Title
Responding to Congestion and Traffic Growth: Transportation Demand Management

Permalink
https://escholarship.org/uc/item/2tb1g8nm

Authors
Giuliano, Genevieve
Wachs, Martin

Publication Date
1992
Responding to Congestion and Traffic Growth: Transportation Demand Management

Genevieve Giuliano
Martin Wachs

Reprint
UCTC No. 86
The University of California
Transportation Center

The University of California Transportation Center (UCTC) is one of ten regional units mandated by Congress and established in Fall 1988 to support research, education, and training in surface transportation. The UC Center serves federal Region IX and is supported by matching grants from the U.S. Department of Transportation, the California Department of Transportation (Caltrans), and the University.

Based on the Berkeley Campus, UCTC draws upon existing capabilities and resources of the Institutes of Transportation Studies at Berkeley, Davis, Irvine, and Los Angeles; the Institute of Urban and Regional Development at Berkeley; and several academic departments at the Berkeley, Davis, Irvine, and Los Angeles campuses. Faculty and students on other University of California campuses may participate in Center activities. Researchers at other universities within the region also have opportunities to collaborate with UC faculty on selected studies.

UCTC's educational and research programs are focused on strategic planning for improving metropolitan accessibility, with emphasis on the special conditions in Region IX. Particular attention is directed to strategies for using transportation as an instrument of economic development, while also accommodating to the region's persistent expansion and while maintaining and enhancing the quality of life there.

The Center distributes reports on its research in working papers, monographs, and in reprints of published articles. It also publishes Access, a magazine presenting summaries of selected studies. For a list of publications in print, write to the address below.

University of California
Transportation Center

108 Naval Architecture Building
Berkeley, California 94720
Tel: 510/643-7378
FAX: 510/643-5456

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the U.S. Department of Transportation. This report does not constitute a standard, specification, or regulation.
Responding to Congestion and Traffic Growth: Transportation Demand Management

Genevieve Giuliano
School of Urban and Community Planning
University of Southern California
Los Angeles, CA 90089-0042

Martin Wachs
Graduate School of Urban Planning
University of California at Los Angeles
Los Angeles, CA 90095-1467

Reprinted from
Growth Management and Sustainable Development
1992

UCTC No. 86
The University of California Transportation Center
University of California at Berkeley
INTRODUCTION

American attitudes toward transportation planning have undergone significant change. For three decades after World War II, public policy emphasized construction of new highway and transit facilities to remove the backlog of needs resulting from the combined effects of depression, a war economy, and postwar economic expansion, suburbanization, and accelerating automobile ownership. There was consensus among transportation policy makers that their primary goal was to accommodate growth by constructing facilities which would have adequate capacity to handle future demand. There was also consensus that providing adequate capacity was an achievable goal. It was understood that land use patterns and economic development were the sources of traffic, yet there was general agreement that transportation policy should aim to accommodate rather than regulate or control land use and economic growth.

In the decade of the 1980’s the policy goal of accommodating traffic demand appeared less and less viable. Continued (and in some areas explosive) urban growth and automobile use without any corresponding increase in highway transportation facilities has led to unprecedented levels of traffic congestion in many metropolitan areas (Hanks and Lomax, 1991). Rising traffic congestion has as a result become a major public policy issue and a primary target for anti-growth activists.

The lack of investment in new highway facilities over the past decade reflects a fundamental change in public attitudes. No longer is there a consensus for highway expansion. Rising costs and shrinking public budgets have made major projects financially infeasible. Environmental coalitions and community interest groups have become
increasingly effective in opposing new highway construction. Consequently, policy makers now often argue that "we can't build our way out of our transportation problems," and that attempting to accommodate growth solely by increasing transportation system capacity imposes more costs than benefits on affected communities.

Transportation demand management, or TDM, has emerged as a policy of choice for responding to growth and traffic congestion problems. TDM is aimed at reducing congestion by reducing or restricting travel demand, rather than by providing more transportation facilities. It includes strategies such as shifting solo drivers to carpool or transit, allowing more employees to work at home, or adjusting work schedules to avoid peak period auto travel. The remainder of this chapter will discuss the development of TDM policy, present some examples of TDM efforts and evaluate the potential role of TDM in growth management policy.

DEVELOPMENT OF TDM POLICY

The historical roots of TDM may be traced at least to World War II, when company buses, carpool and staggered work shifts were used to attract employees and manage on-site congestion problems. In the 1970's the combination of budget constraints, energy crisis and environmental concerns prompted policy makers to focus on increasing the efficiency of the transportation system. These efforts, termed "transportation system management" or TSM included both supply and demand side strategies such as traffic signal synchronization, or reserved lanes for carpool and other "high occupancy" vehicles, as well as carpool matching services, employer-sponsored vanpools, and other incentives to ridesharing. The voluntary,
employer-based program became the model for TDM programs as they emerged in the early 1980's.

By the end of the decade, however, both the expectations and the structure of TDM programs and policies had changed dramatically. TDM programs are now typically mandatory rather than voluntary, and often incorporate specific performance (trip reduction) objectives. They are mandated by means of conditions on development, local ordinance or state law. TDM programs also now often cover many firms (e.g. all future employers in a specific development project) and sometimes large geographic areas.

**SOME WEST COAST EXAMPLES OF TDM PROGRAMS**

Some examples of TDM programs implemented in California will help to illustrate the scope and expectations of current TDM program efforts.

1. **Trip Reduction to Mitigate New Development.** Several large new development projects have been conditioned with specific trip reduction requirements. The Pleasanton Ordinance is one of the first, having been enacted by local referendum in late 1984 (Cervero, 1989, p. 156). Its purpose is to reduce the traffic impacts of Hacienda Business Park, a planned industrial/office park that is expected to have an employment base of 37,000. The ordinance calls for a gradually increased percentage reduction of peak vehicle trips as the project develops. If these trip reductions are not met, the City can withhold approval of later phases or withdraw the project's conditional use permit.

   More extensive is the City of Los Angeles' Traffic Reduction and Improvement Program (TRIP) Ordinance. The ordinance allows the City to designate "traffic impact areas." Such designation invokes special land use controls and development impact fees. It
also requires the development of a local transportation specific plan for the impact area. These plans typically require new non-residential development to 1) take action to reduce the afternoon peak hour trip generation of the project by at least 15% (for example, by offering vanpool and carpool programs, or subsidizing the purchase of monthly transit passes for employees while reducing on-site parking), and 2) to pay a one-time fee per remaining unmitigated afternoon peak-hour trip produced by the project. The fee is deposited in a trust fund which is specific to each impact area and which must be used for the construction of traffic improvement projects identified in the impact area’s transportation specific plan. Projects which qualify for funding may include street and highway improvements and transit capital investment projects.

2. **Trip Ceiling on New Development.** Another growth management strategy is to base development approval directly on peak period trip generation, rather than on development intensity (for example, FAR). The City of Irvine used this approach in approving the Irvine Spectrum, a large multiphase planned industrial/office project with an expected employment base of 150,000. Development conditions required formation of a Transportation Management Association by the landowner/developer, to which all employers in the project must belong. Its purpose is to promote ridesharing and thus reduce peak traffic. A fixed trip generation ceiling is placed on the project, and additional development can be approved only if 1) the trip ceiling is not exceeded, or 2) additional road capacity can be provided. Since an extensive list of road improvements is already incorporated in the development conditions, it is unlikely that additional capacity improvements are possible. Thus the magnitude of the development ultimately depends on the success of the TDM program.
3. **Trip Reduction for Air Quality.** Environmental concerns have once again begun to motivate transportation policy. In this case, the air pollution generated by traffic congestion in the Los Angeles metropolitan area is a major concern. The South Coast Air Quality Management District issued Regulation XV in July 1988 as part of a long range plan to achieve Federal clean air standards by 2010. It established vehicle occupancy requirements that must be met by all work sites at which there are 100 or more workers employed by the same organization. The Regulation affects the entire South Coast Air Basin. An estimated 9,000 companies employing 3.8 million workers are subject to the Regulation. The "average vehicle ridership" (AVR) goals range from 1.3 in the outlying areas of the region to 1.75 in downtown Los Angeles. Employers must develop and implement a plan for achieving these goals within one year. If the goal is not achieved in one year, a more effective plan must be implemented. Enforcement is at the stage of plan approval; employers are subject to fine should they not comply with procedural requirements or if their plan is not approved, but not if they fail to meet the AVR goal.

4. **Land Use Controls to Redistribute Travel Demand** Another growth management strategy which is increasingly being utilized is to change zoning to control density in an effort to affect traffic generation. In some instances "upzoning" is being used to concentrate new development in the vicinity of transit routes so that public transit becomes a more viable mode. In other instances, "downzoning" is being used to reduce the intensity of land use in an effort to reduce trip generation in congested corridors. In 1986, for example, the voters of the City of Los Angeles approved a measure entitled "Proposition U." The Proposition reduced allowable development on most land zoned for commercial development, but
specifically exempted certain designated high-density centers which are planned to be served by rail mass transit. The downzoning reduced allowable development by halving the maximum floor area ratio from 3:1 to 1.5:1 along major arterials in Los Angeles which were located outside of the designated centers. The objective of the Proposition is to concentrate growth where mass transit can accommodate the increased travel demand and limit growth where additional road or transit capacity is not available. Many critics argue, however, that simply redirecting growth to other areas may in fact have little noticeable effect on traffic congestion in Los Angeles.

WHY TDM?

This brief list illustrates both the scope and ambitious goals of TDM policies, and leads to some obvious questions. What accounts for the dramatic policy changes that have taken place? Why has TDM become such an important part of transportation policy? There are several explanations.

Other Alternatives No Longer Available

The magnitude of congestion in major metropolitan areas of the U.S. is so large that traditional solutions are either financially or practically infeasible. In Southern California, for example, studies conducted by the regional planning agency estimated that, given constant travel demand characteristics, even if every conceivable addition of infrastructure were made (at a cost of more than $110 billion), congestion in the year 2010 would remain the same as today because of expected regional growth (Southern California Association of Governments, 1988). Moreover, congested metropolitan areas have already exploited the available supply-side TSM improvements like signal coordination, additional lanes at freeway bottlenecks,
ramp metering, etc. Additional improvements are often dependent on further technological advances. Demand management strategies thus become the best remaining alternative for addressing congestion problems. And demand management is indeed attractive, because even a small reduction in vehicle trips would significantly reduce congestion under most circumstances.

Costs Perceived to be Low

TDM is also attractive because of its perceived cost-effectiveness. If significant trip reductions can be achieved by offering preferential parking to carpools, subsidies to vanpools, or an extra holiday per year to those who rideshare, it is certainly a low cost strategy for reducing congestion, especially from the point of view of the public sector. TDM program costs are borne primarily by employers or developers. Developer costs (e.g. for bike racks and bus turnouts) are often minor compared to total project costs, and most likely passed on. Employer costs are more likely to be significant. Evidence from employers who provide voluntary programs show that they are perceived to be worth the cost. Voluntary programs are provided to avoid the greater expenses of adding parking, to more effectively attract qualified employees, or simply to enhance corporate image. (Teal et al 1984; Ferguson, 1990).

Possibility of Immediate Results

A third attractive feature of TDM is the promise of almost immediate results. Programs can be put into place in a matter of months, in contrast to capital projects which typically involve years of planning. And programs are often expected to generate quick
results. If employees are given the opportunity to join vanpools, for example, it is often anticipated that vanpools will be rapidly formed.

**Actions Not Restricted to Traditional Transportation Agencies**

Perhaps more importantly, TDM policies can be implemented by a wide range of institutions, both public and private; employers and land owners, cities and other local governments; public authorities, non-profit organizations, etc. Transportation agencies need not be involved, and therefore interagency negotiations and conventional planning processes - and the delays associated with them -- can often be avoided. TDM policies thus give other agencies the opportunity to take actions to solve perceived transportation problems. This is particularly important in areas where new projects are resisted because of their negative traffic impacts. For example, local politicians can show their commitment to solving traffic problems while approving new development by imposing TDM requirements as conditions of development.

**Implementation and Impact May be Indirect**

Finally, TDM programs are attractive because they can be mandated in indirect ways. For example, trip reduction requirements imposed as conditions of development are passed on to the project's occupants, who in turn must influence the behavior of their employees. Local ordinances that require employers to join Transportation Management Associations (TMA's) rely on the TMA to alter the behavior of employees. Similarly, the South Coast Air Quality Management District's Regulation XV mandates sweeping increases in peak period vehicle occupancy by placing the responsibility for achieving these increases on local
employers. Such indirect methods have a long history in US transportation policy (Altshuler, 1979).

**TDM EXPERIENCES: SOME CASE STUDIES**

TDM policy can only be effective if in fact workers change their behavior, that is, if a significant proportion of workers shift from driving alone during peak hours to some other means of commuting. Is such a shift a reasonable expectation? And if accomplished, will it have the anticipated effect on traffic congestion?

Despite their rapid proliferation, there is substantial controversy regarding the effectiveness of TDM policies. Critics fear that at best such policies are ineffective, and at worst they could actually worsen congestion. Some have alleged that the real purpose of these programs is to raise revenues for public sector projects by shifting their financial burden to private sector developers and employers. If TDM programs are really fiscally motivated, achievement of the promised congestion reductions may be less important to the framers of the programs than the collection of revenue. This would be shortsighted: failures to relieve congestion will result in public mistrust and disillusionment with those who promised that relief, as well as continued worsening of the quality of urban life.

Skeptics also allege that TDM programs are really political posturing. They give politicians the opportunity to tell the voters that they are addressing the problems of regional growth without actually doing so in any serious way. They can appear to be "tough" on new development and thus responsive to the interests of existing community residents, yet there are no guarantees these programs will have their anticipated effect. Moreover, by the time
large, multiphase projects are built out, the politicians who approved them are unlikely to still be around and accountable for their actions.

Because TDM programs are both novel and controversial, it is important that they be thoroughly evaluated before we reach general conclusions about their effectiveness. In this section, we present case studies of some well-known TDM programs and policies. Two case studies deal with specific policies, alternative work hours and parking management. Two others present results of specific trip reduction programs. Together, these case studies provide valuable insights regarding the potential costs and benefits of TDM policies.

ALTERNATIVE WORK HOURS: THE HONOLULU STAGGERED WORK HOURS DEMONSTRATION PROJECT

Alternative work schedules are among the most widely implemented TDM strategies. They focus on shifting employee work schedules so as to eliminate or spread out peak period work trips. The State of Hawaii conducted a demonstration project to determine whether spreading out the arrival times of downtown workers would relieve peak period congestion. The project took place from February 22 through March 18, 1988. During the project, official office hours for state, city and county employees were shifted from 7:45 a.m. - 4:30 p.m. to 8:30 a.m. - 5:15 p.m. Participation in the project was mandatory for all public employees; nonparticipation required approval via a formal exemption process. Participation by private sector downtown employers was encouraged but not required.

---

The Honolulu project provided the opportunity not only to determine the impact of such strategies on traffic congestion, but to assess impacts on the employees involved. The demonstration project analysis included a four wave panel survey of downtown employees as well as corresponding traffic flow surveys in the three major corridors leading to downtown Honolulu.

About half of all public sector employees actually shifted their work hours to the prescribed later schedule, while only 8.4 percent of private employees shifted to the prescribed schedule. About 4,000 workers, representing 6 to 7 percent of the downtown workforce, are estimated to have participated in the project. Table 1 summarizes the work hours changes observed during the demonstration project.

**TABLE 1 ABOUT HERE**

The demographic characteristics of participants and nonparticipants were quite different. Nonparticipants had more children, used childcare services, were younger and female. Participants were more likely to be in professional or technical occupations and to be from households with fewer workers. Participants were also more likely to be car drivers, while nonparticipants were more frequently carpoolers or bus users. Participants reported more problems with ridesharing, childcare, and other obligations before or after work, suggesting that participation was more difficult for workers with time pressures or schedule constraints.

The project had a significant positive overall effect on traffic conditions. Average estimated time savings for commuters were 3 to 4 minutes, or 7 to 9 percent of the average 45 minute commute. Travel time savings differed both by route and by time of day. The
project did spread out peak travel, and thus improved conditions for those traveling during the most congested time periods while slightly worsening conditions for those traveling during the less congested time periods. Some individuals therefore experienced travel time losses (worse traffic conditions) during the project, even though travel conditions improved overall.

Most project participants experienced little or no significant change in travel conditions during the project. However, there were some important exceptions. Participants who previously worked the regular 7:40 - 4:30 schedule and resided in the most distant suburbs saved 9 to 15 minutes (15 to 25 percent). Participants who had been working an earlier schedule (start work 7:30 or earlier) experienced travel time losses of up to 10 minutes (up to 30 percent). These losses were particularly onerous, since these participants also suffered the greatest change in their regular work schedule. Travel time savings by employee segment are summarized in Table 2.

TABLE 2 ABOUT HERE

The Honolulu project provides several important insights regarding the effects of large scale TDM efforts. First, the overall impact of the project was positive, but of relatively small magnitude. Average time savings of 3 to 4 minutes suggest the change for many commuters was probably not noticeable, and that underlying traffic growth could quickly overwhelm such marginal effects. Second, the benefits of the project were greater for nonparticipants than participants. Most nonparticipants experience small but significant travel time savings without the inconvenience of having to change their work schedules. Participants, in contrast, may or may not have experienced travel time savings. Third, the
project clearly had adverse effects on the daily activity schedule of participants. Daily routines were disrupted; many families had problems with childcare and other household responsibilities; and many transit users were unable to use their regular bus. While these problems were caused in part by the short-term nature of the project, they demonstrate that extended work hours programs require corresponding adjustments in services outside the workplace.

**PARKING MANAGEMENT IN LOS ANGELES EMPLOYMENT CENTERS**

It is well established that as many as 90 percent of American workers receive free parking at the workplace. Of course parking is not really free; most employers either lease or own land and facilities for parking which has some economic value. The cost of parking is particularly high in areas where land values are high, in dense city centers or major suburban activity centers. (These areas are also typically the most congested.) Thus free parking constitutes a significant subsidy (or unpriced benefit) to workers. Free parking has become established as a traditional employee benefit which is not taxable under current law. In downtowns, where the actual cost of parking may be $100 - $150 per month, it represents a significant addition to total compensation.

Free parking also greatly encourages driving to work alone. In a study of parking subsidies at the Los Angeles Civic Center, 72 percent of county employees who parked free at county expense drove to work alone, while only 40 percent of comparable federal employees who paid to park drove to work alone (Francis and Groninga 1969). In Century City, a major office/mixed use center located 10 miles west of downtown Los Angeles, Shoup and Pickrell (1980) found that 92 percent of workers whose parking was available
free, drove to work alone, while 85 percent of those whose parking was partly subsidized and only 75 percent of those who bore the full cost of parking commuted to work as solo drivers. In another study of employees of a company in Central Los Angeles, Surber et al. (1984) found that 42 percent of the company's employees drove alone to work when the company paid the monthly parking fee, but when the company ended the practice of paying for parking at work, the proportion of workers driving alone dropped to 8 percent. In another recent experiment at a large insurance company at Warner Center, a large Los Angeles area suburban industrial/office development, when free parking was eliminated and a fee of thirty dollars per month instituted, the share of solo drivers fell from 90 percent to 46 percent (Willson and Shoup, 1990). These results are summarized in Table 3. While there are enormous differences in both the "free parking" mode share and the impact of priced parking, the pattern is the same in all cases. Higgins (1990) surveyed a large number of transportation demand management programs at suburban mixed-use activity centers. He concluded that a common dimension among the most successful programs was that all of them incorporated parking management, usually involving an increase in the cost of employee parking.

**TABLE 3 ABOUT HERE**

**TRIP REDUCTION I: THE COASTAL TRANSPORTATION CORRIDOR ORDINANCE IN LOS ANGELES**

---

The first TDM plan to be enacted by the City of Los Angeles under the TRIP Program discussed above was the Los Angeles Coastal Transportation Corridor Specific Plan Ordinance, which was passed in 1985. It covers an area of approximately 24 square miles, and is located in the western portion of the Los Angeles metropolitan area, just north of the Los Angeles International Airport (See Figure 1). The area presently has 40 million square feet of office, light industrial, and hotel space and an estimated workforce of 100,000. Planned projects for the area may double this amount of development within the coming five to ten years. The western portion of Los Angeles has experienced rapid growth over the past 15-20 years, and traffic congestion has increased commensurately. The ordinance resulted from active homeowner and community group opposition to new development. The development community and the local city council representative responded, and the ordinance was the outcome of many months of negotiation among these interests. In the end, as is often the case, homeowner groups labeled the ordinance too lenient on developers and opposed its implementation, while some developers complained that the ordinance was too restrictive.

FIGURE 1 ABOUT HERE

The Coastal Transportation Corridor Ordinance requires any new non-residential development that would generate more than 100 afternoon peak hour trips to institute measures to reduce trip generation by at least 15%. The developer is responsible for

---

Several non-residential uses are exempt: government facilities, neighborhood serving commercial, religious facilities and schools.
providing an appropriate set of mitigation measures which are then passed along to the tenants through rental agreements.

The developer must also agree to pay, prior to construction of the project, a one-time fee per remaining unmitigated afternoon peak-hour trip. The fee, (initially set at $2,010 per p.m. peak trip), is to be used by the city for the construction of projects included in the impact area’s transportation specific plan.

The Ordinance also allows additional trip reductions (e.g. a more extensive mitigation or demand management program) to be used as fee offsets. However, if fee reductions are granted and the trip reduction goals are not eventually reached, the original fee is tripled and levied ex post. Needless to say, the feasibility of enforcing this provision is questionable. Large projects, however, must be phased, with later phases being approved for construction only when the earlier ones have been successful in achieving required trip mitigations.

Our analysis of the impacts of the Ordinance is based on data from two samples: an experimental sample, consisting of employees from 44 firms working in three buildings subject to the ordinance, and a control sample, consisting of employees from 73 firms working in five buildings not subject to the ordinance. The samples were selected to be as similar to one another as possible. Information about the TDM programs offered by developers was gathered via personal interviews conducted during 1988 and 1989. Information on employee travel and demographic characteristics was obtained via surveys distributed to employees at the work sites during the summer and fall of 1988. A total of 620 questionnaires were completed at the experimental sites and 596 surveys were completed at the control sites.
Table 4 shows the facilities provided by the developers of the eight buildings in the sample. Reserved parking for ridesharers was provided in two of the three experimental buildings, while only one of the five control buildings offered reserved parking for ridesharers. Similarly, developers of two of the three buildings affected by the ordinance had elected to include bicycle racks, while none of the five control buildings provided racks. Interestingly, none of the eight buildings was found to include showers or lockers for bicycle commuters, suggesting that developers regarded those facilities as unlikely to attract sufficient use to justify the expense of their inclusion.

**TABLE 4 ABOUT HERE**

Parking policy also differed between the two groups. Subsidized parking at work sites is very common in the study area. Table 5 shows that although the majority of workers in both samples have free parking, the control sample proportion is significantly larger (77 percent versus 62 percent). Furthermore, among those paying to park at work, workers in buildings affected by the ordinance typically pay much more. Seventy percent of the control sample employees who pay to park pay less than twenty dollars per month, compared to only eleven percent of the experimental sample employees who pay to park, and three fourths of these employees paid between twenty and thirty-nine dollars per month. These differences suggest a shift toward employee-paid parking at work sites affected by traffic control ordinances such as the Coastal Corridor program.

**TABLE 5 ABOUT HERE**

The primary purpose of the Ordinance is to reduce peak vehicle trips. This can be accomplished by shifting mode or travel schedule. Table 6 gives mode shares for the two
samples. It shows that there is very little difference between the two samples. In the buildings affected by the ordinance, more than twice the proportion of employees carpool to work, but this difference seems to have little impact on the proportion of workers driving to work alone. Only 13.2% of the experimental group employees do not drive alone versus 12.1% of the control group employees. The difference in the drive-alone shares between the two groups is not significant.

TABLE 6 ABOUT HERE

Figures 2 and 3 show how those affected and those not affected by the ordinance differed in terms of their arrival and departure times at their work sites. Most workers in the study area, including those subject to and those not subject to the ordinance, arrive at work during the peak period, defined by the local traffic agency to be between 7:00 a.m. and 10:00 a.m. Only 12.6% of experimental group employees and 15.8% of control group employees arrive at work outside of this morning peak. Almost identical proportions of experimental group employees (19.6%) and control group employees (19.2%) depart from work outside of the afternoon peak period as defined by the Ordinance (i.e. before 4:00 p.m. and after 6:30 p.m.). The figures show that although there is no difference between the two groups in the proportion of workers arriving and departing during the peak, their distribution within the peak is quite different, with control group workers on a generally later schedule.

FIGURES 2 & 3 ABOUT HERE

These results suggest that although more incentives to ridesharing are provided at the buildings subject to the Ordinance, they have had little impact so far on employee travel behavior. Although more workers in the experimental sample carpool, this difference does
not have any significant effect on the proportion of workers who drive alone. Similarly, those affected by the ordinance have arrival and departure times which do not differ substantially from those of the control group. These results must be considered preliminary since the study was conducted early in the history of implementing the Coastal Transportation Corridor Ordinance. However, similar results were found in a study of TDM programs in Bellevue, Washington (Frederick and Kenyon, 1991).

TRIP REDUCTION II: REGULATION XV OF THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

As described earlier, the purpose of this Regulation is to reduce congestion-related air pollution by reducing the volume of peak vehicle trips in the South Coast Air Basin. Its enormous scope, as well as its emerging role as a model for transportation control strategies in other metropolitan areas with serious air pollution problems, justify some background on the Regulation's development.

Legal action on the part of a coalition of environmental interest groups in the 1980's provided the impetus for developing a long range plan for achieving federal and state air quality goals by 2010 within the South Coast Air Basin. The Basin encompasses most of the greater Los Angeles Metropolitan Area and includes Los Angeles, Orange, Riverside and San Bernardino counties. The area affected by this regulation includes more than 13,350 square miles, and is home to a population of more than 12 million people.

The South Coast Air Quality Management District (SCAQMD) is authorized by state law to develop, implement, and enforce the Air Quality Management Plan. Because of the
severe air quality problem in this region, exacerbated by rapid population and economic growth, topography and climate, the plan calls for behavioral changes as well as technological advances in the control of stationary and mobile sources of air pollution. One of the most challenging requirements of the plan is the substantial reduction of automotive air pollution by reducing reliance upon singly-occupied automobiles for journeys to and from work. While work trips are known to be decreasing as a proportion of all travel, they constitute more than a third of all daily trips, and are made primarily at peak hours, when congestion is most severe. Work trips are also believed to be more susceptible to change, since alternative travel options are more likely to be available for work trips than they are for trips made for other purposes.

Implementation of Regulation XV began July 1, 1988. It requires that public and private employers (firms, government agencies, schools, hospitals, etc.) having 100 or more workers at any work site complete and file a plan for that site by which they intend to increase Average Vehicle Ridership to a specified level within one year of the SCAQMD’s approval of its plan. Average vehicle ridership (AVR) is defined roughly as the quotient of: the number of employees reporting to work between 6:00 and 10:00 a.m., divided by the number of motor vehicles driven by these employees. The ratio is calculated over a five-day work week to account for the growing use of modified work weeks, and certain adjustments are made to the ratio to account, for example, for employees who telecommute. Credits are also given for employees who travel to work in automobiles powered by clean fuels such as methanol, propane, and electricity.
The Regulation constitutes the most massive commitment to TDM yet undertaken anywhere. As noted earlier, an estimated 9,000 firms, agencies and institutions employing approximately 3.8 million workers -- about two thirds of all wage earners in the four county area -- are subject to the Regulation. Compliance with the Regulation requires three tasks: 1) submission of an implementation plan within 90 days of notification, 2) designating and training of an on-site Employee Transportation Coordinator (ETC), and 3) approval of the plan by SCAQMD. The target AVR established for each worksite is determined by geographic location: 1.75 for the central core of Los Angeles, 1.3 in outlying, low density areas, and 1.5 for the remainder of the area. These targets were based on development density and transit availability.

The trip reduction plan may consist of any number of incentives and disincentives to achieve the AVR target. Incentives in plans submitted so far shows great diversity. Typical examples include: free parking and preferential parking locations for carpools and vanpools; on site sale of monthly transit passes; carpool and vanpool matching procedures; and a variety of promotional activities, such as posters, prizes, and events promoting ridesharing. Subsidies to vanpools or transit users are less frequent. A few have added services such as automatic teller machines, health clubs, and eating facilities on site in order to reduce employees’ needs for automobiles. Disincentives have thus far been used far less frequently than incentives. An example of a disincentive is the withdrawal of an employee parking subsidy which has previously been given to workers who drive to work alone.

The submitted trip reduction plan is reviewed by SCAQMD staff. The SCAQMD staff may reject the plan and require resubmission if the plan does not seem appropriate for
any of several reasons. Some examples include: incorrect calculation of AVR; inadequate survey of employees; absence of a properly certified ETC; absence of a letter from management committing itself to the implementation of the plan; or inadequate incentives to achieve the intended AVR. In most cases, rejected plans are negotiated with SCAQMD, and revisions are made to satisfy SCAQMD criteria. In some cases, however, employers have ignored the requirements. They have been fined severely as a result: SCAQMD has authority to impose fines of up to $25,000 per day for non-compliance.

The key question related to Regulation XV is of course whether it has had any impact, e.g. whether the target trip reductions have occurred. We evaluated data on 812 employment sites which had implemented Regulation XV plans for at least one full year. We believe these sites to be adequately representative of all worksites affected by the program in terms of their industry mix, workforce size, and location.

The AVR goals established for the region are quite ambitious. Since the average base AVR for our sample is 1.23, achieving the mid-range target of 1.5 (most subject sites are located in the 1.5 target area) requires more than a 20% increase in AVR. Such an increase would require substantial changes in employee behavior -- something that prior research suggests would require correspondingly large changes in the relative costs and convenience of alternative modes (Giuliano, 1991).

TABLE 7 ABOUT HERE
Table 7 gives the mean AVR values for Year 1 and Year 2, as well as the percent change for our sample. The mean AVR increased 2.7%, from 1.226 to 1.259, and this change is statistically significant. Table 8 shows the frequency distribution of changes in AVR. Approximately sixty percent of the employers in our sample achieved AVR increases of between zero and fifteen percent since year one. These changes represent a small positive move toward the SCAQMD's targets. These results are encouraging given the challenges involved in changing travel behavior.

**TABLE 8 ABOUT HERE**

The change in the AVR between years one and two was found to be related to the initial value of the AVR. For example, among the work sites whose AVR decreased during the first year of the program the mean AVR for year one was 1.33. Among work sites whose AVR increased, the initial AVR was 1.17. Perhaps this indicates that the requirements of the program caused employment sites at which AVR was poorest to devote more energy and creativity toward the task of improving ridesharing, while those closer to their targets were less attentive to the need to implement innovative programs.

We also noted that firms having the highest target AVR (1.75) experienced the smallest increase in AVR in one year (0.1%) but had the highest AVR of the three groups (1.71 in year two); firms required to meet an AVR of 1.50 had the next highest AVR in year two (1.24) and experienced an increase in AVR of some 3.0%; while employers

---

4 All AVR values reported here are based on SCAQMD data and are calculated using a slightly modified formula from that used by SCAQMD.
required to meet an AVR target of 1.3 had the lowest AVR (1.21 in year two) and also experienced a 3.0% increase in AVR.

Changes in AVR of course result from changes in ridesharing behavior, so it is also of interest to determine how mode choice changed between years one and two. Shifts in mode choice are summarized in Table 9. They show that the change which occurred in average vehicle occupancy resulted primarily from an increase in carpooling. Vanpooling also increased but because of its small base had little impact on the overall ridesharing rate. Walk/bike decreased slightly, while all other mode shares were relatively unchanged.

TABLE 10 ABOUT HERE

These results suggest some interesting patterns. First, the gains in ridesharing so far have been accomplished by changes which imply little or no institutional change. Carpooling increases have little effect on work schedules and do not entail the organizational effort that establishing a vanpool program or launching a compressed work schedule might. Second, the alternatives which have been most heavily promoted by local politicians and institutions -- transit use, compressed work schedules and telecommuting -- have not been more extensively employed. Though transit use has been heavily marketed, service quality and availability have not materially changed. It is therefore not surprising that these marketing efforts have not had any effect in commuters’ willingness to use transit. Telecommuting clearly requires substantial organizational resources and planing if it is to be employed to any significant extent (e.g. to the effect that AVR would change). It is therefore quite understandable that most companies would choose less difficult and costly strategies.
THE ROLE OF TDM IN GROWTH MANAGEMENT POLICY

This chapter has shown that TDM policies and programs have been extensively implemented. Program results, however, are mixed. Preliminary results of Regulation XV are encouraging, but the Coastal Transportation Corridor results are not. Removing parking subsidies clearly affects the propensity to rideshare, but few companies, even under the formidable influence of the SCAQMD, are prepared to remove such subsidies. The Honolulu staggered work hours experiment resulted in a measurable reduction in downtown traffic congestion, but also had negative impacts on some of the project participants. What do these mixed results imply for future TDM policies?

The potential of using TDM policies to solve urban congestion problems must be considered in the context of how people make travel choices, because the primary purpose of TDM is to promote changes in people's choices. For TDM to be successful, individual travelers must make different choices. The environment in which these choices are made is overwhelmingly dominated by the private auto. Several decades of public policy decisions have made the U.S. a highly mobile society. As a result, the automobile (usually driven alone) has become an integral part of daily life. Persuading enough people to carpool, vanpool, or otherwise avoid peak travel to achieve a measurable impact on traffic congestion is an ambitious goal. It would require truly extensive behavioral changes. Such changes, in turn, would require significant changes in the relative cost or convenience of travel choice alternatives. Thus the real question is, can TDM programs with sufficiently effective (strong) incentives be developed, implemented and enforced? And if so, what are the consequences to employees affected by them?
TDM POLICIES THAT WORK

Although a remarkable variety of ridesharing incentives have been developed, there are only a few that have any significant effect on commuters' choices. These are primarily incentives that raise the price of driving alone, or reduce the price of not driving alone, either in terms of money or time. Some examples include elimination of free parking (removal of parking subsidies), heavily subsidized vanpool seats, or preferential parking at large employment sites where such parking could save a 10 minute walk. The only incentive that is not time or cost based but that has been identified as effective is a guaranteed ride home for ridesharers (Brownstone & Golob, 1991).

Our research and that of others shows that changes in work schedules are also potentially effective in terms of changing behavior. We know that most people avoid traffic congestion when they can. When given the opportunity, they are quite willing to change their work schedule to avoid peak period travel, provided other daily tasks and responsibilities allow such changes. Although work schedule changes may willingly be made, they're likely to have only a limited effect on traffic congestion, however, because they redistribute rather than reduce work-related travel demand, as was clearly illustrated in the Honolulu case study. There is also some question as to how alternative work schedules may affect the ability or propensity to rideshare (Bhatt and Higgins, 1989).

A common characteristic of policies that are both effective and acceptable to those affected is flexibility. That is, policies that increase the set of alternatives are more likely to be implemented and therefore more likely to be effective. For example, replacing free or heavily subsidized employer-provided parking spaces by a cash travel allowance actually
increases the employee's flexibility while reducing a major incentive for commuting in singly occupied autos. When given cash instead of a parking space, the commuter can apply the subsidy toward the most convenient mode, or may choose the least expensive mode while pocketing a cash bonus which would otherwise have been available only in the form of a paid for parking space. The transportation allowance permits parking fees to be imposed while giving employees more flexibility in responding to the fee. Similarly, when offered the option of alternative work hours, employees are typically quite favorable. In the Honolulu demonstration project, it was the mandatory nature of the schedule changes that caused employee opposition. In fact, even those employees who found the mandatory schedule inconvenient were in favor of a voluntary program.

Guaranteed ride home programs are another example of flexibility. Prior studies show that many people state that they are unwilling to carpool because they must be able to respond to home-related emergencies. If a child becomes ill or is injured, the parent must be able to leave work immediately. The guaranteed ride home program provides taxi vouchers, access to company-owned vehicles, or rental vehicles to workers in case of such emergencies. Although few workers who have access to such programs actually ever take advantage of them, they are frequently identified as a major factor in their decision to carpool or vanpool.

Flexibility is also important because it can help to minimize the negative effects that aggressive TDM policies may have on specific groups or classes of workers. For example, if parking subsidies are removed, the most price-sensitive workers are the ones who will shift to other less convenient modes. These are most likely lower wage workers, who
disproportionately are female and/or ethnic or racial minorities. The transportation
allowance concept restores the potentially lost income, and prevents a worker who must drive
alone from being made worse off as a result of the new policy.

Similar conclusions may be drawn from alternative work hour policies. A few
companies subject to Regulation XV have elected to switch their operations to a compressed
work week of four days, 10 hours per day. In doing so, they found that employees who
used childcare services could not meet the typical pick-up/drop-off schedule requirements.
At least one agency acted to provide on-site childcare in response. Others chose to make the
compressed schedule voluntary rather than mandatory, allowing employees to remain on
more conventional schedules if necessary or desired.

TDM ENFORCEMENT ISSUES

When considering TDM in the context of growth management policy, it is important
to address the issue of enforcement. As discussed earlier, TDM policies can be
implemented in a number of ways, but mandatory policies typically are not imposed directly
on employees. Rather, they are imposed on employers, or lessors, or even developers, who
are then responsible for providing the TDM incentives that are to result in the specified or
required trip reductions. Developers, building owners, and tenants may agree to a variety of
conditions requiring them to implement TDM, but unless they are enforced those agreements
may be ineffective.

Enforcement is obviously more feasible when TDM performance requirements are
based on the provision of specific services or facilities rather than on vague trip reduction
goals. In the case of services or facilities, zoning or use permit approvals can be used to
impose such requirements, with occupancy approvals subject to completion of facilities. Ongoing services, though part of a conditional use permit, cannot be provided until after the development is occupied. Thus actual enforcement rests on the local jurisdictions' willingness to withdraw the development's conditional use permit or certificate of occupancy if such services are not provided. This is such a drastic and politically visible action that it rarely occurs.

One strategy often used to make enforcement more likely in the case of larger developments is to divide the project into distinct phases, and to make approval of subsequent phases conditional upon achieving certain trip reduction goals in the earlier phases. Initially, an estimate is made of the number of trips which the first phase of a new project might generate if it had no trip mitigation program, and a goal is set to reduce that number by some defined proportion. Upon completion of the first phase, a traffic count can be performed, and later phases of the project may be approved only if the trip goals have been met in the first phase.

Of course, the art of trip estimation in advance of the construction of a project is quite primitive, and the effectiveness of such phasing limitations is partly dependent on the accuracy of the initial trip generation estimates. Trip reduction goals, such as those specified in the Coastal Transportation Corridor Ordinance, are based on standard traffic engineering trip estimates. These estimates are at best only approximate, and have at least a 15-20% margin of error. Thus, developments could be found to be in conformance with the goals, even if no attempt at all is made to reduce trips (Wachs, 1990).
Recently, in the case of large projects (a movie studio and a major state university) which already existed but which were contemplating major expansions, a careful trip counting procedure resulted in a fairly precise estimate of travel created by the existing project. A contract was then drawn up which required that the traffic generation be monitored on a periodic basis using a trip counting procedure which would ensure comparability with the base count. Then, expansion of the project was allowed on the condition that total trips could grow by a pre-specified number. The developer would have to curtail further expansion of the project whenever the periodic traffic counts exceeded the agreed-upon trip "cap." Such an agreement can be effective in a congested community in which objections to traffic growth are the primary sources of concern about growth management.

In the case of Regulation XV, performance targets are specified in terms of AVR, the SCAQMD ridesharing rate measure at specific sites. The AVR might well be enforceable, but the SCAQMD has chosen, in the early years of the program, not to penalize employers who fail to meet their AVR targets. This choice was based upon the relative newness of the concept of trip reduction, and on the District's desire to win public support for the program. While not levying fines for failure to achieve a specified AVR target, the SCAQMD is now conducting audits of employment sites. At short notice, teams of inspectors may arrive at the work site, where they review records and verify in the field that trip reduction programs are being implemented according to the terms of the plan approved by the SCAQMD. Severe fines are being levied against employer who fail to implement the required programs.
It is important to note that the stated goal of Regulation XV is to reduce congestion-related pollution. In order to truly demonstrate the effectiveness of the Regulation, it would be necessary to establish causal links between changes in AVR and traffic congestion as well as between congestion and air pollution. This is a formidable (but not impossible) task. It is not impossible only because of the vast scope of the program. In the case of specific employment sites or development projects, it is an impossible task, given current state-of-the-art analytical techniques. Traffic associated with any particular site is distributed across the local street system and becomes part of the traffic flow from all the other sites and from traffic passing through the area. Since each site contributes so marginally to the overall flow, it is not possible to trace the effects of single projects with any degree of accuracy. Consequently, enforcement based on congestion mitigation - the ultimate objective of TDM policies - is simply not feasible.

CONCLUSION

Transportation Demand Management policies are expanding rapidly throughout U.S. metropolitan areas. These policies are attractive because they address highly visible public issues. They provide a mechanism for responding to traffic congestion and growth concerns.

Experiences with TDM to date display mixed results. Large-scale TDM efforts have resulted in a complex array of behavioral changes and related indirect effects. TDM offers potentially powerful tools for reducing travel demand, and powerful incentives are likely required if significant changes in work trip travel are to be achieved. The potential of TDM to reduce traffic congestion is more uncertain. Even large scale TDM efforts have had
relatively small impacts on congestion. Finally, TDM may involve significant costs which are borne by employers, employees and their households.
<table>
<thead>
<tr>
<th>Employee Segment</th>
<th>Public Sector Employees</th>
<th>Private Sector Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worked 8:30 - 5:15</td>
<td>49.6%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Non-participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>did not change work schedule</td>
<td>39.7</td>
<td>62.7</td>
</tr>
<tr>
<td>Early Changers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shifted to earlier schedule</td>
<td>.8</td>
<td>11.0</td>
</tr>
<tr>
<td>Late Changers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shifted to later schedule other</td>
<td>5.9</td>
<td>2.6</td>
</tr>
<tr>
<td>than 8:30 - 5:15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varying Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no consistent pattern</td>
<td>4.0</td>
<td>15.2</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>1230</td>
<td>880</td>
</tr>
</tbody>
</table>
### TABLE 2

**Travel Time Savings by Employee Segment**  
**Honolulu Staggered Work Hours**  
**Demonstration Project**

<table>
<thead>
<tr>
<th>Segment</th>
<th>Time Arrangement</th>
<th>Time Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Changed from 7:45 arrival time</td>
<td>Save 2 to 3 minutes</td>
</tr>
<tr>
<td></td>
<td>Changed form 7:30 or earlier</td>
<td>Lose 9 to 10 minutes</td>
</tr>
<tr>
<td><strong>Non Participants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arrive at work 7:30 to 8:00 am</td>
<td>Save 3 to 5 minutes</td>
</tr>
<tr>
<td></td>
<td>Arrive at work after 8:30</td>
<td>Lose 3 to 4 minutes</td>
</tr>
<tr>
<td></td>
<td>All others</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>
TABLE 3
Parking Price and Share of Drive-alone Workers

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Drive-alone Share*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Employer Pays</td>
</tr>
<tr>
<td>Los Angeles Civic Center</td>
<td>1964</td>
<td>72%</td>
</tr>
<tr>
<td>Century City</td>
<td>1980</td>
<td>92</td>
</tr>
<tr>
<td>Central Los Angeles (1 firm)</td>
<td>1984</td>
<td>42</td>
</tr>
<tr>
<td>Warner Center (1 firm)</td>
<td>1989</td>
<td>90</td>
</tr>
</tbody>
</table>

* Drive-alone share = share of workers at site who drive to work alone
**TABLE 4**

Los Angeles Coastal Corridor Ordinance
Facilities Provided

<table>
<thead>
<tr>
<th>Reserved Parking for Ridesharers</th>
<th>Bicycle Racks</th>
<th>Lockers</th>
<th>Showers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Sample</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bldg. 1</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Bldg. 2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bldg. 3</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Control Sample</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bldg. 4</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Bldg. 5</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Bldg. 6</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Bldg. 7</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Bldg. 8</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Do Employees Pay to Park at Work?</td>
<td>Experimental n=324</td>
<td>Control n=538</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>38.0%</td>
<td>23.2%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>62.0</td>
<td>76.8</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amounts paid by those who pay to park (percentages)</th>
<th>Experimental n=123</th>
<th>Control n=125</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $20.</td>
<td>10.6%</td>
<td>70.4%</td>
</tr>
<tr>
<td>Bet. $20-$39.</td>
<td>75.6</td>
<td>8.8</td>
</tr>
<tr>
<td>More than $40.</td>
<td>13.9</td>
<td>20.8</td>
</tr>
</tbody>
</table>
TABLE 6

Los Angeles Coastal Corridor
Mode Split
(percentages)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>86.8</td>
<td>87.9</td>
</tr>
<tr>
<td>Public Bus</td>
<td>2.0</td>
<td>2.3</td>
</tr>
<tr>
<td>Carpool</td>
<td>7.4*</td>
<td>3.5*</td>
</tr>
<tr>
<td>Drop Off</td>
<td>2.9</td>
<td>3.5</td>
</tr>
<tr>
<td>Park &amp; Pool</td>
<td>0.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>0.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Others</td>
<td>0.2</td>
<td>1.2</td>
</tr>
<tr>
<td>N_7</td>
<td>n=615</td>
<td>n=596</td>
</tr>
</tbody>
</table>

* Difference between groups significant at p<.05
### TABLE 7

**SCAQMD Regulation XV**
Mean Change in Ridesharing Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>AVR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>1.226</td>
</tr>
<tr>
<td>Year 2</td>
<td>1.259</td>
</tr>
</tbody>
</table>

<p>| % change | 2.69% |
| t-value  | 6.6   |
| significance | .001  |</p>
<table>
<thead>
<tr>
<th>Change in AVR</th>
<th>Number of Cases</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 0</td>
<td>271</td>
<td>33.4%</td>
</tr>
<tr>
<td>0 to 5%</td>
<td>236</td>
<td>29.1%</td>
</tr>
<tr>
<td>5 to 10%</td>
<td>147</td>
<td>18.1%</td>
</tr>
<tr>
<td>10 to 15%</td>
<td>86</td>
<td>10.6%</td>
</tr>
<tr>
<td>15 to 20%</td>
<td>40</td>
<td>4.9%</td>
</tr>
<tr>
<td>More than 20%</td>
<td>32</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

**TABLE 9**

SCAQMD Regulation XV

Changes in Mode Share

(Share of Commuters Using Each Mode)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Alone</td>
<td>.758</td>
<td>.709</td>
</tr>
<tr>
<td>Carpool</td>
<td>.135</td>
<td>.187</td>
</tr>
<tr>
<td>Vanpool</td>
<td>.008</td>
<td>.012</td>
</tr>
<tr>
<td>Bus</td>
<td>.042</td>
<td>.039</td>
</tr>
<tr>
<td>Walk/Bike</td>
<td>.032</td>
<td>.027</td>
</tr>
<tr>
<td>Telecommuting</td>
<td>.005</td>
<td>.004</td>
</tr>
<tr>
<td>Compressed Hours</td>
<td>.020</td>
<td>.021</td>
</tr>
</tbody>
</table>
References


