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## TRANSPORTATION DEMAND MANAGEMENT AND THE TRAVEL PATTERNS OF WORKING WOMEN: ISSUES AND RECOMMENDATIONS

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TRANSPORTATION DEMAND MANAGEMENT  
AND THE TRAVEL PATTERNS OF WORKING WOMEN:  
ISSUES AND RECOMMENDATIONS

BY  
SUSAN A. LYNCH

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER OF COMMUNITY PLANNING

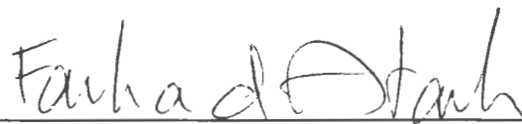
UNIVERSITY OF RHODE ISLAND  
2000

TRANSPORTATION DEMAND MANAGEMENT  
AND THE TRAVEL PATTERNS OF WORKING WOMEN:  
ISSUES AND RECOMMENDATIONS

RESEARCH PROJECT OF  
SUSAN A. LYNCH

Approved:

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Dr. Farhad Atash

## **Abstract**

This study aimed to compare the travel patterns of working women with transportation demand management (TDM) programs to determine how women are affected by these programs. In order to accomplish this objective, this study reviewed the literature on working women's travel patterns and TDM and then analyzed them together. A comprehensive review of working women's travel patterns suggests that they are different from those of working men: women work closer to home than men do, they use public transportation more, are more likely to chain trips on their work commute and commute to suburban employment centers more than men. TDM programs utilize various strategies and incentives, some of which may not be appropriate for women's distinct commuting behavior and may sometimes impose financial burdens and reductions in convenience, especially those that impose financial constraints on SOV users. Women who have greater financial and domestic burdens, for example single mothers, are most greatly affected by these types of strategies.

This study has identified the major factors associated with women's experience with TDM as domestic and childcare responsibilities, and occupational segregation. Although differences do exist between women in terms of ethnicity, income, marital status, and presence of children, these findings seem to apply to all working women. The findings of this paper suggest that, if TDM programs are implemented with flexibility and evaluated with consideration for all employees, negative effects might be mitigated. Also, strategies that address linked trips are beneficial to the program's success in achieving an increase in air quality and treating all employees fairly.

## **Acknowledgments**

I would like to thank all my professors, peers, family and friends who have offered their support and advice throughout this process. Dr. Atash has been there from the very beginning, offering invaluable feedback every step of the way. I would also like to thank Drs. Strom and Feldman their help and input. My inspiration and desire to study of the transportation needs and experiences of working women, however, comes from my mom, who is my own personal “working woman with children”.

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## **List of Abbreviations**

AVR	Average Vehicle Reduction
AVO	Average Vehicle Occupancy
ETC	Employee Transportation Coordinator
GRH	Guaranteed Ride Home
HOV	High-Occupancy Vehicle
SOV	Single-Occupancy Vehicle
TDM	Transportation Demand Management
TMA	Transportation Management Association



## Chapter One Introduction

*"I started part time. In night school....I should have continued, Consuelo. I should have had the discipline!"*

*"It takes more than discipline. It takes money. It takes good public transportation."*  
*Women on the Edge of Time*  
*Marge Piercy*

The aforementioned quote addresses some of the main issues explored in this study. The exchange comes from *Women on the Edge of Time*, a work of feminist science fiction with both utopian and dystopian images. The fact that transportation is mentioned at all, and examined further throughout the novel, in a feminist utopian work, suggests that transportation is an important aspect of one's quality of life and, for women, the transportation network is inadequate. The dialogue implies that inadequacy in the transportation system can prevent women from living their lives and fulfilling themselves. This study will explore women's experience with the transportation system, focusing on their experiences with transportation demand management programs.

### **Problem Statement**

Changes in land use patterns and labor force demographics can impact transportation patterns in many different ways: the number of trips and their patterns, increases in both traffic and congestion, and associated environmental, social and economic issues. Women's increased participation in the labor force has had a significant

impact on the transportation network, not only in the number of trips, but also in the type of trips and travel patterns.

The transportation network has, until recently, expanded to address increasing demand. Recently, however, transportation planning has shifted its focus to controlling the demand for transportation. Transportation demand management (TDM) programs are largely aimed at reducing the number of single-occupancy vehicles (SOVs), thus mitigating the amount of traffic. They use different strategies and incentives, such as subsidized transit passes, rideshare programs, etc.

Certain programs, however, may not be appropriate for women's distinct commuting patterns. Crafting policies that address demand without regard for the different mobility needs of all users of the transportation network can perpetuate, and perhaps exacerbate, problems and inequities. This study examines some of these new policies and programs that address reducing demand, in terms of women's transportation needs.

## **Background**

Women's participation in the labor market and travel patterns have been influenced by many different historical factors and events. Labor demographics in the United States have changed over the past century, and are accompanied by various economic, environmental and social changes. One constant, however, since colonial times, is that women have worked in the home, managing household tasks and, sometimes, balancing these tasks with work outside the home (Berch, 1982). Women have historically participated in the paid labor force and their numbers have been

advancing since the early 1800s (Goldin, 1990). Alexander Hamilton, as a proponent of industry in the early 1800s, argued that industrial work would employ women and children, leaving men to complete their agricultural economic activity (Berch, 1982). In 1860 women comprised 53.4 percent of textile workers, 45 percent of clothing workers, 13.9 percent of tobacco workers and 27.3 percent of study and printing workers. In 1890 the percentages were 40.6 for textiles, 55.9 for clothing, 37.5 for tobacco and 24.8 for study and printing. In total, about 20 percent of women worked outside the home in 1890 (Rosenbloom, 1985).

Around 1842, however, women's role in the domestic sphere began to take on a different spatial significance (Berch, 1982). The formation of these ideas reflected that change from Puritanical work ethic to a re-definition of home and family life (Kessler-Harris, 1982). This re-definition was also taking place at a time when more and more work was performed outside and separate from the home. The definition of home and family life began to take on a spatial component.

After WWII, the proportion of working women began to increase dramatically: by 1950 the figure had reached 37 percent and 1990, the percentage of women ages 16-64 working outside of the home, had reached 57 percent (Rosenbloom, 1985). At this time women comprised 45 percent of the paid labor force (Hanson and Pratt, 1995). The number of women with young children participating in the work force also increased. Of all married working women in 1985, 53.4 percent had children under five and 48 percent had children under one year (Rosenbloom and Burns, 1993).

Women's increased participation in the labor force has had a substantial impact on transportation in terms of both the number and distribution of trips. Due to many

different factors, like household responsibilities, women have different daily travel patterns compared to men. Several studies have identified how women's travel patterns differ from men's travel patterns; women have shorter commutes, use public transportation at higher rates, commute suburb to suburb more than men and link more trips to and from work.

Women, in general, have shorter commutes than men (Rosenbloom, 1993; Wachs, 1993; Gordon et al, 1989; Madden; 1980). Some researchers have identified women's domestic and childcare responsibilities as a factor in this difference (McGuckin and Murakami, 1999; Rosenbloom, 1993; Hanson and Johnson, 1985). These are some variations, also, among working women. For example, Black and Latina women, because of racially segmented labor and housing markets, do not necessarily make shorter commutes (Law, 1991; Ericksen, 1978). Single mothers also have longer work trips than married women with children and have more access to automobiles than their married counterparts (Johnston-Anumonwo, 1989).

Women use transit and ridesharing for their work trips more than men. According to a 1989 study by Johnston-Anumonwo, married mothers used public transportation, carpooled and used other modes of transportation more than men. Guiliano, in 1980, and Rosenbloom, in 1992a, noted that women were more likely to use public transportation compared to men. Wachs noted that women make a larger proportion of their trips as passengers (1992). Marketing studies by various transit authorities indicated that women commuters use carpools and transit more than men (MORPC, 1997; METRO, 1995; RIDES, 1996; PACE, 1999).

Roughly 60 percent of all jobs were located in the suburbs, as of 1980. Women commute, possibly as a result of labor market segmentation, in a suburb to suburb pattern more frequently (Rosenbloom, 1992b). Rosenbloom notes that researchers have questioned whether transportation models take women's distinct travel patterns into account (1992b).

Many nonwork trips are being linked as part of the daily worktrip (Sivasailam and Williams, 1996; Levinson and Kumar, 1995). Research indicates that women, because of their domestic and childcare responsibilities, are more likely to engage in this trip-chaining behavior (McGuckin and Murakami, 1999; Rosenbloom and Burns, 1993; Rosenbloom, 1992a; Rosenbloom, 1992b).

The increase of women participating in the labor force, accompanied by only a small reduction in the percentage of men in the labor force, increases both traffic and congestion and the attendant environmental problems. Recent federal legislation, the Intermodal Surface Transportation Efficiency Act of 1991 and the Clean Air Act of 1990, has been aimed at managing, rather than expanding, transportation systems (Sivasailam and Williams, 1996).

Many states and localities are implementing Transportation Demand Management programs. These programs, a majority of which are employer-based, try to lessen the amount of traffic. Most programs are focused on trying to reduce the number of single-occupancy vehicles. In order to accomplish this goal, they try different strategies and incentives, such as subsidizing transit passes, setting up a rideshare program, maintaining vans and shuttles, and encouraging telecommuting. Many of the programs are also aimed at reducing costs for the employers who participate in these programs. The transportation

models used to help create transportation demand management programs, however, do not take women's distinct commuting patterns into account (Rosenbloom and Burns, 1993).

This situation is problematic for two reasons. First, TDM programs that do not meet the needs of a large segment of the labor force will not achieve their potential to reduce the number of SOVs and, therefore, not achieve their potential to reduce congestion and air pollution. Second, people with travel needs that differ from traditional commuting patterns, like working women, are not well served by these types of programs. This incongruity might diminish their quality of life.

Research suggest that these programs, however, are not effective in meeting the needs of working women with children. The transportation models used to develop transportation demand management programs do not often use gender as a predictive variable and, therefore, do not take women's distinct commuting patterns into account (Rosenbloom, 1993). Because of this failure, these programs are not realizing their potential and women's transportation needs are not served. This study attempts to evaluate the effectiveness of existing TDM programs in meeting the needs of working women with children, and the potential negative effects that might occur if their needs are not met. Secondly, the study aims to identify the types of programs best suited to the travel needs of working women and make recommendations about TDM policies in general.

## **Objectives and Significance of the Study**

Recent local efforts and government initiatives to reduce congestion and traffic have focused on TDM programs. Research suggests that these programs, however, are not effective in meeting the needs of working women, especially those women who act as primary caregivers for their children. Because of this failure, the programs are not realizing their potential and women's transportation needs are not served. This study will:

1. Evaluate the effectiveness of existing TDM programs in meeting the needs of working women with children and:
2. Identify ways in which TDM programs could be modified to meet the needs of working women

## **Methodology**

In order to accomplish these objectives, Chapter Two reviews the literature on the travel patterns of working women. Chapter Three, reviews the literature on the TDM programs used nationally. The literature review will be focused on identifying some of the more successful components of TDM programs. The findings from these two chapters will then be compared and analyzed, according to the two stated objectives in the final three chapters. The next chapter, Four, contains a preliminary analysis of the most common TDM program components in terms of four of the most common characteristics of women's commute patterns. The analysis determines which components are appropriate for women's commute patterns, which are not and which have a variable effect. Chapter Five contains case studies of TDM programs that were effective in

reducing the SOV rate at employment sites. These case studies were analyzed in terms of gender participation. The final chapter concludes the analysis by identifying the impact that the most successful TDM components can have on women's transportation experience and quality of life. This chapter further explores the most appropriate TDM components in terms of their effectiveness in reducing congestion and air pollution.



## **Chapter Two Women's Travel Patterns**

### **Introduction**

Women's experience with transportation is different than men's, and this difference has social and economic consequences. Martin Wachs notes that "travel patterns are among the most clearly gendered aspects of American life." (1998). Because of this fact, women may be less able to access employment and other necessary facilities (Fox, 1983). Women's different experience with the transportation network has been studied and this chapter presents some of the major findings including differences in trip length, mode, and type. These differences are a result of many interrelated factors, including gender roles and responsibilities with domestic and childcare tasks and gendered labor segmentation. Research has quantified the differences in men's and women's travel patterns and researchers have speculated about the causes and effects. Robin Law writes that "gender shapes access to resources, notable time, money, skills and technology. Access to each of these resources will influence travel behavior..."(1999: 578).

Until recently much of the data on journey to work focused on men's travel patterns. Ericksen and Fox observe that most of the research on journey to work concentrated on the census category of "head of household", mostly men and single women, or were conducted in a way to make gender comparisons impossible (1977). In the late 1970s Guiliano and Rosenbloom began to question these practices (Law, 1999). In his 1977 article, Andrews notes that "the journey to work literature....rarely if ever considers married women working outside the house as a distinct sector of the labor

market worthy of closer examination.” Madden argued that the increases in the proportion of women’s work trips combined with the differences between their trips and men’s trips both affect transportation policy and development patterns (1981). Increases in the divorce rate and, therefore, the number of single mothers add another set of travel patterns that are ill-explained by traditional models (Johnston-Anumonwo, 1989). Rosenbloom and Burns (1992) noted that traditional transportation behavior theories do not explain women’s travel patterns and decisions. As more and more women enter the labor force, this conflation of women’s and men’s travel patterns make travel pattern projections inaccurate.

This chapter describes the findings on working women’s travel patterns. First, it offers a brief background of women’s interaction with the transportation network, participation in the labor market and experiences in balancing paid and domestic labor. Secondly, this chapter presents a description of the findings on four distinct aspects of women’s travel. This description is followed by different explanations of these differences. The conclusion of this chapters summarizes these findings on women’s travel patterns.

## **Background**

The contemporary formation of gender roles and responsibilities evolved alongside the notion of the home (private-female) spaces and work (public-male) spaces as separate spheres. The home and work are gendered domains which contribute to traditional notions of gender by reinforcing these notions through spatial separation of women and men into different spheres (Wachs, 1992). Although the traditionally male

work place has been infiltrated by females, the traditionally female home environment has not been likewise integrated (Hanson, 1998). Women have not traditionally had access to the automobile and Berger argues that the stereotype of women as incompetent drivers evolved from a fear that women, with the access afforded by the automobile, would reject their traditional roles (1986). Law argues that the focus of the literature of women and transportation on the work trip represents a bridge between the public and private spheres

Women currently make up slightly less than half of the workforce. In the past women's labor force participation rates, while increasing as a whole, dropped during childbearing age, starting in their mid-twenties. In the 1960's this drop began to decline and in 1990, it did not occur, because women with young children continued their labor force participation. Table 1 describes how married women with children are participating in the labor force at higher rates.

Table 1. Percentage of married women in the labor force by year.

<b>Percent of Married Women</b>	<b>1950</b>	<b>1980</b>	<b>1990</b>
with Children under 18 years	18	52	75
with Children under 3 years		39	60

Source: Rosenbloom 1992.

The Bureau of Labor Statistics stated that, in 1997, 13 percent of all families fit the traditional model of husband as wage earner and wife as homemaker ([www.dol.gov](http://www.dol.gov)). This fact might be related to women's choice of occupation, because of their expectations about responsibilities outside of the paid labor force. Specifically, they might choose, or be constrained to choose, part time and temporary work, work with lower earnings and less benefits. In 1990 women made 71 cents on the dollar compared to men and in 1997

they made 74 cents on the dollar. Some factors that might be related to the wage gap include women's frequent exits and entrances to the labor force, less work experience, less skills and education and discrimination.

Possible explanations for this gap relate to women's different experience with transportation. Although women continue to work with young children, their family roles intrude on this work while men's work is more likely to intrude on their family time. Men, who earn higher incomes, might feel that their increased economic earnings excuse them from domestic tasks. Women's struggle to balance paid labor and domestic tasks might lead them to seek out employment, such as secretarial or clerical work, where re-entry is easier thus perpetuating occupational segregation (Spain and Bianchi, 1996). Also, part-time and secretarial work, while easier to leave and re-enter than other careers, often has less flexibility because of lower occupational status and because it is often structured to meet others' needs. This inflexibility may provide further limitations on women's transportation options.

### **Description of differences**

In general women's work trips differ from men's in some fundamental ways: length of trip, mode of travel, type of trips, and geographical distribution. First, the findings related to each of these differences will be described. It is important to note, however, that different groups of women have different travel patterns. Race, income and household type are all factors that have an effect on women's work trips.

### *Trip distance*

On average women work closer to home than men do and their trips are shorter than men's trips (Fox, 1983; Madden, 1981; Johnston-Anumonwo, 1989; Rosenbloom, 1992; Wachs, 1992). In a study conducted by Hanson and Johnston in Baltimore, Maryland, men's average distance in miles to work was 7.8 and the time in minutes was 28.8 while the figures for women were 5.5 and 25.7 (1985).

There are, however, notable differences between women of different income levels and ethnicities. Gordon et al et al hypothesizes that women with low income jobs, because of a spatial mismatch, would have the longest trips. Low-income people sometimes undertake long trips as a way of maximizing their resources, choosing to minimize rent costs at the expense of longer commutes (Law, 1999). Single women and married women in low-income families, on average, have longer work trips than married women in high-income families (Johnston-Anumonwo, 1989).

McLafferty and Preston note that differences between men and women's commuting times is different among racial groups. Black and Latina women many times have longer journeys to work than white women and commute as far as Black and Latino men (Ericksen, 1977; McLafferty and Preston, 1991; Law, 1999). This difference is perhaps a result of the mode as more black women use public transportation as well as other factors (Ericksen, 1977).

The spatial mismatch hypothesis can be used to explain differences in the commuting patterns of white and minority women. Minority women have poorer spatial access to jobs than white women. African American women are affected most by this mismatch partially due to their reliance on mass transit. Latina women are differently

affected, with better spatial access, but less access to well-paying jobs. Hanson and Pratt (1990) concluded that women employed in gender-typical occupations work closer to home and McLafferty and Preston (1991) applied this conclusion to Latina women as well. These findings indicate that race interacts with gender to affect transportation needs (McLafferty and Preston, 1991).

### *Trip types*

Linked or chained trips, which occur when multiple stops are made along the way to a final destination, using the same mode, are difficult to discern from aggregate data and were assumed to be unimportant to transportation modeling and projecting. For these reasons, they are not often evaluated (Rosenbloom, 1993). Recently, however, transportation modeling has been taking these trips into account (Levinson and Kumar, 1995). Trip chaining, which links people's personal, household and child-care activities into one trip might complicate estimations of total commute time and distance (McGuckin and Murakami, 1999). Women must make multiple stops to transport children to school or daycare, shop and complete other errands and are more likely to chain trips on their work commute (Bianco and Lawson, 1999; Sarmiento, 1999; Fox, 1983; McGuckin and Murakami, 1999; Wachs, 1992).

Women with children make an especially large amount of linked trips because they are more likely to chauffeur dependents (McGuckin and Murakami, 1999; Law, 1998; Rosenbloom, 1992). Daycare is one of the most important factors in women's transportation decisions and they are more likely than their husbands to make trips solely for their children (Rosenbloom, 1993; Ferguson, 1992). About 82 percent of all married women with young children and about 50 percent of married women with teenagers

routinely made these trips while about 50 percent of men made these trips for young children and 18 percent made them for teenagers (Rosenbloom, 1993). Tables 1 and 2 describe the distribution of trips made solely for children.

Table 1. Percentage of parents who make at least one daily trip solely for their children, by age of children.

Age of Children	Married Men	Married Women	Single Women
Under 6	55	82	45
6-12	45	68	40
13-17	20	40	22

Source: Rosenbloom 1992a.

Table 2. Percent of men and women who chain trips.

Number of Stops	Home to Work Trips		Work to Home Trips	
	Men	Women	Men	Women
One or More Stops	18.8	33	46.4	61
No Stops	80.2	67	53.7	38.8

Source: Rosenbloom 1992a.

### *Mode of travel*

A number of studies suggest that women use public transportation more than men (Fox, 1983; Hanson and Johnston, 1985; Rosenbloom, 1992; Guiliano, 1980). Gordon et al suggest that “there is not much difference between men and women in public transit use” (1989).

Various studies indicated that women were more likely to be car passengers and to join carpools (Fox, 1983; Wachs, 1992; Young, 1992; Gordon et al, 1989). Both Davidson and Rosenbloom indicated that women were more receptive to the idea of utilizing transportation alternatives to the automobiles (1992; 1992). Johnston-Anumonwo found that women were more likely to use alternate modes of transportation and more likely to carpool, married mothers being the group most likely to carpool (1989; Ferguson, 1992). Clerical workers, traditionally female, are also more likely to carpool

(Ferguson, 1992). Those drivers with the greatest inclination to switch to carpooling modes also tend to be female (Rosenbloom and Burns, 1993; Ferguson, 1992). The 1990 NPTS indicates that women workers are 35 percent more likely to carpool than male workers.

Findings that indicate women's dependence on public transportation and higher carpool participation rates are contradicted by other studies which demonstrate that women are more likely to drive alone than men because working mothers need to serve their children's transportation needs rarely can carpool (Rosenbloom and Burns, 1992; Ferguson, 1993; Bianco and Lawson, 1999; Jeff and McElroy, 1999). Studies by Bianco and Lawson and Rosenbloom and Burns indicate that women need automobiles for childcare and household maintenance purposes (1999; 1993).

Possible explanations and further understanding are perhaps related to the interactions of income and race. An interesting addition to these findings is that single mothers, who have less access to automobiles, are more likely than married mothers to use the automobile on their journey to work (Johnston-Anumonwo, 1989). The SOV is a convenient mode of transportation for single women who are responsible for all of their own and their children's needs. Families headed by women, however, have higher poverty rates and, theoretically, are less able to purchase cars.

Table 4 shows women's travel modes by race. The findings suggest that mode choice also differs by race. Rosenbloom also suggest that white women are more likely to drive alone to work than minority women in comparable households. At the \$25,000-\$30,000 income level, 80 percent of white women, 68 percent of Hispanic women and about 62 percent of Asian and Black women drove alone to work (1996). Black women



in the \$70,000 and above range were more likely to drive alone to work than white women in comparable salary ranges (1996). White women making between \$30,000-\$40,000 carpooled at 9.8 percent, but Hispanic and Black women carpooled at 15 percent. Additionally, while transit use falls for most women, it rises for white women.

Table 4. Percent women, 16-64 years old in 1990, utilizing mode for all urban trips.

Race	SOV	Transit	Walk	Bike	Taxi	Other
Hispanic	80.4	7.4	11.5	.10	.20	.40
White	92.3	1.5	5.2	.30	.20	.50
Black	78.7	8.5	11.0	-.60	1.2	
Other	80.0	7.7	11.10	.10	.40	.70

Source: Rosenbloom 1998.

Sarmiento writes that the findings on women's mode choice vary and are location specific, depending on the transportation options available at different locations. These mode differences appear to be related to gender, income, race and, possibly, residential and employment location.

#### *Geographic distribution of workplaces and residences*

Suburbanization has also had an impact on women's travel patterns. Roughly two-thirds of suburban working woman probably commute to another suburb (Rosenbloom, 1993). Transit service does not serve suburban areas well. Women, who employed in the suburbs, might suffer from this incompatibility (Rosenbloom, 1993). Urban women without access to autos might also have trouble, as many commercial and recreational facilities have moved to the suburbs (Fox, 1983). Johnston-Anumonwo found that married women were more likely than married men to work in surrounding suburbs (35.5 percent of women versus 25.9 percent of men) (1989).

Shorter distances, more linked trips, usage of alternate modes of transportation and different geographical distribution are all characteristics distinct to the worktrips of working women with children. Different geographical distribution also negatively affects the viability of transit and ridesharing. Many female dominated occupations are predominantly located in suburbs which are not well served by transit and may be too dispersed to promote ridesharing.

### **Possible explanations**

Research has indicated that the location of the workplaces, residences and domestic responsibilities all contribute to these work trip differences (Madden, 1981). Johnston-Anumonwo found that economic, employment and household status factors have different effects on father's trips than mother's trips (1989). MacDonald and Peters suggest six different explanations for the gender differences in commuting patterns. Variations of five of these explanations will be used in the following section. The first two explanations, household and childcare responsibilities and geographical location were two of the more important factors in terms of implications for transportation demand management programs and therefore, this study places more emphasis on them compared to other factors.

#### *Household and childcare responsibilities*

Susan Saegent writes that men who enter the workforce can rely on their wives for support, but women have no wives upon which to rely (1980). Research beginning in the 1970s indicated that working women had to create a balance of domestic and work obligations, with more importance placed on domestic responsibilities (Ericksen, 1977;

Hanson and Johnston, 1985; Hanson, 1998; Rosenbloom and Burns, 1992; Wachs, 1992; Ferguson, 1992). Ericksen argues that the meaning of the journey to work, because of traditional gender roles, has different meanings for men and women. Daycare responsibilities must be provided for from the minute the mother leaves, and continued until the minute she returns. Consequently, women work fewer hours and commute shorter distances.

The presence and age of children in a household has been shown to impact women's travel behavior more than it impacts men's travel behavior. (Johnston and Anumonwo, 1989). Women with children make shorter work trips than women without children (Fox, 1983). Studies have indicated that men and women's travel patterns are much more similar when there are no children in the household (McGuckin and Murakami, 1999; Ferguson, 1992). Gordon et al et al conclude, in contrast to most other studies which find interactions with income, occupational segmentation and domestic responsibilities, that while women make shorter commute trips, the length is not related to lower income, gender-segmented labor markets, reliance on modes other than the automobile or domestic commitments. Their study indicated that the presence of children does not have any affect on the worktrip (Gordon et al et al, 1989).

Research also suggests that a time gap exists between men and women regarding time spent doing housework. (Fox, 1983). Research findings vary, the time spend on housework ranges for 6-14 hours per week for men and 20 to 30 hours per week for women. When children are present, the gap is usually wider (Sarmiento, 1999). In the late 1980s, as indicated by a large national survey, men spend about half the time that women did on housework; 18 versus 37 hours each week (Hanson, 1998). Rosenbloom

(1992) found that women's domestic responsibilities, including their chauffeuring roles, translate to short and long-term differences in their travel behavior.

#### *Geographic distribution of segmented labor market*

Some suggest that most of the differences in male and female wage differentials is explained by occupational segregation (Hanson and Johnston, 1985; Madden, 1981).

Female dominated jobs have lower commute times, and male dominated jobs have longer commute times, regardless of the sex of employee (Singall and Lillydahl, 1986; Wachs, 1992). Gordon et al indicates that technicians, regardless of gender, had the longest worktrip (1989).

Women's preponderance of domestic responsibilities are related to divisions of labor in the paid labor force (Hanson, 1998). Women tend to work in different occupations, have lower wages, and work shorter hours than men (Madden, 1981; Johnston-Anumonwo, 1989). Women also have less tenure and work experience than men (Madden, 1981). Madden notes that all of these variables are related to length of work trip (1981). Traditional female occupations are retail and service jobs, which are both lower paid and located closer to residential areas (McGuckin and Murakami, 1989). Professional jobs for men and nonprofessional jobs for women are usually located in the central city and professional jobs for women are usually located in the suburbs. Female professionals, therefore, who earn wages and salaries comparable to men might have a shorter commute time (Singall and Lillydahl, 1986).

In 1980 Hanson and Johnston found that women were disproportionately employed in teaching, nursing and clerical work. This finding is confirmed in a study by Johnston-Anumonwo, women worked more in sales, clerical and service occupations than

men (1989). In 1985, Hanson and Johnston found high proportions of women in the clerical and service sector and very low proportions in the crafts and blue-collar jobs. In their study, Hanson and Johnston noted that women were concentrated in the lowest income group; 73 percent of women are included in this group compared to 35 percent of men.

#### *Residential location decision making processes*

A corollary of location theory indicates that when there is a two-earner household, the primary earner will select a residence close to his or her employment, then, after the residence has been selected, the spouse with lower earning chooses employment (Fox, 1983). Singall and Lillydahl conducted a study to test this theory and their results support the notion that residential selection depends more on the male's job location (1986). Madden also notes that women are more likely to choose their residential location with a secondary regard for their own workplace location (Madden, 1981).

#### *Less money, not enough for long trip*

The convention of women as "secondary" workers contributes to these limitations and implies that their participation in the labor force is less essential and less normal (Berch, 1982; Wachs, 1992). Women might make shorter trips to work because their lower pay levels indicates that they cannot afford the longer work trip (Hanson and Johnston, 1985; Madden, 1981).

#### *Employers locate close to residential areas to attract desired labor supply*

A possible factor is that the presence of women in suburban residential areas has led service industries employing women to locate there (Hanson and Johnston, 1985).

## **Conclusion**

Gender does influence, or is influenced by, travel patterns. Domestic responsibilities affected labor force participation. Some argue that domestic and childcare roles determine the shorter trip length, to be closer to home in case of emergency and to cut down on the time spent out of the home, and the high number of linked trips, help women to carry out the household tasks of shopping, going to the bank, etc. In both cases women, who integrate domestic tasks into their work trips and, sometimes, their work day may be less able to pursue and to establish a career or high paying job. The Department of Labor Women's Bureau in 1998 estimated that the wage gap widens as women get older, for women ages 16 to 24 the gap is much smaller than the average wage gap (1998). These rates might suggest that childcare responsibilities interfere with work responsibilities more than other household tasks.

The other two characteristics related to women's work trips, higher rates of public transportation and different geographical distribution, are also related to gender roles and their effects. Higher rates of public transit ridership and ridesharing participation are linked to women's lower economic position, resulting perhaps from their domestic and childcare responsibilities. Different geographical distribution may be related to domestic responsibilities and occupational segmentation. The decision process for determining employment for women is based on different factors than for men, resulting in different spatial locations. These different locations are often closer to their residences. Also, female-dominated jobs are increasingly located in suburbs. The distinction between female-dominated and male-dominated work indicates that gendered labor market segmentation plays a role in the spatial distribution of employment. Research has

suggested that traditionally women's occupations are economically less rewarding. Spain suggests that between 35 and 40 percent of the gender differences in earnings are attributable to occupational segmentation. Lower wages combined with fewer retirement benefits, higher susceptibility to unemployment and lower prestige define women's relationship to the labor market (Spain, 1992).

The findings here indicate that women's travel patterns are different from men's. White and Hispanic women have shorter commutes than men. Women from different races and income groups utilize transit and carpooling at different rates and women, in general, use transit differently than men. Gendered labor segmentation plays a role in these differences, as traditionally female occupations are located in different places, increasingly the suburbs, than men. Finally, research suggests that women of all races and income groups link their work trips at higher rates than men. Gender, race and income all play a role in determining travel patterns.

## **Chapter Three**

### **Transportation Demand Management: An Overview**

#### **Introduction**

Orski defines transportation demand management as "a set of actions aimed at decreasing the volume of traffic and vehicle miles of travel by influencing the manner in which people travel to work (1990). Valdez and Wang write that TDM "entails a variety of techniques that lower the demand placed on the transportation system, thereby maximizing its ability to carry traffic" (1989). TDM programs encompass a variety of strategies, including carpooling, vanpooling, transit, subsidized transit, ridesharing coordinators, information centers, bicycle facilities, alternative work hour programs, telecommuting, on-site services, parking management, etc. (Valdez and Wang, 1989; Beaton et al, 1992).

This chapter will begin with a discussion of the history of transportation demand management (TDM) in the United States and continue with background information about its current administrative location and activities. The third section will discuss the different strategies employed for TDM programs, including alternative work hours, parking management, transportation allowances and other strategies. This analysis will be followed by three examples of TDM programs are provided to illustrate their administrative context and components.

#### **History**

In 1944 private transit operators carried 23 million riders. After World War II, however, transit ridership experienced a marked decline. Ridership dropped from 17



billion in 1950 to 9 billion in 1961 due to factors like suburbanization and increased automobile ownership. Private transit operators were financially strapped and public transit authorities were formed as a result. Ridership continued to decline and federal assistance for public transit rose substantially.

The 1970 Clean Air Act Amendment created the Environmental Protection Agency, which then set standards for air quality. States had to craft state improvement plans (SIPs) to meet these standards. These SIPs required transportation control plans (TCPs) as a way of reducing emissions (Weiner, 1992). Shortly after, government sponsored initiatives to reduce air pollution and congestion began.

Different types of demand management strategies, although not officially recognized, have been around since the inception of the automobile. Carpooling has historically been identified as a way of conserving energy, for example during World War II and the energy crisis in the 1970s (Jones and Chambers 1992). Informal ridesharing or carpooling is a familiar mode of transportation, but the organization of ridesharing, through professional coordinators and matching software programs, is a relatively modern concept.

The Surface Transportation Assistance Act of 1978 outlined ways for private involvement in the Transportation Improvement Program. The 1984 Urban Mass Transportation Administration (now the Federal Transit Administration) passed a policy with guidelines that encouraged private participation in mass transportation (Ross et al, 1992). TDM strategies illustrate a way that the private sector can become involved in public transportation. These strategies have developed because they fill needs that regular transit does not, or cannot meet. Witness the situation in Los Angeles and

Chicago, two vastly different cities. The car and vanpool rates for these two cities are the same, at 17 percent. The difference in the cities' travel patterns, however, can be seen in the percentages of public transit riders, 5.1 percent for LA and 16.5 percent for Chicago. The similarity in the percentages making up the car and van pool markets suggests that certain modes of transportation have a niche that cannot or is not met or affected by public transit (Warner, 1992).

The 1990 Clean Air Act Amendments mandated reduced emissions from automobiles. In 1991, the passage of the Intermodal Surface Transportation Efficiency Act changed transportation planning's emphasis from building and expanding to maintaining. Both of these acts require the consideration of transportation demand actions to reduce vehicle trips and vehicle kilometers traveled. The Clean Air Act Amendments of 1990 lists different categories of transportation control measures, some of which are aimed at work trips (Sivasailim and Williams, 1994).. These Acts illustrate a shift from transportation supply management to transportation demand management (Ferguson, 1990). Instead of building new highways to keep up with supply and trying to mitigate congestion, these new programs are aimed at channeling demand.

Many different factors influenced this shift from supply to demand management. Some of the major influences are suburban development patterns, labor markets, travel patterns and demographics. The trend is for the nation's population to leave the denser Northeast and locate in the Sunbelt, where cities are more spread out and auto oriented. Policy makers have depended on public transportation to reduce air pollution and give access to the elderly and handicapped. If public transit, in the traditional sense, cannot meet these goals because of decreased density, alternative modes should be explored.

TDM strategies have evolved, partly, as a way to expand transit alternatives in ways that are too costly for traditional transit, helping to serve these less dense locations. These strategies can be utilized in lower density areas, such as suburbs, at a lower cost than traditional transit (Benjamin et al. 1998).

The changing labor market combines with these other factors to influence alternate modes of transportation development. Increases in women's labor force participation to upwards of 50 percent of the labor force and with it, the increase in two car households, has increased the number of vehicles on the road and decreased the ability of traditional transit to meet the complex travel needs of working parents. Senior citizens who are accustomed to driving and located in the suburbs also affect the decline of traditional transit's effectiveness (Jones and Chambers, 1992; Rosenbloom and Burns, 1993).

As a result of these development and labor market changes, travel patterns are also changing. When primary central business districts were the focal point of the city and its surrounding suburbs, transit routes operating radially through this center worked effectively. As urban areas expand and the old downtowns and business centers are not the only centers of activity, more cross-town and other types of route patterns are needed (Balog et al, 1997; Wallace, 1997). Work commutes combined with sprawling development trends have also influenced the development of TDM services in the United States. The increase in intra- and inter-suburban commuting, where roughly 60 percent of all jobs are located, where free parking is provided at the employment site, is not conducive to traditional fixed route, fixed schedule transit service (Snow, 1989; Rosenbloom, 1992).

Development patterns, travel patterns, and demographics, combine to create the current transportation scheme. Roughly 81 percent of all local trips are made in privately owned vehicles. Of the remaining percentages, only 2.9 percent of local trips are made by public transportation (Jones and Chambers, 1992). As TDM strategies are recognized as a way to address these transportation issues, the federal government is taking steps to aid in its implementation. An example of federal support for non-transit alternatives to the SOV is the Surface Transportation Assistance Act of 1978 which authorized a new program of federal assistance for public transportation projects in small urban and rural areas and allowed highway money to be used for the promotion of car and van pooling (Jones and Chambers, 1992).

The Comprehensive National Energy Policy Act of 1992 provides additional commuter subsidies for transit and vanpools. Title XIX of this act specifically allows employers to give employees \$60 each month, as a tax free subsidy (Beaton et al, 1994). These additional subsidies are designed to complement the 1990 Clean Air Act and aid employers in complying with the regulations (Beaton et al, 1994).

## **Background**

For a variety of different reasons, transportation demand management programs are very often implemented at employment sites. Work trips make up large number of the trips that Americans make and are essential to the functioning of the labor force at large. These trips comprise 25 to 30 percent of all trips in a region (Sivasailam and Williams, 1994). Commute trips are also more likely to be taken alone than leisure trips and more repetitive and predictable (Christianson et al, 1992). Additionally, TDM literature

acknowledges that active support of the private sector is also key to success (Orski, 1990; Jones and Chambers, 1992; Pultz, 1989). For these reasons, Transportation Demand Management has been implemented, and concentrated on employer based programs, in a number of areas to reduce the amount of traffic.

Employers can reap benefits from successfully implemented TDM programs. Benefits to employers utilizing rideshare programs can include reduced parking costs, more parking spaces for business expansion, and meeting air pollution requirements. Additionally, ridesharing programs can positively influence absenteeism (Wegmann, 1989). Employers indicated that they implemented these programs to control parking costs and to help make additional economic development due to freed parking or road space. Employers rarely mention the intangible benefits, improved morale, reduced tardiness, and help in attracting and retaining employees as the sole reason for implementing these programs. Some companies began programs as a result of pressure from employees who pointed out that the employer's provision of free parking treated transit-riding and ridesharing employees unequally. Some companies decided to participate because of their socially and environmentally responsible policies (Bhatt, 1992).

Although some employers are opposed to mandatory programs, others believe these programs are inexpensive and offer benefits. The types of programs that employers are more amenable to are those that are inexpensive and offer a greater degree of control to the private sector (Pultz, 1989). Employers that are most willing to implement these types of programs are those that are relocating and wish to retain their valued employees (Wegmann, 1989; Pultz, 1989). Other factors that influence employer involvement

include commitment to the community and a sense of responsibility for traffic and employees' commuting problems (Pultz, 1989). A transportation demand management market research study carried out in Orange County Florida, asked management at two companies about employer's responsibility in terms of employees' commute and both companies replied that involvement in traffic management is in their self interest (Valdez and Wang, 1989).

Local government regulation can be used to force employers and developers to become involved in ridesharing and other similar efforts (Pultz, 1989) Table 5 provides three examples of local government initiated TDM requirements and the local government and employer strategies. Local government have different ways of ensuring this involvement in transportation demand management activities, ranging from developer conditions, waving impact fees for the creation of a transportation management association (TMA), transportation fees, commute alternative ordinances, incentive ordinances, trip reduction ordinances, or comprehensive TDM ordinances (Pultz, 1989; Jones and Chambers, 1992; Ross et al, 1992). Roughly 50 percent of the TMAs offer flex time, staggered shifts, compressed work weeks and adjustable hours for ridesharers.

Employer based ridesharing programs are relatively new and multi-employer based programs, often called transportation management associations (TMA, sometimes called transportation management organizations, or TMOs) are even newer. The goals of TMAs are to implement travel demand strategies and reduce congestion and air pollution and allow the private sector to act as a service provider (Ross et al, 1992). The services that TMAs provide are the same types of services offered by employers and include information about commuting options, ridesharing assistance, promotional materials,

procurement of services, advocacy planning, and management consulting. These programs have begun to have a presence in transportation policy and planning. In 1989 there were 55 TMAs in the United States (Jones and Chambers, 1992). Over 50 percent of TMAs offer preferential parking for carpools and vanpools, 50 percent sell transit passes on-site and slightly less than 50 percent have shuttle buses available for daytime use. TMAs often provide guaranteed ride home (GRH) programs directly. Although parking pricing has been shown to be one of the most effective strategies, these strategies are least common among TMA strategies (Ferguson et al, 1992). Roughly 30 percent of TMAs promote telecommuting. About 20 percent of TMAs provides access to or information about child care services and facilities, but on-site services are rare. Facility improvements, for transit bicycles, local traffic, pedestrians, and regional highway access, are also rarely provided (Ferguson et. al, 1992).

Different ways that TMAs can be formed are as the result of local ordinances, or at the behest of employers or local activists (Valdez and Wang, 1989). TMAs are usually comprised of mostly private-sector members, usually located in rapidly growing suburban areas, and usually have smaller budgets and staffs. Funding sources can include State Departments of Transportation, the Federal Transit Administration, private members pay dues, contribution from developers and local governments and users fees (Ross et al, 1992; Ferguson et. al, 1992). TMAs can also provide a way for public transit agencies to involve the private sector in public transportation. They can provide centralized transportation service to current employers and help employers develop their own TDM programs. Most TMA's have never been evaluated and better procedures for evaluation and monitoring are needed (Ross et al, 1992; Ferguson et al, 1991).

**Table 5. Examples of local government initiated TDM requirements and strategies.**

City	Type	Requirements	Strategies
Seattle, Washington	Seattle changed its zoning code in 1983. As part of this change, the city established a special category that would require institutions to deal with the traffic impact on surrounding neighborhoods.	<ul style="list-style-type: none"> <li>• Different institutions formed an agreement with the City to provide better transportation alternatives to the employees, to improve congestion and lessen environmental impacts(Snow, 1989).</li> <li>• No major institution could have more than fifty percent of their employees access the employment site by means of single-occupancy vehicles (Snow, 1989).</li> </ul>	<ul style="list-style-type: none"> <li>• Taxi service to park and ride lots</li> <li>• One or two days free parking each month to program participants</li> <li>• Some institutions form their own shuttle/park and ride system</li> </ul>
Pasadena, California	City introduced trip reduction ordinance focusing on specific regulation for new development with more than 100 employees and all existing development planning to increase the gross floor area by 25 percent or more and that would add 100 or more employees.	<p>For employers of 100-499 employees</p> <ul style="list-style-type: none"> <li>• 10 percent carpool preferential parking spaces, matching services, secure bicycle parking, the posting of information and</li> </ul> <p>For employers of 500 or more employees</p> <ul style="list-style-type: none"> <li>• all of the preceding requirements,</li> <li>• carpool loading areas, bus stops, vanpool facilities and a transportation system management (TSM) plan (Ferguson, 1990).</li> </ul>	<ul style="list-style-type: none"> <li>• Travel allowance systems that gives more to employees that use alternate modes of transportation</li> <li>• Administrative support for ridesharing activities</li> </ul>
Bellevue, Washington	In 1980 Bellevue implemented an ordinance for all new developments	<ul style="list-style-type: none"> <li>• Have TDM programs</li> <li>• Provide TDM services to existing employers through a TMA and city ride sharing programs (Flynn and Glazer, 1990).</li> </ul>	<ul style="list-style-type: none"> <li>• Post rideshare and transit information</li> <li>• Provide a transportation coordinator</li> <li>• Guaranteed ride home</li> <li>• Financial employee incentives</li> </ul>



## **Different Strategies**

As mentioned in the introduction, many different types of strategies can be included in transportation demand management. This section describes some of them. Carpooling, for example, is an alternate mode of transportation and a strategy that can be included by an employer as part of a TDM program. The guaranteed ride home program is a program that can be used to encourage alternate modes of transportation, including carpooling, and a strategy that can be included by an employer as part of a TDM program. These different strategies are interrelated and used to support one another, but will be described separately in the following section.

### *Carpooling*

Carpooling might be the most popular TDM. Flexibility, convenience, cost and travel time to work are some of the most important factors in mode choice for co-worker carpoolers. While there is an inverse relationship between commute satisfaction and commute distance for drive-alone commuters, carpoolers exhibited a positive relationship between distance and satisfaction, possibly because those with longer trip distances reap greater financial and emotional benefit than those with shorter trip distances (Young, 1992). Carpooling, however, is more effective for those with a strict schedule and long commute as carpoolers do not have the flexibility to run errands during the day, before or after work (Zupan, 1992). Sixty-four percent of co-worker carpoolers use the freeway, and 80 percent use HOV lanes (Young, 1992).

Although carpooling rates have not changed since 1991, the types and demographics have. Mandatory employer-based trip reduction regulations have increased the rate of co-worker carpooling while the rate of family and friends carpooling has

decreased. Data from the 1993 State of the Commute Survey conducted by Commuter Transportation Services indicates that car-poolers have roughly twice the one-way commute distance than family and friend carpools. Also, more men are carpooling as a result of these employer based trip reduction strategies (Young, 1992).

### *Vanpooling*

The nation's first vanpool was initiated by the 3M Company in Minneapolis, Minnesota in 1973 (Jones and Chambers, 1992; Torluemke and Roseman, 1989). In a study of vanpools in Los Angeles in 1988-89, Kumar and Moilov found that vanpools can increase benefits for the rider, employer and community. Riders benefit in terms of lower expenses, increased speed and reduced driving stress. Employers get access to a wider labor pool and reduced parking requirements. The community experiences a mitigation in traffic congestion (Kumar and Moilov, 1992).

Vanpools have three distinct challenges; insurance concerns, unfamiliarity, and financing (Torluemke and Roseman, 1989). Some of the greatest potential benefits are its size, which better services the less dense suburban areas, its lower driver labor cost, its versatility in comparison to transit and its stability in comparison to carpools (Torluemke and Roseman, 1989; Pultz, 1989). Vanpools, themselves can result in a 5 percent, or higher, rate of switching from the single occupancy vehicle during peak periods (Torluemke and Roseman, 1989). There are three possible ownership schemes for vanpools, employee owned, vendor leased where a third party operates the vans, and employer owned (Torluemke and Roseman, 1989).

A study of two companies, one with an employer sponsored vanpool program, and one relying primarily on vendor vans, found that employer sponsored programs can

provide reduced rates because of economies of scale, fleet purchasing, and other factors (Torluemke and Roseman, 1989) Currently, many employers have vanpool and other ridesharing, paratransit and regular transit programs. Table 7 identifies some of the most successful programs. This table demonstrates that successful employer-based programs can substantially reduce the number of privately driven automobiles for their own employment sites.

**Table 6. Percent reduction in single-occupancy vehicle rates for successful vanpool programs.**

Location	Company	Number of Employers	Percent SOV	Percent Reduction
Hartford, CT	Travelers	10,000	42.8	25.4
Hartford, CT	Hartford Steam Boiler	1100	49.6	13.6
St. Paul, MN	3M Company	12,000	82.7	9.7
Bellevue, WA	US WEST	1150	45.2	47.6
Bellevue, WA	CH2M Hill	400	59.4	31.2
Bishop Ranch, San Ramon, CA	Pacific Bell	6900	72.8	27.8
Hacienda Business Park, Pleasanton, CA	AT&T	3890	80.5	13.4
Los Angeles, CA	UCLA	18,000	79.0	5.5
Los Angeles, CA	ARCO	2000	55.3	19.1
Orange County, CA	State Farm	980	64.2	30.4
Montgomery County, MD	Nuclear Regulatory Commission	1400	53.7	41.6

Source: Jones and Chambers 1992.

### *Alternative Work Schedules*

The reasoning behind alternative work schedules is that spreading out the peak hour can help mitigate peak hour congestion. Alternative work schedules, however, may also discourage ridesharing and transit use (Zupan, 1992). Different types of alternative work schedules include flextime, compressed workweeks, telecommuting and teleconferencing. Flextime requires employees to be at work for a certain core of hours, 9 am to 3 p.m. for example, and allows them to fulfill the remaining hours however they wish. Issues with flextime, however, include internal inefficiencies, coordination

problems and lack of employee supervision. Flextime needs to have a broad application to be successful (Ho and Stewart, 1992).

In compressed workweek programs, employees work longer hours per day and less days each week. Some programs have four ten-hour days each week and a three day weekend. The 9/80 program has nine-hour days and one day off every other week. Results from a 1992 study that looked at the travel effects of 4/40 compressed schedules indicated that the employees made more trips for shopping, medical and personal business, recreation, school for children and trips to the bank and post office on their day off, which was most often Friday. The four day work week is limited in its ability to spread out travel peaks over the workweek, as many employees prefer Mondays and Fridays as their day off (Zupan, 1992). More trips on Fridays, however, after the program implementation, are linked. Employees participating in the program also made more errand trips during their ten hour work days. The average number of weekly trips made by program participants had decreased by 9 percent (Ho and Stewart, 1992). The compressed workweek had no effect on the modal split but some argue that four day work weeks might also reduce transit use (Zupan, 1992). Errand trips on Fridays were also shifted to off peak periods, reducing the number of non-commute trips made during peak hours (Ho and Stewart, 1992).

Telecommuting and teleconferencing has increased in the US. The American Information User survey indicates that, in 1994, there were 9.1 million full and part time telecommuters (Hanson, 1998). Gurstien noted that about 30 percent of the labor force worked at home in 1993 in a variety of ways, and of that 30 percent, about 3 percent were performing telework (1996). According to the Commute Alternative Systems Handbook,

telecommuting can increase flexibility to meet family commitments, job satisfaction and reduce the work commute. Telecommuting can take place at home, at satellite work centers and neighborhood work centers. Los Angeles County started a program in 1989 that allowed 78 of its 8,500 employees to work at home. In two years the number rose to 100. Some benefits the employers cite are air quality compliance, higher employee productivity and savings on office space and parking subsidies (1996).

Telecommuting, however, does have its share of challenges. As indicated by the statistics, the number of employees participating in telework is fairly low.

Telecommuting might reduce transit ridership and encourage more spread out development patterns (Zupan, 1992). Labor unions might oppose telecommuting and zoning might restrict home working situations partly because the lack of interaction between employees might make endanger employees rights and ability to organize (Commute Alternatives Systems Handbook, 1996; Gurstein, 1996).

In order to reach their potential, variable work hour programs should be implemented county-wide and the goal of decreasing vehicle trips should be emphasized. Incentives, such as priority choice in scheduling, for employees who do not drive in single occupancy vehicles (SOVs), can be offered. Having an on-site coordinator for the variable work hour program who is able to work with the company's rideshare coordinator is ideal (Freas and Anderson, 1993).

#### *Transportation Allowance Programs*

Transportation allowance programs provide employees with subsidies for transit fare, vanpool fare, and parking allowances. General travel allowances can be used with the employees' discretion (Bhatt, 1992). These types of programs have different

institutional locations. New York City, for example, has a regional transit fare allowance program, Transitcheck, run by the Transit Center. The Transit Center coordinates the voucher program where employers can buy regional transit vouchers for \$15. Employees can then use them for tokens, tickets or passes. (Bhatt, 1992).

Table 7 provides an overview of transportation allowance programs, their components and effectiveness in reducing drive-alone rates. The private sector has more incentive to pursue program like the general travel allowance program because of its minimal administrative and monitoring requirements (Bhatt, 1992). Different programs and strategies have different costs. The planning and marketing of travel allowance programs is substantial. The actual upkeep, however, including administrative and coordination costs, is low. The more restrictions on the allowance, however, the more expensive the program becomes. Transit and vanpool allowance programs are more expensive. They require on-going administrative support and can cost from \$5,000 to \$10,000 each year (Bhatt, 1992). Parking allowances and subsidies are nontaxable income, but transit and ridesharing allowances are only nontaxable if they are less than \$15 per month (Bhatt, 1992).

#### *Parking Pricing and Management*

Parking management might be the most successful TDM measure (Zupan, 1992; Williams, 1994). Parking management includes raising existing rates or imposing new surcharges, imposing parking taxes, reducing employer subsidies for employee parking, revising the supply of long-term parking through new maximum requirements in zoning codes, allowing reduced supplies in return for in-lieu fees or implementation of TSM strategies, and revising fines and enforcement (Higgins, 1990). In a study by Commuter

**Table 7. Transportation Allowance Programs**

Company	Location	Type of program	Effectiveness
Pacific Northwest Bell Company	Bellevue, WA	<ul style="list-style-type: none"> <li>Free parking - carpools</li> <li>Reduced parking - carpools of 2</li> <li>Full parking costs - drive alone</li> </ul>	SOV 19 to 55 percent
State Farm	Orange County, CA	<ul style="list-style-type: none"> <li>Carpool subsidy program</li> <li>Allowance to carpools instead of parking charges</li> </ul>	Vehicle occupancy 1.21 to 1.55
Atlantic Richfield Company (ARCO)	Los Angeles, CA	<ul style="list-style-type: none"> <li>\$15/month for transit passes and vanpools</li> <li>\$25/month rail: SOV - 1/3 parking subsidized</li> <li>2 person carpool - 2/3 parking subsidized</li> <li>3 person carpool - full parking subsidy</li> </ul>	NA
ARCO Transportation Company	Long Beach, CA	<ul style="list-style-type: none"> <li>SOV - full parking rates</li> <li>2 person carpool - free parking</li> <li>3 person carpool - free parking + \$15/month</li> <li>All transit passes subsidized</li> <li>Walking/bicycling - \$15/month</li> </ul>	NA
Nuclear Regulatory Commission	Montgomery County, MD	<ul style="list-style-type: none"> <li>SOV - high parking charges</li> <li>Carpools/transit - some subsidies</li> </ul>	SOV 54 to 42 percent
Twentieth Century Insurance Company	Los Angeles, CA	<ul style="list-style-type: none"> <li>SOV - 1/4 subsidized parking</li> <li>Carpool - full parking subsidy; transit and vanpool allowance</li> </ul>	Vehicle occupancy 1.1 to 1.46
San Diego Trust and Savings Bank	San Diego, CA	<ul style="list-style-type: none"> <li>SOV - \$55/month; 2 person carpool - \$70/month</li> <li>Three person carpool - \$100/month</li> <li>Transit - full reimbursement of fares + 25 percent for income tax</li> </ul>	SOV - 55 percent and 80 percent at nearby sites
Bank of America	Los Angeles, CA	<ul style="list-style-type: none"> <li>Transit/carpool allowance - \$15/month</li> </ul>	NA
South Coast Air Quality Management District	Los Angeles, CA	<ul style="list-style-type: none"> <li>\$55/month each carpooling employee</li> <li>Driver gets free parking subsidy - \$25/month</li> </ul>	NA
Bellevue City Hall	Bellevue, WA	<ul style="list-style-type: none"> <li>SOV - full cost; carpool - free parking (\$30)</li> <li>Transit - full subsidy</li> </ul>	SOV 75 percent to 58 percent
City of West Hollywood, CA	West Hollywood, CA	<ul style="list-style-type: none"> <li>SOV - full cost (\$45)</li> <li>Other modes - \$45 subsidy</li> </ul>	Parking use declined by 15 percent
Commuter Computer	Los Angeles, CA	<ul style="list-style-type: none"> <li>\$55/month unrestricted travel allowance (UTA)</li> </ul>	SOV 48 to 8 percent
CH2M Hill	Bellevue, WA	<ul style="list-style-type: none"> <li>\$40/month UTA</li> <li>SOV - \$40/month to park</li> <li>Carpoolers park for free</li> <li>Transit users also get 15 transit passes/month</li> </ul>	SOV 96 to 67 percent
American Hospital Supply Corporation	Evanston, Illinois	<ul style="list-style-type: none"> <li>\$30/month salary increase and \$30 parking fee</li> <li>Transit pass 26.5 percent discount</li> </ul>	NA
Latham and Watkins	Los Angeles, CA	<ul style="list-style-type: none"> <li>\$102/month UTA</li> <li>Nearby parking \$135/month</li> </ul>	NA
Linowes and Blocher	Silver Spring, MD	<ul style="list-style-type: none"> <li>\$75/month UTA and no free parking</li> </ul>	NA

Source: Bhatt 1992.

Transportation Services in 1991, 92 percent of small employers paid the full cost of their employees parking (Christianson et al, 1992). The authors conclude that, because so many employees at small sites park for free, parking management would have a strong impact on TDM programs (Christianson et al, 1992).

A study of six San Francisco medical institutions indicated that a monthly charge for parking on-site was the most influential factor in determining drive-alone rates, accounting for up to 80 percent of the variation in modal splits. Parking pricing was also more effective when combined with other strategies. In this case, parking was also most effective when coupled with off-site parking restrictions and enhanced transit services. Some other parking factors include reserved parking spaces and discounts for ridesharers (Dowling, 1992).

Pacific Northwest Bell Company achieved a 19 percent single-occupancy vehicle rate, compared to a rate of 55 percent for comparable sites, using free parking for carpools of three or more people, a reduced cost for carpools with two people and charging solo drivers full parking rates (Bhatt, 1992). Up to 30 percent reductions in SOV rates has been achieved at employment sites where transit and ridesharing initiatives are combined with parking fees for solo drivers or a subsidy for employee parking and New York state, in its guidebook, identifies parking management as a support strategy that increases the success of TDM programs (Saito et al, 1993).

Employers, however, are reluctant to manipulate parking supply and cost for TDM efforts because they do not want to take benefits away from their employees (Dowling, 1992; Saito et al, 1993). The provision of parking, also, is often included in union contracts (Saito et al, 1993). A response to this concern may be the provision of a



travel allowance equal to that of parking price. Users of alternate modes gain a profit and SOV drivers break even. Payment structures that reduce parking fees according to the number of vehicle occupants also encourage ridesharing (Saito et al, 1993).

### *Road Congestion Pricing and Management*

Congestion pricing involves charging a fee on roadways during peak hours and in places where roads are the most congested. Higher fees might also be imposed on single occupancy vehicles (SOVs). There are some different forms that congestion pricing can take: facility pricing and area-wide pricing. Facility pricing is a form of road pricing where road users are charged on their use of congested highway facilities. Automatic vehicle identification can charge vehicles or affected vehicles can purchase windshield permits. In area-wide pricing, vehicles pay a charge when entering a certain area (Bhatta and Higgins, 1993).

Although congestion pricing has been found to be very effective in reducing trips, there are some major obstacles associated with it. Collecting fees is a major obstacle and both methods, facility pricing and area-wide pricing, run into the same issues concerning enforcement of charges and distribution of equipment. Also, public opinion is normally opposed to imposing a price on previously free goods (Zupan, 1992). Rodier and Johnston evaluated the effects of pricing policies and found that congestion pricing provided the greatest reduction in travel time and emissions, increased total consumer welfare, but imposed consumer welfare losses on the lowest income group. They suggest, however, that pricing policies, coupled with transit and roadway capacity expansion, might improve mobility options for the lowest income group, canceling their consumer welfare losses (Rodier and Johnston, 1996).

### *Land use and zoning regulations*

Some of the land use strategies that can be used to reduce trips and promote transit and ridesharing are increases in density and mixed use development. Higher residential density and more compact employment locations are desirable to promote transit use. Locating a mix of commercial and retail uses at their end of the work commute can reduce the number of trips that commuters must make in addition to or during their work trip (Zupan, 1992; Fox, 1983; Levinson and Kumar, 1995; Davidson, 1992).

Transit oriented development (TOD) and Pedestrian Pockets are two types of innovative development strategies that takes both of these recommendations, increased density and mixed use, and develops spaces that are conducive to transit use and pedestrian activities. Land use and zoning regulations that prevent mixed uses and discourage density propagate the use of the automobile as the primary and, in many cases, only mode of transportation.

### *Guaranteed Ride Home*

Without the GRH program employees using alternate modes, especially those with small children, are less able to respond to a personal emergency. Table 8 provides some examples of GRH programs as analyzed by Polena and Glazer. According to focus groups that these authors conducted, straggler vans, or vans that make a later run for those employees who must work later, then carpools are the best way to serve late employees, fleet service rental cars is best for daytime emergency trips, taxi rides are only cost-effective for short distances, pay-per-ride pricing strategy was more desirable than pay-per-month strategies (1992). Per ride, the night rider van is least expensive because it

**Table 8. Guaranteed Ride Home Programs**

Company	Location	Description of Service	Number of riders per 100 eligible employers annually
Hughes Aircraft Co.	Tucson, AZ	<ul style="list-style-type: none"> <li>Limited to vanpoolers</li> <li>One emergency van and two late-schedule vans</li> </ul>	<ul style="list-style-type: none"> <li>Late vans - 195</li> <li>Emergency vans - 65</li> <li>Total - 260</li> </ul>
Flex-Pool Program	San Francisco, CA	<ul style="list-style-type: none"> <li>A late reservation van</li> <li>\$1.50 - \$3.00 fare</li> </ul>	NA
Subsidized Taxi Public Transit	Montgomery County, MD	<ul style="list-style-type: none"> <li>Reimbursement for taxi/public transit for emergencies</li> </ul>	2.2
Reston Commuter Bus Back-Up Vanpool	Reston, VA	<ul style="list-style-type: none"> <li>Late bus (after 7pm) combines routes and runs 3 times</li> <li>Regular fare is charged</li> </ul>	1/4 to 1/3 full
3M Company's Back-Up Vanpool	St. Paul MN	<ul style="list-style-type: none"> <li>Supervisor, carpool/vanpool mate gives employee a ride home</li> </ul>	.03
Nuclear Power Plant Backup Vanpool	Wintersberg, AZ	<ul style="list-style-type: none"> <li>Rideshare coordinator sets up ride home through ad hoc vanpools, another van, or drives them home</li> </ul>	637
Xerox's Company Fleet Car	Palo Alto, CA	<ul style="list-style-type: none"> <li>Use of company car in case of emergency</li> </ul>	27.7
Norther Telecom Back-Up Carpool	Santa Clara, CA	<ul style="list-style-type: none"> <li>No official program, but rideshare coordinator will find a carpool match in an emergency</li> </ul>	1
Prudential's Escort Service	Newark, NJ	<ul style="list-style-type: none"> <li>Appointments necessary for security guard to take employee to their destination with a shuttle van</li> </ul>	33.4
Seattle Metro; City of Bellevue's Subsidized Taxi	Bellevue, WA	<ul style="list-style-type: none"> <li>Employees registered for the program request Yellow Cab and are reimbursed, less \$1.00.</li> </ul>	15.5

Source: Polenta and Glazer 1991.

operates regardless of ridership. None of the case studies, however, were able to statistically support or reject the hypothesis that GRH encourages participation in ridesharing programs because there were no before and after data (Polena and Glazer, 1992). Saito et al have found that GRH programs are not expensive to provide (1993).

#### *Park and Ride Lots*

A survey conducted by Sacramento Rideshare of their 38 park and ride lots indicated that the most successful lots had certain components associated with them: clearly identifiable commute corridors, a large population within easy access to the lot, availability of transit at the site, significance of savings over a drive-alone commute, distance from the site to the employment center, availability of HOV lanes, quality of access to and from the site and the degree of security of the site. The California Department of Transportation has written guidelines for park and ride facilities and these guidelines indicate that the lots should be located in areas already supporting commuter parking and that community support of the facility is important (Al-Kazily, 1991). The results from the State of the Commute survey suggest that employer-based carpool matching efforts consider using park-and-ride lots as connecting points.

#### *Employee Transportation Coordinators (ETCs)*

Many employer based TDM programs have an employee act as the coordinator for ridesharing, marketing and other efforts. Studies have indicated that employee transportation coordinators (ETCs) are important to the effectiveness of TDM programs. Some of their responsibilities include notifying and educating management, informing employees, designing workable program, holding informational sessions with employees and assigning specific targets for different departments (Chen, et al, 1992). To be

successful, ETCs must have support from their supervisors and cooperation from fellow employees (Chen et al, 1993). The New York Employee Commute Option guidebook identifies the tasks of the ETC: establish a schedule, inform the participants, garner management support; form a program team, get union support, conduct a work-site analysis, conduct a commute survey, establish trip reduction targets, select commute options and support strategies, prepare a budget and implementation plan, market, implement, monitor and evaluate the program.

### *High Occupancy Vehicle (HOV) Lanes*

HOV lanes can encourage ridesharing by reducing commute times. Lanes can be physically separated from other lanes, separated by lines. Another form of HOV is the opposing flow lane which is usually operational only during peak periods. HOV lanes can also be operations for 24 hours, only during peak periods or “morning-in” “afternoon-out” (Commute Alternatives Systems Handbook, 1996).

### **Examples of TDM Programs**

Following are three examples of TDM programs. King County, Seattle, Montgomery County, Maryland and Portland Oregon all provide examples of the types of strategies used and the results achieved. All three show different approaches to the involvement of the private sector, a factor identified as important to the success of the TDM program. King County, Seattle used an innovative approach to collaboration with existing businesses. Montgomery County shows the results of active developer involvement in TDM and Portland, Oregon’s private involvement comes as a result of a state mandate.

### *King County, Seattle*

King County Seattle is implementing the Commuter Challenge, which has pushed employers to develop rideshare forms for their employees and provided a vehicle for transportation providers and employers to discuss transportation issues. The Economic Development Council of King County, the representative organization for 800 employers, and representatives from transportation providers participate in the program. Since the program's inception in 1989, 98 major employers in the Seattle area have joined the program. The program is unique in that it targets chief executive officers and began as a public awareness program. The goal, in 1989, was to reduce the number of single-occupant drivers in King County. In order to accomplish this goal, their objectives were to increase awareness of alternate modes of transportation and to demonstrate a public-private commitment to relieve traffic congestion. CEOs were identified, contacted, and given information about the campaign. Of the 50 CEOs contacted, 21 pledged and were contacted again with plans to develop specific TDM programs. Among the tasks requested was the appointment of an employee transportation coordinator, distribution of alternative mode information, promotional events and flex-time.

The program is continuing and garnered the support of the King County Metro, the Washington State Department of Transportation and the City of Seattle. The goals of the second phase of the program are to increase employer commitment and to increase business community awareness. Seventy-seven employers joined the original 21 in the Commuter Challenge. The benefits to the employers, as marketed by the Commuter Challenge include: public recognition, employee reduced expenses and stress, reduced

parking expenses, improved employee moral, retention, lessened traffic congestion and the meeting of federal air quality standards. The program requires employers to:

- Provide at least \$5.00 rideshare subsidy
- Appoint an ETC
- Disseminate transit information
- Distribute a newsletter on commuting options
- Join a professional rideshare organization
- Hold an on-site rideshare promotion each year
- Initiate flextime or telecommuting options
- Run a parking management program
- Maintain a GHR program
- Allow 15 to 30 minute work schedule flexibility for commuters

In February of 1991 a survey was conducted by the Commuter Challenge. Thirty-nine of the 42 employers participated in the survey. Results indicated that most employers exceeded their agreements in providing rideshare incentives. Over one-third of respondents said that the main benefit from participation was helping the community. Almost all respondents indicated that the rideshare incentives gave employees economic benefit and convenience.

The future plans for the Commuter Challenge include increasing the geographic area and the type of agencies that can participate. Because of Washington State's new law regarding TDMs, the involvement in rideshare programming is no longer voluntary, but mandatory. The Commuter Challenge will change its focus accordingly (Legg, 1992).

### ***Montgomery County, Maryland***

Montgomery County, Maryland, a large suburb of Washington, DC that has experienced rapid commercial and residential growth, has tried to implement trip reduction ordinances. Montgomery County residents currently have access to METRO subway, Metrobus regional buses, Ride-On local bus service, and MARC commuter rail service (Flynn and Glazer, 1989). According to the city's Adequate Public Facilities ordinance, new development is delayed until "adequate" transportation facilities are implemented. The way the ordinance is worded, developers must remove trips from existing land uses, by providing park and ride lots, operating a public shuttle bus, organizing a ridesharing program, or purchasing trip reductions from other employers (Orski, 1990).

Of the strategies available for transportation demand management, Montgomery County utilized transportation fees (through impact fee legislation in 1986), incentive ordinances, TMOs (the first of which was incorporated in 1989), and a comprehensive TDM ordinance (enacted in 1987). As of 1988, Montgomery County has 23 negotiated agreements with 74 separate TDM concessions (Ferguson, 1990). Some of the paratransit focused concessions have included shuttle services to Metrorail stations, park and ride lots, guaranteed ride home programs, and mandatory parking pricing strategies (Ferguson, 1990).

A representative from the Division of Transit Services in Montgomery County, which handles paratransit services, aids in the creation of TDM strategies. One of their goals was to maintain a database and assist in matching people for car and van pools. Also, they provide alternate transportation information for regional transit systems.



Additionally, the Transit Services Division has a commuter outreach marketing program for employers, to let them know about the available services. The programs seem to be making a significant impact, and the drive alone rate has been reduced. Two of the major challenges to improving these programs are unfamiliarity and technology. People prefer to drive alone and have for many years. Affecting a major change in this trend is a difficult task. (Car and vanpool administrator, 1999).

### ***Portland, Oregon,***

Portland, Oregon takes part in TDM strategies. Most of the activities take place under Rideshare, a regional organization within the paratransit division, focused on encouraging alternatives to driving alone. Some of the alternatives that it offers are carpooling, vanpooling and utilizing existing transit. Their purpose is, explicitly, to decrease the number of vehicles on the roadways, thereby decreasing air pollution, traffic congestion, repairs and the need for new transportation infrastructure (Flynn and Glazier, 1989). Some of the functions that Rideshare carries out are a matching service for carpools, and spaces in parking garages and lots for these carpools. As of 1989 the vanpools had not been extremely successful (Flynn and Glazier, 1989).

The Oregon Department of Environmental Quality requires all employers with over 50 employees to reduce the number of single-occupancy vehicle work trips by 10 percent. In order to accomplish this goal, according to the head of marketing for Rideshare, different employers use different strategies. The most often used method is the provision of transit subsidies. Additionally, most employees use marketing and education to inform their employees of the programs. More and more companies have

been using their own, or contracted, vans to run shuttles in the cases when public transit is not a viable option. Of all the options for reducing trips, vanpools are one of the most costly. The carpool coordinator indicated that the carpool program was successful, but that some barriers did still exist such as abuse by single passenger cars of the High Occupancy Vehicle (HOV) lanes (Carpool administrator, 1999).

## **Conclusion**

This chapter was intended to provide an overview of the history, institutional background and strategies of TDM. TDM has a range of different institutional settings, from employers to TMAs. These different strategies will be analyzed, in terms of their effectiveness and interaction with gender in the last three chapters of this study.

## **Chapter Four**

### **Analysis**

#### **Introduction**

This chapter will begin the comparison of transportation demand management (TDM) strategies with the findings of the literature on women's travel patterns. The goal of this comparison is to identify the strategies that can be the most effective in meeting women's travel needs and those situations that might negatively affect working women. The chapter will begin with an overview of five case studies of effective TDM programs in terms of their program components. Second, this chapter will describe the results of telephone interviews in which the employee transportation coordinator (ETC) or equivalent was asked about how gender interacts with these programs. The author contacted the ETC and, during the telephone interview, asked the ETC questions about their program's effectiveness and the number or percentage of women participating in their programs.

#### **Description of TDM case studies**

The purpose of exploring these case studies is to look at women's participation rates and interaction with successful transportation demand management programs. In order to complete this analysis, case studies that demonstrate effective results need to be identified. The literature on TDM programs indicated that evaluation of TDM programs was rare and often not comprehensive, making this identification difficult. The 1990 study by Higgins titled, "Demand management in suburban settings: Effectiveness and policy considerations." identified programs according to their success in reducing SOV

rates. The programs labeled as "clearly very effective" were chosen for this analysis. One other case study, Electric Boat in Quonset Point, Rhode Island was chosen for three reasons. First, the Northeast is rarely mentioned in the literature on TDM and this analysis might provide insight on the constraints and opportunities available to northeast employers in terms of demand management. Second, the research is being conducted in Rhode Island and, therefore, the opportunity for an in-depth, in-person interview existed. Third, members of the Express Travel Division of the Rhode Island Public Transit Authority indicated that Quonset Point had the most extensive vanpool program in Rhode Island.

Table 1, on the following page, has a listing of all six case studies and their TDM components, as affirmed by interviews with the ETC or equivalent. For each case study, the ETC or equivalent was contacted. Higgins provided a list of the TDM program components and that list was checked for changes over time. Following the table is an explanation of the different TDM programs. The ETC was also questioned about the gender breakdown of participation in the TDM programs. The results from this inquiry follow the individual program descriptions.

Table 9. TDM case studies and their major components.

<b>Program</b>	<b>Components</b>
Bellevue City Hall, Bellevue, WA	Coordinator; Rideshare matching ;City fleet vehicles for poolers; Free transit passes; Pay parking (\$35/month and scheduled for an increase); Free carpool parking
CH2MHill Bellevue, WA	Coordinator; Rideshare matching; Subsidized transit passes Pay parking (\$110/month); Travel allowance (\$40/month); Free carpool parking
Lawrence Livermore Labs Livermore, CA	Coordinator; Rideshare matching; Preferential parking; Express buses; Vanpools; BART feeder bus; Company bicycles; Showers/repair crew
Nuclear Regulatory Commission North Bethesda, MD	Coordinator; Ridematching; High priced parking (\$60/month); Discount transit passes (Metrochecks);
Varian Palo Alto, CA	Coordinator; Rideshare matching through Rides for Bay Area Commuters; Subsidized transit passes; Bicycle lockers/showers
Electric Boat North Kingston, RI	Coordinator; Vanpools

Source: Higgins 1990 and Electric Boat Vanpool Coordinator 2000.

### *Bellevue City Hall*

The Bellevue City Hall Employee Transportation Services Program was founded in 1987 and reduces the number of SOVs and reducing the demand for parking. The goal is to provide a TDM program which makes the best use of public resources, complies with the Washington State Commute Trip Reduction law to improve air quality, reduce traffic congestion, and decreases fuel consumption. Employees may register for the ETS program. Depending on the employees' commute mode, they might be eligible for free parking on a limited basis. An ETS Program Assistant helps employees select commute modes and has a database for rideshare matching. Incentive payments of \$15 quarterly and 4 free parking coupons per month are offered through the program for employees who carpool, motorcycle, walk, or bike to work 80 percent of the time. Monthly parking fees for those who drive alone 40 percent of the time or more are \$35.00 for full time employees. All registered employees receive a FlexPass, which is a two-zone Metro bus

pass, for free and offers a limited number of guaranteed rides home to those who utilize alternate modes.

### *CH2MHill*

CH2MHill is an international project delivery firm comprised of consultants, planners, economists and scientists. CH2MHill created a transportation management plan as it planned to move from a suburban site with free parking to downtown Bellevue. The plan, also, was crafted at the impetus of an increase in parking fees. CH2MHill is located near the downtown transit center with extensive park and ride support, bike racks, showers and lockers. The plan includes a transportation allowance of \$40 per month and the FlexPass (see Bellevue City Hall description) to all full-time employees. Free parking for two days per month for non-SOV commuters and a carpool discount of \$10 per month for registered carpoolers. All Community Transit riders get up to \$20 per month. CH2MHill also has flexible work hours, a motor pool and company vehicles available for personal use.

### *Lawrence Livermore Labs*

Lawrence Livermore Labs has a program manager responsible for all transportation demand management activities. This program offers rideshare matching, preferential parking for ridesharers, express commuter buses, shuttles and vanpools. Also offered are company bicycles, showers and a repair crew for those that bike to work. The Lab is also served by a Bay Area Rapid Transit feeder bus. The Lab used to participate in the commuter check program, a program that allows employees to put away money, before taxes, for transportation but the program is discontinued due to a lack of funding.

The program at Lawrence Livermore Labs is part of a larger TDM Association, providing support for commuters.

#### *Nuclear Regulatory Commission*

The program at the Nuclear Regulatory Commission, located in suburban Maryland, was set up to comply with a government mandate. The price to park a SOV is \$60 per month but the program offers subsidies for carpool parking and transit use. Additionally, the company offers rideshare matching support for the carpools. The provision of allowances was related to a reduction in the amount of SOVs. The Nuclear Regulatory Commission is located near a metro rail station.

#### *Varian*

The programs at Varian were mostly related to subsidized transit passes that employees could purchase. Employees can buy passes at different levels. The Echo Pass is an annual transit pass for Silicon Valley and covers all bus and light rail for Santa Cruz and Santa Clara as well as the Cal Train. The ETC noted that all employees were given a transit pass, for the transit that is not covered by the Echo Pass. Additionally, employees can get commuter points if they carpool, bike or walk to work which translates to financial reimbursement based on the number of days these modes were used. The ETC noted that women were more likely to carpool than take any other of the alternate modes of transportation.

#### *Electric Boat*

The program at Electric Boat primarily consists of a vanpool program. There is one vanpool coordinator who is responsible for all coordination, administration and operational vanpool activities. The program does have an informal guaranteed ride home

agreement. Although there is no formal program, the coordinator noted that, in an emergency, an employee would be able to get home. Vanpoolers pay a monthly fee that covers the cost of the van's upkeep and gas expenses.

It should be noted that the vanpool program's purpose is not to reduce the number of SOVs, but, rather, to improve the options and job access for Electric Boat workers, many of whom commute from substantial distances. The coordinator noted that some of the vanpool participants could not continue to work at Electric Boat without the vanpool program.

#### *Summary of case studies*

All of these programs, except Electric Boat, have an ETC and rideshare matching. Electric Boat and Varian are the only two without carpooling preferential or cheaper parking, possibly because Varian has a very tight parking supply. All programs but the Lawrence Livermore Labs and Electric Boat have free or subsidized transit passes. Bellevue City Hall, CH2MHill, the Nuclear Regulatory Commission have parking fees. CH2MHill is the only program with a travel allowance (at \$40 per month) and their parking prices (\$110 per month) are almost twice as high as the second highest priced Nuclear Regulatory Commission (\$60 per month). Bellevue City Hall offers financial incentives, up to \$60 each year, for participating in non-SOV commute options.

#### **Gender and TDM case studies**

The ETCs or equivalent (rideshare coordinator, etc.) were asked about male and female participation in their programs. If the ETC did not have statistics or information



on gender, they were asked for their observations and opinions about gender and their programs. Following are their responses:

*Bellevue City Hall, Bellevue WA*

The ETC from Bellevue City Hall indicated that they had no data on gender. She did indicate that taking advantage of alternative modes is more difficult for younger women because of their child care responsibilities. Bellevue City Hall has two separate sites with different carpool rates. One of the sites, the City Hall Campus, has a rate of 14 percent carpoolers. The other site, Bellevue Service Center, has a carpool rate of 59 percent. She noted that the employees at the Bellevue Service Center are about 85 percent men.

*CH2MHill, Bellevue, WA*

CH2MHill does conduct surveys about the TDM programs, but does not use gender as a category. The Rideshare coordinator indicated that everyone at the company was issued a transportation allowance of \$40. He indicated that transit riders for the company are about even among men and women. He also noted, however, that women were more likely to try different modes of transportation and made up a majority of the walkers, carpoolers and vanpoolers (10 out of the 12 vanpoolers are female). Most of the teleworkers (telecommuters) are also female. The coordinator noted that telework becomes an attractive option for employees with children because they viewed it as a way to address both their work and childcare responsibilities.

*Lawrence Livermore Labs, Livermore, CA*

The program manager for the Lawrence Livermore Labs program indicated that they did not evaluate their programs in terms of gender. She mentioned that mostly men

worked at the Lawrence Livermore Labs so, therefore, most of the program participants were male.

*Nuclear Regulatory Commission, North Bethesda, MD*

The rideshare coordinator indicated that the Nuclear Regulatory Commission does not keep statistics on the gender of rideshare participants. She noted, however, that the Nuclear Regulatory Commission has a predominantly male workforce and that the work is "male oriented." Most of the TDM participants are, therefore, male.

*Varian*

The ETC at Varian had observed that there are more men participating in the program because there were more men working at Varian. She noted that Varian was a manufacturing plant. She indicated safety as a deterrent to women's participation.

*Quonset Point, North Kingston, RI*

The vanpool coordinator indicated that the vanpool program primarily serves men, but also that a majority of the workers at Quonset Point were men. Of the 110 people in the vanpool program, only 2 women are involved. Of these two women, one is single and the other has adult children. Single fathers, also, do not participate as often as married fathers in the vanpool program.

**Conclusion**

Branch et al (1996) notice that women are affected differently by incentive programs and suggest that program design should consider equity issues and unintended social consequences. They also suggest that these programs be evaluated in terms of different groups is important for working women with children. None of the case studies

evaluated their programs in terms of gender. They found, however, that most trip reduction programs do not attend to the needs and issues of different social groups. This finding is supported by the overview of the six successful TDM programs. None of the coordinators had statistics on gender or had evaluated the programs in terms of gender or other subgroups of employees.

When asked about their observations about gender and TDM participation, however, the coordinators at all the sites except for CH2MHill, indicated that the employees, and therefore participants in TDM programs, were predominantly male. Because of the predominance of male employees, they explained, most of the participants in the TDM programs are also male. The findings offered by the ETC at Bellevue City Hall, however, are interesting. Bellevue City Hall's program is available for City Hall employees at two different sites and the TDM program at the employment site with mostly men was much more successful than the employment site with a more even gender distribution. It is also possible that locational factors are also responsible for the differences in the success.

In response to the question about gender, some of the coordinators described the situation by naming occupations, rather than citing statistics or observations. Lawrence Livermore Labs' coordinator indicated that they employed physicists, the coordinator at the Nuclear Regulatory Commission indicated that they employed mostly engineers, and Varian noted that they were a manufacturing plant. These responses indicate that labor segmentation exists in actuality and in people's perceptions.

These findings might suggest that gender and labor segmentation are involved with the success of TDM programs. Additional factors might include location. As

indicated in Chapter Two, discussing women's travel patterns, male and female dominated professions tend to have different geographical location and men and women tend to locate their residences differently in related to their employment. The Varian ETC was the only respondent to note that safety was a concern for women commuters.

The success of TDM programs in male predominated occupations might suggest that the current programs serve men's traditional travel needs better than women's traditional travel needs. It is important to note that men with non-traditional travel patterns, for example single fathers, also have problems participating in TDM programs.

## **Chapter Five**

### **Comparison of TDM Strategies with the Travel Patterns of Working Women**

#### **Introduction**

The goals of TDM programs are often explicit, and always involve decreasing the volume of traffic and improving air quality. TDM, therefore, is aimed at reducing the number of work trips by reducing the number of SOVs. The needs met here, theoretically, are those of society at large because reduced traffic translates to reduced congestion and decreased air pollution. Subsidiary needs that are met are those of the employer, who benefits from decreased absenteeism, tardiness and increased worker retention. The employees benefit from increased and affordable transit options and a less stressful commute. This chapter will first explore some of the factors related to the success of TDM programs and then discuss these factors in terms of gender. Secondly, the most successful TDM strategies will be explored. Finally, this chapter will juxtapose the findings from the literature on the travel patterns of working women with these programs in order to determine how working women are affected by them.

#### **Effectiveness**

Past studies that have evaluated the effectiveness of TDM programs have had mixed results. It is still unclear, therefore, whether TDM programs meet their intended goals. Higgins describes the need for better evaluation methodologies to assess trip reduction programs. Pre and post-test designs, which are most often used, do not take other factors into account. Also, evaluations rarely use statistical test to determine

whether changes are significant. There is a notable lack of quantitative information on what types of TDM strategies are most effective.

Although most TDM programs are evaluated by percent of employees that drive alone, share a ride and take transit, these studies and evaluations do not take other issues into account (Dowling et al, 1992). A study in California took into consideration the switch from one HOV mode to another; the amount of drivers driving alone to a pick up point; the emission of shuttle and transit vehicles; standardized emissions factors to determine reductions in reactive organic gases, carbon monoxide, nitrogen oxide and fine particulate matter. The research noted that most self studies inaccurately report total emission reductions (Schreffler et al, 1995).

Problems also exist in governmental support for mandatory programs, because of the lack of quantitative data. On January 1, 1996, the Governor of California signed a bill outlawing mandatory employer-based trip reduction ordinances. Dill explores reasons behind this backlash and has identified policy fragmentation as a reason for the program's demise. She recommends that, in the future, all parties agree on the problem to be solved, targets should be based on evidence, employers should be involved in the development and implementation of programs, programs should be part of a comprehensive effort and costs and benefits should be analyzed before program adoption (Dill, 1997).

Several studies that have evaluated these programs have shown that popular expectations for the impacts of ridesharing have not occurred (Commuting in America, 1990; Ewing, 1999). Higgins evaluated trip reduction strategies in Denver and found that they had no effect (1994). Stewart studied the trip reduction ordinances in Pasadena comparing vehicle trip data from Pasadena Towers, where the ordinance was effective,

and a control site. The results indicated that the average vehicle ridership (AVR) was the same for both sites (Stewart, 1994). The data indicated, however, that they were encouraged to use alternative modes of transportation by the TDM program, and the percentage of employers using alternative modes of transportation at Pasadena Towers was higher than the percentage at the control site (Stewart, 1994). Stewart hypothesizes that a reason for the similarity in AVR at both sites might be that the employers are not accountable and the constraints associated with carpools, vanpools or other alternate modes might be prohibitive (1994).

Other studies have indicated that TDM can be very successful. Bhatt notes that transit and ridesharing allowances, when coupled with information dissemination, convenient parking for carpools, and on-site transportation coordinator, etc. they can reduce SOVs by 5 to 10 percent (1992). The examples of Montgomery County and Portland describe how different situations can yield different results. A firm in Northern New Jersey used models to estimate the impacts of different TDM measures. They concluded that a combination of at least \$1.00 ridesharing coupon, \$.75 daily parking charge for drive-alones, and a GRH program would help them meet the 25 percent increase in average vehicle occupancy (AVO) required by the Clean Air Act. The Urban Mobility Corporation performed a study in which they determined that demand management programs that are both aggressively marketed and accompanied by incentives can result in a reduction of 10 to 15 percentage points of drive alone rates (Orski, 1990). Other studies, such as the 1985 Metropolitan Transportation Commission study puts the figures close to 5 to 8 percent (Pultz, 1989).

## **Factors associated with TDM's effectiveness**

Different authors have looked at some of the factors involved with TDM's effectiveness. These factors can be associated with employee characteristics and other external factors. Some of the employer characteristics include the size and location of the employment site. Giuliano writes that incentives need to change the perceived cost and convenience of alternative modes of travel in terms of cost or time. She suggests that image and persuasion techniques do not work and indicates that transportation allowances, which take parking into account, are much more effective. Modarres suggests that a program's success is contingent upon the types of activities it adopts and the types of neighborhoods from which employees commute (1993). Following are some of the factors associated with TDM's effectiveness.

### *Size of Employer*

Higgins notes that programs targeted to larger employment centers, usually 500 or more employees, often have higher rates of success (1990). Ferguson, in his analysis of Southern California data on employer rideshare programs, identified that larger firms were more likely to offer ridesharing programs and gain benefits from ridesharing (1990). Larger employers generally have more successful ridesharing and transportation demand management programs (Pultz, 1989; Wegmann, 1989).

There are some differences in the commuting behavior between bigger and smaller employment centers (Christianson et al, 1992). A study by Commuter Transportation Services in 1991 identified that commuters at small employment centers are slightly less likely to rideshare than those at larger employment centers, more likely to use transit rather than carpool, to carpool more often with household members than with



coworkers, and are more likely to need their cars for business or personal reasons during the work day. Employees at smaller sites are more interested in ridesharing but are less often offered incentives (Christiansen et al, 1992).

### *Marketing*

Marketing is an integral part of TDM's success. Commuter Transportation Services, Inc. (CTS) conducted and evaluated two market strategies for ridesharing that were not employer focused. CTS concluded that both would have been more successful if they were coupled with employer-based efforts.

### *Development Patterns*

Less dense development patterns are conducive to TDM programs. Most dense urban areas are already well served by transit and TDM measures are more appropriate for those employment sites located in suburban areas where traditional transit service does not exist. Many sunbelt localities, with their less dense cities and proliferation of suburbs are using this type of approach to congestion mitigation and trip reduction (Valdez and Wang, 1989; Pultz, 1989; Orski, 1990). On the other hand more dense residential development is needed to encourage ridesharing. Mixed-use development at workplaces can make ridesharing more attractive.

### *Employer Involvement*

Employers, as mentioned, are hesitant to accept mandatory regulations, and instead stress the government's obligation to provide better transit service and HOV lanes as strategies to improve the traffic and congestion situation (Pultz, 1989). The commitment of a professional staff to organize and implement the employer's program is also essential to the program's success (Orski, 1990; Pultz, 1989; Ferguson, 1990). Other

employment characteristics that affect TDM efforts include working hours, salaries, benefits, regularity of work schedules and location, and need for off-site business travel during the day. Employers committed to reducing air pollution and traffic congestion can work with ETCs and employers to address these factors.

### *Flexibility*

In its effort to produce an employee commute options guidebook, the state of New York studied California's experiences and came up with some recommendations. These recommendations included combining several options and support strategies, including guaranteed ride home, parking management, flexible work hours, provision of shower facilities for bikers and walkers (Saito et al, 1993). Zupan notes that factors related to TDM participation include economic self interest and realistic alternatives (1990). In terms of creating a TDM program and keeping the needs of all employees in mind, Branch et al recommend setting outcome goals, but being flexible about how they are achieved and using multiple options to prevent possible inequities (1996). Zupan recommends that performance objectives, not specific strategies, be utilized (1990). Washington State, which has implemented a successful TDM program, gives minimal specifications about what employers must do to achieve these goals (Branch et al, 1996).

### **Effects On Women**

Different characteristics related to employment and employer location can affect TDM program's effectiveness. These factors include employer size, development patterns surrounding the employment site, working hours, salaries, benefits, regularity of work schedules and location, and need for off-site business travel during the day.

Because of the persistence of occupational segmentation, these factors can all relate to gender. Female versus male dominated occupations might have different working hours, regularity, location and size. Some of these characteristics, then, might vary by gender, affecting women's different experience with TDM programs. These characteristics, along with some of the findings from Chapter Two, including shorter work trips and more suburb to suburb commuting, result from occupational segregation.

Occupational segregation further determines the different experiences that women and men have with TDM programs. The findings of the case studies indicated that most of the successful programs had a larger proportion of men. While occupational segregation and gender roles are connected on many levels, their influence on women's ability to participate in TDM may be different. The case studies have suggested that gender segmentation does exist and play a role in TDM participation. Two of these identified factors in TDM's success, employer size and development patterns, therefore, interact with gendered labor segmentation to affect women's participation. Marketing should not vary by gender, as women and men should have equal access to promotional efforts.

A 1992 study by Waldo Lopez-Aqueres discusses some employee attributes that are related to the effectiveness of trip reduction programs. He discusses employee occupation, noting that management and professional occupations have lower carpool propensity than blue collar occupation and that household characteristics such as the presence of small children may have a negative effect on the ability to participate (1992). Because of the persistence of occupational segmentation, these factors can all interact with gender. Female versus male dominated occupations might have different working

hours, regularity, location and size. Some of these characteristics, then, might vary by gender, affecting women's different experience with TDM programs. Research suggests that TDM programs that promote flexibility are better for women (Spain, 1999; Branch et al, 1996).

### **Most Successful TDM Programs**

The success of different TDM programs depends on a variety of factors. Although these different factors affect each strategy's effectiveness, in terms of reducing environmental impacts, some strategies are generally more effective than others. Studies by Dowling et al and Rodier and Johnston indicated that a combination of strategies is often most effective. Zupan grouped strategies into a table and concluded that strategies that reduce congestion are generally acceptable include alternative work hours, allowance programs, ridesharing, and land use. Pricing strategies, including parking and roadway, are strategies that reduce congestion, but are not generally acceptable (Zupan, 1992). This section will briefly discuss these more effective TDM strategies. Higgins identifies several factors related to TDM's success: programs that are targeted to larger employment centers, are coupled with transit development, involve high occupancy vehicle incentives, and contain parking management strategies (1990).

There are a number of different obstacles to successfully reducing air pollution and traffic congestion through a TDM program. Some of the more important challenges include free parking, public acceptance, and the increasingly complex nature of the work trip. One of the biggest impediments to TDM programs are the availability of free parking. Free parking can impede transit's desirability, thus making alternative

commuting modes less attractive (Shoup, 1999; Cervero, 1997). Public acceptance is a major obstacle to the success of TDM. Another issues complicating TDM for work trips is the increasingly complex nature of the work trip. Sivasailam and Williams analyzed data from the Home Interview Survey for Washington D. C, and found that many of non-work trips are part of the trip from work to home, home to work, or during the work day (1996).

### *Parking Management*

Parking management might be the most successful TDM measure (Zupan, 1992; Williams, 1994; Higgins, 1990). Five out of the seven most successful cases outlined by Higgins had parking pricing strategies in place (1990). Both Dowling et al and Rodier, however, recognize that parking management must be combined with other strategies to fully realize its potential. Dowling et al also recognizes the importance of off-site parking availability and cost, which, when combined with parking charges, accounted for roughly 80 percent of the variation in modal splits. They also indicated that the correlation between parking charge rates, off-site parking restrictions and transit service was too high to separate the effects of the parking charge itself (1992).

### *Alternative work hours*

Ho and Stewart performed a study on the 4/40 compressed workweek, where workers complete their 40 hour workweek in 4 days. This alternative schedule was found to reduce the total distance traveled by about 46 miles. Employees made fewer errands during the workweek. In a study conducted by Freas and Anderson, the variable work hour program had a positive effect on employees ability to rideshare. They found that the variable work hour program was effective in decreasing vehicle trips at minimal cost

(1992). Telecommuting has recently been recognized as a potentially effective TDM strategy (Mokhtarian et al, 1998).

#### *Allowance programs*

Burns noted that economic incentives were linked to trip reduction in metropolitan Phoenix and Los Angeles (1993). Bhatt's review of different transportation allowance programs indicated that the programs could potentially affect a significant shift from solo driving to ridesharing. Bhatt also cites studies that indicate that transit and ridesharing allowances have a modest impact on modal shares. If allowances are combined with other measures, like marketing, preferential carpool parking, ETCs, etc., they can reduce solo driver rates by 5 to 10 percent. When combined with parking pricing, these programs are also more effective at reducing SOV rates (1992).

#### *Ridesharing*

Carpools and vanpools are some of the basic alternate modes of transportation that reduce SOV rates. All other programs are aimed at encouraging and facilitating transit and ridesharing. As Zupan notes, car and vanpools are more appropriate for less dense and suburban areas than transit service. Carpooling is the most widely used commute alternative in Los Angeles (Young, 1993). Most TDM programs, therefore, are aimed at promoting ridesharing. Other factors are related to the success of ridesharing efforts. Among the other strategies discussed, Young suggests that park-and-ride lots and HOV lanes help to facilitate carpooling (1993).

## *Land Use*

Park and ride lots, also indicated as a successful TDM strategy, is included in this section. Land use is important because it can encourage transit and ridesharing. More intense land use, at 5 dwelling units per net acre, can make transit service more viable. Clustering of economic activity in the downtown, at 5 million square feet, is the minimum needed for bus service. A DOT survey indicated that transit use would increase by roughly 40 percent if the DOT relocated near a rail station, indicating that transit friendly land use is an encouragement for TDM participation (Black et al, 1992). Davidson indicated that suburban employee trip chaining is a deterrent to ridesharing. She indicated that these trips need to be addressed by land use changes or service provision in order for TDM strategies to be effective (1992). Further, in a study by Davidson, one quarter of the employees survey identified site-related incentives as the most important types of incentives to TDM programs (1992).

## **Effects On Women**

Comparing the list of all TDM strategies that are successful at reducing congestion and air pollution with women's travel characteristics indicates that women are differently affected by them. Zupan's list of high public acceptance and low public acceptance does not mirror the list of highly beneficial to women and not beneficial to women. Instead, some of the highly publicly acceptable strategies negatively affect women and some of the low public acceptance strategies would be beneficial to the travel needs of working women. Table 2 in Chapter Four indicated the type of impact, positive, negative or neutral, that these strategies seemed to have for working women with

children. Many researchers argued that women's roles and need to link trips to and from work made them more dependent on the SOV. This dependence makes women more likely to have to make a choice between convenience and higher costs.

The same five TDM programs identified in the last section will now be compared to the findings in Chapter Four to determine whether the most successful TDM programs are also successful for women. Additionally, the potential impacts on women's transportation experience and quality of life will be hypothesized. Each of the following TDM components will be evaluated in terms of the key characteristics of women's travel patterns. These characteristics include a) women's shorter work trip b) different rates of transit use, c) preponderance of linked trips, and d) suburb to suburb commuting pattern. Additionally, when appropriate, an attempt will be made to differentiate between women of higher and lower incomes and women of different ethnic backgrounds.

### ***Parking Management***

#### *a) Women's shorter work trip*

Women's shorter commutes make carpooling and vanpooling a less attractive alternative. Women's reliance on the SOV, as a more convenient mode of commuting for shorter trips might make them more likely to be subject to parking fees.

#### *b) Women's different rates of transit use*

The interaction of parking charges and different rates of transit usage are variable.



*c) Women's higher number of linked trips*

According to the previous chapter, parking pricing probably affects women negatively. Rosenbloom and Burns and Branch indicate that programs that offer financial disincentives to the SOV can hurt women. Women, therefore, might be negatively affected by pricing policies. Single mothers are often poor and dependent on the automobile to take care of all their domestic and childcare responsibilities. Pricing policies would force them to choose between convenience and price. Women in general earn less and are responsible for a greater proportion of domestic and childcare tasks. These factors suggest that they are differently affected by increases in pricing and deterrents to convenience. Women who earn less, especially minority women who are disproportionately represented in the lower paying service industries, and are more dependent on their automobiles for the work trip, might be hurt by congestion pricing.

Of the case studies reviewed, CH2MHill had parking prices that were almost twice as high as any other case study. CH2MHill also had a larger proportion of women taking advantage of TDM programs. Perhaps women, as lower paid members of the workforce, are more sensitive to CH2M Hill's high parking rates and are forced to make transportation decisions that negatively affect their quality of life.

*d) Different geographical distribution*

A study by Rodier and Johnston indicated that pricing policies without high intensity land uses and good transit service are not as effective. Pricing combined with improved transit, higher density and a mix of land uses might mitigate these harmful effects (1993). This finding addresses the fact that female dominated jobs, located more often in the suburbs, may be less likely to have compatible land uses surrounding them.

### *Alternative work hours*

Alternative work schedules can have variable effects. Alternative work schedules refers to a variety of programs including compressed workweeks, flexible workweeks and telecommuting. Table 10 describes the participation rates in the alternative work hour program, by gender. Although Table 10 indicates that childcare arrangements are positively or not affected, women seem to participate in different programs than men do. Specifically, they seem more likely to participate in the 9/80 program and less likely to participate in the program in general than men. Men participated in higher rates in the 4/40 and flextime programs. These findings might suggest that childcare arrangements are constrained by certain types of programs, rather than others.

**Table 10. Participation rates by Gender.**

	<b>Female</b>	<b>Male</b>
Completed survey	43	57
4/40	33	66
9/80	49	51
Flextime	33	66
Not participating	47	53

Source: Freas and Anderson 1991.

#### *a) Women's shorter work trip*

The effects of a shorter commute on women's experience with alternative work schedules is not clear.

#### *b) Women's different rates of transit use*

Compressed work weeks and flexible work schedules, however, may have a negative effect for those that are transit dependent. Some researchers have indicated that compressed work weeks and telework make transit a less viable option (Zupan, 1990).

Strategies that make transit less viable might also be harmful to the transit-dependent population.

*c) Women's higher number of linked trips*

The ETC at CH2MHill mentioned that telecommuting was an attractive option for young mothers. Some researchers have noted that timing policies for women sometimes are not attractive as the timing of other services, most importantly daycare, are often rigid (Fox, 1989; Bianco and Lawson, 1999). Bianco and Lawson note that flexible work schedules are not helpful for women workers when childcare continues to have a fixed or limited hours (1996). Freas and Anderson, in their study, noted that schedule conflicts with child care and carpooling arrangements impeded participation in the variable work hour program (1993). These two impediments suggest that women, who are more responsible for child care tasks and more dependent on carpooling, would not benefit from variable work hour programs.

On the other hand, Fox notes that women need new timing policies for work and household in order to have more time for travel, and employment and services that are accessible because of proximity or availability of transportation (1983). In a study by Ho and Stewart the variable work hour program had a positive impact on child care arrangements. Ten employees, however, did not participate in the program or dropped out because of childcare arrangements. Table 11 describes the participating employees' experiences with childcare.

**Table 11. Variable work hour program's effects on childcare.**

	Better	Same	Worse
Flextime	43	57	0
4/40	17	83	0
9/80	19	74	7

Source: Ho and Stewart 1992.

The findings on telecommunications are unclear. Some researchers argue that telecommuting does not make balancing responsibilities any easier. Others suggest that telecommunications can help women, who are largely responsible for domestic tasks, complete both their work and domestic responsibilities. Hanson has shown that men who telecommute take on more domestic responsibility than men who work outside the home (1998). Mokhtarian et al analyzed gender differences in telecommuting experiences and found that women were more likely than men to recognize family and personal benefits and stress reduction as advantages. Women, also, were more concerned than men about the lack of visibility to management. Managers and professionals were more concerned than respondents in other occupational categories about the reduction in workplace interaction leading to a possible hindrance of professional development.

*d) Different geographical distribution*

The effects of geographical distribution on women's experience with alternative work schedules is unclear.

***Allowance programs***

Branch et al notice that women are affected differently by incentives which are used in transportation allowance programs. They suggest that programs design should consider equity issues and unintended social consequences. They found that most trip reduction programs, however, were not paying attention to the needs and issues of different social groups (1996).

*a) Women's shorter work trip*

Women's shorter commutes make carpooling and vanpooling a less attractive alternative. Women's reliance on the SOV, as a more convenient mode of commuting for shorter trips might make them more less likely to take advantage of the fiscal benefits of allowance programs, which encourage the use of alternate modes.

*b) Women's different rates of transit use*

Women's different rates of transit usage might enhance or detract from their ability to benefit financially from these allowance programs. If transit is convenient, then allowance programs can enhance women's ability to participate and benefit from these programs. If transit is not convenient, women would have to choose from a reduction in financial compensation and a reduction in convenience.

*c) Women's higher number of linked trips*

Rosenbloom and Burns, in their 1992 study, suggested that women were treated unfairly by transportation allowance programs, which give financial incentives for not driving a SOV to work. Burns, in 1993, notes that while economic incentives are often effective in reducing SOV miles, they do not fully address the range of family and other responsibilities that affect an individual's commute decision. Because of domestic and childcare responsibilities, women are more dependent on their privately driven automobile (Rosenbloom and Burns, 1992). Other measures must address the concerns of those who do not have a choice about their commute mode (Rosenbloom, 1993).

*d) Different geographical distribution*

Women's different geographical distribution might contribute to their shorter commutes, but otherwise the effect of this different geographical distribution is unclear.

## ***Ridesharing***

Kumar and Moilov surveyed vanpool coordinators and riders in Los Angeles in 1988-1989 and found that most vanpoolers were older married men (1992).

### *a) Women's shorter work trip*

Ridesharing efforts are most effective for trips of at least 20 miles. The average worktrip length for the SOV is 15 miles and 38 miles for carpoolers. Considering that women's work trips are shorter, ridesharing does not seem to be a viable alternative. Vanpool market's are commuters with trip distances over 20 miles (Torluemke and Roseman, 1990).

### *b) Women's different rates of transit use*

Women's different rates of transit usage is related to their different rates of ridesharing. As with transit, women's income level, race and other factors determine their ability to participate in ridesharing activities. Rosenbloom and Burns indicated that women were less likely to carpool, but other researchers have indicated that women, especially ones in lower paying professions, tend to carpool at higher rates.

### *c) Women's higher number of linked trips*

Ridesharing negatively affects women who traditionally fulfill other obligations by linking trips to and from work.

### *d) Different geographical distribution*

Ferguson notes research that suggests that the influx of women in the work force coupled with the continued suburbanization of jobs and housing has caused the decline in carpooling rates, between 1980 and 1990 (1993).

### ***Park and Ride Lots***

#### *a) Women's shorter work trip*

Shorter commutes discourage ridesharing, so the provision of park and ride lots might not affect women.

#### *b) Women's different rates of transit use*

Different rates of transit usage affect the rates at which women utilize park and ride lots. Researchers have suggested that linking park and ride lots to commercial and retail use increases their use. These types of activities could improve the experience of women utilizing the park and ride lot for transit use, or improve the ability of women to utilize the park and ride lot for transit use.

#### *c) Women's higher number of linked trips*

Park and ride lots have the potential to positively effect women's quality of life and participation in transportation demand management. Depending on the surrounding uses, park and ride lots have a variable effect. If childcare or other amenities are available at the park and ride lot, then women might find ridesharing more convenient and cost effective (Al-Kazily, 1991). Locating services and amenities at park and ride lots again cuts down on the amount of linked trips and may also make car or van pooling more accessible to those employees who must make many linked trips.

#### *d) Different geographical distribution*

Different geographical distribution, again, may be related to the length of the commute.

need for parents to chauffeur their children and reduce the need for other linked trips. If uses are concentrated at either end of the work commute, women would be in a better position to participate in ridesharing and benefit from economic and other incentives.

The need for site amenities and surrounding uses of park and ride lots are related to the need for these amenities and uses at employment centers and residences. The home-based work trip has been redefined to include the trips that are linked (to the daycare center, etc.) along the way. The trip begins and ends at home, the intermediate destination is work, but there are stops along the way to work, the way home and during the day. Locating services and amenities at the home or work end reduces the need to link trips, which are largely made during peak hours.

*d) Different geographical distribution*

Changing land use patterns would also alter the existing geographical distribution of women's work commutes.

***Summary***

Table 12, on the following page, summarizes these findings. Those strategies that are negatively affected by each specific characteristic are given a - . Those that are positively affected are given a + . Those that have variable or unclear effects were given a -/+.



**Table 12. TDM Strategies and their effect on the different characteristics of women’s commuting patterns.**

Type of Program	Shorter Commute	Different Rates of Transit Usage	Higher Rates of Linked Trips	Different Geographical Distribution
Parking management	-	-/+	-	-
Alternative work hours	-/+	-	-/+	-/+
Allowance programs	-	-/+	-	-
Ridesharing	-	-/+	-	-
Park and ride lots	-/+	+	+	-/+
Land use	+	+	+	-/+

The results indicate that parking management, allowance programs and ridesharing have the negative effects, while park and ride lots and land use have positive effects.

Alternative work hours have the most area of uncertainty or variability.

### **Conclusion**

This analysis suggests that working women with children could be negatively impacted with the implementation of certain TDM strategies including allowance programs, financial incentives that encourage alternate modes and parking management strategies. Women, who may have different responsibilities than men, are more greatly inconvenienced without the privately driven automobile. Additionally, women who earn less than men, especially single mothers who are largely poor, can less afford to forgo these financial incentives. Alternative work schedules seem to have a variable effect on women, depending on the type of program and existing childcare arrangements. Research is needed as to which types of alternative work schedules are most convenient to women. Table 12 indicates that land use, and park and ride lots are two of the most appropriate TDM strategies for working women.

The analysis suggests that linked trips, combined with other factors, constrain women's work trips and their participation in TDM programs. This tendency to link trips is connected to a preference for the automobile as the mode of travel (McGuckin and Murakami, 1999). Additionally, the geographical distribution is related to these constraints. When destinations are spread out, as happens in sprawl-type development patterns, combining trips becomes more time consuming and difficult. Daycare facilities, because of zoning regulations, are not located in residential areas or industrial areas. They are usually located in commercial areas that are not convenient to either home or work (Fox, 1983). Public transit, which women use more often, makes trip chaining even more difficult because of both increases in time and fare structures (Fox, 1983; McGuckin and Murakami, 1999; Rosenbloom, 1993).

## **Chapter Six**

### **Conclusion and Recommendations**

#### **Introduction**

This final chapter will conclude this analysis and offer recommendations about the types of TDM programs that best meet the needs of working women with children.

Evidence suggests that women are attracted to different types of TDM programs, and are affected differently by these programs (Rosenbloom and Burns, 1992; Georgiadou, 1998; Commute Alternatives Systems Handbook, 1996; Neimeier, 1998; Mokhtarian et. al., 1998). This chapter will attempt to address specific recommendations that would help TDM programs both reach their goal and have a more equitable effect on working women.

This chapter will identify those strategies that seem most appropriate to women's travel patterns, using the findings from Chapter Two, and analyze them in terms of the literature on TDM programs. This section will explore whether these strategies are also successful in affecting air quality and congestion by referring to the analysis of their effectiveness in the previous chapter. This section will also make recommendations about criteria that would promote equity in TDM program evaluation. This section will then be compared to the analysis in the previous chapter to determine the strategies that both positively affect women and mitigate environmental and traffic problems. This chapter will conclude this research by make recommendations about the types of TDM programs that meet the needs of working women with children and are effective in reducing environmental impacts.

## **Most Successful TDM Programs For Working Women**

Ridesharing, both carpooling and vanpooling, has been identified as the TDM strategy most appropriate in suburban areas. Therefore, ridesharing is the strategy with the most potential for reducing SOV rates in areas not already adequately served by transit. Women's participation in ridesharing activities is integral to their participation in TDM programs and ability to take advantage of financial incentives. Keeping this in mind, the three components listed in this next section are assumed to be grouped with ridesharing as a way to reduce SOV rates and still meet the needs of working women.

Some TDM components that have been identified as beneficial to working women with children include land use and zoning changes, improved transit and the GRH program. TDM programs, however, are rarely evaluated in terms of gender and other specific strategies that work best for working women have to be hypothesized rather than stated. This section will identify the programs identified or hypothesized as being most appropriate for working women.

### *Land Use and Zoning*

Strategies that positively affect women's transportation experiences very likely include transit oriented design and the intensification of land uses. Both of these strategies make linking trips easier and less time consuming. Transit oriented design might make transit more convenient for women who are dependent on using it. The intensification of land uses can increase the proximity of different uses, making shopping, banking, childcare and other trips, which women normally take, shorter. A mix of residential and commercial uses might decrease the amount of time spent on different tasks and clustering workplaces might make alternate modes of transportation more

accessible (Fox, 1983). Reducing the time and distance for these other trips might enable women to devote more time to other pursuits, including their careers or their family.

Other factors related to ridesharing and transit are the location of services and other land uses. Daycare and other services on site might improve the situation, as it allows women to continue their domestic responsibilities on the journey to work (Ericksen, 1977). Fox also mentions e-commerce as a potential solution to women's transportation problems, by reducing shopping trips (1983). The location of childcare facilities impacts the travel patterns of working women and men with children. Spain recommends that child care facilities be located at transit transfer stops. These on-site childcare centers help free women from some of their extra trips, perhaps allowing them to utilize transit or ridesharing.

Andrew Ross's *The Celebration Chronicles* details the author's experience in Celebration, Florida, a planned community created by Disney based on planning and design guidelines of the New Urbanist movement. Although Ross notes that many aspects of the wealthy suburban community reinforce traditional gender roles, he also indicates that Celebration's design was intended to liberate women "from having to choose the path of least resistance in their careers and daily lives" (322). He also mentions that most New Urbanism designs attempt to free women of the chauffeur role and increase their access to daycare, school, the playground, etc.

#### *Improved Transit Service*

Since women are traditionally more dependent on transit than men, efforts should be made to make transit use more convenient. Ericksen suggests that improvements in transit would allow women better access to the job market (1977). Improved transit

service coupled with more transit friendly design could address the needs of transit-dependent women. Branch suggests that individual commuter tickets, which allow the employees to use the bus a few days a week, might be more acceptable to women who could complete their errands and drive on other days.

#### *Guaranteed Ride Home Program*

Women who are responsible to responding to their children's needs must have a way of responding to emergencies. During an interview with RIPTA's Director of Express Travel, which markets and implements Rhode Island's TDM efforts, she indicated that nearly all TDM programs include a guaranteed ride home program. Different researchers have pointed out that the guaranteed ride home program is essential for primary caregivers.

#### **Effectiveness Of Women-Friendly Programs**

Sivasailam and Williams note that transportation control measures are often aimed at commute trips despite the fact that many other trips are linked as part of the commute. Their analysis did not focus on gender, but recommended that measures be designed to accommodate linked trips, specifically mixed-use development and day care facilities at transit hubs (1993). A study by Davidson, in 1992, indicated that employees, in general, linked trips on their way to and from work. Only 9 percent of the total respondents indicated that they go directly to and from work without engaging in trip chaining (1993). These recommendations suggest that, as demographics and roles change, suggestions targeted at the transportation needs of working women will also be effective for work men, especially those with children.

### *Land Use and Zoning*

Land use strategies were identified in the first section as one of the most effective TDM programs. Evidence suggests that men also link trips on the way to and from work and that strategies that address these trips will have greater success. Davidson suggests modifying the worksite environment by including more, varied land uses or creating a service-delivery system. She suggests that eliminating the need for linked trips would increase people's ability to rideshare (1993). Some of the incentives that might induce commuters to utilize modes of transportation other than the privately driven automobile are daycare centers at or near the workplace and access to lunch time transportation for errands (Orski, 1990). Dowling notes the importance of the availability of support services within walking distance such as banks, copy centers, lunch stands, and convenience stores (1992).

Employers with on-site child care programs surveyed by the Department of Labor indicated that increased productivity, improved recruitment and retention and lower stress levels accompanied the provision of child care. Allied Signal, Inc. in Morristown, New Jersey implemented an on-site child development center. The employers have indicated that the on-site care arrangement improves morale for all workers. Participating parents were surveyed and results indicated that lost work time decreased by 89 percent. Many new employees indicated that the child care center was part of their decision to work for AlliedSignal, Inc. Some companies also offer back up childcare for those parents who have regular acceptable child care situations. Women at the Cold Springs Harbor Laboratory cited commuting time as a reason for implementing a child care center on-site. The Trout-Blue Chelan, Inc., an apple packing cooperative that employs a majority of

women, implemented a day care center. Management at the Trout-Blue Chelan, Inc. noted an increase in applications and lower turnover (US Department of Labor, Women's Bureau).

#### *Improved Transit Service*

Transit is often not viable in less dense suburban areas, where many of the TDM programs are focused.

#### *Guaranteed Ride Home Program*

Although the effects of the specific GRH program is difficult to quantify, some authors identify them as essential to TDM strategies. A guaranteed ride home can improve a program's effectiveness (Orski, 1990). Higgins, in 1990, identified GRH programs as an important area of research. Beaton et al developed a methodology for using performance measures for different TDM strategies and found that a GRH program, as part of the entire TDM package, would help a New Jersey firm obtain an increase in average vehicle occupancy rate (1991). Burns noted that the Guaranteed Ride Home Program was statistically significant in reducing the number of SOV miles traveled (1992). In an interview, Director of the Express Travel Department of the Rhode Island Public Transit Authority indicated that all TDM programs offered a GRH. A firm in Northern New Jersey used Stated Preference models to estimate the impacts of different TDM measures and concluded that a combination of different programs, including a GRH program, would increase the AVO by 25 percent.



## **Recommendations**

Travel demand management programs are targeted at the general working population, overlooking differences in the household circumstances and travel constraints of different subgroups, for example, working women (Sarmiento, 1999). TDM can impact the quality of life for working women. Research needs to identify whether women find these programs useful and what impact they might have on the employment opportunities for women working women with children (Dittmar, 1999). General recommendations about the implementation of TDM programs that benefit working women with children include flexibility and evaluation.

Niemeier analyzes the priorities and criteria related to ISTEA funding allocation and notes that women are not always included in these processes. Niemeier looks at accessibility, which is rarely mentioned and always defined in reference to access from the home to work. Women who need to access childcare or community support structures are often not included in this definition (1998). The same type of process, that ignores gender differences, also contributes to the creation of TDM programs that are harmful or indifferent to working women.

Zupan notes that factors related to TDM participation include economic self interest and realistic alternatives (1990). Program creators need to understand that economic self interest and realistic alternatives are not the same for all employees. Transportation allowance programs, as noted by Rosenbloom and Burns, can negatively affect women. If these programs are implemented flexibly, with all employees in mind, however, these negative effects might be mitigated.

Branch et al give an example of a program that espouses flexibility. Parking passes can allow registered carpoolers/vanpoolers, bus riders, bicyclists and walkers to park free (or discounted) a number of times each week or month. Branch et al indicate that employees with child care responsibilities could organize their after-work errands to two days a week, drive alone for those days and take transit or carpool the remainder of the week. These programs are helpful for employees with primary care responsibilities because they can participate and still have some flexibility (Branch et. al., 1996).

Another way to be flexible and consider the needs of all employees is to conduct surveys. Black et al illustrated how the U. S. Department of Transportation headquarters in Washington D. C. administered a survey to its employees to determine the selection and packaging of TDM measures. The survey resulted in a set of preferred measures and suggestions about potential TDM strategies. These measures were then tested according to a number of qualitative and quantitative measures of effectiveness, including socioeconomic objectives (1991). The process of surveying employees might result in the creation of a TDM package that benefits all employees.

In terms of evaluation, more attention needs to be paid to the potential for inequities for different types of employees. Information used to evaluate TDM programs, as indicated by the case studies, rarely includes gender, or other demographic characteristics. In terms of creating a TDM program and keeping the needs of all employees in mind, Branch et al recommend setting outcome goals, but being flexible about how they are achieved (1996). Zupan recommends that performance objectives, not specific strategies, be utilized (1990). Washington State gives minimal specifications about what employers must do to achieve these goals (Branch et al. 1996).

Sivasailam and Williams concluded that successful TDM measures should accommodate linked trips, through mixed-use development and day care facilities at transit hubs (1993). As demographics and roles change, suggestions targeted at the transportation needs of working women will also be effective for work men, especially those with children. There are some issues, however, that need to be resolved before linked trips can successfully be integrated into TDM strategies, including inadequate modeling techniques and existing land use and zoning regulations.

#### *Inadequate transportation modeling techniques*

As previously mentioned, traditional modeling techniques are often not effective in looking at complex travel patterns. Different processes need to be established to account for linked trips (Sivasailam and Williams, 1994; Davidson, 1993). Bianco and Lawson note that work trips have become more complex. Workers now complete personal and household business during their commute to and from work. These types of activities often reduce some workers' ability to participate in transportation demand management programs that limit these trip chaining options. Work trips in the Washington DC, as defined by traditional models, account for between 20 and 30 percent of all trips. A redefinition of work trips to include all work related trips brings this percent up to 54.6 (Sivasailim and Williams, 1994).

#### *Land use and zoning regulations*

Land use has been identified as a way to increase employee's ability to rideshare. There are, however, some obstacles to making land use patterns more compatible with transportation. For example, Davidson notes that the zoning ordinance in Brentwood, Tennessee, a suburban community near Nashville, does not provide for planned unit

developments and prohibits mixed use development. Zoning regulations are such that home, work, leisure, school, and shopping locations are all spread out (Spain and Bianchi, 1996). Gurstein suggests that these problems are a result of 20th century cities being designed to promote efficiency in the paid labor market and not to accommodate other tasks (1996). While market forces may ultimately determine urban and suburban form, zoning and land use regulations can help guide the development to more transit and pedestrian friendly development.

### **Future directions of research**

1. Considering all these findings, future research should focus on several areas. First, the design of a TDM program for a female dominated employment site might be useful. This research would help in designing successful TDM programs for female dominated and mixed workplaces. The purpose of this research is not to enforce existing gender inequities and roles. The purpose, instead, is to determine the types TDM strategies that might meet women's needs considering their work and domestic responsibilities. Determining these strategies might help to alleviate the burdens of balancing domestic and work responsibilities. This practice might also help improve the quality of life for single fathers and other men who are responsible for domestic responsibilities.
2. Telecommuting brings an interesting nexus of the public and private spheres and changes the impacts of locational factors (Law, 1999; Hanson, 1998). Men who work in the home are more likely to telecommute than any other homework occupation. Studies about telecommuting, however, rarely discuss gender (Hanson, 1998). Preliminary

evidence suggests that men who are at home while their wives are employed tend to take on a greater share of housework, especially if the men were home during the day (Hanson, 1999). Hanson theorizes that a male presence at home, when it indicates a decrease in the amount of housework for the female, might make it possible for women to work farther away from home (Hanson, 1998; McGuckin and Murakami, 1999).

3. Another area for future research is a better understanding of the variations among different groups of working women by marital status, race, income and household size.

### **Conclusion**

In conclusion, certain TDM programs, especially those that impose financial constraints on SOV users, can negatively affect women. Women who have greater financial and domestic burdens, for example, single mothers, are most greatly affected by these types of strategies. These types of programs, including parking pricing and allowance programs, are effective in reducing SOV rates, a traditional measure of TDM success. If these programs are implemented with flexibility and evaluated with consideration for all employees, however, these negative effects might be mitigated.

Women could be positively affected by certain TDM programs, like land use strategies, that address linked trips and facilitate their ability to rideshare or use transit. These types of strategies are also successful in reducing SOV rates. Because childcare responsibilities strongly affect the travel patterns and employment experiences of women, TDM strategies addressing childcare might be the most effective. This study suggests that the major factors associated with women's experience with TDM programs include domestic and childcare responsibilities and occupational segregation. Although

differences do exist between women in terms of ethnicity, income, marital status, and presence of children. these findings seem to apply to all working women.

In conclusion, it is difficult to address this issue with recommendations about specific TDM strategies. Program flexibility and evaluation in terms of all types of employees are two factors that can help employees develop a package of strategies that are effective, fair and appropriate to their specific needs. In developing these packages, which can help facilitate employees' participation in ridesharing and transit options, it is important to address trip chaining behavior.

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