prohibited air districts or other public agencies from mandating employer trip reduction programs unless such mandates are required by federal law.

In 2008, Assembly Bill 2522 passed allowing the San Joaquin Valley Air District to develop a commute trip reduction program, implemented in late 2009 as Rule 9410. This program is similar to other employee based trip reduction efforts: firms design their own programs which are intended to provide alternatives to solo commuting, and employees are not required to choose any particular commute mode but instead have the option of whether or not to use alternatives to solo driving. See [http://www.valleyair.org/Programs/Rule9410TripReduction/eTRIP\\_main.htm](http://www.valleyair.org/Programs/Rule9410TripReduction/eTRIP_main.htm).

In 2013, the Bay Area Air Quality Management District (BAAQMD) developed the Bay Area Commuter Benefits Program in collaboration with the Metropolitan Transportation Commission. The program was adopted by the BAAQMD as Regulation 14, Rule 1 and was included in the region's Sustainable Communities Strategy adopted in 2013. Under this program, administered by 511.org, employers with 50 or more employees are required to offer commuter benefits to their employees. Employers may choose from one of four options, as shown in Table 2.

*Table 2: Options for Employers in the Bay Area Commuter Benefits Program*

Option 1	Allow employees to exclude their transit or vanpool costs from taxable income, to the maximum amount, as allowed by federal law (currently \$130 per month).
Option 2	Employer-provided transit or vanpool subsidy up to \$75 per month.
Option 3	Employer-provided free or low cost bus, shuttle or vanpool service operated by or for the employer.
Option 4	An alternative employer-provided commuter benefit that is as effective as in reducing single occupant vehicles as Options 1-3.

Source: <https://commuterbenefits.511.org/#options>

## References

- CTR Task Force 2005 Report to the Washington State Legislature, available at [http://www.wsdot.wa.gov/NR/rdonlyres/172087A9-85D1-416B-86C4-33281C7BDE68/0/CTR\\_Report\\_05.pdf](http://www.wsdot.wa.gov/NR/rdonlyres/172087A9-85D1-416B-86C4-33281C7BDE68/0/CTR_Report_05.pdf), accessed Apr. 18, 2010.
- Chan, N. D. and Shaheen, S. A. (2012). Ridesharing in North America: Past, Present, and Future. *Transport Reviews* 32(1), pp. 93-112.
- Concas, Sisinnio, Philip L. Winters, and Francis W. Wambalaba. 2005. Fare Pricing Elasticity, Subsidies, and Demand for Vanpool Services. *Transportation Research Record* 1924, 215-223.
- Dai, Danielle and David Weinzimmer. 2014. Riding First Class: Impacts of Silicon Valley Shuttles on Commute & Residential Location Choice. Report No. UCB-ITS-WP-2014-01, Institute of Transportation Studies, University of California, Berkeley.
- Dill, Jennifer and Erin Wardell. 2007. Factors Affecting Worksite Mode Choice: Findings from Portland, Oregon. *Transportation Research Record* 1994, 51-57.
- Georggi, Nevine Labib, Phil Winters, Sachin Rai, and Liren Zhou. 2007. Measuring the Impacts of Employer-based Transportation Demand Management Programs on an Interstate Corridor. *Journal of Public Transportation* 10 (4), 51-78.
- Giuliano, Genevieve, Keith Hwang, and Martin Wachs. 1993. Employee Trip Reduction in Southern California: First Year Results. *Transportation Research A* 27 (2), 125-137.
- Herzog, Erik, Stacey Bricka, Lucie Audette, and Jeffra Rockwell. 2006. Do Employee Commuter Benefits Reduce Vehicle Emissions and Fuel Consumption? Results of Fall 2004 Survey of Best Workplaces for Commuters. *Transportation Research Record* 1956, 34-41.
- Hillsman, Edward L., Paula Reeves, and Larry Blain. 2001. Estimation of Effects of Washington State's Trip-Reduction Program on Traffic Volumes and Delays: Central Puget Sound Region. *Transportation Research Record* 1765, 16-19.
- Kuzmyak, J. Richard, John E. Evans IV, and Richard H. Pratt. 2005. *Traveler Response to Transportation System Changes: Chapter 19 – Employer and Institutional TDM Strategies*. TCRP Report 95, Transportation Research Board, Washington, DC.
- Lagerberg, Brian. 1997. Washington State's Commute Trip Reduction Program: Phase 1: Assessment and Implications for Program Design. *Transportation Research Record* 1598, 36-42.

Nelson\Nygaard. 2008. *South San Francisco Mode Share and Parking Report for Genentech, Inc.*

### **Acknowledgements**

This document was produced through an interagency agreement with the California Air Resources Board with additional funding provided by the University of California Institute of Transportation Studies MultiCampus Research Program on Sustainable Transportation and the William and Flora Hewlett Foundation.