Formulating Ridesharing Goals for Transportation and Air Quality Plans: Southern California as a Case Study

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This paper summarizes a two-phase technical study of new methodologies to formulate regional ridesharing goals. It was conducted in 1985 and 1986 by the Los Angeles based Commuter Transportation Services, Inc. (CTS, also known as Commuter Computer), for the Southern California Association of Government (SCAG). SCAG, the metropolitan planning organization for the Los Angeles metropolitan area, includes ridesharing goals in two of its regional plans, the Regional Transportation Plan (RTP) of 1984 and the Air Quality Management Plan (AQMP) of 1982. As required by state and federal laws, SCAG must review and update its RTP and AQMP periodically. The update schedule was developed to allow for a simultaneous review of the two plans. In reviewing the plans, one of SCAG's concerns was that these two functionally overlapping planning documents did not have a unified approach to an important transportation program, ridesharing. The methodology recommended by CTS for resolving this inconsistency used the two databases that best reflected the ridesharing activity taking place in the region. These were the Urban Transportation Planning Package (UTPP) and the California State Department of Transportation (Caltrans) high-occupancy vehicle (HOV) counts. The study also recommended average vehicle ridership *(AVR)* and number of ridesharers as unifying measurements for expressing and monitoring ridesharing goals. In this study, a region with severe congestion and air quality problems was used to demonstrate how regional transportation and air quality planning could be linked at the technical level through common ridesharing goals. As a result, the technical solutions proposed in this study are directly applicable to transportation and air quality planning in other metropolitan regions. The study's most problematic areas, not unique to this study, are inadequate information on the interaction of different demand reduction programs and on the dynamics of commuter behavior.

In this paper, a two-phase case study *(1,2)* of technical alternatives for determining comprehensive ridesharing goals in Southern California is described. Commuter Transportation Services, Inc. (CTS, also known as Commuter Computer), the regional commute management organization, conducted this work for the Southern California Association of Government (SCAG), the local metropolitan planning organization. The purpose of this study was to assist SCAG in reviewing regional ridesharing goals. The study findings and recommendations are being reviewed by technical staff and, if adopted by the agency's policy-making body, these goals are to be shared by SCAG's *Regional Transportation Plan (3)* and its regional *Air Quality Management Plan (4)*.

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One of the reasons for this work was the need to integrate ridesharing goals into regional air quality and transportation planning processes. SCAG specifically desired assistance in the plan update process, in the review of recent trends in ridesharing, and in the addition of ridesharing goals at the activity center level. To complete this work, CTS carefully defined issues in terms of the rationale and method of each plan, as well as ridesharing program characteristics, observed commuter behavior, implicit and explicit assumptions, alternative measures and sources of data, and areas for future analysis.

This case study should be of interest to those concerned with air quality and transportation policy, planning, and programming for at least three reasons.

First, the conditions in Southern California that underscore the importance of ridesharing in transportation, air quality, and land use planning, are becoming widespread. These can be summarized as chronic traffic congestion and poor air quality, neither of which has reasonable prospects for easy resolution or mitigation. Although these planning issues may be more pronounced in Southern California, they already or soon will exist in most other metropolitan areas. As a result, the role of ridesharing in the general planning process could increase in many other parts of the country. In this sense, ridesharing has evolved from an emergency response to the energy crisis to an integral role in transportation and air quality planning and policy.

Second, the issues identified in this case study of Southern California are applicable to other regions. For example, SCAG's Regional Transportation Plan (RTP) treats ridesharing as a transportation demand management (TDM) technique for alleviating peak-hour capacity deficiencies in the transportation network *(3)*. In contrast, the Air Quality Management Plan (AQMP) uses ridesharing as a transportation control measure (TCM) designed to achieve air quality standards *(4)*. Whereas the latter plan required a specific number (1.3 million) of ridesharers in the South Coast Air Basin by 1987, the former plan focused on ridesharing goals for major travel corridors for the horizon year, 2000. Whether ridesharing is looked at as a solution for air pollution or traffic congestion, the two goals required different schedules and amounts of traffic reduction.

In addition to this fundamental difference in the role of ridesharing in the two plans, SCAG was also concerned with other differences between the plans that complicated the formulation of regional ridesharing goals. The plans differed in terms of geographical scope and levels, measures and definitions of ridesharing, and assumptions about ridesharing characteristics.

Third, in neither case were ridesharing goals related to the amounts of ridesharing that have been or could be attained under different funding and programming scenarios. Therefore, SCAG desired consideration of the portion of the ridesharing goals that could be met by the two local ridesharing agencies, CTS and the Orange County Transit District's (OCTD's) commuter network.

Finally, the problematic areas left unresolved by this research may spark investigation or resolution in other regions. These are discussed at greater length in the conclusion, but include the dynamics of commuter behavior, the potential of alternative ridesharing measures to influence commuters' mode choices, and the need for effective techniques to monitor ridesharing.

METHODOLOGY

The task of recommending new, attainable ridesharing goals that could simultaneously improve regional air quality and commuter mobility required two preliminary tasks: to thoroughly examine the RTP, AQMP, and related planning documents, as well as to design a new methodology.

The issue of alternative (geographically defined) goals was a central difference between the two plans, with the thrust of the RTP on transportation corridors and that of the AQMP on the region (i.e., the South Coast Air Basin) and on the individual firm. The approach taken by CTS was based on the need for new goals to be comparable to those in existing plans, to be attainable, and to be easily monitored. Therefore, ridesharing goals were developed for five different levels of geographical aggregation: the region, county, travel corridor, activity center, and worksite.

Regarding consistency among data sources, CTS proposed that different data sources could still be used to formulate ridesharing goals at each level, but with the proviso that all goals, regardless of their level, be presented through a unified measure of ridesharing, average vehicle ridership *(AVR) (1).* Alternatively known as the vehicle occupancy ratio, *AVR* was selected as the unified measurement for ridesharing because existing goals expressed in diverse terms of rideshares, carpool capture rates, and automobile passengers could become comparable when transformed into *AVR* figures. In addition, *AVR* could be easily derived from all data sources used to define ridesharing goals and to monitor their implementation. These sources consist of vehicle counts conducted annually by the California Department of Transportation (Caltrans), mode split breakdowns available from Urban Transportation Planning Package (UTPP) data, SCAG model data, and CTS registration and survey data *(5).*

The *AVR* obtained from high-occupancy-vehicle (HOV) counts is computed as follows:

$$AVR = (N_a + N_p)/N_a$$

where N_a is the number of automobiles or automobile drivers, and N_p is the number of automobile passengers.

The basic *AVR* formula was adapted to different data sources selected. For example, in the case of mode split data, *AVR* figures can be derived by dividing the number of commuters by the number of vehicles used for commuting:

$$AVR = \frac{[(N_s + N_c + N_v)]}{N_s + (N_c/ACS) + (N_v/AVS)]}$$

where

ACS = average carpool size of 2.5 ridesharers/carpool, as based on the CTS *Carpool Evaluation Survey (5)*;
AVS = Average vanpool size of 13 ridesharers/vanpool, also based on the *Carpool Evaluation Survey*;
N_s = number of solo drivers;
N_c = number of carpoolers; and
N_v = number of vanpoolers.

This *AVR* formula was applied to the UTPP and Caltrans ridesharing data for the base years 1980 and 1984, as well as to the RTP and AQMP ridesharing goals of 1987 and 2000, respectively. It was then possible to formulate ridesharing goals for 2010, the target year for the new RTP, in terms of both ridesharing rates (i.e., *AVR*) and the number of ridesharers.

This second set of calculations, the number of ridesharers needed in the years 2000 and 2010 to meet *AVR* goals, was based on SCAG's employment forecast for those years. The desired number of ridesharers was extrapolated from *AVR* goals through the following formula. However, it was contingent on extracting the number of estimated commuters (i.e., 88 percent of total employment) for the horizon year.

$$NR_{2010} = NC_{2010}\{(1 - 1/AVR)[1 + 1/(ACS - 1)]\}$$

where NR_{2010} is the number of ridesharers in 2010, and NC_{2010} is the number of commuters in 2010, or $[(NC_{1980}) \cdot$ (Change in employment from 1980 to 2010)].

The weakness of this methodology is that it assumes that the proportion of commuters using automobile modes for work trips will remain constant from 1980 to 2010 (i.e., 88 percent based on 1980 UTPP data). This assumption implies that solo drivers will be diverted only to ridesharing modes, not to other alternative modes (including transit). The alternative commute rate *(ACR)*, computed by dividing the total number of employees at a worksite by the total number of vehicles entering or leaving the worksite during peak hours, would in theory be a better measure for presenting ridesharing goals than the *AVR* measure. Although *ACR* would assess the effectiveness of most TDM programs, not just ridesharing, it could not be applied in this study because it could only be calculated at the level of the worksite.

RECOMMENDING RIDESHARING GOALS

Ridesharing goals were developed for five separate levels of geographical aggregation: the region, county, corridor, activity center, and worksite.

Regional Goals

The formulation of regional ridesharing goals for the years 2000 and 2010 was based on mode split data, vehicle counts, employment forecasts, and model data. The two data sources providing information about the current level of ridesharing activity were the UTPP 1980 census data on mode splits for all work trips, and the Caltrans annual HOV counts. HOV counts, however, reflect ridesharing that occurs during peak periods on trips to the Los Angeles (Los Angeles County) and Santa Ana (Orange County) central business districts (CBDs).

The multinucleus character of Southern California necessitates the use of complementary data representative of all commuter-related ridesharing taking place in the entire transportation network in the two-county regional core area, as well as in the four remaining counties of Riverside, San Bernardino, Ventura, and Imperial. When 1980 UTPP mode split data for Los Angeles and Orange Counties—the two counties in which Caltrans HOV counts *(6)* are performed—were transformed into *AVR*, a value of 1.14 ridesharers/veh was obtained. This *AVR* value was 6 percent lower than the *AVR* value of 1.22 ridesharers/veh measured by Caltrans for the same year.

In an attempt to control differences between the two databases (i.e., time periods and geographical areas) and therefore to devise a more precise estimate of base year and subsequent ridesharing levels, simple arithmetic adjustments were made. More specifically, the regional ridesharing level for the 1984 base year was calibrated as 1.10 ridesharers/veh by scaling down the 1980 UTPP *AVR* of 1.14 ridesharers/veh by 3.3 percent, the decrease in the Caltrans *AVR* values from 1980 to 1984 (Table 1).

The decline in ridesharing during this short period demonstrated that ridesharing rates are not consistently related to employment growth, which amounted to 4 percent during the same 1980 to 1984 period. Nevertheless, regardless of these fluctuations in commuters' mode choices, there is a pressing need for ridesharing levels to be maintained or improved in order to cope with the limited capacity of the transportation network and to attain air quality standards. Such a ridesharing level had been targeted to reach an *AVR* of 1.18 ridesharers/veh by the year 2000 in SCAG's 1984 RTP. However, because of the unexpectedly sharp decline in *AVR* from 1980 to 1984, CTS proposed that the achievement of this goal—a growth of 7.3 percent over 1984 levels—be extended to the year 2010. Using this assumption, 1.7 million commuters would rideshare in SCAG's six-county region by the year 2010. This amount is twice the ridesharing amounts for 1980 (Table 1).

Ridesharing goals were also recommended for the South Coast Air Basin (SCAB), a smaller (four-county) region than the six-county SCAG area. They are presented in the AQMP as a TCM for achieving air quality standards. These goals differ quantitatively and methodologically from those required to alleviate traffic congestion in the region's transportation network. The AQMP ridesharing control measure requires 1.3 million ridesharers by 1987, one-fourth of the SCAB region's projected work force for that year. Because of the unexpected drop in ridesharing between 1980 and 1984, however, this goal could not be realistically achieved until the year 2000.

For methodological reasons, each county's ridesharing goals were aggregated in order to develop ridesharing goals for the entire SCAB area. Although there were differences and fluctuations in the ridesharing rates of individual counties for both the base years and the target years, the extended 1987 ridesharing goals, expressed in *AVR* figures for the SCAB region, coincided with those of the SCAG region. As presented in Table 1, this common goal was 1.15 ridesharers/veh for the year 2000 and 1.18 ridesharers/veh for the year 2010. However, the SCAB ridesharing numerical goals were about 4 percent less for each of these horizon years.

At SCAG's request, the OCTD developed three additional scenarios to determine how ridesharing amounts would fluctuate as a result of variations in ridesharing rates *(7)*. The regional ridesharing goals presented in Table 1 show a small 3.5 percent increase in *AVR* rates from 1980 to 2010. Partly because of expected regional employment growth of 50 percent for the same period, the absolute number of ridesharers would grow at a much faster pace during this period, to nearly double by 2010. The scenarios presented in Table 2 can be compared with that proposed in Table 1 for the SCAG region only.

TABLE 1 RECOMMENDED REGIONAL RIDESHARING GOALS

YEAR	REGION	EMPLOYMENT	COMMUTERS	AVR	RIDESHARERS
1980	SCAG	5,581,300	4,521,045	1.14	873,632
1980	SCAB	5,354,800	4,332,880	1.14	834,786
1984	SCAG	5,780,900	4,682,728	1.10	709,518
1984	SCAB	5,540,100	4,493,397	1.10	679,742
2000	SCAG	7,642,500	6,190,688	1.15	1,345,829
2000	SCAB	7,255,200	5,935,433	1.15	1,288,765
2010	SCAG	8,377,100	6,785,739	1.18	1,725,222
2010	SCAB	7,927,600	6,528,122	1.18	1,658,309

TABLE 2 ALTERNATIVE RIDESHARING GROWTH SCENARIOS

	Scenario I		Scenario II		Scenario III	
	2000	2010	2000	2010	2000	2010
Employment	7,642,500	8,377,100	7,642,500	8,377,100	7,642,500	8,377,100
Commuters	6,190,688	6,785,739	6,190,688	6,785,739	6,190,688	6,785,739
Ride-sharers	873,632	873,632	938,002	1,028,163	1,267,125	1,388,922
Solo-drivers	5,317,056	5,912,107	5,252,686	5,757,576	4,923,563	5,396,817
AVR	1.09	1.08	1.10	1.10	1.14	1.14

Source: Recommendations for RTP/AQMP Rideshare Goals, Product 04

Douglas Levine for OCTD. May 1986.

In the first OCTD scenario, lower *AVR* rates are assumed for the years 2000 and 2010 than for the year 1980 (i.e., 1.09 and 1.08 ridesharers/veh, respectively, versus 1.18 ridesharers/veh), although the number of ridesharers is assumed to remain constant.

In the second scenario, a constant rate of 1.10 ridesharers/veh, the 1984 *AVR* level, is assumed for the years 2000 and 2010. However, as a result of the expected growth in employment, from 37 percent by the year 2000 to 50 percent by the year 2010, the number of ridesharers in the region would increase slightly, from 7 percent in 2000 to 17 percent in 2010.

In the third scenario, the 1980 regional *AVR* of 1.14 ridesharers/veh is applied to the years 2000 and 2010. This procedure yields ridesharing amounts larger than the 1980 amounts by 45 and 59 percent, respectively.

Corridor Goals

The regional ridesharing goals presented by SCAG in the 1984 RTP applied to the six-county region and were to be met by the year 2000. They were broken down by 27 major corridors, each of which included a major section of freeway and adjacent, high-volume arterials. All corridors had one or more screenlines. Based on existing and projected freeway demand-capacity deficiencies for the year 2000, the RTP assigned each corridor specific numerical goals of automobile drivers, automobile passengers, and transit passengers. Expressed as a percentage of the total projected corridor demand to be served, automobile driver and automobile passenger goals were premised on an anticipated transit ridership rate of 6 percent of regional projected work trips.

Although no transportation modeling data for the year 2010 were available when the CTS study was conducted, mode split corridor goals for the year 2000, transformed into *AVR* figures, ranged from a low of 1.08 ridesharers/veh to a high of 1.26 ridesharers/veh. The regional *AVR*, weighted by the demand to be served in each corridor, averaged 1.18 ridesharers/veh. Although the number of ridesharers computed for the year 2000 on major travel corridors represented only one-fifth of the regional ridesharing goal for that year, it is essential that ridesharing be measured on travel corridors because some facility improvements on freeways, such as HOV lanes, are specifically intended to promote ridesharing.

At this time, the only recommended changes for corridor-level ridesharing goals are to extend their time lines to the new RTP horizon year, 2010. This modification is the same as that proposed for the regional level. Later, however, each corridor goal should be modified to reflect local ridesharing characteristics such as the proximity of activity centers. This approach is, in fact, exactly the one SCAG is taking with a series of ongoing corridor-specific studies.

Activity Center Level Goals

Ridesharing goals for the year 2010 were also proposed for smaller geographical areas termed "activity centers." The allocation of ridesharing goals to each activity center was not accomplished through the proportional distribution of regional goals to smaller geographical areas, but by the same formula used to derive *AVR* figures from mode split distributions:

$$AVR = (N_d + N_p)/N_d$$

where N_d is the number of automobile drivers, and N_p is the number of automobile passengers.

In addition to employment growth forecasts, the characteristics of each activity center were used as weighting factors for their mode split distributions. The *AVR* goal of each activity center was computed as follows:

$$AVR_{2010} = 1 + AVR_{1984} \cdot \text{[Regional growth in } AVR \text{ from 1984 to 2010)} + (A_1 + A_2 + A_3 + A_4)]$$

where

A_1 = The activity center's magnitude as defined by SCAG, based on the activity center's employment forecast, commercial development, existing trends, and planned changes.

A_2 = The expected employment growth between 1984 and 2010, as projected by SCAG in their 1982 modified forecast *(8)*. Three growth categories were created with the regional growth forecast used as a point of reference.

A_3 = The current CTS level of activity for each activity center as measured by the CTS database.

A_4 = The activity center's level of ridesharing potential, based on CTS contextual information. This level consists of the local political climate regarding ridesharing, predominant existing land use, current transportation conditions, and expected commercial real estate development.

Each of these characteristics was separately scored, then aggregated for each activity center. Subsequently, different weighting factors were allocated to each activity center.

Depending on these characteristics, the projected growth in ridesharing goals between the years 1984 and 2010 varied from a low of 6.3 percent to a high of 13.3 percent for the Los Angeles CBD. The impact of each activity center's characteristics on ridesharing determined its expected *AVR* growth. For example, an employment center with a moderate magnitude, a projected employment growth of 50 percent of more, a current CTS *AVR* of 1.13 ridesharers/veh or more, where commercial and office development is expected, presents conditions that are favorable for ridesharing activity. This activity center would be assigned a growth in *AVR* much larger than the regional figure for the same period. In contrast, other activity centers with characteristics less conducive to ridesharing would be assigned an *AVR* growth equivalent to or lower than that for the region.

The reason for selecting this modified approach is the importance of local ridesharing characteristics. For example, an important feature of ridesharing is the increased propensity of carpools and vanpools to be formed at concentrations of commuter's work-ends. In addition, qualitative judgments based on CTS data were used to establish this approach. As a result, most current and projected center-level *AVR* figures are substantially higher than the regional ridesharing goals. Excluding the Los Angeles CBD, selected center-level *AVR* figures would grow from 1.24 ridesharers/veh in 1984 to 1.34 ridesharers/veh by the year 2010. This compares with regional figures of 1.10 and 1.18 for the same years.

Firm-Level Ridesharing Goals

In formulating ridesharing goals at the level of the worksite, three major factors affecting employer-based ridesharing have to be considered: the work force size, the type of industry, and the geographical location. The AQMP 1987 ridesharing goals for the South Coast Air Basin proposed ridesharing goals for firms categorized by employment size *(4)*. These goals are expressed in carpool capture rates *(CCR)* that range from 5 percent for firms of fewer than 50 employees to 40 percent for firms of 500 employees or more (Table 3). In order to formulate firm-level ridesharing goals for the year 2010, it was necessary to use the employment forecast for that target year. Because no economic forecast was available to predict the future distribution of firms by their size, the 1987 AQMP proposed distribution of firm size was applied to the employment forecast for the year 2010. The transformation of *CCR* values into *AVR* values required the application of the following formula:

$$AVR = (N_e - N_o)/[N_{da} + (N_r/ACS)]$$

where

N_e = number of employees at a worksite,

N_o = number of users of other modes (12.7 percent based on 1980 UTPP data),

N_{da} = number of drive alones = $N_e - (N_o + N_r)$,

N_r = number of ridesharers = $N_e \cdot CCR$,

ACS = average carpool size, and

CCR = carpool capture rate.

As shown in Table 3, firm-level *AVR* goals for the year 2010 ranged from a low of 1.04 ridesharers/veh for small firms to a high of 1.38 ridesharers/veh for large firms. Both *CCR* and *AVR* figures decrease with firm size. Although size of firm is a significant factor contributing to the formation of carpools, the research of CTS indicates that other worksite characteristics are of equal importance in the commuter mode choice decision process. Those factors include, but are not limited to, industry type, firm location, employees' home-end concentrations, income levels, availability and price of parking, provision of ridesharing amenities, and availability and quality of transit *(9)*. Unless these characteristics are also considered, to assign *AVR* goals to firms based solely on their size would be relatively ineffective. Nevertheless, firm-level ridesharing goals in terms of *AVR* are still useful.

MONITORING

The monitoring of ridesharing goals is important because it allows the effectiveness of ridesharing program and strategies to be assessed. In addition, it also allows ridesharing goals to be modified as new data are collected.

The selection of monitoring techniques for measuring the achievement of ridesharing goals is based on the use of data sources that vary by both geographical level and time frame chosen. Recommendations for using available data sources for monitoring ridesharing and specific suggestions for improvements needed to render those data sources more effective follow.

UTPP data provide highly quantitative information on commuters' mode choices. As a monitoring technique, they can be used for long-range monitoring because the information is based on the decennial census. UTPP data seem, therefore, to be appropriate for monitoring ridesharing activity at the regional and activity center levels. In addition to their monitoring

TABLE 3 RECOMMENDED FIRM-LEVEL RIDESHARING GOALS FOR THE YEAR 2010

	FIRM SIZES				
	500+	250-499	100-249	49-99	1-49
Employment	2,909,429	776,905	1,086,081	824,470	2,330,714
Ridesharers (Carpool Capture Rate)	1,163,772 (40%)	233,072 (30%)	217,216 (20%)	82,447 (10%)	116,536 (5%)
Other Modes Users (12.7%)	369,497	98,667	137,932	104,708	296,001
Solo-Drivers	1,376,160	445,166	730,933	637,315	1,918,177
AVR	1.38	1.26	1.16	1.07	1.04

possibilities, they can also be used to adjust future long-range goals.

The Caltrans HOV counts *(6)* are performed annually, and therefore constitute a useful, short-term monitoring technique for measuring vehicle occupancy rates at the regional and corridor geographical levels. However, they are currently limited to 14 locations in Los Angeles and Orange County and only reflect peak-period ridesharing on freeways entering the Los Angeles and Santa Ana CBDs. Comparison of the Caltrans 1980 *AVR* with the 1980 UTPP *AVR*—1.22 and 1.14, respectively—indicates the need for scaling the Caltrans vehicle occupancy ratios downward to improve their representativeness of the regional ridesharing level. Assuming that the UTPP *AVR* values are, over time, systematically lower than the Caltrans *AVR* values by 6 percent, reducing the Caltrans annual *AVR* by the same proportion should be CTS's best measure of the regional ridesharing level. The expansion of the 14 counting locations to include the 27 SCAG-identified travel corridors could probably solve the issue of representativeness. It would also provide a more accurate means for monitoring ridesharing activity that occurs in the entire SCAG region.

Arterial HOV counts similar to the previously mentioned counting techniques could be performed on major arterials or at specific intersections serving identified employment centers. The monitoring of arterials is as important as the monitoring of freeways because, in Southern California, 48 percent of the morning travel takes place on arterials *(10)*. This monitoring would improve the assessment of ridesharing goals attainment at individual activity centers. The counts could be carried out by county or city transportation or traffic engineering departments.

Registrant data from regional commute management organizations such as Commuter Computer and OCTD could provide a complementary activity center level monitoring technique for the Caltrans HOV counts and for local arterial counts. This improvement could only be made, however, by the aggregation of company data for each activity center. In instances where few companies in a given activity center are clients of a ridesharing agency, the extrapolation of the firms' *AVR* figures to the corresponding activity center's *AVR* should be avoided.

Ridesharing activity at worksites can best be monitored through the marketing activity of agencies delivering ridesharing services. For example, more than 200,000 individuals are currently registered with CTS, and about 1,500 worksites in the SCAB region receive ridesharing-related services. The growing adoption by local government of trip reduction requirements for new developments and related ordinances coupled with the private sector's increasing interest and concern in solving transportation problems increase the chance that ridesharing goals can be met at the firm level. Client companies' registration information, updated annually and collected by these agencies, provides a readily available monitoring technique in itself.

In addition, CTS has promoted the adoption of tracking methods to be implemented by employee transportation coordinators (ETCs) at larger worksites *(2)*. They are aimed at monitoring ridesharing activity at worksites and can be conducted through the periodic surveys of employees, the physical counting of vehicles and occupants entering firm parking lots, and carpool and vanpool enrollments. At worksites where there are no ETCs, ridesharing agencies can perfect their data collection methods by performing individual surveys and random vehicle occupancy counts.

Trip reduction ordinances generally include a reporting component. Although they usually apply to new developments, in the long run they could be expanded to monitor ridesharing at worksites, as well as at activity centers. Ridesharing goals can serve as guidelines to *AVR* requirements imposed on worksites or activity centers as a traffic mitigation measure. Municipalities could induce firms to comply with *AVR* requirements by requesting them to annually report their ridesharing activity, a strategy now used in Pleasanton, California. Later, these reports could be independently verified.

CONCLUSIONS

The problems presented in the introduction of this paper, the need for consistency and attainability in formulating regional ridesharing goals, were addressed in this study.

The analysis of regional ridesharing data and the formulation of ridesharing goals has been made consistent in the following ways:

- Units of measurement. All ridesharing observations and goals were presented in terms of *AVR* as well as number of ridesharers.
- Time frame. In almost all cases, new ridesharing goals were recommended for both the original RTP horizon year, 2000, and the forthcoming horizon year, 2010.
- Different geographical levels. Distinct but interdependent ridesharing goals were presented for five levels of geographical aggregation: the region, county, corridor, activity center, and worksite.

The issue of attainability in proposing ridesharing goals was addressed by two strategies. The first was to establish an empirical base line of observed ridesharing activity at each of the geographic levels for which goals have been presented. Once established, it was clear that the ridesharing goals in the current RTP and AQMP were too ambitious. They were, therefore, recommended to be pushed back by approximately one decade.

The second strategy was to add activity centers as a major geographical level at which ridesharing goals are to be formulated. In this way, the planning process and the implementation process have been linked. This is because employment centers, as well as firms, are the locations at which most organized ridesharing efforts, such as the formation of transportation management associations, take place.

At this point several methodological areas continue to be problematic and need further research.

First, a thorough understanding of the dynamics of commuter behavior is necessary to understand the context in which ridesharing goals are recommended, set, and implemented at the programmatic level. For example, the cost of commuting clearly plays a major role in commuting patterns, yet its precise relationship to ridesharing behavior is not known.

Second, for ridesharing goals to be attainable, the anticipated impacts of ridesharing and other trip reduction techniques on commuter behavior must be better understood. This understanding is particularly important for programs implemented by commute management organizations such as CTS and OCTD. To date, knowledge of these cumulative impacts is sketchy and needs improvement for the type of ridesharing planning presented here to become more rigorous.

Third, the commute management organization's traditional ridesharing programs of carpooling and vanpooling are now being complemented by other transportation demand strategies. These include compressed work weeks, telecommuting, and flexible work hours. As these commute alternatives develop, they will divert commuters from other modes. These trends, which are already under way, will surely be a major factor by the year 2010, the long-term planning horizon used in this work. Nevertheless, they have not been adjusted upward in this work to reflect their presumed growth.

Fourth, as these alternative commute modes develop, *AVR*, the common ridesharing measure used in this work, may become less representative. If these developments do transpire, *ACR* could be used in its place, at least at the level of the activity center and worksite. Although this measure would be an index of all transportation demand management techniques, it, too, suffers from a drawback. Transportation planners do not yet know how to easily apply it to transportation corridors, counties, or regions.

Fifth, for ridesharing goals to be effective, they must be monitored. Without monitoring there is no way to know which ridesharing techniques are successful, or which regional goals are being met. Thus far, ridesharing can be accurately monitored at the regional level through the census, at the corridor level through HOV counts, and at the worksite through ridesharing registration data, as well as employee and vehicle counts. These methods are not, however, clearly related to each other, nor do they offer a suitable technique for activity centers.

Despite these problematic areas, this case study has demonstrated that it is clearly possible to develop long-term regional ridesharing goals that can be simultaneously used in transportation and air quality plans. The goals recommended have the capability of serving both traffic mitigation and air quality requirements. Furthermore, they have been designed to address the major geographical levels at which ridesharing programs are implemented. Therefore, the objective need to better integrate ridesharing into the regional planning process has, in large part, been met.

Although this case study cannot be straightforwardly grafted onto other regions, it does provide a working model, at both the conceptual and technical levels, for how this work should proceed.

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