Evaluating the Cost-Effectiveness of Employer-Based Trip Reduction Programs: Reviewed and Reexamined

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Crucial to the outcome of transportation demand management cost-effectiveness studies is the ability to identify both cost and effect. Unfortunately, neither element is easily identified in practice, and a definitive methodology for determining cost-effectiveness has yet to be developed. To date, three major studies have attempted to determine the cost-effectiveness of employer-based trip reduction programs using such measures as cost per employee and cost per one-way trip reduced. Each study, however, uses slightly different methodologies and assumptions and, as a consequence, arrives at different, noncomparable results. Before embarking on major new cost-effectiveness studies, it is necessary that researchers clearly understand the methodologies used in existing studies. The methodologies and results of cost-effectiveness studies by Comsis Corporation, Commuter Transportation Services, and Ernst and Young are outlined. The problems inherent in such studies are also discussed.

Throughout the United States, local and regional governments are adopting trip reduction regulations that require cities, employers, building owners, and developers to implement transportation demand management (TDM) programs aimed at reducing commute trips. TDM strategies are designed to improve the efficiency with which the existing transportation infrastructure is used by encouraging the use of high-occupancy transportation modes and alternative work schedules.

As regulating agencies increase the pressure to meet their trip reduction goals, they, in turn, are called on to demonstrate the cost-effectiveness of the strategies that they promote and enforce. As a result, recent months have seen the release of two major requests for proposals. At the federal level, TRB is sponsoring research designed to develop a procedure "to better evaluate the benefits, costs, and possible productivity gains resulting from employer-based TDM strategies; and, to provide guidance to public agencies on the system-wide costs, benefits, and other impacts necessary to stimulate and support further implementation of TDM strategies" (*1*). In the Los Angeles region, the South Coast Air Quality Management District (SCAQMD) is funding research which hopes to determine "the true cost-effectiveness of Rule 1501 (formerly Regulation XV)" (*2*).

To date, a number of studies have attempted to determine the cost-effectiveness of employer-based TDM programs. Three major studies include Comsis Corporation's work on the *Cost Effectiveness of Travel Demand Management Programs* (*3,4*), Ernst and Young's *Regulation XV Cost Survey* (*5*), and Commuter Transportation Services's (CTS) *What Price Success? Regulation XV Trip Reduction Plans: Investment Patterns and Cost Effectiveness* (*6*). Although Comsis's work is based on TDM case studies from around the country, Ernst and Young and CTS focus on employers complying with Regulation XV. Both Ernst and Young and CTS use SCAQMD's data base as a measure of effectiveness against which to analyze cost data.

Crucial to the successful outcome of such studies is the ability to identify and quantify both cost and effect. Unfortunately, however, neither element is easily identified, and a definitive methodology for determining cost-effectiveness has yet to be developed. Each of these studies use different measures, methodologies, and assumptions and, as a consequence, arrive at different, noncomparable results. Thus, while the industry waits for answers, there is a need to review the work conducted so far.

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PURPOSE

This paper outlines the methodologies and results of the three studies and outlines the problems inherent in such studies.

COMSIS CORPORATION

Evaluation of Travel Demand Management Measures To Relieve Congestion

In 1989 Comsis Corporation prepared for FHWA a study on the effectiveness of employer-based TDM measures in relieving traffic congestion. The study reviewed the experiences of 11 TDM case study programs from across the nation (*3*).

Methodology

To determine the net impact of each TDM program, the following standards were used: if possible, the program was compared with the situation before program implementation; in cases where such a comparison was not possible, the program was compared with regional averages; in some cases, instead of (or in addition to) regional comparisons, the program was compared with a control site.

The net-change attributable to TDM was expressed as the percentage reduction in one-way vehicle trips. A vehicle trip rate (i.e., 71 vehicles per 100 travelers) was calculated for each site and compared with a control site. The percentage change in the vehicle trip rate was used to represent the effect of the effect of the TDM program. For example, Company A's employees used 71 vehicles per 100 travelers whereas its control group used 86.4 per 100.

Thus the percentage reduction in vehicles in the TDM program at Company A generated was 17.8 percent ([86.4 − 71.0]/86.4). Since there are 1,000 employees at Company A, it is assumed that 178 vehicles were reduced by the TDM program (1,000 × 17.8%). However, since each employee vehicle generates a trip to and from work, the TDM program at Company A can be said to have reduced 356 vehicle one-way trips per day, 265 workdays a year.

Percentage vehicle–trip reduction estimates for the 11 cases ranged from 5.5 to a 47.6 percent, with a weighted average reduction of 20 percent. This study, however, considered only the impact of TDM and not the cost.

Cost Effectiveness of TDM Programs

In 1990 Comsis was commissioned by the Maryland–National Capital Parks and Planning Commission to extend the FHWA study to include an analysis of the cost of TDM programs. Ten of the FHWA cases were included in the cost-effectiveness study along with 2 additional cases, and 10 additional cases were added later to make a total of 22 (*4*).

Comsis's objectives were to (a) determine the total cost to operate a TDM program, (b) distinguish between direct and indirect costs and savings, and (c) determine the net cost per trip reduced. In cases where employers were unable or unwilling to supply all the information for a complete analysis, either a particular cost item was left blank or approximations were made using indirect data.

Results

The results from the 22 cases were summarized and presented at a 1-day "Implementing TDM Programs" seminar sponsored by the U.S. Department of Transportation, FHWA, FTA, and ITE in April 1993 (*7*). For each of the 22 employer-based programs, the percentage change in trip reduction, costs/savings per one-way trip, and daily net cost per employee was calculated.

The vehicle trip reduction rate for the sample ranged from a high of 47.9 percent to a low of 3.7 percent, with an average of 23 percent. In only 7 of the 22 cases, however, was the post-program trip reduction rate compared with the presituation at the same site. For these seven cases the trip reduction rate ranged from 26.1 to 3.7 percent, with an average of 14 percent—results that are less impressive than those of the sample as a whole. In 10 cases the comparison was made between each site and a control site with no TDM program, and in 5 cases the comparison was made between each site and conditions found in surrounding subareas.

Of the 22 cases, 16 employer sites reported positive costs, 3 reported negative costs, and 1 reported no costs. Twelve of the 20 sites reported cost savings. The annual net cost per employee for the 20 sites that provided cost or savings data ranged from −$533 to $480, with an average (mean) of −$12.46. This average is the mean of the individual per-employee costs, originally expressed per day, multiplied by 265 workdays (−0.047 × 265). The annual net cost for the sample as a whole (total net cost/total number of employees) is −$63.6 (−$0.24 × 265).

The net cost per one-way trip reduced for the 20 sites that provided cost and savings data range from −$3.32 to $4.99 per trip, with a mean of $0.43. The net cost per trip reduced for the sample as a whole (total cost/total trips reduced) is $0.72. Using cost data only and excluding savings, the direct cost per one-way trip reduced ranges from −$1.95 to $5.62 per trip with a mean of $1.33, whereas the cost per trip reduced for the sample as a whole is $1.22; again, no explanation is given for three employers experiencing negative costs.

It is important to note that the net cost figures reported by Comsis include, in 12 cases, cost savings resulting from the following:

1. Revenues received from the imposition of parking charges or fees, or payments from users of vanpool or other services or programs.
2. Costs avoided in supplying parking to employees, measured in terms of lot and garage space that did not have to be built or maintained, or lease payments for facilities not owned by the employer.
3. Savings resulting from the freeing of land dedicated for parking for other purposes.

The employers highlighted in the Comsis study implemented TDM programs for a variety of reasons. Three employers were under no legal requirement and did so primarily as a way of dealing with the expense or shortage of parking (or both). Six employers are located in the South Coast Air Basin and are therefore subject to Regulation XV, one is located in Ventura County and is subject to Rule 210. The remaining 10 are subject to some form of local ordinance that requires them to limit or reduce parking, implement TDM measures, or both. It must also be remembered that the sample was chosen as a series of case studies rather than as a random sample of employers subject to a specific regulation. Many of the employers were also providing TDM programs to their employee before they were regulated to do so.

In addition to presenting cost-effectiveness data, Comsis also identifies three groups that incur the costs, and benefit from the savings, of implementing or not implementing TDM: society, employers, and individual travelers. The cost to employers was outlined earlier. The cost to society of not implementing TDM can be expressed in terms of the resources needed to increase highway capacity, environmental costs, opportunity costs, wasted time and energy, and reduced productivity. Comsis uses the cost of providing additional highway capacity to illustrate the cost to society of not implementing TDM. Comsis estimates that the cost to supply the highway capacity to serve a single-occupancy vehicle for a 10.5-mi work trip is $6.75, the cost to supply the highway capacity for one transit trip is $4.10 (saving $2.65/trip), a carpool trip is $2.70 (saving $4.05/trip), and a vanpool trip is $0.56 (saving $6.19/trip).

The cost to the individual, for a similar 10.5-mi one-way trip, is estimated by Comsis to be $4.81 for a single-occupancy-vehicle trip, $1.82 for a transit trip (saving $2.99), $1.92 for a carpool trip (saving $2.89), and $0.40 for a vanpool trip (saving $4.41). Comsis summarizes the "compelling economics of TDM" as follows:

Cost or Saving	*Per Trip ($)*
Savings to society	2.65 to 6.19
Cost to employers	−3.32 to 4.99 (average 0.43)
Savings to individuals	2.99 to 4.41

ERNST AND YOUNG

Regulation XV Cost Survey

Ernst and Young was retained by SCAQMD in early 1992 to estimate the annual costs incurred by employers complying with Regulation XV and to estimate the change in employee commute trips associated with those costs. A cost survey was sent to 5,763 regulated work sites and 1,094 surveys were returned—a response rate of 19 percent. Of the 1,094 work sites, 588 had filed their first update (second) trip reduction plan, and 189 had filed their second update (third) plan.

Methodology

Regulated companies were asked to provide cost data for the following cost categories: employee transportation coordinator (ETC) training, plan implementation and maintenance costs (including office space, marketing, facility improvements, incentive costs, and revenues from reduced parking spaces/increased parking charges), and other costs. Unlike Comsis's study, no significant savings data, such as reduced capital expenditure, were included. The self-reported costs were also not audited for accuracy. To measure effect, Ernst and Young used average vehicle ridership (AVR), the ratio of employee commute trips to vehicles arriving at the work site during the survey period. AVR is the primary measure used by SCAQMD to measure the progress of regulated employers.

Several reasons were given as to why the results of the survey may not accurately reflect Regulation XV costs:

1. The survey respondents may have been those at sites experiencing the highest costs and that are therefore most concerned about the regulation.
2. ETCs may have overlooked or overstated some of the costs.
3. Some sites may have offered commute assistance to employees before the regulation and may have included these costs in their estimates.

Although the number of work sites submitting plans declined with each round of updates, Ernst and Young assumed that those respondents that had completed their second update (third) plans were representative of those that had not yet done theirs. These average AVRs were extrapolated to the entire district and, on the basis of experiences of the sample, the number of vehicle trips that will have been eliminated once all the currently regulated employees have progressed to their second update plans was calculated.

Results

Costs

For the 1,094 work sites returning surveys, the total cost of complying with Regulation XV was estimated to be $30,756,402. The cost per regulated employee (i.e., per employee arriving at the work site between 6 and 10 a.m.) for the sample as a whole was estimated to be $105. This was calculated by dividing the total cost by the total number of regulated employees and is not an average of the individual cost per employee figures for the 1,094 sites. The cost distribution of the individual per-employee costs, however, was negatively skewed with 121 work sites spending less than $25/employee, 299 spending between $100 and $200, and 24 spending more than $500.

The annual cost of $105 per employee for the sample as a whole was extrapolated to the total number of "6 to 10" employees in the district, and the total cost of the regulation was estimated to be $162 million/year. This cost estimation, however, assumes that the cost is divided only among those employees who report to work between 6 and 10 a.m. In many cases, however, many employers extend their commute benefits to all employees. The cost per regulated and nonregulated employee for the sample as a whole would be $81/employee. Comsis and CTS used every employee at the work site as the basis for their per-employee costs.

The mean cost per employee is $128 (the sum of the individual per-employee costs divided by 1,094), and the median cost is $88/employee. Thus, depending on the average chosen to extrapolate from, the annual cost of Regulation XV can range from $136 million to $197 million. As noted, Ernst and Young used the per-employee cost for the sample as a whole to arrive at its annual cost of $162 million.

AVR

The average AVR (total number of employees/total number of employee trips) for the 1,094 employers with initial (first) plans filed was found to be 1.20. The average AVR for the 588 employers with update (second) plans filed was found to be 1.24; the average AVR for the 189 employers with second update (third) plans filed was found to be 1.31. To calculate the average AVR for the entire sample at each plan stage, the total number of "6 to 10" employees was divided by the total number of vehicles.

Ernst and Young extrapolated the AVR data from the sample to the entire regulated community and estimated that there will be a decrease of 41,420 vehicles from initial to first update plans (a reduction of 3.2 percent) and an estimated 66,399 reduced from first to second update plans (a reduction of 5.3 percent) by the time all the currently regulated sites have completed their second update plans (a total of 107,819 vehicles or vehicle round trips).

Ernst and Young also estimated that removing the 107,819 round trips in 2 years will cost employers $323 million (2 $162 million). Thus, attributing the entire change in employee travel behavior to Regulation XV, the average annual cost of reducing one vehicle round trip is $3,000 ($323 million/107,819 round trips). Assuming that each employee makes a trip to and from work, the average annual cost per one-way trip reduced would be $1,500. This, however, is the cost of reducing one commute trip every workday for a year. The cost per daily one-way trip would therefore be $5.66 ($1,500/265 workdays). Using a total annual cost extrapolated from the mean or the median cost per employee, however, would result in costs per trip reduced per day of $6.89 and $4.75, respectively. Again, these figures do not take into account any trips outside of the "6 to 10" window that might have been reduced but that were not recorded in AVR surveys.

Analysis of SCAQMD's data base by CTS in March 1993, however, found that for the 1,327 work sites that had submitted second update (third) plans, the average number of regulated employees per site had declined by the first update (second) plan to 94 percent average number in the initial (first) plan; by the second

update (third) plan, the number had declined to 92 percent of the regulated employees in the initial (first) plan. These figures indicate that the number of regulated employees has not remained constant, and thus the "per-employee cost" of Regulation XV will vary according to the employee base used.

Follow-Up Study

SCAQMD, concerned with the wide variance in annual per-employee costs (from less than $25 to more than $750), asked Ernst and Young to select 20 of the 1,094 companies (1.8 percent) for further clarification of their survey responses. Ten companies were chosen from the top 50, five from the bottom 50, and five from the middle (those spending about $105/employee. On-site interviews were conducted at 17 companies; 11 were at the high end of the cost range, 3 at the bottom, and 3 in the middle.

Ernst and Young found that 10 of the companies had overstated their costs (*8*). Nine of these fell in the high cost range. Verified cost data were consistent with the data reported in the original cost survey at six sites, and one site had underestimated its costs. For the nine companies that overestimated their costs, the degree of overestimation ranged from 9 to 79 percent. The two most stated reasons for overstatement were that the reported costs related to all employees and not just regulated employees, and that the summary section of the survey (the primary source for raw data) was often completed incorrectly. As noted, at no stage during the original study were the cost data checked or verified for accuracy.

Even though the follow-up study cast serious doubt on the integrity of the original study, no attempt was made by Ernst and Young or SCAQMD to calibrate the original cost data. Legitimately, this would not have been sound because the follow-up sample size was only 1.6 percent of the original sample and because the distribution of the sample bore no relationship to the cost distribution of the original sample. In essence, the results of the original study were negated without revised results being put forward.

COMMUTER TRANSPORTATION SERVICES, INC.

What Price Success? Regulation XV Trip Reduction Plans: Investment Patterns and Cost Effectiveness

In 1991 CTS was the first to analyze SCAQMD's Regulation XV data base in relation to the cost of compliance. The objectives were to attempt to (a) determine the level of investment that an employer would need to make in order to be successful in their effort to increase average vehicle ridership and (b) identify the TDM strategies that appeared to produce the greatest return on investment.

Methodology

The 769 employers that had submitted initial (first) and first (second) update trip reduction plans to SCAQMD as of April 1991 were ranked in order of success. Success was measured in terms of increase in AVR. The 65 top-ranking CTS clients were identified and surveyed by CTS to determine plan implementation costs. Completed cost surveys were returned by 37 companies (57 percent), and follow-up telephone calls were made to confirm the data. Data were collected for the following cost categories: ETC salary, guaranteed ride home, marketing, facility improvements, parking management, company vanpool, indirect incentives (prizes, benefits, and services), and direct incentives (subsidies). Like Ernst and Young, CTS did not include savings from reduced capital costs, such as savings from not having to build additional parking spaces.

Each of the 37 employers in the study was very successful in increasing AVR from its initial to first update plan. The purpose of the study was to determine how much it costs to be "successful" and not how much it costs the average employer, regardless of success, to operate a TDM program. The AVR calculation includes "nonresponses," which are automatically treated as single-occupancy vehicles, and compressed workweek and telecommuting responses, which are treated as no vehicles. This means that a difference in the nonresponse rate from one plan to the other can positively or adversely affect AVR without there actually being any change in driving behavior. Alternative schedule responses also raise AVR without, in these 37 cases at least, there being any cost associated with them.

Thus, to analyze cost in relation to AVR change, a modified AVR (MAVR) was calculated that excluded nonresponses and alternative schedule responses. The MAVR also corrected for inconsistencies in the reporting of car and vanpool size by assuming that all carpools carried 2.5 persons and all vanpools 10.5 persons.

Results

The most successful employer succeeded in raising its MAVR by 56 percent; the least successful experienced a reduction in MAVR of 2 percent (the increase in AVR was primarily accounted for by alternative schedules). The average annual investment per transportation program, as reported by the 37 employers, was $29,000, with a range from $1,500 to $133,400. Investment per employee for each of the 37 employers was also calculated, using the average number of workers at the site during the period and not only the number of regulated employees as per updated plan. The per-employee cost was found to range from $6 to $450. The average (mean) of the 37 cost-per-employee figures was found to be $70 (the sum of the individual per employee costs at Sites 1 through 37 divided by 37). The cost per employee for the entire sample, calculated by dividing the total cost by the total number of employees, was $57, whereas the median per employee cost was $32. Unlike Ernst and Young's study, however, the choice of an "average" was not so critical for CTS since no attempt was made to extrapolate the results.

Analysis of MAVR relative to investment found there to be no relationship between the variables. In other words, big spenders did not necessarily achieve large increases in AVR, and low spenders were not necessarily low achievers. This finding may disappoint those who are looking for a formula for success or for an answer to the question of how much they need to spend, but it is good news for those willing and able to experiment and find out what works best and costs the least for them. Analysis of investment in any one incentive and change in MAVR also did not reveal any relationships. This finding is consistent with Comsis's work for SCAQMD that, with analysis of 5,000 employers in the SCAQMD data base, could not isolate the factors that ex-

plain change in commute behavior or assess the impact of any one incentive (*9*).

CTS's original study did not provide a cost per trip reduced; however, reanalysis of CTS's data found the average cost per one-way trip reduced for the 37 employers was $397 for the sample as a whole with a range from $33 to $4,785. The mean cost per trip reduced, however, was $431. As noted, however, unlike Comsis's costs and like Ernst and Young's, these figures do not include cost savings that may result from reduced capital expenditure.

PROBLEMS INHERENT IN CONDUCTING COST-EFFECTIVENESS STUDIES

As one would expect, the primary difficulties in conducting cost-effectiveness studies are, first, isolating cost and effect and, second, determining causal relationships between the two. The studies have illustrated that there are a number of ways to collect and treat cost data and a number of ways to measure effect. The following section seeks to outline some of the inherent difficulties involved in collecting and analyzing cost and effect data and in determining cost-effectiveness.

Determining Cost

The primary difficulties in determining the cost of individual employer-based vehicle trip reduction programs and strategies are as follows:

- Often little or no cost data are available.
- It is often difficult to determine when, and over how long a period, an expense was incurred and, in the case of capital expenditures, to determine the rate of depreciation.
- The costs and savings categories vary from employer to employer and study to study.
- Some costs, such as administrative costs and staff time, are difficult to determine.
- Many costs are buried in corporate overhead and are difficult to quantify.
- The cost of any one incentive is difficult to determine because the cost of marketing and administration is difficult to apportion.
- Some expenditures may not be entirely TDM-related.
- The same strategies can be offered at different costs by different employers.
- The marginal cost of reducing one additional employee trip can be greater than the reward that the employee actually receives.

Determining the aggregate cost of employer-based trip reduction programs, or determining the cost of a particular regulation, is also problematic for the following reasons:

- When a sample is used to extrapolate costs, the sample may not represent the whole.
- The estimated cost of a strategy varies according to the "average" used. For example, the average cost for the sample as a whole can be different from the mean of the costs of the individual programs, which in turn can be different from the median or mode.

Determining Effect

The primary problems inherent in determining the effect of employer-based TDM programs or strategies are as follows:

- There are a number of ways to measure effect (e.g., number of trips reduced, vehicle miles reduced, pounds of pollutants reduced), and each one requires different data.
- To measure the effect of a particular program or strategy, a base level must be determined. This requires that comparable, accurate pre-data or a suitable control be available.
- The effects of individual strategies are difficult to isolate from overall effect.
- An effect may be measured but it is often difficult to determine what caused it; for example, many factors, in addition to the program itself, can influence employee travel behavior.
- Some incentives, such as a guaranteed-ride-home program, may be necessary to encourage employees to take advantage of other incentives, but they may not directly cause behavior change.

Determining Cost-Effectiveness

The primary measures used to assess the cost-effectiveness of employer-based trip reduction programs are cost per employee and cost per trip reduced, and, as noted, there are a number of problems inherent in determining cost, number of trips reduced, and number of employees to use as basis for per-employee costs.

Cost-effectiveness can also be measured in several ways—for example, cost per pound of pollutants reduced or cost per vehicle mile reduced. To make these assessments, however, data such as trip length, number of cold starts, and make, model, and year of car must be known for each employee. The cost-effectiveness of Regulation XV, since its primary purpose is to improve air quality, should probably be measured in terms of pounds of pollutants reduced but, as yet, the necessary data do not exist.

Cost-effectiveness is also a relative term in the sense that a particular strategy is only more or less cost-effective when compared with another. Unfortunately, however, even if it is determined that a particular strategy is less cost-effective than another, it does not necessarily follow that the less cost-effective measure should be abandoned because it may target areas, individuals, or organizations that are not covered by the other measure; a variety of measures are often needed to address the same issue. The most cost-effective strategy may also not be the most politically acceptable.

Cost-effectiveness figures also assume that the expenditure is responsible for the effect. In reality, one cannot necessarily assume that money alone is responsible for a particular result. Lopez-Aqueres identifies "program resources" as only one variable in a myriad of dependent and independent variables that can affect the outcome of a trip reduction program (*10*). Other variables include

- Public policy factors: federal and state income tax codes, labor legislation, public transportation system, land-use regulations, federal and state gasoline taxes, and education;
- Employer factors: management commitment, program incentives/disincentives, labor-management agreements, work site location, and employer size;
- Employee characteristics: personal values, occupation, commute distance, and household characteristics; and

- Travel mode characteristics: travel cost, travel time, convenience, comfort, privacy, and safety.

Thus, it appears that further analysis of TDM cost-effectiveness should consider these factors. The determination of the relative weight of each variable, however, requires that the relative importance of each variable be known—which, as yet, is not.

Finally, even if these difficulties could be overcome and satisfactory cost-effectiveness figures arrived at, there would remain one problem: cost-effectiveness figures can always be "massaged" to prove almost any point. Including or excluding social costs, for example, is a classic strategy for dramatically increasing or decreasing the cost-effectiveness of a particular strategy.

Despite inherent problems, the need to evaluate the cost-effectiveness of employer-based trip reduction programs remains, and efforts to do so continue. Thus, while this paper highlights difficulties in conducting such studies, it is not meant to discourage future work; instead, its purpose is to encourage future research by providing an overview of the work conducted so far and highlighting the critical issues and problems to be addressed in future research.

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REFERENCES

1. *Cost-Effectiveness of TDM Strategies.* Request for Proposals. TRB Cooperative Research Programs, Washington, D.C., 1992.
2. *Evaluation of the Effectiveness of Amended Rule 1501.* Request for Proposals. South Coast Air Quality Management District, Diamond Bar, Calif., May 1993.
3. Comsis Corp. *Evaluation of Travel Demand Management Measures to Relieve Congestion.* FHWA-SA-90-005. FHWA, U.S. Department of Transportation, Feb. 1990.
4. *Cost-Effectiveness of Travel Demand Management Programs.* Comsis Corp., Silver Spring, Md., May 1990.
5. *SCAQMD Regulation XV Cost Survey.* Ernst and Young, Irvine, Calif., Aug. 1992.
6. Stewart, J., and R. Young, et al. *What Price Success? Regulation XV Trip Reduction Plans: Investment Patterns and Cost-Effectiveness.* Commuter Transportation Services, Inc., Los Angeles, Calif., 1992.
7. Comsis Corp. *Effective Travel Demand Management Measures Part III: Synthesis of Findings.* Course material for "Implementing TDM Programs," an ITE Educational Foundation Seminar, 1992.
8. *AQMD Survey Follow-Up.* Ernst and Young, Irvine, Calif., Nov. 1992.
9. *Development Tools for Phase II Regulation XV Ministerial Plan Review Process: Status Report.* Comsis Corp., Los Angeles, Calif., Oct. 1992.
10. Lopez-Aqueres, W. A Conceptual Framework To Study the Effectiveness of Employer Trip Reduction Programs. Presented at 72nd Annual Meeting of the Transportation Research Board, Washington, D.C., 1993.

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