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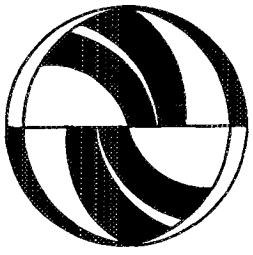

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Elizabeth Burns

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Gender Differences in Commuter Travel in Tucson: Implications for Travel Demand Management Programs

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This paper reports on part of a study funded by the U.S. Department of Labor to evaluate whether individual transportation demand management (TDM) measures differentially affect salaried men and women in various household situations. Working women with children are the least able to make drastic changes in their daily activities but may be the most affected by employer sanctions and financial penalties. The study found that in Tucson, Arizona, women are (a) substantially more dependent on the private car driven alone than are comparable men, (b) far less likely to have switched to alternative modes, and (c) more likely to have chosen different alternative modes when they did switch. Moreover, there were differences between the sexes in travel time and distance to work, none of which could be explained by income or occupation. When workers were asked how effective various TDM strategies would be in increasing their use of alternative modes, women were more likely to see all potential strategies in a favorable light. Moreover, women were more responsive to strategies that addressed their domestic responsibilities (for example, their need to transport children or respond to family emergencies). Ultimately, while being more favorably disposed to TDM measures, women were less likely to give up driving alone because travel modes that are slower and less flexible than the private car may severely affect their working and family lives. These findings show the need to identify the equity consequences of specific TDM requirements, to target appropriate individual measures to working women, and to develop ways to offset the negative impacts on working mothers.

This paper describes the preliminary results of an ongoing U.S. Department of Labor study designed to critically analyze the impact of mandatory transportation demand management (TDM) measures or programs in two major metropolitan areas in Arizona: Tucson and Phoenix. Individual TDM measures, or packaged programs of measures, are designed to reduce traffic congestion, energy consumption, and environmental pollution by changing employee home-to-work travel behavior.

The overall study was structured to evaluate the extent to which TDM measures—from mandatory shifts in work hours to free transit passes—differentially affect salaried men and women in different household situations. A growing body of international research strongly suggests that working women with children may be disproportionately affected by policies that impose additional constraints on their already restricted choices. Working mothers have different travel patterns than their spouses, and single mothers have different patterns than both married parents because they retain child care and domestic responsibilities when they enter the paid labor force.

The analyses are based on mandatory employee surveys undertaken sequentially in 1990 and 1991; the data bases are large (over 50,000 respondents in each region in each year). This paper focuses on the Tucson findings that women are (a) substantially more dependent on the private car driven alone than are comparable men, (b) far less likely to have switched to alternative modes between 1990 and 1991 than comparable men, and (c) more likely to have chosen different alternative modes when electing not to drive alone. The findings for Phoenix are roughly comparable, although income data were not available in the Phoenix region. Full details of the study, the data bases used, the study methodology, and the comparative Tucson-Phoenix analyses appear in work by Rosenbloom and Burns (*1*).

These findings have important policy implications. Working women may have chosen to use the car for their work trip because it is the best—and perhaps only—way to balance their complicated obligations. TDM measures that force women workers with domestic responsibilities to choose slower, less responsive transportation alternatives may severely affect their working and family lives. TDM measures that require them to shift to alternative work schedules not of their own choosing may be equally harmful.

The following section of this paper explains travel demand management programs and describes a growing body of literature that suggests why women may be disproportionately affected by such programs. The next section explains the data on which the study here is based; the section following that describes the research findings from Tucson.

BACKGROUND AND POLICY ISSUES

Travel Demand Management Programs

Transportation demand management (TDM) programs attempt to directly or indirectly persuade, induce, or force workers to change transportation habits and patterns that cause traffic congestion, contribute to environmental pollution, or increase

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consumption of nonrenewable natural resources (*2–4*). These dysfunctional actions include driving alone, traveling during peak periods, and failing to use available alternatives to the private car.

Public TDM programs focus directly on large employers and only indirectly on individual employees; employers are encouraged or required to introduce measures that change their employees' behavior in appropriate ways. Employer TDM programs may include incentives for employee behavioral changes; for example, employers may provide bike lockers and showers to induce cycling and walking to work, or special carpooling parking near the door to encourage ridesharing.

Conversely, employer programs may include disincentives; for example, firms may charge substantial fees for formerly free parking, provide only carpool parking, or even ban employee parking. Firms may also introduce mandatory schedule changes, such as shortened workweeks or earlier or later start times.

Although most government efforts have not been compulsory, there is increasing likelihood that public agencies will soon be forced to implement mandatory TDM programs—and require employers to achieve measurable reductions the number of employees who drive alone. Many regions will have to adopt such programs in response to provisions of the Intermodal Surface Transportation Efficiency Act of 1991 and the Clean Air Act Amendments of 1990 (CAAA). Section 182 of the latter requires states with "severe" or "extreme" ozone nonattainment areas to require all employers of 100 or more workers located in nonattainment areas to reduce work-related automobile-usage among their employees.

The CAAA provisions specifically require all affected employers to develop programs that increase their employee work trip passenger occupancy by 25 percent above the area average—which creates, of course, an ever-increasing standard of attainment. Failure to meet these standards may cause a region to lose significant federal highway and transit funds.

How and Why TDM Programs Affect Women

Historically, salaried women have had different transportation patterns than men: employed women worked closer to home, traveled shorter time and distance to work, and more often used mass transit than men (*5,6*). However, most of these disparities were thought to be the result of economic differences, simply reflecting the fact that so many more women had low incomes. See work by Rosenbloom (*7*) for a review of the literature on traditional beliefs on women's travel patterns. Until recently, few analysts believed that (a) women with comparable incomes but different household situations—single mothers versus married mothers, for instance—might have different travel patterns than one another, (b) employed men and women with comparable incomes might have different travel patterns, or (c) such differences reflected crucial noneconomic considerations.

New Perspectives on the Travel Behavior of Women

Research during the last two decades shows that, in contrast with traditional thought, working women have different patterns than men in comparable households with comparable incomes and that single mothers are different from their married counterparts. These trends have been found in countries as diverse as Sweden, England, France, and the United States and as recently as 1990.

The literature shows that married mothers have different travel patterns than comparable male parents and single working parents have different patterns than their married counterparts. Women appear to make transportation and other decisions in order to successfully juggle a number of employment, child care, and household responsibilities (*6,8*). These needs may limit their ability to use alternative modes or radically change their work schedules (*9*).

For example, Hanson and Hanson found that Swedish married women were more likely to make more shopping and domestic trips than their spouses—and fewer social and recreational trips (*10*). A 1990 study in four Chicago suburbs found that employed women made twice as many trips as comparable men for errands, groceries, shopping, and chauffeuring children (*11*).

Comparative work by Rosenbloom in The Netherlands, France, and the United States found that women's travel patterns varied significantly with the age of their youngest child and were significantly affected by their children's needs in all three countries (*12*). Raux, in a 1983 study in Lyon, France, found that working women were the parent in two-worker households who arranged their work and travel schedules to fit child care needs (*12*). Perez-Cerezo also found that the age and presence of children more influenced the travel patterns of women than men in all types of households (*13*).

Rosenbloom also found that more than 80 percent of all married women made trips solely for children, compared with half of all men; however, the trips made by men were made infrequently and served only a back-up function (*14*). When Rosenbloom asked employed married and single parents to describe their children's most frequent travel mode, both married parents overwhelmingly agreed that the mother was the most frequent chauffeur for children of all ages. Only 5 percent of all American women and 2 percent of all American men reported that the father has greater responsibility for children's transportation (and then only for children under six) (*15*).

The limited research on differences between married and single parents shows comparable differences between traditional economic assumptions and reality. Kostyniuk et al. found that, except for the poorest women who did not drive, single parents in Rochester, New York made more trips and traveled further for all purposes than comparable married workers; they attribute these patterns to the need to balance employment and domestic responsibilities without the help of a resident partner (*16*). Johnston-Anumonowo found that although single women with children in Worcester, Massachusetts, were less likely to own cars, they were more likely to make their work trips in cars; she also found that single mothers had longer work trips than comparable married women (*17*).

Rutherford and Wekerle studied single and married workers in a Toronto suburb and concluded that single mothers spent more time traveling to work and that they were less likely to work in the suburb in which they lived than comparable married women (*18*). Rosenbloom found that single

mothers in Houston and Dallas had different travel patterns than comparable married women, generally traveling further and using a car more often than either married worker at all income levels except below $5,000 a year (*19*).

Clearly the use of the car by even low-income women and the complicated travel patterns of working women reflect transportation needs generated by their primary responsibilities for children and for the conduct of household business (shopping, picking up drycleaning, etc.) To fulfill these obligations, working women alter their travel patterns—they make more linked trips to and from work (*20*), choose travel modes that allow them to respond to children in emergency situations (such as a child becoming ill at school or child care), and routinely chauffeur even their teenage children.

TDM Concerns for Working Women

It is clear that the travel choices of working women and men are dependent on a variety of nonwork, and often nonfinancial, variables—the most important of which may be time. In short, there are only 24 hr in a day in which to carry out multiple activities. Moreover, time becomes money for working women who are paying for child care or elder care, especially those paying premium prices for early or late hours of care. It is important to question, therefore, how TDM measures might negatively or positively affect women in the labor force, particularly those who juggle domestic responsibilities.

Giuliano and Golob (*21*), in a 1989 study of a major TDM program in Honolulu that focused on changing work hours, cautioned,

> . . . research provide[s] valuable information on the degree to which an individual's work schedule is embedded with the household activity schedule. When the work schedule changes, it affects all members of the household, and requires adjustments in all activities. Social activities, child care, children's activities, and household chores may be reorganized and rescheduled. The Honolulu experience also illustrated the dependence of workers on the schedule of other institutions and services. Thus spreading out the normal workday is dependent upon extending hours of child care services, banks, medical offices, etc. as well as extending work-trip oriented transit services.

Employees often report that their unwillingness to stop driving alone is due entirely or in significant part to their need for their car immediately before and after work, their child care needs, and their concern that they might be faced with a family emergency during the middle of the work day (*22–26*).

Although mass transit subsidies have been suggested as a way to offset any inequities imposed by mandatory TDM measures, low-income working women who drive have already accepted the expense of driving because their other economic needs (the hourly cost of child care) or noneconomic needs (the actual availability of a child care provider matched to their work schedule) are more pressing.

Given the average time differentials between the car and all other modes, mass transit subsidies are hardly likely to offset additional costs imposed on these women by mandatory changes in their work trip. For example, the average American work trip was 10.4 mi in 1990—such a trip would take barely 20 min by car in most suburban areas but more than 45 min by mass transit (*27*). Thus, a worker switching to mass transit could lose almost 1.5 hr per day (during which child care costs and the like could be mounting).

THE STUDY DATA SETS: ARIZONA TDM PROGRAMS

Both Tucson and Phoenix (with more than 70 percent of the State's population) have had mandatory TDM programs for more than 3 years. The Tucson program concentrates on increasing commuting participation in alternative modes: 15 percent in the first year, 20 percent in the second year, and 25 percent in the third year. The Tucson standards are far less onerous than they initially sound; mandatory changes in behavior need take place only 1 day a week to be counted.

Both regional TDM programs target only large employers (those with 100 or more employees at one site). The program in Phoenix, with a 1990 population of 2.1 million, includes just under 400,000 employees in 470 firms at 806 work sites. The program in Tucson, with a 1990 population of 670,000, includes 87,000 employees in 120 firms at 150 work sites.

The annual surveys that large employers in each region must administer to these employees constitute the data base for the research described here. In each region, the study team used the regional data bases for 1990 and 1991 to study general patterns and trends; in addition, the study team used the individual data bases from Arizona State University and the University of Arizona. As noted, this paper includes only the 1990 and 1991 Tucson regional findings.

These data bases are quite large, and all the differences reported on here are statistically significant unless otherwise indicated. The 1990 Tucson regional data set includes 50,866 respondents, and the 1991 data base includes 52,244 respondents. The Tucson data bases are not samples—they constitute 100 percent of all usable survey responses and represent more than 60 percent of the covered labor force.

TUCSON ANALYSES

Aggregate Travel Characteristics

Most Tucson respondents worked fairly close to their homes; more than 60 percent of respondents worked less than 20 min away from home in both 1990 and 1991, and less than 6 percent worked more than 40 min from home. Whereas travel times dropped nationally, mean travel time increased slightly in Tucson—from 20.7 to 20.9 min. The work trip distance patterns of Tucson were also slightly different from American trends on the whole. In 1990 the average American work trip was 10.6 mi, up from 9.2 in 1977; in Tucson the average work trip stayed the same at 10.4 mi.

Also in contrast to national trends, the use of the private car declined in Tucson between 1990 and 1991 by almost 7 percentage points. All of the alternative modes gained a share of the decline, but carpooling took the largest share of the drop in single-occupancy vehicles.

Although the TDM programs in Tucson had some success in increasing the use of alternatives to the private car driven alone, most workers still chose to drive alone in the face of TDM incentives and even sanctions. After the 1990–1991 shift

away from the single-occupant car, more than 88 percent of all workers still arrived at work in a car as a passenger or driver, down from 90 percent in 1990.

Women's Travel Patterns

Basic differences between women and men in mode choice and time and distance to work are discussed in this section.

Women workers in Tucson tended to be even younger than the young aggregate labor force, more likely to be employed in low-paying occupations (secretarial instead of managerial jobs, for example), more likely to be in households with fairly low incomes, and less likely to be in households with fairly high incomes. Women were also slightly less likely to work a five-or-more-day workweek than comparable men.

In spite of the fact that women were either more likely to have lower incomes or to be in lower occupational jobs, they were (a) substantially more dependent on the private car than men, (b) far less likely to switch to alternative modes between 1990 and 1991 than men, and (c) when electing not to drive alone, more likely to choose different alternative modes than men.

Women were more likely to drive alone in both 1990 and 1991 by statistically significant margins. The most impressive fact is that, because of differential changes in mode choice from 1990 to 1991, the gap between men and women has intensified sharply. As these data showed, aggregate private car use dropped in Tucson; however, it has dropped the most for men. In 1991 the number of men driving alone to work declined by more than 9 percentage points, whereas women's driving declined by less than 4 percentage points. Thus the differences between the sexes in the use of the private car increased—comparatively speaking, women were even more dependent on driving alone to work in 1991 than men.

The data show that biking is largely a male mode; its use barely increased among women workers while showing meaningful gains among male workers. In Tucson in 1991 the bike accounted for 4 percent of male workers' commute mode while accounting for barely 1 percent of the work trips of female workers. The bus was used more often, on the other hand, by women in 1991 than men, although the gap is not as great.

There are both challenges to, and support for, traditional assumptions when examining time and distance to work by men and women. Women have shorter median work trips in miles than men—as would be expected given historical trends and their income and occupational characteristics. However, given that women had shorter commutes in miles, and were more likely to use a car for their work trips, their travel times were expected to be substantially less than men's. However, mean travel times were longer for women than men—in contrast to both traditional assumptions and the data already presented.

Synthesizing mode choice, time, and distance responses, the authors found more nontraditional than traditional patterns—with the largest discrepancy being the choice of the car by more women. Moreover, there is a problem in making consistent the time and mileage responses—if women overall work much closer to home than men, why does it take them almost as long to get to work, especially considering that they are more likely to be using the car—a faster mode?

One clear possibility is the following: women have retained child care and household duties, and their work trips are linked with trips to drop children at school, take other adults to work, or to carry out domestic responsibilities. If so, it is likely that they are reporting the total time from home to work, including these trip links, thus lengthening the time taken to drive the distance between their home and job.

Travel Patterns by Income

It is, of course, possible that traditional economic variables do explain some of the significant mode and time and distance differences between men and women; that is, in spite of the average income disparities, longer trips and higher automobile use by women could be the result of a small number of higher income or higher occupational status women among female respondents. This section examines that possibility.

Mode Choice by Sex and Income

Analyzing mode choice in Tucson by household income as well as sex shows the same patterns seen in the aggregate data: (a) at all income levels—including the lowest—women were much more likely to drive to work than comparable men; (b) at all income levels, women were less likely to have given up driving alone so that unexpected differences between the sexes intensified between 1990 and 1991, and (c) when changing from driving alone, men and women chose different travel alternatives, which varied with income. In short, the patterns seen in the aggregate travel data by sex are also seen across income groupings.

First, in both 1990 and 1991 the likelihood of driving alone increased for both men and women as income increased, but, at all income levels except the highest (above $80,000), women were more likely to drive alone to work. In general, in all except the lowest income category, the gap between the percentage of men and women driving alone increased as household income levels increased.

Second, as in the data aggregated by sex alone, fewer women stopped driving alone to work at all income levels between 1990 and 1991. As a result, the gap between men and women in the use of the private car widened from 1990 to 1991; again, although private car use dropped for both men and women, it dropped far faster for men at all income levels than for women. For example, at incomes below $10,000, the gap between men and women was 5.8 percent in 1990 and 8.5 percent in 1991—with women always more likely to drive alone.

Figure 1 shows car use by sex and income in 1991. In every income category, women are more likely to drive alone than men, sometimes by substantial, and always by statistically significant, margins. At incomes between $10,000 and $20,000, the gap between men and women in 1991 was just under 7 percent; between incomes of $30,000 to $40,000, the gap was almost 10 percent.

Third, men and women generally chose different alternatives to the private car, and the choices varied with household

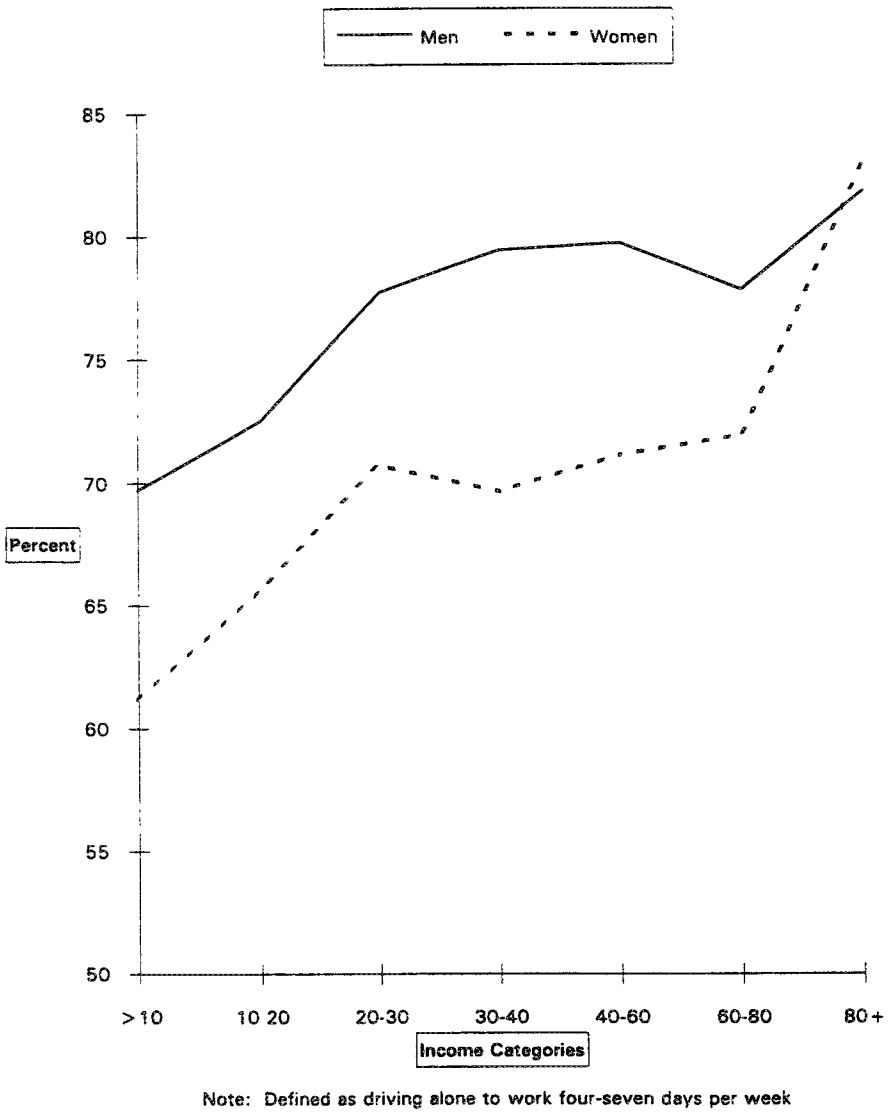


FIGURE 1 Car use by income and sex.

income. At income levels below $20,000 and above $60,000, more women than men carpooled in both years. Between 1990 and 1991, although the use of carpooling generally increased for both men and women, it went down for those with high and low incomes. The alternative of choice for low-income workers of both sexes was the bus, the use of which increased substantially for those with incomes below $10,000.

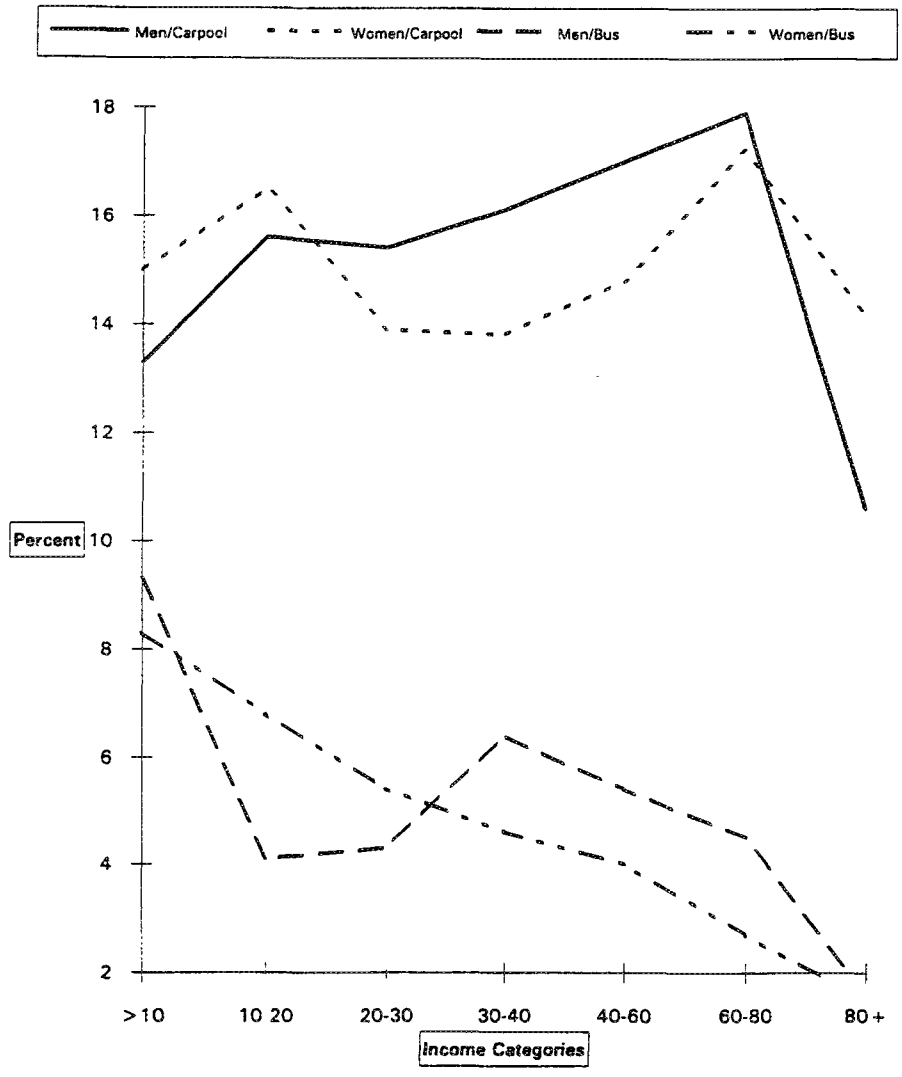
However, as Figure 2 shows, sometimes substantial differences occurred between the sexes in the use of these alternatives in 1991. Women who earned between $20,000 and $80,000 were less likely to carpool than comparable men. At low incomes (below $10,000) and those more than $30,000, women were more likely to use transit as their alternative mode than men. Note, however, that no more than 9 percent of any income group used the bus; less than 5 percent of all women workers in Tucson used the bus, although one-third of all women had incomes below $20,000.

When mode data were categorized by occupation, the analysis indicated that (a) women are more likely to drive alone to work in most occupational categories, regardless of the income potential of the occupation, (b) that women in all occupational categories were less likely to give up driving alone between 1990 and 1991 so that the gap between men and women in each occupational group intensified, and (c) that there were differences in the alternative modes chosen by men and women, which did vary with occupation.

In summary, in contrast with traditional models of travel behavior, neither income nor occupational variables provide an explanation of the most important differences in the mode choice of men and women. However, the analyses do show that income is associated with some differences in travel behavior; the differences between the sexes in the choice of alternatives to driving alone seemed to be affected by income (that is, the differences between the sexes are different at different income levels).

Travel Time and Distance to Work by Sex and Income

This section questions whether the aggregate differences between the sexes in time and distance are explained by the



Note: Mode choice defined as using the mode four-seven days per week

FIGURE 2 Mode to work by income and sex.

traditional variable of income. Overall, trip length to work increases for both men and women as income increases—as traditional theories would hold. However, there are differences, sometimes substantial, between men and women within most income categories, and the differences vary with income in ways that traditional thinking would not predict.

At income levels below $20,000, women had a significantly longer average commute in both 1990 and 1991 than comparable men. On the other hand, as Figure 3 shows, the average commute for women at incomes above $20,000 was less than comparable men until high income levels were reached.

The disaggregated data show that at incomes under $30,000, there were more men than women who worked close to home (less than 5 mi). Conversely, men at all income levels were more likely to work far from home; for example, more than 9 percent of men but less than 2 percent of women with incomes between $30,000 and $40,000 worked more than 26 mi from home.

Alternatively, women have longer mean travel times to work than comparable men for all household income groups below $30,000; for example, at incomes between $10,000 and $20,000, the mean commute for women was more than 20 min compared with 18 min for men. Although these differences are not large, they are significant and important because they move in a different direction than expected, given average travel distances. Figure 4 shows that all women have different commute times than comparable men.

Income data do not provide much explanation for the disparity between women's travel distances and their travel times; women have shorter commutes but take more time to make them, despite that they are more often using the fastest mode available. Overall, these findings support the contention that the other responsibilities of salaried women create diverse needs that are incorporated into their travel patternsneeds that are not incorporated into the patterns of comparable men.

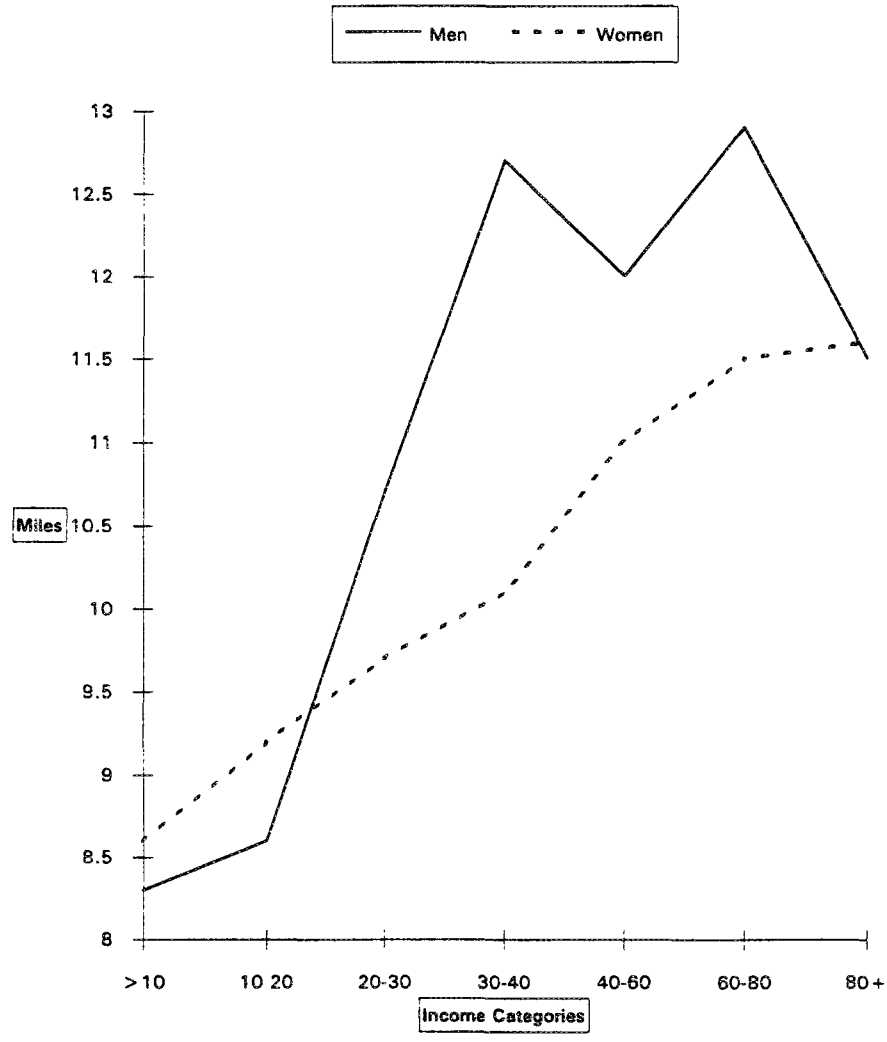


FIGURE 3 Average distance to work by income and sex.

DIFFERENCES BETWEEN THE SEXES IN RESPONSE TO ALTERNATIVE TRAVEL MODES

Workers were also asked in the annual surveys to evaluate the potential effectiveness of ways in which alternatives to the car could be made more appealing. Tucson respondents were asked to identifying the single policy or incentive that would most encourage their use of specific alternative modes.

The data suggest that (a) women are slightly more likely than comparable men to indicate interest in policies that facilitate the use of alternative modes and (b) they tend to be interested in the same policies as men—but then in addition are far more interested in other policies for encouraging the use of specific alternative. That is, men and women generally respond to many of the same measures; most of the top-rated policies in all the specific modal analyses are top-rated for both men and women. However, in addition, women are far more likely to respond to options that affect their children or their flexibility in carrying out domestic obligations.

Table 1 shows response to selected options encouraging transit use. Although all respondents were most interested in bus service improvements (closer home and work stops, no need to transfer, express or frequent bus service), men were slightly more responsive to these improvements than women. Women, however, were more responsive to arrangements for child care and guaranteed rides home. Almost 6 percent of women say that being able to arrange transportation for their children is the single most important factor that would encourage their mass transit use, almost treble the percentage of comparable men. Women were also more likely to be interested in a guaranteed ride home.

Women were also more concerned with safety and security, which is not shown in the table. More than 5 percent of female respondents said that the single most important factor in their potential bus usage would be safer buses and stops (compared with less than 1 percent of comparable men).

Table 1 also shows responses to selected options encouraging carpool use; for both men and women, living near other employees and having compatible work schedules are important. However, women are less likely to highly rank these policies than men. Conversely, women are much more likely to care about arranging children's transportation than men; more than 6 percent of women in the region but only half that percentage of men said that this was the single most important incentive to carpooling. A fairly major response was to another policy that implies flexibility: almost 9 percent

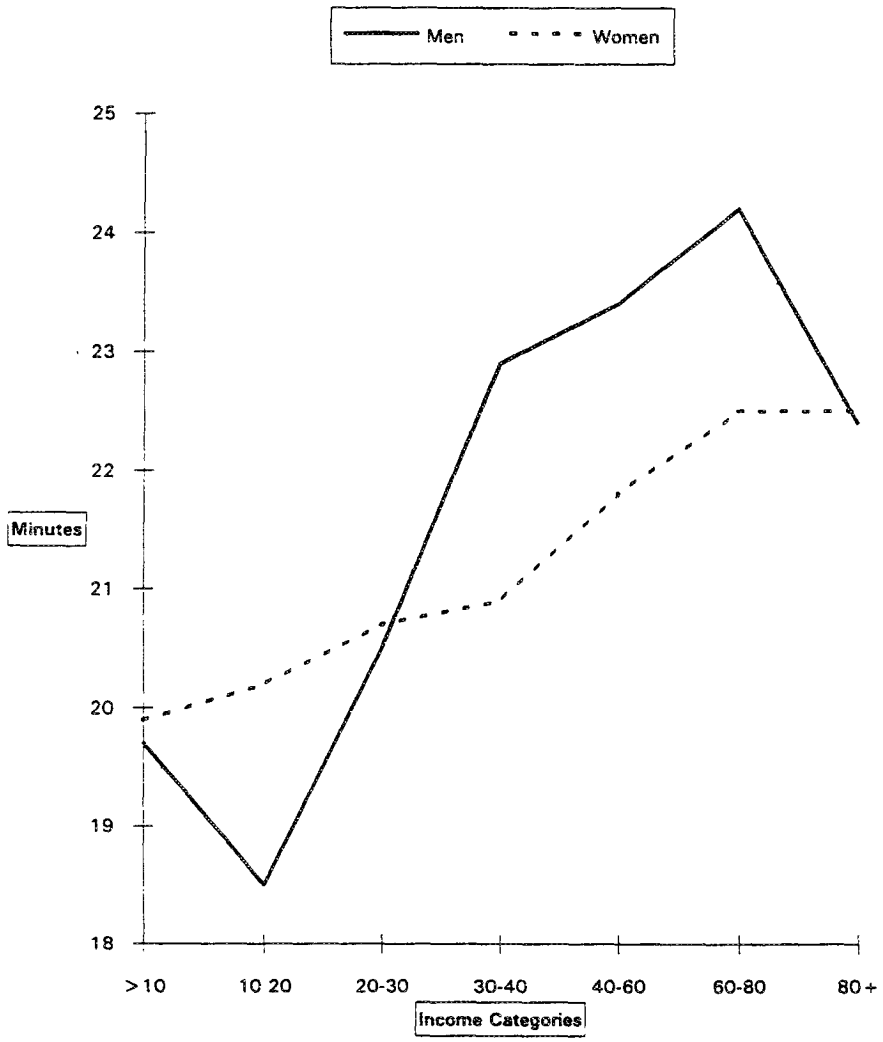


FIGURE 4 Average time to work by income and sex.

TABLE 1 Single Option Encouraging Use of Bus and Carpool by Sex

	Bus			*Carpool*	
Measure	Men	Women	Measure	Men	Women
Close Stops	18.8%	16.9%	Compatible Work Schedules W/Others	22.7%	20.4%
No Transfers	7.5	8.5	Live Close To Others	18.0	16.7
Express Bus Service	6.4	6.6	Can Carpool Often But Not Daily	6.1	8.7
Frequent Bus Service	6.6	5.6	Guaranteed Ride Home	8.4	9.7
Guaranteed Ride Home	4.5	5.4	Arrange Children's Transportation	2.4	6.3
Arrange Children's Transportation	1.9	5.7	Free or Covered Parking	3.5	2.7
Others or None	54.3	51.3	Others or None	38.9	35.5

of women but only 6 percent of men said that being able to carpool regularly but not daily would encourage them to pool.

In short, although men and women tend to respond to similar incentives and encouragement policies for all the alternative modes, there are sometimes substantial differences in the relative importance of those policies. For all the modes analyzed, women were more concerned with, above all, being able to respond to their domestic responsibilities and children's needs. They were also more concerned than men with safety and security.

SUMMARY AND CONCLUSIONS

Salaried women have different travel patterns than comparable men; everything about their actual travel patterns and their stated preferences shows that they are fulfilling multiple roles and meeting multiple obligations. Women's travel decisions are made as part of a network of financial and non-

financial concerns, concerns that include the transportation and other needs of their children. It is clear that traditional theories do not explain women's travel decisions; women's transportation behavior is best understood as a part of a complex set of employment and domestic responsibilities.

Therefore, various TDM measures will have different cost and noncost implications for working women. If employers make certain measures mandatory—for example, banning parking or changing work schedules—working women may be disproportionately affected. Conversely, incentive measures, such as offering showers for bikers or free transit passes, may not provide as much encouragement to women because these incentives do not address the additional time and indirect monetary costs created by using alternative modes. For example, a $52/month transit subsidy may not cover the extra 22 to 44 hr/month of child care expenses created by the additional time required to take a bus.

Working women have slightly more positive attitudes toward alternative modes and are more likely to consider them when provided with ways to address the double and triple burdens that they carry—and that they currently meet in many cases by driving alone to work. TDM measures could only become both effective and equitable if they also included realistic and meaningful options that allow salaried women to get their children safely to and from school, to respond to family emergencies at home, or to shop on the way home from work.

The study reported on here is on-going; in its final phase, the researchers are focusing on the impact of the age and number of children and marital status on the travel and activity patterns of salaried men and women. They are doing so using data from the University of Arizona and the Arizona State University (more than 10,000 respondents), which added special questions to their mandatory annual TDM surveys. This effort will suggest the women most likely to be negatively affected by mandatory TDM measures and how those negative impacts might be offset.

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