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Evaluating the Effects of Parking Cash Out:

Eight Case Studies

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
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EVALUATING THE EFFECTS OF PARKING CASH OUT: EIGHT CASE STUDIES

Final Report

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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

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EVALUATING THE EFFECTS OF PARKING CASH OUT: EIGHT CASE STUDIES

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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

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

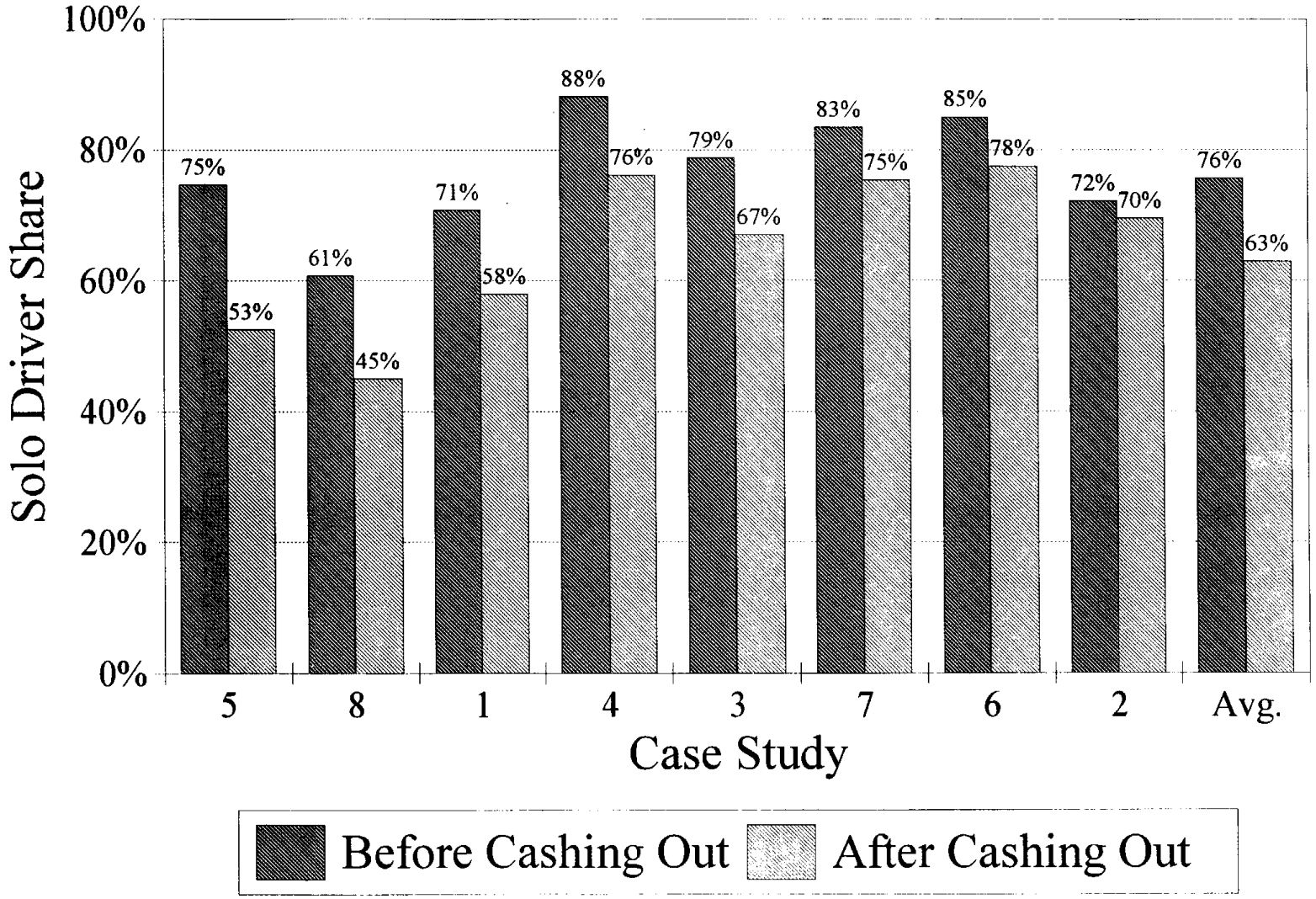
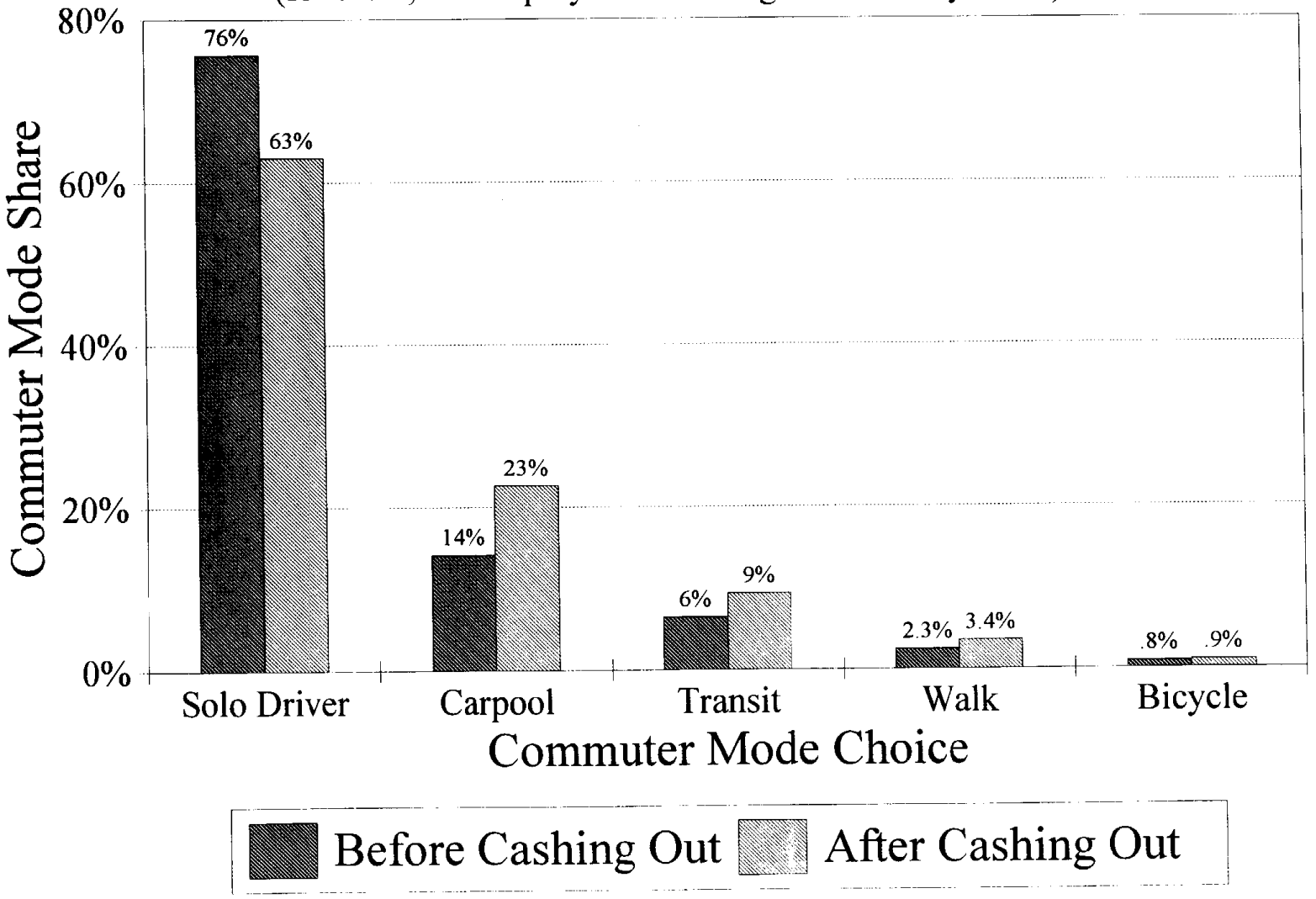


FIGURE 2

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

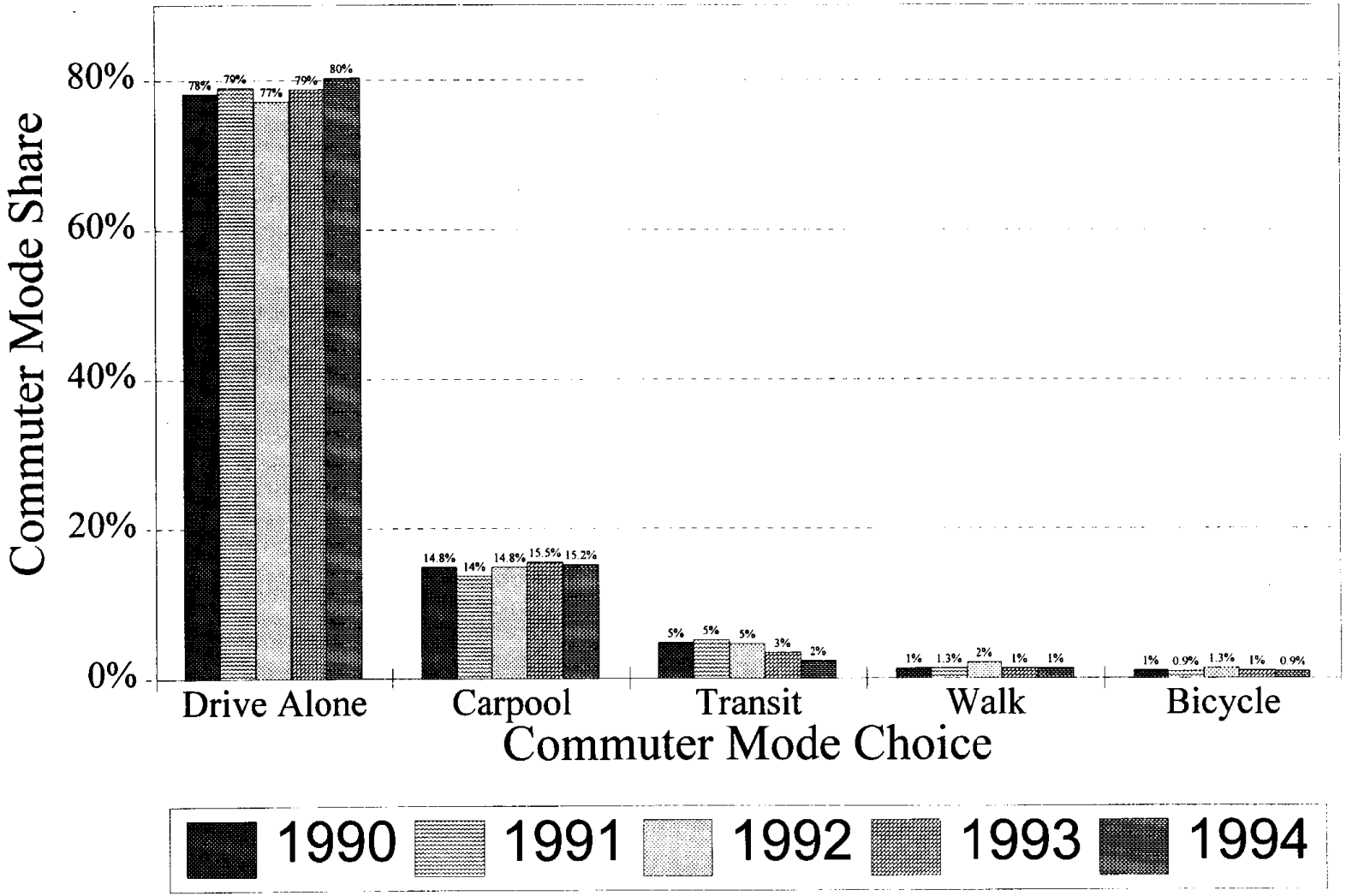
By encouraging ridesharing, cashing out reduced vehicle trips for commuting. The second panel in Table 1 shows how cashing out reduced the number of vehicle trips per employee per year. To obtain the number of vehicle trips, we follow the procedure the SCAQMD uses to calculate vehicle trips. Each solo 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 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. (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)

	Reactive Organic Gases		Nitrogen Oxides		Carbon Monoxide		Particulate Matter	
Case/Location	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 CO_2 EMISSIONS

By reducing VMT, cashing out also reduced gasoline consumption and CO_2 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 CO_2

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 CO_2 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 CO_2 emissions a year for commuting, or 12 percent of the total CO_2 emissions for commuting.

This estimated reduction in CO_2 emissions is conservative because it refers to tailpipe emissions alone. Full-fuel-cycle CO_2 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 CO_2 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*

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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 responsiblity as they always are.

cc: Gerald W. LaFleur, EVP

. . . 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÷ 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 PM_{10} per year. In valuing emission reductions, the California Air Resources Board (1990, 9) treats ROG, NO_x, and PM_{10} 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 CO_2 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 ÷ 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.

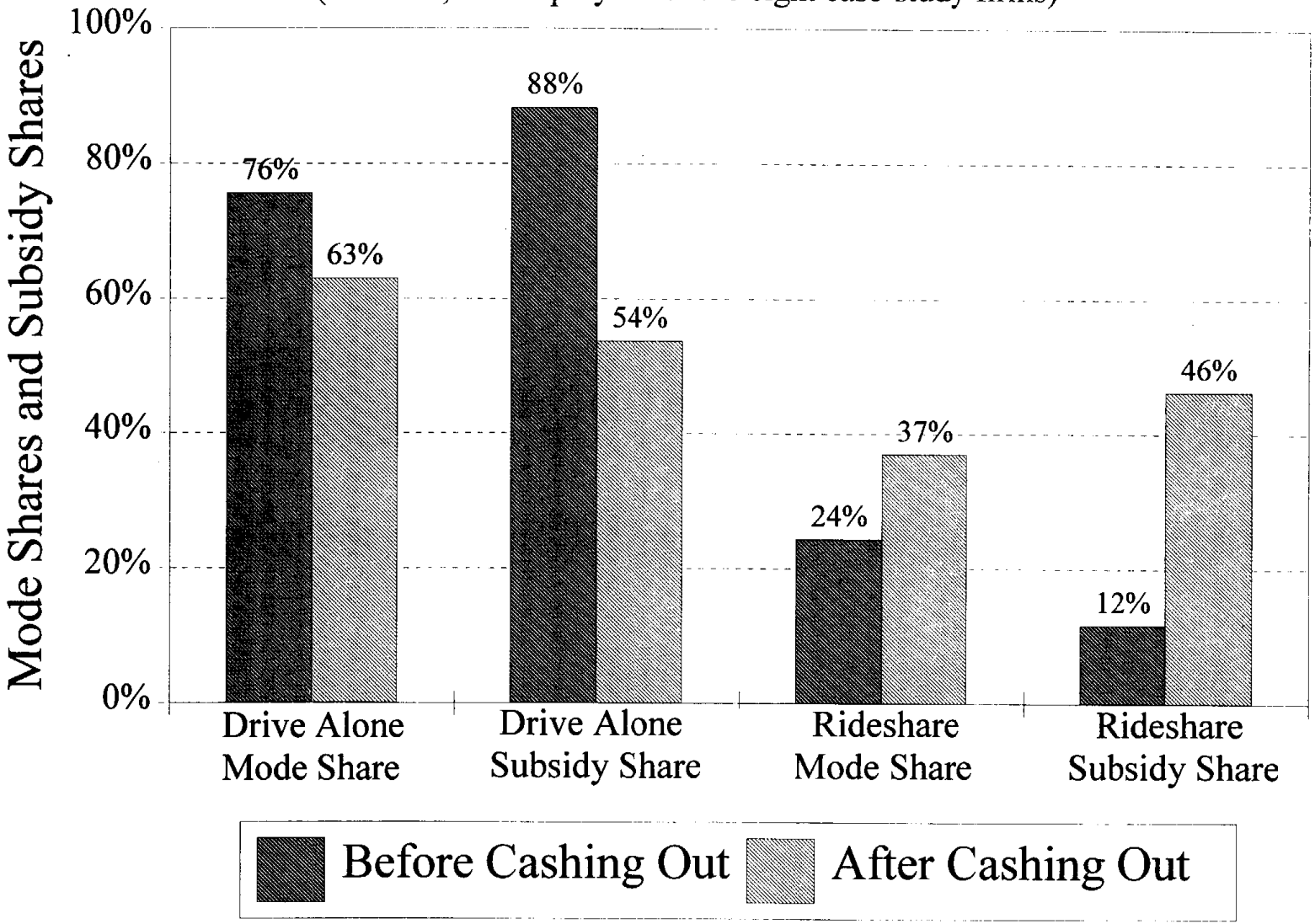
Employer-paid parking subsidizes only commuters who drive to work. Nationwide, 92 percent of non-Hispanic White households own a car, while only 81 percent of Hispanic households

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 CO_2 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

Variable Reduced	Reduction		
	Per Employee	Eight Firms	Percent Change
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.*
> *© 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	Price Elasticity of Demand
Civic Center, Los Angeles, 1969 (with/without)	40%	72%	+32%	50	78	+28	-0.22
Downtown Ottawa, Canada, 1978 (before/after)	28%	35%	+7%	32	39	+7	-0.10
Century City, Los Angeles, 1980 (with/without)	75%	92%	+17%	80	94	+14	-0.08
Mid-Wilshire, Los Angeles, 1984 (before/after)	8%	42%	+34%	30	48	+18	-0.23
Warner Center, Los Angeles, 1989 (before/after)	46%	90%	+44%	64	92	+28	-0.18
Washington, D.C., 1991 (with/without)	50%	72%	+22%	58	76	+18	-0.13
Downtown Los Angeles, 1991 (with/without)	48%	69%	+21%	56	75	+19	-0.15
AVERAGE OF CASE STUDIES	42%	67%	+25%	53	72	+19	-0.15

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 Willson (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		
	Without Cashing Out	*With* Cashing Out	Change	*Without* Cashing Out	*With* 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.

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 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 1

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

Variable Reduced	Reduction		
	Per Employee	For Firm	Percent Change
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

	Subsidy per Employee		Mode Share		Subsidy Distribution	
Commute Mode	**Free Parking**	**Pay Parking**	**Free Parking**	**Pay Parking**	**Free Parking**	**Pay Parking**
(1)	(2)	(3)	(4)	(5)	(6)	(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

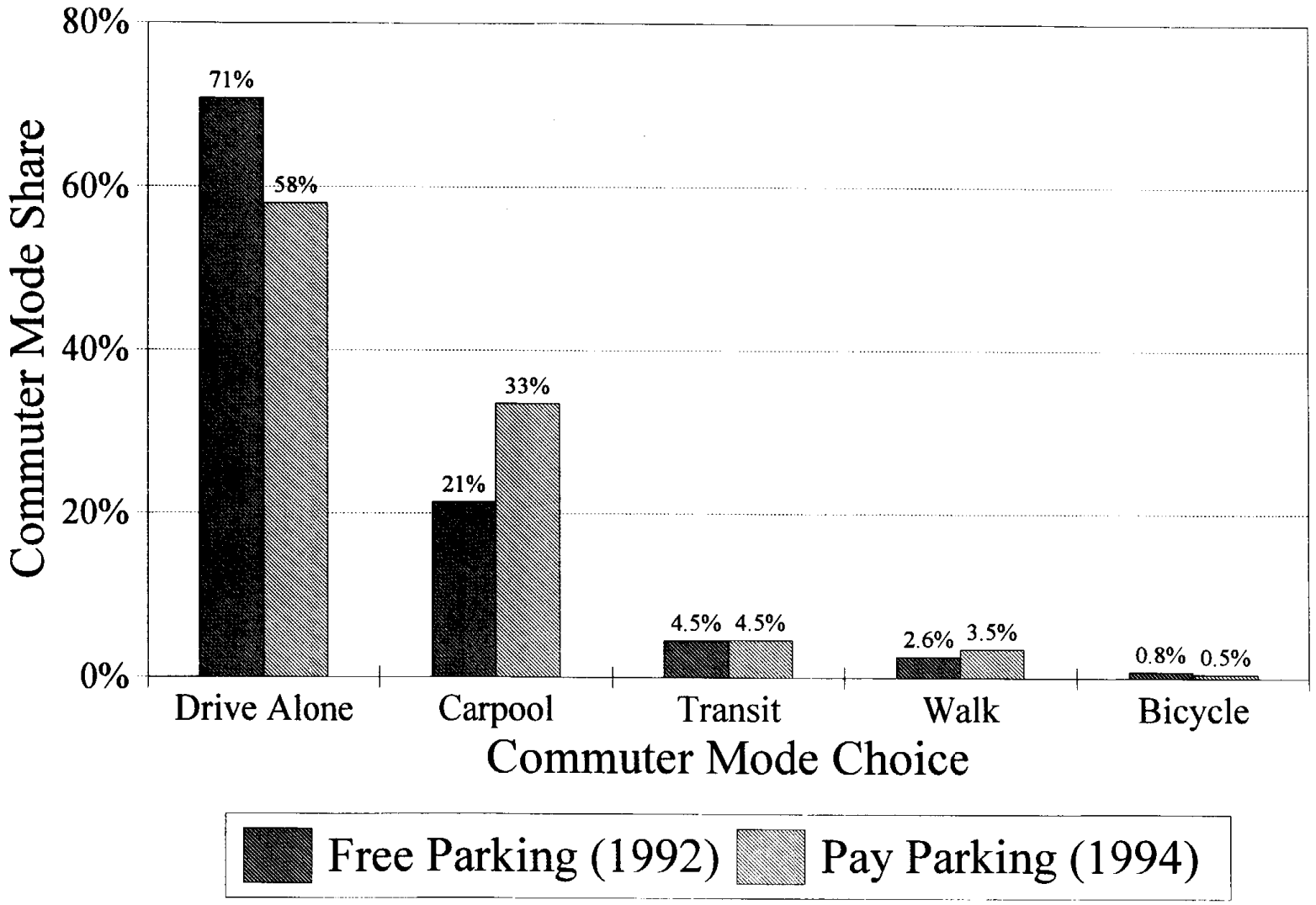


FIGURE 1-2

Commuter Mode Choices

In Southern California

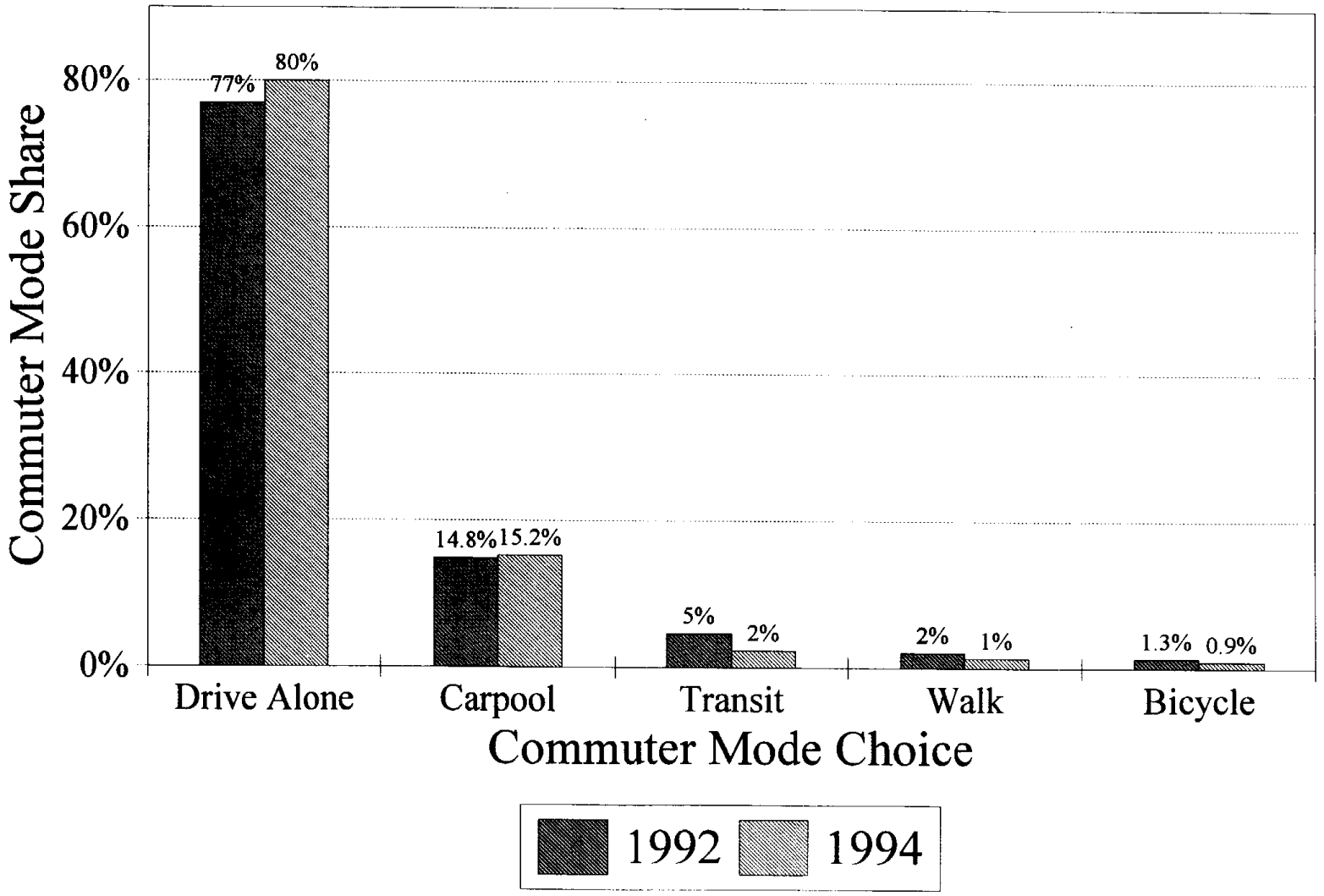


TABLE 1-3

VEHICLE TRIP REDUCTIONS AFTER ENDING PARKING SUBSIDIES

	Free Parking (1)	Pay Parking (2)	Change (3)	Percent Change (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

	Free Parking	Pay Parking	Change	Percent Change
	(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)

	Change	Percent Change
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:

	ROG	NOx	CO	PM
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 CO_2 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

		Free Parking	Pay Parking	Change	Percent Change
		(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)

Travel Mode	Subsidy per Employee	Share of Employees	Share of Subsidy	Cost To Firm
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)

Travel Mode	Subsidy per Employee	Share of Employees	Share of Subsidy	Cost To Firm
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 1

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

Italics indicates an incentive present in 1992 but not in 1994

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

	Subsidy per Employee		Mode Share		Subsidy Distribution	
Commute Mode	**Before (1991)**	**After (1993)**	**Before (1991)**	**After (1993)**	**Before (1991)**	**After (1993)**
(1)	(2)	(3)	(4)	(5)	(6)	(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) occured 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 carpoolers 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

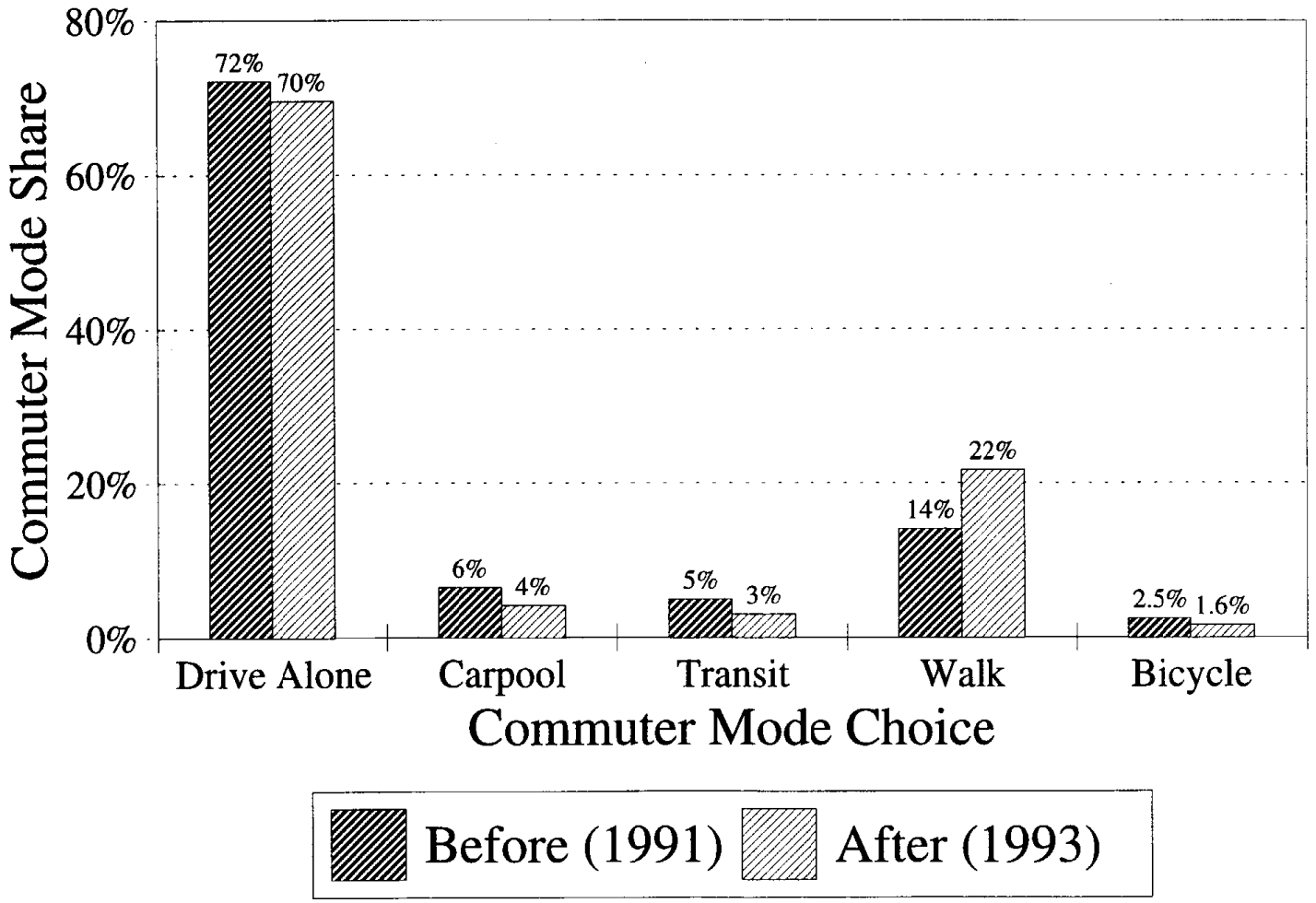
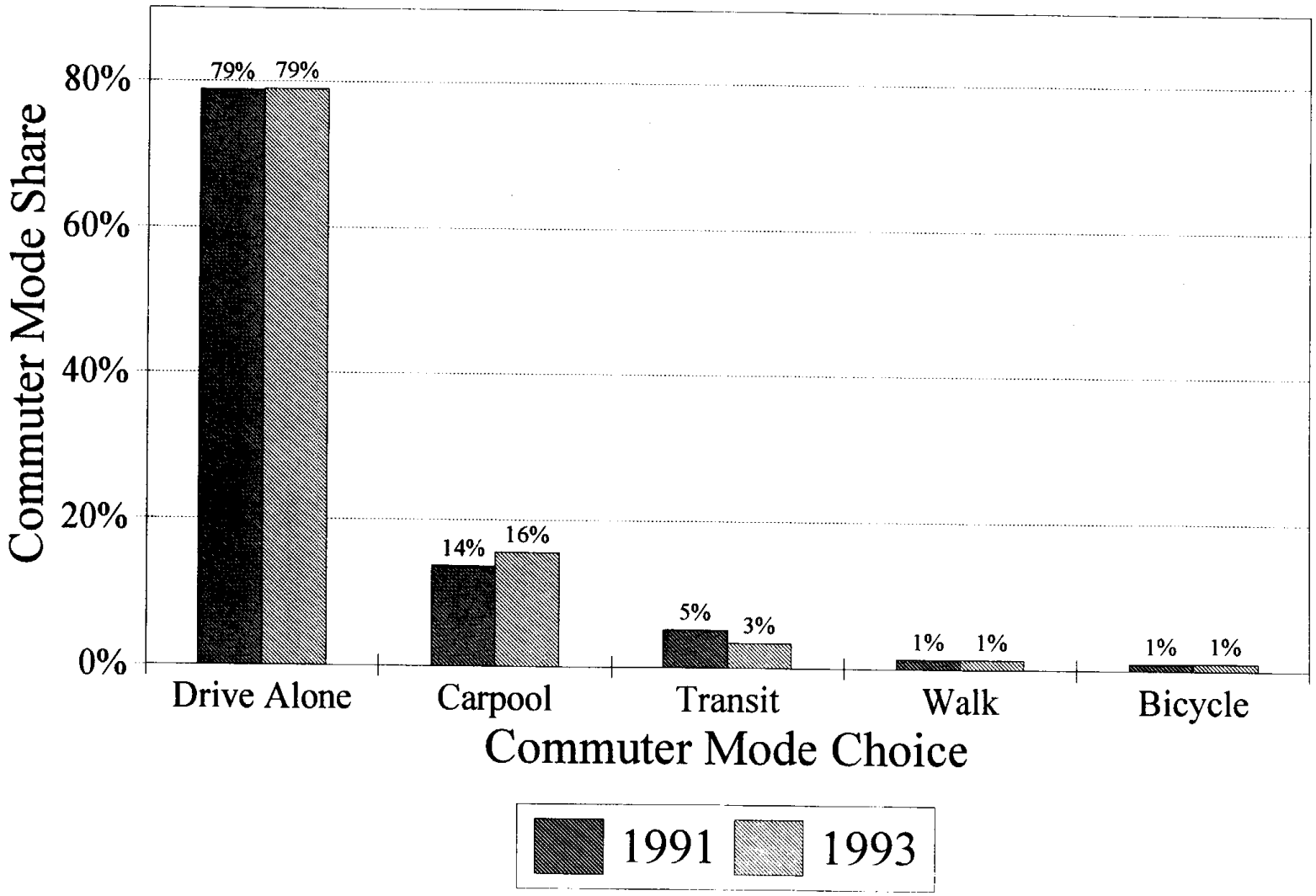


FIGURE 2-2

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

	Before (1991) (1)	After (1993) (2)	Change (3)	Percent Change (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)

	Change	Percent Change
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:

	ROG	NOx	CO	PM
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)

Travel Mode	Subsidy per Employee	Share of Employees	Share of Subsidy	Cost To Agency
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)

Travel Mode	Subsidy per Employee	Share of Employees	Share of Subsidy	Cost To Agency
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	*Parking Alternative (Partial Cash Out)*	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	*Clothes Lockers*	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 Change
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

	Subsidy Per Employee		Commuter Mode Share			
Commute Mode	**1990**	**1992 - 1994**	**1990**	**1992**	**1993**	**1994**
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Drive Alone	$100	$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

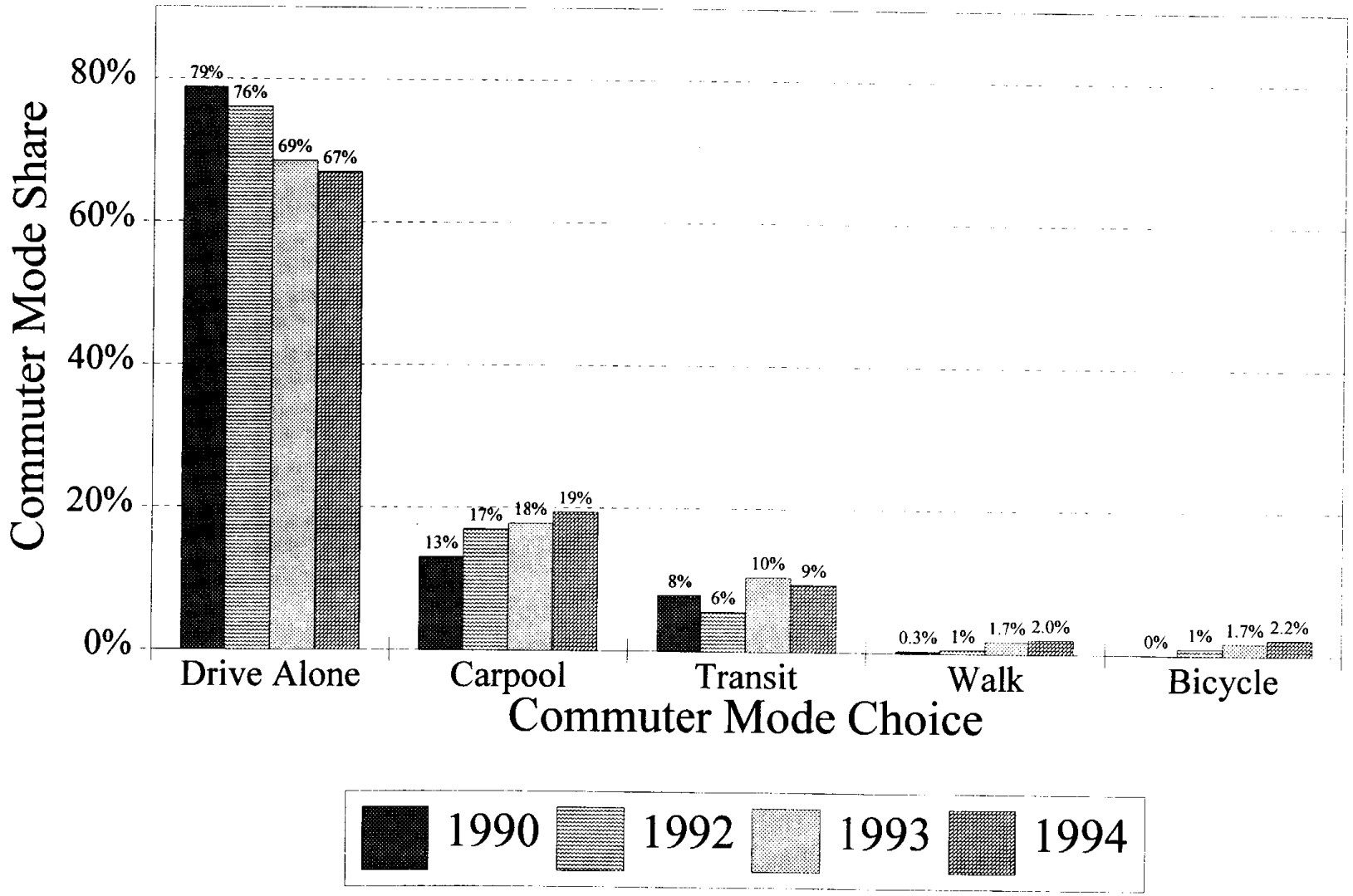
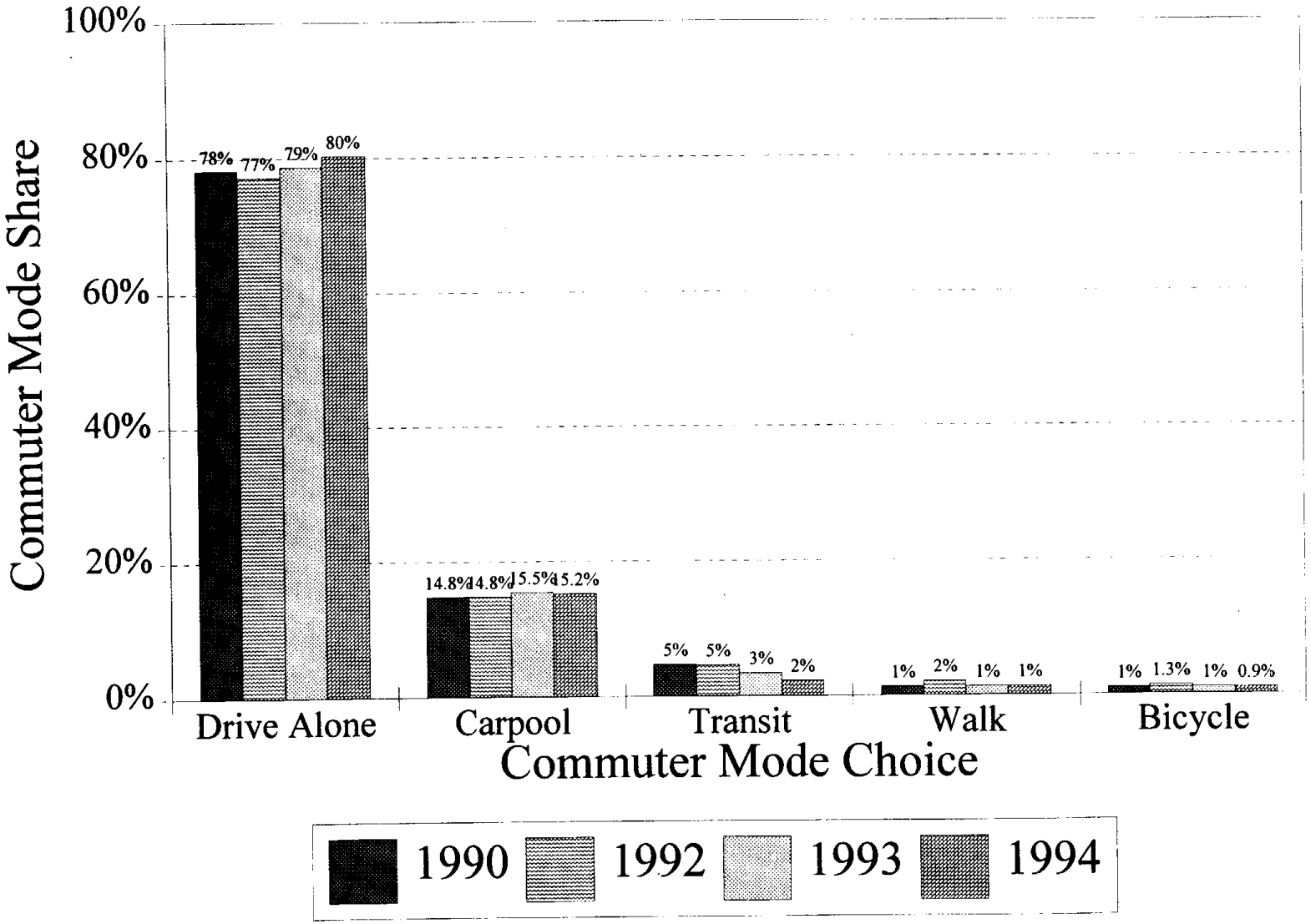


FIGURE 3-2

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 CO_2 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)

	Change 1990-1994	Percent Change
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:

	ROG	NOx	CO	PM
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

	1990	1994	Change	Percent Change
	(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)

Travel Mode	Subsidy per Employee	Share of Employees	Share of Subsidy	Cost To Firm
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)

Travel Mode	Subsidy per Employee	Share of Employees	Share of Subsidy	Cost To Firm
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	*TMA Staff Coordinators*	2	**Clean Commuter Subsidy**
3	On-Site Transportation Coordinator	3	**Cyclocommuting Club**
4	*Marketing & Promotion*	4	**Bicycle Locker Subsidy for Part Time Use**
5	TMA Commuter Center	5	TMA Commuter Center
6	*Carpool/Vanpool/Transit/Bicycle Information*	6	**Prizes and Awards/Part Time**
7	Personalized Assistance	7	Personalized Assistance
8	New Hire Orientations	8	New Hire Orientations
9	*Bus Pass Sales*	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	*Establish Vanpool and/or Express Bus Operations*	16	**TMA Membership**
17	*Tracking*	17	**Poolmatch**
18	*Bulletin Boards*	18	**The Express**
19	*Preferred Parking for Vanpools and Carpools*	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 arterials 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, 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:

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	Percent 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	Subsidy per Employee		Mode Share		Subsidy Distribution	
	Before (1992)	After (1994)	Before (1992)	After (1994)	Before (1992)	After (1994)
(1)	(2)	(3)	(4)	(5)	(6)	(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

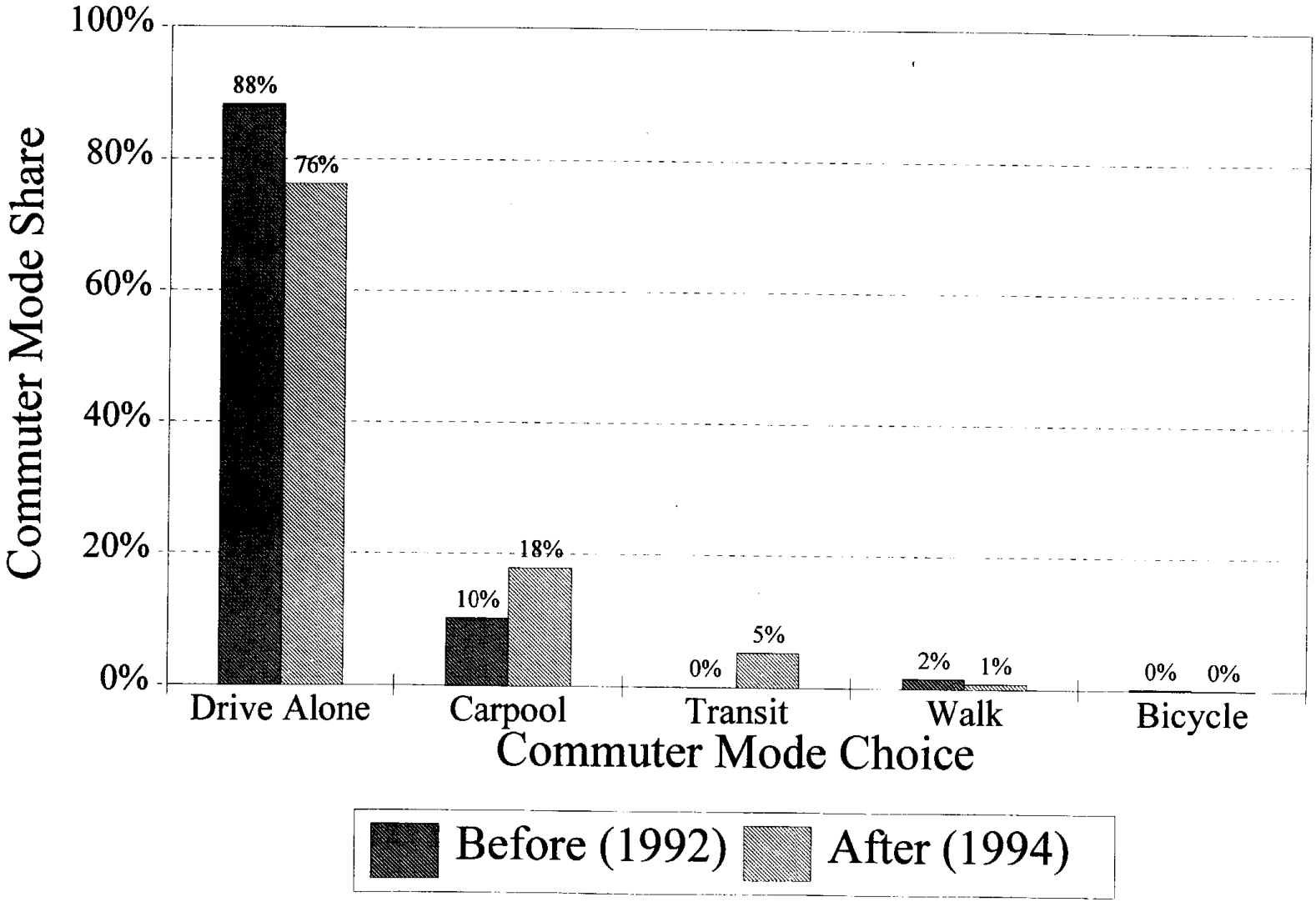
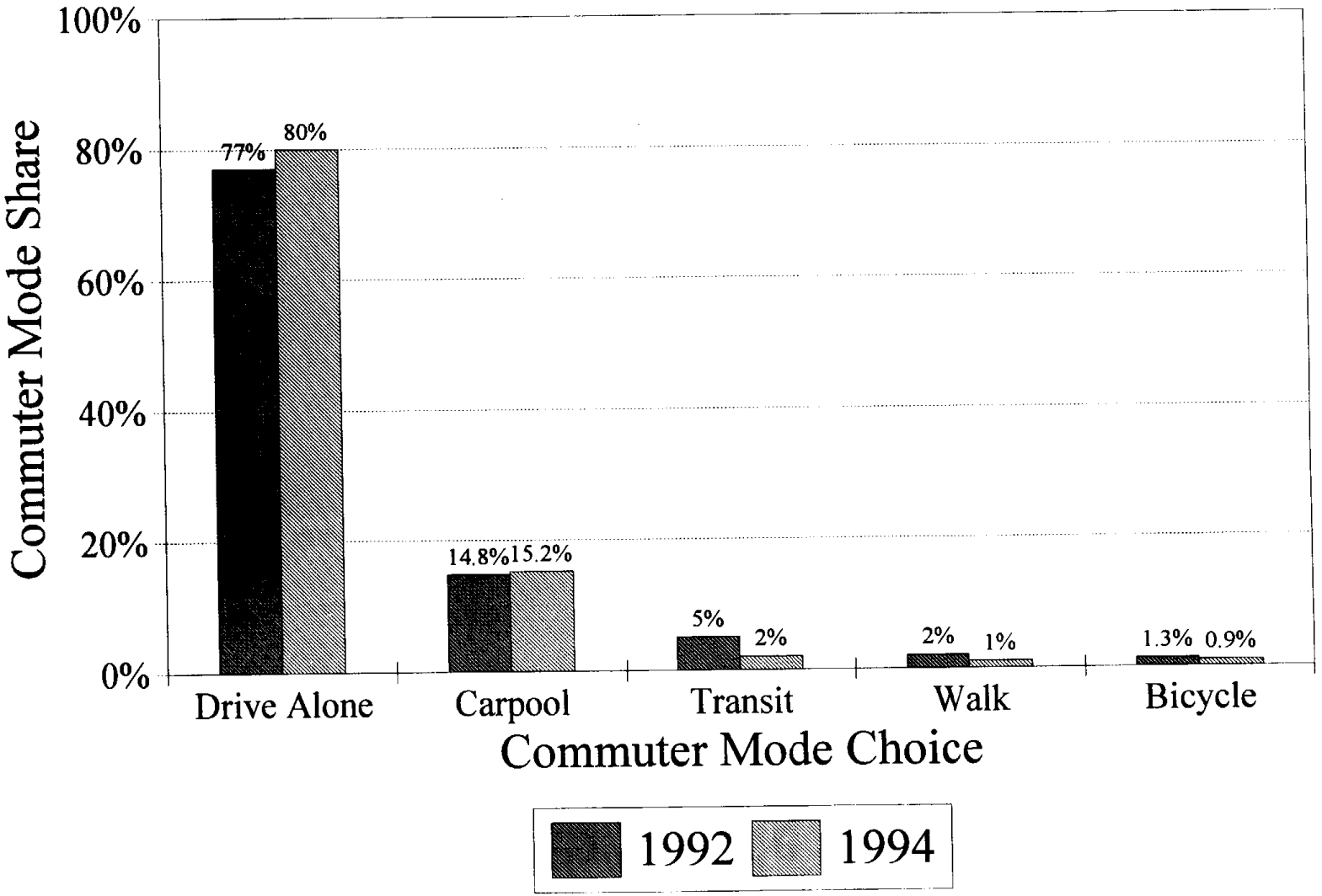


FIGURE 4-2

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 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)	After (1994)	Change	Percent Change
		(1)	(2)	(3)	(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 CO_2 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)

	Change	Percent Change
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:

	ROG	NOx	CO	PM
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

		Before (1992)	After (1994)	Change	Percent Change
		(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)

Travel Mode	Subsidy per Employee	Share of Employees	Share of Subsidy	Cost To Firm
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)

Travel Mode	Subsidy per Employee	Share of Employees	Share of Subsidy	Cost To Firm
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 CO_2 per employee per year, and reduced carbon dioxide emissions for commuting to the firm by 88,050 pounds of CO_2 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	Free Parking
2	*Travel Allowance Points Program*	**Rideshare Incentive/Cash-Out**
3	Free Transit Passes/Tokens	Free Transit Passes/Tokens
4	Vanpool Subsidy	Vanpool Subsidy
5	Prizes and Awards	Prizes and Awards
6	Guaranteed Ride Home	Guaranteed Ride Home
7	Vanpools	Vanpools
8	Mid-Day Vehicle Use	Mid-Day Vehicle Use
9	Carpool/Vanpool Staging Areas	Carpool/Vanpool Staging Areas
10	Occasional Parking for Full Time Clean Commuters	Occasional Parking for Full Time Clean Commuters
11	Bicycle Facilities	Bicycle Facilities
12	On/Near Site Amenities	On/Near Site Amenities
13	Commuter Discount Program	Commuter Discount Program
14	New Hire Orientations	New Hire Orientations
15	ADGAP Rideshare Program/Focus Groups	Focus Groups
16	*Free Car Wash*	**Clean Commuter Recognition Lunches**
17	*Preferred Parking for Vanpools*	**Zip Code of the Month**
18	*Marketing & Promotion*	**Westside RUSH Shuttle Service**
19	*Health Club Membership for Cyclists & Walkers*	
20	*TMA Membership*	
21	*TMA Commuter Center*	
22	*Carpool/Vanpool/Transit/Bicycle Information*	
23	*Personalized Assistance*	
24	*Personalized Poolmatch Information*	
25	*Transit Demonstrations and Transit Day*	
26	*Cyclocommuting Club*	
27	*Zip Code Parties*	
28	*The Commuter X-press*	
29	*Adjustable Work Hours*	
30	*Alternative Work Schedules*	

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%