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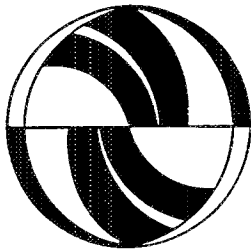
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**Evaluating the Effects of Parking Cash Out:
Eight Case Studies**

Donald C. Shoup

Working Paper
UCTC No. 377

**The University of California
Transportation Center**

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Berkeley, CA 94720

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Evaluating The Effects of Parking Cash Out: Eight Case Studies

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September 1997*

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The University of California Transportation Center
University of California at Berkeley

EVALUATING THE EFFECTS OF PARKING CASH OUT: EIGHT CASE STUDIES

Final Report

Award No. 93-308

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EVALUATING THE EFFECTS OF PARKING CASH OUT: EIGHT CASE STUDIES

ABSTRACT

In 1992, California enacted legislation (AB 2109, KATZ) that requires many employers to offer employees the option to choose cash in lieu of any parking subsidy offered.

This report presents eight case studies of employers who have complied with California's cash-out requirement. One employer is a government agency, and the other seven are private firms, including three law firms, one accounting firm, one bank, one managed-care medical provider, and one video post-production company. They range in size from 120 to 300 employees, with a combined total of 1,694 employees. The price of parking at the worksites ranged from \$36 to \$165 a month.

After cashing out, solo driving to work fell by 17 percent. Carpooling increased by 64 percent. Transit ridership increased by 50 percent. Walking and bicycling increased by 33 percent. Commuter parking demand fell by 11 percent.

These mode shifts reduced total vehicle miles traveled for commuting by 12 percent, with a range from 5 to 24 percent for the eight firms. To put this reduction into perspective, reducing VMT for commuting by 12 percent is equivalent to removing from the road one of every eight automobiles used for driving to work. In total, cashing out reduced 1.1 million VMT per year.

Cashing out reduced total vehicle emissions for commuting by 12 percent, with a range from 5 to 24 percent for the eight firms. To put this reduction into perspective, reducing vehicle emissions by 12 percent is equivalent to eliminating vehicle emissions for automobile commuting from January 1 to February 13 every year.

The eight employers' average commuting subsidy per employee increased from \$72 a month before complying with the cash-out requirement to \$74 a month after complying with the cash-out requirement. The employer's commuting subsidy declined by \$70 per employee per month at one firm, and increased by an average of \$13 per employee per month at the other seven firms, with a range from \$8 to \$33 more per employee per month.

Employers praised the cash option for its simplicity and fairness, and said that it helped to recruit and retain employees. In summary, these eight case studies show that cashing out employer-paid parking can benefit commuters, employers, taxpayers, and the environment.

EVALUATING THE EFFECTS OF PARKING CASH OUT: EIGHT CASE STUDIES

Donald C. Shoup

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EVALUATING THE EFFECTS OF PARKING CASH OUT: EIGHT CASE STUDIES

Donald C. Shoup

I. BACKGROUND--CALIFORNIA'S CASH-OUT LAW

Employers in the United States provide 85 million free parking spaces for commuters. Ninety-one percent of commuters travel to work by automobile, 95 percent of automobile commuters park free at work, and 92 percent of the automobiles driven to work have only one occupant ¹

In 1992, California enacted legislation--Assembly Bill 2109 (Katz, Chapter 552, Statutes of 1992)--that requires many employers to change the way they subsidize commuter parking. The Legislature declared,

- Federal, state, and local policies encourage employers to subsidize commuter parking.
- Most employers subsidize parking, but do not subsidize other commuting options.
- Employer-paid parking encourages commuters to drive to work alone.
- Solo driving contributes to traffic congestion and air pollution.

To deal with these problems, Assembly Bill 2109 requires many employers who subsidize commuter parking also to offer a "parking cash-out program." As defined in the law,

"Parking cash-out program" means an employer-funded program under which an employer offers to provide a cash allowance to an employee equivalent to the parking subsidy that the employer would otherwise pay to provide the employee with a parking space. . . . "Parking subsidy" means the difference between the out-of-pocket amount paid by an employer on a regular basis in order to secure the availability of an employee parking space not owned by the employer and the price, if any, charged to an employee for the use of that space (California Health and Safety Code Section 43845).

The cash-out law applies to employers who:

- employ at least 50 persons;
- subsidize commuter parking in parking spaces they do not own;
- can reduce the number of parking spaces they lease without penalty in any lease agreement,
- are located in an air basin that is designated as "nonattainment" for any California air quality standard.

Offering commuters the choice between a parking subsidy or its cash value makes it clear that even free parking has a cost, the foregone cash. Commuters who forego the cash are in effect spending it on parking. The foregone cash is a new price for taking the free parking, a price that increases the perceived cost of driving to work. Therefore, some commuters who now drive to work

alone will take the cash and begin to rideshare (Throughout this report the term *rideshare* refers to any form of commuting other than solo driving)

California's cash-out law does not require employers to subsidize ridesharing, and does not require an employer to adopt any particular subsidy policy. The cash-out requirement is best understood as a test that each affected employer's subsidy policy must pass. A policy will pass the test if it subsidizes the alternatives to parking (such as transit, walking, or cycling) as much as it subsidizes parking. A policy will fail the test only if it subsidizes parking more than it subsidizes the alternatives.

Many commuter subsidy policies comply with California's cash-out requirement. For example, an employer can comply with the cash-out requirement by offering an employee any of the following

- No parking subsidy
- A parking subsidy only for carpools
- The choice between a parking subsidy or its cash value
- The choice between a parking subsidy or more than its cash value
- A commuting allowance that can be spent on any form of commuting

Cashing out is likely to increase ridesharing, but the law does not require employees to rideshare. The law simply requires employers in certain circumstances to offer commuters the option to choose cash in lieu of any offered parking subsidy

California's cash-out requirement applies only to parking spaces that employers rent, rather than own.² To investigate how many commuters park free in spaces that employers rent, Shoup and Breinholt (1995) conducted a nationwide survey of employers' parking policies. We estimated that firms provide 84.8 million free parking spaces, of which they rent 19.5 million (23 percent), and own 65.3 million (77 percent). Firms with fewer than 50 employees rent 16.2 million parking spaces (83 percent of all rented spaces) for their employees, while firms with 50 or more employees rent 3.3 million spaces (17 percent). California's cash-out requirement does not affect firms with fewer than 50 employees, but (nationwide) these firms provide almost five times more free parking in rented spaces than do firms with 50 or more employees.

California's cash-out requirement applies only to rented parking spaces that are priced separately--not "bundled" with any other lease agreement "at no extra cost." In 1996 the South Coast Air Quality Management District (SCAQMD) commissioned a survey of 417 firms' parking arrangements in Southern California (PCR 1996). Of the forty-nine firms that rented parking spaces and reported their lease arrangements, 55 percent reported that the parking spaces were included (bundled) in the cost of the office spaces they leased. Twenty-nine percent reported that the parking was leased separately (unbundled) from their office space, and 6 percent reported that the parking was included in the lease for office space, but that the cost of parking was separate from the cost of office space (unbundled). Another 10 percent of firms reported "other" arrangements. Thus, between 35

and 45 percent of the rented parking spaces were unbundled. Of the firms that rented parking spaces, 88 percent reported that they could reduce the number of parking spaces leased with no penalty.

II. SUMMARY OF EIGHT CASE STUDIES

Because California has not yet begun to enforce the cash-out requirement, and because of possible complications with the federal Internal Revenue Code, few employers have changed their subsidy policies to comply with the cash-out requirement. This report presents eight case studies of employers who have changed their subsidy policies and now comply with the cash-out requirement.

Although the case study firms are not a random sample of employers in Southern California, they include most of the known population of employers who have complied with the state's cash-out requirement for long enough to provide data on travel behavior before and after coming into compliance. Employers who have changed their subsidy policies to comply with the requirement may be unrepresentative of all employers, and their employees may be unrepresentative of all commuters, so these early outcomes may also be unrepresentative of what will occur when other employers cash out their parking subsidies. Nevertheless, there is much to learn from the experience of employers who have already changed their subsidy policies.

Of the eight employers one is a government agency. The other seven employers are private firms, including three law firms, one accounting firm, one bank, one managed-care medical provider, and one video post-production company. They range in size from 120 to 300 employees, and they have a total of 1,694 employees.

All of the employers are in Southern California. Two are in downtown Los Angeles, three are in Century City (a high-density regional employment center in West Los Angeles), two are in Santa Monica, and one is in West Hollywood. The price of parking at the worksites ranged from \$36 to \$165 a month.

A narrow conception of California's cash-out requirement is that, to comply, an employer must offer employees the option to choose a cash payment equal to the parking subsidy the employer already offers them. In reality, only two employers did this when they changed their subsidy policies. The other six employers went beyond minimal compliance by subsidizing the alternatives to parking more than they subsidized parking.

Two employers did not subsidize all the alternatives equally, but instead subsidized public transit or vanpooling more than they subsidized other alternatives. Two employers reduced parking subsidies, and one employer ended parking subsidies. These varied subsidy changes in the eight case studies show that California's cash-out requirement offers flexibility to employers, **so long as they subsidize the alternatives to parking as much as they subsidize parking**.

The wide range of adopted policies that comply with California's cash-out requirement suggests that cashing out is not one fixed policy. Accordingly, the terms *complying with California's cash-out requirement* and *cashing out* are used interchangeably throughout this report

For each case study we have examined how cashing out affects each of the following

- Commuter mode shares
- Vehicle trips to work
- Vehicle miles traveled to work
- Vehicle emissions for work trips
- Gasoline consumption for work trips
- Employers' spending for subsidizing commuting

CASE STUDY METHODOLOGY

The case study firms were identified in consultation with Commuter Transportation Services (now Southern California Rideshare), a regional agency that assists nearly 5,000 employer sites with rideshare programs. In addition, the City of Santa Monica enforces the state's cash-out requirement as part of its Transportation Management Plan Ordinance; the city's Transportation Management Office provided the data for the two case studies in Santa Monica.

All data for the case studies were taken from the employers' Trip Reduction Plans submitted annually to the SCAQMD. Until 1996, employers were required to conduct employee transportation surveys in a carefully prescribed manner, and to report the results in a uniform format. These surveys were conducted over a five-day period once a year, and the results are a rich source of information on travel behavior. The employees' response rate was typically above 90 percent. Employers also provided detailed information about every ridesharing incentive they offered.

In each case study the "base" year is the year before the firm began to offer employees the option to cash out their parking subsidies. The mode changes were measured in the first, second, or third year after cashing out was offered, depending on the length of time for which data were available after cashing out. The year "after" cash-out (when the reductions in solo driving were measured) was 1993 for Case Study 2, 1994 for Case Studies 1, 3, 4, and 5, and 1995 for Case Studies 6, 7, and 8.

In addition to analyzing the data for each case study, we interviewed five of the firms' transportation coordinators to obtain their evaluation of their firms' experience with cashing out. Appendix 1 contains the transcripts of the interviews with the firms' transportation coordinators on how cashing out has worked in practice. Appendix 2 describes the case-study methodology in detail, and explains the derivation of every estimated change that occurred after cashing out.

SUMMARY OF TRAVEL CHANGES AFTER CASHING OUT

Table 1 summarizes the travel changes that occurred in the eight case studies after cashing out. The changes are described in terms of the solo driver share, vehicle trips to work, and vehicle miles traveled (VMT) for commuting. The case studies are listed in descending order of their solo share reductions after cashing out. The average figures in the last row refer to the weighted average for all 1,694 employees of the eight employers.

Solo Driver Share

The first panel in Table 1 shows the changes in solo driver share after cashing out. The solo share reductions at the eight firms ranged from a low of 3 to a high of 22 percentage points, with an average reduction of 13 percentage points.³ Figure 1 displays the solo driver shares at the eight firms before and after cashing out.

The smallest solo-share reduction occurred in West Hollywood, where the employer had previously offered commuters the choice between a parking subsidy of \$65 a month, or \$45 a month in cash. The agency then raised the cash offer to \$65 a month, equal to the value of the parking subsidy. Because the agency had previously offered a partial cash out of \$45, and raised the cash offer by only \$20 a month, one would expect the small reduction in solo driving.

The largest solo-share reduction occurred in downtown Los Angeles, where the employer had previously offered parking subsidies ranging from \$90 to \$145 per month, or a transit subsidy of \$15 a month, but nothing for other ridesharers. The employer then began to offer commuters the choice between a parking subsidy of \$100 a month, or \$150 a month in cash. This new subsidy arrangement goes beyond compliance with the cash-out requirement because the firm now subsidizes ridesharing more than parking; therefore, one would expect the large reduction in solo driving.

Figure 2 summarizes the changes in commuter mode shares for all 1,694 employees of the eight firms after cashing out. The solo driver share fell from 76 percent to 63 percent. The carpool share rose from 14 percent to 23 percent, the transit share rose from 6 percent to 9 percent, and the combined walk and bicycle share rose from 3 percent to 4 percent.

Per 100 commuters, cashing out employer-paid parking induced 13 solo drivers to change to another mode. Of these 13 former solo drivers, 9 joined carpools, 3 began to ride transit, and one began to walk or bicycle to work. These mode changes reduced the number of solo drivers by 17 percent, increased the number of carpoolers by 64 percent, increased the number of transit riders by 50 percent, and increased the number who walk or bike to work by 39 percent.

Sixty-nine percent of those who shifted from solo driving began carpooling (most in two-person carpools). The shift toward carpooling at the eight cash-out firms runs counter to the national trend. The carpool share at the eight firms rose from 14 percent before cashing out to 23 percent after

TABLE 1
SUMMARY OF TRAVEL CHANGES AFTER CASHING OUT

Case/Location	Solo Driver Share			Vehicle Trips per Employee per Year			VMT per Employee per Year		
	Before	After	Change	Before	After	Change	Before	After	Change
									Percent Change
5. Downtown L.A.	75%	53%	-22%	353	268	-86	5,297	4,013	-1,284 -24%
8 Downtown L.A.	61%	45%	-16%	352	295	-58	5,281	4,418	-864 -16%
1 Century City	71%	58%	-13%	359	328	-31	5,461	4,862	-599 -11%
4. Century City	88%	76%	-12%	438	398	-40	6,578	6,006	-572 -9%
3 Century City	79%	67%	-12%	408	373	-35	6,113	5,589	-524 -9%
7 Santa Monica	83%	75%	-8%	420	397	-22	6,294	5,960	-334 -5%
6. Santa Monica	85%	78%	-7%	432	394	-38	6,478	5,910	-568 -9%
2 West Hollywood	72%	70%	-3%	279	265	-15	N/A	N/A	N/A
Average	76%	63%	-13%	379	335	-43	5,348	4,697	-652 -12%

Sources: Tables 1-2, 1-3, 1-4, 2-2, 2-3, 3-2, 3-3, 4-2, 4-3, 5-2, 5-3, 6-2, 6-3, 7-2, 7-3, 8-2, and 8-3

FIGURE 1

Solo Driver Share

Before and After Cashing Out
(at the eight case-study firms)

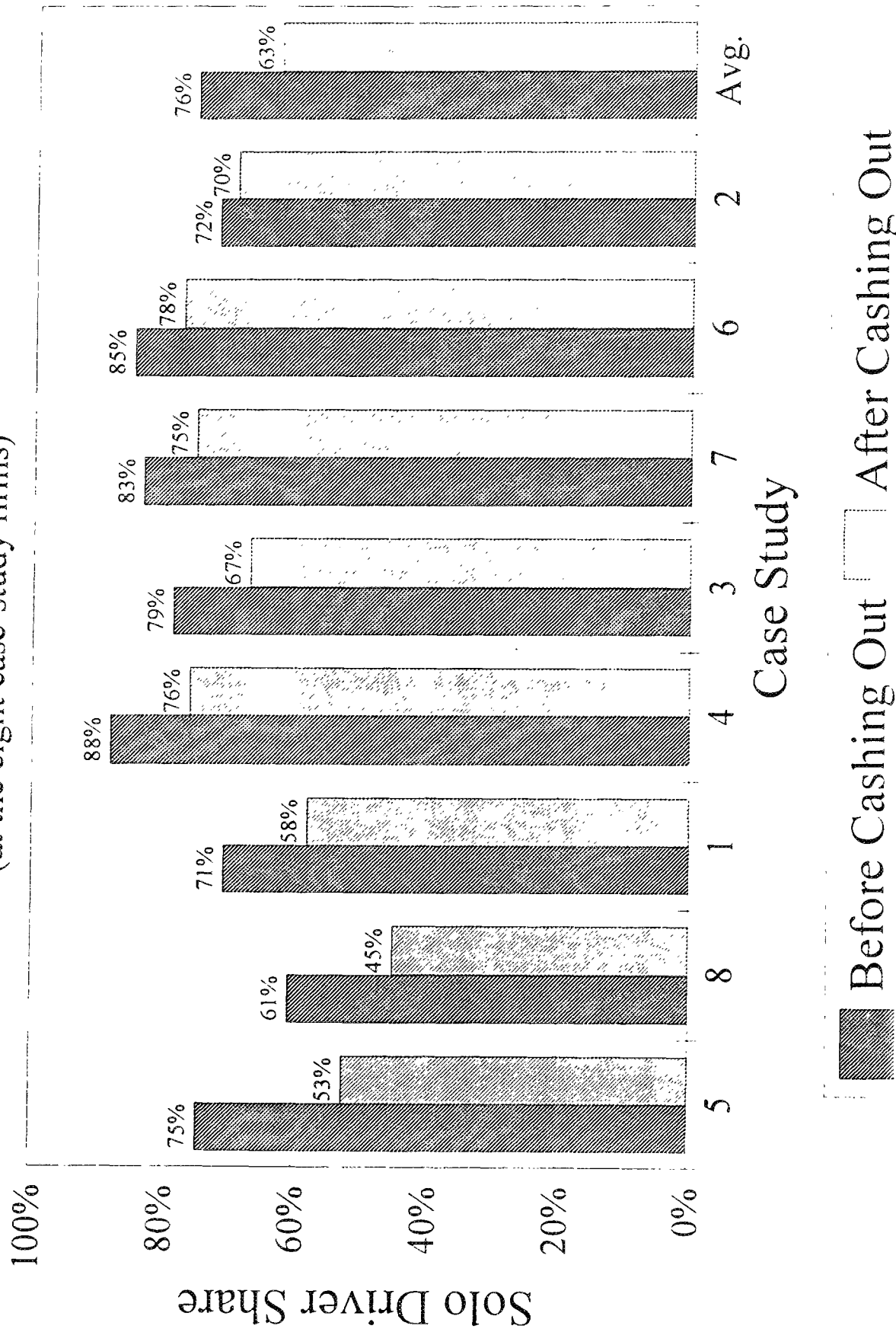
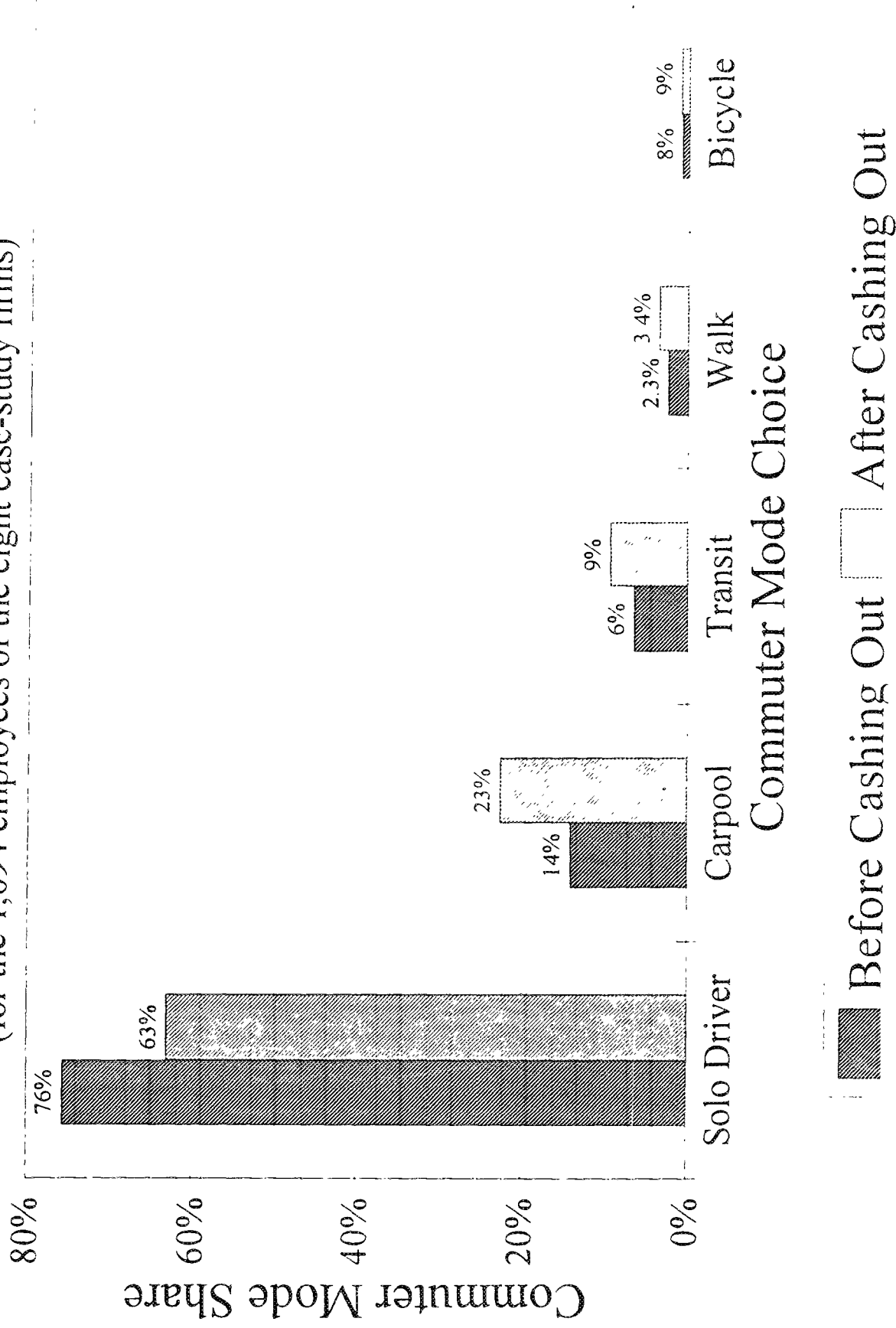


FIGURE 2

Commuter Mode Shares

Before and After Cashing Out

(for the 1,694 employees of the eight case-study firms)



cashing out, while nationwide the carpool share fell from 20 percent in 1980 to 14 percent in 1990.⁴ The sharp increase in carpooling at the eight cash-out firms is therefore especially noteworthy.

Do regional factors rather than cashing out explain these mode shifts? We can answer this question because Commuter Transportation Services conducted annual surveys of commuters in Southern California from 1990 to 1994. Figure 3 displays the commute mode shares they found in these years. The solo driver share in Southern California ranged between 77 and 80 percent, with no downward trend, so regional trends do not explain the decline in solo driver shares at the eight case-study firms.⁵ Before cashing out, the average solo driver share at the eight firms was 76 percent (close to the regional average), and it declined to 63 percent after cashing out.

We have also examined the commuter mode shares for a comparison firm (Case Study 9) that did not cash out its parking subsidies. This firm is an appropriate comparison case because the difference between its parking subsidy and its ridesharing subsidy remained almost unchanged between 1991 and 1995, although it did adopt an array of conventional ridesharing incentives. The firm's solo driver share was 83 percent in both 1991 and 1995. Both the unchanged solo share for Case Study 9, and the rising solo share for all commuters in Southern California between 1990 and 1994 (Figure 3), strengthen the conclusion that cashing out parking subsidies, and not other factors, caused the solo share reductions at the eight firms that cashed out.

The mode shares for commuting to the eight firms before cashing out were almost identical to the nationwide mode shares for commuting to work found in the 1990 Census. Pisarski (1996, 49) reports that, excluding those who work at home, the mode shares for commuting to work in the United States in 1990 were solo driver (75%), carpool (14%), transit (5%), walk plus bicycle (4%). In terms of their commuters' mode shares, the eight case-study firms were therefore quite typical before they cashed out.

Vehicle Trips to Work

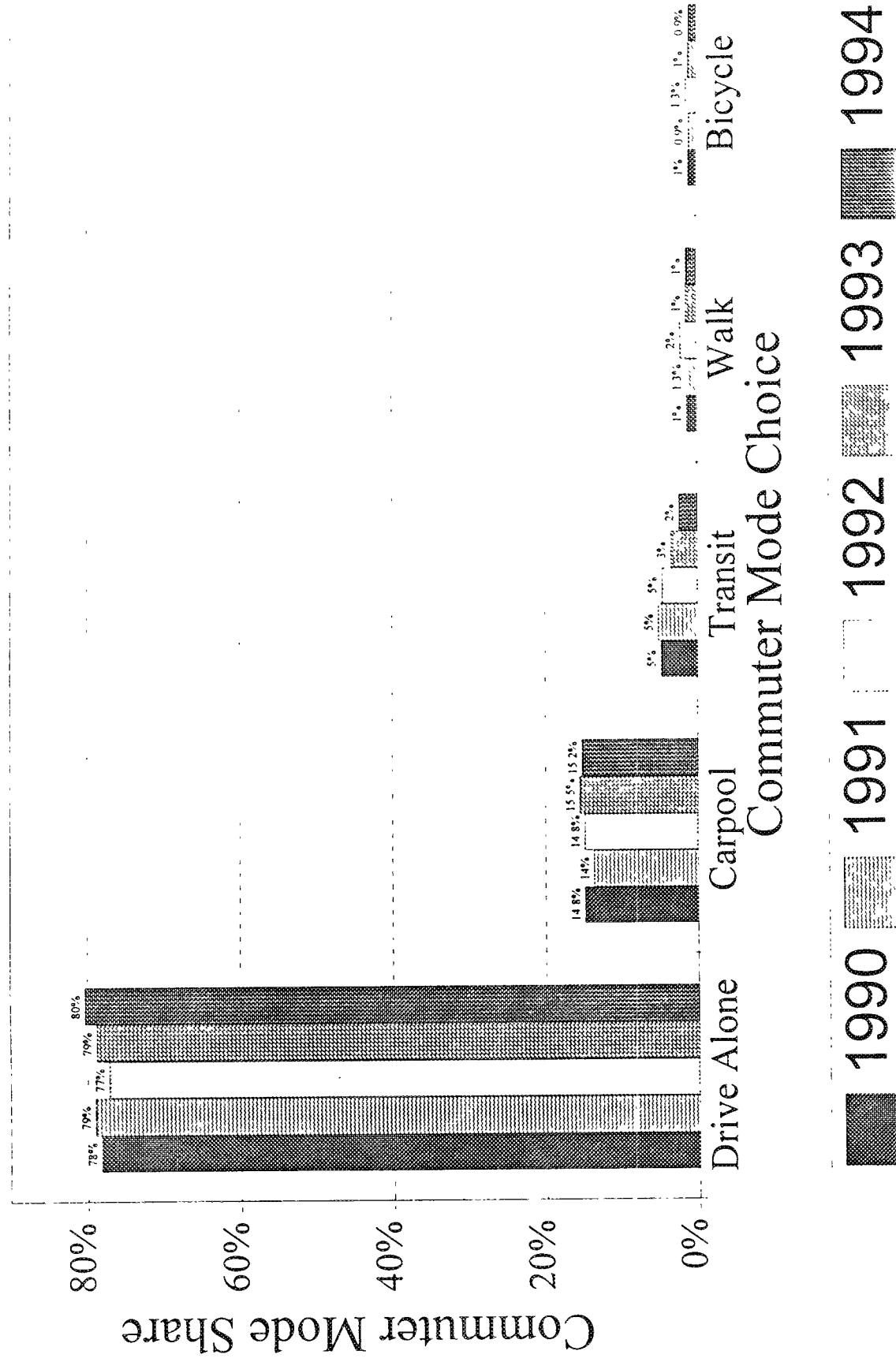
By encouraging ridesharing, cashing out reduced vehicle trips for commuting. The second panel in Table 1 shows how cashing out reduced the number of vehicle trips per employee per year. To obtain the number of vehicle trips, we follow the procedure the SCAQMD uses to calculate vehicle trips. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. (See Appendix 2.)

Because carpoolers and transit riders may drive short access trips to meet their carpool partners or get to a transit stop, the number of vehicle trips reduced by mode shifts to carpooling and transit may be overestimated. However, annual surveys conducted by Southern California Rideshare (published as the "State of the Commute" report) suggest additional access trips by carpoolers are not a significant disadvantage of cashing out parking subsidies. Of all two-person carpools who are not

FIGURE 3

Commuter Mode Choice

In Southern California: 1990 - 1994



from the same household, 72 percent reported no travel out of the way on the home end of the trip, and 84 percent reported no travel out of the way on the work end of the trip

Because carpoolers and transit riders who do not have their vehicles available at work may make fewer vehicle trips at work during lunchtime, the number of vehicle trips reduced by carpooling may also be underestimated. The two factors (more access trips but fewer trips during lunchtime) are offsetting, and it is unclear whether the net effect is to overestimate or underestimate the resulting reduction in vehicle trips when commuters shift from solo driving to carpools

At the eight firms, commuters made from 15 to 86 fewer vehicle trips per employee per year, with an average of 43 fewer vehicle trips per employee per year. This figure of 43 fewer vehicle trips is per employee offered the cash option (all 1,694 employees), not per employee whose mode choice changed because of the cash option

In percentage terms, the reduction in vehicle trips ranged from a low of 5 percent in West Hollywood to a high of 24 percent in downtown Los Angeles. On average, cashing out reduced vehicle trips to work by 11 percent, and thus also reduced the demand for parking at work by 11 percent.

The rank-ordering of reductions in vehicle trips is generally the same as the rank-ordering of reductions in solo shares. A notable exception is the ordering of Case Studies 6 and 7, both in Santa Monica. Case 6 had a smaller reduction in solo share but a larger reduction in vehicle trips than Case 7. The new mode choices of former solo drivers explain this anomaly. In Case 6, most of the former solo drivers shifted to transit, walking, and bicycling, so vehicle trips declined by almost as much as the solo share declined. In Case 7, most of the former solo drivers shifted to carpooling, so vehicle trips declined by less than the decline in the solo share.⁶

Vehicle Miles Traveled to Work

By reducing the number of vehicle trips, cashing out reduced the number of vehicle miles traveled (VMT) for commuting. We follow the SCAQMD's procedure to calculate how cashing out reduces VMT. In calculating VMT reductions, the SCAQMD assumes that the average one-way distance for each avoided automobile trip is 15 miles. The Southern California Association of Governments (1993) found this average 15-mile commute distance in a 1991 travel survey for all commuters in the South Coast Air Basin. Other evidence also suggests that the average one-way trip distance is close to 15 miles. In its annual surveys conducted between 1989 and 1994, Commuter Transportation Services (1994) found average one-way trip distances that ranged from 14.8 and 16.5 miles. VMT per employee is derived by multiplying the number of vehicle trips per employee per day by an average 30-mile round trip to work.

When commuters join carpools, they may have to drive a more circuitous route to work than if they drove solo. If travel circuitry is a serious problem with carpooling, the method we have used to calculate VMT will underestimate the VMT by carpoolers, and will therefore overestimate the

VMT reduced when commuters shift from solo driving to carpooling. We have investigated this issue, and find that it is inconsequential. (See Appendix 2, Table A-1)

The third panel of Table 1 shows the VMT reductions that occurred after cashing out. At the eight firms, commuters drove from 334 to 1,284 fewer VMT per employee per year, with an average of 652 fewer VMT per employee per year. The reductions in VMT ranged from 5 to 24 percent, with an average of 12 percent fewer VMT per employee per year.

This estimate of a 12-percent average VMT reduction after cashing out is conservative because it measures only short-term effects. Cashing out is a new practice, and few employers have sufficient years of experience to provide evidence of the long-term effects. One employer (Case Study 3) began to offer the option to take cash in lieu of a parking subsidy in 1991, however, and did not change its subsidy policy after that time, so we can measure the continuing impact during the following three years. The solo driver share fell in each successive year. When we discussed this result with transportation coordinators, they offered an important practical explanation for this continuing decline in solo driving.

Encouraging new employees to try ridesharing is much easier after cashing out has been implemented. New employees have not already become fixed in their commuting choices, and are more willing to try alternatives to solo driving if they have the cash option. Second, when cashing out is available, word of mouth spreads the idea among fellow employees. Those who have taken the cash describe the deal to others, and a few more begin to try it. Therefore, the normal patterns of employee turnover and word of mouth can subsequently augment the initial shift toward ridesharing after employers offer cash. Because six of our eight case studies examined the responses after only one or two years of cashing out, they may underestimate the long-term reductions in vehicle travel.

SUMMARY OF TOTAL TRIPS AND VMT REDUCED

Table 2 shows the total reductions in vehicle trips and VMT for all 1,694 employees of the eight firms. The total reduction at each firm is calculated by multiplying the firm's reduction per employee by firm's number of employees. The total reduction for all eight firms is calculated by adding together the totals for each firm.

Cashing out reduced 73,500 vehicle trips per year for commuting to the eight firms, an 11 percent reduction. Cashing out also reduced 1.1 million VMT per year for commuting to the eight firms, a 12 percent reduction. To put this result into perspective, reducing VMT for commuting by 12 percent is equivalent to removing from the road one of every eight automobiles used for driving to work.

SUMMARY OF EMISSIONS REDUCTIONS

By reducing vehicle trips and VMT, cashing out reduced vehicle emissions. Table 3 shows for the eight firms the emissions reductions per employee per year for reactive organic gases (ROG).

TABLE 2

SUMMARY OF TOTAL TRIP AND VMT REDUCTIONS PER YEAR

Case/Location	Number of Employees	Total Vehicle Trips Reduced		Total VMT Reduced	
		Number	Percent Change	Number	Percent Change
5. Downtown L.A.	281	-24,047	-24%	-360,709	-24%
8. Downtown L.A.	285	-16,414	-16%	-246,215	-16%
1. Century City	257	-7,957	NA	-153,986	NA
4. Century City	191	-7,562	-9%	-111,739	-9%
3. Century City	120	-4,191	-9%	-62,870	-9%
7. Santa Monica	300	-6,682	-5%	-100,227	-5%
6. Santa Monica	121	-4,582	-9%	-68,730	-9%
2. West Hollywood	139	-2,064	-5%	N/A	N/A
Total	1,694	-73,500	-11%	-1,104,476	-12%
Average (per Firm)	212	-9,187	-11%	-138,059	-12%
Average (per Employee)		-43	-11%	-652	-12%

The total reduction for each firm is calculated by multiplying the number of employees for the firm by the reductions per employee reported in Table 2. The total reduction for all firms is calculated by adding together the totals for each firm.

Sources: Tables 1-3, 1-4, 2-3, 3-3, 4-3, 5-3, 6-3, 7-3, and 8-3.

TABLE 3
SUMMARY OF EMISSIONS REDUCTIONS AFTER CASHING OUT
(Pounds per Employee per Year)

Case/Location	Reactive Organic Gases		Nitrogen Oxides		Carbon Monoxide		Particulate Matter	
	Change	Percent Change	Change	Percent Change	Change	Percent Change	Change	Percent Change
5. Downtown L.A.	-3.6	-24%	-3.0	-24%	-32.3	-24%	-2.1	-24%
8 Downtown L.A.	-2.3	-16%	-1.9	-16%	-20.1	-16%	-1.4	-16%
1. Century City	-1.5	-10%	-1.4	-11%	-13.8	-10%	-1.0	-11%
4 Century City	-1.6	-9%	-1.4	-9%	-14.8	-9%	-1.0	-9%
3. Century City	-1.5	-9%	-1.2	-9%	-13.2	-9%	-0.9	-9%
7. Santa Monica	-0.9	-5%	-0.7	-5%	-7.8	-5%	-0.6	-5%
6 Santa Monica	-1.5	-9%	-1.3	-9%	-13.2	-9%	-0.9	-9%
2 West Hollywood	-0.2	-5%	-0.1	-5%	-2.2	-5%	N/A	N/A
Average	-1.8	-12%	-1.5	-12%	-15.9	-12%	-1.1	-12%

Sources: Tables 1-5, 2-4, 3-4, 4-4, 5-4, 6-4, 7-4, and 8-4.

nitrogen oxides (NO_x), carbon monoxide (CO), and inhalable particulate matter less than 10 microns in diameter (PM10)

The emissions reductions are calculated by considering the reductions in both automobile *trips* and *VMT*. Pollution emissions are caused at the beginning and end of each automobile commute trip by the "cold start" as the engine warms up and the "hot soak" as the engine cools down, these "trip-end" emissions are independent of the total distance traveled for the commute. The "running" emissions are a function of total VMT for the trip.

We have already estimated the reductions in vehicle trips and VMT. We multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting, using emission factors specific to the year in which the reductions were estimated. The emissions per trip-end and per VMT in 1994 were taken from the ARB's EMFAC7F1.1/B7F model (see the table of emission factors in Appendix 2).

The EMFAC7F1.1/B7F model was the source of emission factors when the emissions reductions shown in Table 3 were estimated. The ARB has since released the EMFAC7F1.1/B7G model, which shows higher emission factors. Using the emissions factors from the 7G model would increase by 12 percent the estimate of vehicle emissions reduced after cashing out, compared to the estimates of vehicle emissions reduced in Table 3. The procedure used here (with lower emissions factors from the older 7F model) therefore produces a conservative estimate of emissions reductions after cashing out.

Table 4 shows the total reductions in vehicle emissions for commuting. Cashing out reduced the average vehicle emissions by 5 to 24 percent per employee per year, with an average reduction of 12 percent. Cashing out eliminated a total of 3,027 pounds of ROG, 2,558 pounds of NO_x, 26,997 pounds of CO, and 1,826 pounds of PM10 per year for automobile commuting. Cashing out reduced the average emissions per employee per year by 1.8 pounds of ROG, 1.5 pounds of NO_x, 15.9 pounds of CO, and 1.1 pounds of PM10 per employee per year, or by 12 percent.

To put this 12 percent emissions reduction into perspective, the vehicle emissions for commuting in one month are 8.3 percent (1/12) of the vehicle emissions for commuting in a year. Therefore, in a year, cashing out parking subsidies eliminated more than a month's worth of vehicle emissions for commuting. To be exact, reducing vehicle emissions for automobile commuting by 12 percent is equivalent to eliminating vehicle emissions for automobile commuting from January 1 to February 13, every year.

SUMMARY OF REDUCTIONS IN GASOLINE CONSUMPTION AND CO₂ EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and CO₂ emissions. Table 5 shows these results. At the eight firms, cashing out saved between 13 and 51 gallons of gasoline per employee per year, with an average saving of 26 gallons a year. Cashing out reduced CO₂

TABLE 4
SUMMARY OF TOTAL EMISSIONS REDUCTIONS
(Pounds per Year)

Case/Location	Number of Employees	Reactive Organic Gases		Nitrogen Oxides		Carbon Monoxide		Particulate Matter	
		Change	Percent Change	Change	Percent Change	Change	Percent Change	Change	Percent Change
5 Downtown L.A.	281	-1,012	-24%	-852	-24%	-9,071	-24%	-596	-24%
8 Downtown L.A.	285	-649	-16%	-551	-16%	-5,730	-16%	-407	-16%
1. Century City	257	-397	-10%	-349	-11%	-3,550	-10%	-255	-11%
4 Century City	191	-315	-9%	-265	-9%	-2,826	-9%	-185	-9%
3 Century City	120	-176	-9%	-149	-9%	-1,581	-9%	-104	-9%
7. Santa Monica	300	-264	-5%	-224	-5%	-2,332	-5%	-166	-5%
6. Santa Monica	121	-181	-9%	-154	-9%	-1,600	-9%	-114	-9%
2. West Hollywood	139	-33	-5%	-14	-5%	-308	-5%	N/A	N/A
Total	1,694	-3,027	-12%	-2,558	-12%	-26,997	-12%	-1,826	-12%
Average (per Firm)	212	-378	-12%	-320	-12%	-3,375	-12%	-228	-12%
Average (per Employee)		-1.8	-12%	-1.5	-12%	-15.9	-12%	-1.1	-12%

The total reduction for each firm is calculated by multiplying the number of employees for the firm by the reductions per employee reported in Table 3. The total reduction for all firms is calculated by adding together the totals for each firm.

Sources: Tables 1-5, 2-4, 3-4, 4-4, 5-4, 6-4, 7-4, and 8-4.

TABLE 5

**SUMMARY OF REDUCTIONS IN GASOLINE CONSUMPTION
AND CARBON DIOXIDE EMISSIONS
(per Employee per Year)**

Case/Location	Gasoline Consumption (gallons)	CO2 Emissions (pounds)	Percent Change
5. Downtown L A	-51	-1,012	-24%
8. Downtown L.A.	-35	-681	-16%
1. Century City	-24	-472	-11%
4. Century City	-23	-461	-9%
3 Century City	-21	-413	-9%
7 Santa Monica	-13	-263	-5%
6 Santa Monica	-23	-448	-9%
2. West Hollywood	N/A	N/A	N/A
Average	-26	-514	-12%

Sources Tables 1-6, 2-5, 3-5, 4-5, 5-5, 6-5, 7-5, and 8-5.

emissions by between 263 and 1,012 pounds per employee per year, with an average of 514 fewer pounds of CO₂ a year

Table 6 shows that cashing out saved 44,179 gallons of gasoline a year for commuting to all eight firms. Cashing out also reduced a total of 870,327 pounds of CO₂ emissions a year for commuting, or 12 percent of the total CO₂ emissions for commuting

This estimated reduction in CO₂ emissions is conservative because it refers to tailpipe emissions alone. Full-fuel-cycle CO₂ emissions (counting emissions from extraction, transport, and refining) are 57 percent more than tailpipe emissions alone. When the additional non-tailpipe emissions are included, cashing out reduced 807 pounds of CO₂ emissions per employee per year

HOW MUCH DOES CASHING OUT COST EMPLOYERS?

Cashing out is not an entirely new cost to employers. For commuters who trade a parking space for cash, cashing out is simply a more flexible way to use existing subsidies now devoted to parking. Employers will, however, be liable for payroll taxes on the cashed out parking subsidies. The firms' combined Social Security and Medicare tax rate was 7.65 percent. There are also payroll taxes for State Unemployment Insurance (SUI), Federal Unemployment Tax (FUTA), and Employment Training Tax (ETT), but these taxes rates are calculated on only the first \$7,000 of an employee's income. The firms' payroll tax rate was thus 7.65 percent of taxable cash, and this cost is included in the calculations below.

Employers will incur a new cost for commuters who are now offered a parking subsidy but do not drive to work. These commuters will become eligible to take the cash alternative to a parking space, and the employer will not save anything on reduced parking subsidies with which to finance the new cash payment. This expense for employers is a payment to employees who are already ridesharing, and it will occur only to the extent that employers now subsidize commuters more for parking at work than for ridesharing to work.

Because the eight case-study firms adopted a variety of cash-out programs, their spending for parking subsidies and cash in lieu of parking subsidies changed in a variety of ways. Table 7 shows the changes in the eight firms' spending for both parking and cash payments in lieu of parking. One firm (Case 1) eliminated its parking subsidy of \$110 a month, but pays \$55 a month to all commuters who do not drive to work alone; this firm saved \$70 per employee per month. The other seven firms spent more after cashing out. Of these seven, two minimally complied with the law by offering commuters either a parking subsidy or its cash value; one (Case 2) spent \$6 more per employee per month, while the other (Case 3) spent \$16 more per employee per month. The five other firms voluntarily went beyond compliance by offering commuters either a parking subsidy or more than its cash value, they spent from \$8 (Cases 6 and 7) to \$33 (Case 5) more per employee per month.

TABLE 6

**SUMMARY OF TOTAL REDUCTIONS IN GASOLINE CONSUMPTION
AND CARBON DIOXIDE EMISSIONS
(per Firm per Year)**

Case/Location	Number of Employees	Gasoline Consumption (gallons)	CO2 Emissions (pounds)	Percent Change
5 Downtown L A	281	-14,428	-284,239	-24%
8. Downtown L A.	285	-9,849	-194,017	-16%
1 Century City	257	-6,159	-121,341	-11%
4 Century City	191	-4,470	-88,050	-9%
3. Century City	120	-2,515	-49,541	-9%
7 Santa Monica	300	-4,009	78,979	-5%
6. Santa Monica	121	-2,749	-54,160	-9%
2 West Hollywood	139	N/A	N/A	N/A
Total	1,694	-44,179	-870,327	-12%
Average (per Firm)	212	-5,522	-108,791	-12%
Average (per Employee)		-26	-514	-12%

The total reduction for each firm is calculated by multiplying the number of employees for the firm by the reductions per employee reported in Table 5. The total reduction for all firms is calculated by adding together the totals for each firm.

Sources: Tables 1-6, 2-5, 3-5, 4-5, 5-5, 6-5, 7-5, and 8-5.

TABLE 7

SUMMARY OF EMPLOYERS' SUBSIDY COST PER EMPLOYEE

Case/Location	Before	After	Change	Percent Change
5. Downtown L.A	\$95	\$128	\$33	34%
8. Downtown L.A	\$21	\$34	\$13	59%
1 Century City	\$95	\$25	-\$70	-74%
4. Century City	\$116	\$130	\$14	12%
3 Century City	\$85	\$101	\$16	19%
7 Santa Monica	\$59	\$67	\$8	14%
6. Santa Monica	\$48	\$56	\$8	16%
2. West Hollywood	\$60	\$66	\$6	10%
Average	\$72	\$74	\$2	3%

Sources. Tables 1-7, 2-6, 3-6, 4-6, 5-6, 6-6, 7-6, and 8-6.

For the firms that went beyond compliance with the cash-out requirement, much of their spending increase stemmed from this voluntary choice. For example, Case 5 offers commuters either a parking subsidy of \$100 a month or \$150 a month in cash. If this firm had chosen to comply minimally by offering only \$100 a month in lieu of the parking subsidy, its spending per employee would have increased by only \$5 per year, or 14 percent of the actual \$33-per-year increase.

The eight firms, considered together, reduced their parking subsidies by almost as much as they increased their cash payments in lieu of parking subsidies. In Case 1, the firm's saving of \$70 per employee per month resulted from reducing the subsidies to solo drivers, who previously received larger subsidies than ridesharers; this saving is a transfer from solo drivers to the firm. In the other seven cases, the firms' spending increase resulted from increasing the subsidies to ridesharers, who previously received smaller subsidies than solo drivers; this spending increase is a transfer from the firms to the ridesharers. Because these transfers to and from employees "net out," the eight firms' *total* spending for both parking and cash in lieu of parking rose by only 3 percent. The eight firms' average commuting subsidy per employee rose from \$72 to \$74 a month, or by \$2 a month.

The employers' 3-percent increase in spending after cashing out refers only to payments for parking subsidies and for cash in lieu of parking subsidies. But when they began to offer the cash option, five of the employers simultaneously eliminated other ridesharing incentives they had previously offered. Among these deleted incentives were:

- Employee focus groups
- Free breakfast in the parking lot for carpoolers
- Free car wash for carpoolers
- Health club membership for cyclists and walkers
- Management education seminars
- Monthly raffles for carpoolers
- Ridesharer recognition program
- Transit demonstrations and transit days
- Travel allowance points program
- Walk and bike club
- Zip code parties

Employers who offer a parking subsidy *without* the cash option often try to encourage ridesharing with various incentives to counter the parking subsidy itself. When these employers begin to offer the straightforward choice between a parking subsidy or its cash value, they can dispense with some of these other ridesharing incentives. In all cases where employers adopted a cash-out program and simultaneously deleted other ridesharing incentives, ridesharing increased. This result suggests that employers benefit from cashing out by reducing their spending on other incentives. We have not estimated this reduced spending associated with cashing out, although it can be substantial. Because reduced spending on other ridesharing incentives will reduce the employer's cost of cashing out, we have overestimated the employers' spending increase associated with cashing out. Therefore, the average cost of cashing out is less than \$2 per employee per month.

This minor increase in the eight firms' average commuting subsidy after cashing out suggests how an individual firm can cash out without spending more on commuting subsidies *redistribute the existing total parking subsidy equally among all employees, independent of the employees' travel modes*. This redistribution will neither increase the firm's total cost nor reduce the employees' total subsidy, but it will reduce VMT and vehicle emissions and save gasoline, and it will treat all commuters equally. The redistribution will also comply with California's cash-out requirement.

Given the varying policy changes that occurred at the eight firms, can we attribute the results at all eight firms to "cashing out" parking subsidies? One way to answer this question is to compare the results for the three Century City firms that complied with the cash-out requirement in different ways

Case 1 previously offered either a parking subsidy of \$110 a month, or \$55 in cash, it then eliminated the parking subsidy, and offered the \$55 in cash only to those who did not drive to work alone. Case 3 previously offered either a parking subsidy of \$100 a month, or nothing, it then began to offer either a parking subsidy of \$100 a month, or \$100 in cash. Case 4 previously offered either a parking subsidy of \$120 a month, or between \$50 and \$90 a month in cash for various alternative travel modes; it then began to offer either a parking subsidy of \$120 a month, or \$150 in cash. Table 1 shows that, despite differences in the specific terms of cashing out, each of the three firms' number of vehicle trips per employee per day fell by 9 percent.

The results in Century City suggest that differences in the specific terms of cashing out did not greatly affect the outcomes in terms of the resulting travel changes. The "before" and "after" subsidies, and the changes in these subsidies, differed among the three firms, but the reductions in solo shares and vehicle trips after complying with the cash-out requirement were similar.

Although one firm (Case 1) eliminated parking subsidies without changing ridesharing subsidies, this firm had the average reduction in solo-driver share, and a smaller than average reduction in vehicle trips and VMT for all 1,694 employees. Therefore, the inclusion of this "outlier" case did not increase the average reductions found for the eight firms.

In addition to the firms' spending for parking subsidies and cash in lieu of parking subsidies, there is also the cost of administering cash-out programs. The firms' representatives all said that administration was simple. For example:

- *It's very simple. It's not difficult at all. (Case 2)*
- *The cash-out program is really simple. It is very easy to administer. (Case 4)*
- *Cash back doesn't cause a problem, it helps you. It's the biggest single help. I give it to payroll and they put it on a computer. It's automatic. (Case 6)*

When the firms' representatives were asked to estimate the administrative cost of cashing out, one firm's representative estimated that she spent approximately two minutes per employee per month for administering the firm's cash-out program. The other representatives reported that the

administrative cost was imperceptible. One likened it to the cost of administering changes in the number of exemptions for employees' income tax withholding

When the firms' representatives were asked whether administering the payroll taxes on cash subsidies was a problem, and they all said "No." For example

- *No, it didn't create any problems. (Case 4)*
- *There's no problem at all. (Case 5)*
- *I would say it's minor because it's just one small detail. Payroll is automated, so it's just a simple computer entry. Whether the payroll is up or down by \$55 [the cash option], your work is the same. (Case 6)*

The firms' payroll taxes on cash subsidies increased by \$1.63 per employee per month after cashing out, and these payroll taxes are already included in the employers' estimated cost of cashing out

California's cash-out requirement applies only to parking spaces that firms rent, and not to parking spaces they own. Three of the case-study firms both own *and* rent parking spaces for commuters. When asked whether both owning and renting parking spaces caused a difficulty with the cash-out program, all three firm's representatives said "No." One responded, "*Not at all. Why would it?*" These firms offer the cash-out option to all commuters in both the owned and rented spaces. When a commuter who parks in an owned space takes the cash, a commuter who formerly parked in a rented space takes the owned space, and the firm reduces the number of spaces it rents.

Six of the eight employers (1, 3, 4, 5, 7, and 8) had multiple worksites. We investigated only one worksite for each employer, but none of the employers' representatives said that having multiple worksites created any difficulty in cashing out their parking subsidies.

In contrast with cashing out, many other employer-based trip-reduction programs have high administrative costs. In a study of one major firm's trip-reduction program required by the SCAQMD's Regulation XV, Green (1994, 56) found that only 28 percent of the firm's budget for ridesharing was delivered to commuters as incentives and subsidies. The other 72 percent of the firm's ridesharing budget was spent for salaries, equipment, facilities, travel, and training for the firm's transportation coordinators. Although the firm spent \$1.3 million to encourage ridesharing in 1992 and 1993, ridesharing declined during these two years. (In addition to subsidizing ridesharing, the firm offered free parking to all employees, with no option to cash it out.)

Because Regulation XV formerly applied only to firms with 100 or more employees, firms whose employment level fell below 100 became exempt from the regulation. The memorandum shown on the next page, from the "former employee transportation coordinator" for a firm that shrank below 100 employees, suggests how cashing out differs from other ridesharing incentives. After becoming exempt from Regulation XV, the firm immediately withdrew all ridesharing incentives except cashing out. "*Our most successful incentive was to offer to cash out monthly paid parking*



Pacific Holding Company

MURDOCK PLAZA
10900 WILSHIRE BOULEVARD
LOS ANGELES, CALIFORNIA 90024
213 208 6055

INTERCOMPANY MEMORANDUM

TO: PHC Murdock Plaza Employees - 16th Floor DATE: 12 Oct. 92
FROM: John Anzulis
 Former Employee Transportation Coordinator
SUBJECT: SCAQMD Regulation XV

Effective 16 September 1992 the PHC/Murdock companies were exempted from attempting to comply with our mandated Employee Trip Reduction (ETR) plan. This was because our site employee population dropped below the AQMD threshold of 100. Therefore all ridesharing incentives are withdrawn effective immediately.

Our most successful incentive was the offer to "cash out" monthly paid parking here at Murdock Plaza. Several of our employees found that they did not need this as they could use public transportation or carpooling efficiently, i.e. at less cost than the taxable net of the current \$115 monthly parking cost here. It is our intention, as there is very little administrative burden and "the right thing to do", to continue to offer this benefit subject to Mr. LaFleur's approval.

Eligible employees wishing to continue or who may wish to "cash out" paid parking here must understand that there WILL NOT be the supporting programs as before, e.g. guaranteed ride home, subsidized parking on PA, flex-time, etc. Your transportation requirements will be your own responsibility as they always are.

cc: Gerald W. LaFleur, EVP

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. . . *It is our intention, as there is very little administrative burden and [it is] the right thing to do, to continue to offer this benefit."*

COST-EFFECTIVENESS OF CASHING OUT

In cashing out, some commuters trade a parking space for its cash equivalent, so the employer breaks even. Commuters who were already ridesharing also receive cash, however, and they do not give up a parking space; in this case, the employer does incur a cost, which the previous ridesharers receive as a benefit. The employers' increased cost is a transfer payment to previously undercompensated ridesharers (undercompensated when compared with otherwise identical solo drivers), similar to a pay increase.

Textbooks in cost-benefit analysis explain why a transfer payment is not a use of resources, and why transfer payments should be excluded in measuring cost-effectiveness. For example, in his text on cost-benefit analysis, Mishan (1973, 60) says,

A transfer payment, as the term suggests, is simply a transfer in money or kind made by one member or group in the community to others, one which is made *not* as payment for services received but as a gift or as a result of legal compulsion . . . to the economy as a whole [transfer payments] are neither costs nor benefits; only a part of the pattern of *distributing* the aggregate product. In undertaking a cost-benefit analysis the economist must be careful to exclude them from the relevant magnitudes. (*italics in the original*)

In cashing out, the eight firms both increased ridesharing subsidies and reduced parking subsidies. Most of the redistribution occurred among employees, from solo drivers (who had previously received larger commuting subsidies) to ridesharers (who had previously received smaller commuting subsidies). This redistribution created a small *net* increase in the eight firms' *total* spending for parking and for cash payments in lieu of parking.

This aggregate result for the eight firms suggests that *an individual firm can reduce parking subsidies by as much as it increases cash payments in lieu of parking subsidies, so its total spending will not change, and cashing out will cost nothing*. If a firm now subsidizes solo drivers more than ridesharers, redistributing the existing commuting subsidy equally among all commuters--regardless of mode choice--will not consume additional resources. The resulting reductions in VMT, gasoline consumption, and vehicle emissions will be free.

It is the author's professional judgment that transfer payments should not be counted as resource costs in estimating cost-effectiveness measures. Nevertheless, one may wish to relate the employers' spending changes to the resulting changes in vehicle emissions, *keeping in mind that the change in employers' spending is a (transfer) payment to previously undercompensated ridesharers, that benefits to employees are not considered, and that any resulting recruitment and retention benefits for the employers are not considered*.

Table 8 shows that, after cashing out, the eight firms spent , in total, an additional \$3,562 per month, or \$41,544 per year, on parking subsidies and cash payments in lieu of parking subsidies. We can compare this figure to the resulting reduction in vehicle emissions.

When a program has multiple benefits, cost-effectiveness analysis is not a simple issue of dividing one of these benefits by the program's total costs. The text of the legislation (AB 2109) that established the cash-out requirement states that the objective of cashing out employer-paid parking is to reduce both traffic congestion and air pollution. In contrast, some programs have a single objective. For example, reformulated gasoline reduces vehicle emissions but does not produce other significant benefits. Cashing out employer-paid parking not only reduces vehicle emissions, but also reduces traffic congestion. Comparing the cost-effectiveness of cashing out parking subsidies and of reformulated gasoline simply by dividing each program's emissions reductions by the program's total cost would neglect the other major public benefit of cashing out--reducing traffic congestion. Therefore, attributing all the cost of cashing out parking subsidies to reducing vehicle emissions is clearly inappropriate.

The California Air Resource Board's cost-effectiveness guidelines recommend that, in dealing with programs that have multiple objectives, one should allocate part of the total program cost to each objective, although it is difficult to identify which costs are attributable to achieving which objectives.⁷ If we divide the firms' added spending of \$41,544 per year equally between the two objectives of reducing VMT and reducing vehicle emissions, the firms spent \$20,722 per year for each objective.

Table 2 shows that cashing out reduced a total of 1,104,476 VMT per year. Therefore, the firms spent 1.9¢ per VMT reduced ($\$20,722 \div 1,104,476$).

Table 4 shows that cashing out reduced a total of 3,027 pounds of ROG, 2,558 pounds of NO_x, 26,997 pounds of CO, and 1,826 pounds of PM₁₀ per year. In valuing emission reductions, the California Air Resources Board (1990, 9) treats ROG, NO_x, and PM₁₀ as equally valuable, but treats seven pounds of CO as equivalent to one pound of the other three pollutants. This valuation method gives an estimated total reduction of 11,268 pounds (5.6 tons) of vehicle emissions per year for commuting. Therefore, the firms spent \$1.84 per pound (\$3,678 per ton) of emissions reduced.

The firms' spending of \$3,678 per ton of emissions reduced compares well with the cost of other mobile-source emissions reduction measures. When the ARB estimated the cost-effectiveness of twenty other mobile-source reduction measures, their average cost was \$10,000 per ton of emissions reduced.⁸ Another ARB publication states,

As air pollution control programs have been implemented, a generally accepted range of cost-effectiveness has emerged. The cost of ARB mobile source measures is typically less than \$10,000 per ton of pollutant reduced, although sometimes much lower. District stationary source measures have at times had higher costs (up to \$20,000).⁹

TABLE 8

SUMMARY OF EMPLOYERS' TOTAL SUBSIDY COST PER MONTH

Case/Location	Number of Employees	Total Subsidy Cost			Percent Change
		Before	After	Change	
5. Downtown L.A.	281	\$26,805	\$36,007	\$9,202	34%
8. Downtown L.A.	285	\$6,087	\$9,653	\$3,566	59%
1. Century City	257	\$24,411	\$6,340	-\$18,072	-74%
4 Century City	191	\$22,157	\$24,764	\$2,607	12%
3 Century City	120	\$10,241	\$12,167	\$1,926	19%
7. Santa Monica	300	\$17,594	\$20,024	\$2,430	14%
6. Santa Monica	121	\$5,844	\$6,794	\$950	16%
2. West Hollywood	139	\$8,371	\$9,225	\$854	10%
Total	1,694	\$121,510	\$124,973	\$3,462	3%
Average (per Firm)	212	\$15,189	\$15,622	\$433	3%
Average (per Employee)		\$72	\$74	\$2	3%

The total reduction for each firm is calculated by multiplying the number of employees for the firm by the reductions per employee reported in Table 7. The total reduction for all firms is calculated by adding together the totals for each firm.

Sources: Tables 1-7, 2-6, 3-6, 4-6, 5-6, 6-6, 7-6, and 8-6.

The average spending of \$3,678 per ton of emissions reduced results from a wide range of spending changes for the eight firms. One firm (Case 1) *saved* \$216,864 per year because it eliminated parking subsidies for solo drivers while paying \$55 a month to ridesharers. This policy reduced 1,508 pounds of vehicle emissions per year. If half of this saving is associated with reducing vehicle emissions, this firm *saved* \$144,000 per ton of vehicle emissions it reduced.

Of the seven firms that spent more after cashing out, two complied with the law by offering commuters either a parking subsidy or its cash value; Case 2 spent \$6 more per employee per month, while Case 3 spent \$16 more per employee per month. The other five firms voluntarily went beyond compliance by offering commuters the choice between a parking subsidy or more than its cash value; they spent from \$8 (Cases 6 and 7) to \$33 (Case 5) more per employee per month. These voluntary choices suggest that, when the employers calculated their commuter subsidies in simple cash values, they decided that ridesharing deserves larger subsidies than does solo driving.

The six firms' voluntary decision to go beyond mere compliance with the cash-out requirement explains much of the spending increase they incurred. For example, Case 5 offers commuters either a parking subsidy of \$100 a month or \$150 a month in cash. If this firm had chosen merely to comply by offering \$100 a month in lieu of the parking subsidy, its spending per employee would have increased by only \$5 a month, or by only 15 percent of the actual \$33 a month increase.

Table 8 shows that the seven firms that increased spending spent an additional \$258,408 per year after cashing out. Table 4 shows that these firms reduced 9,760 pounds of vehicle emissions per year. If half of this spending increase is associated with reducing vehicle emissions, these firms spent \$26,000 per ton of vehicle emissions they reduced.

Neither the saving of \$144,000 per ton of emissions reduced by Case 1 nor the spending of \$26,000 per ton of emissions reduced by the other seven firms are a true measure of cost-effectiveness, because both the savings and the spending are transfer payments, not a consumption of resources. The firm with the highest spending increase is Case 5, with a spending increase of \$33 per month. From this firm's point of view, cashing out raised wages by \$33 per employee per month. A pay increase is an incentive for employee recruitment and retention, the benefits of which should at least partly offset the employers' increased cost. In the interviews, employers said the cash-out option is an added fringe benefit that helps to recruit and retain employees.

- *It's a good hiring incentive for us. (Case 4)*
- *[Cashing out] is an excellent recruiting point because people count it as income. (Case 5)*
- *Employees are grateful and thankful and more motivated. So, that's a plus for the company. (Case 6)*
- *[Cashing out] made employees happy. It became a benefit we were offering to employees. We emphasize it in our new employee orientation. (Case 8)*

On true cost-effectiveness grounds, an employer would always prefer an emissions-reduction policy that increases employees' wages (which cashing out does), compared to a policy that costs the employer the same amount of money but does not increase employees' wages (for example, a payment to SCAQMD to retire older vehicles). Therefore, although it is tempting simply to divide the employer's spending increase or decrease by the resulting emissions reduction to estimate the cost-effectiveness of cashing out in reducing emissions, this procedure misstates the cost of cashing out as a way to reduce emissions, and does not accurately compare cashing out with other methods of reducing emissions.

In Case 1, the firm saved \$144,000 per ton of emissions reduced because it ended parking subsidies to solo drivers. If one neglected that this policy reduced wages by \$70 per employee per month, one would be tempted to recommend that the most cost-effective way to reduce vehicle emissions is simply to reduce parking subsidies without offering employees any alternative subsidy. But neglecting the effects of reduced wages in Case 1 would be a mistake, just as neglecting the effects of increased wages in the other seven cases would be a mistake.

In summary, the estimates that firms spent 1.9¢ per VMT reduced and \$3,678 per ton of vehicle emissions reduced overstate the cost to the economy of reducing congestion and pollution by cashing out parking subsidies. They overstate cost because (1) the firms' spending increase is a transfer payment to commuters who are already ridesharing, not a consumption of resources, (2) the benefit of reducing greenhouse gas emissions by 807 pounds of CO₂ per employee per year is not counted, and (3) other benefits to both employers and employees are not counted. Employers' comments in the interviews reveal these other benefits.

EMPLOYERS' COMMENTS ON CASHING OUT

In addition to providing public benefits, cashing out privately benefited employers and their employees. When asked to describe their experience with cashing out, the firms' representatives all responded positively.

- *The employees think it's fair. (Case 2)*
- *[Cashing out] has been really positive. (Case 2)*
- *Since we moved to cash out, we've always received a good response. (Case 4)*
- *I would definitely recommend [cashing out]. We've always found that cash works. Cash is always a good incentive. (Case 4)*
- *[Cashing out] has been a really good experience. People really like it. (Case 5)*
- *People like the idea, they like the cash in hand, and it does add to their paycheck. (Case 5)*
- *[Employees] love it. The ones that qualify love it. And the ones who drive alone don't care because they get free parking. (Case 6)*
- *Compared to the previous policy, I think [cashing out] is fairer. (Case 8)*
- *If we decided to scratch the program, we would probably end up with at least fifty or sixty more employee cars, with no place to park. (Case 8)*

- *Cash works very well for us. (Case 8)*

When the eight employers considered cashing out as an alternative to conventional parking subsidies, six chose to subsidize ridesharing more than parking. Of the two employers who comply minimally by subsidizing parking and ridesharing equally, one is a government agency, while of the six employers who subsidize ridesharing more than parking, all are private firms. These firms who go beyond compliance with California's cash-out requirement are evidently willing to do their part in reducing traffic congestion and air pollution, once they have thought through the full implications of their commuting subsidies.

THE DISTRIBUTION OF SUBSIDIES AMONG MODE SHARES

Figure 4 shows the distributions of commuter mode shares and of commuter subsidies for all 1,694 employees of the eight firms. After cashing out, the share of commuters who drove alone fell from 76 to 63 percent, and the share of commuters who walked, bicycled, rode transit, or carpooled rose from 24 to 37 percent. After cashing out, the solo drivers' share of the total commuting subsidy fell from 88 to 54 percent, and the ridesharers' share rose from 12 to 46 percent.

The subsidy ratio for a mode is that mode's share of the total commuting subsidy divided by its share of total commuters. Before cashing out, the subsidy ratio for solo driving was 1.16 ($= 88 \div 76$), because 76 percent of commuters drove alone and received 88 percent of the total commuting subsidy. The subsidy ratio for solo driving fell from 1.16 before cashing out to 0.86 after cashing out. The subsidy ratio for ridesharing rose from 0.50 before cashing out to 1.24 after cashing out.

THE DISTRIBUTION OF SUBSIDIES AMONG EMPLOYEES

Commuters who are in the lowest income-tax bracket gain the most after-tax income from the cash option. Commuters who cannot drive because of a physical disability, and therefore cannot receive a parking subsidy, also benefit from the cash option. These points directly respond to the conventional criticism that pricing parking will harm low-income commuters and those who need to drive to work.

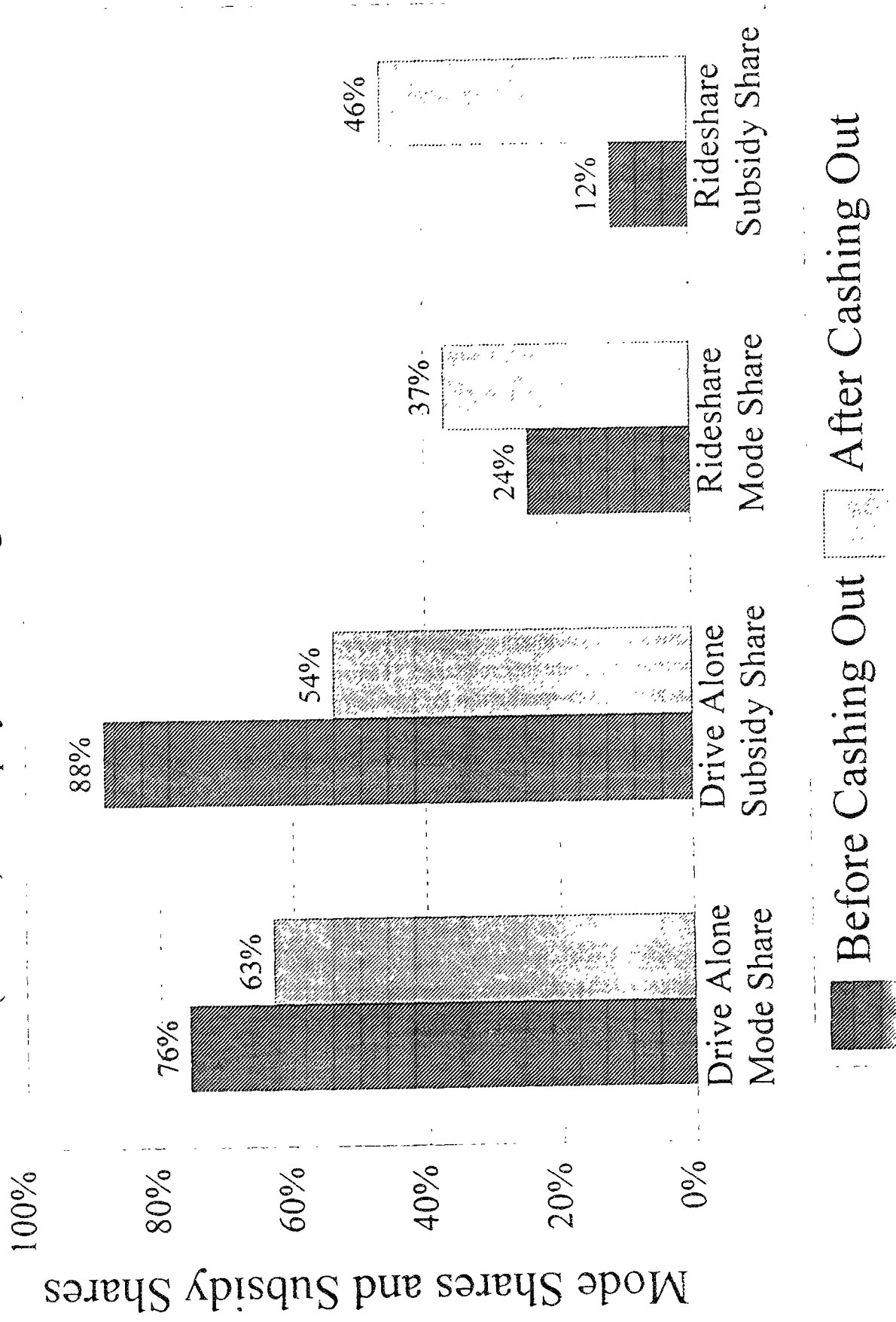
Cashing out can also eliminate any gender or ethnic bias in employer-paid parking. To see the possible gender bias in parking subsidies, consider the results in Case Study 1. In 1992 the firm offered all commuters either a parking subsidy of \$110 a month, or \$55 a month in cash. Although the policy was biased in favor of solo drivers, it did not obviously favor either men or women. But the firm's employee travel survey before cashing out showed that 78 percent of men and only 62 percent of women drove to work alone. Therefore, the apparently gender-neutral policy of subsidizing parking more than ridesharing inadvertently subsidized men more than women.

Employer-paid parking subsidizes only commuters who drive to work. Nationwide, 92 percent of non-Hispanic White households own a car, while only 81 percent of Hispanic households

FIGURE 4

Mode Shares and Subsidy Shares

Before and After Cashing Out
(for the 1,694 employees of the eight case-study firms)



and 69 percent of African-American households own a car.¹⁰ Therefore, parking subsidies will benefit different groups differently. Cashing out allows an employer to subsidize parking, and yet offer commuters the same subsidy whatever their mode choices. Offering to cash out parking subsidies can thus avoid any inadvertent gender or ethnic bias (or any other bias) in subsidizing commuting.

For many observers, eliminating gender and ethnic bias would be necessary to ensure simple “transportation justice.” Because employers subsidize parking for one third of all automobile travel in the United States, and because employer-paid parking subsidies are tax-exempt fringe benefits, ensuring justice in the distribution of these subsidies is a significant issue.¹¹

Regarding transportation justice, cashing out raises the question of who should save money when a commuter decides to forego parking at work. Without the cash option, the employer saves money. With the cash option, the employee saves money. One firm's representative explained the issue clearly:

If an employee chooses to use an alternative form of transportation, it wouldn't be fair for the company to say oh, goody, we saved \$55 [for parking] this month. I think the benefit should go to the employee who makes the sacrifice. Maybe you want to go on an errand or go shopping and your car is at home and you are at work. So I think that the employee should be compensated and that the company shouldn't benefit. (Case 6)

Because cash in lieu of a parking subsidy is taxable, while the parking subsidy itself is tax exempt, commuters who voluntarily choose taxable cash in lieu of a tax-exempt parking subsidy will pay more in federal and state income taxes. Tax revenues rise without an increase in tax rates, and without eliminating the tax-exemption for parking subsidies.

Cash offered in lieu of a parking subsidy is taxable, while the parking subsidy itself is tax exempt. Therefore, commuters who choose cash in lieu of a parking subsidy pay more in federal and state income taxes. Because many commuters chose taxable cash at the eight firms, the 1,694 employees' taxable cash commuting subsidies rose by \$432,314 a year, or by \$255 per employee per year, after cashing out. This \$255 per year increase is an average for all employees offered the cash option, not simply of those who took the cash.

The Joint Tax Committee of Congress uses a marginal income tax rate of 19 percent to estimate the revenue effects of changes in taxable wages; at this tax rate, federal income tax revenues increased by \$48 per employee per year after cashing out.¹² The California Franchise Tax Board uses a marginal income tax rate of 6.5 percent to evaluate the revenue effects of changes in taxable wages, at this tax rate, California income tax revenues increased by \$17 per employee per year after cashing out.¹³ These federal and state revenues accrued without an increase in tax rates, and without eliminating the tax-exemption for parking subsidies.

Employers and employees also pay Social Security payroll taxes on the cashed-out parking subsidies. These additional Social Security tax payments will eventually increase the

employees' Social Security benefits, however. By sheltering wages from Social Security taxes, tax-exempt employer-paid parking reduces employees' future retirement income, and cashing out employer-paid parking will increase employees' retirement income. This higher retirement income will compensate employees for the higher payroll taxes on their cashed out parking subsidies.

CONCLUSION

Employer-paid parking is an invitation to drive to work alone. Therefore, employer-paid parking increases traffic congestion, wastes gasoline, and pollutes the air. In contrast, the eight case studies have shown that cashing out employer-paid parking can reduce vehicle trips, save gasoline, and clean the air.

Table 9 summarizes the resulting reductions in vehicle travel and vehicle emissions, per employee and for all the 1,694 employees of the eight firms. Cashing out reduced:

- 43 vehicle trips per employee per year.
- 652 VMT per employee per year
- 1.8 pounds of ROG emissions per employee per year.
- 1.5 pounds of NO_x emissions per employee per year.
- 15.9 pounds of CO emissions per employee per year.
- 1.1 pounds of PM₁₀ emissions per employee per year.
- 26 gallons of gasoline consumption per employee per year.
- 514 pounds of CO₂ emissions per employee per year.

Vehicle miles traveled for commuting fell by 12 percent, equivalent to removing from the road one of every eight automobiles used for commuting to the eight firms. Because the eight firms' spending for parking subsidies declined by almost as much as their cash payments in lieu of parking subsidies increased, total spending for commuting subsidies rose by only \$2 per employee per month. Because many commuters voluntarily traded their tax-exempt parking subsidies for taxable cash, federal income tax revenues rose by \$48 per employee per year, and state income tax revenues rose by \$17 per employee per year. Employers praised cashing out for its simplicity and fairness, and said that it helps to recruit and retain employees. In summary, cashing out employer-paid parking can benefit commuters, employers, taxpayers, and the environment.

Despite the auspicious outcomes experienced in these eight case studies, few employers in California have complied with state's cash-out requirement, in part because of possible conflicts with the Federal Internal Revenue Code. The next section explains how federal tax considerations have inhibited cashing out.

TABLE 9

SUMMARY OF REDUCTIONS AFTER CASHING OUT PARKING SUBSIDIES

<u>Variable Reduced</u>	<u>Reduction</u>		<u>Percent Change</u>
	<u>Per Employee</u>	<u>Eight Firms</u>	
Vehicle Trips (per year)	43	73,500	-11%
Vehicle Miles Traveled (per year)	652	1,104,476	-12%
Reactive Organic Gas Emissions (pounds per year)	1.8	3,027	-12%
Nitrogen Oxide Emissions (pounds per year)	1.5	2,558	-12%
Carbon Monoxide Emissions (pounds per year)	15.9	26,997	-12%
Particulate Matter Emissions (pounds per year)	1.1	1,826	-12%
Gasoline Consumption (gallons per year)	26	44,179	-12%
Carbon Dioxide Emissions (pounds per year)	514	870,327	-12%

These reductions refer to the 1,694 employees of the eight case-study firms.

Sources: Tables 2, 3, 4, 5, 6, and 7.

III. AN UNEXPECTED CONFLICT WITH THE FEDERAL TAX CODE

Unfortunately, California's cash-out law conflicts with a little-known section of the federal Internal Revenue Code, Section 132(f)(4), which provides that if an employer offers commuters the option to take cash in lieu of a parking subsidy, the parking subsidy itself ceases to qualify as a tax-exempt fringe benefit. Therefore, if an employer complies with California's cash-out requirement, employees must pay income tax on their otherwise tax-exempt parking subsidies.

The Comprehensive Energy Policy Act of 1992 inadvertently introduced the conflict between California's cash-out law and the Internal Revenue Code. The Energy Policy Act created a new tax-exempt fringe benefit, called a "qualified transportation fringe," in Section 132(f) of the Internal Revenue Code

QUALIFIED TRANSPORTATION FRINGE

(1) IN GENERAL - For purposes of this section, "qualified transportation fringe" means any of the following provided by an employer to an employee:

(A) Transportation in a [van that seats at least six adults not including the driver].

(B) Any transit pass.

(C) Qualified parking.

(2) LIMITATION ON EXCLUSION - The amount of the fringe benefits which are provided by an employer to any employee and which may be excluded from gross income . . . shall not exceed -

(A) \$60 per month in the case of [vanpool subsidies and transit passes], and

(B) \$155 per month in the case of qualified parking.

The tax exemptions are indexed to inflation, and in 1997 the qualified transportation fringe exempts from income tax the first \$170 a month (\$2,040 a year) of employer-paid parking subsidies, and the first \$65 a month (\$780 a year) of employer-paid vanpool or transit subsidies.¹⁴ The cap on tax-exempt parking subsidies (which were previously uncapped) and the \$65 a month exemption for vanpool and transit subsidies (which were previously capped at \$21 a month) are important changes, but the tax-exemption for parking subsidies is over two-and-a-half times greater than the tax-exemption for vanpool and transit subsidies. There is no tax exemption for other ridesharing subsidies, such as for carpooling, bicycling, or walking to work. Therefore, the tax code still has a strong tax bias in favor of driving to work alone.

Surprisingly, one feature of the "qualified transportation fringe" specifically prohibits employers from offering commuters the option to choose cash in lieu of a tax-exempt parking subsidy. Section 132(f)(4) provided,

BENEFIT NOT IN LIEU OF COMPENSATION.--Subsection (a)(5) [which excludes qualified transportation fringe benefits from an employee's gross income] shall not apply to any

qualified transportation fringe unless such benefit is provided in addition to (and not in lieu of) any compensation otherwise payable to the employee

This benefit-not-in-lieu-of-compensation provision means that if an employer offers commuters the option to choose cash in lieu of a parking subsidy, the parking subsidy itself ceases to qualify as a tax-exempt transportation fringe benefit. The parking subsidy ceases to qualify as a tax-exempt transportation fringe benefit because the parking subsidy "is provided in lieu of, and not in addition to, compensation otherwise payable to the employee."

Section 132(f)(4) of the Internal Revenue Code thus discourages an employer from offering commuters the option to choose cash in lieu of a tax-exempt parking subsidy. If an employer *does* offer cash as an alternative to a parking subsidy, the commuters who continue to take the parking must pay income tax on the full market value of the parking. This negative tax consequence naturally deters employers who know of it from offering the option to cash out a parking subsidy. (Most employers who do offer cash in lieu of a parking subsidy seem unaware that they should report their employees' parking subsidies as taxable income, all the employers in our case-study firms did report the cash subsidies to ridesharers as taxable income, as required by the cash-out legislation.) Therefore, even after the reforms contained in the 1992 Energy Policy Act, the Internal Revenue Code still encourages employers to offer parking subsidies (up to \$165 a month), strongly discourages employers from offering any ridesharing subsidies except those for mass transit or vanpooling (up to \$65 a month), and has effectively blocked implementation of California's parking cash-out requirement.

The largest employers have tax departments who are well aware of the peculiar tax consequences of cashing out parking subsidies. These employers have understandably opposed enforcement of California's cash-out requirement, because they are in no position to offer cash in lieu of a parking subsidy without also reporting their parking subsidies as taxable income to their employees. These employers have been placed in the difficult position of either (1) ignoring the cash-out requirement in order to keep their employees' parking subsidies tax exempt, or (2) obeying the cash-out requirement and reporting their employees' parking subsidies as taxable income.

The case study employers who said that cashing out was simple and easy would surely not have done so if they had been aware that they should have reported their employees' parking subsidies as taxable income. Because of the potential tax consequences caused by Section 132(f)(4) of the Internal Revenue Code, California has been unable to enforce its cash-out requirement.

The Taxpayer Relief Act of 1997 inserted a new provision in the Internal Revenue Code to accommodate California's cash-out law. It amended Section 132(f)(4), which now states,

BENEFIT NOT IN LIEU OF COMPENSATION.--Subsection (a)(5) shall not apply to any qualified transportation fringe unless such benefit is provided in addition to (and not in lieu of) any compensation otherwise payable to the employee. This paragraph shall not apply to any qualified parking provided in lieu of compensation which otherwise would

have been includible in gross income of the employee, and no amount shall be included in the gross income of the employee solely because the employee may choose between the qualified parking and compensation.

The new second sentence of Section 132(f)(4), which will apply to taxable years beginning after December 31, 1996, means that employers will be able to offer commuters the option to choose taxable cash in lieu of a tax-exempt parking subsidy. This amendment will therefore remove the tax barrier to enforcing California's parking cash-out law.

IV. EMPLOYER-PAID PARKING AND CASHING OUT: A COMPARISON

When an employer offers free parking *at work*, commuters must still pay the cost of driving *to work*. This arrangement is essentially a matching grant for driving to work: the employer pays part of the cost of commuting by car (the parking cost) only if the employee is willing to pay the rest of the cost of commuting by car (the driving cost). Employees who are unable or unwilling to commute by car cannot take advantage of the parking subsidy.

Matching grants are usually offered to stimulate additional spending for an activity, not replace existing spending for the activity. To estimate whether employer-paid parking stimulates additional solo driving or merely replaces commuters' existing payments for parking, we can examine the evidence from case studies of how employer-paid parking affects commuters' travel choices. Appendix 4 presents a literature review of employer-paid parking's effects on commuter travel behavior. To summarize this literature, Table 10 presents the results of seven case studies that have either: (1) compared the mode shares of commuters *before* and *after* employer-paid parking was eliminated; or (2) compared the mode shares of matched samples of commuters *with* and *without* employer-paid parking.

EMPLOYER-PAID PARKING STIMULATES SOLO DRIVING

Case studies conducted in different locations (in Canada and on both coasts of the United States) at different times (1969 through 1991) cannot be generalized to all commuters, but the results are nevertheless provocative. When commuters paid for their parking, they drove an average of 53 cars to work per 100 commuters. When employers paid for parking, commuters drove an average of 72 cars per 100 commuters. These case studies therefore suggest that, per 100 commuters, employer-paid parking replaced the commuters' existing payments for parking for 53 cars (the number driven to work when commuters pay for parking), and stimulated the driving of 19 more cars, a 36 percent increase in the number of cars driven to work. For every three cars already on the road to work, employer-paid parking added another car.

TABLE 10

EMPLOYER-PAID PARKING STIMULATES SOLO DRIVING TO WORK

Location, Date, and Type of Case Study	Solo Driver Mode Share			Cars Driven to Work per 100 Employees		
	Driver Pays for Parking	Employer Pays for Parking	Stimulated Increase	Driver Pays for Parking	Employer Pays for Parking	Stimulated Increase
Civic Center, Los Angeles, 1969 (with/without)	40%	72%	+32%	50	78	+28
Downtown Ottawa, Canada, 1978 (before/after)	28%	35%	+7%	32	39	+7
Century City, Los Angeles, 1980 (with/without)	75%	92%	+17%	80	94	+14
Mid-Wilshire, Los Angeles, 1984 (before/after)	8%	42%	+34%	30	48	+18
Warner Center, Los Angeles, 1989 (before/after)	46%	90%	+44%	64	92	+28
Washington, D.C., 1991 (with/without)	50%	72%	+22%	58	76	+18
Downtown Los Angeles, 1991 (with/without)	48%	69%	+21%	56	75	+19
AVERAGE OF CASE STUDIES	42%	67%	+25%	53	72	+19

Source: Shoup (1995). The original sources of these studies are Groninga and Francis (1969), Transport Canada (1978), Shoup and Pickrell (1980), Surber, Shoup, and Wachs (1984), Soper (1989), Miller (1991), and Wilkon (1991). "With/without" refers to a case study comparing the commuting behavior of employees with and without employer-paid parking. "Before/after" refers to a case study comparing the commuting behavior of employees before and after employer-paid parking was eliminated. The estimated price elasticity of demand for commuter parking is the midpoint arc elasticity.

Other studies have also shown that employer-paid parking strongly affects travel choices. For example, to identify the factors affecting individuals' choices to commute by transit, the Center for Urban Transportation Research (1989) surveyed 4,000 persons who live within one-half mile of public transportation in seventeen cities. Of the survey respondents who rode transit to work, approximately 70 percent were identified as "choice" transit riders, defined as those who own a car but choose to ride transit to work. These "choice" transit riders were asked "Why do you not take your car to work?" Fifty-one percent of the "choice" transit riders responded that their reason for not driving to work was either that it costs too much to park, or that there is no place to park at work (another way of saying that it costs too much). This response implies that half of all "choice" transit commuters surveyed (and 35 percent of all transit commuters surveyed) would stop riding transit and start driving to work if their employer offered to pay for their parking.

CASHING OUT REDUCES SOLO DRIVING

We can compare the eight new case studies of how cashing out parking subsidies reduces driving to work with the seven previous case studies (shown in Table 10) of how employer-paid parking increases driving to work. Table 11 shows the results of the eight new cash-out studies presented in the same format as Table 10 presents the results of the earlier seven employer-paid-parking studies.¹⁵

Table 10 shows that employer-paid parking increased the average number of cars driven to work from 53 per hundred employees when drivers pay for parking, to 72 per hundred employees when employers pay for parking without the cash option. Table 11 shows that cashing out reduced the average number of cars driven to work from 75 per hundred employees when employers pay for parking without the cash option, to 67 per hundred employees with the cash option.

Table 10 shows that employer-paid parking stimulated 19 more cars driven to work per 100 employees, while Table 11 shows that cashing out reduced 8 cars driven to work per 100 employees. Employers who offer free parking will always have difficulty encouraging ridesharing, but if an employer does offer free parking, also offering the cash-out option will reduce the incentive to drive to work.

There is a close match in Tables 10 and 11 for the number of cars driven to work when employers offer free parking without the cash option--72 per hundred employees for the seven previous case studies in Table 10 and 75 per hundred for the eight new case studies in Table 11. This mere 4 percent difference between the results of the previous and new case studies suggests that the new case studies are consistent with previous research on the effects of employer-paid parking.

V. TWO ISSUES IN CASHING OUT EMPLOYER-PAID PARKING

Two important issues in cashing out employer-paid parking are (1) how it will affect income tax revenues, and (2) how it will affect employers who both own and rent parking spaces.

TABLE 11

CASHING OUT EMPLOYER-PAID PARKING REDUCES SOLO DRIVING TO WORK

Case/Location	Solo Driver Share			Cars Driven to Work per 100 Employees		
	<i>Without</i> Cashing Out	<i>With</i> Cashing Out	Change	<i>Without</i> Cashing Out	<i>With</i> Cashing Out	Change
5. Downtown L.A.	75%	53%	-22%	70	53	-17
8. Downtown L.A.	61%	45%	-16%	70	58	-12
1. Century City	71%	58%	-13%	71	65	-6
4. Century City	88%	76%	-12%	87	79	-8
3. Century City	79%	67%	-12%	81	74	-7
7. Santa Monica	83%	75%	-8%	83	79	-4
6. Santa Monica	85%	78%	-7%	86	78	-8
2. West Hollywood	72%	70%	-3%	55	52	-3
AVERAGE	77%	65%	-12%	75	67	-8

HOW WILL CASHING OUT AFFECT TAX REVENUES?

Cash in lieu of a parking space is taxable, while the parking subsidy is tax exempt. Some commuters, however, will still prefer taxable cash to a free parking space. For example, suppose an employer pays \$100 a month to provide an employee a free parking space at work, and the employee is in the 30 percent marginal income tax bracket. If the employer offers a taxable \$100 payment in lieu of the tax-exempt \$100 a month parking space, the employee would receive, after taxes, \$70 a month for giving up the parking. Thus, the employee would "pay" \$70 a month to park at work. If the employee then chooses cash in lieu of the parking, this choice proves that the employer's in-kind parking subsidy of \$100 a month was worth less to the employee than \$70 a month in cash.

When a commuter does voluntarily choose taxable cash rather than a tax-exempt parking subsidy, federal and state income tax revenues will increase. If an employee in the 30 percent marginal tax bracket chooses \$70 in after-tax cash rather than a \$100 tax-exempt parking space, the employee pays \$30 extra in taxes and is still better off as a result. *This increase in tax revenue occurs without an increase in tax rates, and without eliminating the tax-exemption for parking subsidies.* The revenue increase results from voluntary action: cashing out an inefficient subsidy that costs the employer \$100 to provide but is worth less than \$70 to the employee. Thus, the opportunity to cash out parking subsidies can convert economic waste into increased government revenue and increased employee benefits.

Put most simply, cashing out an inefficient parking subsidy will convert economic waste into increased tax revenue and enhanced employee welfare, at little cost to the employer.¹⁶ The revenue windfall is an additional benefit beyond the reductions in air pollution, traffic congestion, and energy consumption that also result when a commuter voluntarily trades in a tax-exempt parking subsidy for taxable cash.¹⁷ The revenue windfall is funded solely by reducing the economic waste that occurs when, faced with the typical choice between free parking or nothing, an employee takes a parking space that he or she values at less than what the employer pays to provide it. Finally, this revenue windfall occurs without increasing any tax rates, and without removing the existing tax exemption for employer-paid parking.

The cash subsidies reported in the eight case studies can be used to estimate the tax revenue windfall resulting from cashing out. The 1,694 employees' taxable cash commuting subsidies rose by \$36,026 a month after cashing out, or by \$432,314 a year. The increase in taxable income was therefore \$255 per employee per year after cashing out. A marginal income tax rate of 19 percent is conventionally used to estimate the effects of revenue changes; using this rate, federal income tax revenues increased by \$48 per employee per year after cashing out, or by \$82,139 per year for the 1,694 employees of the eight firms.

WHAT WILL HAPPEN IF AN EMPLOYER BOTH OWNS AND RENTS PARKING SPACES?

California's cash-out requirement applies only to parking spaces that employers rent, and not to parking spaces they own. What will happen when an employer both owns *and* rents parking

spaces? It may seem unfair for an employer to offer the cash option to commuters who park in rented spaces but not to those who park in owned spaces, because this would unfairly discriminate against commuters who park in the owned spaces

One aspect of this "unfair discrimination" argument is the implicit acknowledgment that the cash option *is* a benefit to commuters who receive it, quite aside from the social benefits of reducing traffic congestion and improving air quality. If the firm could offer the cash option to *all* commuters, discrimination would not be an issue. Consider, then, how a firm that both owns and rents parking spaces can offer the cash option to all commuters

• Suppose a firm does not own enough parking spaces to provide parking for all automobile commuters, and therefore rents additional spaces to satisfy the excess parking demand. Table 12 illustrates this situation. The first row shows that if the firm offers free parking, commuters will demand 150 parking spaces. If the firm owns only 100 spaces, it must rent an additional 50 spaces to meet the demand for free parking. If the firm pays \$100 per month per space to lease these 50 spaces, the firm's total cost for renting parking is \$5,000 per month.

The second row shows that if the firm offers *all* commuters the option of \$100 per month in lieu of a parking space, the demand for parking is assumed to decline by 10 percent, to 135 parking spaces. If commuters cash out owned spaces, these spaces can be reassigned to commuters who park in rented spaces, and the number of rented spaces falls from 50 to 35. Therefore, the firm pays commuters \$1,500 per month in lieu of the 15 parking spaces they cash out, but the firm also pays \$1,500 per month less in rent for the leased parking. If the firm offers the cash option to all commuters, all of the cash paid to commuters is financed by reducing the firm's out-of-pocket payments for rented parking spaces.¹⁸

Firms that both own *and* rent parking spaces can take advantage of this dual situation by offering the cash-out benefit not only to commuters who park in the rented spaces but also to those who park in the owned spaces. Therefore, both owning *and* renting parking spaces is an advantage, because it allows the firm to offer cash not only to those who park in rented spaces, but also to those who park in owned spaces.

If a firm both owns and rents parking spaces, the owned spaces are typically closer to the work site, and more convenient. When an employee who parks in an owned space takes cash in lieu of parking, another employee can shift from a rented space to a more convenient owned space. The commuter who cashes out is better off, and the commuter who shifts to an owned space is also better off. Therefore, cashing out can benefit even commuters who do not cash out

At first glance, California's requirement to cash out rented parking spaces might seem to create a problem for employers who both own and rent parking spaces. On closer analysis, cashing out creates an additional benefit for these employers.

TABLE 12
CASHING OUT EMPLOYER-PAID PARKING WITH BOTH OWNED AND RENTED SPACES

Parking Arrangement	Parking Demand	Owned Spaces	Rented Spaces	Rental Cost	In-Lieu Cash	Total Cost
Free Parking (without cash out)	150	100	50	\$5,000	\$0	\$5,000
Free Parking (with cash out)	135	100	35	\$3,500	\$1,500	\$5,000
Change	-15	0	-15	-\$1,500	+\$1,500	\$0

Assumptions:

1. Cashing out reduces the demand for parking spaces by 10%.
2. The employer pays \$100 per space per month to rent parking spaces.

The numerical example in Table 12 is not unrealistic. Three case-study firms (3, 6, and 8) both owned and rented parking spaces, and they offered the cash option to *all* commuters, in the owned *and* rented spaces.

The three firms' employee transportation coordinators reported no problems in offering cash to commuters in both owned and rented spaces. If a commuter who parks in an owned space takes the cash, a commuter who formerly had to park in a more distant rented space takes the owned space, and the firm reduces the number of spaces it rents. Thus, two commuters are better off when only one takes the cash. When asked whether both owning and renting parking spaces caused any difficulty in cashing out, one firm's representative responded, "*Not at all. Why would it?*"

Finally, there is another side to the argument that offering the cash option only to commuters who park in rented spaces would discriminate against commuters who park in owned spaces. *Without* the cash option, employer-paid parking gives solo drivers the biggest subsidies, but this discrimination in favor of solo drivers is rarely mentioned as an objection to employer-paid parking itself. Offering the cash option to all commuters can eliminate any inadvertent discrimination in favor of solo drivers.

VI. EVALUATION OF CASHING OUT: EIGHT CASE STUDIES

Although few firms have brought their parking subsidy policies into compliance with California's cash-out requirement, we have identified eight cases to study. All eight initially offered parking subsidies that were greater than the alternative subsidies they offered. All eight subsequently adopted subsidy programs that comply with the cash-out requirement. Table 13 shows the employers' characteristics.

To control for factors other than cashing out, it would be desirable to examine the results at a comparison firm that did everything that a cash-out case study did, except cash out. Because all firms in Southern California with more than 100 employees were subject to Regulation XV during the period we have examined, however, we have been unable to find a comparison firm that has not been adding ridesharing incentives (such as raffles, point programs, transit passes, guaranteed rides home, and zip code parties). If these incentives have any effect, one would expect the solo share to fall at the potential comparison firms even if they did not cash out their parking subsidies. Most of the case-study firms, however, eliminated other ridesharing incentives after they began to cash out, so one would expect their solo shares to increase, except for the effect of cashing out. Therefore, we have been unable to find a comparison firm that did everything the case study firms did, except cash out.

Case Study 9 is a potential comparison firm because the difference between its parking subsidy and its ridesharing subsidy remained almost unchanged between 1991 and 1995, although it did adopt an array of conventional ridesharing incentives. The firm's solo driver share was unchanged (at 83 percent) between 1990 and 1995. Both the unchanged solo share for Case Study 9, and the rising solo share for all commuters in Southern California between 1990 and 1994 (Figure 3),

TABLE 13
SUMMARY OF EMPLOYER CHARACTERISTICS

Case Study	Number of Employees	Industry	Location	Parking Price
Case Study 1	257	Accounting	Century City	\$110
Case Study 2	139	City government	West Hollywood	\$65
Case Study 3	120	Banking	Century City	\$110
Case Study 4	191	Law	Century City	\$120
Case Study 5	281	Law	Downtown L.A.	\$165
Case Study 6	121	Video Post-production	Santa Monica	\$55
Case Study 7	300	Law	Santa Monica	\$77
Case Study 8	285	Medical Group	Downtown L.A.	\$36

strengthen the conclusion that cashing out parking subsidies, and not other factors, caused the solo share reductions at the eight firms that cashed out

The case study firms were identified in consultation with Commuter Transportation Services (now Southern California Rideshare), the regional ridesharing agency that assists Employee Transportation Coordinators at nearly 5,000 employer sites with rideshare programs. In addition, the City of Santa Monica enforces the state's cash-out requirement as part of its Transportation Management Plan Ordinance; the city's Transportation Management Office provided the data for the two case studies and the comparison firm in Santa Monica.

In addition to the data analyses, we have interviewed five of the firms' transportation coordinators to obtain their evaluation of their firms' experience with cashing out parking subsidies. These interviews add essential information on how cashing out has worked in practice. Appendix 1 presents the transcripts of the five interviews.

The following nine sections present the case studies of the eight firms that cashed out, and of the comparison firm.

ENDNOTES TO PAGES 1 - 46

1. Of the 91 million private vehicles driven to work in the United States in 1990, solo drivers occupied 92 percent, two-person carpools occupied 7 percent, and carpools of three or more persons occupied 1 percent. The share of commuters who drive to work alone increased by 14 percent between 1980 and 1990, while the bicycle share fell 15 percent, the transit share fell 18 percent, the walk share fell 30 percent, and the carpool share fell 32 percent. These percentages are calculated from 1980 and 1990 Census reported in Pisarski (1996, 49). The 1990 Nationwide Personal Transportation Survey found that 95 percent of all automobile commuters park free at work (Shoup 1995, 14). A 1994 survey found that employers offer 84.8 million free parking spaces for their employees (Shoup and Breinholt 1995).

2. The 1990 *Nationwide Personal Transportation Survey* found that 95 percent of automobile commuters park free at work (Shoup 1995, 15).

3. The average reduction is for all 1,694 employees of the eight firms, it is not the unweighted average reduction for the eight firms.

4. See Pisarski (1996, 49). The increase in carpooling at the eight cash-out firms is likely to have been among nonfamily members (because family members could presumably have carpooled even before cashing out), while in the 1980s carpooling among nonfamily members declined even faster than did all carpooling.

5. The sample size was 1,208 commuters in 1990, 2,548 in 1991, 2,487 in 1992, 2,591 in 1993, and 2,625 in 1994. These results are presented in Table 2.1 of *Commuter Transportation Services* (1994). No surveys were made after 1994.

6. A similar experience explains the rank ordering of vehicle trip reductions for the three firms in Century City. Case 1 with the 13-percent solo share reduction had a smaller vehicle trip reduction than the two firms with the 12-percent solo share reduction. In Case 1, the carpool share increased by as much as the solo share declined, while in the other two cases transit, walking, and bicycling increased. As a result, the mode shifts reduced vehicle trips less for Case 1 than for the other two cases in Century City.

7. See "Cost-Effectiveness, District Options for Satisfying the Requirements of the California Clean Air Act," prepared by the Office of Air Quality Planning & Liaison, California Air Resources Board, September 1990, page 9-10.

8. These projects include alternative fuel vehicles, vehicle scrappage, shuttle services, employer-based trip reduction programs, and bicycle infrastructure. See Table 1 of "Technical Support Document for Evaluation of Selected Projects Financed by Motor Vehicle Registration Fees," June 1995 Report to the Legislature, by the California Air Resources Board. Table 1 attributes the full cost of each project to reducing vehicle emissions, and does not report CO reductions, when only half the cost of the project is attributed to reducing emissions, and CO is included, the average cost effectiveness is \$10,000 per ton of emissions reduced.

9. See California Air Resources Board, Office of Air Quality and Transportation Planning, "Criteria and Guidelines for Use of Motor Vehicle Registration Fees," June 1995, page 6
10. The 1990 Census reports automobile ownership and commuter mode shares by gender and ethnicity (Pisarski 1996)
11. These percentages refer to all automobile travel to and from work as a share of total personal automobile travel, and are derived from data in the 1990 NPTS (Shoup 1995)
12. The 1,694 employees' taxable commuting subsidies rose by \$36,026 a month after cashing out, or by \$432,314 a year. The increase in taxable income was therefore \$255 per employee per year after cashing out. The average marginal income tax rate of all taxpayers in the United States who report a positive tax liability, weighted by the number of taxpayers paying each marginal tax rate, was 19 percent in 1996 (Shoup 1997). Using this 19-percent rate, the 1,694 employees' state and federal income tax payments increased by \$82,140 a year, or \$48 per employee per year. This tax revenue is a transfer to the government from commuters who would otherwise have received the full value of the cash-out payments.
13. The California Franchise Tax Board uses this marginal tax rate of 6.5 percent to calculate the effects of changes in taxable wage income. In making federal conformity estimates, the Franchise Tax Board also calculates that California income tax revenues will rise by one-third of the rise in federal income tax revenues; given the federal marginal tax rate of 19 percent, this rule of thumb yields a 6.3 percent marginal tax rate for California.
14. The rationale for the \$155 per month cap on tax-exempt parking subsidies was that taxes on employer-paid parking subsidies over \$155 per month will raise enough new tax revenue to replace the revenue lost by exempting the first \$60 per month of employer-paid transit and vanpool subsidies.
15. The average solo share reduction of twelve percentage points in Table 11 is unweighted by employer size. Table 2 showed that when we weight the eight employers by their number of employees, the average reduction in solo share is thirteen percentage points.
16. The size of the waste created by employer-paid parking is measured by the difference between what the employer pays to provide the space and the cash value that an employee places on receiving the space. In cashing out employer-paid parking, the value that an employee places on a parking space is the lowest price he or she would accept to "sell" the parking space back to the employer. The price the employee would be willing to accept may be higher than the price he or she would be willing to pay for the parking space if the employer did not provide it "free." Adamowicz *et al.* (1993) survey the literature on the divergence between willingness to accept and willingness to pay, and present evidence supporting Hanemann's (1991) hypothesis that the availability of substitutes for a good reduces the divergence between prices that someone will pay for a good or accept for it. This suggests that the difference between willingness to pay for parking and willingness to accept cash in lieu of parking will differ least in situations where mass transit and carpooling are available alternatives to solo driving.
17. Some commuters may choose cash in lieu of a parking subsidy, pay taxes on the cash, and then use the after-tax income to park in a cheaper space, without ceasing to drive to work alone. In that case, the

employee is better off, the employer is no worse off, and federal and state income tax revenues increase. The *option* to cash out an inefficient parking subsidy (worth much less to the employee than it costs the employer) converts economic waste into both increased employee welfare and increased government revenue, even if it does not always reduce driving to work.

18. Offering the cash option to *all* commuters would cause a problem only if it reduces the total demand for parking by more than the number of parking spaces the firm rents.

CASHING OUT EMPLOYER-PAID PARKING

THE CASE STUDIES

CASE STUDY 1
CASE STUDY 2
CASE STUDY 3
CASE STUDY 4
CASE STUDY 5
CASE STUDY 6
CASE STUDY 7
CASE STUDY 8
CASE STUDY 9

CASE STUDY I

I. EXECUTIVE SUMMARY

The employer is an accounting firm in Century City. In 1992, the firm offered employees the choice of *either* free parking, which cost the firm \$110 per space per month, *or* a "clean commuter" subsidy of \$55 per month. The firm thus offered a parking subsidy to solo drivers that was twice as large as the subsidy it offered to clean commuters (defined as any commuter other than a solo driver).

The firm then changed its commuter subsidy policy in one important way. Since 1992, the firm has continued to offer clean commuters \$55 a month, but it now offers no parking subsidies. Therefore the firm's parking subsidy declined from \$110 a month to nothing, while all its other ridesharing programs remained the same. The firm's new policy satisfies California's parking cash-out law because parking subsidies were eliminated. The firm's policy goes beyond the cash-out requirement by offering a subsidy for clean commuting (\$55 a month) without offering a subsidy for parking. The following changes occurred after the firm changed its commuting subsidy policy:

- The solo driver share fell from 71 to 58 percent.
- The carpool share rose from 21 to 33 percent.
- The other mode shares did not change.
- Vehicle-round-trips to work fell from 0.71 to 0.65 per employee per day.

The shift from solo driving to carpooling reduced the number of vehicle trips for commuting by 9 percent, and VMT for commuting by 11 percent. Table 1 summarizes the reductions (per employee and for the firm) in vehicle trips, pollution emissions, and gasoline consumption that occurred after parking subsidies were eliminated.

II. BACKGROUND

The employer is an accounting firm specializing in real estate finance. The firm is located in Century City, a regional shopping and employment center in West Los Angeles. The firm employed 308 people at this worksite in 1992, and 273 in 1994.

Before the end of May 1992 the firm offered parking subsidies to all employees, at a cost to the firm of \$110 per space per month. The firm also offered a "clean commuter" subsidy of \$55 a month to employees who did not drive to work alone (carpool, mass transit, walking, or cycling). In addition, the firm offered other ridesharing benefits, such as guaranteed ride home by taxi or rental car, short term auto rental for midday use by clean commuters, and two days of free parking per month for clean commuters when they needed to drive alone because of such occasions as a doctor's appointment. The firm also offered various rideshare support services such as personalized rideshare matching, rideshare information expos, on-site transit pass sales, and rideshare videos at monthly mixers.

TABLE 1-1

SUMMARY OF REDUCTIONS AFTER ENDING PARKING SUBSIDIES

<u>Variable Reduced</u>	<u>Reduction</u>		<u>Percent Change</u>
	<u>Per Employee</u>	<u>For Firm</u>	
Vehicle Trips (per year)	31	7,957	9%
Vehicle Miles Traveled (per year)	599	153,986	11%
Reactive Organic Gas Emissions (pounds per year)	1.5	397	10%
Nitrogen Oxide Emissions (pounds per year)	1.4	349	11%
Carbon Monoxide Emissions (pounds per year)	13.8	3,550	10%
Particulate Matter Emissions (pounds per year)	1	255	11%
Gasoline Consumption (gallons per year)	24	6,159	11%
Carbon Dioxide Emissions (pounds per year)	472	121,341	11%

There were 257 employees who reported to this work site during the 1994 survey period.

Table 2 shows the pattern of commuter subsidies before May 1992 (in Columns 2, 4, and 6 labeled "Free Parking"). Column 2 shows that solo drivers received the largest subsidy of \$110 per month per employee. All other commuters received a clean commute subsidy of \$55 per employee per month. Therefore, the subsidy for a solo driver was double the subsidy for a clean commuter.

Column 4 shows the results found in a transportation survey required by the South Coast Air Quality Management District (SCAQMD) which was conducted in May 1992, the last month in which the firm offered parking subsidies.¹ Seventy-one percent of employees drove to work alone, 21 percent carpooled, 4 percent rode transit, and 4 percent walked or bicycled to work.

Column 6 shows the distribution of the firm's parking and clean commute subsidies among its employees in 1992. Seventy-one percent of commuters drove solo, but they received 83 percent of the total subsidy. Twenty-one percent of commuters carpooled, but they received only 12 percent of the total subsidy. Four percent of commuters rode transit, but they received only 3 percent of the total subsidy.

The firm was generous to clean commuters in the sense that it offered a subsidy of \$55 per month to anyone who did not drive to work solo. But even a generous ridesharing program is ineffective if the subsidy for solo driving is double the subsidy for ridesharing. This subsidy arrangement also violated California's parking cash-out law which requires employers "to provide a cash allowance to an employee equivalent to the parking subsidy that the employer would otherwise pay to provide the employee with a parking space" (California Health and Safety Code Section 43845).

III. ENDING PARKING SUBSIDIES REDUCED SOLO DRIVING

The firm changed its commuter subsidy policy in May 1992. It eliminated employer-paid parking, but continued to offer its clean commuter subsidy of \$55 per month to all commuters except solo drivers. The firm continued to offer all its other significant rideshare incentives, such as a guaranteed ride home and rideshare matching services. The firm eliminated several insignificant rideshare incentives--management education seminars, clean fuel vehicle seminars, zipcode meetings, employee focus groups, and other types of general busywork that employers carry out either to reduce vehicle trips or else to convince the SCAQMD that they are trying to reduce vehicle trips (see attached list of incentives offered in 1992 and 1994). Thus, eliminating parking subsidies was the only significant policy change from 1992 to 1994.

Table 2 shows (in Columns 3, 5, and 7 labeled "Pay Parking") the results of the firm's most recent employee transportation survey, conducted in July 1994, a little more than two years after the firm eliminated parking subsidies for solo drivers.

Column 3 shows the new pattern of commuter subsidies. Solo drivers receive no subsidy, and all other employees receive \$55 a month.

TABLE 1-2
COMMUTER MODE CHOICES WITH AND WITHOUT PARKING SUBSIDIES

Commuter Mode (1)	Subsidy per Employee		Mode Share		Subsidy Distribution	
	Free Parking (2)	Pay Parking (3)	Free Parking (4)	Pay Parking (5)	Free Parking (6)	Pay Parking (7)
Drive Alone	\$110	\$0	71%	58%	83%	0%
Carpool	\$55	\$55	21%	33%	12%	80%
Transit	\$55	\$55	4%	5%	3%	11%
Walk	\$55	\$55	3%	3%	2%	8%
Bicycle	\$55	\$55	1%	0%	0%	1%

Note: The survey response rate was 87% in 1992 and 90% in 1994. A Chi-Square test shows that the probability was less than 1 percent that the difference in commuter mode shares observed in Columns (3) and (4) occurred by chance.

Column 5 shows that many employees shifted from solo driving to carpooling after the firm stopped subsidizing parking. The share of commuters who drive to work alone fell from 71 to 58 percent, and the share of commuters who carpool rose from 21 to 33 percent. There was little or no change in other mode shares. A Chi-square test shows that there is less than a one percent chance that this mode shift occurred randomly.

Figure 1 shows how ending parking subsidies at this firm encouraged commuters to form carpools. The figures are taken from Columns 4 and 5 of Table 2, and they show that almost the entire increase in carpooling came at the expense of solo driving. Although nothing at the firm changed except that parking subsidies were ended after the 1992 survey, it may be asked whether regional trends can explain part of this observed shift from solo driving to carpooling. We can answer this question because Commuter Transportation Services conducts annual surveys of commuters in Southern California. Figure 2 displays the commute mode shares they found in 1992 and 1994. As can be seen, the share of commuters who drove to work alone in Southern California increased from 77 to 80 percent between 1992 and 1994.² Therefore, the 13 percent reduction in solo driving shown in Figure 1 for the firm that ended its parking subsidies is not explained by, and in fact runs counter to, the 3 percent increase in solo driving shown in Figure 2 for the region.

The last column of Table 2 shows the distribution of the firm's commuter subsidies among its employees in 1994. Solo drivers, who represent 55 percent of all employees, receive no subsidy. Carpoolers, who represent 33 percent of employees, receive 80 percent of the total subsidy. Transit riders, who represent 5 percent of employees, receive 11 percent of the total subsidy. The previous subsidy distribution (in 1992) favored solo drivers, while the new subsidy distribution favors clean commuters.

IV. ENDING PARKING SUBSIDIES REDUCED COMMUTER VEHICLE TRIPS

One aim of transportation demand management is to reduce vehicle trips, and Table 3 summarizes the results of ending parking subsidies in terms of the number of vehicle trips it has reduced. The table shows that ending parking subsidies reduced the number of vehicle trips by 9 percent.

Row 1 shows that in 1992 and 1994 there were, on average, 0.88 commuters per employee. On an average day, 12 percent of employees were on vacation, sick, or did not commute to work for another reason, so the firm's attendance rate was 88 percent.

Row 2 shows the number of vehicle round-trips per day per commuter, calculated from the data used to create Table 2. Each solo driver is counted as one vehicle-trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle-trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. The total number of vehicle round-trips is then divided by the total number of responding commuters to give the ratio of vehicle round-trips per commuter. Thus there were 0.81 vehicle trips per commuter per day in 1992 when the firm

FIGURE 1-1
Commuter Mode Choices
 With and Without Parking Subsidies

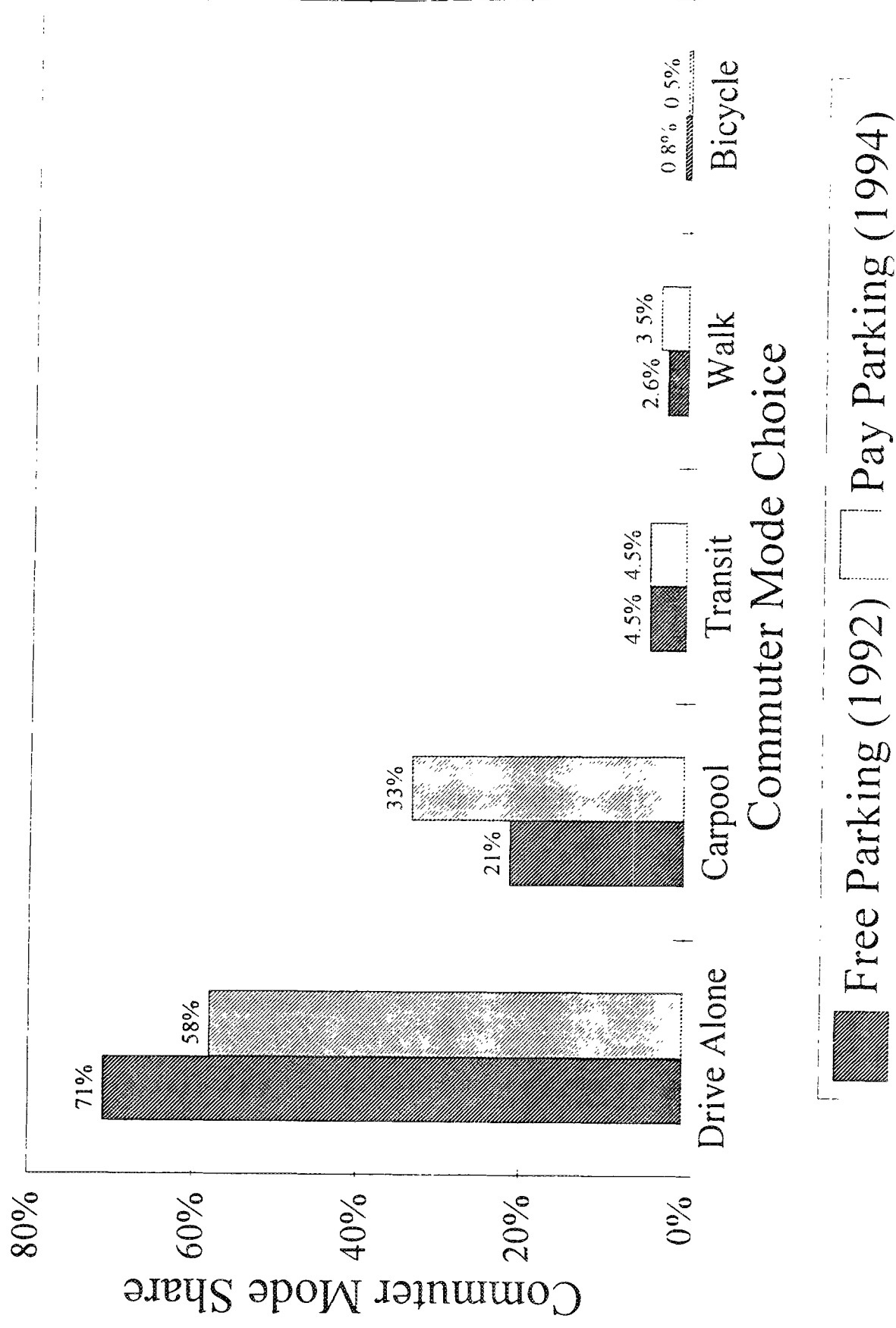


FIGURE 1-2

Commuter Mode Choices

In Southern California

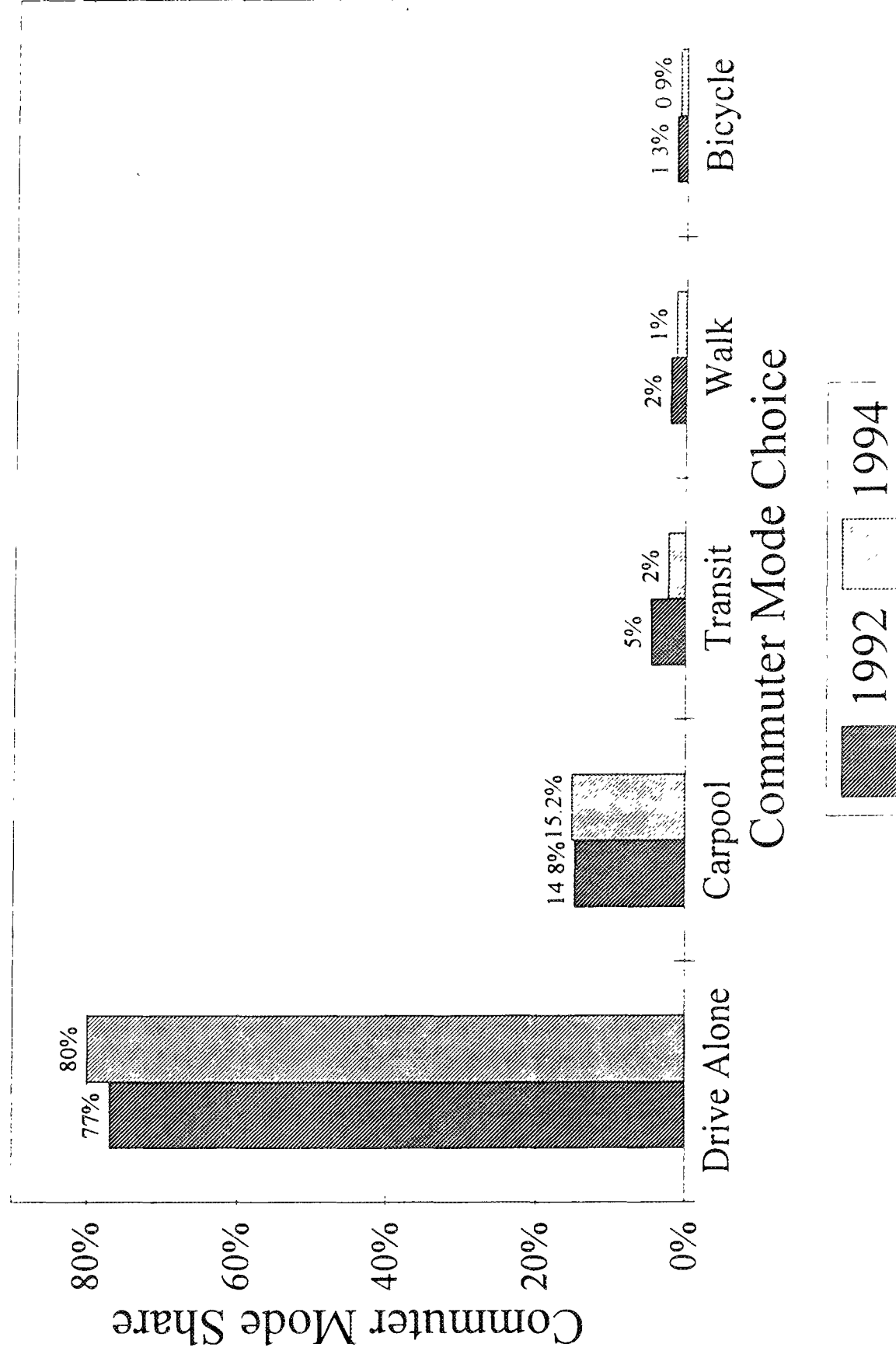


TABLE 1-3

VEHICLE TRIP REDUCTIONS AFTER ENDING PARKING SUBSIDIES

	Free Parking	Pay Parking	Change	Percent Change
	(1)	(2)	(3)	(4)
1 Commuters per Employee	0.88	0.88		
2 Vehicle Trips per Commuter per Day (Round-trip)	0.81	0.74	-0.07	-9%
3 Vehicle Trips per Employee per Day (Round-trip)	0.71	0.65	-0.06	-9%
4 Vehicle Trips per Employee per Year (One-way)	359	328	-31	-9%
5 Total Vehicle Trips per Year (One-way)	92,139	84,182	-7,957	-9%

There were 257 employees who reported to this work site during the 1994 survey period.

Row 3 = Row 2 x Row 1

Row 4 = Row 3 x 252 x 2.

Row 5 = Row 4 x 257.

subsidized parking, and 0.74 in 1994 when the firm did not subsidize parking. As a result, the number of vehicle-round-trips per commuter per day fell by 9 percent between 1992 and 1994.

Row 3 shows the number of vehicle round-trips per employee per day, obtained by multiplying the 0.88 vehicle trips per commuter by the number of commuters per employee. The number of vehicle trips per employee fell from 0.71 with parking subsidies to 0.65 without parking subsidies, or by 9 percent.

Row 4 shows the number of one-way vehicle trips per employee per year to the worksite, with and without parking subsidies. The number of one-way vehicle trips in 1994 (with pay parking) is calculated by multiplying the 0.65 vehicle round-trips per employee per day found in 1994 by 252 work days per year, and doubling the result to obtain the number of one-way trips.³ The number of one-way vehicle trips in 1992 (with free parking) is calculated by multiplying the 0.71 vehicle round-trips per employee per day found in 1992 by the same 252 working days per year, and doubling the result to obtain one-way trips. The resulting change in the number of vehicle trips per employee per year therefore represents the change that occurred because parking subsidies ended.

Row 4 thus shows that there were 359 vehicle trips per employee in 1992. Because subsidies for solo drivers were ended, there were only 328 vehicle trips per employee in 1994. Thus, ending subsidies for solo drivers eliminated 31 vehicle trips per employee per year, a 9 percent decrease.

Vehicle trips for all commuting to the firm were calculated by multiplying the number of trips per employee by the total 257 employees who reported to the worksite. Row 5 shows that in 1992 employees made 92,139 vehicle trips for commuting to the firm. Ending parking subsidies reduced the number of vehicle trips to 84,182, or by 7,957 vehicle trips per year, a 9 percent decrease.

V. ENDING PARKING SUBSIDIES REDUCED VEHICLE MILES TRAVELED

The SCAQMD's survey instrument asks each employee not only about mode choice, which we have just analyzed, but also about the distance an employee travels to work. Although this additional information on distance traveled to work is not used to measure a firm's compliance with SCAQMD's Rule 1501 (which sets only mode-share goals), it is available in the individual survey responses. For this case study we were able to obtain all the individual responses for both the 1992 and 1994 surveys, and we were thus able to recode all the responses to examine the results in detail. With the additional information on each employee's person-miles-traveled (PMT) to work, and with the employee's reported commute mode, we can estimate the employee's vehicle-miles-traveled (VMT) to work.

We assume that the commuter's PMT is the same as his or her reported distance traveled to work, but the commuter's VMT depends on both the commute mode and the distance traveled to work. For example, if the employee is a solo driver, the employee's PMT and VMT are the

same. If the employee reports being part of a two-person carpool, however, the employee's VMT are counted as one-half the PMT because the vehicle is carrying two commuters and the VMT is divided equally between the two. Likewise, if the employee reports being part of a three-person carpool, the employee's VMT are counted as one-third the PMT. If the employee walks, bicycles, rides transit, or telecommutes, the employee's VMT are counted as zero.

The ratio of VMT/PMT reveals the "vehicle-intensity" of the commuting pattern to a firm. If the ratio of VMT/PMT is 1.0, all employees drive to work alone because every person-mile of travel creates a vehicle-mile of travel. If the ratio of VMT/PMT is 0.5, every person-mile of travel creates only one-half a vehicle-mile of travel; for example, if all employees commuted from home in two-person carpools, the ratio of VMT/PMT would be 0.5. Given the geographical distribution of employees (and therefore of total PMT to work), the ratio of VMT/PMT determines the number of vehicle-miles of travel to work.

Table 4 shows how the commuters' PMT and VMT changed after parking subsidies were ended. Row 1 shows the commuters' average distance traveled to work (PMT) declined by 5 percent, and Row 2 shows their average "vehicle intensity" of commuting (VMT/PMT) declined by 7 percent. Row 3 shows that these two changes together reduced the commuters' average VMT for commuting by 11 percent, or by 2.7 VMT per day. When all employees of the firm are considered (including those who did not commute during the survey week), ending parking subsidies eliminated 2.4 VMT per employee per day (Row 4), and 599 VMT per employee per year (Row 5). Because 257 employees reported to the work site in 1994, ending parking subsidies eliminated a total of 153,986 VMT per year for automobile commuting to the firm.⁴

VI. ENDING PARKING SUBSIDIES REDUCED VEHICLE EMISSIONS

We estimate the emissions reductions by considering the reductions in both automobile *trips* and *VMT*. The "cold start" as the engine warms up and the "hot soak" as the engine cools down cause pollution emissions at the beginning and end of each automobile commute trip; these "trip-end" emissions are independent of the total distance traveled for the commute. The "running" emissions are a factor of total VMT for the trip. In Tables 3 and 4 we have already estimated the reductions in automobile trips and VMT. Therefore, we can multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting.

Cashing out reduced 31 trips and 599 VMT per employee per year. We multiply these reductions by the emission factors for ROG, NO_x, CO, and PM₁₀ for both trip ends and VMT. We use the emission factors specific to 1994, the year in which the vehicle-trip and VMT reductions were estimated. We add the two sources of pollution, and then divide by 454 grams per pound to obtain the emissions reductions in pounds per employee per year. Table 5 shows that cashing out eliminated 1.5 pounds of ROG, 1.4 pounds of NO_x, 13.8 pounds of CO, and 1.0 pounds of PM per employee per year.

TABLE 1-4

VMT REDUCTIONS AFTER ENDING PARKING SUBSIDIES

	<u>Free Parking</u>	<u>Pay Parking</u>	<u>Change</u>	<u>Percent Change</u>
	(1)	(2)	(3)	(4)
1 PMT per Commuter	29.1	27.8	-1.4	-5%
2 VMT per PMT	0.85	0.79	-0.06	-7%
3 VMT per Commuter per Day	24.7	22.0	-2.7	-11%
4 VMT per Employee per Day	21.7	19.3	-2.4	-11%
5 VMT per Employee per Year	5,461	4,862	-599	-11%
6 Total VMT per Year	1,403,560	1,249,574	-153,986	-11%

There were 257 employees who reported to this work site during the 1994 survey period.

Row 3 = Row 2 x Row 1.

Row 4 = Row 3 x Row 1 (Table 1-3).

Row 5 = Row 4 x 252.

Row 6 = Row 5 x 257.

TABLE 1-5
REDUCTIONS IN VEHICLE EMISSIONS
AFTER ENDING PARKING SUBSIDIES
(Pounds Per Year)

	<u>Change</u>	<u>Percent Change</u>
ROG		
per Employee	-1.5	-10%
for Firm	-397	-10%
NOx		
per Employee	-1.4	-11%
for Firm	-349	-11%
CO		
per Employee	-13.8	-10%
for Firm	-3,550	-10%
PM		
per Employee	-1.0	-11%
for Firm	-255	-11%

The pollution emissions per trip-end and per VMT in 1994 are taken from the Air Resources Board's EMFAC7F1.1/B7F model.

These 1994 factors are:

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>PM</u>
Trip end factor (grams/trip)	6.93	2.88	63.4	0
VMT factor (grams/mile)	0.81	0.88	7.18	0.75

These factors are multiplied by the reduction of 31 trips and 599 VMT per employee per year in Tables 1-3 and 1-4 to give the reduction in emissions per employee in 1994.

The emissions reductions for all employees of the firm are found by multiplying the emissions reduction per employee by the 257 employees of the firm in 1994. Cashing out eliminated a total of 397 pounds of ROG, 349 pounds of NO_x, 3,550 pounds of CO, and 255 pounds of PM per year for automobile commuting. The final column shows that cashing out reduced automobile emissions by between 10 and 11 percent.

VII. ENDING PARKING SUBSIDIES REDUCED GASOLINE CONSUMPTION AND CO₂ EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and carbon dioxide emissions. Table 6 shows these results. The SCAQMD has estimated that the average fuel efficiency of light-duty passenger vehicles in Southern California is 25 miles per gallon in 1996. Therefore, the VMT figures estimated in Table 4 (Rows 5 and 6) are divided by 25 miles per gallon to estimate gasoline consumption for commuting.⁵ Ending parking subsidies reduced gasoline consumption per employee by 24 gallons per year, and reduced total gasoline consumption for commuting to the firm by 6,159 gallons per year, an 11 percent decrease.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide. Therefore, the reduction in gasoline consumption reduced carbon dioxide emissions per employee by 472 pounds employee per year, and reduced total carbon dioxide emissions for commuting to the firm by 121,341 pounds per year, an 11 percent decrease.

VIII. ENDING PARKING SUBSIDIES REDUCED COMMUTING SUBSIDIES

The firm continued to offer a subsidy of \$55 a month to all clean commuters, but ended its parking subsidies of \$110 a month for solo drivers. Table 7 shows how this policy change reduced the firm's spending for commuter subsidies. To isolate the change in subsidy cost caused solely by the change in the number of employees, we use the total of 257 employees in 1994 for both years.

Table 7 shows that the total commuter subsidy with free parking was \$24,411 a month, including \$267 a month for payroll taxes on the \$4,125 cash benefits for ridesharers. Without free parking the total commuter subsidy fell to \$6,430 a month, including \$407 a month for payroll taxes on the \$5,933 cash benefits for ridesharers. Thus, ending parking subsidies saved this firm \$18,071 a month, or 74 percent of its spending on commuter subsidies. The subsidy per commuter declined from \$95 to \$25 a month, also a 74 percent decline.

IX. SUMMARY

The firm previously offered employees the choice of *either* free parking *or* a "clean commuter" subsidy. The parking subsidy cost the firm \$110 per space per month, and its clean commuter subsidy was \$55 per month. The firm's commuter subsidy policy thus violated California's parking cash-out law. In 1992 the firm stopped offering employer-paid parking, but

TABLE 1-6

REDUCTIONS IN GASOLINE CONSUMPTION AND CARBON DIOXIDE EMISSIONS

	<u>Free Parking</u>	<u>Pay Parking</u>	<u>Change</u>	<u>Percent Change</u>
	(1)	(2)	(3)	(4)
1 Gasoline Consumption per Employee (gallons per year)	218	194	-24	-11%
2 Total Gasoline Consumption (gallons per year)	56,142	49,983	-6,159	-11%
3 Carbon Dioxide Emissions per Employee (pounds per year)	4,304	3,831	-472	-11%
4 Total Carbon Dioxide Emissions (pounds per year)	1,106,005	984,664	-121,341	-11%

There were 257 employees who reported to this work site during the 1994 survey period.

The average fuel efficiency is 25 miles per gallon.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide.

TABLE 1-7

COMMUTING SUBSIDIES WITH FREE PARKING

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$110	71%	83%	\$20,019
2 Person Carpool	\$55	20%	12%	\$2,786
3 Person Carpool	\$55	2%	1%	\$230
Mass Transit	\$55	4%	3%	\$636
Walk	\$55	3%	2%	\$365
Bicycle	\$55	1%	0.4%	\$108
Monthly Subsidies for 257 employees:				\$24,144
Taxes on Cash Subsidies:				\$267
Total Cost per Month:				\$24,411
Cost per Employee per Month:				\$95

COMMUTING SUBSIDIES WITHOUT FREE PARKING

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$0	58%	0%	\$0
2 Person Carpool	\$55	29%	70%	\$4,142
3 Person Carpool	\$55	4%	10%	\$588
Mass Transit	\$55	5%	11%	\$643
Walk	\$55	3%	8%	\$492
Bicycle	\$55	0.5%	1%	\$68
Monthly Subsidies for 257 employees:				\$5,933
Taxes on Cash Subsidies:				\$407
Total Cost per Month:				\$6,340
Cost per Employee per Month:				\$25
Change in Total Cost per Month:				-\$18,071
Change in Cost per Employee per Month:				-\$70
Percent Change in Commuting Subsidy:				-74%

did not change its other ridesharing incentives. The firm's new commuter policy satisfies the requirements of the cash-out law.

In response to eliminating parking subsidies, the share of commuters who drive to work alone fell from 71 to 58 percent, and the carpool share rose from 21 to 33 percent, with other mode shares almost unchanged. These commuter mode changes from solo driving to carpooling reduced the number of vehicle trips per day by 9 percent.

These changes in mode choice reduced 31 vehicle trips per employee per year, and 599 VMT per employee per year. A total of 7,957 vehicle trips and 153,986 VMT per year were eliminated for commuting to the firm.

By reducing both vehicle trips and VMT, ending parking subsidies reduced automobile pollution emissions for commuting to work by 10 to 11 percent. Per year, this reduction was 397 pounds of ROG, 349 pounds of NO_x, 3,559 pounds of CO, 255 pounds of PM, and 121,341 pounds of carbon dioxide. Gasoline consumption for commuting declined by 6,159 gallons, or 24 gallons per employee per year.

Finally, ending parking subsidies reduced the firm's spending on commuter subsidies by \$18,071 a month, or by 74 percent.

ENDNOTES

1. A sample of the questionnaire is attached. The survey response rate was 87 percent in 1992 and 90 percent in 1994.
2. The sample size was 2,487 commuters in 1992 and 2,625 commuters in 1994. These results are presented in Table 2.1 of Commuter Transportation Services (1994).
3. Vacations, sick days, and other absences are already accounted for in the calculation of the firm's average attendance rate, so the number of work days per year is five days per week for 52 weeks, minus the conventional eight national holidays.
4. We assume that cashing out does not affect the number of employees. Thus, we have estimated the VMT that would have occurred in 1992 when parking was free if there had been the same number of employees as there were in 1994. The difference between our estimate of (1) the VMT that would have occurred in 1992 with free parking if there had been the same number of employees as in 1994, and (2) the VMT that did occur in 1994 after free parking was ended, shows how the firm's policy change reduced VMT per day for commuter travel.
5. This estimated fuel efficiency of 25 miles per gallon was made using the Air Resources Board's EMFAC7F1.1/B7F model to represent conditions in Southern California on a workday in 1996. I am grateful to Waldo Lopez of the SCAQMD for this information. Average fuel efficiency of the fleet has been steadily increasing; it was only 22 miles per gallon in 1990. Because the estimates of VMT reductions refer to 1994, when average fuel efficiency was lower than in 1996, using a fuel efficiency of 25 miles per gallon produces a conservative estimate of how reducing VMT reduced fuel consumption.

REFERENCES

Commuter Transportation Services, *State of the Commute Report, 1994*, Los Angeles: Commuter Transportation Services, 1994.

Commuter Policies Case Study I

1992		1994
1	<i>Free Parking</i>	1
2	Subsidies for Clean Commuters	2
3	Parking Management	3
4	TMA Membership/TMA Commuter Center	4
5	Personalized Poolmatch Information	5
6	Transit Pass and Token Sales	6
7	On/Near-Site Amenities	7
8	Guaranteed Ride Home	8
9	Short Term Auto Rental (STAR)	9
10	Bulletin Boards	10
11	New Hire Orientation	11
12	Free Day Off	12
13	Commuter Discount Program	13
14	Adjustable Work Hours	14
15	Commuter X-Press	15
16	Rideshare Matching w/ Clients & Off-Site Employees	16
17	Transit Promotions	17
18	Transit Day/Transit Demonstrations	18
19	Telecommuting	19
20	Alternative Work Schedules	20
21	Vanpools	21
22	Facilities for Bicycles	22
23	Carpool/Vanpool Staging Areas	23
24	Parking for Vanpools	24
25	Cyclocommuting Club	25
26	Rideshare Videos at Monthly Mixers	25
27	<i>Rainy Day Parking Passes</i>	26
28	<i>Bicycle Program</i>	
29	<i>Personalized Assistance</i>	
30	<i>Management Education Seminars</i>	
31	<i>Employee Focus Groups</i>	
32	<i>Carpool Promotion (Zip Code Meetings)</i>	
33	<i>Clean Fuel Vehicle Seminars</i>	
34	<i>Ridesharer Recognition Program</i>	
35	<i>Marketing & Promotion</i>	
36	<i>Carpool/Vanpool/Transit/Bicycle Information</i>	

Case Study 1

Employer characteristics

Case study 1 provides accounting services. This firm had a total of 273 employees in 1994, with 257 employees reporting to work between 6am and 10am, Monday through Friday.

Case study 1 is located at 2049 Century Park East in Century City. Two major freeways - Santa Monica (10) and San Diego (405) -- provide nearby access to the firm. Major arterials serving this area include Avenue of the Stars, Santa Monica Boulevard and Olympic Boulevard. Eight bus routes serve this area.

Case study 1 provides on-site amenities such as retail establishments, restaurants, banks, goods and services. The firm is also conveniently accessible to nearby numerous restaurants, banks and retail establishments.

Surrounding streets have wide sidewalks, pedestrian signals, crosswalks and good lighting. Surrounding terrain is flat.

The distribution of job categories is:

Professional	62.4%
Clerical	31.1%
Officials/Administrators	6.5%

CASE STUDY 2

I. EXECUTIVE SUMMARY

The employer is a government agency in West Hollywood, California. In 1991, the agency offered employees the choice of *either* free parking, which cost the agency \$65 per space per month, *or* a "clean commuter" subsidy of \$45 per month. This subsidy arrangement was therefore a "partial" cash out because commuters who did not take a parking space were offered a cash subsidy (\$45) that was only 69 percent as large as the cash value of the parking subsidy (\$65). The agency offered several other ridesharing benefits including guaranteed ride home, preferential parking for carpoolers, a bus pass incentive, and special promotions.

The agency then changed its commuter subsidy arrangement to a "full" cash out: free parking, which costs the agency \$65 per space per month, *or* a cash subsidy of \$65 per month. All other ridesharing incentives remained the same. The following changes occurred after parking subsidies were fully cashed out.

- The solo driver share fell from 72 to 70 percent.
- The carpool share fell from 6 to 4 percent.
- The transit share fell from 5 to 3 percent.
- The walking share rose from 14 to 22 percent.
- Vehicle round-trips to work fell from 0.55 to 0.52 per employee per day.

These shifts from all forms of motorized transport (solo driving, carpooling, transit) to walking reduced the number of vehicle trips for commuting to work by 5 percent. Table 1 summarizes the reductions (per employee and for the firm) in vehicle trips, pollution emissions, and gasoline consumption that occurred after the agency offered employees the option to cash out their parking subsidies.

II. BACKGROUND

The employer is a government agency in West Hollywood, California. In 1991, the agency offered free parking to all employees. The agency paid \$65 per space per month to lease the parking spaces it provided to employees. The agency also offered a "clean commuter" subsidy of \$45 per month to employees who did not drive to work alone (transit, carpool, bicycling, or walking). The agency offered other ridesharing benefits including guaranteed ride home, preferential parking for carpoolers, a bus pass incentive, and special promotions. In addition, the agency provided bicycle racks and clothes lockers for cyclists and laptop computers for telecommuting.

Table 2 shows the pattern of commuter subsidies in 1991 (Columns 2, 4, and 6 labeled "Before"). Column 2 shows that solo drivers received a parking subsidy of \$65 a month. All other commuters received a cash subsidy of \$45 per month per employee. This subsidy

TABLE 2-1

SUMMARY OF REDUCTIONS AFTER FULL CASH OUT

Variable Reduced	Reduction		
	Per Employee	For Firm	Percent Change
Vehicle Trips (per year)	15	2,064	5%
Vehicle Miles Traveled (per year)	N/A	N/A	N/A
Reactive Organic Gas Emissions (pounds per year)	0.2	33	5%
Nitrogen Oxide Emissions (pounds per year)	0.1	14	5%
Carbon Monoxide Emissions (pounds per year)	2.2	308	5%
Gasoline Consumption (gallons per year)	N/A	N/A	N/A
Carbon Dioxide Emissions (pounds per year)	N/A	N/A	N/A

There were 139 employees who reported to this work site during the 1993 survey period.

TABLE 2-2
COMMUTER MODE CHOICES BEFORE AND AFTER FULL CASH OUT

Commute Mode (1)	Subsidy per Employee		Mode Share		Subsidy Distribution	
	Before (1991) (2)	After (1993) (3)	Before (1991) (4)	After (1993) (5)	Before (1991) (6)	After (1993) (7)
Drive Alone	\$65	\$65	72%	70%	79%	70%
Carpool	\$45	\$65	6%	4%	5%	4%
Transit	\$45	\$65	5%	3%	4%	3%
Walk	\$45	\$65	14%	22%	11%	22%
Bicycle	\$45	\$65	2%	2%	2%	2%

Note: The survey response rate was 86% in 1991 and 99% in 1993. A Chi-Square test shows that the probability was less than 1 percent that the difference in commuter mode shares observed in Columns (4) and (5) occurred by chance.

arrangement is a "partial" cash out because commuters who did not take a parking space were offered a cash subsidy (\$45) that is only 69 percent as large as the cash value of the parking subsidy (\$65).

Column 4 shows the results found in a transportation survey required by the South Coast Air Quality Management District (SCAQMD) which was conducted in July 1991, before the agency increased the clean commuter cash subsidy to equal the full cash value of a parking subsidy. Seventy-two percent of employees drove to work alone, 6 percent carpooled, 5 percent rode transit, 2 percent bicycled, and 14 percent walked to work.

III. INCREASING THE CASH OFFER CHANGED COMMUTER MODE CHOICES

The agency changed its commuter subsidy program in 1992. The agency continued to offer a parking subsidy of \$65 per parking space, but now offers a subsidy of \$65 per month to employees who do not take a parking space. Thus it increased its commuter subsidy from a "partial" to a "full" cash out. All other ridesharing incentives such as preferential parking for carpools and guaranteed ride home remained the same. Cashing out was the only relevant policy change from 1991 to 1993.¹

Column 5 (labeled "After") in Table 2 shows the results of the agency's 1993 employee transportation survey, conducted in July 1993, a little more than one year after the agency began to offer employees the option to cash out the full value of their parking subsidy. The solo driver share fell by 2 percentage points, from 72 percent in 1991 to 70 percent in 1993. The carpool and transit shares each fell by two percentage points, but the share of employees who walk to work increased from 14 percent to 22 percent. Therefore, commuters shifted away from all forms of motorized transport to walking. This surprising increase in the walking share was made possible because West Hollywood is a very small city (only 1.9 square miles) and a large share of the work force lives either within the city (26 percent) or in the directly adjacent zip codes (another 14 percent).

Figure 1 shows how shifting from a partial to a full parking cash out shifted mode shares. The data are taken from Columns 4 and 5 of Table 1, and they show that the increase in walking came at the expense of all other mode shares.

Although ridesharing policies at the agency did not change except for the shift from partial to full parking cash out, one may ask whether regional trends can explain part of the observed shift from driving and transit to walking. We can answer this question because Commuter Transportation Services conducts annual surveys of commuters in Southern California. Figure 2 displays the commute mode shares they found in 1991 and 1993. The share of commuters who drove to work alone in Southern California remained at 79 percent between 1991 and 1993, and the carpool share increased from 14 to 16 percent, while the walk share remained at 1 percent.² Therefore, the shifts from driving--both solo driving and carpooling--and the 8 percent increase in the walk share for the agency are not explained by any overall trends for the region.

FIGURE 2-1
Commuter Mode Choices
 Before and After Full Cash Out

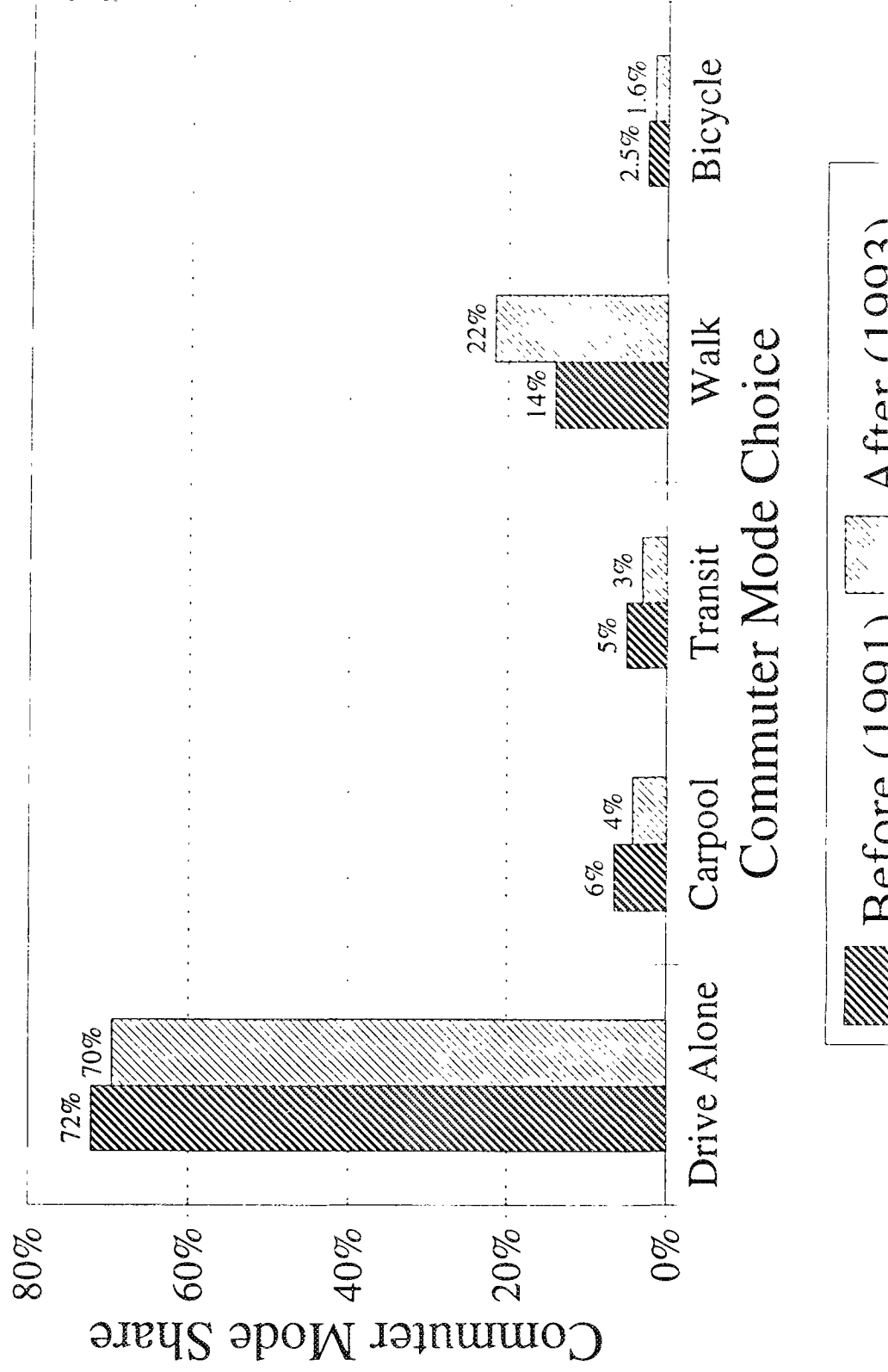
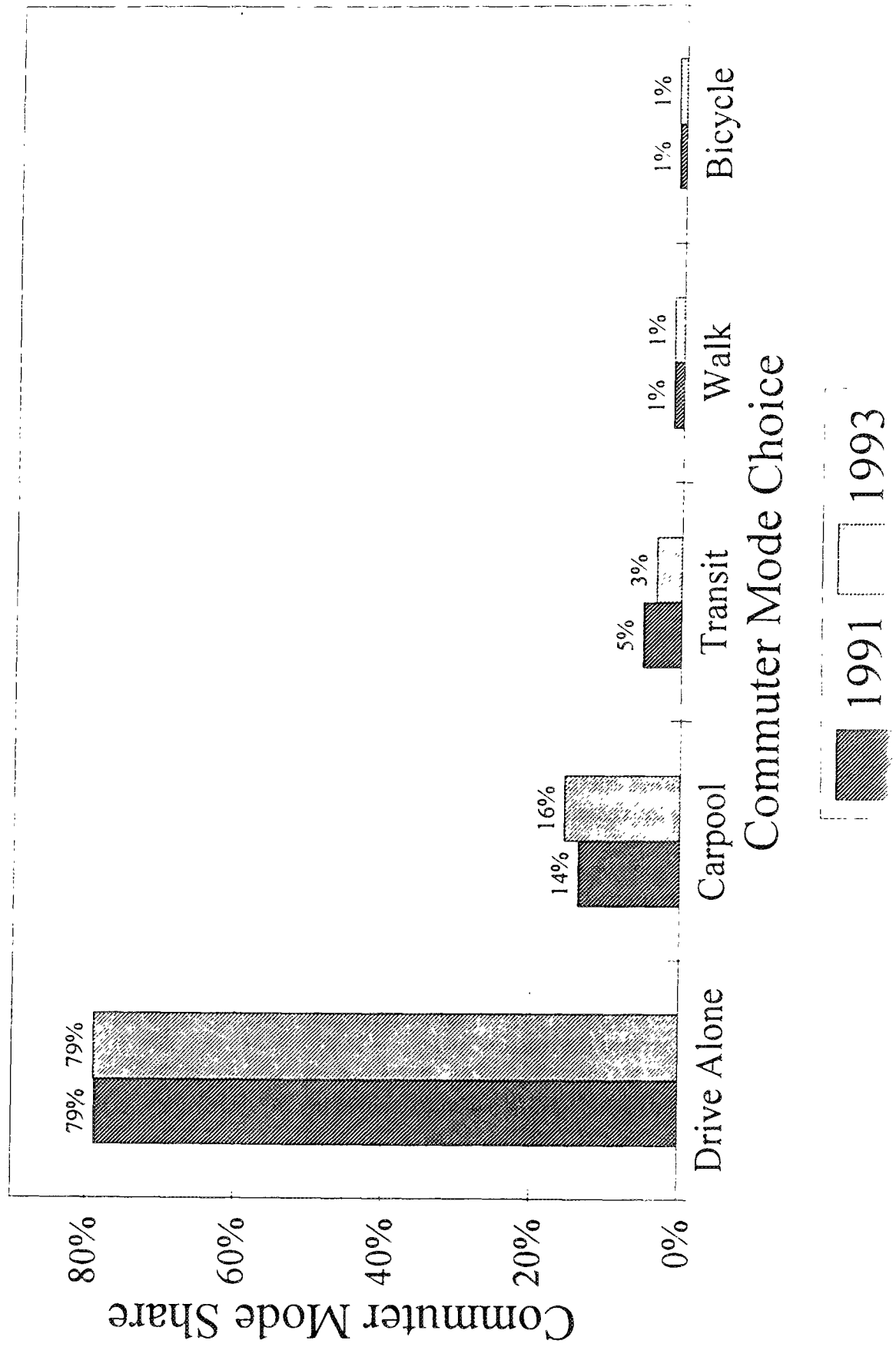


FIGURE 2-2

Commuter Mode Choices

In Southern California



Columns 6 and 7 in Table 2 shows how the firm's subsidy distribution among its employees changed between 1991 and 1993. In 1991, 72 percent of employees drove solo and received 79 percent of the total subsidy, while 14 percent of employees walked to work and received 11 percent of the subsidy. In 1993, the distribution of subsidies matches the distribution of mode shares because all commuters receive the same subsidy per person. The subsidy share for solo drivers declined from 79 to 70 percent from 1991 to 1993, and the share for employees who walked to work doubled from 11 to 22 percent.

IV. CASHING OUT REDUCED VEHICLE TRIPS

Table 3 shows that cashing out parking subsidies reduced the number of vehicle trips to work by 5 percent. Row 1 shows that in 1993 there were 0.73 commuters per employee. On an average day, 27 percent of employees were absent because of compressed work weeks, vacation, illness, or for another reason; therefore, the agency's attendance rate was 73 percent.³ Row 2 shows the number of vehicle round-trips per commuter, calculated from the data used to create Table 2. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. The total number of vehicle trips is then divided by the total number of responding commuters to give the ratio of vehicle trips per commuter. Thus the number of vehicle trips per commuter fell from 0.76 in 1991 to 0.72 in 1993, a 5 percent decrease.

Row 3 shows the number of vehicle round-trips per employee per day, obtained by multiplying the number of vehicle trips per commuter by 0.73 commuters per employee. Cashing out reduced the number of vehicle trips per employee by 5 percent, from 0.55 in 1991 to 0.52 in 1993.⁴

Row 4 shows the total number of one-way vehicle trips per employee per year. The number of one-way vehicle trips per employee in 1993 is calculated by multiplying the 0.52 vehicle round-trips per employee per day found in 1993 by 252 work days per year, and doubling that number to obtain the number of one-way trips. The number of vehicle trips in 1991 is calculated by multiplying the 0.55 vehicle trips per employee per day found in 1991 by the same 252 days, and doubling that number.

Row 4 thus shows that there were 279 vehicle trips per employee in 1991, and 265 vehicle trips per employee in 1993. Cashing out eliminated 14 vehicle trips per employee per year for commuting, a 5 percent decrease.

Vehicle trips for all automobile commuters to the agency were calculated by multiplying the trips per employee per year by the total of 139 employees. Row 5 shows that in 1991 there were 38,831 vehicle trips for commuting to the firm. Shifting to a full cash out reduced the number of vehicle trips to 36,767 in 1993, or by 2,064 vehicle trips per year, a 5 percent decrease. This change in the number of vehicle trips isolates the change that occurred because

TABLE 2-3

VEHICLE TRIP REDUCTIONS AFTER FULL CASH OUT

	<u>Before (1991)</u>	<u>After (1993)</u>	<u>Change</u>	<u>Percent Change</u>
	(1)	(2)	(3)	(4)
1 Commuters per Employee	0.73	0.73		
2 Vehicle Trips per Commuter per Day (Round-trip)	0.76	0.72	-0.04	-5%
3 Vehicle Trips per Employee per Day (Round-trip)	0.55	0.52	-0.03	-5%
4 Vehicle Trips per Employee per Year (One-way)	279	265	-15	-5%
5 Total Vehicle Trips per Year (One-way)	38,831	36,767	-2,064	-5%

There were 139 employees who reported to this work site during the 1993 survey period.

Row 3 = Row 2 x Row 1

Row 4 = Row 3 x 252 x 2.

Row 5 = Row 4 x 139

the commute policy changed, with the number of employees and their attendance rate held constant at the 1993 level.

V. REDUCTIONS IN VEHICLE EMISSIONS AFTER FULL CASH OUT

An ultimate goal of cashing out parking subsidies is to reduce automobile pollution emissions. How much did shifting from partial to full cash out reduce pollution emissions?

An unusual consequence in the present case is that commuters shifted to walking from all forms of motorized travel--solo driving, carpooling, and public transit. The survey results do not include information on the commuters' travel distances, but anyone who shifts to walking must have a short commute trip. Therefore, we cannot assume that the trip distance for those who shifted modes was the same as the average distance for all travelers.

As a conservative estimate of the reduction in pollution emissions, we can estimate the reduction in emissions associated with trip ends--the emissions caused by starting a cold engine at the beginning of the trip, and letting the hot engine cool down at the end of the trip. Shifting commuters from driving to walking reduces these emissions, and estimating the reduction in these emissions provides a conservative estimate of the total reduction in emissions.

Table 4 shows the estimated reductions in ROG, NO_x, and CO as a result of shifting to a full cash out. The pollutant emissions per employee per year were calculated by multiplying the pollution emissions per trip end by number of vehicle trips per employee per year. The reduction in total emissions for all employees is then calculated by multiplying the reduction per employee by the 139 employees who reported to the work site in 1993. The results shown in the last column of Table 4 is that shifting from partial to full cash out reduced ROG, NO_x, and CO emissions by 5 percent.⁵

VI. CASHING OUT INCREASED COMMUTING SUBSIDIES

In 1992, the agency increased its cash-out offer to equal the parking subsidy given to solo drivers. Table 5 shows how this policy change increased the agency's spending for commuter subsidies.⁶

In 1991 the agency's commuter subsidy was \$8,261 a month; the agency also paid \$110 a month in payroll taxes on the cash benefits for ridesharers.⁷ In 1993 the firm's commuter subsidy was \$9,035 a month; the firm also paid \$190 in payroll taxes on the cash benefits to ridesharers. Cashing out therefore increased total commuting subsidies, including payroll taxes, by \$855 a month, or by 10 percent. The average subsidy per employee, including payroll taxes, increased from \$60 to \$66 a month. Almost all of the increased spending is accounted for by the large increase in the number of employees who walk to work.

TABLE 2-4

**REDUCTIONS IN VEHICLE EMISSIONS
AFTER FULL CASH OUT
(Pounds Per Year)**

	<u>Change</u>	<u>Percent Change</u>
ROG		
per Employee	-0.2	-5%
for Firm	-33	-5%
NOx		
per Employee	-0.1	-5%
for Firm	-14	-5%
CO		
per Employee	-2.2	-5%
for Firm	-308	-5%

The pollution emissions per trip-end and per VMT in 1993 are taken from the Air Resources Board's EMFAC7F1.1/B7F model.

These 1993 factors are:

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>PM</u>
Trip end factor (grams/trip)	7.3	3	67.58	0
VMT factor (grams/mile)	0.86	0.94	7.72	0.75

These factors are multiplied by the reduction of 15 trips per employee per year in Table 2-3 to give the reduction in emissions per employee in 1993.

TABLE 2-5

COMMUTING SUBSIDIES BEFORE FULL CASH OUT (1991)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Agency</u>
Drive Alone	\$65	72%	79%	\$6,520
2 Person Carpool	\$45	6%	4%	\$367
3 Person Carpool	\$45	1%	0.4%	\$36
Mass Transit	\$45	5%	4%	\$308
Walk	\$45	14%	11%	\$877
Bicycle	\$45	2%	2%	\$154
Monthly Subsidies for 139 employees:				\$8,261
Taxes on Cash Subsidies:				\$110
Total Cost per Month:				\$8,371
Cost per Employee per Month:				\$60

COMMUTING SUBSIDIES AFTER FULL CASH OUT (1993)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Agency</u>
Drive Alone	\$65	70%	70%	\$6,285
2 Person Carpool	\$65	4%	4%	\$375
Mass Transit	\$65	3%	3%	\$268
Walk	\$65	22%	22%	\$1,964
Bicycle	\$65	2%	2%	\$143
Monthly Subsidies for 139 employees:				\$9,035
Taxes on Cash Subsidies:				\$190
Total Cost per Month:				\$9,225
Cost per Employee per Month:				\$66
Change in Total Cost per Month:				+\$854
Change in Cost per Employee per Month:				+\$6
Percent Change in Commuting Subsidy:				+10%

VII. SUMMARY

In 1991, the agency offered employees a parking subsidy of \$65 a month. Employees who carpooled, rode transit, bicycled or walked to work were offered a cash subsidy of only \$45 a month. In 1992, the agency began to offer all employees the option to choose between a parking subsidy of \$65 a month or a cash subsidy of \$65 a month. All other ridesharing incentives remained the same.

In response to the shift from a partial to full cash out, the share of commuters who drive to work alone fell from 72 to 70 percent, and the share who walk to work increased from 14 to 22 percent. Carpooling and transit use decreased while the bicycle/motorcycle share remained the same. These commuter mode changes from solo driving and carpooling reduced the number of vehicle commutes per day by 5 percent, eliminating a total of 14 vehicle trips per employee per year. Automobile pollution emissions were also reduced by 5 percent. Finally, the agency's spending for commuter subsidies increased by \$6 per employee per month, or by 10 percent. Commuters who walk to work received all of the increased subsidy.

ENDNOTES

1. The city introduced a "9/80" compressed work schedule for all employees in 1992. The compressed work schedule is not a "ridesharing" strategy *per se*, but is instead a strategy designed to reduce *all* commute trips. Tables 1 shows the modes shares of employees on the days they did commute to work, in both 1991 and 1993. The mode shifts thus do not register any effects caused by reducing the number of days that employees commuted to work. The compressed work week reduced the number of commute trips, but this reduction is not counted in the present analysis, which considers only the trip reductions caused by mode shifts of commuters on the days they did commute to work.
2. The sample size was 2,487 commuters in 1991 and 2,591 commuters in 1993. These results are presented in Table 2.1 of Commuter Transportation Services' *State of the Commute Report* (1994).
3. To isolate any change in the number of commuter trips caused solely by a change in the attendance rate, the attendance rate for 1993 is used for both years.
4. The mode shares of employees who did not respond to the survey are assumed to be the same as for employees who did respond to the survey.
5. Reductions in PM emissions are not calculated because they are associated with changes in VMT, not trip ends.
6. To isolate the change in subsidy cost caused solely by the change in the number of employees, the number of employees (139) who reported to this worksite in 1993 is used for both years.
7. The firm's payroll tax rate was 7.65 percent on cash benefits paid to ridesharers. The first \$55 a month in transit benefits were tax exempt in 1994. See Table 1 in Appendix 2 for the payroll tax rates.

Case Study 2

Employer characteristics

Case study 2 is a city government. This agency had a total of 160 employees in 1995, with 139 employees reporting to work between 6am and 10am, Monday through Friday.

Case study 2 is located at 8611 Santa Monica Boulevard. Three freeways -- Santa Monica (10), San Diego (405) and Ventura (101) -- provide proximate access to the agency. The major arterials serving this area are La Cienaga and Santa Monica Boulevards. Four bus routes serve this area.

Case study 2 is conveniently accessible to nearby restaurants, supermarkets, health clubs, medical services and retail establishments. Surrounding neighborhoods have wide streets, pedestrian signals and crosswalks.

The distribution of job categories is:

Professional	49%
Clerical	28%
Officials/Administrators	19%
Technical	3%
Service/Maintenance	1%

Commuter Policies Case Study 2

1991		1993	
1	Free Parking	1	Free Parking
2	<i>Parking Alternative (Partial Cash Out)</i>	2	Parking Alternative (Full Cash Out)
3	Variable Work Hours	3	Variable Work Hours
4	Telecommuting	4	Telecommuting
5	Guaranteed Ride Home	5	Guaranteed Ride Home
6	Carpool Preferential Parking	6	Carpool Preferential Parking
7	Bus Pass Incentive	7	Bus Pass Incentive
8	Occasional Rideshare Incentive	8	Occasional Rideshare Incentive
9	Special Promotions	9	Special Promotions
10	Bicycle Racks	10	Bicycle Racks
11	<i>Clothes Lockers</i>	11	9/80 Work Week

Bold indicates an incentive present in 1993 but not 1991

Italics indicates an incentive present in 1991 but not 1993

CASE STUDY 3

EXECUTIVE SUMMARY

The employer is a bank in Century City. The firm offers all employees free parking, which costs the firm \$100 per space per month. In 1991, the firm began to offer all employees the option to cash out their parking subsidies; that is, employees were given the new choice between free parking *or* a “clean commuter” subsidy of \$100 per month.

Cashing out is a new practice, so few employers have sufficient years of experience to provide evidence of the long-term effects. Because this employer began to offer cash in lieu of a parking subsidy in 1991, we can measure the continuing impact during the following three years.

When an employer offers to cash out parking subsidies, the typical response is for some commuters to take the cash and shift from solo driving to ridesharing. An unanswered question is whether commuters sustain their initial shift from solo driving to ridesharing. As the years go by, do commuters gradually shift back to driving alone, or do more commuters begin to rideshare? The transportation surveys conducted in the subsequent years show the *continuing* shifts in mode shares that followed the initial shift. These surveys show that cashing out produced these effects in the following three years:

- The solo driver share fell from 79 to 67 percent.
- The carpool share rose from 13 to 19 percent.
- The transit share rose from 8 to 9 percent.
- The bicycle and walking shares each rose from 0 to 2 percent.
- Vehicle round-trips to work fell from 0.80 to 0.73 per employee per day.

These shifts from solo driving to all other modes reduced the number of vehicle trips for commuting by 9 percent. Table 1 summarizes the reductions (per employee and for the firm) in vehicle trips, pollution emissions, and gasoline consumption that occurred after the firm offered employees the option to cash out their parking subsidies.

These results suggest that the effects of cashing out are not temporary. Instead, the effects increase over time. In discussing this result with Employee Transportation Coordinators, several of them offered an important practical explanation of this continuing downward trend in solo driving. After the firm begins to offer cash, encouraging new employees to try ridesharing is much easier because the cash gives them an incentive to avoid solo driving. New employees who have not already become fixed in their commuting ways are more willing to try alternatives to solo driving because the opportunity to cash out the parking subsidy removes a lopsided incentive in favor of solo driving. Therefore, the normal pattern of employee turnover through quits and hires can over time augment the initial shift toward ridesharing when employers cash out parking subsidies.

TABLE 3-1

SUMMARY OF REDUCTIONS AFTER CASHING OUT

Variable Reduced	Reduction		
	Per Employee	For Firm	Percent Chang
Vehicle Trips (per year)	35	4,191	9%
Vehicle Miles Traveled (per year)	524	62,870	9%
Reactive Organic Gas Emissions (pounds per year)	1.5	176	9%
Nitrogen Oxide Emissions (pounds per year)	1.2	149	9%
Carbon Monoxide Emissions (pounds per year)	13.2	1,581	9%
Particulate Matter Emissions (pounds per year)	0.9	104	9%
Gasoline Consumption (gallons per year)	21	2,515	9%
Carbon Dioxide Emissions (pounds per year)	413	49,541	9%

There were 120 employees who reported to this work site during the 1994 survey period.

This case study suggests that the longer commuters have to adjust to cashing out parking subsidies, the more they shift from solo driving to ridesharing. Therefore, studies that examine only the first-year responses to cashing out parking subsidies can seriously underestimate the long-term effects that occur after commuters have had enough time to adjust fully to the opportunity cost of taking a "free" parking space.

BACKGROUND

The employer is a bank in Century City, a regional shopping and employment center in West Los Angeles. The firm employed 120 individuals at this worksite in 1994.

In 1990, the firm offered free parking to all employees, at a cost to the firm of \$100 per space per month. Solo drivers thus received a subsidy of \$100 a month; carpoolers split a parking subsidy, and others received no subsidy. The firm also offered several ridesharing benefits, including guaranteed ride home, bicycle facilities, and various prizes and awards.

In 1991 the firm began to offer \$100 a month in cash to employees who did not take a parking space. Introducing the cash option was the only significant change in the firm's commuting subsidy policy since 1990 (see attached list of incentives in 1990 and 1994).

CASHING OUT REDUCED SOLO DRIVING

Table 2 shows the pattern of commuter subsidies and travel mode shares in 1990 and in subsequent years. In 1990, the firm offered all employees free parking, at a cost to the firm of \$100 per space per month. Since 1991, the firm has offered all employees the same subsidy of \$100 a month whatever their commute mode; the only difference among modes is that solo drivers receive a parking subsidy and all other commuters receive a cash subsidy. Columns 4, 5, 6, and 7 show the travel mode shares found in transportation surveys required by the South Coast Air Quality Management District (SCAQMD) which were conducted in the years 1990, 1992, 1993, and 1994.¹ Table 2 shows that cashing out parking subsidies in 1991 produced a steady decrease in the solo driver share from 1992 to 1994. The solo driver share fell from 79 percent in 1990 to 67 percent in 1994, the carpool share increased from 13 to 19 percent, and the transit share rose from 8 to 9 percent. The mode shares for bicycling and walking each rose by one percentage point in 1992 and 1993, and leveled off at 2 percent in 1994.

Figure 1 shows these continuing results of cashing out parking subsidies. The data are taken from Columns 4, 5, 6, and 7 of Table 2. The solo driver share fell steadily, while the carpool, bicycle, transit, and walking shares rose.

Can regional trends, rather than the firm's cashing out its parking subsidies, explain some of this observed continuing shift from solo driving to ridesharing? We can answer this question because Commuter Transportation Services conducts annual surveys of commuters in Southern California. Figure 2 displays the commute mode shares they found in the years from 1990 to 1994. The share of commuters who drove to work alone in Southern California rose rather than

TABLE 3-2
COMMUTER MODE CHOICES BEFORE AND AFTER CASHING OUT

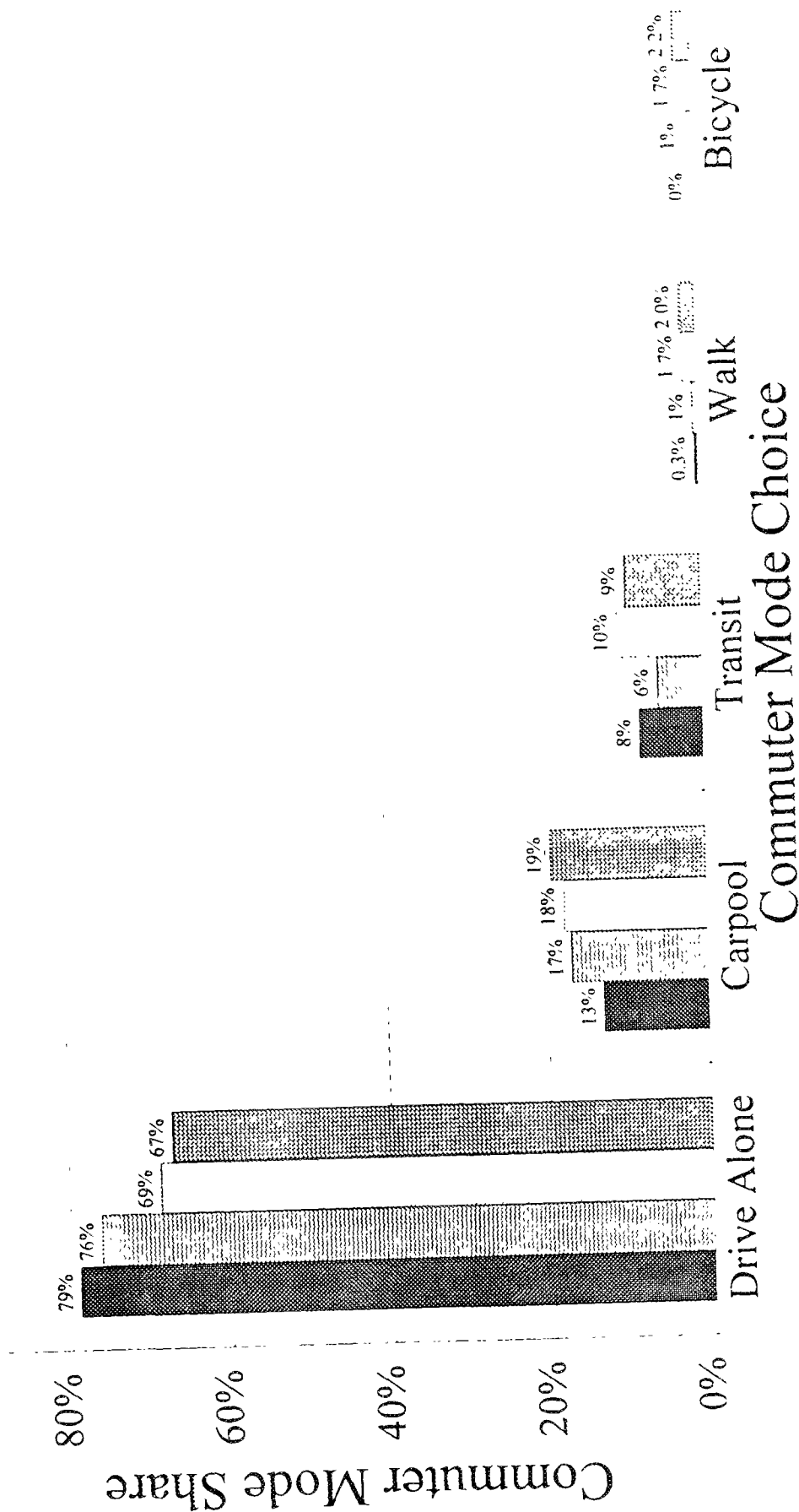
Commuter Mode (1)	Subsidy Per Employee		Commuter Mode Share			
	1990 (2)	1992 - 1994 (3)	1990 (4)	1992 (5)	1993 (6)	1994 (7)
Drive Alone	\$100		79%	76%	69%	67%
Carpool	\$50	\$100	13%	17%	18%	19%
Transit	\$0	\$100	8%	6%	10%	9%
Walk	\$0	\$100	0.3%	1%	2%	2%
Bicycle	\$0	\$100	0%	1%	2%	2%

Note: The survey response rate was 90% in 1990, 77% in 1992, 83% in 1993, and 85% in 1994. A Chi-Square test shows that the probability was less than 1 percent that the difference in commuter mode shares observed in Columns (4), (5), (6), and (7) occurred by chance.

FIGURE 3-1

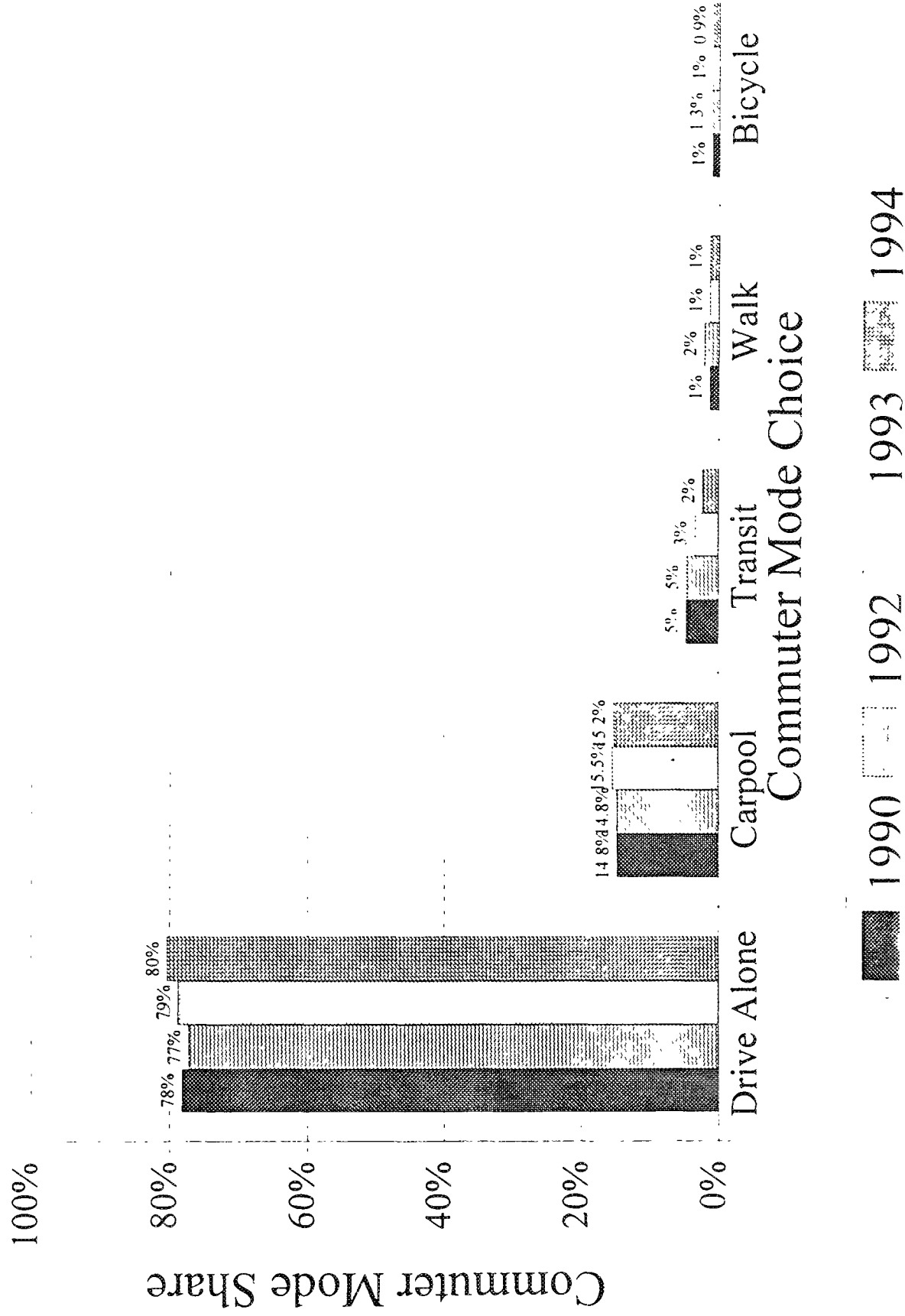
Commuter Mode Choices

Before and After Cashing Out



1990 1992 1993 1994

FIGURE 3-2
Commuter Mode Choices
 In Southern California



fell between 1990 and 1994.² Therefore, the fall in the solo driver share shown in Figure 1 for the firm that cashed out its parking subsidies is not explained by, and in fact runs counter to, the rise in the solo driver share shown in Figure 2 for the region.

CASHING OUT REDUCED VEHICLE TRIPS AND VMT

Table 3 shows how cashing out parking subsidies reduced the number of vehicle trips to work between 1990 and 1994. Row 1 shows that over this period there was an average of 0.95 commuters per employee. On an average day, 5 percent of employees were on vacation, sick, or did not commute to work for another reason; therefore, the firm's attendance rate was 95 percent.³

Row 2 shows the number of vehicle round-trips per commuter, calculated from the data used to create Table 2. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. The total number of vehicle trips is then divided by the total number of responding commuters to give the number of vehicle trips per commuter. Thus the number of vehicle trips per commuter declined from 0.85 in 1990 to 0.78 in 1994, a 9 percent decrease.

Row 3 shows the number of vehicle round-trips per employee per day, obtained by multiplying the number of vehicle round-trips per commuter by 0.94 commuters per employee. The number of vehicle trips per employee fell by 9 percent, from 0.80 in 1991 to 0.74 in 1994.

Row 4 shows the total number of vehicle round-trips per employee per year. For each year, the number of one-way vehicle trips per year is calculated by multiplying the number of vehicle round-trips per employee per day by 252 work days per year, and doubling the number to obtain the number of one-way trips. The resulting change in the number of vehicle trips per employee per year therefore represents the change that occurred cashing out parking subsidies.

Row 4 shows there were 408 vehicle trips per employee per year 1990. By 1994, there were only 373 vehicle trips per day. Therefore, cashing out eliminated 35 vehicle trips per employee per year, a 9 percent decrease.⁴

Vehicle trips for all automobile commuting to the firm were calculated by multiplying the trips per employee by the total of 120 employees of the firm. Row 5 shows that employees made 48,905 vehicle trips for commuting to the firm in 1990. Cashing out reduced the number of vehicle trips to 44,714 in 1994, or by 4,191 vehicle trips per year, a 9 percent decrease.

The SCAQMD survey reports do not include information on commuter trip distances. In calculating VMT reductions, the SCAQMD assumes that the average one-way distance for each avoided automobile trip is 15 miles.⁵ If we follow this procedure, we can calculate how cashing out reduced VMT. Rows 6 and 7 show that cashing out eliminated 2.1 VMT per employee per day, and 524 VMT per employee per year. When all 120 employees are

TABLE 3-3

CASHING OUT REDUCED VEHICLE TRIPS AND VMT

	1990	1992	1993	1994	Change 1990-1994	Percent Change
	(1)	(2)	(3)	(4)	(5)	(6)
1 Commuters per Employee	0.95	0.95	0.95	0.95		
2 Vehicle Trips per Commuter per Day (Round-trip)	0.85	0.84	0.77	0.78	-0.07	-9%
3 Vehicle Trips per Employee per Day (Round-trip)	0.81	0.79	0.73	0.74	-0.07	-9%
4 Vehicle Trips per Employee per Year (One-way)	408	399	370	373	-35	-9%
5 Total Vehicle Trips per Year (One-way)	48,905	47,864	44,359	44,714	-4,191	-9%
6 VMT per Employee per Day	24.3	23.7	22.0	22.2	-2.1	-9%
7 VMT per Employee per Year	6,113	5,983	5,545	5,589	-524	-9%
8 Total VMT per Year	733,576	717,965	665,378	670,706	-62,870	-9%

There were 120 employees who reported to this work site during the 1994 survey period.

Row 3 = Row 2 x Row 1.

Row 4 = Row 3 x 252 x 2.

Row 5 = Row 4 x 120.

Row 6 = Row 3 x 30.

Row 7 = Row 6 x 252.

Row 8 = Row 7 x 120.

considered, Row 8 shows that cashing out eliminated 62,870 VMT per year for commuting to the firm.

CASHING OUT REDUCED VEHICLE EMISSIONS

The emissions reductions are calculated by considering the reductions in both automobile *trips* and *VMT*. Pollution emissions are caused at the beginning and end of each automobile commute trip by the "cold start" as the engine warms up and the "hot soak" as the engine cools down; these "trip-end" emissions are independent of the total distance traveled for the commute. The "running" emissions are a factor of total VMT for the trip. In Table 3 we have already estimated the reductions in automobile trips and VMT. Therefore, we can multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting.

Cashing out reduced 35 trips and 524 per employee per year. We multiply these reductions by the factors for ROG, CO, NOx, CO, and PM10 for both trip ends and VMT. We use the emission factors specific to 1994, the year in which the vehicle-trip and VMT reductions were estimated. We add the two sources of pollution, and then divide by 454 grams per pound to obtain the emissions reductions in pounds per employee per year. Table 4 shows that cashing out eliminated 1.5 pounds of ROG, 1.2 pounds of NOx, 13.2 pounds of CO, and 0.9 pounds of PM per employee per year.

The emissions reduction for all employees of the firm is found by multiplying the emissions reduction per employee by the 120 employees of the firm in 1994. Cashing out eliminated a total of 176 pounds of ROG, 149 pounds of NOx, 1,581 pounds of CO, and 104 pounds of PM per year for automobile commuting. The final column shows that cashing out reduced automobile emissions by 9 percent.

CASHING OUT REDUCED GASOLINE CONSUMPTION AND CO₂ EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and carbon dioxide emissions. Table 5 shows these results. The SCAQMD has estimated that the average fuel efficiency of light-duty passenger vehicles in Southern California is 25 miles per gallon in 1996. Therefore, the VMT figures estimated in Table 3 (Rows 7 and 8) are divided by 25 miles per gallon to estimate gasoline consumption for commuting.⁶ Cashing out reduced gasoline consumption per employee by 21 gallons per year, and reduced total gasoline consumption for commuting to the firm by 2,515 gallons per year, a 9 percent decrease.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide. Therefore, the reduction in gasoline consumption reduced carbon dioxide emissions per employee by 413 pounds per year, and reduced total carbon dioxide emissions for commuting to the firm by 49,541 pounds per year, a 9 percent decrease.

TABLE 3-4
CASHING OUT PARKING SUBSIDIES
REDUCED VEHICLE EMISSIONS
(Pounds Per Year)

	<u>Change 1990-1994</u>	<u>Percent Change</u>
ROG		
per Employee	-1.5	-9%
for Firm	-176	-9%
NOx		
per Employee	-1.2	-9%
for Firm	-149	-9%
CO		
per Employee	-13.2	-9%
for Firm	-1,581	-9%
PM		
per Employee	-0.9	-9%
for Firm	-104	-9%

The pollution emissions per trip-end and per VMT in 1994 are taken from the Air Resources Board's EMFAC7F1.1/B7F model.

These 1994 factors are:

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>PM</u>
Trip end factor (grams/trip)	6.93	2.88	63.4	0
VMT factor (grams/mile)	0.81	0.88	7.18	0.75

These factors are multiplied by the reduction of 35 trips and 524 VMT per employee per year in Table 3-3 to give the reduction in emissions per employee in 1994.

CASHING OUT INCREASED COMMUTING SUBSIDIES

In 1991 the firm began to offer employees the option to cash out their employer-paid parking subsidies. Table 6 shows how this policy change increased the firm's spending for commuter subsidies. In 1990, the firm's commuter subsidy was \$10,241 a month. In 1994 the firm's commuter subsidy was \$12,167 a month, including \$167 a month in payroll taxes on cash benefits to ridesharers.⁷ Cashing out therefore increased total commuting subsidies, including payroll taxes, by 19 percent. The average subsidy per employee, including payroll taxes, increased from \$85 to \$101 a month.

SUMMARY

Since 1991, the firm has offered employees either a parking subsidy of \$100 a month *or* a cash subsidy of \$100 a month. Fortunately, the firm's first commuter transportation survey was done in 1990, a year before the firm introduced the cash option. Three subsequent transportation surveys were conducted in 1992, 1993, and 1994. Therefore, we can measure the impact during the three years following the cash out. The share of commuters who drive to work alone fell from 79 to 67 percent, and the carpool share increased from 13 to 19 percent. The transit, walking, and bicycling shares also increased. These commuter mode changes from solo driving to carpooling, transit, walking, and bicycling reduced the number of vehicle commutes per day by 9 percent.

Cashing out eliminated a total of 35 vehicle trips per employee per year, and 524 VMT per employee per year. In total, cashing out eliminated 4,191 vehicle trips and 62,870 VMT per year for commuting to the firm.

Cashing out parking subsidies reduced automobile pollution emissions by 1.5 pounds of ROG, 1.2 pounds of NOx, 13.2 pounds of CO, and 0.9 pounds of PM per employee per year. When all 120 employees of the firm are considered, cashing out eliminated a total of 176 pounds of ROG, 149 pounds of NOx, 1,581 pounds of CO, and 104 pounds of PM per year for automobile commuting.

The firm's spending for commuter subsidies per employee per month increased from \$86 in 1990 to \$101 in 1994.

The results of this case study suggest that the effects of cashing out on solo driving and ridesharing are not temporary. Instead, the effects increase over time. In discussing this result with Employee Transportation Coordinators, several of them offered one important practical explanation of this continuing downward trend in solo driving. After cashing out, encouraging new employees to try ridesharing is much easier because the cash offer gives them an incentive to avoid solo driving. New employees who have not already become fixed in their commuting ways are more willing to try alternatives to solo driving because the opportunity to cash out the parking subsidy removes a lopsided incentive in favor of solo driving. Therefore, the normal

TABLE 3-5

CASHING OUT REDUCED GASOLINE CONSUMPTION AND CARBON DIOXIDE EMISSIONS

	<u>1990</u>	<u>1994</u>	<u>Change</u>	<u>Percent Change</u>
	(1)	(2)	(3)	(4)
1 Gasoline Consumption per Employee (gallons per year)	245	224	-21	-9%
2 Total Gasoline Consumption (gallons per year)	29,343	26,828	-2,515	-9%
3 Carbon Dioxide Emissions per Employee (pounds per year)	4,817	4,404	-413	-9%
4 Total Carbon Dioxide Emissions (pounds per year)	578,058	528,517	-49,541	-9%

There were 120 employees who reported to this work site during the 1994 survey period.

The average fuel efficiency is 25 miles per gallon.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide.

TABLE 3-6

COMMUTING SUBSIDIES (1990)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$100	79%	92%	\$9,459
2 Person Carpool	\$50	13%	8%	\$782
Mass Transit	\$0	8%	0%	\$0
Walk	\$0	0.3%	0%	\$0
Bicycle	\$0	0%	0%	\$0
Monthly Subsidies for 120 employees:				\$10,241
Taxes on Cash Subsidies:				\$0
Total Cost per Month:				\$10,241
Cost per employee per Month:				\$85

COMMUTING SUBSIDIES (1994)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$100	67%	67%	\$8,048
2 Person Carpool	\$100	15%	15%	\$1,844
3 Person Carpool	\$100	1%	1%	\$120
4 Person Carpool	\$100	3%	3%	\$359
Mass Transit	\$100	9%	9%	\$1,126
Walk	\$100	2%	2%	\$240
Bicycle	\$100	2%	2%	\$263
Monthly Subsidies for 120 employees:				\$12,000
Taxes on Cash Subsidies:				\$167
Total Cost per Month:				\$12,167
Cost per Employee per Month:				\$101
Change in Total Cost per Month:				+\$1,926
Change in Cost per Employee per Month:				+\$16
Percent Change in Commuting Subsidy:				+19%

pattern of employee turnover through quits and hires can over time augment the initial shift toward ridesharing when employers cash out parking subsidies.

This case study suggests that the longer commuters have to adjust to cashing out parking subsidies, the more they shift from solo driving to ridesharing. Therefore, studies that examine only the first-year responses to cashing out parking subsidies can seriously underestimate the long-term effects that occur after commuters have had enough time to adjust fully to the opportunity cost of taking a "free" parking space.

ENDNOTES

1. The survey response rate was 90 percent in 1990, 77 percent in 1992, 83 percent in 1993, and 85 percent in 1994.
2. The sample size was 2,548 commuters in 1991, 2,487 in 1992, 2,591 in 1993, and 2,625 in 1994. These results are presented in Table 2.1 of Commuter Transportation Services (1994).
3. To isolate any change in the number of commuter trips caused solely by a change in the attendance rate, the attendance rate is an average of the number of commuters per employee for 1990, 1992, 1993, and 1994.
4. Vacations, sick days, and other absences are already accounted for in the calculation of the firm's average attendance rate, so the number of work days per year is five days per week for 52 weeks, minus the conventional eight national holidays.
5. This average trip distance was found in a 1991 travel survey for all commuters in the South Coast Air Basin. See Southern California Association of Governments (1993).
6. This estimated fuel efficiency of 25 miles per gallon was made using the Air Resources Board's EMFAC7F1.1/B7F model to represent conditions in Southern California on a workday in 1996. I am grateful to Waldo Lopez of the SCAQMD for this information. Average fuel efficiency of the fleet has been steadily increasing; it was only 22 miles per gallon in 1990. Because the estimates of VMT reductions refer to 1994, when average fuel efficiency was lower than in 1996, using a fuel efficiency of 25 miles per gallon produces a conservative estimate of how reducing VMT reduced fuel consumption.
7. The firm's payroll tax rate was 7.65 percent on cash benefits paid to ridesharers. The first \$55 a month in transit benefits were tax exempt in 1994. See Table 1 in Appendix 2 for the payroll tax rates.

REFERENCES

Commuter Transportation Services, *State of the Commute Report, 1994*, Los Angeles: Commuter Transportation Services, 1994.

Commuter Policies Case Study 3

	1990	1994
1	Free Parking	1 Free Parking
2	<i>TMA Staff Coordinators</i>	2 Clean Commuter Subsidy
3	On-Site Transportation Coordinator	3 Cyclocommuting Club
4	<i>Marketing & Promotion</i>	4 Bicycle Locker Subsidy for Part Time Use
5	TMA Commuter Center	5 TMA Commuter Center
6	<i>Carpool/Vanpool/Transit/Bicycle Information</i>	6 Prizes and Awards/Part Time
7	Personalized Assistance	7 Personalized Assistance
8	New Hire Orientations	8 New Hire Orientations
9	<i>Bus Pass Sales</i>	9 Free Company-provided Transit Passes
10	Guaranteed Ride Home	10 Guaranteed Ride Home
11	Carpool/Vanpool Staging Areas	11 Carpool/Vanpool Staging Areas
12	On/Near Site Amenities	12 On/Near Site Amenities
13	Bicycle Facilities	13 Bicycle Facilities
14	Prizes and Awards	14 Prizes and Awards
15	Adjustable Work Hours for Ridesharing	15 Adjusted Work Hours
16	<i>Establish Vanpool and/or Express Bus Operations</i>	16 TMA Membership
17	<i>Tracking</i>	17 Poolmatch
18	<i>Bulletin Boards</i>	18 The Express
19	<i>Preferred Parking for Vanpools and Carpools</i>	19 Commuter Discount Program
		20 Vanpools
		21 Westside RUSH Shuttle Service
		22 Free Company-provided Tokens for Part Time/Trial Use
		23 Occasional Parking for Full Time Commuters

Bold indicates an incentive present in 1994 but not in 1990

Italics indicates an incentive present in 1990 but not in 1994

Case Study 3

Employer characteristics

Case study 3 provides banking services. This firm had a total of 120 employees in 1994. All 120 employees reported to work between 6am and 10am, Monday through Friday.

Case study 3 is located at 2049 Century Park East in Century City. Two major freeways - Santa Monica (10) and San Diego (405) -- provide nearby access to the firm. Major arterial serving this area include Avenue of the Stars, Santa Monica Boulevard and Olympic Boulevard. Eight bus routes serve this area.

Case study 3 provides on-site amenities such as retail establishments, restaurants, bank goods and services. The firm is also conveniently accessible to nearby numerous restaurants, banks and retail establishments.

Surrounding streets have wide sidewalks, pedestrian signals, crosswalks and good lighting. Surrounding terrain is flat.

The distribution of job categories is:

Clerical	58%
Professional	27%
Officials/Administrators	14%
Service/Maintenance	1%

CASE STUDY 4

I. EXECUTIVE SUMMARY

The employer is a law firm in Century City. In 1992, the firm offered employees the choice of either free parking, which cost the firm \$120 per space per month, or the option of accruing "rideshare points" that were redeemable for various prizes. The cash value of these ridesharing points was less than the parking subsidy, so this arrangement was a "partial" cash out. The firm also offered other ridesharing benefits including guaranteed ride home, preferential parking for vanpools, and personalized ridesharing assistance.

In 1992, the firm adopted a new commuter subsidy arrangement that satisfies, and even exceeds, the requirements of AB 2109: free parking, which costs the firm \$120 per space per month, or a cash subsidy of \$150 per month. Other ridesharing incentives remained the same. The following changes occurred after the firm offered employees to option to cash out parking subsidies.

- The solo driver share fell from 88 to 76 percent.
- The carpool share rose from 10 to 18 percent.
- The transit share rose from 0 to 5 percent.
- The walking share fell from 2 to 1 percent.
- Vehicle round-trips to work fell from 0.87 to 0.79 per employee per day.

The shift from solo driving to ridesharing reduced the number of vehicle trips and VMT for commuting to work by 9 percent. Table 1 summarizes the reductions (per employee and for the firm) in vehicle travel, vehicle emissions, and gasoline consumption after employees were offered the option to cash out parking subsidies.

II. BACKGROUND

The employer is a law firm specializing in several practices including litigation, real estate, and tax law. The employer is located in Century City, a regional shopping and employment center in West Los Angeles. The firm employed 193 people at this worksite in 1992 and 191 in 1994. The firm offers free parking to all employees, and in 1994 paid \$120 per space per month to lease its parking spaces. Until 1992, the firm also offered a travel subsidy based on "rideshare points" that were redeemable for prizes. With a point/dollar exchange rate of 200 points per dollar, carpoolers received the equivalent of \$45 per month, transit riders received \$50 per month, and employees who walked or bicycled each received \$90 a month. The firm offered several other ridesharing benefits including guaranteed ride home, preferential parking for vanpools, bicycle facilities, and personalized ridesharing assistance.

Table 2 shows the pattern of commuter subsidies in 1992 (Columns 2, 4, and 6 labeled "Before"). Column 2 shows that solo drivers received a parking subsidy of \$120 a month, and

TABLE 4-1

SUMMARY OF REDUCTIONS AFTER CASHING OUT

Variable Reduced	Reduction		
	Per Employee	For Firm	Percentage Change
Vehicle Trips (per year)	40	7,562	9%
Vehicle Miles Traveled (per year)	585	111,739	9%
Reactive Organic Gas Emissions (pounds per year)	1.6	315	9%
Nitrogen Oxide Emissions (pounds per year)	1.4	265	9%
Carbon Monoxide Emissions (pounds per year)	14.8	2,826	9%
Particulate Matter Emissions (pounds per year)	1	185	9%
Gasoline Consumption (gallons per year)	23	4,470	9%
Carbon Dioxide Emissions (pounds per year)	461	88,050	9%

There were 191 employees who reported to this work site during the 1994 survey period.

TABLE 4-2

COMMUTER MODE CHOICES BEFORE AND AFTER CASHING OUT

Commute Mode (1)	Subsidy per Employee		Mode Share		Subsidy Distribution	
	Before (1992) (2)	After (1994) (3)	Before (1992) (4)	After (1994) (5)	Before (1992) (6)	After (1994) (7)
Drive Alone	\$120	\$120	88%	76%	92%	72%
Carpool	\$81	\$150	10%	18%	7%	21%
Transit	\$50	\$150	0%	5%	0%	6%
Walk	\$90	\$150	2%	1%	1%	1%
Bicycle	\$90	\$150	0%	0%	0%	0%

Note: The survey response rate was 89% in 1992 and 83% in 1994. A Chi-Square test shows that the probability was less than 1 percent that the difference in commuter mode shares observed in Columns (4) and (5) occurred by chance.

other commuters received less than this. This subsidy arrangement is a "partial" cash out because commuters who did not take a parking space were offered a subsidy that was less than the cash value of the parking subsidy.

Column 4 shows the results found in a transportation survey required by the South Coast Air Quality Management District (SCAQMD) which was conducted in June 1992, soon before the firm eliminated the travel allowance points program. Eighty-eight percent of employees drove solo, 10 percent carpooled, and 2 percent walked to work.

III. INCREASING THE CASH OFFER REDUCED SOLO DRIVING

The firm abandoned the points program in 1992. The firm continues to offer a parking subsidy of \$120 per parking space, but now offers a cash subsidy of \$150 per month to employees who do not take a parking space. Thus it increased its commuter subsidy from a "partial" cash out and went beyond the full cash-out requirement.

The firm continued to offer all its other significant rideshare incentives, such as a guaranteed ride home and midday vehicle use. The firm eliminated several insignificant rideshare incentives--free carwash, zipcode parties, transit demonstrations, transit days, and other types of general busywork that employers carry out either to reduce vehicle trips or to convince the SCAQMD that they are trying to reduce vehicle trips. Thus, cashing out was the only significant policy change from 1992 to 1994 (see attached list of incentives offered in 1992 and 1994).

Column 5 (labeled "After") in Table 2 shows the results of the firm's 1994 employee transportation survey, conducted in November 1994, approximately two years after the firm began to offer employees the cash option. The solo driver share fell from 88 percent in 1992 to 76 percent in 1994. The carpool share rose from 10 to 18 percent, and the transit share increased from 0 to 5 percent. The share of employees who walked to work decreased from 2 to 1 percent.

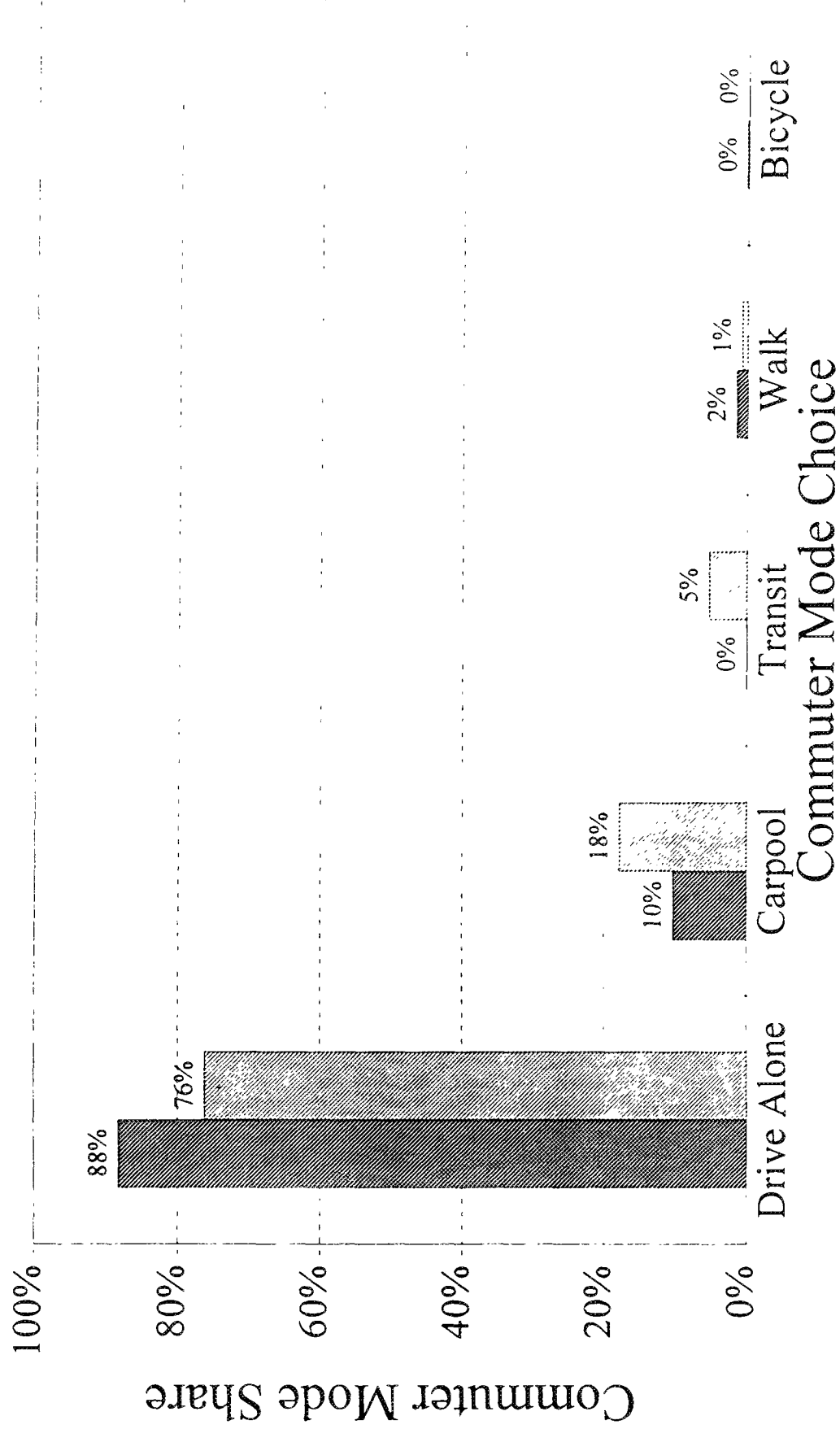
Figure 1 shows these mode shifts. The data are taken from Columns 4 and 5 of Table 2, and they show that the increase in transit and carpooling came at the expense of solo driving.

Can regional trends explain part of the observed shift from driving to carpooling and transit? We can answer this question because Commuter Transportation Services conducts annual surveys of commuters in Southern California. Figure 2 shows the commute mode shares they found in 1992 and 1994. The share of commuters who drove to work alone in Southern California increased from seventy-seven to 80 percent between 1992 and 1994, and the car pool share increased only slightly from 14.8 percent to 15.2 percent, while the transit share decreased from five to 2 percent.¹ Therefore, the shifts from solo driving to ridesharing shown in Figure 1 for the firm are not explained by, and in fact run counter to, the trends shown in Figure 2 for the region.

FIGURE 4-1

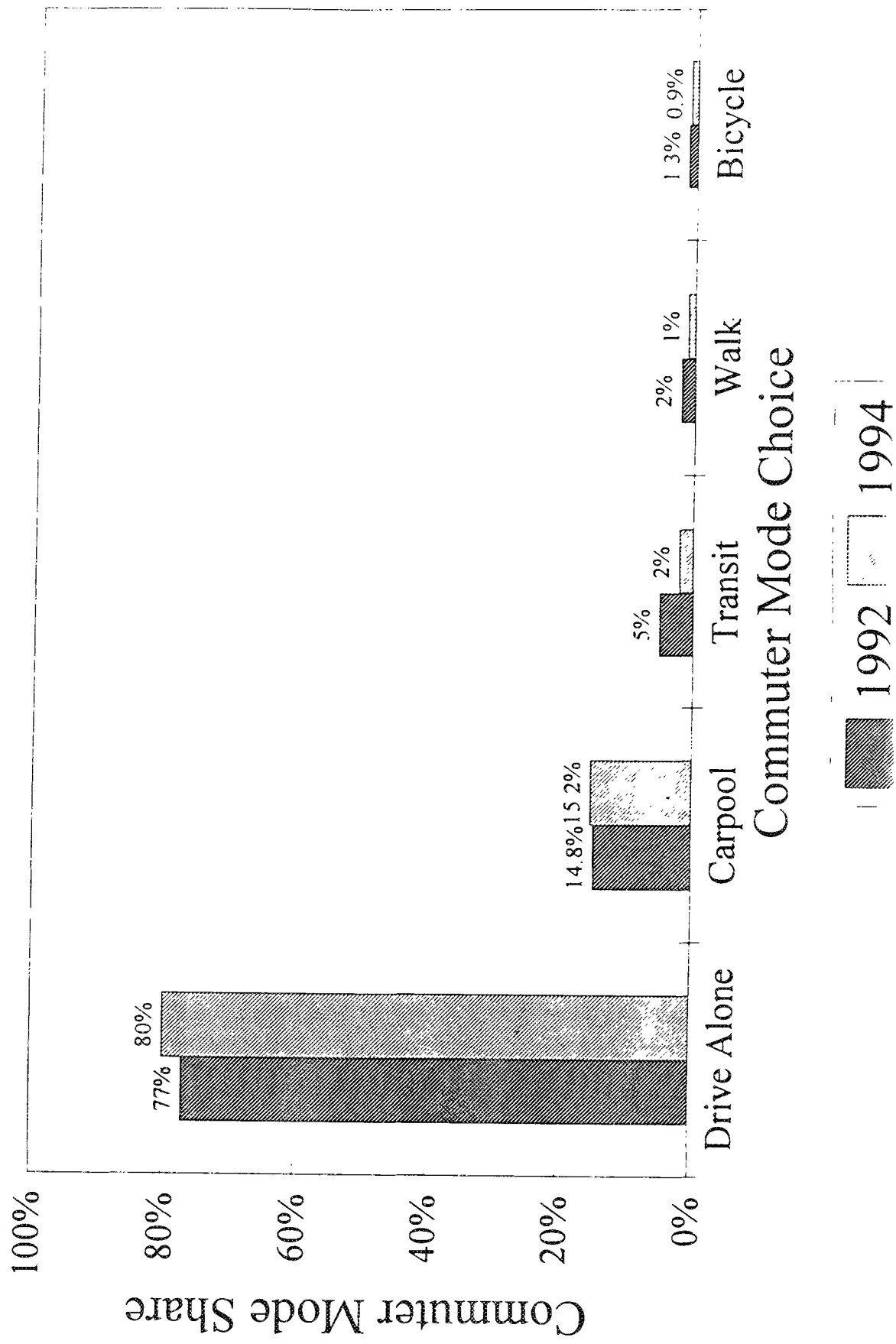
Commuter Mode Choices

Before and After Cashing Out



■ Before (1992) ▨ After (1994)

FIGURE 4-2
Commuter Mode Choices
 In Southern California



Columns 6 and 7 in Table 2 shows how the firm's subsidy distribution among its employees changed between 1992 and 1994. In 1992, 88 percent of employees drove solo and received 92 percent of the total subsidy. In 1994, 76 percent of employees drove solo and received 72 percent of the total subsidy. The subsidy distribution in 1992 favored solo driving, while the subsidy distribution in 1994 favored ridesharing.

IV. CASHING OUT PARKING SUBSIDIES REDUCED VEHICLE TRIPS AND VMT

Table 3 shows how cashing out reduced vehicle trips and VMT. Row 1 shows that there was an average of 0.93 commuters per employee. On an average day, 7 percent of employees did not commute to work because they were on vacation, sick, or for another reason; therefore, the firm's attendance rate was 93 percent.²

Row 2 shows the number of vehicle round-trips per commuter per day, calculated from the data used to create Table 2. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. The total number of vehicle trips is then divided by the total number of responding commuters to give the ratio of vehicle trips per commuter per day. Cashing out reduced the number of vehicle round-trips per commuter from 0.93 per day in 1992 to 0.85 per day in 1994, a 9 percent decrease.

Row 3 shows the number of vehicle round-trips per employee per day, obtained by multiplying the number of vehicle round-trips per commuter by 0.93 commuters per employee. Cashing out reduced the number of vehicle round-trips per employee per day from 0.87 in 1992 to 0.79 in 1994, a 9 percent decrease.³

Row 4 shows the total number of one-way vehicle trips per employee per year. The number of one-way vehicle trips in 1992 is calculated by multiplying the 0.87 vehicle round-trips per employee per day found in 1992 by 252 work days per year, and doubling the result to obtain the number of one-way trips.⁴ The number of one-way vehicle trips in 1994 is calculated by multiplying the 0.79 vehicle trips per employee per day found in 1994 by the same 252 working days per year, and doubling the result to obtain the number of one-way trips. The resulting change in the number of vehicle trips per employee per year therefore represents the change that occurred because the commute subsidy policy changed.

Row 4 thus shows that there were 438 vehicle trips per employee in 1992, and 398 vehicle trips per employee in 1994. Increasing the offer of cash in lieu of parking subsidies therefore eliminated 40 vehicle trips per employee for commuting in 1994 (20 vehicle trips to work, and another 20 vehicle trips from work), a 9 percent decrease.

Vehicle trips for all automobile commuting to the firm were calculated by multiplying the trips per employee by the total of 191 employees of the firm. Row 5 shows that employees

TABLE 4-3

CASHING OUT REDUCED VEHICLE TRIPS AND VMT

	Before (1992) (1)	After (1994) (2)	Change (3)	Percent Change (4)
1 Commuters per Employee	0.93	0.93		
2 Vehicle Trips per Commuter per Day (Round-trip)	0.93	0.85	-0.08	-9%
3 Vehicle Trips per Employee per Day (Round-trip)	0.87	0.79	-0.08	-9%
4 Vehicle Trips per Employee per Year (One-way)	438	398	-40	-9%
5 Total Vehicle Trips per Year (One-way)	83,657	76,095	-7,562	-9%
6 VMT per Employee per Day	26.0	23.7	-2.3	-9%
7 VMT per Employee per Year	6,561	5,976	-585	-9%
8 Total VMT per Year	1,253,159	1,141,420	-111,739	-9%

There were 191 employees who reported to this work site during the 1994 survey period.

Row 3 = Row 2 x Row 1.

Row 4 = Row 3 x 252 x 2.

Row 5 = Row 4 x 191.

Row 6 = Row 3 x 30.

Row 7 = Row 6 x 252.

Row 8 = Row 7 x 191.

made 83,657 vehicle trips for commuting to the firm in 1992. Cashing out reduced the number of vehicle trips to 76,095 in 1994, or by 7,562 vehicle trips per year.

The SCAQMD survey reports do not include information on commuter trip distances. In calculating VMT reductions, the SCAQMD assumes that the average one-way distance for each avoided automobile trip is 15 miles.⁵ If we follow this procedure, we can calculate how cashing out reduced VMT. Rows 6 and 7 show that cashing out eliminated 2.3 VMT per employee per day, and 585 VMT per employee per year. Row 8 shows that cashing out eliminated 111,739 VMT for commuting to the firm in 1994.

V. CASHING OUT REDUCED VEHICLE EMISSIONS

The emissions reductions are calculated by considering the reductions in both automobile trips and VMT. Pollution emissions are caused at the beginning and end of each automobile commute trip by the "cold start" as the engine warms up and the "hot soak" as the engine cools down; these "trip-end" emissions are independent of the total distance traveled for the commute. The "running" emissions are a factor of total VMT for the trip. In Table 3 we have already estimated the reductions in automobile trips and VMT. Therefore, we can multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting.

Cashing out reduced 40 trips and 585 per employee per year. We multiply these reductions by the factors for ROG, CO, NO_x, CO, and PM10 for both trip ends and VMT. We use the emission factors specific to 1994, the year in which the vehicle-trip and VMT reductions were estimated. We add the two sources of pollution, and then divide by 454 grams per pound to obtain the emissions reductions in pounds per employee per year. Table 4 shows that cashing out eliminated 1.6 pounds of ROG, 1.4 pounds of NO_x, 14.8 pounds of CO, and 1.0 pound of PM per employee per year.

The emissions reduction for all employees of the firm is found by multiplying the emissions reduction per employee by the 191 employees of the firm in 1994. Cashing out eliminated a total of 315 pounds of ROG, 265 pounds of NO_x, 2,826 pounds of CO, and 185 pounds of PM per year for automobile commuting. The final column shows that cashing out reduced automobile emissions by 9 percent.

VI. CASHING OUT REDUCED GASOLINE CONSUMPTION AND CO₂ EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and carbon dioxide emissions. Table 5 shows these results. The SCAQMD has estimated that the average fuel efficiency of light-duty passenger vehicles in Southern California is 25 miles per gallon in 1996. Therefore, the VMT figures estimated in Table 3 (Rows 7 and 8) are divided by 25 miles per gallon to estimate gasoline consumption for commuting.⁶ Cashing out reduced gasoline consumption per employee by 23 gallons per year, and reduced total gasoline consumption for commuting to the firm by 4,470 gallons per year, a 9 percent decrease.

TABLE 4-4
CASHING OUT PARKING SUBSIDIES
REDUCED VEHICLE EMISSIONS
(Pounds Per Year)

	<u>Change</u>	<u>Percent Change</u>
ROG		
per Employee	-1.6	-9%
for Firm	-315	-9%
NOx		
per Employee	-1.4	-9%
for Firm	-265	-9%
CO		
per Employee	-14.8	-9%
for Firm	-2,826	-9%
PM		
per Employee	-1.0	-9%
for Firm	-185	-9%

The pollution emissions per trip-end and per VMT in 1994 are taken from the Air Resources Board's EMFAC7F1.1/B7F model.

These 1994 factors are:

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>PM</u>
Trip end factor (grams/trip)	6.93	2.88	63.4	0
VMT factor (grams/mile)	0.81	0.88	7.18	0.75

These factors are multiplied by the reduction of 40 trips and 585 VMT per employee per year in Table 4-3 to give the reduction in emissions per employee in 1994.

TABLE 4-5

CASHING OUT REDUCED GASOLINE CONSUMPTION AND CARBON DIOXIDE EMISSIONS

	<u>Before (1992)</u>	<u>After (1994)</u>	<u>Change</u>	<u>Percent Change</u>
	(1)	(2)	(3)	(4)
1 Gasoline Consumption per Employee (gallons per year)	262	239	-23	-9%
2 Total Gasoline Consumption (gallons per year)	50,126	45,657	-4,470	-9%
3 Carbon Dioxide Emissions per Employee (pounds per year)	5,170	4,709	-461	-9%
4 Total Carbon Dioxide Emissions (pounds per year)	987,490	899,439	-88,050	-9%

There were 191 employees who reported to this work site during the 1994 survey period.

The average fuel efficiency is 25 miles per gallon.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide. Therefore, the reduction in gasoline consumption reduced carbon dioxide emissions per employee by 461 pounds per year, and reduced total carbon dioxide emissions for commuting to the firm by 88,050 pounds per year, a 9 percent decrease.

VII. CASHING OUT INCREASED COMMUTING SUBSIDIES

In 1994, the firm went beyond compliance with California's cash out requirement; it offered a parking subsidy of \$120 a month or a cash subsidy of \$150 a month. Table 6 shows how this policy change increased the firm's spending for commuter subsidies.⁷

In 1992 the firm's commuter subsidy was \$22,157 a month, including \$91 in payroll taxes on the cash benefits for ridesharers.⁸ In 1994 the firm's commuter subsidy was \$24,764 a month, including \$480 in payroll taxes on the cash benefits to ridesharers. The average subsidy per employee, including payroll taxes, increased by \$14 a month. Cashing out increased total commuting subsidies, including payroll taxes, by \$2,607 a month, or by 12 percent.

Part of this 12 percent cost increase is caused by the generous nature of the firm's parking cash out. Solo drivers receive a parking subsidy of \$120 a month, while ridesharers receive a cash subsidy of \$150 a month. The commuting subsidy offered to ridesharers is 25 percent higher than is required for compliance with California's cash-out requirement.

VIII. SUMMARY

In 1992, the firm offered employees a parking subsidy of \$120 a month. Employees who carpooled, rode transit, bicycled or walked were offered varying subsidies in the form of "rideshare points" redeemable for prizes that were worth less than the parking subsidy. The firm abandoned the "rideshare points" program at the end of 1992 and began to offer all employees the option of a parking subsidy of \$120 a month or a cash subsidy of \$150 a month. All other ridesharing incentives remained the same.

After cashing out, the solo driver share fell from 88 to 76 percent. The carpool share increased from 10 to 18 percent and the transit share increased from 0 to 5 percent. The walk share decreased from 2 to 1 percent. These changes from solo driving to carpooling and transit reduced the number of vehicle trips by 9 percent.

Cashing out eliminated a total of 40 vehicle trips per employee per year, and 585 VMT per employee per year in 1994. In total, cashing out eliminated 7,562 vehicle trips and 111,739 VMT per year for commuting to the firm.

These reductions in automobile use reduced vehicle emissions for automobile commuting by 9 percent. Cashing out eliminated 1.6 pounds of ROG, 1.4 pounds of NO_x, 14.8 pounds of CO, and 1.0 pounds of PM per employee per year. In total, cashing out eliminated 315 pounds

TABLE 4-6

COMMUTING SUBSIDIES BEFORE CASHING OUT (1992)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$120	88%	92%	\$20,217
2 Person Carpool	\$83	9%	6%	\$1,384
3 Person Carpool	\$70	1%	1%	\$185
Mass Transit	\$50	0%	0%	\$0
Walk	\$90	2%	1%	\$259
Bicycle	\$90	0%	0%	\$22
Monthly Subsidies for 191 employees:				\$22,066
Taxes on Cash Subsidies:				\$91
Total Cost per Month:				\$22,157
Cost per Employee per Month:				\$116

COMMUTING SUBSIDIES AFTER CASHING OUT (1994)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$120	76%	72%	\$17,464
2 Person Carpool	\$150	15%	18%	\$4,408
3 Person Carpool	\$150	2%	3%	\$707
Mass Transit	\$150	5%	6%	\$1,497
Walk	\$150	1%	1%	\$208
Bicycle	\$150	0%	0%	\$0
Monthly Subsidies for 191 employees:				\$24,284
Taxes on Cash Subsidies:				\$480
Total Cost per Month:				\$24,764
Cost per Employee per Month:				\$130
Change in Total Cost per Month:				-\$2,607
Change in Cost per Employee per Month:				+\$14
Percent Change in Commuting Subsidy:				+12%

of ROG, 265 pounds of NO_x, 2,826 pounds of CO, and 185 pounds of PM per year for commuting to the firm.

By reducing VMT, cashing out reduced gasoline consumption for commuting by 23 gallons per employee per year, and reduced gasoline consumption for commuting to the firm by 4,470 gallons per year. Finally, cashing out carbon dioxide emissions by 461 pounds of CO₂ per employee per year, and reduced carbon dioxide emissions for commuting to the firm by 88,050 pounds of CO₂ per year.

The firm's spending for commuter subsidies increased by \$14 per employee per month, or by 12 percent.

ENDNOTES

1. The sample size was 2,487 commuters in 1992 and 2,625 commuters in 1994. These results are presented in Table 2.1 of *Commuter Transportation Services* (1994).
2. To isolate any change in the number of trips caused solely by a change in the attendance rate, the attendance rate for 1994 is used for both years.
3. The mode shares of employees who did not respond to the survey are assumed to be the same as for employees who did respond to the survey.
4. Vacations, sick days, and other absences are already accounted for in the calculation of the firm's average attendance rate, so the number of work days per year is five days per week for fifty-two weeks, minus the conventional eight national holidays per year.
5. This average trip distance was found in a 1991 travel survey for all commuters in the South Coast Air Basin. See Southern California Association of Governments (1993).
6. This estimated fuel efficiency of 25 miles per gallon was made using the Air Resources Board's EMFAC7F1.1/B7F model to represent conditions in Southern California on a workday in 1996. I am grateful to Waldo Lopez of the SCAQMD for this information. Average fuel efficiency of the fleet has been steadily increasing; it was only 22 miles per gallon in 1990. Because the estimates of VMT reductions refer to 1994, when average fuel efficiency was lower than in 1996, using a fuel efficiency of 25 miles per gallon produces a conservative estimate of how reducing VMT reduced fuel consumption.
7. To isolate the change in subsidy cost caused solely by the change in the number of employees, the number of employees reported in 1994 is used for both years.
8. The firm's payroll tax rate was 7.65 percent on cash benefits paid to ridesharers. The first \$22 a month in mass transit benefits were tax exempt in 1992, and the first \$55 a month in transit benefits were tax exempt in 1994.

REFERENCES

- Commuter Transportation Services, State of the Commute Report, 1994*, Los Angeles: Commuter Transportation Services, 1994.
- Southern California Association of Governments, "1991 Southern California Origin-Destination Survey--Summary Findings," Los Angeles, 1993.

Commuter Policies Case Study 4

1992		1994
1	Free Parking	1 Free Parking
2	<i>Travel Allowance Points Program</i>	2 Rideshare Incentive/Cash-Out
3	Free Transit Passes/Tokens	3 Free Transit Passes/Tokens
4	Vanpool Subsidy	4 Vanpool Subsidy
5	Prizes and Awards	5 Prizes and Awards
6	Guaranteed Ride Home	6 Guaranteed Ride Home
7	Vanpools	7 Vanpools
8	Mid-Day Vehicle Use	8 Mid-Day Vehicle Use
9	Carpool/Vanpool Staging Areas	9 Carpool/Vanpool Staging Areas
10	Occasional Parking for Full Time Clean Commuters	10 Occasional Parking for Full Time Clean Commuters
11	Bicycle Facilities	11 Bicycle Facilities
12	On/Near Site Amenities	12 On/Near Site Amenities
13	Commuter Discount Program	13 Commuter Discount Program
14	New Hire Orientations	14 New Hire Orientations
15	ADGAP Rideshare Program/Focus Groups	15 Focus Groups
16	<i>Free Car Wash</i>	16 Clean Commuter Recognition Lunches
17	<i>Preferred Parking for Vanpools</i>	17 Zip Code of the Month
18	<i>Marketing & Promotion</i>	18 Westside RUSH Shuttle Service
19	<i>Health Club Membership for Cyclists & Walkers</i>	
20	<i>TMA Membership</i>	
21	<i>TMA Commuter Center</i>	
22	<i>Carpool/Vanpool/Transit/Bicycle Information</i>	
23	<i>Personalized Assistance</i>	
24	<i>Personalized Poolmatch Information</i>	
25	<i>Transit Demonstrations and Transit Day</i>	
26	<i>Cyclocommuting Club</i>	
27	<i>Zip Code Parties</i>	
28	<i>The Commuter X-press</i>	
29	<i>Adjustable Work Hours</i>	
30	<i>Alternative Work Schedules</i>	

Bold indicates an incentive present in 1994 but not in 1992

Italics indicates an incentive present in 1992 but not in 1994

Case Study 4

Employer characteristics

Case study 4 provides legal services in the areas of litigation, bankruptcy, corporate, entertainment, probate, real estate, tax and intellectual property. This firm had a total of 191 employees in 1994. All 191 employees reported to work between 6am and 10am, Monday through Friday.

Case study 4 is located at 2121 Avenue of the Stars in Century City. Two major freeways -- Santa Monica (10) and San Diego (405) -- provide nearby access to the firm. Major arterials serving this area include Avenue of the Stars, Santa Monica Boulevard and Olympic Boulevard. Four bus routes serve this area.

Case study 4 provides many on-site services and amenities, including general store, dry cleaners and video store. Moreover, the firm is conveniently accessible to nearby restaurants, banks and retail establishments.

Surrounding streets have wide sidewalks, pedestrian signals, crosswalks and good lighting. Surrounding terrain is flat.

The distribution of job categories is:

Professional	43%
Clerical	42%
Other / Contracted - Pitney Bowes	7%
Officials/Administrators	6%
Technical	2%

CASE STUDY 5

I. EXECUTIVE SUMMARY

The employer is a law firm in downtown Los Angeles. In 1990, the firm offered employees parking subsidies that ranged from \$90 to \$145 per space per month. The firm also offered such ridesharing benefits as guaranteed ride home, in-house carpool/vanpool matchlists, on-site bus pass sales, prize drawings, and promotional campaigns.

Since 1990, the firm's commuting policy has gradually changed every year. In 1993-1994, the firm offered all employees either a parking subsidy of \$100 a month, or a cash transportation allowance of \$150 per month. Except for minor changes, other ridesharing incentives remained the same. The following changes occurred after the firm began to offer employees the option to take cash in lieu of parking subsidies.

- The solo driver share fell from 75 to 53 percent.
- The carpool share rose from 10 to 23 percent.
- The transit share rose from 15 to 24 percent.
- The walking share remained the same at 1 percent.
- Vehicle round-trips to work fell from 0.70 to 0.53 per employee per day.

The shift from solo driving to ridesharing and transit reduced the number of vehicle trips and VMT for commuting to work by 24 percent. Table 1 summarizes the reductions (per employee and for the firm) in vehicle travel, pollution emissions, and gasoline consumption that occurred after cashing out.

II. BACKGROUND

The employer is a law firm in downtown Los Angeles. In 1990, the firm paid \$145 per space per month to rent parking spaces for its employees; it offered free parking to attorneys, a parking subsidy of \$90 a month for administrative employees with less than three years of service, and a parking subsidy of \$120 a month to administrative employees with more than three years of service. The firm also offered other ridesharing benefits including guaranteed ride home, in-house carpool/vanpool matchlists, on-site bus pass sales, and promotional campaigns.

Table 2 shows the pattern of commuter subsidies in 1990 (Columns 2, 4, and 6). Column 2 shows that solo drivers received an average parking subsidy of \$118 a month. Carpoolers split a parking subsidy, and received an average subsidy of \$54 per carpooler per month. Transit riders received a subsidy of \$15 a month, and others received nothing.

Column 4 shows the results found in a transportation survey required by the SCAQMD which was conducted in 1990. Seventy-five percent of employees drove solo, 10 percent carpooled, 15 percent rode transit, and 1 percent walked to work.

TABLE 5-1

SUMMARY OF REDUCTIONS AFTER CASHING OUT

Variable Reduced	Reduction		Percent Change
	Per Employee	For Firm	
Vehicle Trips (per year)	86	24,047	24%
Vehicle Miles Traveled (per year)	1,284	360,709	24%
Reactive Organic Gas Emissions (pounds per year)	3.6	1,012	24%
Nitrogen Oxide Emissions (pounds per year)	3.0	852	24%
Carbon Monoxide Emissions (pounds per year)	32.3	9,071	24%
Particulate Matter Emissions (pounds per year)	2.1	596	24%
Gasoline Consumption (gallons per year)	51	14,428	24%
Carbon Dioxide Emissions (pounds per year)	1,012	284,239	24%

There were 281 employees who reported to this work site during the 1994 survey period.

TABLE 5-2
COMMUTER MODE CHOICES BEFORE AND AFTER CASHING OUT

Commuter Mode (1)	Subsidy per Employee		Mode Share		Subsidy Distribution	
	1990 (2)	1994 (3)	1990 (4)	1994 (5)	1990 (6)	1994 (7)
Drive Alone	\$118	\$100	75%	53%	92%	43%
Carpool	\$54	\$150	10%	23%	5%	28%
Transit	\$15	\$150	15%	24%	2%	29%
Walk	\$0	\$150	1%	1%	0%	1%
Bicycle	\$0	\$150	0%	0%	0%	0%

Note: The survey response rate was 100% in 1990 and 100% in 1994. A Chi-Square test shows that the probability was less than 1 percent that the difference in commuter mode shares observed in Columns (4) and (5) occurred by chance.

III. CASHING OUT REDUCED SOLO DRIVING

The firm gradually changed its commuter subsidy program starting in 1990. By 1993-1994, the firm paid \$165 a month to rent parking spaces, and charged employees \$65 a month for parking, so it offered a parking subsidy of \$100 a month. The firm also offered a cash transportation allowance of \$150 per month to employees who do not take a parking space. Thus it went beyond compliance with California's cash-out requirement. From 1990 to 1994, minor improvements were made in the quality of ridesharing services provided to employees, including preferential parking for carpools, a rideshare fair, promotional campaigns, partnership education program, and various award programs. The cash transportation allowance was the major policy change from 1990 to 1994.

Column 5 in Table 2 shows the results of the firm's employee transportation survey, conducted in February 1994. The solo driver share fell from 75 to 53 percent. The carpool share rose from 10 to 23 percent. The transit share increased from 15 to 24 percent. The share of employees who walked to work remained at 1 percent.

Figure 1 shows these mode shifts. The figures are taken from Columns 4 and 5 of Table 2, and show that the increase in transit and carpooling came at the expense of solo driving.

One may ask whether regional trends can explain part of the observed shift from driving to carpooling and transit. We can answer this question because Commuter Transportation Services conducts annual surveys of commuters in Southern California. Figure 2 shows the commute mode shares they found in 1990 and 1994. The share of commuters who drove to work alone in Southern California increased from 78 to 80 percent between 1990 and 1994, and the carpool share increased only slightly from 14.8 percent to 15.2 percent, while the transit share decreased from 5 to 2 percent.¹ Therefore, the shifts from solo driving to ridesharing and transit shown in Figure 1 for the firm are not explained by, and in fact run counter to, the results shown in Figure 2 for the region.

Columns 6 and 7 in Table 2 show how the firm's subsidy distribution among its employees changed between 1990 and 1994. In 1990, 75 percent of employees drove solo and received 92 percent of the total subsidy. In 1994, 53 percent of employees drove solo and received 43 percent of the total subsidy. The subsidy distribution in 1990 favored solo driving, while the subsidy distribution in 1994 favored ridesharing.

IV. CASHING OUT PARKING SUBSIDIES REDUCED VEHICLE TRIPS AND VMT

Table 3 shows how the changes in mode shares reduced vehicle trips and VMT. Row 1 shows that there was an average of 0.88 commuters per employee. On an average day, 12 percent of employees did not commute to work because they were on vacation, sick, or for another reason; therefore, the firm's attendance rate was 88 percent.² Row 2 shows the number of vehicle round-trips per commuter per day, calculated from the data used to create Table 2. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted

FIGURE 5-1

Commuter Mode Choices

Before and After Cashing Out

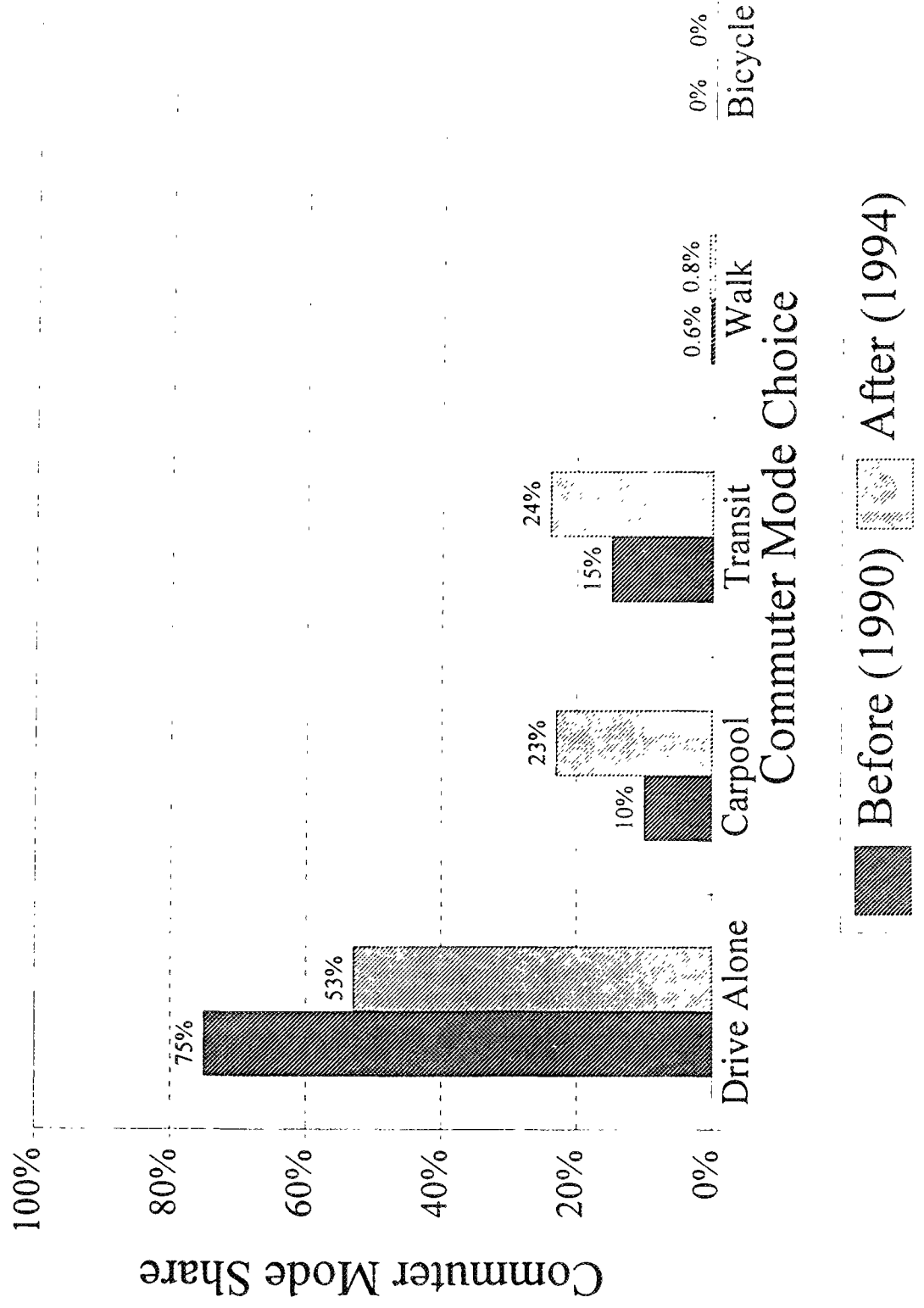


FIGURE 5-2

Commuter Mode Choices

In Southern California

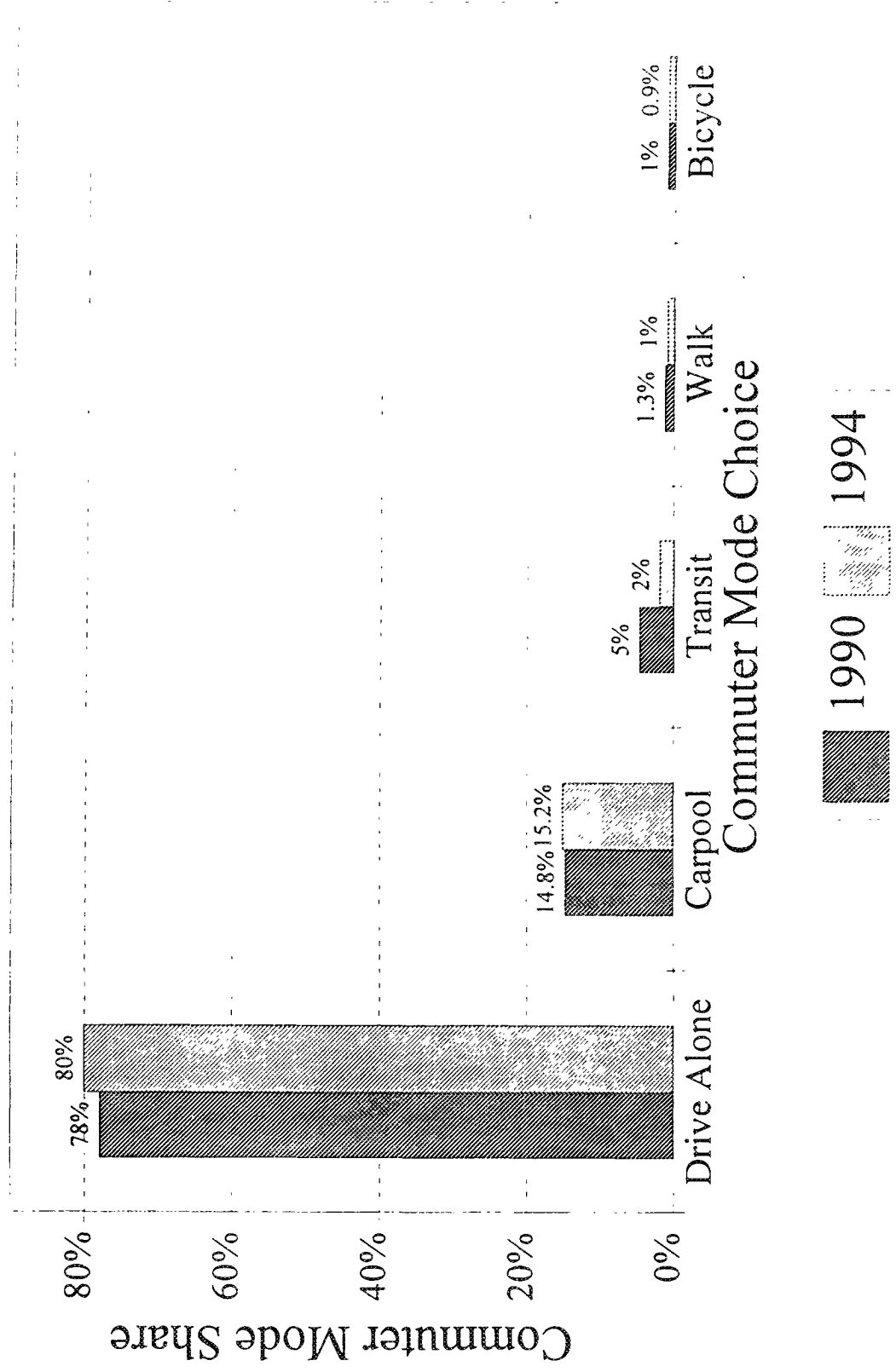


TABLE 5-3

CASHING OUT REDUCED VEHICLE TRIPS AND VMT

	1990 (1)	1994 (2)	Change (3)	Percent Change (4)
1 Commuters per Employee	0.88	0.88	.	
2 Vehicle Trips per Commuter per Day (Round-trip)	0.79	0.60	-0.19	-24%
3 Vehicle Trips per Employee per Day (Round-trip)	0.70	0.53	-0.17	-24%
4 Vehicle Trips per Employee per Year (One-way)	353	268	-86	-24%
5 Total Vehicle Trips per Year (One-way)	99,232	75,185	-24,047	-24%
6 VMT per Employee per Day	21.0	15.9	-5.1	-24%
7 VMT per Employee per Year	5,297	4,013	-1,284	-24%
8 Total VMT per Year	1,488,483	1,127,774	-360,709	-24%

There were 281 employees who reported to this work site during the 1994 survey period.

Row 3 = Row 2 x Row 1.

Row 4 = Row 3 x 252 x 2.

Row 5 = Row 4 x 281.

Row 6 = Row 3 x 30.

Row 7 = Row 6 x 252.

Row 8 = Row 7 x 281.

as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. The total number of vehicle trips is then divided by the total number of responding commuters to give the ratio of vehicle trips per commuter per day. Cashing out reduced the number of vehicle round-trips per commuter from 0.79 per day in 1990 to 0.60 per day in 1994, a 24 percent decrease.

Row 3 shows the number of vehicle round-trips per employee per day, obtained by multiplying the number of vehicle round-trips per commuter by the number of commuters per employee. Cashing out reduced the number of vehicle round-trips per employee by 24 percent, from 0.70 to 0.53 per day.

Row 4 shows the total number of one-way vehicle trips per employee per year. The number of one-way vehicle trips in 1990 is calculated by multiplying the 0.70 vehicle round-trips per employee per day found in 1990 by 252 work days per year, and doubling the result to obtain the number of one-way trips.³ The number of one-way vehicle trips in 1994 is calculated by multiplying the 0.53 vehicle trips per employee per day found in 1994 by the same 252 working days per year, and doubling the result to obtain the number of one-way trips. The resulting change in the number of vehicle trips per employee per year therefore represents the change that occurred because mode shares changed.

Row 4 thus shows that there were 353 vehicle trips per employee in 1990, and 268 vehicle trips per employee in 1994. Offering cash in lieu of parking subsidies eliminated 86 vehicle trips per employee per year for commuting (43 vehicle trips to work, and another 43 vehicle trips from work), a 24 percent decrease.

Vehicle trips for all automobile commuting to the firm were calculated by multiplying the trips per employee by the total of 281 employees of the firm. Row 5 shows that employees made 99,232 vehicle trips for commuting to the firm in 1990. Cashing out reduced the number of vehicle trips to 75,185 in 1994, or by 24,047 vehicle trips per year.

The SCAQMD survey reports do not include information on commuter trip distances. In calculating VMT reductions, the SCAQMD assumes that the average one-way distance for each avoided automobile trip is 15 miles.⁴ If we follow this procedure, we can calculate how cashing out reduced VMT. Rows 6 and 7 show that cashing out eliminated 5.1 VMT per employee per day, and 1,284 VMT per employee per year. Row 8 shows that cashing out eliminated 360,709 VMT per year for commuting to the firm.

V. CASHING OUT REDUCED VEHICLE EMISSIONS

The emissions reductions are calculated by considering the reductions in both automobile *trips* and *VMT*. Pollution emissions are caused at the beginning and end of each automobile commute trip by the "cold start" as the engine warms up and the "hot soak" as the engine cools down; these "trip-end" emissions are independent of the total distance traveled for the commute.

The "running" emissions are a factor of total VMT for the trip. In Table 3 we have already estimated the reductions in automobile trips and VMT. Therefore, we can multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting.

Cashing out reduced 86 trips and 1,284 VMT per employee per year. We multiply these reductions by the factors for ROG, NO_x, CO, and PM10 for both trip ends and VMT. We use the emission factors specific to 1994, the year in which the vehicle-trip and VMT reductions were estimated. We add the two sources of pollution, and then divide by 454 grams per pound to obtain the emissions reductions in pounds per employee per year. Table 4 shows that cashing out eliminated 3.6 pounds of ROG, 3.0 pounds of NO_x, 32.3 pounds of CO, and 2.1 pounds of PM per employee per year.

The emissions reduction for all employees of the firm is found by multiplying the emissions reduction per employee by the 281 employees of the firm in 1994. Cashing out eliminated a total of 1,012 pounds of ROG, 852 pounds of NO_x, 9,071 pounds of CO, and 596 pounds of PM per year for automobile commuting. The final column shows that cashing out reduced automobile emissions by 24 percent.

VI. CASHING OUT REDUCED GASOLINE CONSUMPTION AND CO₂ EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and carbon dioxide emissions. Table 5 shows these results. The SCAQMD has estimated that the average fuel efficiency of light-duty passenger vehicles in Southern California is 25 miles per gallon in 1996. Therefore, the VMT figures estimated in Table 3 (Rows 7 and 8) are divided by 25 miles per gallon to estimate gasoline consumption for commuting.⁵ Cashing out reduced gasoline consumption per employee by 51 gallons per year, and reduced total gasoline consumption for commuting to the firm by 14,428 gallons per year, a 24 percent decrease.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide. Therefore, the reduction in gasoline consumption reduced carbon dioxide emissions per employee by 1,012 pounds per year, and reduced total carbon dioxide emissions for commuting to the firm by 284,239 pounds per year, a 24 percent decrease.

VII. CASHING OUT INCREASED COMMUTING SUBSIDIES

In 1994, the firm went beyond compliance with California's cash out requirement; it offered a parking subsidy of \$100 a month or a transportation allowance of \$150 per month. Table 6 shows how this policy change increased the firm's spending for commuter subsidies.⁶

In 1990, the firm's commuter subsidy was \$26,805 a month. In 1994 the firm's commuter subsidy was \$36,007 a month, including \$1,245 a month in payroll taxes on the cash benefits to ridesharers.⁷ Total commuting subsidies, including payroll taxes, rose by \$9,202 a month, or by 34 percent. The average subsidy per employee, including payroll taxes, increased

TABLE 5-4

**CASHING OUT PARKING SUBSIDIES
REDUCED VEHICLE EMISSIONS**

(Pounds Per Year)

	<u>Change</u>	<u>Percent Change</u>
ROG		
per Employee	-3.6	-24%
for Firm	-1,012	-24%
NOx		
per Employee	-3.0	-24%
for Firm	-852	-24%
CO		
per Employee	-32.3	-24%
for Firm	-9,071	-24%
PM		
per Employee	-2.1	-24%
for Firm	-596	-24%

The pollution emissions per trip-end and per VMT in 1994 are taken from the Air Resources Board's EMFAC7F1.1/B7F model.

These 1994 factors are:

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>PM</u>
Trip end factor (grams/trip)	6.93	2.88	63.4	0
VMT factor (grams/mile)	0.81	0.88	7.18	0.75

These factors are multiplied by the reduction of 86 trips and 1,284 VMT per employee per year in Table 5-3 to give the reduction in emissions per employee in 1994.

TABLE 5-5**CASHING OUT REDUCED GASOLINE CONSUMPTION AND CARBON DIOXIDE EMISSIONS**

	<u>1990</u>	<u>1994</u>	<u>Change</u>	<u>Percent</u> <u>Change</u>
	(1)	(2)	(3)	(4)
1 Gasoline Consumption per Employee (gallons per year)	212	161	-51	-24%
2 Total Gasoline Consumption (gallons per year)	59,539	45,111	-14,428	-24%
3 Carbon Dioxide Emissions per Employee (pounds per year)	4,174	3,163	-1,012	-24%
4 Total Carbon Dioxide Emissions (pounds per year)	1,172,925	888,686	-284,239	-24%

There were 281 employees who reported to this work site during the 1994 survey period.

The average fuel efficiency is 25 miles per gallon.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide.

from \$95 to \$128 a month. This increase occurred largely because the commuting subsidy offered to ridesharers is 50 percent higher than is required for compliance with California's cash-out requirement.

VIII. SUMMARY

In 1990, the firm offered employees parking subsidies that ranged between \$90 and \$145 a month. Carpoolers split a parking subsidy, transit riders received \$15 a month, and others received nothing. The firm gradually changed its commuter subsidy between 1990 and 1994; in 1994 it offered all employees the option of a parking subsidy of \$100 a month or a cash subsidy of \$150 a month.

In response to cashing out parking subsidies, the share of commuters who drive to work alone fell from 75 to 53 percent. The carpool share increased from 10 to 23 percent and the transit share increased from 15 to 24 percent. The walk share remained at 1 percent. These commuter changes from solo driving to carpooling and transit reduced the number of vehicle trips by 24 percent, eliminating a total of 24,047 vehicle trips and 360,709 VMT per year.

These reductions in automobile use reduced pollution emissions for automobile commuting by 24 percent. Cashing out eliminated 3.6 pounds of ROG, 3.0 pounds of NO_x, 32.3 pounds of CO, and 2.1 pounds of PM per employee per year. In total, cashing out eliminated 1,012 pounds of ROG, 852 pounds of NO_x, 9,071 pounds of CO, and 596 pounds of PM per year for commuting to the firm.

By reducing VMT, cashing out reduced gasoline consumption for commuting by 51 gallons per employee per year, and reduced gasoline consumption for commuting to the firm by 14,428 gallons per year. Finally, cashing out reduced carbon dioxide emissions by 1,012 pounds of CO₂ per employee per year, and reduced carbon dioxide emissions for commuting to the firm by 284,239 pounds of CO₂ per year.

The firm's spending for commuter subsidies increased by \$33 per employee per month, or by 34 percent.

TABLE 5-6

COMMUTING SUBSIDIES BEFORE CASHING OUT (1990)
(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$118	75%	92%	\$24,686
2 Person Carpool	\$59	8%	5%	\$1,313
3 Person Carpool	\$39	1%	0%	\$131
4 Person Carpool	\$29	1%	0.2%	\$41
Vanpool	\$17	0.2%	0.0%	\$9
Mass Transit	\$15	15%	2%	\$626
Walk	\$0	1%	0%	\$0
Bicycle	\$0	0%	0%	\$0
Monthly Subsidies for 281 employees:				\$26,805
Taxes on Cash Subsidies:				\$0
Total Cost per Month:				\$26,805
Cost per Employee per Month:				\$95

COMMUTING SUBSIDIES AFTER CASHING OUT (1994)
(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$100	53%	43%	\$14,776
2 Person Carpool	\$150	18%	22%	\$7,490
3 Person Carpool	\$150	5%	6%	\$2,213
Mass Transit	\$150	24%	29%	\$9,908
Walk	\$150	1%	1%	\$340
Bicycle	\$150	0.1%	0%	\$34
Monthly Subsidies for 281 employees:				\$34,762
Taxes on Cash Subsidies:				\$1,245
Total Cost per Month:				\$36,007
Cost per Employee per Month:				\$128
Change in Total Cost per Month:				+\$9,202
Change in Cost per Employee per Month:				+\$33
Percent Change in Commuting Subsidy:				+34%

ENDNOTES

1. The sample size was 1,208 commuters in 1990 and 2,625 commuters in 1994. These results are presented in Table 2.1 of Commuter Transportation Services (1994).
2. To isolate any change in the number of trips caused solely by a change in the attendance rate, the attendance rate for 1994 is used for both years.
3. Vacations, sick days, and other absences are already accounted for in the calculation of the firm's average attendance rate, so the number of work days per year is five days per week for fifty-two weeks, minus the conventional eight national holidays per year.
4. This average trip distance was found in a 1991 travel survey for all commuters in the South Coast Air Basin. See Southern California Association of Governments (1993).
5. This estimated fuel efficiency of 25 miles per gallon was made using the Air Resources Board's EMFAC7F1.1/B7F model to represent conditions in Southern California on a workday in 1996. I am grateful to Waldo Lopez of the SCAQMD for this information. Average fuel efficiency of the fleet has been steadily increasing; it was only 22 miles per gallon in 1990. Because the estimates of VMT reductions refer to 1994, when average fuel efficiency was lower than in 1996, using a fuel efficiency of 25 miles per gallon produces a conservative estimate of how reducing VMT reduced fuel consumption.
6. To isolate the change in subsidy cost caused solely by the change in the number of employees, the number of employees reported in 1994 is used for both years.
7. The firm's payroll tax rate was 7.65 percent on cash payments to ridesharers.

REFERENCES

- Commuter Transportation Services, *State of the Commute Report, 1994*, Los Angeles: Commuter Transportation Services, 1994.
- Southern California Association of Governments, "1991 Southern California Origin-Destination Survey--Summary Findings," Los Angeles, 1993.

Commuter Policies Case Study 5

1990		1994	
1	Parking Subsidy	1	Parking Subsidy
2		2	Commute Allowance
3	Guaranteed Ride Home	3	Guaranteed Ride Home
4	In-House Carpool/Vanpool Matchlists	4	In-House Carpool/Vanpool Matchlists
5	Promotional Campaigns	5	Promotional Campaigns
6	Back-up Transportation Program	6	Back-up Transportation Program
7	On-Site Sale of Bus Passes	7	On-Site Sale of Bus Passes
8	Commuter Information Center	8	Commuter Information Center
9	<i>Prize Drawings</i>	9	Public Transit/Vanpool Bonus
10	<i>Telecommuting</i>	10	Buy Back Rideshare Days Reward Program
		11	One Week Bus/Transit Subsidy
		12	Preferential Parking for Carpools
		13	Partnership Education Program
		14	Partner Rideshare Program
		15	Associate Education Program
		16	Partner Education Program
		17	Free DASH Coupons
		18	Flex Hour Scheduling
		19	Commuter Discount Cards
		20	Rideshare Fair
		21	Focus Group Meetings
		22	Reward Program
		23	Commuter of the Month
		24	Award Program

Bold indicates an incentive present in 1994 but not in 1990

Italics indicates an incentive present in 1990 but not in 1994

Case Study 5

Employer characteristics

Case study 5 provides legal services in the area of litigation. This firm had a total of 281 employees in 1994. All 281 employees reported to work between 6am and 10am, Monday through Friday.

Case study 5 is located at 333 South Hope Street in downtown Los Angeles. Three major freeways -- Harbor (110), Hollywood (101) and Century (105) -- provide nearby access to the firm. Major arterials serving this area include Grand Avenue, Flower Street and Figueroa Street. Fifteen bus routes serve this area.

Case study 5 provides many on-site services and amenities, including bank services, general store, restaurant, dry cleaners and barber / beauty shop. Moreover, the firm is conveniently accessible to nearby restaurants and retail establishments, and fitness centers.

Surrounding streets have wide sidewalks, pedestrian signals, crosswalks and good lighting.

The distribution of job categories is:

Professional	44.5%
Clerical	44.4%
Officials/Administrators	7.4%
Other	3.7%

CASE STUDY 6

I. EXECUTIVE SUMMARY

The employer does video and audio post-production for the entertainment industry. It offers all employees free parking in rented spaces that cost the firm \$55 per space per month. In 1994, the firm began to offer employees the option to take cash in lieu of free parking. The following changes occurred after employees were offered the option to cash out parking subsidies.

- The solo driver share fell from 85 to 78 percent.
- The carpool share rose from 7 to 8 percent.
- The transit share doubled from 1 to 2 percent.
- The walking share doubled from 3 to 6 percent.
- The bicycle share rose from 4 to 6 percent.
- Vehicle round-trips to work fell from 0.86 to 0.78 per employee per day.
- Vehicle travel for commuting fell from 25.7 to 23.5 VMT per employee per day.

The shift from solo driving to ridesharing reduced the number of vehicle trips and VMT for commuting to work by 9 percent. Table 1 summarizes the reductions (per employee and for the firm) in vehicle travel, pollution emissions, and gasoline consumption after employees were offered to option to cash out parking subsidies.

II. BACKGROUND

The firm is located in Santa Monica, and employed 173 people in 1995. It specializes in video and audio post-production. The firm offers free parking to all employees; it has 19 parking spaces in its own building, and pays \$55 per space per month to lease additional parking spaces off-site. The firm offers several other ridesharing benefits including guaranteed ride home, preferential parking for carpools, bicycle lockers, and a transit subsidy of \$15 per month.

Table 2 shows the pattern of commuter subsidies in 1994 (Columns 2, 4, and 6 labeled "Before"). Column 2 shows that solo drivers received a parking subsidy of \$55 a month, carpoolers split a parking subsidy of \$55 a month, and other commuters received nothing.

Column 4 shows the results found in a transportation survey required by the South Coast Air Quality Management District (SCAQMD) which was conducted in February 1994, before the firm began to offer the cash option. Eighty-five percent of employees drove solo, 7 percent carpooled, 1 percent rode transit, 3 percent walked, and 4 percent bicycled to work.

TABLE 6-1

SUMMARY OF REDUCTIONS AFTER CASHING OUT

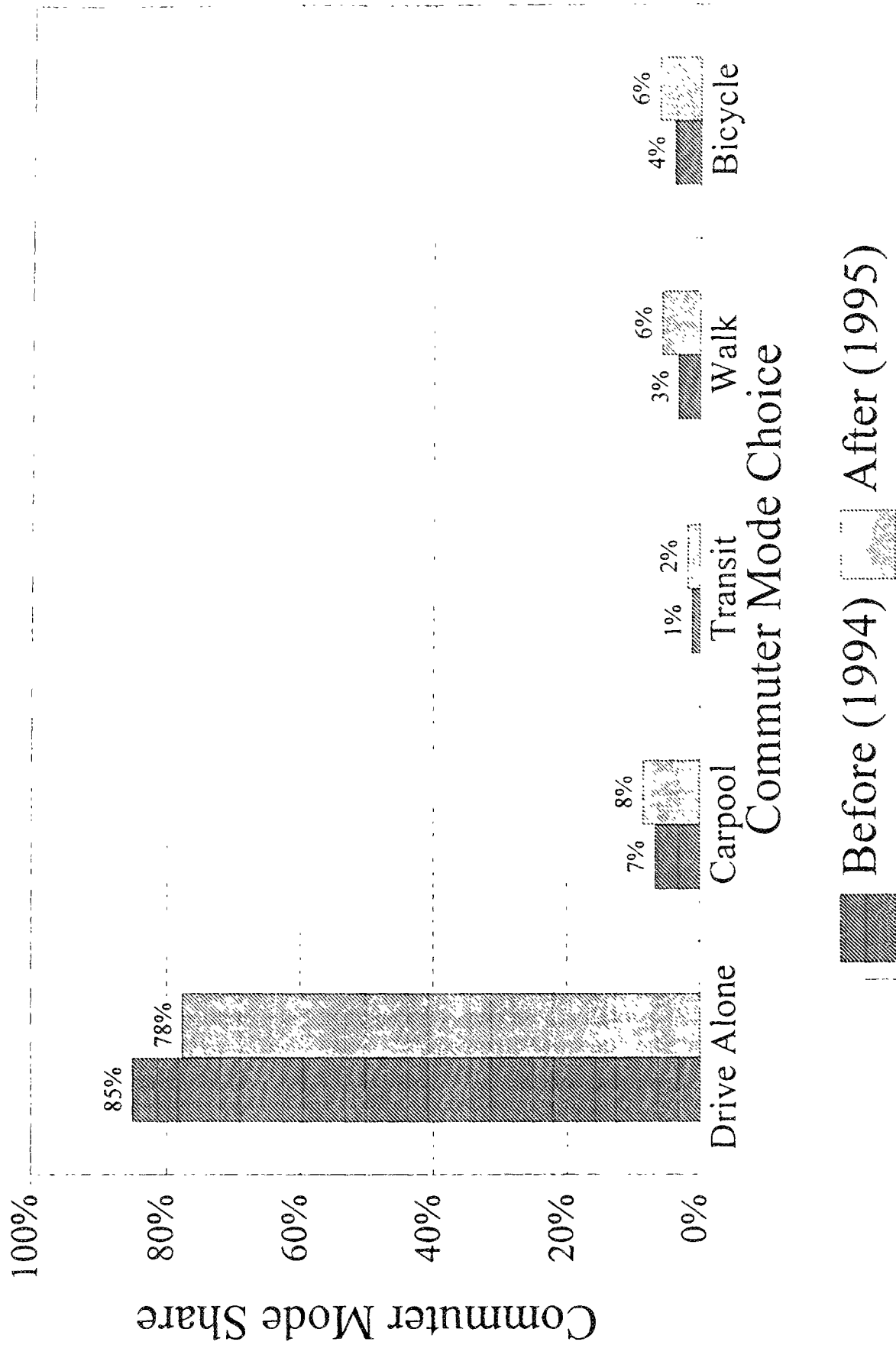
Variable Reduced	Reduction		Percent Change
	Per Employee	For Firm	
Vehicle Trips (per year)	38	4,582	9%
Vehicle Miles Traveled (per year)	568	68,730	9%
Reactive Organic Gas Emissions (pounds per year)	1.5	181	9%
Nitrogen Oxide Emissions (pounds per year)	1.3	154	9%
Carbon Monoxide Emissions (pounds per year)	13.2	1,600	9%
Particulate Matter Emissions (pounds per year)	0.9	114	9%
Gasoline Consumption (gallons per year)	23	2,749	9%
Carbon Dioxide Emissions (pounds per year)	448	54,160	9%

There were 121 employees who reported to this work site during the 1995 survey period.

FIGURE 6-1

Commuter Mode Choices

Before and After Cashing Out



III. CASHING OUT REDUCED SOLO DRIVING

In 1994 the firm began to offer a cash subsidy of \$55 per month to employees who do not take a parking space. (This cash offer was introduced because Santa Monica required the firm to comply with California's cash-out requirement.) In addition, the firm offers an extra subsidy of \$15 a month to transit riders. The firm thus complies with California's cash-out requirement, and goes beyond compliance because of the transit subsidy.

The firm also introduced guaranteed ride home, raffles, preferential parking spaces for carpools, and bicycle lockers in 1994. Although cashing out was not the only change between 1994 and 1995, it was the major change (see attached list of incentives offered in 1994 and 1995).

Column 5 (labeled "After") in Table 2 shows the results of the firm's 1995 employee transportation survey, conducted in June 1995, approximately 15 months after the firm began to offer employees the option of cash in lieu of parking. The solo driver share fell from 85 percent in 1994 to 78 percent in 1995. The carpool share rose from 7 to 8 percent, the transit share doubled from 1 to 2 percent, the walk share doubled from 3 to 6 percent, and the bicycle share increased from 4 to 6 percent.

Figure 1 shows these mode shifts. The data are taken from Columns 4 and 5 of Table 2, and they show that the increase in carpooling, transit, walking, and bicycling came at the expense of solo driving.

Columns 6 and 7 in Table 2 shows how the firm's subsidy distribution among its employees changed between 1994 and 1995. In 1994, 85 percent of employees drove solo and received 97 percent of the total subsidy. In 1995, 78 percent of employees drove solo and received 77 percent of the total subsidy. The subsidy distribution in 1994 favored solo drivers, while the subsidy distribution in 1995 was almost evenly distributed, with a slight preference for transit riders.

IV. CASHING OUT PARKING SUBSIDIES REDUCED VEHICLE TRIPS AND VMT

Table 3 shows how cashing out reduced vehicle trips and VMT. Row 1 shows that there was an average of 0.95 commuters per employee. On an average day, 5 percent of employees did not commute to work because they were on vacation, sick, or for another reason; therefore, the firm's attendance rate was 95 percent.¹

Row 2 shows the number of vehicle round-trips per commuter per day, calculated from the data used to create Table 2. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. The total number of vehicle trips is then divided by the total number of responding commuters to give the ratio of vehicle trips per commuter per

TABLE 6-2

COMMUTER MODE CHOICES BEFORE AND AFTER CASHING OUT

Commuter Mode (1)	Subsidy per Employee		Mode Share		Subsidy Distribution	
	Before (1994) (2)	After (1995) (3)	Before (1994) (4)	After (1995) (5)	Before (1994) (6)	After (1995) (7)
Drive Alone	\$55	\$55	85%	78%	97%	77%
Carpool	\$23	\$55	7%	8%	3%	8%
Transit	\$0	\$70	1%	2%	0%	2%
Walk	\$0	\$55	3%	6%	0%	6%
Bicycle	\$0	\$55	4%	6%	0%	6%

Note: The survey response rate was 83.8% in 1994 and 92% in 1995. A Chi-Square test shows that the probability was less than 1 percent that the difference in commuter mode shares observed in Columns (4) and (5) occurred by chance.

day. Cashing out reduced the number of vehicle round-trips per commuter from 0.90 per day in 1994 to 0.82 per day in 1995, a 9 percent decrease.

Row 3 shows the number of vehicle round-trips per employee per day, obtained by multiplying the number of vehicle round-trips per commuter by 0.95 commuters per employee. Cashing out reduced the number of vehicle round-trips per employee per day from 0.86 in 1994 to 0.78 in 1995, a 9 percent decrease.²

Row 4 shows the total number of one-way vehicle trips per employee per year. The number of one-way vehicle trips in 1994 is calculated by multiplying the 0.86 vehicle round-trips per employee per day found in 1994 by 252 work days per year, and doubling the result to obtain the number of one-way trips.³ The number of one-way vehicle trips in 1995 is calculated by multiplying the 0.78 vehicle trips per employee per day found in 1995 by the same 252 working days per year, and doubling the result to obtain the number of one-way trips. The resulting change in the number of vehicle trips per employee per year therefore represents the change that occurred because the commuter mode shares changed.

Row 4 thus shows that there were 432 vehicle trips per employee in 1994, and 398 vehicle trips per employee in 1995. Cashing out therefore eliminated 38 vehicle trips per employee per year for commuting (19 vehicle trips to work, and another 19 vehicle trips from work), a 9 percent decrease.

Vehicle trips for all commuting to the firm were calculated by multiplying the trips per employee by the total of 121 employees who reported to this work site during the five-day survey period. Row 5 shows that employees made 52,255 vehicle trips for commuting to the firm in 1994, and 47,673 in 1995. Cashing out therefore eliminated 4,582 vehicle trips per year, a 9 percent decrease.

In calculating VMT reductions, the SCAQMD assumes that the average one-way distance for each avoided automobile trip is 15 miles, which is the average trip distance found in a 1991 travel survey for all commuters in the South Coast Air Basin.⁴ If we follow this procedure, we can calculate how cashing out reduced VMT.

Row 6 shows that cashing out reduced VMT per employee per day from 25.7 in 1994 to 23.5 in 1995, or by 2.3 VMT per employee per day, a 9 percent decrease. Row 7 shows that cashing out reduced VMT per employee from 6,478 in 1994 to 5,910 in 1995, or by 568 VMT per employee per year, a 9 percent decrease. Row 8 shows that cashing out eliminated 68,730 VMT per year for all commuting to the firm.

V. CASHING OUT REDUCED VEHICLE EMISSIONS

The emissions reductions are calculated by considering the reductions in both automobile *trips* and *VMT*. Pollution emissions are caused at the beginning and end of each automobile commute trip by the "cold start" as the engine warms up and the "hot soak" as the engine cools

TABLE 6-3

CASHING OUT REDUCED VEHICLE TRIPS AND VMT

	Before (1994)	After (1995)	Change	Percent Change
	(1)	(2)	(3)	(4)
Commuters per Employee	0.95	0.95		
Vehicle Trips per Commuter per Day (Round-trip)	0.90	0.82	-0.08	-9%
Vehicle Trips per Employee per Day (Round-trip)	0.86	0.78	-0.08	-9%
Vehicle Trips per Employee per Year (One-way)	432	394	-38	-9%
Total Vehicle Trips per Year (One-way)	52,255	47,673	-4,582	-9%
VMT per Employee per Day	25.7	23.5	-2.3	-9%
VMT per Employee per Year	6,478	5,910	-568	-9%
Total VMT per Year	783,824	715,094	-68,730	-9%

There were 121 employees who reported to this work site during the 1995 survey period.

Row 3 = Row 2 x Row 1.

Row 4 = Row 3 x 252 x 2.

Row 5 = Row 4 x 121.

Row 6 = Row 3 x 30.

Row 7 = Row 6 x 252.

Row 8 = Row 7 x 121.

down; these "trip-end" emissions are independent of the total distance traveled for the commute. The "running" emissions are a factor of total VMT for the trip. In Table 3 we have already estimated the reductions in automobile trips and VMT. Therefore, we can multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting.

Cashing out reduced 38 vehicle trips and 568 VMT per employee per year. We multiply these reductions by the factors for ROG, CO, NO_x, CO, and PM10 for both trip ends and VMT. We use the emission factors specific to 1995, the year in which the vehicle-trip and VMT reductions were estimated. We add the two sources of pollution (trip ends and VMT), and then divide by 454 grams per pound to obtain the emissions reductions in pounds per employee per year. Table 4 shows that cashing out eliminated 1.5 pounds of ROG, 1.3 pounds of NO_x, 13.2 pounds of CO, and 0.9 pounds of PM per employee per year.

The emissions reduction for all employees of the firm is found by multiplying the emissions reduction per employee by the 121 employees of the firm in 1995. Cashing out eliminated a total of 181 pounds of ROG, 154 pounds of NO_x, 1,600 pounds of CO, and 114 pounds of PM per year for automobile commuting. The final column shows that cashing out reduced automobile emissions by 9 percent.

VI. CASHING OUT REDUCED GASOLINE CONSUMPTION AND CO₂ EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and carbon dioxide emissions. Table 5 shows these results. The SCAQMD has estimated that the average fuel efficiency of light-duty passenger vehicles in Southern California is 25 miles per gallon in 1996. Therefore, the VMT figures estimated in Table 3 (Rows 7 and 8) are divided by 25 miles per gallon to estimate gasoline consumption for commuting.⁵ Cashing out reduced gasoline consumption per employee by 23 gallons per year, and reduced total gasoline consumption for commuting to the firm by 2,749 gallons per year, a 9 percent decrease.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide. Therefore, the reduction in gasoline consumption reduced carbon dioxide emissions per employee by 448 pounds per year, and reduced total carbon dioxide emissions for commuting to the firm by 54,160 pounds per year, a 9 percent decrease.

VII. CASHING OUT INCREASED COMMUTING SUBSIDIES

Table 6 shows how cashing out increased the firm's spending for commuter subsidies.⁶ In 1994 the firm's commuter subsidy was \$48 per employee per month.⁷ In 1995 the firm's commuter subsidy was \$56 per employee month, including payroll taxes on the cash benefits paid to ridesharers. Cashing out increased total commuting subsidies, including payroll taxes, by \$948 a month, or by 16 percent. The average subsidy per employee, including payroll taxes, increased by \$8 a month.

TABLE 6-4

**CASHING OUT PARKING SUBSIDIES
REDUCED VEHICLE EMISSIONS**

(Pounds Per Year)

	<u>Change</u>	<u>Percent Change</u>
ROG		
per Employee	-1.5	-9%
for Firm	-181	-9%
NOx		
per Employee	-1.3	-9%
for Firm	-154	-9%
CO		
per Employee	-13.2	-9%
for Firm	-1,600	-9%
PM		
per Employee	-0.9	-9%
for Firm	-114	-9%

The pollution emissions per trip-end and per VMT in 1995 are taken from the Air Resources Board's EMFAC7F1.1/B7F model.

These 1995 factors are:

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>PM</u>
Trip end factor (grams/trip)	6.54	2.78	58.74	0
VMT factor (grams/mile)	0.76	0.83	6.64	0.75

These factors are multiplied by the reduction of 38 trips and 568 VMT per employee per year in Table 6-3 to give the reduction in emissions per employee in 1995.

TABLE 6-5**CASHING OUT REDUCED GASOLINE CONSUMPTION AND CARBON DIOXIDE EMISSIONS**

	<u>Before (1994)</u>	<u>After (1995)</u>	<u>Change</u>	<u>Percent</u> <u>Change</u>
	(1)	(2)	(3)	(4)
1 Gasoline Consumption per Employee (gallons per year)	259	236	-23	-9%
2 Total Gasoline Consumption (gallons per year)	31,353	28,604	-2,749	-9%
3 Carbon Dioxide Emissions per Employee (pounds per year)	5,105	4,657	-448	-9%
4 Total Carbon Dioxide Emissions (pounds per year)	617,654	563,494	-54,160	-9%

There were 121 employees who reported to this work site during the 1995 survey period.

The average fuel efficiency is 25 miles per gallon.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide.

TABLE 6-6

COMMUTING SUBSIDIES BEFORE CASHING OUT (1994)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$55	85%	97%	\$5,661
2 Person Carpool	\$28	4%	2%	\$145
3 Person Carpool	\$18	1%	0.4%	\$25
6 Person Carpool	\$9	1%	0.2%	\$13
Mass Transit	\$0	1%	0%	\$0
Walk	\$0	3%	0%	\$0
Bicycle	\$0	4%	0%	\$0
Monthly Subsidies for 121 employees:				\$5,844
Taxes on Cash Subsidies:				\$0
Total Cost per Month:				\$5,844
Cost per Employee per Month:				\$48

COMMUTING SUBSIDIES AFTER CASHING OUT (1995)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$55	78%	77%	\$5,164
2 Person Carpool	\$55	7%	7%	\$452
3 Person Carpool	\$55	2%	2%	\$113
Mass Transit	\$70	2%	2%	\$158
Walk	\$55	6%	6%	\$384
Bicycle	\$55	6%	6%	\$418
Monthly Subsidies for 121 employees:				\$6,689
Taxes on Cash Subsidies:				\$105
Total Cost per Month:				\$6,794
Cost per Employee per Month:				\$56
Change in Total Cost per Month:				+\$948
Change in Cost per Employee per Month:				+\$8
Percent Change in Commuting Subsidy:				+16%

In addition to this cash outlay, the firm's facility manager estimates that she spends from three to five hours per month administering *all* of the firm's worksite transportation program (of which cashing out is one part), or less than two minutes per employee per month.

VIII. SUMMARY

The firm offers all employees free parking, at a cost to the firm of \$55 per space per month. In 1994 the firm began to offer all employees the option to take \$55 a month in lieu of taking the free parking. The firm's new commuter subsidy policy thus complies with California's cash-out requirement.

After cashing out, the share of commuters who drive to work alone fell from 85 to 78 percent. The carpool share increased from 7 to 8 percent, the transit share doubled from 1 to 2 percent, the walk share increased from 3 to 6 percent, and the bicycle share increased from 4 to 6 percent. These changes reduced the number of vehicle trips to work by 9 percent.

Cashing out eliminated a total of 38 vehicle trips per employee per year. Cashing out reduced vehicle travel for commuting by 2.3 VMT per employee per day, and by 568 VMT per employee per year. In total, cashing out eliminated 4,852 vehicle trips and 68,730 VMT per year for commuting to the firm.

These reductions in automobile use reduced pollution emissions for automobile commuting by 9 percent. Cashing out eliminated 1.5 pounds of ROG, 1.3 pounds of NO_x, 13.2 pounds of CO, and 0.9 pounds of PM per year. In total, cashing out eliminated 181 pounds of ROG, 154 pounds of NO_x, 1,600 pounds of CO, and 114 pounds of PM per year for commuting to the firm.

By reducing VMT, cashing out reduced gasoline consumption for commuting by 23 gallons per employee per year, and reduced gasoline consumption for commuting to the firm by 2,749 gallons per year. Finally, cashing out carbon dioxide emissions by 448 pounds of CO₂ per employee per year, and reduced carbon dioxide emissions for commuting to the firm by 54,160 pounds of CO₂ per year.

The firm's spending for commuter subsidies increased by \$8 per employee per month, or by 16 percent.

ENDNOTES

1. To isolate any change in the number of trips caused solely by a change in the attendance rate, the attendance rate for 1995 is used in the calculations for both years.
2. The mode shares of employees who did not respond to the survey are assumed to be the same as for employees who did respond to the survey.
3. Vacations, sick days, and other absences are already accounted for in the calculation of the firm's average attendance rate, so the number of work days per year is five days per week for fifty-two weeks, minus the conventional eight national holidays per year.
4. See Southern California Association of Governments (1993).
5. This estimated fuel efficiency of 25 miles per gallon was made using the Air Resources Board's EMFAC7F1.1/B7F model to represent conditions in Southern California on a workday in 1996. I am grateful to Waldo Lopez of the SCAQMD for this information. Average fuel efficiency of the fleet has been steadily increasing; it was only 22 miles per gallon in 1990. Because the estimates of VMT reductions refer to 1995, when average fuel efficiency was lower than in 1996, using a fuel efficiency of 25 miles per gallon produces a conservative estimate of how reducing VMT reduced fuel consumption.
6. To isolate the change in subsidy cost caused solely by the change in the number of employees, the number of employees reported in 1995 is used for both years.
7. The firm's payroll tax rate was 7.65 percent on cash benefits paid to ridesharers. The first \$55 a month in transit benefits were tax exempt in 1995. See Table 1 in Appendix 2 for the payroll tax rates.

REFERENCES

Commuter Transportation Services, *State of the Commute Report, 1994*, Los Angeles: Commuter Transportation Services, 1994.

Southern California Association of Governments, "1991 Southern California Origin-Destination Survey--Summary Findings," Los Angeles, 1993.

Commuter Policies

Case Study 6

1994		1995
1	Free Parking	1 Free Parking
2		2 Parking Cash-Out
3		3 Flexible Work Hours
4		4 Guaranteed Ride Home
5		5 Bicycle Locker
6		6 Preferential Parking Space
7		7 Raffles
8		8 Transit Subsidy

Bold indicates an incentive present in 1995 but not in 1994

Case Study 6

Employer characteristics

Case study 6 provides video and audio production and post production services. This firm had a total of 173 employees in 1995, with 121 employees reporting to work between 6am and 10am, Monday through Friday.

Case study 6 is located at 730 Arizona Avenue in Santa Monica. One freeway -- Santa Monica (10) -- provides nearby access to the firm. The major arterial serving this area is Lincoln Boulevard. Six bus routes serve this area.

Case study 6 is conveniently accessible to nearby restaurants, banks, medical services and retail establishments.

The neighborhood is flat and safe, with good sidewalks and lighting. Bike lanes connecting from the beach to Arizona Avenue to 20th Street provide easy access to the firm.

The distribution of job categories is:

Skilled Craft	60%
Professional	10%
Technical	9%
Clerical	6%
Sales & Associates	5%
Officials/Administrators	4%
Semi-skilled	4%

CASE STUDY 7

I. EXECUTIVE SUMMARY

The employer is a law firm in Santa Monica. It charges employees \$15 a month for parking in rented spaces that cost the firm \$77 per space per month. In 1994, the firm began to offer employees the option of cash in lieu of a parking subsidy. The following changes occurred after cashing out parking subsidies.

- The solo driver share fell from 83 to 75 percent.
- The carpool share rose from 13 to 20 percent.
- The transit share tripled from 1 to 3 percent.
- The walking share remained at 1 percent.
- The bicycle share fell from 1 to 0 percent.
- Vehicle round-trips to work fell from 0.83 to 0.79 per employee per day.
- Vehicle travel for commuting fell from 25 to 23.6 VMT per employee per day.

The shift from solo driving to ridesharing reduced the number of vehicle trips and VMT for commuting to work by 5 percent. Table 1 summarizes the reductions (per employee and for the firm) in vehicle travel, pollution emissions, and gasoline consumption that occurred after employees were offered to option to cash out parking subsidies.

II. BACKGROUND

The firm is located in Santa Monica, and employed 300 people at this worksite in 1995. The firm offers parking to all employees at \$15 per month; it owns no parking, and pays \$77 per space per month to lease its parking spaces. The firm offers several other ridesharing benefits including guaranteed ride home, preferential parking for carpools, and an introductory transit subsidy.

Table 2 shows the pattern of commuter subsidies in 1994 (Columns 2, 4, and 6 labeled "Before"). Column 2 shows that solo drivers received a parking subsidy of \$62 a month; carpools received free parking, so they shared a single \$77 subsidy among the carpool members. Vanpoolers received \$175 a month, transit riders received \$75 a month, and those who walked or bicycled received \$25 a month.

Column 4 shows the results found in a transportation survey required by the South Coast Air Quality Management District (SCAQMD) which was conducted in October 1994, before the firm began to offer the cash option. Eighty-three percent of employees drove solo, 13 percent carpooled, 1 percent rode transit, 1 percent walked, and 1 percent bicycled to work.

TABLE 7-1

SUMMARY OF REDUCTIONS AFTER CASHING OUT

Variable Reduced	Reduction		Percent Change
	Per Employee	For Firm	
Vehicle Trips (per year)	22	6,682	5%
Vehicle Miles Traveled (per year)	334	100,227	5%
Reactive Organic Gas Emissions (pounds per year)	0.9	264	5%
Nitrogen Oxide Emissions (pounds per year)	0.7	224	5%
Carbon Monoxide Emissions (pounds per year)	7.8	2,332	5%
Particulate Matter Emissions (pounds per year)	0.6	166	5%
Gasoline Consumption (gallons per year)	263	78,979	5%
Carbon Dioxide Emissions (pounds per year)	13	4,009	5%

There were 300 employees who reported to this work site during the 1995 survey period.

TABLE 7-2

COMMUTER MODE CHOICES BEFORE AND AFTER CASHING OUT

Commute Mode (1)	Subsidy per Employee		Mode Share		Subsidy Distribution	
	Before (1994) (2)	After (1995) (3)	Before (1994) (4)	After (1995) (5)	Before (1994) (6)	After (1995) (7)
Drive Alone	\$62	\$62	83%	75%	88%	71%
Carpool	\$37	\$77	13%	20%	8%	23%
Vanpool	\$175	\$165	0.3%	0.3%	1%	1%
Transit	\$75	\$77	1%	3%	2%	3%
Walk	\$25	\$77	1%	1%	1%	1%
Bicycle	\$25	\$77	1%	0%	0%	0%

Note: The survey response rate was 94% in 1994 and 83% in 1995. A Chi-Square test shows that the probability was less than 1 percent that the difference in commuter mode shares observed in Columns (4) and (5) occurred by chance.

III. CASHING OUT REDUCED SOLO DRIVING

In 1994 the firm began to offer a cash subsidy of \$77 per month to employees who do not take a parking space. (This cash offer was introduced because Santa Monica required the firm to comply with California's cash-out requirement.) The firm thus goes beyond compliance with California's cash-out requirement because it offers \$77 a month to ridesharers while subsidizing parking for solo drivers by only \$62 a month. The firm reduced the vanpooler subsidy to \$165 a month, and simultaneously eliminated several insignificant ridesharing subsidies, such as free breakfast for ridesharers in the parking lot, a walking and cycling club, and a monthly prize drawing of \$50 for ridesharers. Cashing out was the only significant change between 1994 and 1995 (see attached list of incentives offered in 1994 and 1995).

Column 5 (labeled "After") in Table 2 shows the results of the firm's 1995 employee transportation survey, conducted in December 1995, one year after the firm began to offer employees the option of cash in lieu of a parking subsidy. The solo driver share fell from 83 percent in 1994 to 75 percent in 1995. The carpool share rose from 13 to 20 percent, the transit share tripled from 1 to 3 percent, the walk share remained at 1 percent, and the bicycle share fell from 1 to 0 percent. Figure 1 shows these mode shifts.

Columns 6 and 7 in Table 2 shows how the firm's subsidy distribution among its employees changed between 1994 and 1995. In 1994, 83 percent of employees drove solo and received 88 percent of the total subsidy. In 1995, 75 percent of employees drove solo and received 71 percent of the total subsidy. The subsidy distribution in 1994 favored solo driving, while the subsidy distribution in 1995 favored ridesharing.

IV. CASHING OUT PARKING SUBSIDIES REDUCED VEHICLE TRIPS AND VMT

Table 3 shows how cashing out reduced vehicle trips and VMT. Row 1 shows that there was an average of 0.92 commuters per employee. On an average day, 8 percent of employees did not commute to work because they were on vacation, sick, or for some other reason; therefore, the firm's attendance rate was 92 percent.¹

Row 2 shows the number of vehicle round-trips per commuter per day, calculated from the data used to create Table 2. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. The total number of vehicle trips is then divided by the total number of responding commuters to give the ratio of vehicle trips per commuter per day. Cashing out reduced the number of vehicle round-trips per commuter from 0.90 per day in 1994 to 0.85 per day in 1995, a 5 percent decrease.

Row 3 shows the number of vehicle round-trips per employee per day, obtained by multiplying the number of vehicle round-trips per commuter by 0.92 commuters per employee.

Commuter Mode Choices

Before and After Cashing Out

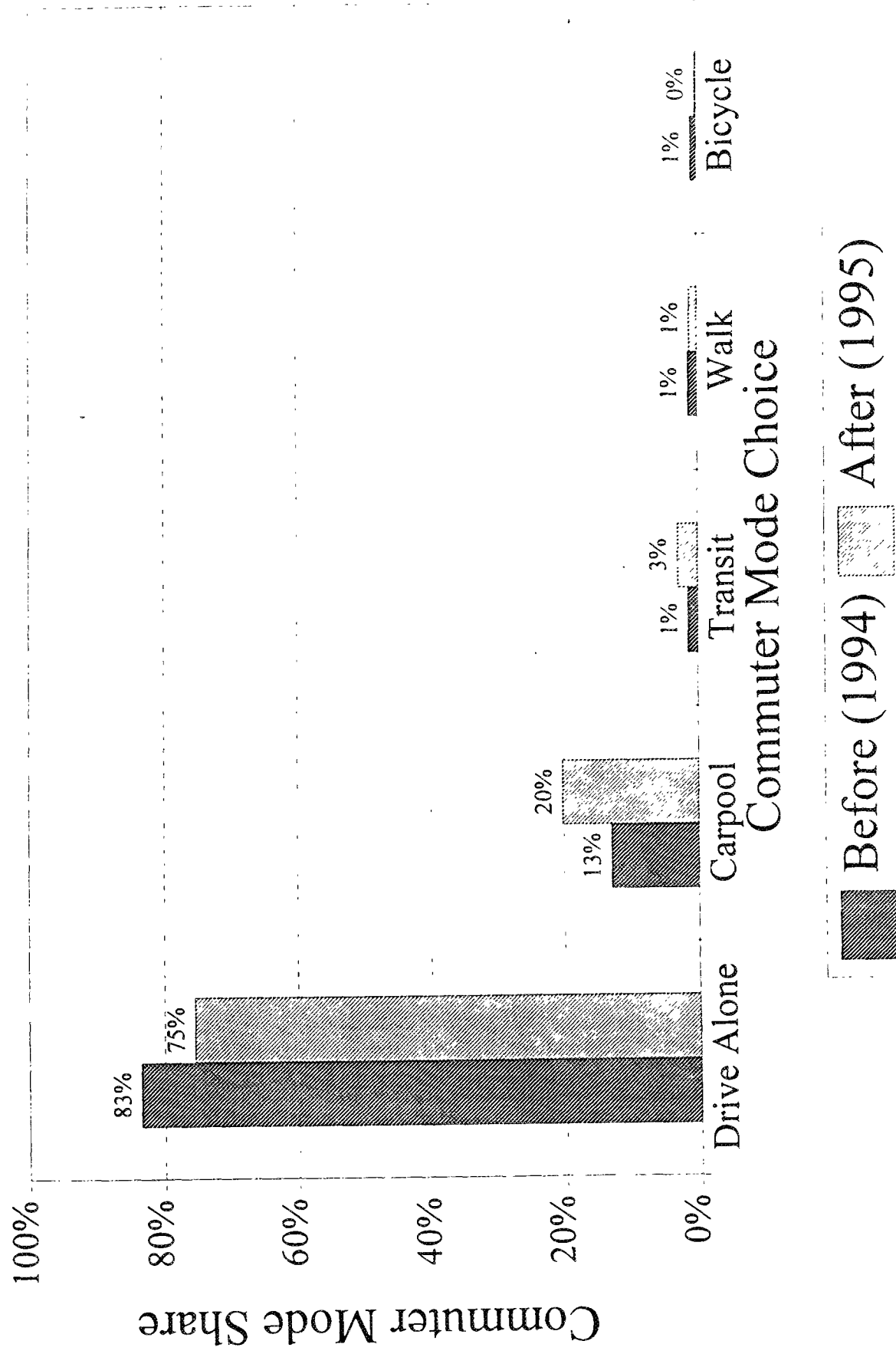


TABLE 7-3

CASHING OUT REDUCED VEHICLE TRIPS AND VMT

	Before (1994) (1)	After (1995) (2)	Change (3)	Percent Change (4)
1 Commuters per Employee	0.92	0.92		
2 Vehicle Trips per Commuter per Day (Round-trip)	0.90	0.85	-0.05	-5%
3 Vehicle Trips per Employee per Day (Round-trip)	0.83	0.79	-0.04	-5%
4 Vehicle Trips per Employee per Year (One-way)	420	397	-22	-5%
5 Total Vehicle Trips per Year (One-way)	125,872	119,190	-6,682	-5%
6 VMT per Employee per Day	25.0	23.6	-1.3	-5%
7 VMT per Employee per Year	6,294	5,960	-334	-5%
8 Total VMT per Year	1,888,080	1,787,853	-100,227	-5%

There were 300 employees who reported to this work site during the 1995 survey period.

Row 3 = Row 2 x Row 1.

Row 4 = Row 3 x 252 x 2.

Row 5 = Row 4 x 300.

Row 6 = Row 3 x 30.

Row 7 = Row 6 x 252.

Row 8 = Row 7 x 300.

Cashing out reduced the number of vehicle round-trips per employee per day from 0.83 in 1994 to 0.79 in 1995, a 5 percent decrease.²

Row 4 shows the total number of one-way vehicle trips per employee per year. The number of one-way vehicle trips in 1994 is calculated by multiplying the 0.83 vehicle round-trips per employee per day found in 1994 by 252 work days per year, and doubling the result to obtain the number of one-way trips.³ The number of one-way vehicle trips in 1995 is calculated by multiplying the 0.79 vehicle trips per employee per day found in 1995 by the same 252 working days per year, and doubling the result to obtain the number of one-way trips. The resulting change in the number of vehicle trips per employee per year therefore represents the change that occurred because the mode shares changed.

Row 4 thus shows that there were 420 vehicle trips per employee in 1994, and 397 vehicle trips per employee in 1995. Cashing out therefore eliminated 22 vehicle trips per employee per year for commuting, a 5 percent decrease.

Vehicle trips for all automobile commuting to the firm were calculated by multiplying the trips per employee by the total of 300 employees who reported to this work site during the five-day survey period. Row 5 shows that employees made 125,872 vehicle trips for commuting to the firm in 1994, and 119,190 in 1995. Cashing out therefore eliminated 6,682 vehicle trips per year, a 5 percent decrease.

In calculating VMT reductions, the SCAQMD assumes that the average one-way distance for each avoided automobile trip is 15 miles, which is the average trip distance found in a 1991 travel survey for all commuters in the South Coast Air Basin.⁴ If we follow this procedure, we can calculate how cashing out reduced VMT.

Row 6 shows that cashing out reduced VMT per employee per day from 25.0 in 1994 to 23.6 in 1995, or by 1.3 VMT per employee per day, a 5 percent decrease. Row 7 that cashing out reduced VMT per employee from 6,294 in 1994 to 5,960 in 1995, or by 334 VMT per employee per year, a 5 percent decrease. Row 8 shows that cashing out eliminated 100,227 VMT per year for all commuting to the firm.

V. CASHING OUT REDUCED VEHICLE EMISSIONS

The emissions reductions are calculated by considering the reductions in both automobile *trips* and *VMT*. The "cold start" as the engine warms up and the "hot soak" as the engine cools down cause pollution emissions at the beginning and end of each automobile trip; these "trip-end" emissions are independent of the total distance traveled for the commute. The "running" emissions are a factor of total VMT for the trip. In Table 3 we have already estimated the reductions in automobile trips and VMT. Therefore, we can multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting.

Cashing out reduced 22 trips and 334 VMT per employee per year. We multiply these reductions by the factors for ROG, NO_x, CO, and PM10 for both trip ends and VMT. We use the emission factors specific to 1995, the year in which the vehicle-trip and VMT reductions were estimated. We add the two sources of pollution, and then divide by 454 grams per pound to obtain the emissions reductions in pounds per employee per year. Table 4 shows that cashing out eliminated 0.9 pounds of ROG, 0.7 pounds of NO_x, 7.8 pounds of CO, and 0.6 pounds of PM per employee per year.

The emissions reduction for all employees of the firm is found by multiplying the emissions reduction per employee by the 300 employees of the firm in 1995. Cashing out eliminated a total of 264 pounds of ROG, 224 pounds of NO_x, 2,332 pounds of CO, and 166 pounds of PM per year for automobile commuting. The final column shows that cashing out reduced automobile emissions by 5 percent.

VI. CASHING OUT REDUCED GASOLINE CONSUMPTION AND CO₂ EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and carbon dioxide emissions. Table 5 shows these results. The SCAQMD has estimated that the average fuel efficiency of light-duty passenger vehicles in Southern California is 25 miles per gallon in 1996. Therefore, the VMT figures estimated in Table 3 (Rows 7 and 8) are divided by 25 miles per gallon to estimate gasoline consumption for commuting.⁵ Cashing out reduced gasoline consumption per employee by 13 gallons per year, and reduced total gasoline consumption for commuting to the firm by 4,009 gallons per year, a 5 percent decrease.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide. Therefore, the reduction in gasoline consumption reduced carbon dioxide emissions per employee by 263 pounds per year, and reduced total carbon dioxide emissions for commuting to the firm by 78,979 pounds per year, a 5 percent decrease.

VII. CASHING OUT INCREASED COMMUTING SUBSIDIES

Table 6 shows how cashing out increased the firm's spending for commuter subsidies.⁶ In 1994 the firm's commuter subsidy was \$59 per employee per month.⁷ In 1995 the firm's commuter subsidy was \$67 per employee month, including payroll taxes on the cash benefits paid to ridesharers. Cashing out increased total commuting subsidies, including payroll taxes, by \$2,430 a month, or by 14 percent. The average subsidy per employee, including payroll taxes, increased by \$8 a month.

VIII. SUMMARY

The firm offers parking to all employees at \$15 a month, in spaces the firm rents for \$77 per space per month. In 1994 the firm began to offer all employees the option to take \$77 a month in lieu of taking the parking subsidy. The firm's new commuter subsidy policy thus

TABLE 7-4
CASHING OUT PARKING SUBSIDIES
REDUCED VEHICLE EMISSIONS
(Pounds Per Year)

	<u>Change</u>	<u>Percent Change</u>
ROG		
per Employee	-0.9	-5%
for Firm	-264	-5%
NOx		
per Employee	-0.7	-5%
for Firm	-224	-5%
CO		
per Employee	-7.8	-5%
for Firm	-2,332	-5%
PM		
per Employee	-0.6	-5%
for Firm	-166	-5%

The pollution emissions per trip-end and per VMT in 1995 are taken from the Air Resources Board's EMFAC7F.1/B7F model.

These 1995 factors are:

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>PM</u>
Trip end factor (grams/trip)	6.54	2.78	58.74	0
VMT factor (grams/mile)	0.76	0.83	6.64	0.75

These factors are multiplied by the reduction of 22 trips and 334 VMT per employee per year in Table 7-3 to give the reduction in emissions per employee in 1995.

TABLE 7-5

CASHING OUT REDUCED GASOLINE CONSUMPTION AND CARBON DIOXIDE EMISSIONS

	<u>Before (1994)</u>	<u>After (1995)</u>	<u>Change</u>	<u>Percent Change</u>
	(1)	(2)	(3)	(4)
1 Gasoline Consumption per Employee (gallons per year)	252	238	-13	-5%
2 Total Gasoline Consumption (gallons per year)	75,523	71,514	-4,009	-5%
3 Carbon Dioxide Emissions per Employee (pounds per year)	4,959	4,696	-263	-5%
4 Total Carbon Dioxide Emissions (pounds per year)	1,487,807	1,408,828	-78,979	-5%

There were 300 employees who reported to this work site during the 1995 survey period.

The average fuel efficiency is 25 miles per gallon.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide.

TABLE 7-6

COMMUTING SUBSIDIES BEFORE CASHING OUT (1994)

(Per Month)				
<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$62	83%	88%	\$15,528
2 Person Carpool	\$39	11%	8%	\$1,319
3 Person Carpool	\$26	0.5%	0.2%	\$38
4 Person Carpool	\$19	0.3%	0.1%	\$19
6 Person Carpool	\$13	0.4%	0.1%	\$16
Vanpool	\$175	0.3%	1%	\$173
Mass Transit	\$75	1%	2%	\$314
Walk	\$25	1%	1%	\$99
Bicycle	\$25	1%	0%	\$62
Monthly Subsidies for 300 employees:				\$17,567
Taxes on Cash Subsidies:				\$27
Total Cost per Month:				\$17,594
Cost per Employee per Month:				\$59

COMMUTING SUBSIDIES AFTER CASHING OUT (1995)

(Per Month)				
<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Firm</u>
Drive Alone	\$62	75%	71%	\$14,035
2 Person Carpool	\$77	19%	22%	\$4,338
3 Person Carpool	\$77	1%	1.1%	\$222
4 Person Carpool	\$77	0.2%	0.2%	\$40
Vanpool	\$165	0.3%	1%	\$173
Mass Transit	\$77	3%	3%	\$686
Walk	\$77	1%	1%	\$262
Bicycle	\$77	0%	0%	\$40
Monthly Subsidies for 300 employees:				\$19,797
Taxes on Cash Subsidies:				\$227
Total Cost per Month:				\$20,024
Cost per Employee per Month:				\$67
Change in Total Cost per Month:				+\$2,430
Change in Cost per Employee per Month:				+\$8
Percent Change in Commuting Subsidy:				+14%

omplies with California's cash-out requirement, and goes beyond compliance because it offers a \$77 cash subsidy for ridesharers that is greater than the \$62 a month subsidy for solo drivers.

After cashing out parking subsidies, the share of commuters who drive to work alone fell from 83 to 75 percent. The carpool share increased from 13 to 20 percent, the transit share tripled from 1 to 3 percent, the walk share remained at 1 percent, and the bicycle share fell from 1 to 0 percent. These changes reduced the number of vehicle trips to work by 5 percent.

Cashing out eliminated a total of 22 vehicle trips per employee per year. Cashing out reduced vehicle travel for commuting by 1.3 VMT per employee per day, and by 334 VMT per employee per year. In total, cashing out eliminated 6,682 vehicle trips and 100,227 VMT per year for commuting to the firm.

These reductions in automobile use reduced pollution emissions for automobile commuting by 5 percent. Cashing out eliminated 0.9 pounds of ROG, 0.7 pounds of NO_x, 7.8 pounds of CO, and 0.6 pounds of PM per year. In total, cashing out eliminated 264 pounds of ROG, 224 pounds of NO_x, 2,332 pounds of CO, and 166 pounds of PM per year for commuting to the firm.

By reducing VMT, cashing out reduced gasoline consumption for commuting by 13 gallons per employee per year, and reduced gasoline consumption for commuting to the firm by 4,009 gallons per year. Finally, cashing out reduced carbon dioxide emissions by 263 pounds per employee per year, and reduced carbon dioxide emissions for commuting to the firm by 78,979 pounds per year.

The firm's spending for commuter subsidies increased by \$8 per employee per month, or by 14 percent.

ENDNOTES

1. To isolate any change in the number of trips caused solely by a change in the attendance rate, the attendance rate for 1995 is used in the calculations for both years.
2. The mode shares of employees who did not respond to the survey are assumed to be the same as for employees who did respond to the survey.
3. Vacations, sick days, and other absences are already accounted for in the calculation of the firm's average attendance rate, so the number of work days per year is five days per week for fifty-two weeks, minus the conventional eight national holidays per year.
4. See Southern California Association of Governments (1993).
5. This estimated fuel efficiency of 25 miles per gallon was made using the Air Resources Board's EMFAC7F1.1/B7F model to represent conditions in Southern California on a workday in 1996. I am grateful to Waldo Lopez of the SCAQMD for this information. Average fuel efficiency of the fleet has been steadily increasing; it was only 22 miles per gallon in 1990. Because the estimates of VMT reductions refer to 1995, when average fuel efficiency was lower than in 1996, using a fuel efficiency of 25 miles per gallon produces a conservative estimate of how reducing VMT reduced fuel consumption.
6. To isolate the change in subsidy cost caused solely by the change in the number of employees, the number of employees reported in 1995 is used for both years.
7. The firm's payroll tax rate was 7.65 percent on cash benefits paid to ridesharers. The first \$55 a month in transit benefits were tax exempt in 1995.

REFERENCES

Commuter Transportation Services, *State of the Commute Report, 1994*, Los Angeles: Commuter Transportation Services, 1994.

Southern California Association of Governments, "1991 Southern California Origin-Destination Survey--Summary Findings," Los Angeles, 1993.

Commuter Policies Case Study 7

1994		1995
1	Parking Subsidy	1 Parking Subsidy
2		2 Parking Cash-Out/Transportation Allowance
3	Preferred Parking	3 Preferential Parking for Ridesharers
4	Bus Subsidy	4 Introductory Transit Pass or Subsidy
5	Vanpool Subsidy	5 Direct Cash Subsidies for Vanpoolers
6	Emergency Ride Home	6 Guaranteed/Emergency Ride Home
7	Match List	7 Rideshare Matching Service
8	<i>Walk & Bike Club</i>	8 Compressed Work Week
9	<i>Breakfast</i>	9 Telecommuting
10	<i>Monthly Give Away</i>	
Bold indicates an incentive present in 1995 but not in 1994		
<i>Italics</i> indicates an incentive present in 1994 but not in 1995		

Case Study 7

Employer characteristics

Case study 7 provides legal services in the area of insurance defense. With three offices in Santa Monica, Santa Ana and Riverside, this firm had a total of 332 employees in 1995. The largest of the three offices is situated in Santa Monica. All 300 employees reported to work between 6am and 10am, Monday through Friday.

Case study 7 is located at 1620 26th Street in Santa Monica. Two major freeways -- Santa Monica (10) and San Diego (405) -- provide nearby access to the firm. Major arterials serving this area include Cloverfield Avenue, 26th Street, Colorado Avenue and Olympic Boulevard. Three bus routes serve this area.

Case study 7 provides many on-site services and amenities, including child care, post office, food delivery / cafeteria, bank messenger and hair salon. Moreover, the firm is conveniently accessible to nearby restaurants, banks and health clubs.

The accessibility to the site by bicycle is limited to experienced bike riders. The lack of designated bike lanes discourages many commuters from riding their bikes to work. For those who live in Santa Monica, however, it is a good option.

CASE STUDY 8

I. EXECUTIVE SUMMARY

The employer is a managed care medical provider located on the edge of downtown Los Angeles. In 1990, the firm charged employees \$10 a month to park in spaces the firm rented for \$40 per space per month; the firm thus offered a parking subsidy of \$30 a month. The firm offered no ridesharing benefits.

In 1991 the firm began to charge employees \$25 a month to park, and to offer \$50 a month to employees who did not take a parking space. In 1995, the firm paid \$36 a month to rent parking spaces, so its parking subsidy was only \$11 a month. The following changes occurred after the firm began to offer employees the option to take cash in lieu of parking subsidies.

- The solo driver share fell from 61 to 45 percent.
- The carpool share rose from 23 to 35 percent.
- The transit share rose from 12 to 15 percent.
- The walking and bicycling shares each rose from 0 to 1 percent.
- Vehicle round-trips to work fell from 0.70 to 0.58 per employee per day.

The shift from solo driving to ridesharing and transit reduced the number of vehicle trips and VMT for commuting to work by 16 percent. Table 1 summarizes the reductions (per employee and for the firm) in vehicle travel, pollution emissions, and gasoline consumption that occurred after cashing out.

II. BACKGROUND

The employer provides managed care medical services at a location on the edge of downtown Los Angeles. In 1990, the firm rented parking spaces at \$40 a month, and offered them to employees at \$10 a month. The firm offered no ridesharing benefits.

Table 2 shows the pattern of commuter subsidies in 1990 (Columns 2, 4, and 6). Column 2 shows that solo drivers received a parking subsidy of \$30 a month. Carpoolers split a parking subsidy, with an average subsidy of \$13 per carpooler. Others received nothing.

Column 4 shows the results found in a transportation survey required by the SCAQMD, which was conducted in 1990. Sixty-one percent of employees drove solo, 23 percent carpooled, and 12 percent rode transit.

TABLE 8-1

SUMMARY OF REDUCTIONS AFTER CASHING OUT

Variable Reduced	Reduction		Percent Change
	Per Employee	For Firm	
Vehicle Commute Trips (per year)	58	16,414	16%
Vehicle Miles Traveled (per year)	864	246,215	16%
Reactive Organic Gas Emissions (pounds per year)	2.3	649	16%
Nitrogen Oxide Emissions (pounds per year)	1.9	551	16%
Carbon Monoxide Emissions (pounds per year)	20.1	5,730	16%
Particulate Matter Emissions (pounds per year)	1.4	407	16%
Carbon Dioxide Emissions (pounds per year)	681	194,017	16%
Gasoline Consumption (gallons per year)	35	9,849	16%

There were 285 employees who reported to this work site during the 1995 survey period.

III. CASHING OUT REDUCED SOLO DRIVING

In 1991 the firm began to offer a cash transportation allowance of \$50 per month to employees who do not take a parking space. The firm also reduced its parking subsidies by raising its parking charge to employees to \$25 a month. The firm introduced several other ridesharing benefits in 1991, such as guaranteed ride home, bicycle racks, and raffles, but reducing the parking subsidy and introducing the cash transportation allowance were the major policy changes from 1990 to 1995. In 1995 the firm's cost of renting parking spaces near its worksite had fallen to \$36 a month, so its parking subsidy in 1995 was only \$11 a month.

Column 5 in Table 2 shows the results of the firm's employee transportation survey, conducted in 1995. The solo driver share fell from 61 to 45 percent. The carpool share rose from 23 to 35 percent. The transit share increased from 12 to 15 percent. The share of employees who walked or bicycled to work each rose from 0 to 1 percent.

Figure 1 shows these mode shifts. The figures are taken from Columns 4 and 5 of Table 2, and show that the increase in carpooling, transit, walking, and bicycling all came at the expense of solo driving.

Columns 6 and 7 in Table 2 show how the firm's subsidy distribution among its employees changed between 1990 and 1995. In 1990, 61 percent of employees drove solo and received 85 percent of the total subsidy. In 1995, 45 percent of employees drove solo and received only 15 percent of the total subsidy. The subsidy distribution in 1990 favored solo driving, while the subsidy distribution in 1995 favored ridesharing.

IV. CASHING OUT PARKING SUBSIDIES REDUCED VEHICLE TRIPS AND VMT

Table 3 shows how the changes in mode shares reduced vehicle trips and VMT. Row 1 shows that there was an average of 0.93 commuters per employee. On an average day, 7 percent of employees did not commute to work because they were on vacation, sick, or for another reason; therefore, the firm's attendance rate was 93 percent.¹ Row 2 shows the number of vehicle round-trips per commuter per day, calculated from the data used to create Table 2. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. The total number of vehicle trips is then divided by the total number of responding commuters to give the ratio of vehicle trips per commuter per day. Cashing out reduced the number of vehicle round-trips per commuter from 0.75 per day in 1990 to 0.63 per day in 1995, a 16 percent decrease.

Row 3 shows the number of vehicle round-trips per employee per day, obtained by multiplying the number of vehicle round-trips per commuter by the number of commuters per employee. Cashing out reduced the number of vehicle round-trips per employee by 16 percent, from 0.70 to 0.58 per day.

TABLE 8-2
COMMUTER MODE CHOICES BEFORE AND AFTER CASHING OUT

Commute Mode (1)	Subsidy per Employee		Mode Share		Subsidy Distribution	
	Before (1990) (2)	After (1995) (3)	Before (1990) (4)	After (1995) (5)	Before (1990) (6)	After (1995) (7)
Drive Alone	\$30	\$11	61%	45%	85%	15%
Carpool	\$13	\$50	23%	35%	15%	54%
Transit	\$0	\$50	12%	15%	0%	24%
Walk	\$0	\$50	0.4%	1%	0%	2%
Bicycle	\$0	\$50	0.4%	1%	0%	6%

Note: The survey response rate was 100% in 1990 and 76% in 1995. A Chi-Square test shows that the probability was less than 1 percent that the difference in commuter mode shares observed in Columns (4) and (5) occurred by chance.

Commuter Mode Choices

Before and After Cashing Out

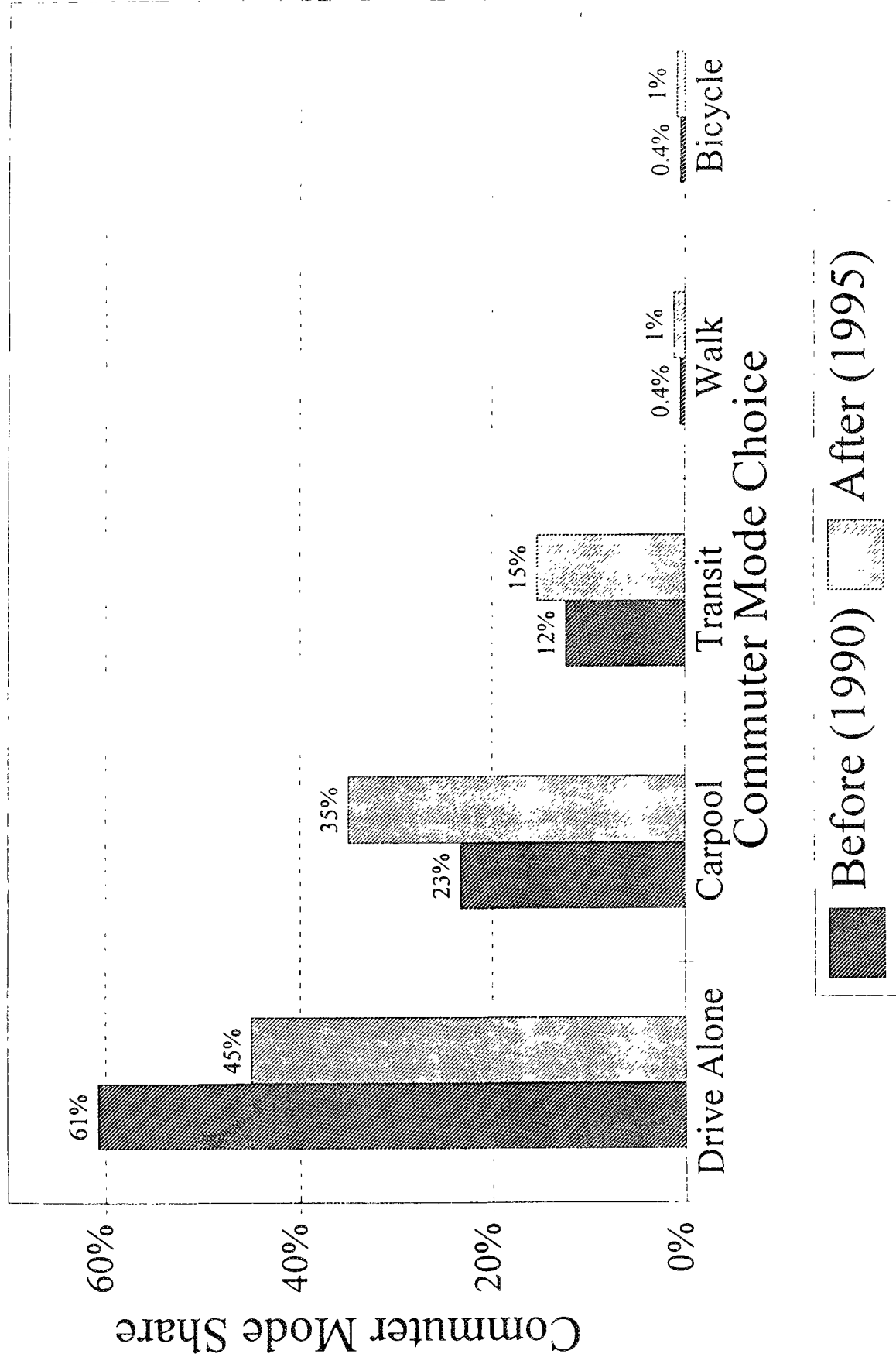


TABLE 8-3

CASHING OUT REDUCED VEHICLE TRIPS AND VMT

	<u>Before (1990)</u>	<u>After (1995)</u>	<u>Change</u>	<u>Percent Change</u>
	(1)	(2)	(3)	(4)
1 Commuters per Employee	0.93	0.93		
2 Vehicle Trips per Commuter per Day (Round-trip)	0.75	0.63	-0.12	-16%
3 Vehicle Trips per Employee per Day (Round-trip)	0.70	0.58	-0.11	-16%
4 Vehicle Trips per Employee per Year (One-way)	352	295	-58	-16%
5 Total Vehicle Trips per Year (One-way)	100,348	83,934	-16,414	-16%
6 VMT per Employee per Day	21.0	17.5	-3.4	-16%
7 VMT per Employee per Year	5,281	4,418	-864	-16%
8 Total VMT per Year	1,505,220	1,259,005	-246,215	-16%

There were 285 employees who reported to this work site during the 1995 survey period.

Row 3 = Row 2 x Row 1.

Row 4 = Row 3 x 252 x 2.

Row 5 = Row 4 x 285.

Row 6 = Row 3 x 30.

Row 7 = Row 6 x 252.

Row 8 = Row 7 x 285.

Row 4 shows the total number of one-way vehicle trips per employee per year. The number of one-way vehicle trips in 1990 is calculated by multiplying the 0.70 vehicle round-trips per employee per day found in 1990 by 252 work days per year, and doubling the result to obtain the number of one-way trips.² The number of one-way vehicle trips in 1995 is calculated by multiplying the 0.58 vehicle trips per employee per day found in 1995 by the same 252 working days per year, and doubling the result to obtain the number of one-way trips. The resulting change in the number of vehicle trips per employee per year therefore represents the change that occurred because the mode shares changed.

Row 4 thus shows that there were 352 vehicle trips per employee in 1990, and 295 vehicle trips per employee in 1995. Offering cash in lieu of parking subsidies therefore eliminated 58 vehicle trips per employee per year for commuting (29 vehicle trips to work, and another 29 vehicle trips from work), a 16 percent decrease.

Vehicle trips for all automobile commuting to the firm were calculated by multiplying the trips per employee by the total of 285 employees of the firm. Row 5 shows that employees made 100,348 vehicle trips for commuting to the firm in 1990. Cashing out reduced the number of vehicle trips to 83,934 in 1995, or by 16,414 vehicle trips per year.

The SCAQMD survey reports do not include information on commuter trip distances. In calculating VMT reductions, the SCAQMD assumes that the average one-way distance for each avoided automobile trip is 15 miles.³ If we follow this procedure, we can calculate how cashing out reduced VMT. Rows 6 and 7 show that cashing out eliminated 3.4 VMT per employee per day, and 864 VMT per employee per year. Row 8 shows that cashing out eliminated 246,215 VMT per year, or 16 percent of all VMT for commuting to the firm.

V. CASHING OUT REDUCED VEHICLE EMISSIONS

The emissions reductions are calculated by considering the reductions in both automobile *trips* and *VMT*. Pollution emissions are caused at the beginning and end of each automobile commute trip by the "cold start" as the engine warms up and the "hot soak" as the engine cools down; these "trip-end" emissions are independent of the total distance traveled for the commute. The "running" emissions are a factor of total VMT for the trip. In Table 3 we have already estimated the reductions in automobile trips and VMT. Therefore, we can multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting.

Cashing out reduced 58 trips and 864 VMT per employee per year. We multiply these reductions by the factors for ROG, NO_x, CO, and PM10 for both trip ends and VMT. We use the emission factors specific to 1995, the year in which the vehicle-trip and VMT reductions were estimated. We add the two sources of pollution, and then divide by 454 grams per pound to obtain the emissions reductions in pounds per employee per year. Table 4 shows that cashing out eliminated 2.3 pounds of ROG, 1.9 pounds of NO_x, 20.1 pounds of CO, and 1.4 pounds of PM per employee per year.

TABLE 8-4
CASHING OUT PARKING SUBSIDIES
REDUCED VEHICLE EMISSIONS
(Pounds Per Year)

	<u>Change</u>	<u>Percent Change</u>
ROG		
per Employee	-2.3	-16%
for Firm	-649	-16%
NOx		
per Employee	-1.9	-16%
for Firm	-551	-16%
CO		
per Employee	-20.1	-16%
for Firm	-5,730	-16%
PM		
per Employee	-1.4	-16%
for Firm	-407	-16%

The pollution emissions per trip-end and per VMT in 1995 are taken from the Air Resources Board's EMFAC7F1.1/B7F model.

These 1995 factors are:

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>PM</u>
Trip end factor (grams/trip)	6.54	2.78	58.74	0
VMT factor (grams/mile)	0.76	0.83	6.64	0.75

These factors are multiplied by the reduction of 58 trips and 864 VMT per employee per year in Table 8-3 to give the reduction in emissions per employee in 1995.

The emissions reduction for all employees of the firm is found by multiplying the emissions reduction per employee by the 285 employees of the firm in 1995. Cashing out eliminated a total of 649 pounds of ROG, 551 pounds of NO_x, 5,370 pounds of CO, and 407 pounds of PM per year for automobile commuting. The final column shows that cashing out reduced automobile emissions by 16 percent.

VI. CASHING OUT REDUCED GASOLINE CONSUMPTION AND CO₂ EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and carbon dioxide emissions. Table 5 shows these results. The SCAQMD has estimated that the average fuel efficiency of light-duty passenger vehicles in Southern California is 25 miles per gallon in 1996. Therefore, the VMT figures estimated in Table 3 (Rows 7 and 8) are divided by 25 miles per gallon to estimate gasoline consumption for commuting.⁴ Cashing out reduced gasoline consumption per employee by 35 gallons per year, and reduced total gasoline consumption for commuting to the firm by 9,849 gallons per year, or 16 percent of all gasoline consumption for automobile commuting to the firm.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide. Therefore, the reduction in gasoline consumption reduced carbon dioxide emissions per employee by 681 pounds per year, and reduced total carbon dioxide emissions for commuting to the firm by 194,017 pounds per year, a 16 percent decrease.

VII. CASHING OUT INCREASED COMMUTING SUBSIDIES

In 1995, the firm went beyond compliance with California's cash out requirement; it offered a parking subsidy of \$11 a month or a transportation allowance of \$50 per month. Table 6 shows how this policy change increased the firm's spending for commuter subsidies.⁵

In 1990, the firm's commuter subsidy was \$6,087 a month. In 1995 the firm's commuter subsidy was \$9,653 a month, including \$431 in payroll taxes on the cash benefits to ridesharers.⁶ Cashing out increased the average commuting subsidy per employee, including payroll taxes, by \$13 a month.

The generous nature of the firm's cash offer caused part of this cost increase. Solo drivers receive a parking subsidy of \$11 a month, while ridesharers receive a cash subsidy of \$50 a month. The commuting subsidy offered to ridesharers is thus almost five times higher than is required for compliance with California's cash-out requirement.

VIII. SUMMARY

In 1990, the firm offered employees a parking subsidy \$30 a month. Carpoolers split parking subsidy, and others received nothing. The firm changed its commuter subsidy in 1991, and now offers employees the option of a parking subsidy of \$11 a month or a cash subsidy of \$50 a month.

TABLE 8-5**CASHING OUT REDUCED GASOLINE CONSUMPTION AND CARBON DIOXIDE EMISSIONS**

	<u>Before (1990)</u>	<u>After (1995)</u>	<u>Change</u>	<u>Percent Change</u>
	(1)	(2)	(3)	(4)
1 Gasoline Consumption per Employee (gallons per year)	211	177	-35	-16%
2 Total Gasoline Consumption (gallons per year)	60,209	50,360	-9,849	-16%
3 Carbon Dioxide Emissions per Employee (pounds per year)	4,162	3,481	-681	-16%
4 Total Carbon Dioxide Emissions (pounds per year)	1,186,113	992,096	-194,017	-16%

There were 285 employees who reported to this work site during the 1995 survey period.

The average fuel efficiency is 25 miles per gallon.

Combustion of each gallon of gasoline produces 19.7 pounds of carbon dioxide.

TABLE 8-6

COMMUTING SUBSIDIES BEFORE CASHING OUT (1990)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Agency</u>
Drive Alone	\$30	61%	85%	\$5,196
2 Person Carpool	\$15	17%	12%	\$730
3 Person Carpool	\$10	5%	2%	\$138
4 Person Carpool	\$8	1%	0.3%	\$17
Buspool (7 Person)	\$4	1%	0%	\$7
Mass Transit	\$0	12%	0%	\$0
Walk	\$0	0.4%	0%	\$0
Bicycle	\$0	0.4%	0%	\$0
Monthly subsidies for 285 employees:				\$6,087
Taxes on Cash Subsidies:				\$0
Total Cost per Month:				\$6,087
Cost per Employee per Month				\$21

COMMUTING SUBSIDIES AFTER CASHING OUT (1995)

(Per Month)

<u>Travel Mode</u>	<u>Subsidy per Employee</u>	<u>Share of Employees</u>	<u>Share of Subsidy</u>	<u>Cost To Agency</u>
Drive Alone	\$11	45%	15%	\$1,411
2 Person Carpool	\$50	29%	45%	\$4,124
3 Person Carpool	\$50	2%	3%	\$268
4 Person Carpool	\$50	3%	5%	\$438
5 Person Carpool	\$50	1%	2%	\$141
Mass Transit	\$50	15%	24%	\$2,175
Walk	\$50	1%	2%	\$155
Bicycle	\$50	1%	6%	\$509
Monthly subsidies for 285 employees:				\$9,222
Taxes on Cash Subsidies:				\$431
Total Cost per Month:				\$9,653
Cost per Employee per Month:				\$34
Change in Total Cost per Month:				+\$3,566
Change in Cost per Employee per Month:				+\$13
Percent Change in Commuting Subsidy:				+59%

In response to the change in commuting subsidies, the share of commuters who drive to work alone fell from 61 to 45 percent. The carpool share rose from 23 to 35 percent, and the transit share increased from 12 to 15 percent. The walk share increased from 0.4 to 1 percent. These commuter changes from solo driving to carpooling and transit reduced the number of vehicle trips by 16 percent, eliminating a total of 16,414 vehicle trips and 246,215 VMT per year.

These reductions in automobile use reduced pollution emissions for automobile commuting by 16 percent. Cashing out eliminated 2.3 pounds of ROG, 1.9 pounds of NO_x, 20.1 pounds of CO, and 1.4 pounds of PM per employee per year. In total, cashing out eliminated 649 pounds of ROG, 551 pounds of NO_x, 5,730 pounds of CO, and 407 pounds of PM per year for commuting to the firm.

By reducing VMT, cashing out reduced gasoline consumption for commuting by 35 gallons per employee per year, and reduced gasoline consumption for commuting to the firm by 9,849 gallons per year. Finally, cashing out reduced carbon dioxide emissions by 681 pounds per employee per year, and reduced carbon dioxide emissions for commuting to the firm by 194,017 pounds per year.

The firm's spending for commuter subsidies increased by approximately \$13 per employee per month, or by 59 percent.

ENDNOTES

1. To isolate any change in the number of trips caused solely by a change in the attendance rate, the attendance rate for 1995 is used for both years.
2. Vacations, sick days, and other absences are already accounted for in the calculation of the firm's average attendance rate, so the number of work days per year is five days per week for fifty-two weeks, minus the conventional eight national holidays per year.
3. This average trip distance was found in a 1991 travel survey for all commuters in the South Coast Air Basin. See Southern California Association of Governments (1993).
4. This estimated fuel efficiency of 25 miles per gallon was made using the Air Resources Board's EMFAC7F1.1/B7F model to represent conditions in Southern California on a workday in 1996. I am grateful to Waldo Lopez of the SCAQMD for this information. Average fuel efficiency of the fleet has been steadily increasing; it was only 22 miles per gallon in 1990. Because the estimates of VMT reductions refer to 1995, when average fuel efficiency was lower than in 1996, using a fuel efficiency of 25 miles per gallon produces a conservative estimate of how reducing VMT reduced fuel consumption.
5. To isolate the change in subsidy cost caused solely by the change in the number of employees, the number of employees reported in 1995 is used for both years.
6. The firm's payroll tax rate was 7.65 percent on cash payments to ridesharers.

REFERENCES

Commuter Transportation Services, *State of the Commute Report, 1994*, Los Angeles: Commuter Transportation Services, 1994.

Southern California Association of Governments, "1991 Southern California Origin-Destination Survey--Summary Findings," Los Angeles, 1993.

Commuter Policies

Case Study 8

1990		1995	
1	Parking Subsidy	1	Parking Subsidy
2		2	Non-Driver Subsidy
3		3	Flexible Work Hours
4		4	Guaranteed Ride Home
5		5	Bicycle Racks, Clothing Lockers and Showers
6		6	Preferential Parking Space
7		7	Raffles
Bold indicates an incentive present in 1995 but not in 1990			

Case Study 8

Employer characteristics

Case study 8 provides managed care medical services. In 1995, the firm had a total of 361 employees, with 285 employees reporting to work between 6am and 10am, Monday through Friday.

Case study 8 is located at 1025 W. Olympic Blvd. in the downtown Los Angeles area. Two major freeways -- Harbor (110) and Century (105) -- provide nearby access to the firm. Major arterials serving this area include Figueroa Street and Olympic Boulevard. Three bus routes and the Metro Rail Blue Line serve this area.

This area is noted for its heavy traffic and high crime.

The distribution of job categories is:

Clerical	48%
Professional	20%
Technical	17%
Officials/Administrators	11%
Service/Maintenance	4%

CASE STUDY 9

Two of the firms that cashed out their parking subsidies were in Santa Monica (Case Studies 6 and 7). We have also examined the commuter mode shares for a comparison case study in Santa Monica to show the experience of a firm that did not cash out its parking subsidies.

Because all firms of with more than 100 employees have been subject to Regulation XV during the period we have examined, we have been unable to find a comparison firm that has not been attempting to increase ridesharing among its employees. Case Study 9 is a suitable comparison firm, however, because the difference between its parking subsidy and its ridesharing subsidy remained almost unchanged between 1991 and 1995.

In 1991 the firm offered all employees free parking in spaces that it rented for \$75 per space per month. Column 2 in Table 1 shows that solo drivers thus received a subsidy of \$75 a month. Carpoolers also received free parking, and split the \$75 per space subsidy; the larger the carpool, the smaller the subsidy per employee. Those who rode transit, walked, or bicycled to work received no subsidy.

Column 3 shows the subsidy arrangement in 1995. The firm continued to offer free parking, but the price it paid to rent spaces had risen to \$114 per space per month. Therefore, solo drivers received a subsidy of \$114 a month. Everyone who did not take a parking card received a subsidy of \$40 per month--a partial cash out. A two-person carpool thus received one free parking space worth \$114, plus \$40 for the space not taken, for a total subsidy of \$154 divided among two employees, or \$77 each. Larger carpools received smaller subsidies per person, while those who rode transit, walked, or bicycled to work received \$40 a month.

Although employees who did not take a parking card in 1995 received \$40 a month, the parking subsidy itself had risen from \$75 a month in 1991 to \$114 a month in 1995, or by \$39. Therefore, the *difference* in subsidy between solo drivers and those who rode transit, walked or bicycled remained almost constant between 1991 and 1995--it was \$75 in 1991 and \$74 (= \$114 - \$40) in 1995. The firm also adopted a number of typical ridesharing incentives, such as guaranteed ride home, prize drawings, and free meals for carpoolers once every three months.

Column 4 and 5 of Table 1 compare the mode shares in 1991 and 1995. The solo share was 83 percent in both years. The carpool share increased slightly, and the bicycle share decreased slightly. The changes are not statistically significant. Figure 1 displays these mode share data in both years.

The unchanged solo share at this comparison firm strengthens the conclusion that cashing out parking subsidies, and not some exogenous factor, caused the reductions in solo share observed at the two other firms in Santa Monica.

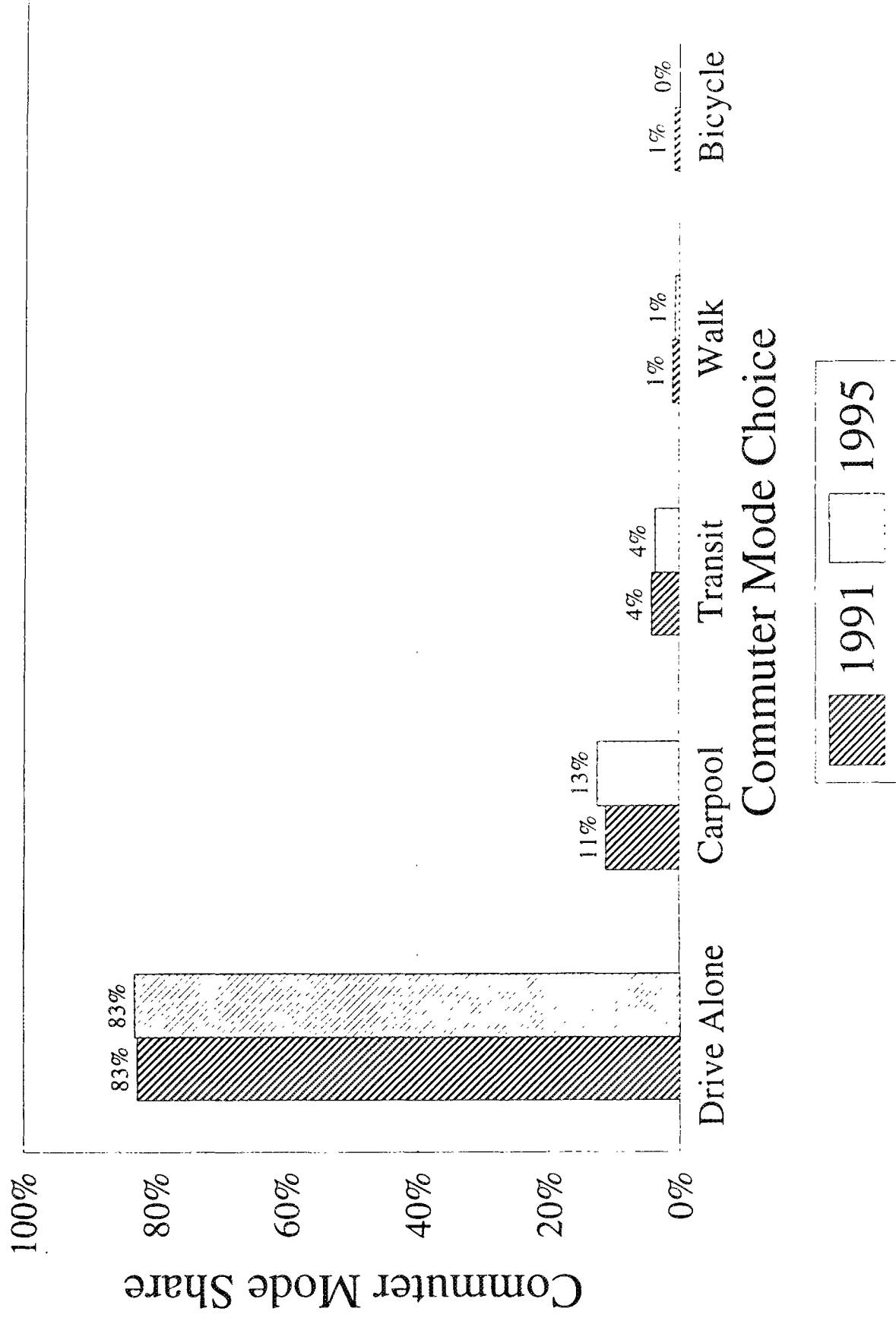
TABLE 9-1
SUBSIDIES AND MODE SHARES AT THE COMPARISON FIRM IN SANTA MONICA

Commute Mode (1)	Subsidy per Employee		Mode Share		Subsidy Distribution	
	Before (1991) (2)	After (1995) (3)	Before (1991) (4)	After (1995) (5)	Before (1991) (6)	After (1995) (7)
Drive Alone	\$75	\$114	83%	83%	94%	90%
Carpool	\$35	\$77	11%	13%	6%	9%
Transit	\$0	\$40	4%	4%	0%	1%
Walk	\$0	\$40	1%	1%	0%	0.2%
Bicycle	\$0	\$40	1%	0%	0%	0%

Note: The survey response rate was 100% in 1991 and 100% in 1995. A Chi-Square test shows that the difference in commuter mode shares observed in Columns (4) and (5) is not statistically significant at the .10 significance level.

Commuter Mode Choices

At the Comparison Firm in Santa Monica



Commuter Policies Comparison Firm

1991		1995
1	Free Parking	1 Free Parking
2		2 Transportation Allowance
3		3 Direct Cash Subsidies
4		4 Guaranteed/Emergency Ride Home
5		5 Rideshare Matching Service
6		6 Flexible Hours
7		7 Prize Drawings
8		8 Free Meals
Bold indicates an incentive present in 1995 but not in 1991		

Case Study 9

Employer characteristics

Case study 9 is a perfume manufacturer. In 1996, the firm had a total of 113 employees, with all 113 employees reporting to work between 6am and 10am, Monday through Friday.

Case study 9 is located at 2400 Broadway in Santa Monica. Two major freeways -- Santa Monica (10) and San Diego (405) -- provide nearby access to the firm. Major arterials serving this area include Cloverdale and Broadway Avenues. Five bus routes serve this area. A bike path, lane or route exist within 1/2 mile of the worksite.

Case study 9 provides many on-site services and amenities, including fitness center, day care center, restaurants, and dry cleaning. Moreover, the firm is conveniently accessible to nearby restaurants, retail stores, and medical services.

Surrounding streets have wide sidewalks, pedestrian signals, crosswalks and good lighting.

Clerical	44%
Professional	34%
Officials/Administrators	17%
Technical	5%

APPENDIX 1: INTERVIEWS WITH TRANSPORTATION MANAGERS

INTERVIEW QUESTIONS REGARDING CASH-OUT PROGRAMS

- I. How did your company come to have the cash-out program?
 - A. Why did management decide to implement your cash-out program?
- II. How would you describe your experience with the program?
- III. Has the program had any financial effects on your company?
 - A. When an employer cashes out parking subsidies, it must give cash to employees who already rideshare, without saving an equivalent amount by reducing parking expenditures.
 1. Did this create any problems for your firm?
 2. Do you think this is an objection to offering a cash-out program?
 - B. Employers must pay payroll taxes on cash offered in lieu of a parking subsidy.
 1. Did this create any problems for your firm?
 2. Do you think this is an objection to offering a cash-out program?
- IV. What is the administration of the parking cash-out program like?
 - A. Did implementing the parking cash-out program cause any particular problems?
 - B. Does continuing to offer the parking cash-out program cause any problems?
 - C. Compared to other rideshare programs--carpool matching, guaranteed ride home, and so on--how difficult is administering the cash-out program?
 - D. If you both own and rent parking spaces, has this caused any difficulty?
- V. How would you describe your employees' experience with the cash-out program?
 - A. Is the cash-out policy fair to employees and to the company? Compared to what it replaced?
 - B. Do employees feel the cash-out policy is fair?
- VI. Could you list the benefits of the cash-out program?
- VII. Could you list the disadvantages of the cash-out program?
- VIII. If a transportation coordinator at another company asked you for advice in setting up a trip-reduction program, which policies would you recommend. Which would you warn against? Would you recommend a parking cash-out program to other employers? Why? What is most important?

INTERVIEW WITH TRANSPORTATION MANAGER (Case Study 2)

West Hollywood, CA
February 29, 1996

Shoup: How did the agency come to have the cash-out program?

JR: We started a cash-out program because we did not have enough parking spaces for employees. So in order to accommodate those employees who did not have a parking space and encourage them to not use parking spaces, we offered a cash out, offered them money, \$45 a month to not drive.

Shoup: Why did the agency later increase the cash offer to \$65 a month?

JR: We increased it to \$65 because the rate that it cost to lease the spaces from one of the offsite locations, had increased to \$65. So we thought we should offer \$65 instead of \$45, comparable to the value of the parking that we were leasing.

Shoup: How would you describe your experience with the cash-out program?

JR: I think it has been really positive with the employees. Employees see it as getting extra money, extra income. And also I think that it also encourages the opinion that it's important to walk, it's important to not drive. And if you're close, then you should not drive. And it seems to lead to a more conscious level of the involvement.

Shoup: Has the program had any financial effects on the agency? Did it create any problems?

JR: I don't think so. I think at the time when it was implemented, and even today, that the parking spaces are so limited for employees that I'm not aware that anyone looked at it that way. They weren't concerned about making the employees feel like they were going to get something if they didn't have to, in place of the parking spaces.

Shoup: In introducing a cash-out program, an employer would have to give cash to employees who already rideshare; do you think that's an objection to offering a cash-out program?

TM: No, I don't think it's a fair objection, because the people that are ridesharing anyway, I think it will encourage them to feel good about ridesharing. And feel like yes, I'm doing something and they appreciate me for doing something. My employer is compensating me fairly. They care about me and they care about the environment. You know?

Shoup: I see. Not just me, but the environment.

JR: Right.

Shoup: Another problem about financial effects is that the employers must pay payroll taxes on cash offered in lieu of a parking subsidy. Would you say this creates any problems for the agency?

JR: Again, I am not aware of any problems. I think that it is a separate line item on our checks. So I'm not really sure how it's perceived in the accounting department.

Shoup: So do you think this would be a general objection to offering a cash-out program?

TM: It could be for bigger employers. But I guess it depends. For us, if we didn't pay the \$65, we'd have to pay a lot more money probably in parking or in parking structures. Or in parking spaces. We'd be spending the money somewhere else and having to provide parking for the employees who are using it.

Shoup: What is the administration of the parking cash-out program like?

JR: It's very simple. When an employee is a new hire during their first week when we fill out all the paperwork, Human Resources discusses the parking cash-out program and they can register then. Or if they decide later that they'd like to participate in it, then they can just go to Human Resources and register, sign a letter that they'll not be using a parking space. And then it is just automatically added to their paycheck every month.

Shoup: What about somebody who takes the cash out and wants to drive on a day when they don't feel well?

JR: That's not an option. The way our regulation is prepared, it is not an option.

Shoup: But can they pay to park in a commercial lot?

JR: There are no commercial lots around here. So, what may happen is that the employee may end up parking on the streets. We have watch-dog employees that if they see something like that, it's generally reported. They're not supposed to be receiving the money and they can be. The regulation is part of the general agency guidelines and that employee if discovered that they are breaking the rules so to speak, then they could be written up and go in their personnel file.

Shoup: Compared to other rideshare programs, like carpool matching and guaranteed rides home, how difficult is administering the cash-out program?

JR: It's not difficult at all. As I mentioned before, it's automatically added to the payroll check. The Human Resources fills out the paperwork. If someone wants to stop using the program

then they'll have to go to Human Resources and say I don't want to use it any more. I need a parking permit so I can have a parking space. And then I think it's a month later then they're out of the program.

Shoup: You are the first employer that we've run across that both owns and rents their parking spaces. Some employers have said that cashing out parking subsidies would be a real hassle if you both own and rent parking spaces because are you going to offer cash only to those who are in owned spaces and not in rented spaces? Has this caused any problem for you?

JR: No. The way our parking is assigned here, all the big shots get it first. The council people and the directors and then from there it's seniority and anyone who falls below their hire date after we've used up all the spaces in the lot we own then they're the ones who are shifted out to the off site parking. People who are higher up in the seniority level, they can still have the option to take the parking alternative if they want. If they find later that they need the space, they don't really lose their seniority.

Shoup: I see. How would you describe your employees' experience with the cash-out program? Is it fair to employees and to the agency?

JR: I think that in general the employees think it's fair. The problems that have arisen in the past were where do I park when I have a doctor's appointment, or where do I park when I have to leave early, that's been a general problem. And other problems have been like the seniority. I think previously if you were hired first, and you were taking a cash out and then you decided to change your mind, in the past you could have been bumped. You had to go to the bottom of the line.

Shoup: So that made you want to hold onto your parking space?

JR: Yes, but that was changed recently. And so now it doesn't matter where you're at.

Shoup: Do you think that change led anybody to consider cashing out? Because they knew they could cash back in if they wanted to?

JR: Yeah. I think there were a few people. I don't think very many. But I think there were a few people who that did happen with. But generally, the problem for employees has mostly been what do I do on the day that I need to drive?

Shoup: Some firms give you a couple of days of free parking if you take the cash. I don't know how you would do that in a place like West Hollywood where the parking is tight. I suppose on rainy days, everybody would want to park.

JR: Or there's always meetings going on that some people have to drive to. So that's why there isn't any room for that. For us to build that in. Because our parking lot is very small.

Shoup: Could you list the benefits of the cash-out program?

JR: I think as far, in relation to the Reg 15, I think it's made a big difference. The value, the extra money does mean a lot to some of the employees. It allows them to pay for their bus pass if they're farther away. And then for other people who are closer in, they can either use a bus pass if they want, or they can ride a bike or they can walk. And it's money in their pocket that they didn't have before. They don't have to worry about parking and they don't have to worry about gas and all those things that come with driving a car to work. And so I think that's one thing. I think it has improved the awareness about the environment here. Our employee base is a lot different than most other places. Most of the people here are not married. Most of the people do not have kids and while a lot of them may have outside commitments that they might need their car after hours, it's not the same as someone who might be in a family situation where they have to drive their kids to school. And they have to drive their, do whatever for the family.

Shoup: So that's why they can walk?

JR: And that's why they can walk. And that's why they can ride their bike.

Shoup: Could you list any disadvantages of the cash-out program?

JR: There is the possibility that some employees will take the money and park on the street. Or take the money and park in the parking lot and it kind of creates a problem with other employees who are following the rules and you know obviously looking at what other people do and then being upset because no one does anything about it. I think that's a problem. But overall, no. I don't think there are any disadvantages. For us, I think it's been really a good thing. And it's good for making the employees aware that the agency is very interested in keeping cars away. Don't use it if you don't need it.

Shoup: If a transportation coordinator at another company asks you for advice in setting up a trip production program, which policies would you recommend? Would you recommend the parking cash-out program to other employers?

JR: Yes, I would. I think it makes people more aware about the importance of parking and just not take it for granted. And also what their options could be for walking. I would recommend that they consider some free days of use depending on their situation. For us, that is probably not a reality, but for other places who may have a lot more parking available to them, I think that's a really good idea.

Shoup: Well, thank you very much.

JR: Thank you.

INTERVIEW WITH FACILITIES MANAGER (Case Study 4)

Century City
Los Angeles, CA 90067
March 26, 1996

Shoup: How did your company come to have the cash-out program?

HD: Before the state law was passed, we had a rideshare program that gave people points they could use to buy items from a catalog. When I came on board in 1993, I polled all the rideshare participants in the program and asked them how they liked the points program. They were pretty much dissatisfied with it because they were forced to buy things out of a catalogue. We took a vote and I asked if they would rather have the cash to spend on whatever they wanted. Now we use a cash incentive program, which includes "cash out" for those who do not use a parking space.

Shoup: How much does it cost the firm to rent parking spaces?

HD: \$130 a month.

Shoup: Why did you set the cash out at \$150 a month, rather than \$130?

HD: We wanted to give the employees an extra incentive to rideshare. Our rideshare participation increased due to this.

Shoup: What do the bus riders get? Do you pay for their bus pass?

HD: We pay for the bus pass.

Shoup: And anything else?

HD: A bus pass is typically \$50 a month. In addition, we give them a cash incentive of \$100.

Shoup: How would you describe your experience with the program?

HD: Since we moved to cash out, we've always received a good response. Especially when new employees come on board. When we orient new employees and explain cash out to them, they're very open to ridesharing. Especially in the legal industry, most of the people that we hire usually come from a prior law firm. If they come from downtown, most downtown firms don't pay for parking. So when they come here, if they're used to ridesharing, they are going to get a bonus, because the firm will cash them out. So in the orientation, this is a pleasant thing to be able to tell them.

Shoup: Has the program had any financial effects on your company? When an employer cashes out parking subsidies, it has to give cash to employees who already rideshare, without really saving on parking expense. Did this create any problem for your firm?

HD: No, it didn't.

Shoup: Do you think that this is an objection to offering a cash-out program, that you have to reward current ridesharers who are not getting anything?

HD: Not at all.

Shoup: A second question is that employers must pay payroll taxes on cash offered in lieu of a parking subsidy. Did this create any problems for your firm?

HD: No, it didn't create any problems.

Shoup: Do you think that this is an objection to a parking cash-out program?

HD: An objection?

Shoup: That you have to pay payroll taxes on the cash.

HD: No, I don't.

Shoup: What is the administration of the parking cash-out program like? Did the implementation cause any particular problems?

HD: Not really. We have a pretty sophisticated accounting and payroll department. The duties are split. I'm the ETC [employee transportation coordinator], and I handle all the paperwork as far as the ridesharing program goes.

Shoup: Compared to other rideshare programs like your previous points program, how difficult is administering the cash-out program?

HD: I think it's probably the easiest. The points program was very difficult to administer. There was a lot of paper work and you had to handle a lot of complaints from people who did not like the points program. The cash-out program is really simple.

Shoup: How would you describe your employees' experience with the cash-out program? Is the cash-out policy fair to employees and to the company?

HD: Yes. I definitely think it's fair. When new employees come on board, I think it's a great incentive to them. We're finding that most of the people who cash out are serious carpoolers. I think it's great to reward them that way.

Shoup: Compared to what it replaced, do you think the employees like the cash-out program?

HD: Yes they do. They voted for it.

Shoup: Do you think employees feel the cash-out policy is fair?

HD: Yes, I do.

Shoup: Could you list the benefits of the cash-out program?

HD: It's very easy to administer. It doesn't take up very much of my time, less paper work than previous programs that we've had before, and it's a good hiring incentive for us.

Shoup: How does that show up?

HD: We list the cash-out program as a benefit when recruiting new employees, and we receive positive feedback. Our employees are concerned about the pollution problems in Southern California, and what the AQMD is doing to improve air quality. They appreciate our efforts.

Shoup: That's fascinating. When you look at financial incentive schemes, you assume that they will work because of self-interest. But you often find there's a big response simply because people think this is the right thing to do.

HD: Exactly.

Shoup: Could you list the disadvantages of the parking cash-out program?

HD: I really don't see any. I remember when the cash-out law first came about, I talked to other companies. I don't know why, but people were kind of unsure about it. Because we were already offering something very similar, it really didn't have any effect on us.

Shoup: If a transportation coordinator at another company asked you for advice in setting up a trip reduction program, would you recommend a parking cash-out program to other employers?

HD: Yes, I would definitely recommend it. I would recommend staying away from things we've done before that haven't worked. Like a points program. Or trying to offer too many options for people to choose from. And to keep it simple. We've always found that cash works. Cash is always a good incentive.

Shoup: Thank you very much.

HD: You're welcome.

INTERVIEW WITH TRANSPORTATION COORDINATOR (Case Study 5)

Los Angeles, CA 90071

May 3, 1996

- Shoup How did your firm come to have the cash-out program?
- AG We were looking for something that would make ridesharing more appealing, and the only thing that seems to work is money. We became aware of parking cash out, so I presented it to management, and management felt that it was okay.
- Shoup How would you describe your experience with the program?
- AG It has been a really good experience. People really like it. People wanted that \$150, so they looked for ways to rideshare and pocket some money. It is a good experience, and people are happy.
- Shoup Has the program had any financial effects on your company? When you offer cash to your employees who already rideshare, you don't save money on parking. Did this create any problems for the firm?
- AG Actually, no, because we lowered the parking subsidy when we began to offer cash to ridesharers. We were spending the money already, so the money just shifted to ridesharers.
- Shoup When you offer cash to the ridesharers, you also have to pay payroll taxes. Has this caused a problem for the firm?
- AG It caused a little bit of a problem at first, but it worked out okay. Sitting down with payroll and figuring it out did take a little bit of time. Once we figured out the right way to do it, it was fine. We have a very sophisticated accounting system and it didn't take them more than an hour or two, and now it is basically automatic. There's no problem at all.
- Shoup What is the administration of the program like? Did implementing it cause any particular problem?
- AG It caused a problem because we had to go through the budget line by line. We needed to explain to management how it was going to work . . . but once we got it rolling it was fine.
- Shoup Does operating the program cause any problems?

AG No. You have to keep up on it though. I get a report on a monthly basis on who gets what allowance and I do have to go through and check it, because once in awhile you have a human error and you put in the wrong amount. But, now that it's going, it's fine.

Shoup Compared to other rideshare programs, how difficult is cashing out?

AG People would rather see the cash than a lot of other little goodies. Many people have said, "Can't you just forget the drawings? Just give us some money." And, to tell you the truth, it would be easier if I just gave them money and didn't do all of the rest. But you have to keep ridesharing in their minds, so you have to keep those monthly drawings. Everybody who ride shares, their name goes into a huge basket, we have little drawings, and I give out 15 dozen donuts. They want those donuts -- oh, yes. For Valentines Day I get pink donuts. It's more trouble than the cash sure. But, you have to keep ridesharing in their heads constantly. I don't know if it encourages ride sharing . . . but I think they like to win something. It's just one little extra benefit.

Shoup Is the cash out policy fair to employees and to the company?

AG Compared to the previous policy, I think this is fairer.

Shoup Could you list any benefits of the cash out program?

AG I think it has benefits as a recruiting point. It is an excellent recruiting point because people count it as income. I think it makes the firm look like they want to help the environment. This is a way to encourage people to stop using their cars. It is a good benefit for the staff and it shows that we are trying to do something. Some of the recruits, fresh out of law school, are young and idealistic, and they think more of the firm because of its cash-out policy rather than just offering free parking. We get about 10 to 12 new attorneys every year, and they are more apt to ride share than the older attorneys. They are more environment conscious, and I'd say probably 90% of them make some effort to carpool on a regular basis. And, we have several attorneys, all in that younger group, who take the bus. The younger attorneys really like it. Why not sit on the bus and let the bus driver fight the traffic? A lot of people take the train or the bus so they can relax on their way home for a half an hour or 45 minutes. They are not behind the wheel, and some people do use that as a tool to relax.

Shoup Can you think of any disadvantages of the cash out program?

AG The expense is the only disadvantage. Other than that, I don't see any disadvantage. But we have to stay competitive in the market, so we have to give some kind of an allowance. So we are going to do this in order to stay competitive in the market.

- Shoup If a transportation coordinator of another company asked you for advice, would you recommend a cash out program?
- AG I would. I would because it is not a little drawing where they might win, or they might not win. This is a definite benefit that people are seriously going to look at. People like the idea, they like the cash in hand, and it does add to their pay check.
- Shoup Thank you very much.

INTERVIEW WITH FACILITIES MANAGER (Case Study 6)

Santa Monica, CA

April 1, 1996

- Shoup: How did your company come to have the cash-out program?
- LL: I heard about it from the City. I think the cash-back program is required by state law.
- Shoup: How would you describe your experience with the program?
- LL: At first, I had a very difficult time interesting anyone in any type of participation in the program. But more and more people are getting interested. So I have more cooperation and participation than I did in the beginning. On the intake interview, I spend ten or fifteen minutes with each new person. And I tell them about cash back, and sometimes it does motivate them. The information does motivate them to seek another method. But just as often, they don't think about it at that time, but later they talk with other employees. Some even move closer and walk to work.
- Shoup: Has your program had any financial effects on your company?
- LL: I don't think it's significant.
- Shoup: Do you think that the cost of offering cash to people who were already ridesharing is an objection to cash back?
- LL: In our case, no. And management doesn't complain. Some of the employees really appreciate the benefits. The ones on the entry level really do. And the other ones really don't care.
- Shoup: Employers must pay payroll taxes on the cash offered in lieu of a parking subsidy. Does this requirement to pay payroll taxes on the cash create any problem for your firm?
- LL: I don't handle payroll, but I would say it's minor because it's just one small detail. Each employee has many details. And payroll is automated, so it's just a simple computer entry.
- Shoup: Do you think that paying payroll taxes on the cash offered in lieu of a parking subsidy is an objection to offering a cash-out program?
- LL: No, because you have to pay payroll taxes on their check anyway. Whether the number is up or down by \$55, your work is the same.

- Shoup: What is the administration of the parking cash-out program like? Did implementing it cause any particular problems?
- LL: Cash back doesn't cause a problem, it helps you. It's the biggest single help. At first, I couldn't interest anyone in this. They just thought I was a big cornball to go around and try and push this rideshare thing when we had never had it before. No one was jumping. Later, people kind of warmed up. They would hear from so and so at the lunch table that you can get cash back. And now, I won't say they're beating my door down, but I've got a lot of people interested.
- Shoup: Are there any operating problems with offering the cash back?
- LL: The only problem that I've had from my own personal experience is if people don't understand very specifically what the rules are, and what the procedures are, then you can get some hard feelings. So I think administratively it has to be handled well.
- Shoup: Compared to other rideshare programs like carpool matching and guaranteed ride home, is administering the cash-back program difficult?
- LL: Not at all. I give it to payroll and they put it on a computer. It's automatic.
- Shoup: You have your own parking spaces in the building, and you also rent additional parking spaces off site. Has this caused any difficulty with the cash-back program?
- LL: Not at all. Why would it?
- Shoup: I don't think it does, but some people ask about it. How would you describe your employees' experience with the cash-out program? Do you think it's fair to employees and to the company?
- LL: Yes. If an employee chooses to use an alternative form of transportation, it wouldn't be fair for the company to say oh, goody, we saved \$55 this month. I think the benefit should go to the employee who makes a sacrifice. Maybe you want to go on an errand or go shopping and your car is at home and you are at work. So I think that the employee should be compensated and that the company shouldn't benefit.
- Shoup: Do you think the employees feel the cash-back policy is fair?
- LL: They love it. The ones that qualify love it. And the ones who drive alone don't care because they get free parking.
- Shoup: Could you list the benefits of the cash-out program?

LL: Benefits for whom? The benefits for the City are that traffic congestion is reduced and air pollution is reduced. The employees have cash in their pockets. And if they're doing something like biking or walking or rollerskating, they have the opportunity to be out of doors for a longer period. Some people rollerskate to work and get the cash back. If they're in a van pool from a great distance, it would be very possible that they could have their car insurance reduced if they could register their car as being for pleasure only. This could represent more savings to the employee, more cash benefits in a year than the cash back itself. The amount of stress that the employee experiences could be reduced by an alternate form of transportation. No one likes gridlock. The company has employees who are grateful and thankful and more motivated. So, that's a plus for the company.

Shoup: Could you list any disadvantages of the program?

LL: Explaining it in a way that everyone understands. Sometimes you have to explain things again and again.

Shoup: If a transportation coordinator at another company asked you for advice in setting up a trip reduction program, would you recommend the parking cash-back program to other employers?

LL: You mean if it weren't mandatory already?

Shoup: Yes.

LL: I don't know how many employers would do it, if it wasn't mandatory. But it is a good way to get participation. And I would recommend it. And if you want to get participation, cash means something to most people.

Shoup: Thank you.

INTERVIEW WITH FACILITIES MANAGER (Case Study 8)

Los Angeles, CA 90015

May 3, 1996

- Shoup How did your firm come to have the cash-out program?
- MK When we initiated the program, our parking committee decided that \$50 would be an appropriate cash offer. From no carpools at all, or relatively few, we jumped up to probably 80 carpools when we initiated this program. So that decreased at least 40 employee cars or so immediately, and freed up parking spaces for our patients. That helped us. We were doing our part in relieving congestion, but at the same time we were taking a big burden from ourselves, which was our parking problem.
- Shoup How would you describe your experience with the cash-out program?
- MK Oh, it made employees happy. It became a benefit that we were offering our employees. We emphasize it in our new employee orientation.
- Shoup Has the program had any financial effect on your company?
- MK The company is very much pro-staff. We do a lot of things to keep people happy. Cash was the easy way out of our parking problem.
- Shoup When you start offering cash to people who don't take a parking subsidy, you have to begin offering cash to people who are already ridesharing. Do you think this is an objection to offering cash to ridesharers?
- MK No.
- Shoup You have to pay payroll taxes on the cash offered in lieu of a parking subsidy. Does this create any problems?
- MK Not that I am aware of.
- Shoup Do you think that paying payroll taxes on cash is an objection to a cash-out program?
- MK No, I don't.
- Shoup What is the administration of the cash program like? Does it cause any problems?
- MK I am responsible for ridesharing, and I probably spend about 6 to 10 hours per month on it. The \$50 cash is a only a part of this time.

Shoup Compared to other rideshare programs, how difficult is offering cash in lieu of free parking?

MK How difficult is offering cash rather than parking?

Shoup Yes. Has offering the \$50 a month created much of a problem?

MK No. Basically, if you do not drive, you get the \$50.

Shoup You own the parking spaces that are in the facility, and you also rent extra spaces offsite. Does that cause difficulty in offering cash?

MK No.

Shoup Is the cash-out policy fair to employees?

MK Oh, I believe so, definitely.

Shoup Could you list some of the benefits of offering cash if you don't take the parking subsidy?

MK Well, the benefits are relieving congestion on the freeways, and cleaning up the air, which I think everybody should play a part in one way or another. And the company doesn't have to do other things that we would have to do, like give free movie passes for ridesharing.

Shoup Do you think there are any disadvantages of offering cash to people who ride share?

MK Well, if we would decide to scratch the program, it would be a disadvantage to us and to our patients. If we decided to scratch the program, we would probably end up with at least 50 to 60 more employee cars, with no place to park.

Shoup If a transportation coordinator of another company asked you for advice in setting up a trip reduction program, what would you recommend?

MK Cash works very well for us. If I were going to assist somebody in setting up program or giving them advice I would want to see what type of operation they have, how many employees they have, and what their financial status is. I think we took the easy way out, but we were also fortunate that we have the financial capabilities to pay the \$50 per month. If we took the cash away from our employees now, it would hit them very hard. And, if we offered movie passes or dinners in lieu of the \$50, I don't think that would go over very well.

Shoup Thank you very much.

APPENDIX 2: METHODS FOR ESTIMATING CHANGES IN MODE SHARES, VEHICLE TRIPS, VMT, VEHICLE EMISSIONS, AND GASOLINE CONSUMPTION

SOURCES OF DATA

The mode share data in Case Studies 2 through 8 are derived from survey data reported in the employers' Trip Reduction Plans (TRP) submitted to the SCAQMD. The SCAQMD requires employers to conduct employee transportation surveys in a carefully prescribed manner, and to report the results in a uniform format. These surveys are conducted over a five-day period once a year, and the results are a rich source of information on travel behavior.

In Case Study 1, we were able to obtain all the individual responses for both the 1992 and 1994 surveys, not simply the summary reports submitted in the firm's TRP. We were thus able to recode all the responses to examine the results in detail. The SCAQMD's survey instrument asks each employee not only about mode choice, but also about the distance traveled to work. Although this additional information on distance traveled to work is not used to measure a firm's compliance with SCAQMD's Rule 1501 (which sets only mode-share goals), it is available in the individual survey responses. With the additional information on each employee's distance traveled to work, and with the employee's reported commute mode, we can estimate the employee's VMT for commuting. The results obtained by the intensive data analysis in this case study are very similar to the results obtained in all the other case studies. This similarity of results increases our confidence in the results of all our other case studies.

METHOD OF DERIVING MODE SHARES FROM TRIP REDUCTION PLANS

We have devised two methods for using the data in TRPs submitted to the SCAQMD to estimate commuters' travel mode shares. To illustrate these two methods, we will use the data reported for West Hollywood on pp. IV-1 to IV-4 of its 1993 TRP (see attached). Both methods should give the same results, and we have used both to check the accuracy of the reported mode shares.

Method 1

Page IV-2B of the TRP shows the results of the "Weekly Employee Survey Form." Rows A through K report all the trips made to work in the week of February 1 to 5, 1993.

There were 352 drive-alone trips, 21 two-person carpool trips, 15 transit trips, 110 walk trips, and 8 bicycle trips, for a total of 506 trips ($= 352 + 21 + 15 + 110 + 8$). The drive-alone share is thus 70% ($= 352/506$), the carpool share is 4% ($= 21/506$), the transit share is 3% ($= 15/506$), the

walk share is 22% ($= 110/506$), and the bicycle share is 2% ($= 8/506$). These shares are shown in Column 5 of Table 2 of the West Hollywood study.

Method 2

Form A (attached) shows our second method of calculating mode shares. A version of Form A was prepared for every case study for every year of data reported.

Page IV-3 of West Hollywood's 1993 TRP shows a summary of the survey results. Box W shows a total of 643 employee trips, whereas the previous page IV-2B showed only 506 employee trips (as used in the paragraph describing Method 1 above). What accounts for this difference in the total number of trips?

To obtain the mode share data from page IV-3, we first calculate the total number of physical commute trips made to the worksite during the survey week (February 1 to February 5). Box W shows a total of 643 employee trips, as defined by the SCAQMD. From this total we must make several deductions to obtain a more conventional measure of commute trips.

First, we must deduct the 5 "trips" in Box M; the SCAQMD counts nonresponses to the survey as work trips, but this is a legal requirement, not conventional survey procedure. We want to measure the mode shares of those who did respond to the survey, without making assumptions about those who did not respond (the response rate was 99%).

Second, we must deduct the 5 "telecommute" trips in Box L; the SCAQMD counts telecommuters as making commute trips, but these trips should not be included in calculating the mode shares of those who physically commute to work.

Third, we must deduct the 127 "days off" for compressed work weeks in Boxes N, O, and P; the SCAQMD counts as work trips the trips that commuters would have made if they had not had days off because of compressed work weeks; again, in calculating the mode shares of those who did physically commute to work, these "days off" should not be included.

Therefore, the total number of work trips actually made during the survey week is 506 ($= 643 - 5 - 5 - 127$). The SCAQMD's unusual definition of a trip accounts for the difference between the 643 trips counted by the SCAQMD and the 506 trips found in Method 1.

To obtain the mode shares of those who did commute to work, we divide the number of reported trips using each mode by the total 506 work trips. For example, Box A shows 352 drive-alone trips; therefore, the drive-alone *share* is 70% ($= 352/506$). The two-person carpool share is 4% ($= 21/506$). And so on. The results are the same as shown for Method 1.

These two methodologies examine the travel behavior only of those who physically commute to work. Thus it abstracts from any changes that occurred because of changes in

compressed work weeks or telecommuting, or simply from changes in the survey response rate. Cashing out is expected to change mode shares of those who do commute to work, and those changes are the focus of our analysis. If cashing out also encourages workers to telecommute or shift to compressed work weeks, it will have an additional effect in reducing work trips, but we do not attempt to measure this additional effect.

METHOD OF ESTIMATING VEHICLE TRIP REDUCTIONS

Form B shows our method of calculating work trips. A version of Form B was prepared for every case study for every year of data reported.

The number of *work* trips by respondents to the survey is calculated by the two methods just described--506 commuter work trips during the survey week.

To obtain the number of *vehicle* trips per respondent, we follow the procedure required by the SCAQMD in calculating vehicle trips. Each solo driver is counted as one vehicle trip, each person in a two-person carpool is counted as one-half of a vehicle trip, each person in a three-person carpool is counted as one-third of a vehicle trip, and so on. No vehicle trips are attributed to transit riders, bicyclists, and pedestrians. Box V shows that 367.5 vehicle trips were reported to the SCAQMD for the survey week. From this we deduct the 5 trips in Box M, which are the nonrespondents to the survey. In calculating vehicle trips, the SCAQMD requires regulated employers to count all nonrespondents as solo drivers. This procedure obviously encourages employers to obtain the highest possible survey response rate, but it is not a standard research procedure when analyzing survey results. For our purposes, we want to estimate the vehicle trips made by respondents. There were 362.5 ($= 367.5 - 5$) vehicle trips made by the respondents.

We divide the 362.5 vehicle trips by the 506 commuter work trips to obtain the average of **0.72 vehicle trips per commuter**.

Next we calculate the number of employees who did not commute to work during the survey week. This is the sum of Box L (5 who telecommuted), Boxes O and P (127 who were off because of a compressed work week), Box Q (17 who were on vacation), Box R (15 who were sick), and Box S (20 who were off for other reasons). In total, there were 184 reported days off during the survey week. The survey response rate was 99 percent; to estimate the total days off, including nonrespondents, we divide 184 by 0.99 to give 185.9 employee-days-off during the survey week. Per day, the average number of employees off is 37.2 ($= 185.9 \div 5$).

To obtain the number of commuters per employee, we obtain the number of commuters who report to the work site. Box C on page IV-1 shows that 139 employees reported to the work site. We deduct the average 37.2 employees who did not come to work per day to give 101.8 employees who actually commuted to work per day ($= 139 - 37.2$). We then estimate that there are **0.73 commuters per employee** ($= 101.8 \div 139$) during the survey week.

Because there are 0.72 vehicle-trips per commuter, and 0.73 commuters per employee, there are **0.52 vehicle-trips per employee** ($= 0.72 \times 0.73$).

This calculation refers to 1993. A similar calculation was carried out for the 1991 survey results. In that year there were 0.76 vehicle-trips per commuter. This is higher than the 0.72 vehicle-trips per commuter found in 1993 because there were a higher solo driver share and a lower walking share in 1991. To calculate the number of vehicle trips in 1991 we use the ratio of 0.73 commuters per employee found in 1993 (to eliminate any change due to changes in attendance rate. As a result, there were 0.55 vehicle-trips per employee in 1991 ($= 0.73 \times 0.76$). Alternatively, we could say that there would have been 0.55 vehicle trips per employee in 1993 (rather than 0.52) if there had been the same mode shares in 1993 as in 1991.

To calculate the number of vehicle trips per employee in 1993, we multiply the 0.52 vehicle round-trips per employee by the 252 work days per year, and double that number to find a total of 265 one-way vehicle trips per employee per year. For 1991 we find 279 one-way vehicle trips per employee. Therefore, the change in mode shares reduced 15 one-way vehicle trips per year per employee.

Finally, we calculate the total number of vehicle trips per year for commuting to the firm by multiplying the number of trips per employee per year in 1991 and 1993 by the total of 139 employees who commuted to the firm in 1993. We use the 1993 employment for both years to estimate the change in trips caused by the change in mode shares between the two years, holding the number of employees constant. The 1991 vehicle-trip total is therefore the number of trips that would have occurred in 1991 with (1) the mode shares found in 1991, (2) the same 139 employees as in 1993, and (3) the same 73 percent attendance rate as in 1993. The difference between 1991 and 1993 therefore shows how the change in mode shares, by itself, changed the number of trips from 1991 to 1993.

We find 38,831 vehicle-trips in 1991, and 36,767 in 1993. Therefore, the shift from driving to walking in West Hollywood between 1991 and 1993 eliminated 2,064 vehicle trips. Another interpretation of this result is that if in 1993 there had been the same mode shares as in 1991, commuters would have made an extra 2,064 vehicle trips.

METHOD OF ESTIMATING VMT REDUCTIONS

The survey summaries reported to the SCAQMD do not include information on commuter trip distances. In calculating VMT reductions, the SCAQMD assumes that the average one-way distance for each avoided automobile trip is 15 miles. The Southern California Association of Governments (1993) found this average 15-mile commute distance in a 1991 travel survey for all commuters in the South Coast Air Basin. Other evidence also suggests that the average one-way trip distance is close to 15 miles. In its annual surveys conducted between 1989 and 1994, Commuter Transportation Services (1994) found average one-way trip distances that ranged from 14.8 and 16.5 miles.

We follow the SCAQMD's procedure to calculate how cashing out reduces VMT. In Case Study 4, for example, Row 6 of Table 3 shows that commuting created an average of 26.0 VMT per employee per day in 1992; this figure is derived by multiplying the 0.87 vehicle trips per employee per day in Row 3 by an average 30-mile round trip to work ($26.1 = 0.87 \times 30$). Because the average number of vehicle trips per employee per day declined to 0.79 in 1994, the average VMT per employee per day declined to 23.7 in 1994. Cashing out thus reduced vehicle commuting by 2.3 VMT per employee per day.

To calculate VMT per employee per year, we multiply the VMT per employee per day by 252 work days per year. Vacations, sick days, and other absences are already accounted for in the calculation of the firm's average attendance rate, so the number of work days per year is five days per week for 52 weeks, minus the conventional eight national holidays. Row 7 of Table 3 in Case Study 4 shows that cashing out reduced 585 VMT per employee in 1994. When all 191 employees of the firm are considered, Row 8 shows that cashing out reduced 111,739 VMT for commuting to the firm in 1994.

The Circuity Factor

When commuters join carpools, they may have to drive a more circuitous route to work than if they drove solo. Fricker (1986, 34) defined circuity as "the extra distance that a member of a carpool travels, compared to that person's drive-alone distance between home and work." He defined the "circuity factor" as the "ratio of ridesharing distance to drive-alone distance."

If circuity is a serious problem with carpooling, the method we have used to calculate VMT will underestimate the VMT by carpoolers, and will therefore overestimate the VMT reduced when commuters shift from solo driving to carpooling. We have investigated this issue, and find that it is inconsequential.

Fricker estimated an average circuity factor of 1.071 for carpooling. That is, a commuter would drive 7.1 percent farther to work if carpooling than if solo driving. Because we have the trip distances for both solo drivers and carpoolers for Case Study 1, we can estimate the circuity factor for commuters who travel from the same zip code. The estimated circuity factor is 1.035, which is less than the 1.071 estimated by Fricker. One reason for this difference is that Fricker estimated circuity for carpoolers traveling to multiple work sites, so there was circuity possible on both the home-end and work-end of the commute trip. In contrast, the Case Study data were gathered at a single work site, so there would be no circuity on the work-end of the commute trip.

If we assume that half of the trip circuity occurs at the work end and the other half occurs at the home end, we can divide Fricker's circuity factor (1.071) in half, attributing half of the circuity to the home end and half to the work end. This leaves a circuity factor of 1.035; since the Case Study employees all work at the same site, the circuity factor of 1.035 is in line with the previously published data.

Our methodology of estimating VMT, which is the same as that used by the SCAQMD, implicitly assumes that the circuitry factor is zero. The VMT for each person in a two-person carpool is one-half the distance to work for the carpool; the VMT for a three-person carpool is one-third the distance to work for the carpool; and so on. We have tested the outcomes of this method to examine their sensitivity to the circuitry factor. Table A-1 shows a test of the data in Case Study 4 to test the outcomes for their sensitivity to assumed circuitry in carpooling.

Column 1 shows assumed circuitry factors from 1.00 to 1.12. Columns 2 and 3 show the VMT per employee per day for Case Study 4 in 1992 and 1994, given the assumed circuitry factor; a higher circuitry factor increases VMT per employee per day in both years. Because there was more carpooling in 1994, the VMT per employee is more sensitive to the circuitry factor in 1994 than in 1992.

Column 4 shows the change in VMT per employee per day between 1992 and 1994, given the assumed circuitry factor. The change in VMT is only slightly affected by the circuitry factor. Column 5 shows the percent change in VMT between 1992 and 1994; again the percent change is only slightly affected by the circuitry factor. For this reason, we have not used circuitry factors in estimating the effects of cashing out.

METHOD OF ESTIMATING VEHICLE EMISSION REDUCTIONS

The emissions reductions are calculated by considering the reductions in both automobile *trips* and *VMT*. Pollution emissions are caused at the beginning and end of each automobile commute trip by the "cold start" as the engine warms up and the "hot soak" as the engine cools down; these "trip-end" emissions are independent of the total distance traveled for the commute. The "running" emissions are a factor of total VMT for the trip.

We have already estimated the reductions in vehicle trips and VMT. We multiply these reductions in trips and VMT by the emissions created per trip-end and per VMT to obtain the reduction in total emissions caused by automobile commuting. We use emission factors specific to the year in which the reductions were estimated. For example, in Case Study 4, Table 3 shows the estimated reductions in trips and VMT achieved in 1994. Therefore, we use the emission factors for 1994. The emissions per trip-end and per VMT in 1994 were taken from the ARB's EMFAC7F1.1/B7F model (see attached table of emission factors).

Cashing out reduced 40 trips and 585 VMT per employee per year. Multiplying these reductions by the factors for ROG, CO, NO_x, and PM10 for both trip ends and VMT, adding the two sources of pollution, and dividing by 454 grams per pound gives the emissions reductions in pounds per employee per year. Multiplying the emissions reduction per employee by the 191 employees of the firm in 1994 gives the emissions reduction for all the firm's employees.

Reactive organic gases (ROG) and nitrogen oxides (NO_x) react in the presence of sunlight to form ozone, the chief component of urban smog. Over 70 percent of ROG and NO_x

TABLE A-1
CIRCUITY SENSITIVITY ANALYSIS

Circuitry Factor	VMT per Employee per Day			Percent Change
	Before (1992)	After (1994)	Change	
(1)	(2)	(3)	(4)	(5)
1.00	26.04	23.71	-2.32	-8.92%
1.01	26.05	23.74	-2.31	-8.87%
1.02	26.06	23.76	-2.30	-8.83%
1.03	26.08	23.79	-2.29	-8.78%
1.04	26.09	23.81	-2.28	-8.74%
1.05	26.10	23.83	-2.27	-8.69%
1.06	26.12	23.86	-2.26	-8.65%
1.07	26.13	23.88	-2.25	-8.61%
1.08	26.14	23.91	-2.24	-8.56%
1.09	26.16	23.93	-2.23	-8.52%
1.10	26.17	23.95	-2.22	-8.47%
1.11	26.18	23.98	-2.21	-8.43%
1.12	26.20	24.00	-2.20	-8.39%

emissions in California are caused by motor vehicles. Ozone has been linked to lung tissue damage, breathing difficulties, and vegetation damage.

Carbon monoxide (CO) is formed by incomplete fuel combustion, and motor vehicles are its largest source. Exposure to excessive CO can cause headaches, fatigue, slow reflexes, and dizziness, as well as chest pains in heart patients.

Particles small enough to be inhaled deep into the lungs are called inhalable particulate matter (PM₁₀). Particulate matter from motor vehicles includes road dust, particles due to brake and tire wear, and exhaust emission particles. The adverse health effects linked to particulate matter include increased respiratory disease, lung damage, and cancer.

METHOD OF ESTIMATING GASOLINE CONSUMPTION REDUCTIONS

By reducing VMT, cashing out also reduces gasoline consumption for commuting. To estimate the gallons of gasoline consumed for commuting, we divide the average VMT per employee per year by the average number of miles per gallon for light-duty passenger vehicles.

The SCAQMD has estimated that the average fuel efficiency of light-duty passenger vehicles in Southern California is 25 miles per gallon in 1996. This estimate was made using the Air Resources Board's EMFAC7F1.1/B7F model to represent conditions in Southern California on an average workday in 1996. Average fuel efficiency of the fleet has been steadily increasing in recent years; it was only 22 miles per gallon in 1990. The estimates of VMT reductions in the case studies refer to the years 1993, 1994, and 1995, when average fuel efficiency was lower than in 1996. Therefore, using a 1996 fuel efficiency of 25 miles per gallon produces a conservative estimate of how cashing out reduced fuel consumption in these earlier years, and a realistic estimate of how cashing out can reduce fuel consumption in 1996.

METHOD OF ESTIMATING CARBON DIOXIDE EMISSION REDUCTIONS

Combustion of each gallon of gasoline produces 19.4 pounds of tailpipe emissions of carbon dioxide (Energy Information Administration 1994, 79). Therefore, multiplying the reduction in gasoline consumption by 19.4 pounds per gallon gives the reduction in tailpipe carbon dioxide emissions produced by commuting. This estimate is conservative because the full-fuel-cycle emissions (counting emissions from extraction, transport, refining, and so forth) are 30.5 pounds of carbon dioxide per gallon of gasoline consumed for commuting. When these additional non-tailpipe emissions are included, cashing out reduces total carbon dioxide emissions by 57 percent more than the reduction in tailpipe emissions alone.

METHOD OF ESTIMATING EMPLOYERS' COMMUTING SUBSIDIES

A firm's total subsidies for parking and for cash in lieu of parking are derived from data reported in the firm's Trip Reduction Report. For solo drivers, the firm's parking subsidy is the price

the firm pays of parking, less what the firm charges solo drivers for parking. For carpools, the subsidy per carpooler is the parking subsidy per carpool divided by the number of commuters in the carpool, plus any additional cash paid to carpoolers.

For example, see Table 7-6 for Case Study 7. In 1994, the firm paid \$77 a month to rent parking spaces, and charged solo drivers \$15 a month to park, so each solo driver received a parking subsidy of \$62 a month. Carpools parked free, so they split a subsidy of \$77 a month. A two-person carpool received a subsidy of \$38.50 per employee; a three-person carpool received a subsidy of \$25.66; and so on. Vanpoolers received a subsidy of \$175 a month, transit riders received \$75 a month, and others received \$25 a month.

The total cost to the firm in 1994 was the subsidy per employee in each mode, multiplied by the number of employees who chose that mode. For example, solo drivers received \$15,528 a month ($= \$62 \times 0.83 \times 300$). The monthly subsidy for all 300 commuters was \$17,567, of which solo drivers received 88 percent ($= \$15,528 \div \$17,567$).

The parking subsidies were tax exempt, but the cash paid to commuters who walked or bicycled were fully taxable. The first \$55 a month of a vanpool or transit subsidy was exempt from income taxes in 1994, but the subsidy in excess of \$55 a month was taxable. Thus, of the one vanpool subsidy, \$118 was taxable, and of the four transit subsidies, \$80 was taxable. The total taxable subsidy was therefore \$359 ($= \$118 + \$80 + \$99 + \62).

In addition to income taxes, there are also payroll taxes. The firm's combined Social Security and Medicare tax rate was 7.65 percent. There was also payroll taxes for State Unemployment Insurance (SUI), Federal Unemployment Tax (FUTA), and Employment Training Tax (ETT). These taxes rates are neglected because they are calculated on only the first \$7,000 of an employee's income. The firm's payroll tax rate was 7.65 percent of taxable cash. The payroll tax on the taxable cash paid to ridesharers was thus \$27 a month ($= \359×0.765).

In 1995, cashing out changed the subsidy pattern for everyone except solo drivers. Those who didn't take a parking card received a cash subsidy of \$77 a month, and the vanpool subsidy was reduced to \$165 a month. The total subsidy for solo drivers fell to \$14,035 a month because the solo driver share fell from 83 to 75 percent. The cash subsidies paid to others was taxable, except for the first \$60 a month paid to vanpoolers and bus riders.

Of the subsidy for two-person carpools, we assume that one carpooler took a tax-exempt parking space, and the other took \$77 in cash. Therefore, one-half of the \$4,388 subsidy for two-person carpools (\$2,169) was taxable. Of the total subsidy to three-person carpools, two-thirds was taxable. In 1995, the first \$60 of subsidy to vanpoolers and transit riders was taxable. All the cash to commuters who walked or bicycled was taxable. The total taxable cash in 1995 was therefore \$2,969, and the payroll tax was \$227.

These estimates refer only to the employers' spending for parking subsidies and for cash payments in lieu of parking subsidies. Five of the eight employers eliminated other ridesharing subsidies when they began to cash out, however, so this would reduce their cost of cashing out. Table 8 showed that, on average, the employers' spending for parking subsidies and for cash payments in lieu of parking subsidies increased by 3 percent, or by \$2 per employee per month, after complying with the cash-out requirement. Because we have not estimated the firms' savings from eliminating other ridesharing subsidies after cashing out, the firms' net cost of cashing out should be less than \$2 per employee per month.

In the broader context of cost-benefit analysis (rather than the narrower context of cost-effectiveness analysis) most of the employer's spending increase is a transfer to previously undersubsidized ridesharers, not a use of resources. In cashing out, employers began to offer cash to commuters who were already ridesharing, so the cash was a pure transfer--employees gained what the employers spent, so there was no net cost to society. And the employers' payroll taxes are a transfer to the government, not a use of resources. Even the employers gained as a result of cashing out, because the cash became a fringe benefit to their employees, and served as a recruiting tool. Therefore, the employers' estimated spending of \$2 per employee per month clearly overestimates the cost of cashing out employer-paid parking.

Section IV: Employee Survey Process

Section IV must be completed by employers filing both initial and update plans. Use AQMD approved survey forms only. Attach a blank survey form including employee involvement questions.

A. Survey Methodology

Describe the survey methodology used to obtain the data to calculate your Average Vehicle Ridership (AVR). The same survey used for the 1st update plan was used for the 2nd update. Minor revisions were made to reflect changes in the incentives which were implemented after the first survey. The CTS AVR was used to calculate AVR. Management was notified of surveys and employees were noticed at union meetings and electronic mail.

- B. Which group of employees did you survey? Check one only. Employees reporting to work 6:00am to 10:00am? ☐
All employees? ☒

C.

138	divided by	139	x 100 =	99	%
Number of Surveys Received from 6:00am - 10:00am employees		Number of 6:00am - 10:00am employees Box 1 on form III -1		Survey Response Rate	

- D. Name of person responsible for survey administration:

Joyce	Rooney	Associate Transportation Planner
First	Last	Title

- E. Survey Date Start:

 Survey Date End:
- YY / MM / DD YY / MM / DD

- F. Specific Location Where Surveys are Stored

Main Transportation files in City Hall

Weekly Employee Survey Summary Form

Section IV-2B must be completed and submitted only by employers filing both initial and update plans. This form is for employers reporting to work between 6:00am and 10:00am. Please read instructions before completing this Form

Mode	Mon	Tue	Wed	Thu	Fri	Total
	1	2	3	4	5	6
A. Drive Alone	83	86	88	87	8	352
B. Motorcycle						
C. 2 person carpool	5	6	4	5	1	21
D. 3 person carpool						
E. 4 person carpool						
F. 5 person carpool						
G. 6 person carpool						
H. Vanpool						
I. Transit (bus/rail)	3	5	4	3		15
J. Walk	27	30	27	26		110
K. Bicycle	2	2	2	2		8
L. Telecommute*	1		2	1	1	5
M. No Survey Response	1	1	1	1	1	5

Compressed Work Week

N. 3/36 work week					
O. 4/40 work week				4	4
P. 9/80 work week	4			119	123

Days Off

Q. Vacation	5	4	4	4	0	17
R. Sick	3	2	4	5	1	15
S. Other	5	3	3	5	4	20

Note: If the total number of employees at this site includes employees who did work one or more days during the survey week (s.. as part-time, on call or weekend workers) mark this number in the other (S) category and attach an explanation.

*Attach a copy of company's formal telecommuting policy.

Weekly Employee / Vehicle Calculation

Section IV-3 must be completed by employers filing both initial and update plans

Mode	Column 1	Column 2	Column 3
A. Drive Alone	352	A. divided by 1 =	352
B. Motorcycle		B. divided by 1 =	-
C. 2 person carpool	21	C. divided by 2 =	10.5
D. 3 person carpool		D. divided by 3 =	-
E. 4 person carpool		E. divided by 4 =	-
F. 5 person carpool		F. divided by 5 =	-
G. 6 person carpool		G. divided by 6 =	-
H. Vanpool (7 or more)		H. Weekly van trips**	-
I. Transit (bus/rail)	15	** Value from Appendix E.	
J. Walk	110		
K. Bicycle	8		
L. Telecommute	5		
M. No Survey Response	5	M. divided by 1 =	5
Compressed Work Week Credit (days off)		V. Subtotal (A thru M)	367.5
N. 3/36 work week			
O. 4/40 work week	4		
P. 9/80 work week	123		
		Clean Fuel Vehicle Credit (See Page 50) U:	-
W. Employee Trips (Total A thru P)	643	T. Total Vehicles (V-U)	367.5
Days Off			
Q. Vacation	17		
R. Sick	15		
S. Other	20		
X. Total (W + Q + R + S)	695		
Y. Enter Number- from Box 1 on Page 16.	139	Note: The numbers in box X and box Z should be the same.	
Z. Multiply box Y by 5	695		

AVR Planning Form

Section IV must be completed by employers filing both new and update plans

Section A

1. Total employee trips generated Monday through Friday between 6:00am - 10:00am inclusive (Column 1 (X) Form IV-3). 1. 643
2. Total vehicles arriving at the worksite Monday through Friday between 6:00am - 10:00am. (Column 3 use (T) if claiming clean fuel vehicle credit, otherwise use (V) form IV-3). 2. 367.5
3. Divide line #1 by line #2 for current AVR. 3. 1.75
4. Enter AVR target here. 4. 1.50
5. Prior year AVR (leave blank if filing for first year). 5. 1.34
6. Divide line #1 by line #4. This is the maximum weekly number of vehicles at which you reach the target AVR. 6. 428.6
7. Subtract line #6 from line #2. This is your weekly necessary vehicle reduction to reach your target AVR. 7. N/A
8. Divide line #7 by 5 to calculate the necessary daily vehicle reduction to reach your target AVR. 8. N/A

Instructions: Print or type the Employee Information requested.
Print or type an (X) to identify your survey responses.

Employee Information

Name: _____
First Last
Employee I.D.#: _____ Dept./Section: _____
Phone Ext.: _____ Home Zip Code: _____ Miles to Worksite (one way): _____
Signature: _____ Date: _____

Mode	Report Time	Mon	Tue	Wed	Thu	Fri	(circle AM or PM as applicable)
		a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	
A. Drive Alone							
B. Motorcycle							
C. 2 person carpool							
D. 3 person carpool							
E. 4 person carpool							
F. 5 person carpool							
G. 6 person carpool							
H. Vanpool H1. Capacity							
I. Buspool							
J. Transit (bus/rail/plane)							
K. Walk							
L. Bicycle							
M. Zero Emission Vehicles							
N. Telecommute (reduction of more than 50% of trip)							
O. Noncommuting							

Compressed Work Week Day(s) Off

P. 3/36 work week					
Q. 4/40 work week					
R. 9/80 work week					

Other Days Off

S. Vacation					
T. Sick					
U. Other					

(Jury duty, Leave of Absence, Home Dispatched, etc.)

Alternative Fuel Vehicles*

If alternative fuel vehicles were used for commuting during the survey period, please indicate by using the appropriate type in each box as shown below:

--	--	--	--	--

Type: P=Propane LPG=Liquidified Petroleum Gas M=Methanol NG=Natural Gas

Note: Alternative fuels do not include reformulated gasoline.

FORM A

Methods of Calculating Reported Mode Shares for City of West Hollywood for 1993 (from the data reported on page IV-3 of City of West Hollywood's 1993 Trip Reduction Plan)

Work trips reported by respondents to the survey:

643 =	Box W, employee work trips counted, including nonresponses and noncommuters
5 =	Box M, vehicle trips attributed to nonresponders (No survey response)
5 =	Box L, Telecommute
127 =	Boxes N, O, P, compressed work week credits
506 =	W-M-L-N-O-P work trips reported by respondents in survey (This number includes the phantom work trips "saved" by the compressed work weeks, reported in Boxes N,O, and P)
352 =	Box A, drive alone trips
352/506 =	Drive alone mode share
69.6% =	Drive alone mode share
21 =	Boxes C, D, E, F, G, H, carpool trips
21/506 =	Carpool mode share
4.2% =	Carpool mode share
15 =	Box I, transit trips
15/506 =	Transit mode share
3.0% =	Transit mode share
110 =	Box J, walk trips
110/506 =	Walk mode share
21.7% =	Walk mode share
8 =	Boxes B, K, bicycle/motorcycle trips
8/506 =	Bicycle/motorcycle mode share
1.6% =	Bicycle/motorcycle mode share
127 =	Boxes N, O, P, phantom work trips saved by compressed work weeks
127/506 =	Phantom work trip mode share
25% =	Phantom work trip mode share

FORM B

Methods of Calculating Work Trips and Vehicle Trips for City of West Hollywood for 1993 (from the data reported on page IV-3 of City of West Hollywood's 1993 Trip Reduction Plan)

Work trips reported by respondents to the survey:

- 643 = Box W, employee work trips counted, including nonresponses and noncommuters
- 5 = Box M, vehicle trips attributed to nonresponders (No survey response)
- 5 = Box L, Telecommute
- 127 = Boxes N, O, P, Compressed work week credits
- 506 = W-M-N-O-P work trips reported by respondents in survey
(This number includes the phantom work trips "saved" by the compressed work weeks, reported in Boxes N,O, and P)

All non-responses were counted as solo drivers, and therefore as worktrips, so

- 367.5 = Box V, vehicle trips counted
- 5 = Box M, vehicle trips attributed to nonresponders (No survey response)
- 362.5 = Box V-M, vehicle trips reported by respondents in survey
- 362.5/506 = Box V-M/W-M-L-N-O-P, vehicle-trips/work-trip reported by respondents in survey
- 0.72 = vehicle-trips/work-trips reported by respondents in survey**

The number of employees who do not travel to work:

- 4 = Box O, 4/40 work week
- 123 = Box P, 9/80 work week
- 17 = Box Q, Vacation days
- 15 = Box R, Sick days
- 20 = Box S, other days
- 5 = Box L, Telecommute
- 184 = Boxes O+P+Q+R+S+L, reported employee-days off.

- 0.99 = Response rate to survey (Box C, Pg. IV-1)

So if all those with days off had the same response rate as for all employees, the number of employee-days off were:

- 184/0.99 = Boxes Q+R+S+L/Response rate, employee-days off
- 185.9 = Employee days-off during survey week
- 185.9/5 = Employees off per day
- 37.2 = Employees off per day (including nonrespondents to the survey)

- 139 = Number of employees (Box C, Pg. IV-1)
- 139-37.2 = Number of Commuters
- 101.8 = Number of Commuters
- 101.8/139 = Commuters/employee
- 0.73 = Commuters/employee**

$$\begin{array}{rclcl} \text{Commuters/employee} & \times & \text{vehicle-trips/commuter} & = & \text{vehicle-trips/employee} \\ 0.73 & \times & 0.72 & = & 0.52 \end{array}$$

Emission Factors 1992 - 2020

Average Light Duty Fleet with Cold Starts

Methodology: Multiply miles traveled for each year by the VMT factor to get emissions in grams

Multiply number of trips by the trips factor (trip ends) for each year.

Add VMT emissions to trip end emissions.

	1992	1993	1994	1995	
ROG					
VMT (g/mi)	0.92	0.86	0.81	0.76	
trips (g/trip)	7.63	7.30	6.93	6.54	
NOx					
vmt	1.00	0.94	0.88	0.83	
trips	3.14	3.00	2.88	2.78	
CO					
vmt	8.27	7.72	7.18	6.64	
trips	70.54	67.58	63.40	58.74	
	1996	1997	1998	1999	2000
ROG					
VMT (g/mi)	0.58	0.55	0.51	0.47	0.44
trips (g/trip)	5.7	5.39	5.04	4.65	4.23
NOx					
vmt	0.71	0.67	0.64	0.6	0.57
trips	2.28	2.23	2.17	2.09	2
CO					
vmt	4.56	4.19	3.86	3.56	3.29
trips	62.47	58.18	53.76	49.19	44.53

Source: EMFAC7F1.1/B7F. Includes annual average statewide emissions for light duty cars and trucks plus motorcycles.

VMT factor equals running exhaust plus running losses divided by daily VMT.

Trips factor equals (cold starts divided by cold trips) plus (hot soaks divided by daily trips).

PM10

0.75 grams per mile*

* There is no year-specific or trip end emission factor for PM10.
Includes 0.66 g/mi from entrained road dust (dust from roads that becomes airborne because of traffic) and 0.09 g/mi from tire wear and exhaust.

APPENDIX 3: TEXT OF CALIFORNIA'S CASH-OUT LEGISLATION

Text of Parking Cash-Out Law

§ 43845. Parking cash-out program. California Health and Safety Code.

(a) In any air basin designated as a nonattainment area pursuant to Section 39608, each employer of 50 persons or more who provides a parking subsidy to employees, shall offer a parking cash-out program. "Parking cash-out program" means an employer-funded program under which an employer offers to provide a cash allowance to an employee equivalent to the parking subsidy that the employer would otherwise pay to provide the employee with a parking space.

(b) A parking cash-out program may include a requirement that employee participants certify that they will comply with guidelines established by the employer designed to avoid neighborhood parking problems, with a provision that employees not complying with the guidelines will no longer be eligible for the parking cash-out program.

(c) As used in this section, the following terms have the following meanings:

(1) "Employee" means an employee of an employer subject to this section.

(2) "Parking subsidy" means the difference between the out-of-pocket amount paid by an employer on a regular basis in order to secure the availability of an employee parking space not owned by the employer and the price, if any, charged to an employee for use of that space.

(d) Subdivision (a) does not apply to any employer who, on or before January 1, 1993, has leased employee parking, until the expiration of that lease or unless the lease permits the employer to reduce, without penalty, the number of parking spaces subject to the lease.

(e) It is the intent of the Legislature, in enacting this section, that the cash-out requirements apply only to employers who can reduce, without penalty, the number of paid parking spaces they maintain for the use of their employees and instead provide their employees the cash-out option described in this section.

Related Provisions

Sections 17202 and 24343.5, California Revenue & Taxation Code. Specifies that costs related to a parking cash-out program may be deducted as business expenses for employers.

Section 17090, California Revenue & Taxation Code. States that the cash allowance given to employees must be included in gross income subject to state income and payroll taxes (except any portion used for ridesharing purposes).

Sections 65088.1, 65089, and 65089.3, California Government Code. Requires (1) congestion management agencies to consider parking cash-out when developing and updating the trip reduction and travel demand elements of their congestion management plans, and (2) requires cities or counties to grant appropriate reductions in parking requirements to new and existing commercial developments if they offer parking cash-out programs.

Uncodified language:

The Legislature hereby finds and declares all of the following:

(a) Existing local, state, and federal policies tend to encourage the provision of subsidized parking by employers.

(b) Subsidized parking creates a strong incentive for employees to commute to work in a single occupancy vehicle.

(c) Commuting in a single occupancy vehicle contributes to traffic congestion and air pollution.

(d) In Los Angeles and Orange Counties, more than 90 percent of the commuters receive free worksite parking, but less than 10 percent of employers provide an employee ridesharing or transit benefit.

APPENDIX 4: PARKING SUBSIDIES AND TRAVEL CHOICES: ASSESSING THE EVIDENCE

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Parking subsidies and travel choices: Assessing the evidence

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Key words: mode choice, parking, transportation demand management, travel behavior

Abstract. This article reviews empirical studies of how employer-paid parking affects employees' travel choices. A strong effect is found: parking subsidies greatly increase solo driving. When employers reduce or remove parking subsidies, a significant number of solo drivers shift to carpools and/or transit. This conclusion is based on studies of parking subsidies in a variety of circumstances, including central city and suburban areas, private and public employers, and clerical and professional employees. Three measures are developed to compare changes in commute patterns: changes in the share of solo drivers, changes in the number of autos driven to work per 100 employees, and the parking price elasticity of demand for solo driving. The studies reviewed here show that 19 to 81 percent fewer employees drive to work alone when they pay for their own parking. Because 90 percent of American commuters who drive to work receive employer-paid parking, these findings are significant for designing transportation policies to reduce air pollution, traffic congestion, and energy consumption.

Introduction

Nine out of every ten American commuters who drive to work park free at work.¹ Although employer-paid parking may appear to be a generous, enlightened, and popular employment policy, it is also a strong incentive to drive to work alone, and it strongly works at cross purposes with public policies designed to reduce traffic congestion, energy consumption, and air pollution.

To illustrate how strongly employer-paid parking can sway a commuter's decision toward driving to work alone, consider how much a parking subsidy can reduce the cost of driving to work. Using the 172,000 office workers in the Central Business District (CBD) of Los Angeles as an example, we find that 105,000 of them drive to work alone, and approximately 54,000 of them park free in employer-provided spaces. The cost of

the gasoline for the average commute trip is approximately \$1.75 per day, and the average daily equivalent market cost of monthly parking in the Los Angeles CBD is \$4.32 per day, so if an auto commuter pays for parking the sum of the gasoline and parking cost for the round trip is \$6.07 per day.² Thus, employer-paid parking reduces the cost of driving alone to work from \$6.07 to \$1.75 per day, when compared to the out-of-pocket cost for gasoline and parking faced by a commuter who has to pay to park at work. The federal tax on gasoline would have to rise from the present 9 cents per gallon to \$2.56 per gallon merely to counteract the parking subsidy now given to the approximately 54,000 solo drivers in the Los Angeles CBD who park free at their employers' expense.

As the price of travel by any one mode (as measured by monetary costs and time) rises, demand decreases. Demand decreases because of reduced trips or shifts in travel mode or travel time. The objective of this study is to assemble, summarize, and compare previous research showing how employer-paid parking subsidies affect the price of travel and thus commuter mode choice. We review case studies covering a wide range of locations, employers and employees. The assembled studies clearly demonstrate that employer-paid parking greatly increases solo driving, in some cases more than doubling the share who drive to work alone. Further, employers who remove or reduce parking subsidies find that many solo drivers shift to carpools or transit.

Techniques for summarizing the results of the case studies

We use three techniques to summarize and compare the results found in each of the case studies. The first and most direct way to measure the effect of employer-paid parking on commuter travel choices is to compare the *share of commuters who drive to work alone* between conditions where

- the employer pays for employees' parking, and
- employees pay for their own parking.

For example, in one study of commuters to the Civic Center of Los Angeles, 72 percent of employees who received employer-paid parking drove to work alone, while only 40 percent of otherwise similar employees who paid for their own parking drove to work alone (Francis & Groninga 1969).

The second way to measure the effect of employer-paid parking on commuter travel choices is to compare the *number of autos driven to work per 100 employees* between conditions where the employer or the driver

pays for parking.³ The advantage of this “autos/100 employees” technique is it expresses the effects of employer parking subsidies in a way that reveals the implications for vehicular trip generation rates and parking requirements. For example, when an employer in the mid-Wilshire district of Los Angeles ended parking subsidies for solo drivers, the number of autos driven to work per 100 employees fell from 48 to 30 (Surber et al. 1984).

The third way to measure the effect of employer-paid parking on travel choices is to calculate the *parking price elasticity of demand* for solo driving. The advantage of a price elasticity is that it standardizes the parking price changes in each of cases studies. Elasticities estimate the percentage change in the proportion of solo drivers that results from a one percent change in parking price.⁴ Accordingly, we expect to find negative price elasticities, meaning that solo commuting decreases as parking price increases. For example, when an employer at the Warner Center in suburban Los Angeles reduced its parking subsidy for solo drivers from \$45 to \$15 per month, and thus increased the price of solo driver parking from \$0 to \$30, the share of solo drivers decreased from 90 percent to 46 percent (Soper 1989). The mid-point parking price elasticity of demand for solo driving for this example is estimated to be -0.32 .

How do parking subsidies change mode choice?

The key question in examining parking subsidies is whether there is a clearly established relationship between levels of parking subsidies and commuter behavior. The studies reviewed generally examine the effects of *changes or differences* in the amount of subsidy employers offer.

The strongest evidence demonstrating that employer-paid parking encourages commuters to drive to work alone largely comes from case studies that have either

- examined the commuting behavior of employees *before* and *after* employer-paid parking was eliminated; or
- compared the commuting behavior of matched samples of employees *with* and *without* employer-paid parking.

Both types of studies are of interest. The “before/after” studies show short-term adjustments to changes in parking subsidy. This technique helps to ensure the comparability of the cases. These “before/after” studies are most useful when other employer policies and external conditions are held constant during the comparison period. The “with/without” studies show the long-term adjustment that commuters make to varying

levels of transportation subsidy. Again, the results of these studies are most useful when the effects of other factors affecting mode choice, such as the employer's characteristics, location, and support for ridesharing, are controlled.

Many of the available case studies are from Southern California, but the reader should note that this does not preclude circumstances where substantial transit service is available — three of the case studies are in or near downtown Los Angeles, where bus transit is a reasonable option for many commuters.

This article also reviews studies of parking pricing which either did not provide a basis for "before/after" or "with/without" comparisons, or did not directly concern employee parking subsidies. Finally, commuter surveys that provide insights to the effect of parking subsidies are reviewed.

All the studies reviewed show that ending employer-paid parking greatly reduces solo driving. The degree of influence varies with local conditions, as expected. However, the reduction in solo driving achieved by ending parking subsidies is usually greater than that achieved by providing subsidies to mass transit and ridesharing when parking continues to be subsidized. Table 1 shows how ending employer-paid parking reduces the solo driver share. The smallest reduction in the number of solo drivers was 19 percent and the largest reduction was an impressive 81 percent (in this case the employer eliminated free parking only for solo drivers).

Table 1. How employer parking subsidies affect solo driving.

Case study and type	Solo driver mode share		
	Employer pays for parking	Driver pays for parking	Decrease in solo drivers
Mid Wilshire, Los Angeles (before/after)	42%	8%	—81%
Warner Center, Los Angeles (before/after)	90%	46%	—49%
Century City, Los Angeles (with/without)	92%	75%	—19%
Civic Center, Los Angeles (with/without)	72%	40%	—44%
Downtown Ottawa, Canada (before/after)	35%	28%	—20%
Average of case studies	66%	39%	—41%

Table 2 shows how ending employer-paid parking reduces the number of automobile trips to the site. Because many solo drivers shift to carpools when employers eliminate parking subsidies, the number of autos driven to work does not decline by as much as the number of solo drivers, but

Table 2. How employer parking subsidies affect automobile trips.

Case study and type	Autos driven per 100 employees		
	Employer pays for parking	Driver pays for parking	Decrease in auto trips
Mid Wilshire, Los Angeles (before/after)	48	30	−38%
Warner Center, Los Angeles (before/after)	92	64	−30%
Century City, Los Angeles (with/without)	94	80	−15%
Civic Center, Los Angeles (with/without)	78	50	−36%
Downtown Ottawa, Canada (before/after)	39	32	−18%
Average of case studies	70	51	−27%

the decline is still very impressive, ranging from 15 to 38 percent. *Thus, all the cases show that ending employer-paid parking reduces, and in some cases greatly reduces, both solo driving and automobile trips.*

Overviews

A comprehensive examination of employer parking subsidies is found in *Free Parking as a Transportation Problem* (Shoup & Pickrell 1980), which examined the effect of employer parking subsidies. Using five case studies and six alternative travel models, they show that free parking causes more solo driving. The case studies include three examples in “auto-dependent” Los Angeles — Civic Center employees, Century City employees and UCLA students. All the case studies show that employer-paid parking increases solo driving. The strength of the effect depended on transportation conditions (e.g., parking price, transit service) in the area studied. The study also tested the response of existing mode split models to increases in parking cost. The models all predict decreases in drive-alone commuting. The best model produced results close to the generalized results of the case studies. Based on the models and case studies, the authors conclude that 20 percent fewer employees drive alone to work when they pay to park than when the employer provides free parking.

The study also examined the prevalence of free parking in U.S. cities. Using national data, the authors show that for 93 percent of all auto work trips the driver did not pay for parking. Comparing components of travel cost, Shoup & Pickrell conclude that free parking is a greater incentive to drive alone than an offer of free gasoline. They also find that parking subsidies tend to benefit higher income groups, because of the distribution of subsidies and the effects of tax law.

Before / after studies

Four strong before/after case studies are reviewed in this section. In each case, the employer reduced parking subsidies for commuters who drive alone, and realized dramatic changes in mode split. Table 3 summarizes the mode choice and parking price data assembled, and is followed by a discussion of each case study.

In the first "before/after" case study, Commuter Computer, the non-profit ridesharing agency for Southern California, ended employer-paid parking for its employees who drive to work alone (Surber et al. 1984). The employment site is the mid-Wilshire area near downtown Los Angeles, and has good transit service. Although its employees clearly understood all the arguments in favor of ridesharing and had complete access to all conceivable ridesharing matching facilities, when parking was free to all employees only 17 percent carpooled to work, and 42 percent drove to work alone.

After parking for solo drivers was desubsidized in 1983, the carpool share rose from 17 percent to 58 percent, and the solo driver share fell from 42 percent to 8 percent. This study included a mode survey at a nearby control site, to determine if external factors contributed to the change. There was no change in the mode split at the control site, where the employer continued to offer free parking. Thus, this dramatic change

Table 3. Parking price and mode share data for "before/after" case studies.

Location/organization	Variable	Before (full subsidy)	After (subsidies reduced)	Change
Mid-Wilshire Area (near CBD)	Parking Cost/Mo.	\$0	\$58	+\$58
Los Angeles, CA	Solo Driver	42%	8%	-81%
Mid-sized non-profit	Carpool/Vanpool	17%	58%	+241%
	Transit	38%	28%	-26%
Warner Center (suburban)	Parking Cost/Mo.	\$0	\$30	+\$30
Los Angeles, CA	Solo Driver	90%	46%	-49%
Large private firm	Carpool/Vanpool	6%	48%	+700%
	Transit	0%	0%	0%
Central Business District	Parking Cost/Mo.	\$0	\$23	+\$23
Ottawa, Canada	Solo Driver	35%	28%	-20%
Federal Government	Carpool/Vanpool	11%	11%	0%
	Transit	42%	49%	+17%

in commuting behavior (more than tripling the number of carpoolers and cutting the number of solo drivers to less than one-fifth of the previous figure) can be attributed solely to the desubsidization of parking for solo drivers. The “autos/100 employees” measure dropped from 48 to 30, a 38 percent decrease, and the price elasticity of demand for solo driving is estimated to be -0.68 .

It appears that many solo drivers at Commuter Computer responded to the increase in parking cost by recruiting bus riders into carpools. Bus ridership actually fell by 26 percent after solo drivers were charged for parking. This case also confirms growing evidence that employers who provide rideshare incentives while continuing to subsidize solo drivers rarely achieve significant increases in ridesharing.

In the second “before/after” case study, the 20th Century Insurance Company eliminated free parking for solo drivers (Soper 1989). The firm is located in Warner Center, a suburban community in Los Angeles’ San Fernando Valley, where transit service is not extensive. This office has a high percentage of female employees and a high percentage of clerical positions. The firm first tried offering traditional rideshare incentives, such as transit and vanpool subsidies, preferential carpool parking spaces and a transportation coordinator, but these programs had almost no effect on mode choice.

In 1989, the firm raised the price of solo driver parking from no charge to two thirds of the market rate (\$30 per month) and continued to offer rideshare incentives. A dramatic 49 percent decrease in solo driving was achieved, mostly as the result of increased ridesharing. The “autos/100 employees” measure dropped from 92 to 64, and the price elasticity of demand for solo driving demand is estimated to be -0.32 .

A lack of transit service is often cited as a reason why employers subsidize employees’ parking at suburban employment locations. The argument is made that sufficient alternatives to solo driving do not exist. However, the 20th Century case study demonstrates that significant changes in mode split can be achieved at suburban locations that lack transit service — carpooling is the underutilized option. After solo driver parking was desubsidized, carpooling was broadly distributed throughout the firm’s departments, with the exception of non-participation by the actuary and executive management departments. This study did not include a control group at a similar site, but it is highly unlikely that such large mode split changes occurred at employment sites where the parking subsidy policy did not change. A key research question is whether these kinds of improvements can be achieved by smaller suburban employers, and by different types of businesses.

A *third "before/after" study* in Canada provides further evidence that reducing parking subsidies reduces solo driving (Transport Canada 1978). This study examined the results when the Canadian government stopped providing free parking to its employees in Ottawa in 1974. Ottawa has an all-bus transit system with high ridership levels. Employees were asked to report their travel mode choice before and after the date of the policy change. Although the parking subsidy was not entirely eliminated, the subsidy was reduced from 100 percent to 30 percent of the cost of parking. Based on 3,500+ survey responses and corroborating cordon counts, the study found that 20 percent fewer employees drove to work alone, and 17 percent more were riding transit within a year. Two employees began ice skating to work. The "autos/100 employees" measure fell from 39 to 32, and the price elasticity of demand for solo driving is estimated to be -0.11 . Unlike the suburban case studies, the increase in ridesharing was in the form of higher bus patronage, reflecting the good CBD bus service and a trend of improved bus service and patronage in the Ottawa area. No special subsidies to carpools were provided.

Most of the Canadian Federal Government employees who shifted modes did so because of the change in parking subsidies. Contrary to expectations, the shift away from solo driving was greater among higher income male employees. Many of these higher income drivers switched to transit. In addition, the number of women who drove alone *increased* after parking was desubsidized. Both of these unexpected results probably occurred because when parking was free there were not enough spaces for everyone who wanted one, and the available spaces were allocated according to job title or seniority, which meant that the free parking spaces were more likely to go to higher income males. This finding undercuts the claim that it is "unfair" to charge for parking; rather, after parking charges were instituted, men and women were able to compete on a more equal basis for the available spaces, and women took advantage of the new opportunity to bid spaces away from men who had previously parked free.

A *fourth before/after study* examined the results when the U.S. Federal government raised solo driver parking prices in fifteen central city and suburban facilities in Washington D.C. in 1979 (Miller & Everett 1982). The parking charges were raised from mostly free to one-half the market parking rate. Before the program, parking charges varied from \$0 to \$15.10 per month; after the prices were raised charges varied from \$14.50 to \$32.50 per month. Solo driving decreased, but not uniformly. The solo driver share decreased between one and six percent at 11 sites and increased between one and five percent at four sites. The mode shift away from solo driving was measured with before and after surveys, and com-

parisons with control groups. Overall, the effect of the reduced parking subsidy was less than in the other case studies. This case is not summarized in the Tables 1 or 2 because the varied mode shifts and parking prices preclude the usefulness of a single quantitative expression of the results.

The researchers analyzed responses to follow-up surveys to determine the reasons for differences in mode choice among the various sites. They found the following important: locational characteristics (e.g., transit accessibility, on-street parking), existing mode split characteristics, the socioeconomic characteristics of the workforce, and employer-controlled aspects (e.g., number of employer-provided spaces). For example, some locations already had high levels of carpooling, due to a parking permit allocation process that favored carpools. These locations did not experience large mode shifts. In the central city area, price increases had the effect of shifting carpool participants to transit. The single case where solo drivers increased by a significant amount occurred when existing carpoolers shifted to available free on-street parking to avoid the increased parking charge, thereby making available on-site spaces for those who wished to drive alone.

Although the greatest rate of mode change occurred in the lower income categories, the study found cases of large shifts among high income groups. Therefore, higher parking prices are not necessarily a policy change which stratifies high and low income groups into particular modes. Another finding of significance is that workforce size did *not* have much impact on mode shift — for instance, smaller workforces were not at any disadvantage in forming carpools. Finally, the study points to the importance of evaluating unintended effects of parking policy changes, such as creating spill-over parking around the employment site.

With / without comparisons

Comparing mode choice among employers having different parking subsidy policies can also reveal the reaction of commuters to parking costs. The key issue is ensuring the comparability of the comparison groups. Three “with/without” studies are reviewed here; the data are summarized in Table 4.

The first research on the effects of employer-paid parking was done in the Los Angeles Civic Center (Francis & Groninga 1969). This area has relatively good bus transit and moderately high parking prices. In 1969, researchers surveyed a sample of employees of the County of Los Angeles (who received employer-paid parking if they drove to work) and an

Table 4. Parking price and mode share data for "with/without" case studies.

Location/organization	Variable	Full subsidy	No subsidy	Difference
Civic Center (in CBD)	Parking Cost/Mo.	\$0	\$30	+\$30
Los Angeles, CA	Solo Driver	72%	40%	-44%
Federal and county Gov't.	Carpool/Vanpool	16%	27%	+69%
	Transit	12%	33%	+175%
Century City	Parking Cost/Mo.	\$0	\$30	+\$30
Los Angeles, CA	Solo Driver	92%	75%	-19%
Private employers	Carpool/Vanpool	4%	12%	+200%
	Transit	4%	13%	+225%
		Company B	Company A	Difference
Central Business District	Parking Cost/Mo.	\$50	\$60	+\$10
Los Angeles, CA	Solo Driver	48%	49%	+2%
Private employers	Carpool/Vanpool	34%	20%	-41%
(see text for explanation)	Transit	18%	31%	+72%

otherwise similar sample of employees of the Federal government (who paid for their parking if they drove to work). Of the County employees *with* employer-paid parking, 72 percent drove to work alone, while of the Federal employees *without* employer-paid parking, only 40 percent drove to work alone. Thus, the County's offer of employer-paid parking almost doubled the share of its employees who drove to work alone. The "autos/100 employees" measure is 78 for County employees and 50 for Federal employees. The price elasticity of demand for solo driving is estimated to be -0.29.

Francis and Groninga examined the differences in mode share among subgroups of the sample representing income and gender, and found statistically significant differences in each group. Although the groupings do not completely control for factors other than parking price, the consistent differences in commuting behavior in each group show clearly that parking subsidy policy exerts a strong influence.

A 1976 survey of 3,500 employees working in Century City reinforced the importance of parking subsidies on commuter travel choices (Shoup & Pickrell 1980). Century City is a relatively high density, but highly automobile oriented employment center in West Los Angeles. Among employees receiving free parking, 92 percent drove to work alone, compared to a 75 percent solo driver share for those who paid to park. Carpooling and transit ridership increased from four percent for each among those

with employer-paid parking to 12 and 13 percent, respectively, among those who paid to park. The “autos/100 employees” measure dropped from 94 at the firms subsidizing parking, to 80 at firms where the driver paid for parking. The estimated price elasticity of demand for solo driving is -0.10 . Controls for the effects of variables other than parking are absent, so the data must be interpreted cautiously.

A more recent study comparing the parking subsidies of two downtown Los Angeles companies also shows the strong impact of offering parking subsidies to solo drivers (Mehranian et al. 1987). The first company, nationally known for its aggressive promotion of ridesharing, subsidizes half the parking cost for solo drivers, three-quarters of the parking cost for two-person carpools, and all the parking cost of carpools of three or more (Company “B”). (Although this subsidy structure is intended to encourage carpooling by increasing the parking subsidy *per auto* as vehicle occupancy increases, it should be noted that the parking subsidy *per employee* decreases as the vehicle occupancy rate increases). The second company has no ridesharing program, but does not provide a parking subsidy to three-quarters of its employees. A partial subsidy is provided to the remaining employees, with no preference to carpoolers (Company “A”). When the mode split of the two companies is compared, the share of solo drivers is almost identical for the two companies.

Because the company with the elaborate plan to subsidize carpooling also continued to subsidize half the cost of parking for all who drove alone, its parking subsidy program primarily shifted commuters from mass transit to carpooling and vanpooling, and thus actually *increased* the number of vehicles driven to work. While the workers of the company with extensive ridesharing and parking benefits no doubt appreciated the commute choices they had, the implication of this finding is that it is difficult or impossible to significantly reduce solo driving by subsidizing carpooling if solo driving also remains subsidized.

The companies were located in the same development, and their employees faced similar transit access and market parking prices. Crosstabulations and chi square tests were conducted to identify possible associations between the characteristics of the companies’ workforces and the distribution of their mode choices. No significant differences between the companies were found in travel distances, need for an auto at work, job classifications, and the availability of market rate parking.

Other studies

The studies summarized in this section report on other interesting parking

pricing experiments, but do not provide data on employee parking in a form that permits the comparisons made in the previous sections.

In Seattle, Washington, a major employer moved from downtown Seattle to Bellevue, (a suburban employment center) and maintained low levels of solo driving (Kenyon 1984). Only 19 percent of the employees in the new location were solo drivers, the result of parking supply and pricing limitations (\$60 month for parking; limited number of spaces available) and a strong rideshare program. Most workers (51 percent) commuted in carpools of three or more persons.

In downtown Seattle, the city lowered parking charges for carpools of 3+ persons at two city facilities, to encourage mode shifts (Olsson & Miller 1978). Given that many commuters already paid low prices for parking, the lowered price encouraged relatively few solo drivers to form carpools — about one quarter of the users of the discounted carpool spaces were former solo drivers. The study cites a City of Toronto, Canada experiment showing similar results (23 percent of discounted carpool spaces users were former solo drivers). The shift did encourage transit riders to form carpools, and also encouraged shifts from other less convenient but low cost parking locations.

In Madison, Wisconsin a peak period surcharge of \$1.00 was instituted in four public parking facilities (Charles River Associates, Inc. 1984). Shifts in travel patterns were studied using a panel of commuters who were surveyed before and after the city imposed the surcharge. Although the surcharge did change the temporal characteristics of parking use, it did not result in substantial carpool formation. The surcharge did result in a five to eight percent switch to transit among a panel of commuters who used that same facility before the surcharge. Commuters frequently shifted parking locations or arrived after the peak period to avoid the surcharge. Morning peak period occupancy in the parking facilities decreased by 40 percent. Although shifts in mode split were not great, the location and temporal shift could be of assistance in congestion reduction efforts. The experiment points out the importance of considering the boundaries and extent of parking pricing efforts (the “surcharge” spaces represented only six percent of total downtown parking spaces).

Higgins & Miller (1981) summarize additional experiments. For example, San Francisco instituted a 25 percent off-street parking tax in the CBD in 1970. It generated substantial funds for the city, mostly coming from parking operator profits rather than increased parking charges. The number of autos parked declined slightly, with substantial variation between facilities. Long-term parkers were more sensitive to the price increase than short-term parkers. Chicago raised parking charges in municipal lots from below market rates to about equal to long-term

market rates. Parking revenues went up, and the number of all-day parkers arriving before 9:30 am dropped by 72 percent. Although mode shifts were not documented, officials believe significant shifts to transit and carpooling occurred. In 1980, Eugene, Oregon raised parking prices at downtown lots by about 100 percent. Monthly permit sales decreased, as some commuters shifted to carpools and a shuttle system. Most others parked in other locations.

Surveys

Most travel surveys do not provide a matched sample of employee and employer responses, which is needed to provide evidence on the relationship between an organization's parking policies and its mode split. However, a few sources do provide the needed information.

A 1985 mail survey of Commuter Transportation Services, Inc. clients probed *employers* on their rideshare policies and their attitudes concerning the same. Most of these firms had collected information on their employees' mode split, so it is possible to relate parking subsidies to mode split. Although the survey was not representative of all firms in Southern California, it demonstrates that parking subsidies lead to more solo driving. Those firms charging no parking fee to solo drivers reported that 77 percent of their employees drove to work alone; employers charging solo drivers \$40 or more per month to park reported 52 percent drive-alone commuting. The difference was made up in transit patronage. It is not possible to determine from the report the proportion of the difference attributable to the employer's location (e.g., CBD versus suburban).

A 1986 workplace commute mode survey in downtown Los Angeles provides a matched sample of 118 employers and 5,060 office worker employees (Barton Aschman Associates, Inc. 1986). Willson & Shoup (1990) reanalyzed this data, investigating the effect and prevalence of subsidized parking. When they compared the mode choice of employees who get free parking to the mode choice of those who pay to park, they found that 24 percent fewer commuters drive to work alone if they pay for their own parking. This finding is significant because almost half of the drivers in downtown Los Angeles receive free parking at work. Currently, sixty percent of downtown office commuters are solo drivers; 80 percent of the solo drivers do *not* need their auto at work for work travel purposes.

Another survey collected information on the level of parking subsidies received by auto drivers crossing bridges and tunnels into New York City (Port Authority of New York and New Jersey, 1984). The study confirmed that most auto drivers receive parking subsidies: between 54 and 64 percent of the auto commuters surveyed received parking subsidies.

The survey also collected attitudinal information indicating auto commuters' willingness to shift to transit if public transit fares were subsidized.

Conclusion

This literature review provides strong evidence that employer-paid parking greatly increases solo driving to work, and that ending employer-paid parking significantly decreases solo driving. One might argue that each of the case studies is unique and that findings will not be replicated in other situations. Yet the case studies cover a variety of locations (both downtown and suburban), employer types (public and private) and employee categories (professional and clerical), and the case study results are reinforced by the survey findings. The consistency of the studies is striking. Free parking at work does have an important effect on commuter mode choice — it invites commuters to drive to work alone.

The evidence from the case studies shows that ending employer-paid parking reduces the number of solo drivers by between 19 and 81 percent, and reduces the number of autos driven to work by between 15 and 38 percent. Estimates of the price elasticity of demand for solo driving range between -0.10 and -0.68 , meaning that as the after-subsidy price of parking is doubled, solo driving is likely to decrease by between 10 and 68 percent. Such changes can have a major impact on regional mobility.

A critical perception that future research should address is whether employees would really prefer to drive alone if those who do not drive alone were offered a cash travel allowance as an option to employer-paid parking. It is important to note that an employer can offer a cash travel allowance to those who do not drive to work *without* eliminating the offer of employer-paid parking, and yet the offer of cash in lieu of free parking in effect raises the price of parking for all employees from zero to the level of the cash alternative. In this way, the effective price of employee parking can be raised by offering a new fringe benefit (the cash allowance in lieu of free parking) and without reducing any existing fringe benefit.

Another important topic for future research is the connection between parking subsidies and minimum parking requirements in local zoning ordinances. Employer-paid parking increases the amount of parking "demanded," leading jurisdictions to require more parking than a market would support. If local requirements force over-building of parking, they will depress the market price for parking and further increase solo driving. A coordinated approach to reduce both employer-paid parking *and* local parking requirements is needed.

Because employer-paid parking encourages solo driving and discourages carpool and transit use, it increases air pollution, traffic congestion, and energy consumption, and undermines the effectiveness of public investments in transit. Further, ending parking subsidies does not mean a loss in employee benefits if commute allowances are provided. We believe that the harmful consequences of free parking's current status as a "take it or leave it" benefit can no longer be ignored.

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Notes

1. A national survey conducted in 1989 found that 90% of those who drive to work park free (Center for Urban Transportation Research 1989). Commuter Transportation Services Inc. (1988) found that 91% of employees in Los Angeles, Riverside, San Bernardino, and Ventura Counties receive employer-paid parking.
2. The average round trip to work for those who drive to work alone is 35 miles, so at an average fuel efficiency of 20 miles per gallon, the round trip to work requires 1.75 gallons of gasoline; at \$1 per gallon, the cost of gasoline for the average round trip to work is \$1.75. The number of workers and drive-alone commuters, parking subsidies, and average trip length were calculated from data collected in 1986 for the *Los Angeles Central Business District Employee Travel Baseline Survey* (Barton Aschman Associates, Inc. 1986). The average daily cost of parking was calculated by dividing the weighted average of the CBD monthly parking rate by 21.75 working days per month. The average CBD monthly parking rate was derived from the *Downtown Los Angeles Parking Price Survey* (Anil Verma Associates 1986).
3. The number of automobiles driven to work per 100 commuters incorporates the effect of employer-paid parking subsidies not only on the number of employees who drive to work solo, but also on the number who carpool, ride public transit, walk and bike to work. Most of the case studies surveyed include information on the share of employees who carpool, but not on the average carpool size. In order to estimate the number of cars driven to work by carpoolers, we used the figure of one vehicle per 2.62 carpool/vanpool commuters, which was found in the 1988 *Commuter Survey* of Southern California commuters conducted by Commuter Transportation Services, Inc. We also tested the sensitivity of the measure to larger and smaller carpool sizes, and found that the results generally varied no more than 5 percent.
4. This measure estimates elasticity of demand for single occupancy commuting with respect to parking price. The elasticity is calculated as follows. The numerator is the difference in percentage of solo drivers between when the employer pays and when the driver pays for parking, divided by average percentage of solo drivers in the two instances. The denominator is the difference in price paid by the commuter between

when the employer pays and when the driver pays for parking, divided by the average price to commuters in both instances. The outcome of this calculation indicates the percentage change in solo driving expected given a one percent increase in parking cost. This "midpoint" estimate approximates the average elasticity along a demand curve.

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