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16. Abstract This study examines strategies employed to encourage and enhance transit use in Texas and throughout the country. Two reports document the results of this research. The first is <i>Design Guidelines to Enhance Pedestrian and Transit Interaction</i> , which presents a step-by-step process for planning and designing transit facilities to enhance passenger convenience, comfort, and safety. The report presented here documents the second portion of the study which examined policies and programs supporting transit use. It includes a state-of-the-art literature review of the use and the experience with different techniques, a general discussion of the different approaches, and more detailed case studies of the strategies used in four metropolitan areas. The report identifies the policies and programs that appear most appropriate for further application in Texas. Finally, examples are provided of the general approaches and implementation techniques that can be used by transit providers, municipalities, the Texas Department of Transportation, private business, and other groups to support increased transit use in the state.					
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**EXAMINATION OF POLICIES AND PROGRAMS
SUPPORTING TRANSIT USE IN TEXAS**

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IMPLEMENTATION STATEMENT

Examining ways to increase the use of public transportation services and all forms of high-occupancy vehicles (HOVs) are being considered in many metropolitan areas and mid-sized communities throughout Texas and the United States. These efforts are often focused on responding to issues associated with increasing levels of traffic congestion, and maintaining mobility and accessibility for residents and visitors, as well as air quality and environmental concerns. Transit, HOVs, and other alternatives to driving alone appear to be most effective when supporting policies and programs are also in place. These may include policies related to land use, zoning, parking pricing and supply, trip reduction, growth management, and employer participation.

This study investigated the national and state experience with different policies and programs to enhance the use of all forms of transit and HOVs, as well as walking, bicycling, and alternative work arrangements. Based on this assessment, potential policies and programs are appropriate for further consideration in Texas. The results of this study should be of benefit to the Texas Department of Transportation (TxDOT), transit agencies and service providers, metropolitan planning organizations (MPOs), local communities, private businesses and developers, federal agencies and other groups interested in encouraging greater use of transit, HOVs, and alternative work arrangements.



DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the findings and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Federal Transit Administration or the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation, and is not intended for construction, bidding, or permit purposes.

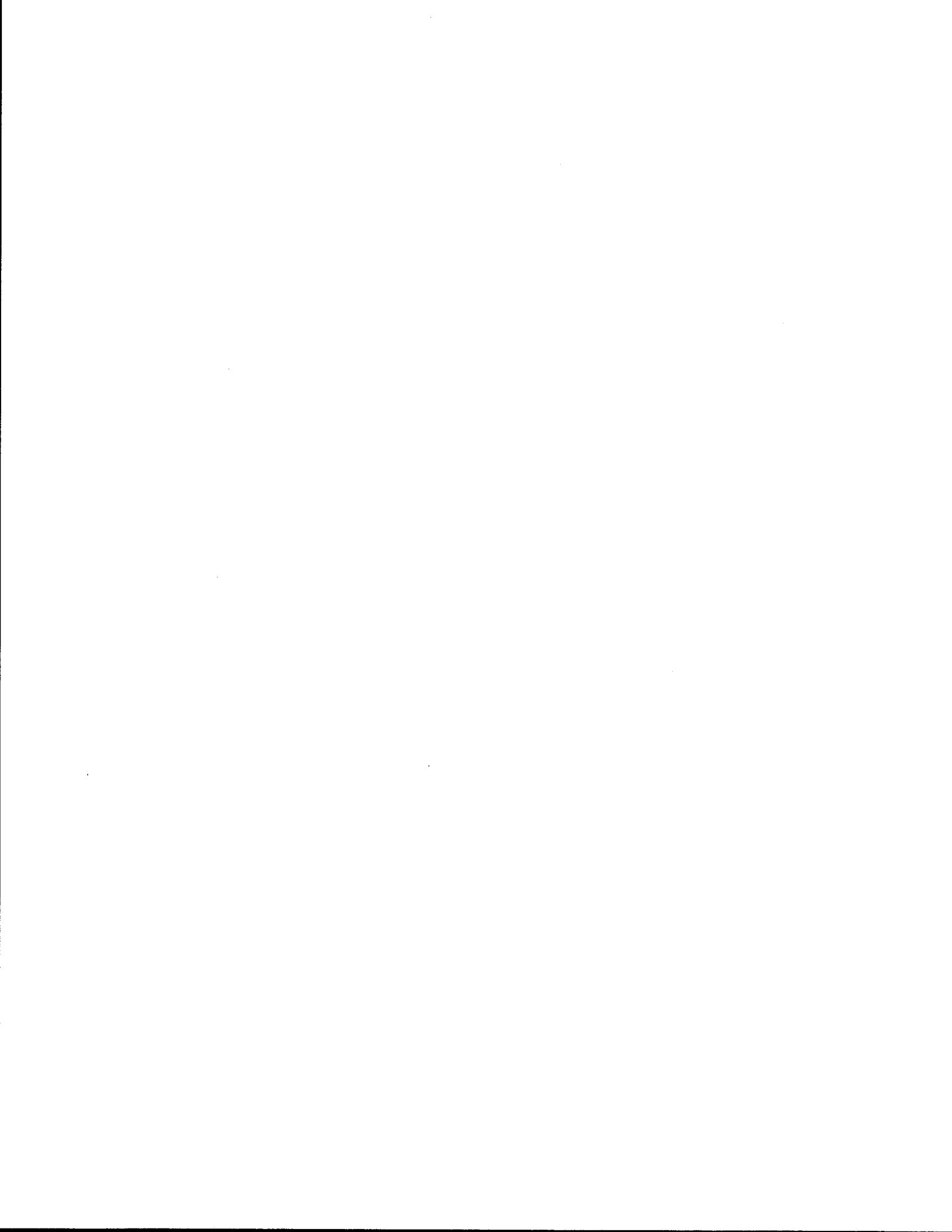


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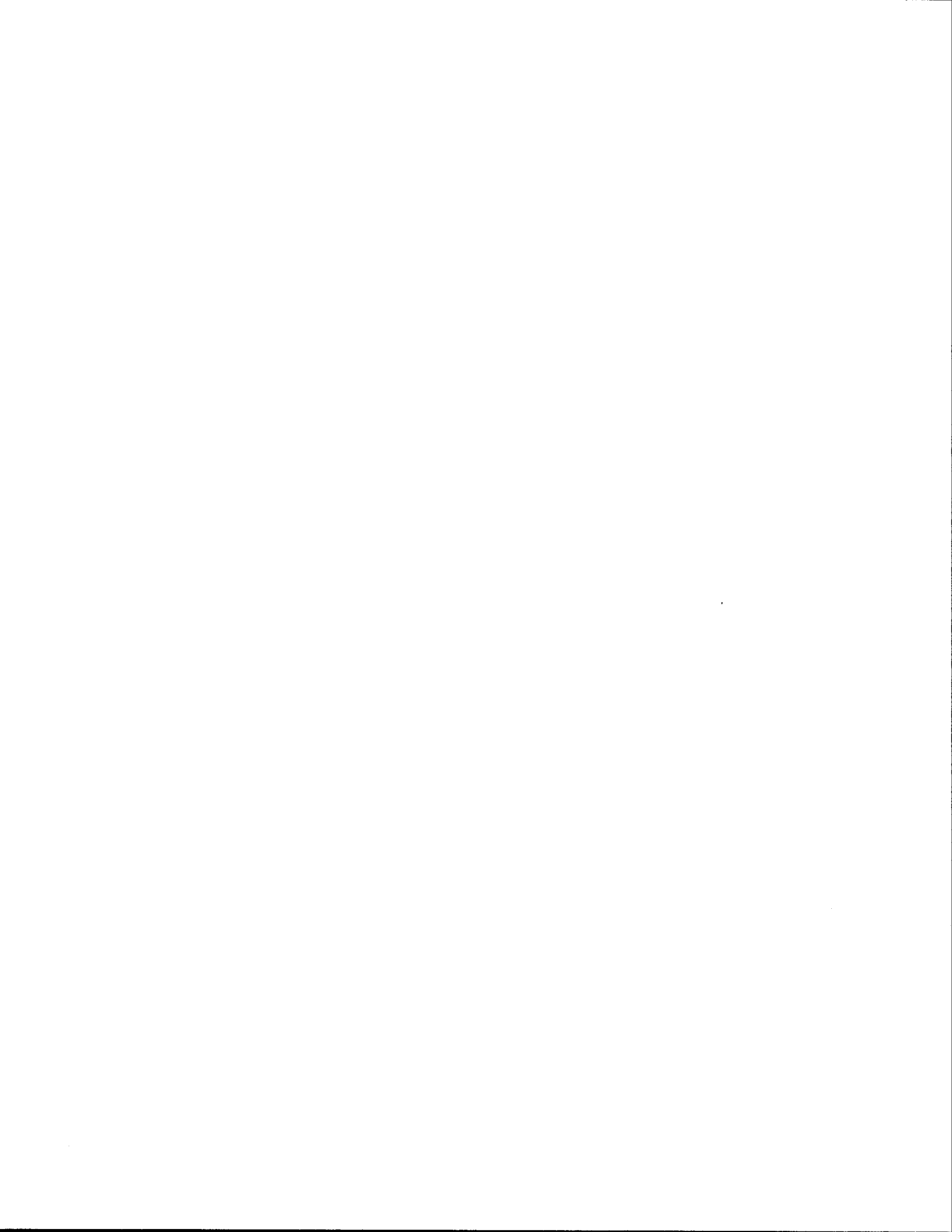
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SUMMARY

Increasing transit use and vehicle occupancy levels are important objectives in many metropolitan areas, including those in Texas. National research studies and project experience around the nation indicate that transit is most effective when supporting policies and programs—such as employer programs, parking pricing and supply, transit-sensitive site design, trip reduction ordinances, or land use planning—are also in use. Ensuring that policies and programs in these areas are supportive of all types of transit may increase ridership and assist in addressing traffic congestion, air quality, and environmental concerns. This is of particular interest in those areas that must meet specific federal air quality standards or other environmental goals, including several areas in Texas.

The Texas Transit Research Task Force identified the need to examine the impacts of the implementation or expansion of transit-supportive policies and programs in Texas. The Texas Transportation Institute (TTI), under contract to the Texas Department of Transportation (TxDOT), has completed a research study to address this need. Two reports document the results of this research. The first is *Design Guidelines to Enhance Pedestrian and Transit Interaction*, which presents a step-by-step process for planning and designing transit facilities to enhance passenger convenience, comfort, and safety. The report presented here documents the second portion of the study which examined policies and programs supporting transit use. This effort included a review of national experience with the use of various strategies related to transportation demand management measures, land use planning and zoning, and growth management. More detailed case studies were conducted to examine the approaches used in Portland, Oregon; Montgomery County, Maryland; Boulder, Colorado; and Pleasanton, California. The current use of strategies supporting transit use in Texas was also examined. The results from these analyses are used to identify approaches that appear most appropriate for application in Texas.

Over thirty strategies were identified as being supportive of transit and were investigated for this study. These were grouped into three broad categories: transportation demand management, land use planning and controls, and growth management. A literature review and interviews were conducted to gather information about the policies and programs identified. This report provides a brief description and examples of each of the strategies.

Four metropolitan areas—Portland, Oregon; Montgomery County, Maryland; Boulder, Colorado; and Pleasanton, California—were selected for further examination because of the broad range of transit-supportive strategies employed, as well as for their diversity in terms of scenarios, geography, and population. Each of the policies and programs implemented by the case study areas have varying degrees of success, but the overarching lesson of the case studies is the importance of cooperative action by the public and private sectors.

The report identifies policies and programs currently used in Texas to encourage transit use. A number of existing policies and programs which could be classified as transportation demand management measures were identified. One example of education and outreach is TxDOT's investigation of a rideshare support program and the TxDOT brochures, *Public Transportation in Texas* and *Metropolitan Rideshare Programs in Texas*. Other examples from around the state include the transit pass programs offered by five Texas metropolitan transportation authorities (MTAs) and five of the state's municipal transit systems. In addition, six of the seven MTAs offer rideshare programs, and most offer some form of guaranteed ride home service. This report also discusses the high-occupancy vehicle (HOV) facilities in Houston and Dallas, as well as park-and-ride facilities. Many transit systems, especially MTAs, have developed extensive park-and-ride networks to support both transit and ridesharing. In addition, employer programs were investigated: both those education and outreach programs offered by transit agencies, and the growing number of transportation management organizations (TMOs), employer-based organizations involved in transit and transportation activities. The study also identified those areas of the state utilizing land use planning and controls to encourage transit use. Some examples are found in Dallas, Houston, Del Rio, and Laredo.

Finally, some characteristics unique to Texas, which might impact the implementation and effectiveness of policies and programs supportive of transit use, are examined. These include low density land use and development patterns, the existence of large rural areas, the fact that Texas cities generally employ fewer land use controls, the existence of stable transit funding sources, and an active private sector.

The report's conclusions and recommendations identify some strategies to encourage transit use which are appropriate for further consideration in Texas. The first recommendation is increased emphasis on education and outreach programs to inform the public of the traffic congestion and air quality issues associated with single-occupant vehicle use. Additionally, comprehensive programs, such as the one described in Boulder, Colorado, are suggested. These may include transit service improvements, employer pass programs, bicycle and pedestrian improvements, and extensive education and outreach activities. Transit agencies may consider providing more innovative transit services, especially additional reverse commute services. Also highlighted is the role of TMOs in fostering effective private sector participation. Other recommendations include parking management, station area planning and zoning, and joint development opportunities.

CHAPTER ONE

INTRODUCTION

Large metropolitan areas, as well as smaller communities and rural areas, are facing numerous issues related to increasing levels of traffic congestion, maintaining mobility and accessibility for residents and visitors, and air quality and environmental concerns. Increasing the use of public transportation services and all forms of high-occupancy vehicles (HOVs), as well as walking, bicycling, and alternative work arrangements, are all being considered in many areas to address these concerns. Transit, HOVs, and other alternatives to driving alone appear to be most effective when supporting policies and programs are also in use. These may include policies and programs relating to land use, zoning, development design, parking pricing and supply, trip reduction, growth management, and employer participation. In addition, many areas are expanding the types of services available and enhancing the convenience of using these modes.

Although some of these approaches have been implemented in Texas, others have not. Examining the potential of supporting policies and programs to enhance the use of all forms of transit and HOVs—including rail, bus, vanpooling, and carpooling—as well as other alternative modes and work arrangements, was identified as a priority research need in the *Texas Transit Research Agenda* (1). To address these needs, this research study was undertaken by the Texas Transportation Institute (TTI), a part of The Texas A&M University System, for the Texas Department of Transportation (TxDOT). Two reports have been prepared documenting the results of this research. The first, *Design Guidelines to Enhance Pedestrian and Transit Interaction* (2), presents a step-by-step process for planning and designing transit facilities that enhance passenger convenience, comfort, and safety.

This report documents the second portion of the research study which examined policies and programs supporting greater use of transit. The study included a review of the national experience with the use of policies and programs relating to land use and zoning, parking pricing and supply, trip reduction, growth management, employer participation, and transit service enhancements. In addition, researchers conducted more detailed case studies to examine the approaches utilized in four metropolitan areas in the United States. The current use of supporting policies and programs within Texas was also examined. The results from these analyses are used to identify approaches that appear to be appropriate for further consideration in Texas.

STUDY OBJECTIVES

This element of the research study was designed to meet a number of objectives. The first objective was to explore the use of different supporting policies and programs and to assess their impact on increasing transit use. The different techniques utilized throughout the country

were reviewed, and detailed case studies were examined from four metropolitan areas. Further, specific applications currently utilized in Texas were explored.

Based on this assessment, the second objective of the study was to identify potential policies and programs for further consideration in Texas given the unique features associated with land use, development, zoning, and the transportation system in the state. The final objective of the study was to outline the general approaches and techniques that can be used by transit agencies, local and state governments, and other groups to implement these policies and programs.

The results of this study should be of benefit to all groups interested in enhancing the use of transit, alternative commute modes, and other strategies to enhance the mobility and accessibility of residents and visitors, and to reduce the negative impacts of increasing levels of traffic congestion and single-occupant vehicle use. Interested groups include TxDOT, transit agencies and service providers, metropolitan planning organizations (MPOs), local communities, businesses, and other public and private organizations. In addition, the Federal Transit Administration (FTA) and groups throughout the country may find the results of benefit.

RESEARCH APPROACH

A number of research activities were conducted to accomplish the objectives of this study. First, a state-of-the-art literature review was completed on the subject of policies and programs supporting transit use. This review included an extensive examination of the different types of policies and programs used by transit agencies, local communities and counties, MPOs, regional associations, private businesses, and other groups to promote greater use of all HOV modes, other travel options, and alternative work schedules. Available information on the experience with these different techniques was also assessed.

Second, the general approaches and the specific techniques implemented in four metropolitan areas were examined in more detail. The case studies were selected to provide a mix of programs and strategies, institutional arrangements, experiences, and geographical locations. The attempt was also made to focus on applications that may be appropriate for further consideration in Texas. Portland, Oregon; Montgomery County, Maryland; Boulder, Colorado; and Pleasanton, California represent the four case studies. Information was gathered on each case study from national literature, local reports, and telephone conversations with staff members from local agencies.

In addition to reviewing the national experience with different supporting policies and programs, researchers examined the use of these strategies within Texas. Available information on the approaches used in large metropolitan areas, smaller communities, and rural areas was examined. After reviewing the available literature, representatives from numerous transit systems, MPOs, and private sector groups were contacted to obtain additional information about the use of and experience with different techniques.

The information gathered from both the national and the state experiences was used to identify potential approaches for further application by both public and private sector groups in Texas. Further, techniques for planning, implementing, and evaluating these strategies were outlined. Thus, the study results, as documented in this report, are intended to provide a useful guide for public agencies, private businesses, and other groups interested in exploring additional policies and programs to support transit use in Texas.

REPORT ORGANIZATION

The remainder of this report is divided into five chapters. Chapter Two presents a summary of the policies and programs currently in use throughout the country to support public transportation. The national experience with strategies in the three general categories of travel demand management (TDM), land use planning and controls, and growth management is examined in this chapter. Chapter Three contains the detailed case studies of the transit-supporting policies and programs used in Portland, Oregon; Montgomery County, Maryland; Boulder, Colorado; and Pleasanton, California. A discussion of the current use of different approaches in Texas follows. The final chapter provides a summary of the key elements examined in the study and identifies the policies and programs that appear most appropriate for further use in Texas.



CHAPTER TWO

NATIONAL OVERVIEW OF POLICIES AND PROGRAMS SUPPORTING TRANSIT USE

OVERVIEW

This chapter provides a national overview of the different policies and programs available to support transit use. The general policies and programs are described, and, where appropriate, examples of specific applications are highlighted. Three general categories are used to classify the different approaches. The three categories are travel demand management, land use planning and controls, and growth management. A general description of each approach is provided next. Figure 1 identifies the specific strategies and techniques within each of the three categories. Chapter 4 further examines these strategies, with examples of their implementation in Texas.

Travel Demand Management—Travel demand management (TDM) involves policies and programs which encourage more efficient use of the transportation system. TDM focuses on better managing the demand on transportation facilities by acting to shift more commuters into transit and multi-occupant vehicles, and into less congested travel periods. For example, encouraging drive-alone commuters to use transit, to join vanpools, or to form carpools can help increase the person-carrying capacity—rather than vehicle-carrying capacity—of a congested roadway. TDM strategies may include education and outreach programs to inform commuters about alternatives, enhanced transit and rideshare programs, employer-based programs, parking pricing and supply, employer subsidization of transit passes or providing incentives for HOV use, congestion pricing, reducing subsidies for owning and operating automobiles, alternative work schedules, and telecommuting. TDM strategies can take the form of both incentives and disincentives for people to change their commute behavior.

Land Use Planning and Controls—Land use and development patterns influence the transportation system and impact the types of services that may be provided. For example, low density, curvilinear developments are difficult to serve with conventional regular route transit. As a result, the automobile is usually the option for travel in this environment. The design of metropolitan areas, neighborhoods, and individual buildings can discourage or encourage transit use in a number of ways. Policies and techniques in this category may include comprehensive plans, zoning and land use controls, site design requirements, provisions or requirements for transit-oriented development, and joint development projects.

TRAVEL DEMAND MANAGEMENT
<ul style="list-style-type: none"> Trip reduction ordinances Education and outreach programs Enhanced transit and HOV services and facilities Transit pass program Ridesharing services Guaranteed ride home programs Reverse commute services High-occupancy vehicle (HOV) facilities Park-and-ride facilities Innovative services Employer initiatives Employer based programs Transportation management organizations Alternative work arrangements Telecommuting Parking management Congestion pricing Increasing the costs of owning and operating automobiles
LAND USE PLANNING AND CONTROLS
<ul style="list-style-type: none"> Transit-sensitive comprehensive plan and policies Zoning and land use controls <ul style="list-style-type: none"> Transit zoning districts Mixed use zoning Special commercial zones Transition zoning Pedestrian priority zones Incentive zoning Floating zones Planned unit developments Transit easements Land banking Transfer of development rights Site design Transit-oriented development Joint development projects
GROWTH MANAGEMENT
<ul style="list-style-type: none"> Urban growth boundaries Adequate public facilities ordinances Impact fees

Figure 1. Strategies to Encourage Transit Use

Growth Management—Growth management strategies focus on limiting or directing development in certain areas. Growth management strategies attempt to direct new developments to areas with adequate infrastructure and away from environmentally sensitive areas. Growth management recognizes the link between transportation and development. In cases where growth management is used to increase densities, it may be one tool for supporting transit use. Techniques examined in this category include growth management ordinances, urban growth boundaries, adequate public facilities ordinances, and impact fees.

TRAVEL DEMAND MANAGEMENT

Most TDM strategies focus on encouraging the use of high-occupancy commute modes over single occupant vehicles—increasing the person-movement capacity of congested roadways—and on moving travel outside the peak periods or eliminating trips altogether. To date, the majority of TDM strategies have focused on work trips and peak-period commuting. The various techniques summarized in this section include education and outreach programs, enhanced transit and HOV services, employer-based programs, parking pricing and supply, congestion pricing, and increasing the cost of owning and operating an automobile. Each approach is briefly described in this section and examples of current projects are highlighted, as appropriate.

Trip Reduction Ordinances

Some municipalities and counties have enacted ordinances requiring employers, developers, and property owners to participate in transportation management programs. These trip reduction ordinances (TROs) seek to alleviate some of the effects of areawide traffic congestion. About two-thirds of all TROs in existence are in California, and municipalities in at least ten other states have enacted such ordinances (3). Many of the TDM techniques described in this section have been initiated in response to these ordinances.

Trip reduction ordinances act to combat existing congestion or to prevent congestion from occurring. Employers with more than a specific number of employees, usually 50 or 100, and developers of large multi-use complexes may be required to implement programs to encourage the use of transit, ridesharing, and other commute alternatives. Trip reduction ordinances usually specify a target reduction in the number of vehicle trips expected from a development, or a reduction in existing trips established in baseline measurements. An ordinance may vary the required actions based on the number of employees at a site. Because of the potentially greater impact a large worksite can have on traffic congestion, a higher level of participation in trip reduction activities may be required for larger companies. A business with ten or fewer employees, for example, may be required only to post ridesharing and transit information, while the largest worksites might be required to provide an on-site employee transportation coordinator and develop a broad-ranging transportation management plan (4).

Progress toward meeting the goals of transportation management activities established under TROs is generally measured through annual surveys of employee travel modes and patterns. If performance under the TRO has been poor, a program review may be initiated and program revisions may be required. A hearing to review progress may follow a grace period to allow time for implementation of the revised program. Continued noncompliance with ordinance requirements may result in fines for each element of a trip reduction plan not implemented. Further fines may be increased for repeat violations. In some cases, refusal to comply with the procedural aspects of an ordinance may result in misdemeanor convictions. However, most ordinances merely try to ensure that the mitigation activities planned by employers or developers are of sufficient quality to achieve their trip reduction goals. Failure to achieve targeted goals is seldom punished, so long as a "good faith" attempt to comply with the TRO has been made. Under some ordinances, developers may be required to post a performance bond, or provide a letter of credit or place funds in an escrow account to cover costs should a local government find it necessary to take over management of a poorly run trip reduction program (4).

Table 1 provides an overview of characteristics of the trip reduction ordinances in two of the case studies which will be presented in Chapter Three. The ordinances summarized here are from the City of Pleasanton, California and Silver Spring, Montgomery County, Maryland.

Education and Outreach Programs

A key element of any TDM program is an education and outreach effort. Providing information on the alternatives offered, the reasons the programs are being implemented, and the benefits that can be realized by individuals, the business, and the community are often integral components of any TDM strategy. Commuters must be made aware of the alternatives and options available and be encouraged to use them. At a basic level, education and marketing programs disseminate information on available commute options and alternative work arrangements, incentives and disincentives for their use, and how individuals can access these alternatives. More extensive programs may include personalized commute planning assistance, special promotional activities, areawide marketing activities, and other specialized services (5).

Support Option B Program—South Carolina Department of Highways and Public Transportation (SCDHT)—This education and outreach program, which was implemented in 1992 and 1993, focused on increasing the statewide awareness and use of public transportation. The program budget was approximately \$500,000 and was funded by the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), and state revenues. The program included a market research phase and a public awareness campaign. The market research phase included interviews with public officials; surveys of transit users, the general public, and specialized transportation providers; and a statewide telephone survey. The results of these surveys indicated a need to increase the general public's awareness of the availability and benefits of public transportation services in the state.

Table 1. Characteristics of Selected Trip Reduction Ordinances

Trip Reduction Ordinance Characteristics	Pleasanton, California	Silver Spring CBD (Montgomery Co., MD)
Those Affected	New and existing	New and existing in TMD
Impact Fees	Yes	No
Year Approved	1984	1988
Minimum Number of Employees	50	25
Ridesharing & Transit Information Required	Yes (Required for all with at least 10 workers)	Yes
Annual Employee Survey Required	Yes (Required for all employers)	Yes
ETC Required	Yes	No
Approved Trip Reduction Plan Required	Yes	Yes
Preferential Parking for Pool Cars & Vans Required	No	No
Park & Ride Lots Required	No	No
Target for Work Trips	55% of all workers driving alone during a.m. or p.m. peak	New developments: 30% transit use and 1.3 AVO Existing employers: 25% transit use and 1.3 AVO
Years Allowed for Achieving Targets	4	—

An advisory committee, which included representatives from numerous agencies and groups involved in transit, was used to develop a public awareness campaign. The marketing effort focused on four groups—rural workers, commuters in large cities, elderly and disabled individuals, and public officials. Specific messages were targeted toward the needs of each group. Media used in the marketing campaign included radio, television, billboards, newspapers, and signs on buses. In addition, a statewide speaker's bureau was used and informational packages and calendars were distributed. An evaluation of the campaign indicated that it was successful at raising the awareness of residents throughout the state about transit options (6).

Enhanced Transit and HOV Services and Facilities

Alternatives to driving alone must be available for commuters if they are to be expected to change modes. Historically, public transit agencies have focused on providing regular route services oriented primarily toward the downtown or other major activity centers. In response to recent trends—which include increases in the number of workers in this country, increases in suburb-to-suburb travel patterns, and increases in automobile availability—many transit systems have adopted more customer oriented approaches and have implemented a wide range of new services and programs to match changing travel markets. Pass programs, employer-based activities, ridesharing services, guaranteed ride home programs, reverse commute services, HOV facilities, park-and-ride lots, and innovative service strategies represent the most common types of initiatives being implemented by transit agencies. Each of these approaches is summarized next, along with current examples from throughout the country.

Transit Pass Programs

Historically, transit agencies have offered some type of convenient pre-paid fare medium to regular riders. Weekly and monthly passes, tokens, and tickets have been the most commonly used methods. Both transit agencies and riders benefit from these fare payment methods. Benefits to the transit system include receiving fare revenues in advance, realizing savings in fare collection and accounting, and simplifying fare collection for operators. Pre-paid fares are more convenient for riders and may provide cost savings, as many transit systems price these medium at a slight discount. A number of new programs, including the use of transit vouchers and transit checks, have been implemented recently.

U-Pass Program, University of Washington—The U-Pass Program, which was implemented at the University of Washington in 1991, provides a wide range of commute options for the 50,000 students, faculty, and staff at the Seattle campus. Students pay \$20 a quarter and faculty pay \$27 for a sticker which is attached to an individual's University identification card. This sticker allows the individual to use bus services provided by Seattle Metro and Community Transit, free carpool parking spaces, ridematching services, University shuttle bus services, a guaranteed ride home program, and discounts at participating merchants. The program has been very popular and is well utilized. An evaluation of the U-Pass Program indicated that it has reduced the number of single-occupant vehicle trips to the campus by 15 percent and has increased transit ridership and carpooling (7).

Ridesharing Services

Transit agencies or other regional organizations often provide ridematching, carpooling, and vanpooling programs for commuters who do not have access to regular route services or who desire more flexibility in their commute. Ridematching involves the creation of match lists of potential carpool or vanpool members based on their origins, destinations, and schedules. Most rideshare programs use one of a number of commercially available computer software

programs or a specially designed system to provide ridematching services. The available systems all use some type of geographic base to record and track individual origins and destinations and to identify potential carpool matches.

An individual accesses the rideshare system by providing the necessary information over the telephone or by mailing in a ridesharing application. The computer system matches their origin, destination, and travel times with others in the database, and the individual is provided with a match list of possible carpoolers. It is usually left up to the individual to make contact with prospective vanpool or carpool members. When the demand is large enough, vanpools may be formed. A number of approaches are used to organize and operate vanpools. These include owner operated, employer sponsored, and third-party arrangements.

A number of areas have implemented innovative approaches to attract more riders to carpools and vanpools. Most of these focus on enhancing the convenience of ridesharing. However, some programs are attempting to provide more personalized service to help commuters form pools. Many of the approaches being tested focus on providing greater flexibility for those who may not be able to rideshare every day.

Bellevue, Washington—A test in Bellevue, Washington examined the potential for the use of pagers for real-time carpool matching. Participants, who lived in Bellevue, a suburb of Seattle, could either request or respond to a request for a carpool match through the pager. The initial test indicated relatively low response levels, but an expanded effort is planned (8).

Antelope Valley/San Francisco Valley, Burbank, Los Angeles, California—A vanpool initiative launched by Kaufman and Broad, a large single-family home builder in Southern California, offers vanpool transportation to residents of Antelope Valley to their jobs in San Fernando Valley, Burbank, and Los Angeles (8).

Casual Carpooling, Washington D.C. and San Francisco—Casual carpooling is in use in both the Shirley Highway corridor in the northern Virginia/Washington D.C. area and on the Oakland Bay Bridge in the San Francisco area. In both cases, the same phenomenon is occurring; individuals are forming informal instant carpools on a daily basis to take advantage of the travel time savings afforded by the HOV facilities in the corridor. Further, both were started by commuters and continue to operate without any formal planning or sanctions by any agency or organization. In both cases, individuals wanting rides gather at park-and-ride lots and other locations and are picked up by drivers going to the same destination. The vehicle occupancy requirement on the Shirley Highway and the Bay Bridge HOV facilities is three or more individuals (3+), although the Shirley Highway HOV lanes used to have a 4+ occupancy requirement.

Guaranteed Ride Home Programs

Lack of back-up transportation in the case of an emergency at home or the need to stay late at work is often cited as an important reason why many commuters do not use transit or ridesharing (4,5,9,10). The provision of guaranteed ride home services is one approach that has been used in some areas to overcome these concerns. The intent of guaranteed ride home programs is to provide a source of transportation which individuals who use high-occupancy commute alternatives can access if their travel needs change. Guaranteed ride home programs take many forms and may be offered by transit and ridesharing agencies or through employers. Local taxi companies, agency or company vehicles, or personal automobiles may be used to provide the service (4,9,10).

U-Pass Program, University of Washington—The U-Pass Program described previously provides a guaranteed ride home program. Faculty and staff who need to leave due to an emergency may call a taxi and be reimbursed for 90 percent of the fare for up to 80 kilometers (50 miles) of travel per quarter (7).

Reverse Commute Services

Many of the new jobs created in large metropolitan areas are located in suburbs rather than the central city. In many areas, public transportation to suburban industrial and office parks is unavailable or limited. Since transportation is an important link connecting people with jobs and providing access to economic opportunities, low income job seekers who do not own cars may be denied access to employment opportunities in suburban areas. Reverse commute services are being implemented in many areas to address this problem. These services provide transportation to suburban locations for inner city residents through regular route bus service and customized ridesharing arrangements. In some cases, fixed route bus service has been extended to suburban office and industrial parks, while in other areas employer-sponsored shuttle services operate from outlying regional bus and rail stations to office and industrial parks. Still other reverse commute programs provide subscription vans and buses to bring workers to suburban jobs (11).

Southwest Metro, Minneapolis, Minnesota—Southwest Metro provides transit services in three southwestern suburbs of Minneapolis. In addition to operating express service into downtown Minneapolis, Southwest Metro has implemented reverse commute service, providing inner city residents of Minneapolis with access to jobs in suburban areas.

ACCEL Transportation, Chicago, Illinois—ACCEL Transportation provides door-to-door services to inner-city residents to employment sites located in the south and southwest suburbs of Chicago. In 1992, 150 daily riders were using the service (12).

High-Occupancy Vehicle (HOV) Facilities

High-occupancy vehicle facilities, which offer priority treatments to buses, vanpools, and carpools, focus on increasing the person-movement—rather than vehicle-movement—efficiency of a travel corridor. Currently in North America, approximately 50 HOV lanes are in operation on freeways or separate rights-of-way in 22 metropolitan areas. Many more HOV projects are in the planning, design, and construction stages (13).

The primary concept behind HOV facilities is to provide travel time savings and more predictable travel times to buses, carpools, and vanpools. These two benefits serve as incentives for individuals to choose a higher-occupancy mode. Four general categories are usually used to describe HOV facilities. HOV facilities in separate rights-of-way are roadways or lanes developed in a separate right-of-way and designated for the exclusive use of HOVs. Most existing facilities of this type are utilized by buses only. HOV facilities in freeway rights-of-way are physically separated from the general purpose freeway lanes, either by concrete barriers or painted buffers, and used exclusively by HOVs. Concurrent flow lanes are freeway lanes in the same direction of travel as the general-purpose lanes. They are not physically separated from the general-purpose lanes and are usually located on the inside lane or shoulder. Contraflow lanes are typically the innermost lanes in the off-peak direction of travel, designated for exclusive use by HOVs traveling in the peak direction. Plastic posts or pylons separate the lane from the off-peak direction general-purpose travel lanes. Contraflow lanes are usually operated only during the peak periods.

Ottawa, Canada—About 24 kilometers (15 miles) of an exclusive 2-lane, 2-direction transitway system is in operation in Ottawa, Ontario. This is part of a 30.4 kilometer (19-mile), 26-station Phase I system. An additional 30.4 kilometers (19 miles) is planned for the future. About 180 buses, carrying 11,000 passengers, operate on the facility in the peak hour peak-direction (13).

Pittsburgh, Pennsylvania—Two types of HOV lanes currently are found in the Pittsburgh area. Two, 2-lane, bus-only facilities, located in separated rights-of-way, have been in operation since 1977 and 1983. The East Busway is 11.2 kilometers (7 miles) and the South Busway is 6.4 kilometers (4 miles). The opening of both facilities reduced bus travel times from 25 minutes to 10 minutes on some routes. The East Busway currently carries some 6,000 passengers in 103 buses (13).

Los Angeles and Orange County, California—Several HOV lanes are in operation in the Southern California area, and many more are in the planning, design, and implementation stages. The San Bernardino Freeway (I-10) Busway operates from downtown Los Angeles to El Monte. The 2-lane, 2-direction facility is 20.8 kilometers (13 miles) long. Open to buses, vanpools and carpools, the facility is supported by park-and-ride lots and transit centers at strategic locations. Currently, some 1,440 vehicles carrying 7,100 passengers use the facility in the peak direction during the morning peak hour. Other HOV lanes are currently in operation on Route 55, I-405, Route 57, Route

91 and I-5. Although bus service is provided in some corridors, most of these facilities are used by carpools (13).

Park-and-Ride Facilities

Park-and-ride facilities provide a common location for individuals to transfer from a low-occupancy travel mode to a high-occupancy travel mode. In most cases, this means transferring from an automobile to a bus or a rail system. Thus, most park-and-ride lots are oriented toward providing ample parking spaces for automobiles connected with bus or rail stations and frequent transit services. In areas where bus and rail service is not available, park-and-pool lots may be provided to encourage the formation of carpools and vanpools. Further, many park-and-ride lots associated with bus and rail systems allow use of the parking areas for carpool and vanpool formations. Access may also be accomplished by walking or bicycling. Many park-and-ride facilities provide accommodations, such as bicycle storage lockers, for these modes. In addition, some travelers may be dropped off and picked up, rather than leaving their vehicle in the lot all day. Short term waiting areas, called kiss-and-ride facilities, are often provided at lots to accommodate these travelers.

Seattle, Washington—Park-and-ride facilities represent an important element of the overall transportation system in the Seattle metropolitan area and the State of Washington as a whole. Currently, some 96 exclusive park-and-ride lots, providing almost 19,000 parking spaces are in operation in King and Snohomish Counties. Further, approximately 42 leased park-and-ride lots, with some 2,079 spaces, are in operation. Many of these facilities are oriented toward the HOV lane system in the area and support both bus and carpool use. The park-and-ride system has been developed through the cooperative efforts of the Washington State Department of Transportation (WSDOT), Seattle METRO, Community Transit, and local jurisdictions. To the south of Seattle, 19 lots, providing 1,998 parking spaces, are located in the City of Tacoma and Pierce County. WSDOT, Pierce Transit, and local jurisdictions are responsible for these facilities, which are oriented toward the bus system and carpooling. Some 238 park-and-ride facilities are in use throughout the State of Washington, accounting for a total of 28,793 parking spaces. WSDOT is responsible for 121 of these lots, while transit systems operate 26 and other groups have developed 91 facilities (14).

Connecticut—The Connecticut Department of Transportation (ConnDOT), in cooperation with FHWA, local jurisdictions, transit operators, rideshare agencies, and other groups, has developed a statewide system of park-and-ride lots. These facilities are oriented toward encouraging commuters to change from driving alone to carpooling, vanpooling, or taking the bus or train. Currently, approximately 226 lots are in operation. Of these, 95 provide rail or express bus service, while the remainder are oriented toward local bus services, carpools, or vanpools. The facilities range in size from small lots of 10 to 20 parking spaces, to large lots averaging 800 to 1,000 spaces (14).

Innovative Services

Many transit systems are exploring service strategies to meet suburb-to-suburb travel patterns. Rather than providing regular route transit services in these areas, new and innovative service concepts are being explored and implemented. Timed transfer system, suburban circulation services, and point or route deviation represent a few of these approaches. At the same time, some areas are providing extra services to special events. The I-394 timed transfer system described below provides one example of a new service strategy.

I-394 Corridor, Minneapolis—A timed transfer bus system is being implemented in the I-394 corridor as part of an overall system that includes an HOV lane and other supporting facilities. The timed transfer system is oriented to provide transit routes designed to facilitate fast and convenient transferring among different routes. The system focuses on major transit centers and park-and-ride lots in the corridor. Timed transfer networks have been set up so that routes and buses are linked at these major interchange points. Buses on all routes serving the transfer points operate on the same headways or service frequencies. Buses are scheduled to arrive at the interchange point at the same time. Following a layover period that allows passengers to change buses, the vehicles all leave the interchange point at the same time. The advantage of this system is that passengers do not have to go to downtown Minneapolis to transfer, as in a radial system, and riders can reach many more destinations quicker and more conveniently.

Employer Programs

Many transit and rideshare agencies have developed extensive employer based marketing programs. The focus of these efforts is on providing a wide range of services to major employers in the area. Employer outreach and assistance services usually focus on large businesses, companies, institutions, and governmental agencies. Services provided by transit agencies may include assistance to encourage greater use of carpooling, vanpooling, and transit by conducting surveys, creating match lists, and providing vanpool start-up information, specialized travel option itemizing, and discounted transit passes. In addition, assistance is often provided to employers who have recently relocated. Employer assistance programs have become even more important to help employers meet some of the requirements of the Clean Air Act Amendments of 1990.

Employer Initiatives

Employers in many areas have taken an increased interest in the promotion of transit and ridesharing. This may be due in part to a number of factors, including the requirements of the Clean Air Act Amendments of 1990, the Energy Policy Act of 1992, as well as a recognition of the benefits of ridesharing and transit. These benefits may include financial savings as a result of reduced parking demand and increased working productivity and morale. Employers offering transportation alternatives may also receive public recognition for their involvement and their concern with quality of life in the area. Employer involvement in offering commute

alternatives may include carpool and vanpool programs, transit subsidies, Guaranteed Ride Home programs, allowing alternative work schedules, and membership in transportation management organizations (TMOs) to coordinate services and address transportation issues on a wider geographic scale.

Recent federal legislation has provided employers and employees with greater financial incentives to use public transit. The *Transit Commuter Benefit* provision in the Energy Policy Act of 1992 allows companies to provide employees with a transportation benefit of up to \$60 per month tax free. Thus, employees using public transit or qualifying vanpools to commute to work are entitled to receive up to \$60 per month tax free from their employer. This benefit is deductible as an ordinary business expense by the employer. Before this legislation, the benefit offered to employees could not exceed \$21, and, if it did, the entire amount was considered taxable income to the employee. Today, an employee is liable for income tax only if the benefit exceeds \$60.

Private employers, non-profit organizations, and public agencies can provide the benefit to employees, tax-free, while federal government employees and members of the military are also eligible to receive the transit commuter benefit. In addition, qualified transit parking, described as parking at a location from which the employee commutes to work by carpool, vanpool, or public transit vehicle, is eligible for up to \$155 in tax-free monthly benefits. The pre-payment fare mediums described previously—monthly passes, tickets, tokens, vouchers, and transit checks—are commonly used to provide this benefit.

In addition to subsidizing transit passes, some large companies offer their own carpool and vanpool programs. For example, 3M in St. Paul, Minnesota, is well known for its extensive vanpool program. Other companies may provide on-site rideshare coordinators and matching services. Some businesses have also implemented their own Guaranteed Ride Home Programs. Preferential parking for HOVs has been used by some companies to encourage greater use of carpooling and vanpooling.

Finally, some businesses have offered travel allowance and other incentives for HOV use. For example, employers may provide a travel allowance to employees to help support any mode of travel. Employees who choose to walk, bicycle, carpool, vanpool, or take the bus may be able to keep any unused dollars. In other cases, incentives, such as extra vacation time, prizes, or bonuses, may be given to employees who use HOV modes.

Transportation Management Organizations

As transportation and environmental issues have become more important to employers, many have begun to organize public/private associations to promote the use of public transit, decrease traffic congestion, and improve air quality. Increased concern with these issues in the public and private sector has served as the impetus for the creation of transportation management organizations (TMOs) or transportation management associations (TMAs). These are voluntary,

nonprofit, membership associations which involve representatives from both the private and the public sector.

Representatives from major employers and developers, local communities, state departments of transportation, and transit authorities typically comprise TMOs. The purpose of these organizations is to work together to address community transportation issues and concerns. In addition to planning on a general scale, TMOs may help facilitate the implementation of ridesharing and transit services to private employment sites and serve as a forum for public/private discussions on local transportation improvements. TMOs are typically located in rapidly expanding metropolitan areas where traffic congestion and air quality improvement are major issues. The typical activities a TMO might perform are outlined in Figure 2.

Alternative Work Arrangements

The use of alternative work schedules can be viewed as a travel demand management tool by spreading the time people start and stop work, and thus spreading the demand on the transportation system. These strategies can help to ease congestion without requiring large investments in additional transportation facilities. In several studies, employers have found that implementing alternative work schedules resulted in increased productivity and provided a major benefit to employees (4). The three most common alternative work strategies include compressed work weeks, flextime, and staggered hours.

The compressed work week arrangement usually consists of a four day work week composed of ten hour days. This schedule allows participating employees to complete the normal 40 hour work week while eliminating one day of work—and thus commuting—entirely. There are also variations on this schedule, including the maxiflex arrangement, which allows employees one extra day off every two weeks, and an arrangement with nine hour days incorporated into nine work days during a two week period. In addition to reducing vehicle miles of travel each week, compressed work weeks spread the normal peak commute times out due to the ten hour work day.

Flextime allows individual employees to choose their own work schedules within certain guidelines. For example, a company may allow employees to start work anytime between 7 a.m. and 9 A.M., as long as they put in a complete eight hour day. In most cases, employees are allowed to vary their arrival times from day to day. The core times when all employees must be at the worksite allows the opportunity for meetings, group activities, and makes employees available for peak client times.

Results of recent studies on flextime scheduling have been mixed concerning its impact on the promotion of transit. Evidence has shown that flextime may promote transit use where good service before peak travel periods already exists, but where this is not available, flextime may actually discourage transit use (4). Benefits of flextime include reductions in absenteeism, tardiness, and employee turnover, in addition to increases in productivity.

<p>Offer a forum for public-private consultation on:</p> <ul style="list-style-type: none"> • Transportation infrastructure funding priorities • Transit service improvements • Minimizing disruptions from road repairs • Traffic engineering improvements
<p>Represent and advocate the needs and interests of TMO members before public agencies, legislative bodies, and the transportation planning process by:</p> <ul style="list-style-type: none"> • Monitoring traffic conditions and recommending appropriate transportation improvements • Conducting employee travel surveys, assessing commuter travel needs, and recommending appropriate changes in transit service • Monitoring development and employment trends and assessing their impact on future transportation needs • Advising on new locations and alignments for transportation facilities
<p>Build a local constituency for better transportation and raise funds for local transportation improvements</p>
<p>Promote, coordinate, and support transportation demand management strategies to reduce peak-hour demand on transportation facilities and help TMO members comply with local traffic reduction requirements (trip-reduction ordinances, parking codes, conditions of development, etc.):</p> <ul style="list-style-type: none"> • Ridesharing (carpooling, vanpooling, public transit) • Variable work hours to spread peak-hour traffic • Parking management • Market research, promotion, and evaluation • Guaranteed Ride Home program
<p>Facilitate commuting and provide internal circulation within the area through:</p> <ul style="list-style-type: none"> • Daytime circulators • Subscription vans/buses • Short-term car rentals • Shuttles to transit stations and fringe parking lots • Emergency rides for employees who rideshare • Reverse commute services for employees
<p>Provide specialized membership services to TMO members:</p> <ul style="list-style-type: none"> • Conduct employee “travel audits” and provide relocation assistance to new employees • Train employee transportation coordinators • Manage shared tenant services, such as day-care centers, security, sanitation, and landscaping

Figure 2. Typical Activities of a Transportation Management Organization

Source: (15).

Staggered hour work schedules allow employees to select their own work schedules within pre-set limits. In contrast to flextime, work schedules remain the same once selected. Thus, some employees may work 8:00 A.M. to 5:00 P.M. schedules while others work from 7:30 A.M. to 4:30 P.M.

Telecommuting is increasingly being utilized as an alternative work strategy which allows employees to work at home one or more days a week. In most cases, employees are connected to the office by computer, modem, and/or fax machine. This allows them to communicate, and send and receive work during the day. Employers may also allow employees to simply take work home which does not require the use of a computer. There are several different forms of telecommuting, including work-at-home arrangements, satellite work centers, and neighborhood work centers. One employer usually operates satellite centers while multiple employers have neighborhood centers.

The obvious benefit of telecommuting is that it eliminates or shortens the home-to-work trips for participating employees. This helps mitigate congestion on the roads and allows employees to save substantially on transportation costs. Additionally, employees enjoy personal advantages from working at home at their own pace. Studies on telecommuting have demonstrated decreases in employee work trip rates for those employees participating in such a program (16). However, studies have not been able to determine telecommuting's effect on mode choice.

Although telecommuting has been shown to reduce home-to-work trips, the effect on non-work trips may not be as positive. Telecommuters may make other trips during the day as a result of having a more flexible schedule. In addition, errands which were previously done by foot from the worksite may require automobile travel from home. Telecommuting may also encourage employees to move further from the worksite than they would without the telecommuting option. This may actually result in more travel miles per week if a telecommuter comes into the office several days during the week. Other potential areas of concern with telecommuting arrangements include loss of social contacts for employees, supervision of telecommuters, job performance measurements, tax and liability implications, and issues concerning organized labor. All of these factors need to be considered before a telecommuting arrangement is implemented.

Parking Management

Numerous studies have verified that the availability, cost, and accessibility of parking has an influence on mode choice (17,18,19). If convenient, and reasonably priced parking is available, an individual is more likely to drive. If parking is expensive or located far from an employee's work site, transit and ridesharing may be more attractive. Further, many employees receive subsidized parking, and thus do not have to pay the true cost of parking. Recognition of the important role parking plays in determining travel behavior has led to the use of parking management strategies as one of the tools to encourage and support transit, ridesharing, and other alternatives to single-occupant vehicle use.

Parking management encompasses a variety of techniques to influence mode choice. Parking supply and location programs may include favoring short-term over all-day parking; strictly enforcing municipal parking regulations; providing fringe and transportation corridor parking to facilitate transfers to transit and other high-occupancy vehicles; and limiting the available parking supply to carpools and vanpools, while providing only off-site parking for drive alone commuters. Strategies to regulate the price of parking include the elimination of subsidies and the institution of parking charges. Transportation allowances which can be used to pay parking charges, or can be cashed out each month if the commuter utilizes alternative transportation, provide additional financial incentive.

Both the public and private sector may realize benefits from managing parking through limiting its availability and through pricing strategies. For municipalities, limiting the amount of parking can contribute to more efficient use of space, since parking takes up valuable land that could be used for housing, employment, and tax revenue generation. Limiting or reducing parking can also enhance the aesthetics of an area by providing more opportunities for open space and landscaping. Cities can also profit from reduced traffic and roadway maintenance costs, since more parking generates more traffic, which requires more road space. This, in turn, increases the cost of maintaining and providing roads. Finally, parking pricing can lead to greater equity; where there is a charge for parking, the user pays a portion of the cost of providing the parking, just as the transit user has to pay for part of the transit cost.

For the private sector, cost savings per parking space eliminated have been estimated to range anywhere from \$1,000 to more than \$15,000, depending on the type of parking facility and land costs (20). Savings may be realized by not building, maintaining, or leasing parking. Space saved through parking management strategies may allow growing businesses to avoid site expansion and or relocation. Thus, the private sector can also benefit from reducing parking, especially when parking management is implemented in conjunction with transit and ridesharing incentives or pedestrian amenities.

Parking management has been called the single most effective employer-based strategy for achieving increased transit and carpool use (19). To understand how managing parking pricing and supply can have such an effect on mode choice, one must first realize the extent to which parking is subsidized. Employers may subsidize employee parking at a rate of up to \$155 per month, free of federal taxes. Thus, if the employer pays for parking, it is a tax-exempt fringe benefit, if it is paid for by the worker, there is no exemption. As noted previously, until late 1992, the transit subsidy that an employer could provide to workers tax free was \$21. A recent study in the Los Angeles area found that employer-paid parking stimulated a 33 percent increase in vehicle miles traveled to work annually per employee. The study also reported that 41 percent of the employees who drove alone did so only because they did not have to pay to park (18).

A number of parking pricing strategies can be used, including instituting parking charges, removing or reducing employer subsidies, eliminating discounts for long-term commuter parking, and reducing charges for carpools and vanpools. Studies indicate that increasing an

already high parking charge will have more effect than increasing a relatively low price by the same percentage (5). The imposition of charges where parking had previously been free or the reduction or removal of the employer subsidy may also impact drive alone rates and transit use. The degree to which pricing strategies influence mode choice also depends on the availability and attractiveness of travel and parking alternatives.

The effectiveness of parking pricing programs depends on both the availability of transit and other alternative commute modes and the availability of alternative, uncontrolled parking areas. Uncontrolled parking areas include on-street parking in neighborhoods, vacant lots, and other areas. If adequate unregulated parking is readily available, drive alone commuters will often park in such areas, rather than paying the increased prices at their former facility or changing to an HOV mode. In addition, parking pricing strategies should be implemented only when efficient, reliable transit services or well-organized carpool and vanpool programs are available. Increasing parking rates or eliminating employer subsidies without offering some reasonable alternative to commuters will not provide the desired results.

Strategies to manage parking focus on controlling the supply and location. Preferential parking spaces—either close to the main entrance or in garages—are provided for carpools and vanpools. Rather than having a parking space waiting for them at their destination, solo drivers are forced to think about the potential inconvenience associated with their mode choice. As a result, driving alone may not be an automatic option and commuters may change to other modes. However, strategies to induce mode change through limiting parking supply must be introduced only when alternatives to the automobile are convenient, secure, and reliable.

Congestion Pricing

The concept of charging travellers to use congested roadways during peak hours is intended to discourage drivers from using roadways and creating congested situations. It is expected that such charges would discourage drive alone commuting and encourage commuters to use transit, ridesharing, or to switch to off-peak travel. Economic theory holds that the general welfare of all drivers would be greater if traffic could be limited to a level at which average total costs equaled average total benefits, which could be achieved by charging each driver a toll for using the road during peak hours (21). Economists further argue that this charge should be set to bring the total cost to the individual entering a congested roadway up to the average total costs that person is imposing on others (21).

Some transportation economists advocate congestion pricing not to reduce traffic congestion to the lowest possible levels, but to more efficiently use society's economic resources, including both the capital invested in roads and the time motorists spend commuting. Economists hold that these resources would be used more efficiently if more travel could be shifted from peak to nonpeak hours (21). In addition to shifting some trips to nonpeak hours, congestion pricing would provide a monetary incentive for those commuters who must travel during peak hours to rideshare or use transit. It would also provide a new revenue source for local, state, and federal governments.

The two main arguments against congestion pricing are that it is unequitable and inefficient. The equity argument holds that congestion pricing permits those with high incomes to travel at the most convenient times, while those with lower incomes cannot afford peak-hour tolls. One remedy suggested to combat the regressive nature of congestion pricing strategies is to re-distribute the funds collected to low-income households or to provide them with a voucher for use of the system. Another strategy suggested to address the equity issue is to spend the funds collected on improving roads and public transportation systems.

Criticisms as to the inefficiency of congestion pricing schemes arise from questions regarding the actual collection and enforcement of tolls. However, with the advent of new technologies such as automatic vehicle identification (AVI), long lines at toll booths would not be necessary. In an AVI system, electronic transponders are placed on each vehicle and electronic sensors are located in or along the roadway. Computers register vehicles as they pass the sensors, charges are calculated, and bills are sent to vehicle owners.

One such system has already been successfully demonstrated in Hong Kong. Also part of this demonstration was a method for tracking drivers who used priced roadways during peak hours without paying. Closed circuit television cameras photographed the rear license plates of such vehicles. The photos were then transmitted to the system's control center, along with data on where and when the violation occurred. The Hong Kong demonstration which lasted eight months, illustrated that congestion pricing could be successfully implemented, with toll collection and enforcement using existing technologies.

Increasing the Costs of Owning and Using Automobiles

The current widespread use of the automobile is the result of economic forces and governmental policies that have created an atmosphere extremely supportive of the automobile and less supportive of other forms of transportation. These forces serve to partially mask the true cost of driving. Government programs such as the interstate roadway system, low-interest housing loans, and low gasoline taxes have created a physical and philosophical environment where the automobile has become the most convenient choice for transportation. Ultimately, these policies make driving seem less expensive than it really is and encourage the excessive use of automobiles. According to the U.S. Department of Transportation, roadway user charges, taxes, and fees combined cover only 60 percent of government expenditures for roadway construction, maintenance, and administration. General government revenues finance the remaining 40 percent and represent a direct subsidy to auto use, which amounted to \$31 billion in 1990 (22).

Driving costs can be categorized as either direct costs or indirect costs. Direct costs are actually reflected in economic transactions, such as purchasing a car, buying fuel, constructing and repairing roads, paying for parking, or purchasing automobile insurance. These are the direct, ordinary, expected costs of owning and operating an automobile. In contrast, indirect costs are not reflected in market transactions. These hidden expenses include the costs for addressing air pollution problems and other external lists.

Some states and municipalities throughout the country are beginning to charge, or propose charging, taxes on fuel and vehicle emissions in order to close the gap between infrastructure costs and direct user fees, such as registration fees and auto sales taxes. For example, in Florida, all towns and counties have the authority to implement their own motor fuel taxes on top of the state tax. Other states have proposed so-called “smog taxes” which would require drivers to pay a fee based on emissions and odometer readings at the time of routine inspections. The revenues from such fees would go toward alternative modes of transportation (23).

Additional strategies to increase the cost of automobile use and to help defray the cost to the government and society include increasing the actual amount paid for a vehicle and increasing operating licenses and fees. Increasing the sales tax on gasoline is another alternative. Compared to other countries, the sales tax on gasoline in this country is very low.

LAND USE PLANNING AND CONTROLS

Land use planning and related activities can be used to support transit use. Coordination between the land use planning and development process and public transportation can occur at many different points. These may include the development of a comprehensive plan, the zoning ordinance, and during the site plan review process. Strategies that can be used in comprehensive plans and land use controls to encourage development patterns and levels that support transit use include:

- Requirements for consistency between transportation capacity and land use plans and zoning.
- Site design requirements for clustering of buildings to make walking, bicycling, and other commute alternatives more feasible and attractive.
- Subdivision and site plan requirements for bicycle lanes, pedestrian pathways, transit turnouts and shelters, and preferential parking areas for carpools and vanpools
- Requirements for the provision of on-site services, for example, convenience stores in housing developments or restaurants, banking facilities, and child care facilities in office parks.
- Adequate public facilities provisions requiring compliance with minimum performance and level of service standards.
- Conditional zoning—setting a range of permitted uses and densities, but allowing more intense uses if impacts are fully mitigated or sufficient points are earned for additional publicly desired uses, services, and amenities.
- Density increases or bonuses in areas well served by transit or as incentives for developer provision of transit and ridesharing (24).

This section discusses techniques to encourage transit use through the application of land use planning and controls including comprehensive plans and policies, zoning and other land use controls, site design, transit-oriented development, and joint development.

Transit-Sensitive Comprehensive Plan and Policies

The strongest tool a municipality possesses for encouraging transit sensitive development is its comprehensive plan. A comprehensive plan provides a statement of municipal policy and an expression of community intentions and aspirations. The functions performed by a comprehensive plan fall into three principal categories:

- The plan is an expression of what a community wants—a statement of goals, a listing of objectives, and a vision of what it might be.
- Once prepared, the plan serves as a guide to decision-making, providing the means for guiding and influencing the many public and private decisions that create the future city.
- The comprehensive plan may represent the fulfillment of a legal requirement, as in a state with some form of growth management legislation.

Given that transit is most effective where there are high levels of activity, parking is limited, and access to the transit system is good, the municipality responsible for formulating land use policies, plans, and controls can have an enormous impact on the quality of transit service. Municipalities which realize the link between transportation and land use patterns, and which choose to reinforce those links, may benefit from a more efficient transportation network. The major factor which a community should consider in creating a land use plan supportive of transit are population densities, the location of activity centers, site design criteria, and parking policies.

Zoning which allows for higher densities and a mix of land uses—residential, retail, and office development—encourages people to walk or use transit for the shorter trips necessary to accomplish their errands. Transit-sensitive plans containing growth management elements promote higher densities by requiring development of the existing urban area before extending infrastructure and services into the surrounding region.

Further, a comprehensive plan can require that major activity centers, such as large office parks, medical facilities, universities, or regional shopping malls, be located in areas that are well served by transit. The zoning ordinance can then be used to focus desired development in transit corridors or nodes. Supported by the guidelines established in the comprehensive plan, zoning can foster a transit-friendly mix of uses around activity centers. In addition, the comprehensive plan can establish the community's vision regarding the enhancement of transit services and the mix of land uses at existing activity centers.

Site design criteria which encourage transit use can be incorporated into a comprehensive plan. Possible site design criteria include locating buildings so that they are oriented toward transit, with entrances and walkways very near the street, rather than being surrounded by parking. Transit-sensitive site design may also call for the provision of minimal parking on-site to discourage auto use. Distances from transit stops and between buildings should be easily walkable, with well-drained, lighted walkways provided.

Zoning and Land Use Controls

Once the overall goals and policies have been established in the comprehensive plan, land use policies that promote transit-friendly development can be implemented through the zoning ordinances and other land use controls. The tools discussed in this section include transit zoning districts, mixed use zoning, special commercial zones, transition zones, pedestrian priority zones, incentive zones, floating zones, transit easements, land banking, and transfer of development rights.

Transit Zoning Districts—Transit zoning districts are typically used in areas immediately adjacent to high capacity transit centers. This type of district permits higher residential and office densities in close proximity to a transit stop. Mixed land uses are encouraged through incentive zoning and other re-zoning techniques near the transit facilities. A major objective of this approach is to design for a high residential population and supporting land uses within walking distance of the transit facility. Residential and other land uses within the district may be interconnected with a comprehensive pedestrian circulation system. Land uses that encourage automobile use are prohibited. Parking is limited and may be traded-in by the developer in exchange for greater allowable densities. Site design reviews are essential when considering these types of districts to ensure the overall quality and benefits are achieved.

The city of Gresham, Oregon has the most established system of transit zoning districts with three located adjacent to the area's light rail facilities. Each development is approximately ten to eleven acres in size. The primary land uses within the districts are high-density residential and office development. Residential densities within these districts may be as high as 75 dwelling units per acre if the developer provides direct pedestrian access to the transit station. However, the average residential densities are much lower, ranging from 24 to 45 dwelling units per acre (25).

Mixed Use Zoning—Allowing for dissimilar but compatible land uses through mixed use zoning creates more diverse developments than the traditional single use zoning. In single use zones, activities are typically concentrated in peak periods. In contrast, activities occur over extended periods in developments with diverse land uses, promoting greater transit use. Further, mixed use zoning encourages not only transit use, but also bicycling and walking.

Special Commercial Zones—These districts or zones are designed to encourage pedestrian access to commercial land uses from transit facilities by controlling the types of land uses allowed in the area. The zones are specially designed commercial centers typically located in downtown areas or an area adjacent to transit facilities. Single-occupant vehicles are strongly discouraged and carpooling is encouraged through the implementation of strict parking regulations. The city of Portland, Oregon has established special commercial zones in coordination with its transit system.

Transition Zoning—Transition zones are used by municipalities to buffer section types of developments from adjacent land uses near transit facilities. High density land uses may be encouraged around transit stations or stops to generate the high ridership levels. Conflicts may arise, however, with nearby lower density neighborhoods. Transition zoning provides an area of medium density between the high- and low-density developments. The zone provides a gradual change between development densities and protects the quality of low-density single-family neighborhoods from high density developments adjacent to transit stations.

Pedestrian Priority Zones—A pedestrian priority zone is an area that establishes a network of pathways and pedestrian spaces that connect private and public spaces. In this zone, building atriums, lobbies, plazas, and open spaces are linked into a unifying system to increase access to the transit system. Pedestrians are thus given priority in these areas. Emphasis is on creating spaces and environments that are aesthetically pleasing, safe, and that provide a human scale of activities. A pedestrian priority zone is usually delineated by the distance a person is able to walk in five minutes, which is the assumed convenient maximum travel time for pedestrians.

Incentive Zoning—Incentive, or bonus, zoning includes provisions that allow builders to acquire expanded development rights. Upon meeting certain defined criteria, the developer must provide some public benefit as part of the project in exchange for increased densities, building heights, or floor area ratio bonuses. An increase in the density of a development can help support transit use in the area. In return, the municipality may require improvements from the developer to enhance transit use. For example, the developer may be asked to provide pedestrian amenities or to provide a direct link into a transit station or stop.

Floating Zones—A floating zone allows for certain uses, but is not fixed to any geographic location in the municipality. Floating zones are commonly used to establish planned unit developments (PUDs). Municipalities can use this zoning tool to encourage transit friendly developments. In exchange for approval of floating zones, transit related amenities may be required, such as bus shelters, walkways to transit facilities, or bus pull-outs.

Planned Unit Developments—Development plans are usually reviewed and approved on a lot-by-lot or subdivision basis. Planned unit developments (PUDs) were created to allow for large tracks of land or entire developments to be approved at one time, with the intent of fostering better community design. In exchange, the developer of a PUD is required to dedicate various public amenities. A local government intent on promoting transit may require land to be dedicated for transit facilities as part of the PUD approval process.

Transit Easements—By definition, an easement is a right given by the legal owner of a property to another party, typically a governmental agency or public utility, to use the

land for a particular purpose. The designated portion of land granted can be used only for that specific purpose. Easements designated for transit use can be used to reserve land for transit amenities at future bus stops or for other improvements. This approach has been used with the LRT system in Portland, Oregon (25). Developers might also use transit easements as leverage or as a trade-in for increasing the allowable densities of a site.

Land Banking—Land banking is a land use planning tool to shape and control the development of communities through the public acquisition of land for eventual use by the government or for resale to the private sector. Property held in land banks most often includes undeveloped or under-used public land and tax-delinquent properties.

The government can influence both the character and the timing of growth by deciding when to sell land banked property and by placing restrictions upon future development of the property. Land banking could be used to hold land for future transit facilities.

By imposing restrictions on the property sold from a land bank, the municipality can affect the density and quantity of growth and major types of development. In addition, use restrictions can limit the development options of a particular site or assure that new development has the attributes or quality level desired by the community. For example, a community which desires higher densities in order to increase transit efficiency can use land banking to create infill housing and to establish mixed-use developments.

In certain states, enabling legislation may be required in order to initiate a land banking program. Land banking has been applied successfully in several cities including St. Louis, Missouri and Cleveland, Ohio in the United States, and Edmonton, Alberta and Saskatoon, Saskatchewan in Canada.

Transfer of Development Rights—The concept behind this approach is that ownership of land gives the owner several rights, each of which may be separated from the rights associated with the rest of the property and transferred to someone else. The right to develop the property is one of these separable rights, and, under a transfer of development rights program, an owner can sell or transfer the right to develop his property to another person for use on a different parcel of land. The selling property is referred to as the donor site, and the purchaser's property is called the receiver site.

Property owners sell their development rights because they either do not want to develop them or because they are prohibited by some land use regulation. Transfer of development rights may serve as a means of preserving agricultural land, open space, historic landmarks, and ecologically sensitive areas. It may also be used to help direct growth in desired directions. For example, a local government may wish to safeguard land for agricultural uses or preserve an historically significant property, and prohibit development of these sites under its police powers. Thus, the owner is denied full use of the property. A transfer of development rights program offers the property owner fair

compensation; the property owner's loss under the land use regulation is offset by the ability to sell or trade the development right.

Site Design

Site design strategies can be used to encourage and support transit and other alternative means of transportation by making developments more attractive, safe, and convenient for transit users. This can be accomplished by providing adequate lighting, seating, and sidewalks, and by ensuring that the circulation pattern on a site is well defined and convenient for all users. Efforts to coordinate larger site design concepts, such as proximity and orientation toward transit, can also help to make public transportation an attractive alternative to the automobile.

A number of site design elements can be used by the public and private sectors to support and encourage transit use. These include the orientation of buildings, the location and the amount of parking, and the provision of on-site transit facilities such as stops, shelters, information kiosks and ticket outlets. In addition, the design of a site's pedestrian and vehicular circulation system can be used. Additional site design considerations are provided in the second report prepared as part of this research study, *Design Guidelines to Enhance Pedestrian and Transit Interaction (2)*.

Transit-Oriented Development

Many communities are increasingly looking to maximize existing services and facilities in the face of continued urban expansion and increasing demands for new facilities and services. Development that is oriented towards mass transit and emphasizes alternatives to the automobile, such as bicycling, walking, or transit, allows people of all ages and incomes to access jobs, public services, and shopping centers. The concept of transit-oriented development (TOD), represents an approach being used in some areas to encourage these types of land use patterns. TODs focus on creating mixed-use urban environments along transit lines that are easily accessible to pedestrians. The Laguna West development in Sacramento, California represents the first use of this concept.

In contrast to the traditional pattern of suburban development, a TOD is compact, higher in density, and contains mixed land uses within close proximity. The internal environment of a TOD is pedestrian-oriented and de-emphasizes the automobile. Walking is encouraged by visually appealing tree-lined streets and easy access to neighboring land uses and transit stations. Public transportation is viewed as an integral element of the development, providing access and mobility to open spaces, retail centers, diverse residential styles, and office buildings.

A TOD can be created in an existing urban environment as infill development to maximize existing public facilities and reduce the consumption of non-urbanized areas, or it can be designed along a planned transit line extension in an undeveloped area. Regionally, TODs can be designed to satisfy a wide variety of conditions. Three types of TODs have been identified that serve distinctly different purposes and land uses: urban, neighborhood, and

secondary. Each is oriented toward existing or planned transit lines, and each TOD contains a commercial or “urban core” directly adjacent to the transit facilities to enhance the convenience of utilizing transit (26). Figures 3 and 4 provide examples of TODs.

Joint Development Projects

Due to limitations in traditional funding sources, many public transit agencies continue to explore alternative financing techniques for both capital and operating needs. One such technique is joint development. This concept focuses on developing public transit facilities in conjunction with the private sector. Joint development became more prevalent in the early 1970s with the development of new rapid transit systems in several U.S. cities. Based on the concept of value capture, the theory that the public sector is entitled to share in the economic benefits resulting from a public investment, transit-related joint development has the potential to provide benefits for both public transit systems and the private sector (27). These benefits may include increased revenues to the transit system through lease or rental payments, reduced costs for property, increased ridership levels, promotion of economic development or redevelopment, encouragement of transit compatible land use, and support for local and regional policies.

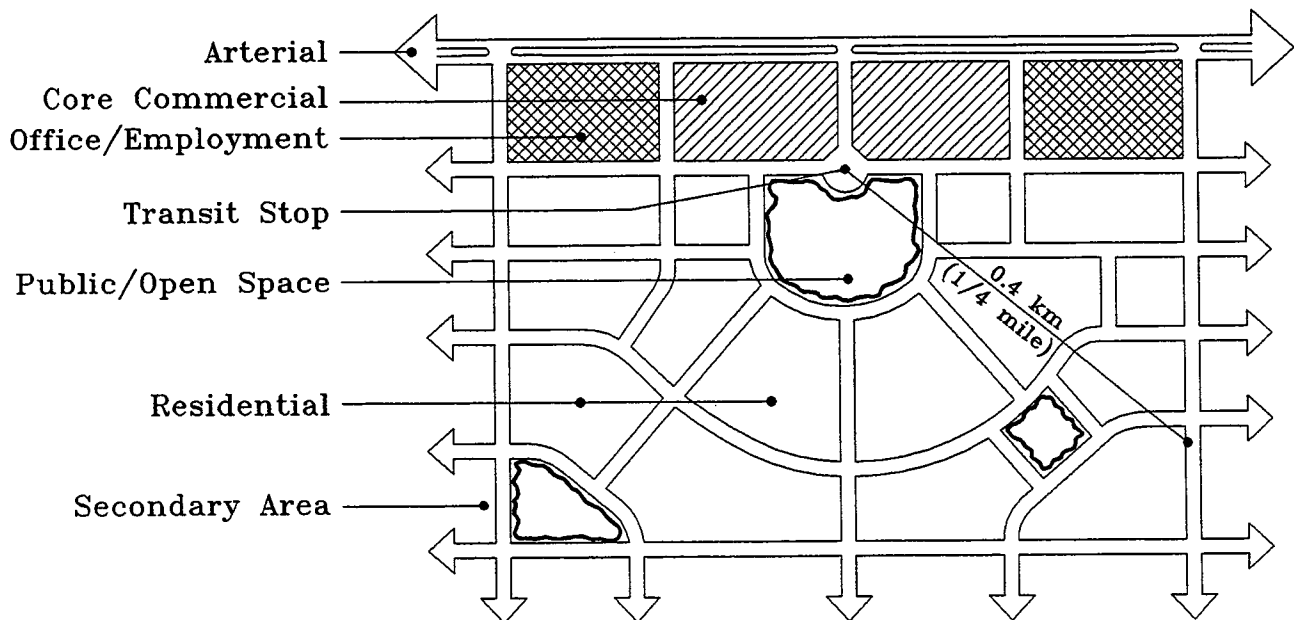


Figure 3. Typical Transit-Oriented Development

Source: (26).

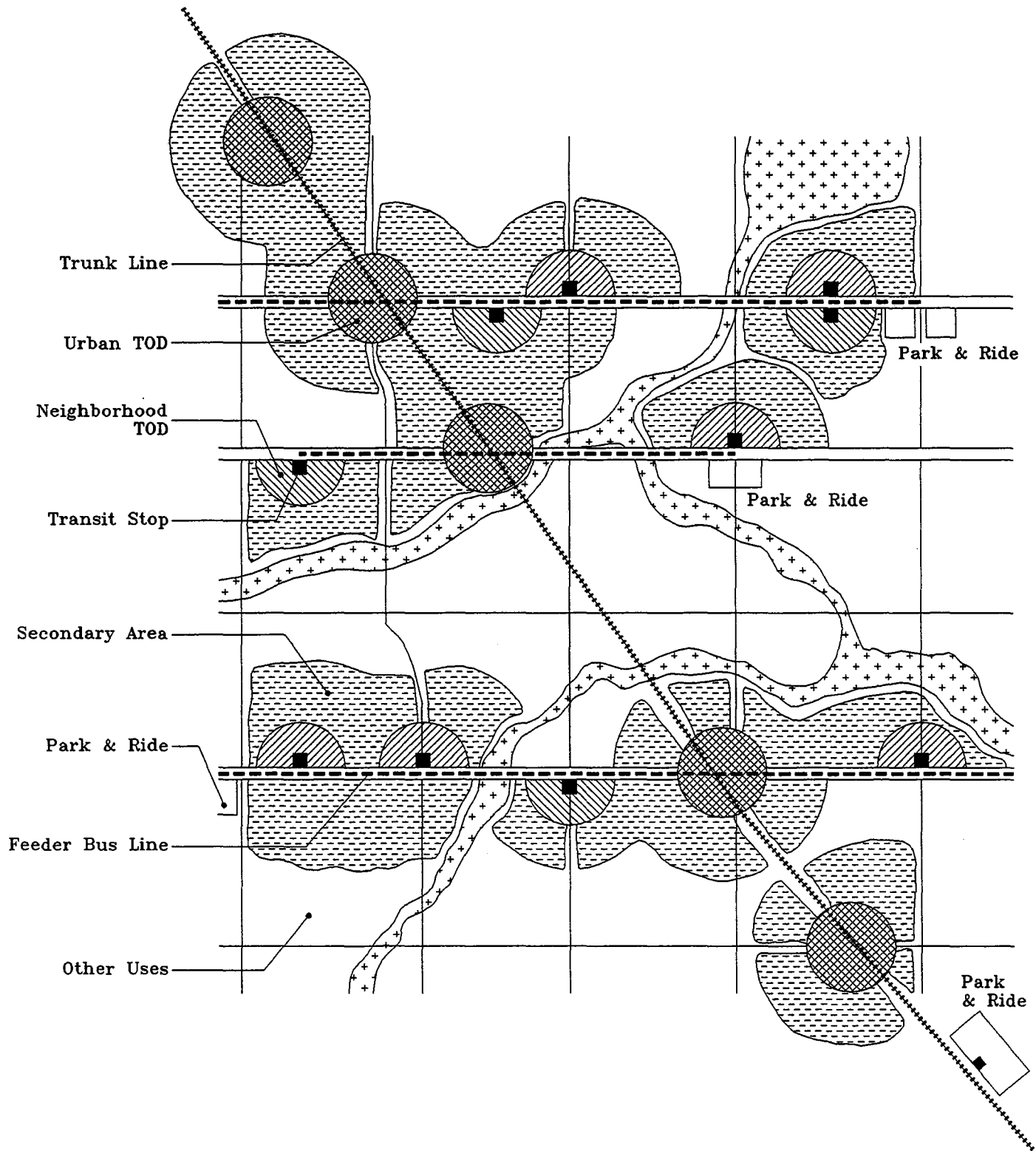


Figure 4. TODs in Conceptual Urban Setting

Source: (26).

Transit systems have two characteristics that create opportunities for value capture. First, transit stations are often located in areas with relatively high real estate values, and second, the construction of those stations typically requires the acquisition of excess property. Under these conditions, transit agencies may seek ways to use their excess real estate holdings to enhance ridership and to generate revenue by leasing the right to develop to private groups. As the name implies, joint development provides for the joint use or improvement of property. Transit facilities have been constructed on land owned by private developers, and private businesses have utilized property and facilities leased from public transit agencies.

There are four commonly used strategies for joint development. The first involves leasing development rights, where surplus transit agency land is leased to the private sector for an extended period. The second strategy is to lease facilities, similar to leasing development rights. Cost sharing, the third strategy, is a voluntary process in which multiple parties determine how the costs of a particular project are to be divided among the beneficiaries. Finally, negotiated land leases involve a voluntary, mutually beneficial arrangement between a transit agency and a public or private land owner (28).

Two recent examples of joint development projects are the San Francisco Bay Area's transit-based housing and the Santa Clara, California trandominium project. Projects such as these help reduce roadway congestion and increase ridership on the region's rail systems. In the Bay Area, there have been eleven multifamily developments built during the past five years within a one-quarter mile radius of rail stations. About 70 percent of the projects are strictly residential, but the remainder include residential units above or adjacent to retail or commercial space (29).

The Santa Clara County Transit District is pursuing a project to build trandominiums, a combination of transit and condominium development. The concept calls for medium- to high-rise units, buffered by surrounding lower-rise townhomes, built in the air rights above park-and-ride lots serving light rail and commuter rail lines. The ground level of these developments would be reserved for parking; the second floor might include convenience stores, and the upper stories would be housing. The projects are being bid competitively on a long-term lease basis. The project seeks to address Santa Clara County's severe housing shortage, as well as traffic congestion and air quality issues in the region (30).

Joint development, and specifically transit-based housing, is emerging as an important notion for supporting transit use. It offers promise for building significantly more housing in areas served by transit, without overcrowding established neighborhoods. It also has the potential to help reduce roadway congestion and increase ridership on under-utilized transit systems. A 1991 University of California at Berkeley National Transit Access Center survey of residents of four transit-based housing developments near Bay Area Rapid Transit (BART) stations found that the residents' rate of transit ridership was significantly higher than that of the general public. Among all East San Francisco Bay residents, approximately eight percent use BART regularly for their commute, while transit ridership for transit-based housing residents averaged over 35 percent.

GROWTH MANAGEMENT

The concept of growth management resulted from concerns in areas experiencing rapid growth, as well as those on the fringes of such areas. Growth management focuses on controlling the pattern, type, intensity, location, and timing of development. Growth management policies can impact transit use by encouraging more compact urban development patterns, helping to alleviate urban sprawl and its subsequent long distance commutes and increased dependence on the automobile.

Growth management policies can be pursued at the state, regional, or local level. A number of states, including Washington, Oregon, Colorado, California, Florida, Maryland, and New Jersey, have enacted state-wide growth management legislation. Tools for implementing growth management strategies include mandatory comprehensive plans, local capital facilities plans, adequate public facilities ordinances, impact fees, establishment of urban growth boundaries, trip reduction ordinances, and criteria for jobs/housing balance. Historically, many regulations at the local level have included restrictions, or caps, on yearly housing permits in an attempt to control population growth, regardless of the adequacy of the transportation system or transit service.

The most powerful tool for controlling land use at the local level is the comprehensive plan and the capital facilities plan. Most states implementing growth management strategies require consistency between the transportation and land use elements in the comprehensive plan. Internal consistency within the plans can be accomplished by identifying the effect of future growth to established level-of-service standards for current or planned transportation facilities and transit services.

Level-of-service standards (LOS) are criteria used to determine the adequacy of the current transportation system and to predict the capacity of future transportation systems that are impacted by new growth. If the transportation system is not able to handle the anticipated loss, the developer must be allowed to build or there may be requirements to provide some of the needed infrastructure.

For example, Florida's concurrency policy states that an adequate level-of-service must be in place at the time of the development, or growth will not be allowed. Any growth that causes the system to drop below the minimum defined adequate LOS will not be allowed, and mitigating actions may be required, such as the implementation of impact fees, exactions, travel demand measures, or increased transit services. In Florida, it is essential within the comprehensive plan that the land use element encourages growth that is consistent with existing public facilities and service.

Another strategy for controlling growth and encouraging transit utilization is linking the development approval process to the capital facilities plan. A capital facilities plan is an inventory of existing public facilities and a forecast of future needs along with a financing and expenditure plan to fund these needs. Under growth management legislation, projects that

exceed the level of available funding, or are not included in plans, cannot be approved until funding has been acquired or arranged.

Urban Growth Boundaries

In response to the pressures of increasing development, some states have established legislation requiring communities to establish urban growth boundaries (UGB). Urban growth boundaries allow communities to direct growth to areas having adequate public facilities and services. UGBs can establish limits to sprawl and can encourage more compact development patterns that are conducive to transit operations. The limits of a UGB are typically established to accommodate 20 to 25 years of growth within an urbanized area. Land uses outside of the defined limits of the UGB are designated for rural uses or resource preservation.

Oregon and Washington are two states that allow communities to develop well-defined urban growth boundaries and to strengthen the linkage between land use and transit through state mandated legislation. Oregon's 1973 Senate Bill 100 gave communities the power to delineate boundaries to urban growth and to define urban and rural land uses. The Washington State Growth Management Act of 1990 provides municipalities with the initiative to create UGBs. Counties in Florida, without the backing of state legislation, have begun enacting urban service areas. For example, Dade County, one of Florida's largest counties, has established level of service standards for urban and rural roads to encourage infill development and higher densities within a defined urban service area. Thus, the communities in these states are attempting to direct development to specific areas which can accommodate new growth.

Adequate Public Facilities Ordinances

Adequate public facilities ordinances are growth management tools that allow new development to occur only where infrastructure and public services are adequate to support them. This approach may encourage more compact urban forms. This concept is also referred to as concurrency. Adequate public facilities ordinances are commonly enacted in areas undergoing rapid growth or by municipalities on the fringe of high growth areas, in an effort to control and direct development. These ordinances usually apply to roads, transit, water and sewer service, and schools.

Adequate public facilities ordinances vary greatly from one municipality to another in terms of level of specificity, rigor, and equity. Generally, under an adequate public facility ordinance, developments that will result in unacceptable level of service conditions on nearby roads and intersections are not allowed. The development must either be postponed until improvements have been made to the transportation infrastructure, or solutions must be found to address the issues. In some cases, developers may be able to negotiate transportation management agreements in order to facilitate project development. The actions that may be required of developers under negotiated agreements include financing private transit services and vanpool programs, providing transit subsidies to employees, and providing on-site employee transportation coordinators and ridematching assistance.

Thus, adequate public facilities ordinances pertaining to roadways can encourage transit use in one of two ways. First, they can promote more compact development patterns, resulting in densities necessary for an efficient transit system. Second, they can require developers to undertake TDM activities in order to proceed with a project.

Impact Fees

Under a system of impact fees, a municipality charges developers for having to extend infrastructure and public services to outlying areas. Impact fees are generally implemented in areas of high growth or where municipalities have limited budgets for improvements. Impact fees are designed to make developers pay a fair share of the costs generated by new development. Impact fees can only be used for mitigating the effects of the specific development from which the fee is collected. Funds from impact fees cannot be used to correct an existing problem. Impact fees can be used to direct development to desired areas, thus supporting public transit services.

CHAPTER THREE

CASE STUDIES

More detailed information was examined on four metropolitan areas throughout the country that have implemented policies and programs to encourage and enhance transit use. This chapter profiles the experiences of the four case studies—Portland, Oregon; Montgomery County, Maryland; Boulder, Colorado; and Pleasanton, California. The studies were selected to provide a mix of approaches and techniques, institutional arrangements, and geographic locations. Further, an attempt was made to focus on applications that may be appropriate for additional consideration in Texas.

Table 2 identifies the general approaches used in the four case studies. For each case study, a general background is provided first, highlighting the issues encountered and the approaches utilized. The specific strategies utilized to encourage greater use of transit are described next, along with the experience to date with these techniques. Finally, future activities are summarized. A description of the institutional arrangements for each case study is also included.

Table 2. Policies and Programs to Support Transit Use in the Case Studies

Case Study	General Policies and Programs
Portland, Oregon	Improved Transit Service and Facilities Light Rail Transit Improved Pedestrian Environment Land Use Planning and Controls Parking Management Growth Management
Montgomery County, Maryland	Adequate Public Facilities Ordinance Transit Improvements Transportation Management Districts
Boulder, Colorado	Education and Outreach Programs Enhanced Transit Services Parking Management Downtown TDM Program Monitoring Program
Pleasanton, California	Transportation Systems Management Ordinance

PORTLAND, OREGON

Background

Portland's strategies for promoting transit use include growth management, land use planning and control, and demand management. State law requires Portland to create urban growth boundaries and to otherwise comply with the state's growth management legislation. Portland has also implemented an LRT system, and the city regulates parking supply in the downtown to stimulate transit use. Equally important, the city has taken steps to create a physical environment that is attractive and inviting to pedestrians and transit riders.

In the 1960s and early 1970s, Portland's downtown went through a decline similar to that experienced in many other American cities. The privately owned bus system went out of business, the downtown was nearly deserted after 5:00 P.M. each day, and stores were closing or moving out to the suburbs. At one point during the early 1970s, there were more parking lots in downtown Portland than buildings. In addition, the region's air quality was extremely poor, failing to meet federal standards one day out of every three.

Improved Transit Service and Facilities

In the early 1970s, policymakers, planners, and city residents began to examine potential steps to reinforce the local economy. City leaders decided to turn from an auto-oriented downtown to one focusing on pedestrians and transit. In 1972, a downtown plan was adopted which included innovative transportation initiatives. The city concentrated on creating a more efficient transit system, regulating parking, and enhancing pedestrian amenities. A bus mall through the commercial and retail core of downtown, which was completed in 1977, represented a major part of the plan. In addition to strengthening its transit service, Portland placed a cap on the number of parking spaces in the downtown area, and required that new buildings include street level retail activities which would attract pedestrians. Another aspect of the downtown's orientation to transit was the creation of Fareless Square, an area within which unlimited free travel is allowed on transit. As a result of these improvements, the downtown's share of the regional retail market grew from 7 percent to nearly 30 percent in just over ten years. In less than a decade, the transit mall encouraged the development of almost five million square feet of public and private projects.

Further opportunities for redevelopment of the downtown area were provided in 1975 when an existing expressway along the Willamette River was demolished. This opened the area for new developments, which have included shops, restaurants, a hotel, a condominium complex, a park, and a marina. Also in 1975, the concept of transitways, or LRT as alternatives to freeways, began to be discussed in the Portland area. Two planned freeway projects were withdrawn, leaving nearly \$500 million in federal funds that could be allocated to local transit and highway improvements. In 1976, regional priority was given to a transit alternative to serve the rapidly growing corridor east of downtown Portland to Gresham.

LRT was the locally preferred alternative from the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS), which represented the first joint highway and transit undertaking of its kind in the nation. The construction of the LRT system also represented the joint efforts of the Oregon Department of Transportation (ODOT), and the Tri-County Metropolitan Transportation District of Oregon (Tri-Met). ODOT was responsible for eight kilometers (five miles) of freeway relocation and rehabilitation, bridge rebuilding to accommodate light rail, and the construction of several light rail structures. Tri-Met was the lead agency for overall project management, planning, scheduling, budget administration, and construction of the 24.2 kilometer (15.1 mile) LRT system.

A number of important factors have been identified in the decision to build an LRT system in Portland. From a transit-operations perspective, the projected reductions in operating costs, increased ridership and improved safety, speed, and reliability were all important. Further, the LRT alternative had the least impact on housing and business relocations, and it had the highest level of public support. For the city, LRT was consistent with plans to reduce air and noise pollution and traffic congestion downtown. It also offered the greatest opportunity to focus and enhance adopted development and redevelopment plans. The LRT alternative was consistent with the city's transportation plan, which called for diverting regional auto and transit trips from inner-city arterials to regional facilities. The proposed rail alignment was consistent with the land use policies and plans of Multnomah County and offered environmental advantages (31).

The Tri-Met Metropolitan Area Express (MAX) light rail system began operation on September 8, 1986. Over the first eight months, MAX ridership averaged 19,700 per day on weekdays, with weekend ridership often exceeding 25,000 per day. A patronage profile published in 1990 assessed ridership, trip purpose, access modes, fare information, demographics, and station information compiled since MAX began operation. The profile found that weekday ridership had remained fairly constant since the 1986 opening, at about 20,000 passengers. This study also reported that home-based work trips accounted for 53 percent of all weekday MAX trips, the same percentage as on the bus. Two-thirds of all trips on the MAX system began or ended in downtown Portland. Approximately 38 percent of all MAX trips included a walk at both ends; about 30 percent involved park-and-ride lots; and about 30 percent involved a bus transfer (32).

The Transit Station Area Planning program (TSAP) was originally organized in three phases to be conducted by the participating local jurisdictions—Gresham, Portland, and Multnomah County. Phase I formulated goals and policies, compiled and analyzed data, and evaluated alternative station locations. Phase II concentrated on developing concept plans for each station area, which included consideration of land use, urban design, circulation, pedestrian access, and other factors. Phase III was intended to prepare detailed development plans for each station area and LRT segment, along with implementation and finance strategies. Due to lack of funding, the final phase was never totally completed, although plans for some station areas were drafted.

The TSAP concentrated on planning for the areas within a radius of 0.4 kilometers (one-quarter mile) or less of each transit station. Portland, Gresham, and the county had the flexibility to establish boundaries for areas within their jurisdictions and to develop individual approaches to station area planning.

Parking Policies

The City of Portland has limited the number of parking spaces allowed downtown in order to limit driving and encourage transit use. This approach has focused on limiting parking for commuter trips; hotel and residential parking is not counted in the controlled supply. Portland's parking code sets a maximum number of parking spaces allowed depending on the proximity of the building to available transit services, with no minimum except for residential uses. Requirements in most areas are one space per 328 square meters (1,000 square feet) of development, but may be as low as 0.7 spaces per 328 square meters (1,000 square feet). This contrasts with the traditional practice of allowing anywhere from three to five spaces per 328 square meters (1,000 square feet) for office and retail uses. Parking is approved by conditional use permit only. The city manages several residential permit programs in neighborhoods adjacent to the CBD. In addition, carpools receive preferential parking in public garages and at on-street meters (17).

The parking policies have generally been attributed to helping maintain high transit usage. As noted previously, approximately 48 percent of commuters into the downtown use transit on a regular basis. Tri-Met has estimated that without the parking measures, transit, and pedestrian improvements initiated in the 1970s, nine 42-story parking structures would be needed downtown.

Land Use Planning and Controls

An important component of the LRT system was the \$1.2 million Transit Station Area Planning Program (TSAP). The goal of this program was to maximize the land use and development benefits of the LRT system by evaluating the market potential of sites along the line and then planning and rezoning for higher densities around appropriate transit stops. The station-area planning efforts were supported by the regional planning activities and were conducted to ensure a balance of all transportation improvements in the region.

Growth Management

The Portland metropolitan area is expected to grow dramatically in the next two decades, and although the region is well equipped to deal with the challenges of growth, with an organized growth management system and strong transportation-land use linkages, there are still many growth-related problems on the horizon. As required by the state's growth management legislation, the Portland area has a growth boundary which encompasses 579 square kilometers (362 square miles). The city encourages building inside the boundary, where much open land remains. Outside the boundary, development is discouraged, with policies that refuse to allow

certain road improvements or sewer service. However, the region's basic pattern of development has not changed; residential, retail, and employment continue to develop mainly in separate zones. Consequently, people have been driving more. Despite advances in the transit system, total miles driven in the Portland area increased by 55 percent during the 1980s (33).

Institutional Arrangements

One of the most important aspects of the transit-supportive strategies undertaken in Portland relates to the interaction of the region's many decision-making institutions. The City of Portland laid the groundwork with the adoption of a downtown plan that contained a transit and pedestrian focus. The city was responsible for land use planning and design around the light rail transit system, including the Transit Station Area Plans. In addition, the City of Portland instituted and manages the parking program in the downtown area.

At a regional level, Multnomah County was involved in the initial decision to build the LRT system and participated in the TSAP. The Tri-County Metropolitan Transportation District of Oregon (Tri-Met) is the transit operator for the region and is responsible for the LRT and bus system. Tri-Met was also involved in the TSAP. The Metropolitan Service District (Metro) is the directly elected regional government and is responsible for transportation and land use planning. Metro is also involved in the evaluation of the TSAP process. Finally, the neighboring city of Gresham participated in planning for the LRT and in station area planning.

At the state level, the Oregon Department of Transportation participated in planning and constructing the LRT system. The State of Oregon enacted and oversees the growth management legislation which helped shape the region physically.

Future Activities

In addition to the requirements of Oregon's statewide growth management law, the Metropolitan Service District (Metro) addresses growth and quality of life issues by bringing urban and suburban interests together. Metro is the directly elected regional government that serves over one million residents in Clackamas, Multnomah, and Washington counties, including the 24 cities in the region. Its responsibilities include transportation and land-use planning, solid waste management, operating the zoo, and providing technical services to the region's local governments.

Metro is undertaking a long-range planning program, *Region 2040*, in order to determine the broad policy decisions that must be made regarding future regional growth. Elements being assessed to help develop a growth concept for the region include air quality, transportation, land use, housing, employment, open space, public services, water supply, and necessary government regulations. Three concepts of growth have been developed for consideration by the public. These include satellite communities outside the existing urban growth boundary, the concept of

expanding the current boundary, and a concept emphasizing more compact development and increased reliance on walking, bicycling, and transit.

The Portland Planning Bureau is also confronting the challenges of accommodating growth without sacrificing quality of life. Strategies suggested to address the issue of growth, land use, and transportation include the following:

- increasing the supply of low-rise housing in the downtown area
- creating compact urban villages around transit stations
- increasing residential and commercial uses along neighborhood “main streets”
- increasing density and housing supply without disturbing rural land through infill development in existing residential neighborhoods
- creating more compact neighborhood development on unused tracts of urban land, such as abandoned commercial properties

These and other potential solutions are being discussed by Metro, the City Planning Bureau, and others interested in maintaining the region’s quality of life. This includes examining ways to organize development more densely along the current and future MAX routes.

MONTGOMERY COUNTY, MARYLAND

Background

Montgomery County, Maryland is a rapidly growing suburb in the Washington, D.C. area. The county has used growth management, an adequate public facilities ordinance including negotiated traffic mitigation requirements, and transportation management districts to address traffic congestion issues and to encourage greater use of HOVs. Counties in Maryland are authorized to carry out planning and zoning functions and tend to have well-developed transportation planning programs. The ability to plan at the county level affords the opportunity to address transportation issues on a broader, regional scale. Many counties in Maryland face the pressure of high levels of growth, and resulting congestion, due to proximity to the nation's capital.

A program in the late 1970s and early 1980s to create a more efficient transit system did not result in the hoped for decrease in traffic congestion. As a result, the county realized that it was not enough to provide good transit service; it must be marketed and other incentives and disincentives provided to encourage changes in residents' travel behavior. Montgomery County's original strategy for preventing increased congestion included creation of a General Plan concentrating development to prevent sprawl and provide efficient use of the transportation system. The General Plan provided for corridors of higher-density development and wedges of less-intense development between corridors to prevent sprawl. In addition, the county was divided into subareas, called Planning Policy Areas, and a master plan prepared for each. These master plans established zoning in accord with the General Plan to control density and specified the transportation infrastructure needed to prevent excessive congestion.

Adequate Public Facilities Ordinance

Montgomery County's adequate public facilities ordinance was enacted in 1973 as part of the county's strategy to deal with congestion. The ordinance allowed the planning board to delay new subdivision approval until the necessary transportation infrastructure was available. This means that the planning board can withhold subdivision approval if existing roads, new roads, and transit scheduled to be completed in the capital improvements program will not satisfactorily handle the additional traffic from the proposed subdivision, along with traffic from existing and previously approved development. In the late 1970s, a recession drastically curtailed all types of development in the county, and many planned road improvements were postponed, even though the development that depended on the roads had already been approved. It was expected that the recovery from the recession would take place gradually, allowing ample time to reprogram essential road construction projects to meet the demands for development. A dramatic increase in residential and commercial construction occurred in a period of less than two years, however, providing no time for the planned roadway expansion (34). As a result, Montgomery County faced the congestion it had hoped to forestall with its carefully crafted strategy.

By 1983, congestion levels in Montgomery County had become severe and public polls indicated that it was the most important issue for residents. In order to address the problem of congestion spawned by rapid growth, the county modified the adequate public facilities ordinance and capital improvements process and set about creating policies and programs that would encourage transit and HOV use. The county placed a moratorium on new development because the road system was not able to meet current and projected demands.

Montgomery County's adequate public facilities ordinance requires planning officials to examine the adequacy of transportation facilities and services before approving new developments. If a proposed development will result in unacceptable level of service (LOS) conditions on nearby roads and intersections, public or private solutions must be found to either increase capacity or to reduce vehicle trips. The county's LOS for the roadway system is determined by such factors as the availability of transit, high-occupancy vehicle lanes, and pedestrian and bicycle paths. In recent years, the county planning board has encouraged developers to finance private transit and rideshare programs and to provide other assistance to commuters. In many cases, developers must also contribute on-site improvements and, in some districts of the county, pay transportation impact fees (4).

The adequate public facility ordinance also empowers county planners to negotiate special agreements with developers. These agreements specify a calculated, vehicular trip reduction target intended to maintain an acceptable level of service—after accounting for the planned improvements—on roads and intersections near a new development. The county planning board can then negotiate with developers for trip reduction programs that will maintain the traffic levels anticipated from proposed commercial and residential projects at reasonable levels. The programs and services offered may include rideshare matching, financial incentives for vanpools and transit, assistance in setting up vanpools and subscription buses, preferential parking, employer relocation assistance, and transit information. Roadway and intersection improvements may also be negotiated.

When denied a permit because of traffic problems, a developer may reapply for approval after the county provides the necessary improvements. In order to speed up the approval process, developers may agree to pay for and construct certain road improvements or implement traffic mitigation programs to reduce the peak-hour congestion. County planners have negotiated for progressively more stringent and more comprehensive traffic mitigation programs as experience with these programs has increased. Recent developer agreements have included subsidized vanpools, discounted transit fares, free shuttles to Metrorail, and construction of bus shelters and park-and-ride lots (4).

These developer negotiated programs are required to reduce the number of peak-hour vehicle trips by a designated amount, using transportation management techniques. Such programs must be implemented over a specified time period, usually 10 years. Deadlines for implementing certain measures and achieving trip reduction goals are set high enough so that after the new development is fully occupied, congestion on affected roads is no worse than before. Monthly tallies and annual performance reports by the developer must be submitted to

the county. If a program does not perform as expected and no means can be found of strengthening the program so that trip reduction goals are met, the developer is either prevented from building or occupying his project or forfeits a substantial performance bond. A performance bond or letter of credit equal to the cost of operating the program over a ten-year period ensures that the county can take over the program if private sector performance proves inadequate. When such a takeover occurs, the county attempts to use the forfeited money to more effectively operate the program (4).

Transit Improvements

During the recession in the late 1970s, county officials concentrated the limited resources available for construction of capital facilities and purchases of capital equipment on transit. The extension of Metrorail service into the county proceeded on schedule, and the county made a commitment to establish Ride-On, its own bus service. It was anticipated that the benefits of fast, efficient Metrorail service in conjunction with new, modern bus service from neighborhoods to the rail stations would be obvious to residents and ridership would increase. Ridership levels were not high enough to make a difference in traffic congestion. As a result, approaches to marketing the new services and the use of commuting patterns were planned.

Improvements to the adequate public facilities ordinance and the capital improvements program in the 1980s were designed to prevent problems in the future. In order to address the congested conditions existing at that time, the county not only expedited the completion of roads, but sought to dramatically increase the use of alternative transportation modes. Although the county had invested in its own bus system and ensured the extension of Metrorail into the county, it had failed to make sure that people used the system in sufficient numbers to reduce congestion. County leaders decided to commit the resources needed to develop incentives to increase ridership in alternative transportation and disincentives to auto use. Thus, Montgomery County began a vigorous campaign to promote transit and HOV use (34).

The county began to provide park-and-ride lots and free fifteen-minute interval bus service from these lots to the metrorail station or to business districts. At one lot, ridership increased from 18 people a day to more than 1,000 per day in only two years. In order to relieve congestion on I-270, the county's most congested roadway, free bus service from two major housing developments was initiated. The buses run to the Metro station at 15-minute intervals and travel on dedicated shoulder bus-only lanes, bypassing the congestion and decreasing travel time by an average of ten minutes (34).

The Maryland-National Capital Parks Planning Commission (M-NCPPC) initiated the county's Share-A-Ride program during the oil crisis of 1979-1980. The program utilized direct marketing to large employers, as well as personalized staff involvement in seeking successful ridesharing matches. Staff members made regular personal contacts with employer transportation coordinators to help promote the program among workers. After the success of a county-run program in Silver Spring, Maryland, the M-NCPPC began negotiating agreements

with some developers and employers to develop similar programs for the purposes of traffic mitigation (4).

In high-growth areas of the county where it is difficult to make the necessary road improvements, an effort to establish TMOs is underway. Much of the private sector interest in TMOs is from developers who cannot get their projects approved unless the traffic situation is improved. In addition, the county has begun to establish Transportation Management Districts, with the support of interested private-sector developers.

Transportation Management Districts

The Silver Spring Transportation Management District was established as part of Montgomery County's plan to revitalize the Silver Spring central business district, an employment center located just outside Washington D.C.'s northern boundary, with over five million square feet of office space. Several development proposals spurred interest in revitalizing the area, including a large shopping mall and the move of the National Oceanic and Atmospheric Administration (NOAA) to a site adjacent to the Silver Spring Metrorail station. With over 28,000 daily passengers in 1987, the Silver Spring station was the busiest Metrorail station outside of downtown Washington, D.C. The station's frequent Metrorail service, its importance as an interim terminal for bus riders transferring to rail, and its connections to MARC commuter trains helped to make the station area attractive for development (4).

Any development in the area had to be in accordance with the public facility ordinance, however. In order to permit development to proceed, a traffic mitigation strategy had to be devised. Since opportunities for roadway expansion in the Silver Spring CBD were severely limited, the county established a transportation management district (TMD) through a special ordinance in November 1987 and put in place a program to reduce the vehicle trips generated by new and existing developments. The county hired an executive director and five other staff members to coordinate the TMD's traffic mitigation programs. An advisory board of employers and retailers, workers, and residents of adjacent neighborhoods was created to oversee the district's programs (4).

Participation in the TMD program was made mandatory for all businesses with 25 or more employees, and for all new developments. All participants are required to develop and submit a transportation management plan. Strategies may include providing transit subsidies to employees, facilitating employee ridesharing, providing parking incentives for carpoolers, instituting a guaranteed ride home program, and introducing flexible working arrangements. Each development and each affected employer is required to have a transportation coordinator who serves as a liaison with the county staff. To monitor the overall success of the program, the county conducts an annual commuter survey.

The Silver Spring TMD ordinance applies to employers, developers, and building owners. Employers with 25 or more employees must attain a 25 percent mass transit use and an average vehicle occupancy (AVO) of 1.3 percent per vehicle or any combination of modes

that results in at least 46 percent non-drivers during peak periods. New developments must attain 30 percent mass transit use and an AVO rate of 1.3 persons per vehicle, or any combination of modes that results in at least 50 percent non-drivers during peak periods.

In addition, an overall goal was adopted for the Silver Spring TMD of 25 percent transit use and average vehicle occupancy of 1.3, or a 46 percent rate of non-drivers in the peak-periods. Developers must enter into formal traffic mitigation agreements to provide commuter assistance programs as a condition of subdivision approval. Fines are levied against employers and property owners who fail to comply with procedural requirements. Developers can also forfeit performance bonds, escrow accounts, or letters of credit equivalent to the cost of running their programs for ten years if the county must take over the program because of poor program performance.

Other performance objectives of the TMD program address the level of congestion and the volume of traffic within the Silver Spring CBD. These include a requirement that the average level of service for intersections surrounding the CBD must not be worse than LOS D/E, defined by traffic engineers as severely restricted speed and maneuverability. Additionally, the outbound local and through traffic must not exceed the practical cordon capacity of 18,000 vehicles per day.

Parking at public and private facilities is deliberately constrained, and parking in surrounding residential streets is strongly discouraged. A maximum of 17,500 public and private long-term parking spaces will be provided at commercial build-out. Long-term public parking spaces will be priced to reflect the market value of parking in the CBD. With the Silver Spring TMD employee population projected at 42,500, the parking ratio works out to be 2.4 (35). A package of incentives for transit and HOV use has been developed. This includes subsidizing bus, metro, and commuter rail passes, discounts for pool vehicles in county-operated parking facilities, and additional incentives for employers who exceed the targeted goals.

As illustrated in Table 3, the transportation management district has significantly affected the travel behavior of Silver Spring commuters during its six years of operation, especially in terms of average vehicle occupancy. A decline in transit usage probably reflects the effects of discontinuing a county-funded transit fare incentives program. However, the prospects for increasing transit usage and sustaining the high participation rate in alternative transportation are thought to be good because of growing traffic congestion and parking limitations in downtown Silver Spring.

Table 3. Silver Spring Transportation Management District TDM Performance

	1988	1989	1990	1991	1992	1993
Driving Alone (%)	66	60	55.5	55	52	58
AVO	1.08	1.12	1.15	1.17	1.12	1.29
Transit Usage (%)	19	23	25	25	24	20

Source: *The Silver Spring Transportation Management District*. Innovation Briefs, June 1994

Institutional Arrangements

The institutions involved in encouraging transit use in Montgomery County include the county government, the private sector, the Maryland-National Capital Parks Planning Commission, and the Washington Metropolitan Transit Authority (WMTA). Governing at a county level provides the opportunity to address issues with a more regional scope—such as congestion problems and growth management. Thus, the county is able to use a variety of strategies to address problems associated with growth and the attendant transportation issues. Other organizations also played important roles. These include the Planning Commission, which initiated the county's rideshare program, and WMTA, which oversees the Metro system in the greater Washington, D.C. area.

In addition, private sector participation in Montgomery County's strategies to encourage transit use is extremely important. Under the county's adequate public facilities ordinance, negotiated special agreements with developers help to ensure that the transportation impacts of new and expanded developments are mitigated. Through participation in these programs, including sponsoring rideshare programs, subscription buses, and discounted transit fares, the private sector is helping to encourage more people to use transit.

Future Activities

Montgomery County is planning to establish a transportation management district in North Bethesda, a rapidly growing and highly congested employment and retail center. However, employer participation in the North Bethesda Transportation Management District will be voluntary. If the TMD should find that voluntary measures have not been successful in achieving its objectives, it may establish certain mandatory requirements for employers. A proposal to create the North Bethesda Transportation Management District is scheduled to be presented to the County Council later this year.

Three organizational models have been considered for the North Bethesda TMD. These include a county-operated, publicly funded transportation management district, similar to the one

in Silver Spring; a private non-profit corporation; or an urban district corporation. The planning task force has recommended a private non-profit transportation management organization to be funded by grant contribution from the county and private membership fees. An existing transportation management association—the Transportation Action Partnership of North Bethesda and Rockville—could provide the corporate structure for the new program.

The North Bethesda transportation demand management program will also differ from the Silver Spring program in its initial performance objectives. Unlike the Silver Spring program which included measurable, quantifiable objectives, the North Bethesda TMD may have its mission defined in broader terms. These may include promoting the efficient use of transportation resources, widening the range of commute options available for employees, encouraging sound transportation planning, and improving the livability of the community.

BOULDER, COLORADO

Background

The City of Boulder has addressed the issues associated with land use and transportation, and the use of transportation alternatives in a number of ways. Boulder's population is approximately 90,000, including 25,000 students at the University of Colorado. The Boulder Valley is a place of great natural beauty, and its residents are particularly concerned with preserving this environment and the quality of life they enjoy. To limit sprawl, Boulder is surrounded by a city-owned greenbelt and also employs an adequate public facilities ordinance. The city's commitment to transit, bicycling, and walking is evidenced by the existence of *Great Options Boulder (GO Boulder)*, a city department dedicated to promoting transit use, ridesharing, and alternative travel modes, especially bicycling.

As a result of its Transportation Master Plan (TMP), which calls for a 15 percent reduction in SOV use by 2010, Boulder has a vested interest in promoting transit use along with other alternatives to the SOV. In August 1986, the City Council formed an Ad Hoc Transportation Committee to direct the preparation of the TMP. This committee had two specific charges: to develop a series of transportation policies in conjunction with the five year update of the Boulder Valley Comprehensive Plan; and to explore opportunities for increased public participation in the transportation capital improvements process.

The committee identified as community goals the desire to protect and preserve the Boulder Valley's natural environment, as well as the character of the community, coupled with the need for a transportation system that allowed for quick and safe access to all points of the Boulder Valley. Adopted in October 1989, the TMP includes proposals to begin shifting local travel gradually from automobiles to transit and other alternatives in order to help mitigate the deleterious effect excessive automobile use could have on the Valley's environment and character. The TMP's goal is to reduce SOV use to 58 percent by the year 2010.

The Transportation Master Plan includes incentives to encourage this shift through major improvements to the transit, bicycle, and pedestrian systems. The plan provides for a series of check points to determine whether these incentives are helping to achieve the desired shift. If evidence shows that incentives alone are not producing the necessary results, the city will consider a series of disincentives. These include parking restrictions, mandatory no-drive days, and taxing strategies to increase the cost of owning and operating an automobile.

Education and Outreach Programs

As a result of increasing community concern about the transportation impacts of continued growth, especially environmental and quality of life issues and the amount of land being given over to automobiles, the TMP included a recommendation that the city establish and fund an alternative transportation center. *Great Options Boulder (GO Boulder)* was created in October 1989 by the Boulder City Council, as recommended in the TMP. *GO Boulder* is part

of the Transportation Division of the City's Public Works Department and has seven full-time employees, one three-quarter time employee, and many volunteers. The center provides information and programs to encourage transit use, ridesharing, bicycling, walking, telecommuting, and alternative work schedules.

GO Boulder has also implemented programs offering transit passes for University of Colorado students and students at Boulder area high schools. Carpooling and vanpooling programs developed by *GO Boulder* are administered by RideArrangers, a division of the Denver Regional Council of Governments (DRCOG). Guaranteed ride home services are also offered. Other programs and events sponsored by *GO Boulder* to promote transit and other auto alternatives include the following:

BikeWeek - An annual community-wide program to increase awareness of the bicycle as a commuting option.

Find Another Way Day - Held on the third Wednesday of each month, with competition among more than 40 local companies to encourage commute alternatives.

ETC Network - Provides support for 95 area ETCs, who represent over 20,000 employees.

Pedestrian Conference - Annual international forum for the exchange of ideas and information on all forms of alternative transportation.

Bikeway/Pedway Programs and Improvements - Provides benches, shelters, and sidewalks to encourage bicycling and walking. The program includes the following elements.

- The Bicycle Facility Construction project provides bike lanes, routes, and paths to get around the city by bicycle. Businesses are encouraged to provide bicycle parking facilities.
- Bike to Work Tours demonstrate the easiest and safest routes for employees who commute by bicycle.
- Bicycle Pedestrian Safety Education programs educate bicyclists, pedestrians, and motorists on safety issues.

Marketing Program - A community-wide effort to increase awareness of alternative transportation as a commuting option and to motivate people to shift trips from single occupancy vehicles.

Realtor Program - This program will work with realtors to inform new residents of commute options to encourage use of alternative transportation.

GO Boulder staff also assisted the City's Development Inspection Services office in designing a checklist to help address the needs of alternative transportation users in proposed residential developments. This checklist will demonstrate Boulder's concern for creating environments that are conducive to walking, bicycling, or transit use when new developments are designed.

Enhanced Transit Services

Perhaps the most successful program developed by Boulder in support of transit has been the ECO Pass, introduced in 1989 as the Mobility Pass, in coordination with the Denver Regional Transportation District (RTD). The ECO Pass was modeled after the Seattle U-Pass. The 250 employees of Boulder's Central Area General Improvement District (CAGID) businesses that initially participated were provided with free unlimited bus usage on the twelve local Boulder routes. RTD billed CAGID according to the amount of actual use, as indicated by data recorded by bus drivers. The program gradually expanded to include travel on the ten regional bus routes serving Boulder. In September 1991, RTD assumed responsibility for the program and offered an expanded and modified version throughout its service area.

Employers may purchase the ECO Pass—an annual, unlimited use photo ID pass—and provide it to employees as a benefit. The program uses a group insurance concept for pricing and enrollment with graduated rates based on the level of bus service at the business location and the number of employees. The funds the employer expends for this program are fully tax deductible.

Parking Management

Boulder is also encouraging transportation alternatives through parking management. Recognizing that access—not the amount of parking available—is the issue, the City Council passed a moratorium on building more parking in the downtown, with a long term goal to actually reduce the amount of parking in the area. This move has been controversial, with some downtown merchants opposing it due to concerns that it will negatively impact business. Overall, however, the business community is supportive of transportation options because it recognizes the negative effect that traffic can have on further economic growth. The Central Area General Improvement District levies a tax on all businesses in the central city, based on their square footage of office space. This tax is used to provide parking facilities, landscaping, and other improvements in the area.

Downtown Transportation Demand Management Program

Based on its decision to limit parking, city council drew up an implementation plan to provide alternatives to automobile use and to complement the available bus service. Approved in October 1993, the TDM program for downtown Boulder includes an ETC position, expansion of the ECO Pass program, marketing and promotion, carpool and vanpool programs, telecommuting options, child care support services, and improved bicycle parking.

Monitoring Program

GO Boulder measures the effectiveness of its programs and promotions through a home diary survey, carried out every two years. The first diary study was conducted in 1990 to determine Boulder Valley's baseline modal split. The biennial study provides feedback to *GO*

Boulder staff on the effectiveness of the programs aimed at encouraging transportation alternatives. The comparison of modal split for both surveys is shown in Table 4.

A randomly chosen group of Boulder Valley residents records all travel for a specific period, including mode, destination, and reason for travel. The 1990 survey included 1,217 residents and 1,332 residents in the 1992 survey. Following the 1992 survey, the city's Center for Policy and Program Analysis prepared a report comparing the modal split for 1990 and 1992. The survey showed that the percentage of SOV trips in the Boulder Valley decreased by 2.1 percent from 1990 to 1992, from 41.3 percent to 39.2 percent. Bicycle trips increased by 2.9 percent, from 9.6 percent in 1990 to 12.7 percent in 1992.

Other measures of effectiveness include an annual telephone survey of every tenth County employee and "spot" surveys of specific *GO Boulder* programs and promotions, such as the ECO Pass and Bike Week.

Table 4. Boulder Valley Modal Split, 1990 and 1992

Mode	1990	1992	Percent Change
Single Occupant Vehicle	41.3%	39.2%	-2.1%
Multiple Occupant Vehicle	25.8%	25.5%	-0.3%
Bus	1.6%	2.1%	+0.5%
Bicycle	9.6%	12.7%	+2.9%
Foot	19.4%	18.5%	-0.9%
Other ¹	2.1%	1.8%	-0.3%

¹Truck, school bus, or motorcycle

Institutional Arrangements

The City of Boulder has taken a proactive stance to address transportation and growth management issues. As recommended in Boulder's Transportation Master Plan, the city acted to create *GO Boulder*, a special city office to support and promote transportation alternatives. *GO Boulder* works with other city departments, the private sector, the Denver Regional Council of Governments, and the Denver Regional Transportation District (DRTD) to carry out its programs. The Council of Governments administers carpool and vanpool programs that serve the Boulder area, while the RTD provides transit service and administers the ECO Pass program. Boulder's private sector is involved through participation in the ECO Pass and in a variety of other programs. In the central city area, the private sector has organized a Central

Area General Improvement District which cooperates with *GO Boulder* to implement the precursor to the ECO Pass, and also taxes its member businesses to provide parking facilities and other improvements.

Future Activities

A Transit Sketch Plan to prioritize transit improvements is now being developed. The improvements are designed to reduce traffic congestion and air pollution. The Sketch Plan focuses on improvements to the transit system and advocates increased transit service. The plan also calls for providing all 80,000 employees within the city boundaries of Boulder with ECO Passes. Other strategies to increase the daily proportion of transit trips include improving transit access for bicyclists and pedestrians, improving regional transit services, and increasing the level of local transit service to 2.5 times the current level.

A city tax increase may be necessary to fund the improved and increased transit service. The city estimates that about \$5 million would be raised annually through the tax. The RTD is also planning to hold a tax election and Boulder officials are discussing the establishment of a matching fund with the RTD. This fund would encourage other municipalities to provide transit service and would help to extend local transit dollars. According to a public opinion poll, citizens of Boulder favor increasing taxes to support transportation alternatives over an increase to support automobiles alone, or automobiles and alternative transportation. Thus, Boulder's residents are aware of and supportive of transportation alternatives (36).

PLEASANTON, CALIFORNIA

Background

The opening of the Interstate system transformed Pleasanton from a quiet agricultural community to a busy suburb of San Francisco during the 1950s and 1960s. Between 1960 and 1965, the town's population grew from 5,000 to 33,000. In the mid-1970s, Pleasanton implemented policies to slow growth, in response to increased air pollution and other environmental problems. Housing development was restricted and population growth was limited to approximately two percent annually. At the same time, the city also started to pursue commercial development to meet its financial needs. In 1984, Pleasanton, with 38,400 residents, began to experience a dramatic increase in office, commercial, high-technology, and light-industrial development. Housing costs increased rapidly, making it economically infeasible for many workers to live near their jobs (4).

City officials became concerned about the costs associated with improving existing freeway interchanges and building new ones, as well as providing ramps, additional lanes, and access roads. The congestion associated with this increased access was also of concern. In the early 1980s, a proposal to develop one of the most ambitious, large scale business parks in the country spurred the creation of Pleasanton's innovative transportation systems management ordinance. The Hacienda Business Park—a \$1 billion, two phase development—was projected at build out to cover 876 acres, with about 11 million square feet of business space, 36,600 workers, and 800 residents.

In 1983, prior to city approval of the Hacienda project, the city conducted a regional traffic study to determine the effect of the proposed development on the volume of traffic and the patterns of travel in Pleasanton and its three neighboring cities. This analysis, the Tri-Valley Transportation Study, found that the planned development would increase traffic to levels deemed unacceptable by city officials. A major conclusion of the study was that peak hour vehicle trips would have to be reduced by 45 percent in order to keep traffic volumes within reasonable levels. Major arterial and highway improvements were also suggested. The needed improvements were elaborated in other studies, financed by the developers of Hacienda and neighboring projects. These studies affirmed that a program of transportation systems management (TSM), including improved signalization and demand management strategies, would help to achieve the most efficient use of the existing and proposed transportation network (4).

In negotiations with the developers of Hacienda, city officials set two transportation-related conditions for project approval. First, the developers agreed to form and operate a traffic mitigation program and to attach covenants, conditions, and restrictions to tenant leases and buyer contracts to ensure that employers at the business park participated in the program (4). The developers created a TMO, Hacienda Business Park Owner's Association, to implement and enforce the TSM program. Second, the developers of Hacienda and neighboring projects established the North Pleasanton Improvement District (NPID), a special assessment district to contribute to road and traffic signal improvements by issuing tax-exempt bonds. Under the

NPID, existing arterial roadways have been improved and new ones constructed; a major east-west connection through the Hacienda business park also serves the city. Freeway access was improved with two new interchanges constructed and two existing interchanges upgraded (37).

Transportation Systems Management Ordinance

In 1984, a group of Pleasanton residents approached the city council to express concern over the effects of the development of Hacienda Business Park on the predominantly residential community. In response to these concerns, the city council created the Industrial General Plan Review Committee to examine the development's impact on the community as a whole. The Committee recommended that the city adopt a TSM ordinance which would apply to all companies and commercial complexes.

Hacienda's developers supported the proposed ordinance and assisted city staff in setting up meetings for Pleasanton-area employers and business owners to discuss how best to structure such an ordinance. Overall, developers supported the concept because they realized that building permits could be delayed if traffic became a problem. In contrast, many employers initially ignored invitations to attend meetings to learn about the ordinance. When a draft of the ordinance—outlining severe penalties for noncompliance—was made public, employers finally became involved in the process. Several meetings were held with traffic engineers, planners, Hacienda Business Park's transportation manager, and the city attorney explaining why an ordinance was necessary. Information was presented to demonstrate that the ordinance's goal of a 45 percent reduction in peak hour trips was achievable. At these meetings, employers revealed their strong objections to having the city impose mandatory TSM elements, fearing that the prescribed elements might not be feasible or cost-effective.

The business community made a number of suggestions regarding the TSM program and the content of the ordinance. These included developing local transit service, hiring a full-time city transportation coordinator to assist employers in complying with the ordinance requirements, and assigning enforcement responsibilities to a TSM task force with predominantly employer representation. Oversight by a group of peers was preferred to having the city enforce the ordinance. As a result of the collaborative nature of the process, many of the employers' suggestions were incorporated in the ordinance (38).

With the support of residents and the business community, the ordinance establishing Pleasanton's TSM program went into effect in November 1984. Helping with passage of the ordinance were a firm city council commitment to the concept; early backing by important developers; bringing employers and developers together to discuss the ordinance; incorporating the business community's comments into the ordinance; and the willingness of city staff to explain the ordinance to employers on an individual basis when necessary (38).

The ordinance requires both new and existing employers to conduct annual surveys of employee commute modes, work schedule times, and residential location. The ordinance provides for progressive traffic mitigation actions according to the number of employees. Thus,

businesses with ten or more workers must distribute ridesharing and transit information to employees. Employers and office complexes with 50 or more workers are required to develop traffic mitigation programs aimed at changing travel behavior so that no more than 55 percent of all workers drive alone during the morning and evening peak hours of 7:30 to 8:30 A.M. and 4:30 to 5:30 P.M. In addition, companies with more than 100 employees must also appoint a representative to the city's enforcement task force. A city transportation coordinator assists employers and developers in complying with the ordinance. The city can assess fines of \$250 per for noncompliance with procedural requirements (4).

Under the Pleasanton ordinance, the city's transportation coordinator created a checklist of TSM program elements for use by larger employers in devising their trip reduction plans. The following elements are included in the check list to help employers specifically facilitate transit use.

- Coordinating with the local transit provider on stops, schedules, and routes serving the work site.
- Providing transit amenities - bus shelters, benches, and bus turn-outs.
- Selling transit passes on-site, at or below cost.
- Sponsoring buspools or subscription bus service either at cost or subsidized.
- Providing shuttle bus service to transit stops and park-and-ride lots (38).

As an example of the type of trip reduction programs created under Pleasanton's ordinance, Hacienda Business Park offers computerized ridematching for carpools and vanpoolers, as well as shuttle bus service to BART rail stations. In addition, bus shelters, preferential parking for those who rideshare, bicycle lanes, and bicycle racks are provided. In the first year under the ordinance, Hacienda's employers achieved the target goal of a 15 percent reduction in peak-hour vehicle trips (39). A BART station in the business park is expected to open in late 1995, and it is anticipated that daily freeway use will decrease by 16,000 cars.

In 1993, the developers of Hacienda Business Park began renegotiations with Pleasanton officials to amend the original development agreements. A downturn in the region's economy has resulted in a delay in the original development schedule. The requirement that a separate traffic study be completed in order for each new building project to be approved was noted as burdensome by the developers. As a result, the development agreement was amended to eliminate the need for individual traffic studies. The city determined that traffic levels of service upon buildout were acceptable, contingent on anticipated local and regional traffic improvements (37).

Pleasanton's TSM ordinance and the process to develop it, provide examples for other areas. It represents one of the first efforts to successfully overcome many of the problems that have been associated with creating and enforcing such ordinances. From the beginning, the Pleasanton ordinance was a collaborative effort: first initiated at the request of residents, with the strong backing of the development community, and finally with major input from the business sector. Key strengths of Pleasanton's ordinance include the following:

- It reaches all employers, not only new developments.
- It avoids predetermining the effectiveness of given transportation systems management or demand management measures and leaves the choice of how to reach the specified trip reduction goals up to the individual employer.
- It uses annual employee surveys to determine commute mode, which serves as a frequent reminder to solo drivers and provides a good source of detailed planning and performance data.
- It provides for a series of escalating interventions by the enforcement task force and the city, culminating in stiff daily fines in cases where commute trip reduction goals are not met by an employer. This process, together with the common wish of employers and the city to minimize commute traffic problems, is more effective than the usual ordinance penalties (38).

Institutional Arrangements

Pleasanton's TSM program was a the result of a collaborative effort by the City of Pleasanton and the private sector. The city provides staff support, including a full-time city transportation coordinator, while the private sector furnishes oversight and enforcement. This arrangement has lead to a program that is flexible in nature and compatible with the needs of businesses while fulfilling the city's transportation goals.

CHAPTER FOUR

POLICIES AND PROGRAMS SUPPORTING TRANSIT USE IN TEXAS

This chapter examines policies and programs being utilized by public agencies, private businesses, and other groups throughout Texas to promote transit. These strategies are presented following the format used in the previous chapter. The techniques focusing on TDM are presented first, followed by land use planning, and growth management. Fewer examples exist of the latter two techniques in Texas. This chapter also examines the characteristics that may be unique to Texas transit systems.

TRAVEL DEMAND MANAGEMENT

Education and Outreach Programs

TxDOT, numerous transit agencies, and other groups have undertaken education and outreach programs focused on encouraging greater use of HOV modes. For example, TTI, under contract to TxDOT, conducted a study to examine the need for and to facilitate the development of a Statewide Rideshare Support Program (40). Such a program would provide a statewide focus for ridesharing and transit use, assist in promoting the benefits, and enhance the visibility of local transit agencies and rideshare programs.

This study included a set of preliminary ideas for a Texas Rideshare Support Program. The main elements included promotional and educational activities at the state level to increase public awareness of the necessity and benefits of ridesharing and transit use. These efforts could be coupled with TxDOT's continued support of transit and ridesharing through the provision of infrastructure such as HOV facilities, park-and-ride lots, and highway signs.

Specific elements of the rideshare support program included the promotion of a statewide Texas Rideshare Week, production of summary brochures on transit and ridesharing in Texas, establishing a statewide clearinghouse for ridesharing information and technical assistance, an educational outreach program, television and radio advertisements, continued support for HOV facilities and park-and-ride lots, and encouraging state employees to rideshare (40).

Several elements suggested in this program were implemented by TxDOT and other groups. As a result of meetings between staff members from TxDOT, TTI, local rideshare programs and transit agencies, other state agencies, and interested professional organizations, a limited rideshare promotion was conducted in conjunction with national *Try Transit Week* in May 1993. It was agreed that a statewide support effort should build on activities planned at the local level, with TxDOT and other state entities providing support in the form of proclamations, press releases, and other publicity.

Elements of the program included a proclamation from the Governor's office. Other state agencies and interested organizations provided support during the initial statewide promotion. For example, the Texas Air Control Board proclaimed Thursday, May 20, as *Texas Clean Air Day*, and the Texas Chapter of the American Lung Association designated May as *Clean Air Month*. Further, the Texas Land Commissioner issued a proclamation in support of *Try Transit Week*.

In conjunction with the decision to promote *Try Transit Week*, TxDOT requested that TTI produce two brochures relating to transit and ridesharing activities in the state. One brochure provides information on all types of public transit services within the state, while the other focuses on ridesharing programs. The brochures are being distributed by TxDOT, public transit providers, local rideshare programs, and other groups.

The *Public Transportation in Texas* brochure describes the variety of transit options available throughout the state, including MTAs, small city transit operators, rural and non-urban providers, elderly and handicapped services, and ridesharing. Telephone numbers for the various providers are included for those desiring further information about public transportation options in specific areas of the state. A second brochure, *Metropolitan Rideshare Programs in Texas*, contains information on the benefits of ridesharing, the requirements of the 1990 Clean Air Act Amendments, and information on local ridesharing agencies, including the names and telephone numbers of individuals to contact for more information.

Most of the transit systems in the state have some type of marketing and public outreach program. The nature, scope, and focus of these programs varies greatly, however. As could be expected, the more extensive programs are found at the MTAs. Most of the MTAs have fairly extensive marketing resources—both in terms of staff and funding for promotional activities. Many transit systems in smaller communities and rural areas have more limited resources, and, as a result, have little or no outreach and information programs.

Transit Pass Programs

Many of the transit systems in Texas offer prepayment options, such as monthly passes for regular transit riders. A number of different approaches and pricing scenarios are used. In some cases, the passes are priced at a discount to encourage use. Some programs are available to all passengers while others focus on discounts provided only through employers. The pass programs currently in use by the MTAs and the municipal systems in the state are briefly summarized next.

Table 5 provides an overview of the transit pass programs currently offered at five MTAs in Austin, Dallas, Fort Worth, Houston, and San Antonio. The remaining two MTAs in Corpus Christi and El Paso do not currently have pass programs.

In Austin, Capital Metro's corporate pass program has five participants, concentrated in the city's central business district. Most participants are federal or state government agencies.

Capital Metro estimates that an average of 60 passes are sold per month under the program. Participating employers are encouraged, but not required to discount the price of the passes to their employees. Capital Metro does not provide a discount to employers, however. The pass program is marketed through brochures and other promotional material, as well as by presentations to interested employers and community groups.

Table 5. Employer Transit Pass Programs Offered by Texas MTAs

MTA	Number of Participating Employers	Types of Passes Offered	Avg. No. of Passes Sold Per Month	Number of Passes Per Employer	Pass Price Discounted	Marketing Strategies
Capital Metro Austin	5	Monthly	60	3-10	No	Direct contact
DART Dallas	300	Monthly, Coupons, Punch card	10,000	2-2,000	Yes	Direct contact, TV ads
The T Fort Worth	22	Monthly, Annual, Vouchers	275	15	Yes	Direct contact, trans. fairs
METRO Houston	100	Monthly, Ticket books	17,000	300	Yes	Direct contact, brochures
VIA San Antonio	13	Monthly	538	4-155	No	None

Dallas Area Rapid Transit (DART) has a large pass program, with approximately 300 participating employers. A total of 10,000 passes per month are sold through this program. Participants are concentrated mainly in the Dallas CBD. DART sells monthly passes, punch tickets, and coupons to employers who receive a discount through the program. Employers provide a subsidy to employees who purchase transit passes. For example, a local pass regularly sells for \$23, but participating employers can purchase this pass for \$19. Depending on the subsidy offered by the employer, an employee may pay \$17 or less for the pass.

In addition to the pass program, other corporate services offered by DART include buspools, subscription van service, and a guaranteed ride home program offered to vanpool only. DART encourages employers participating in the transit pass program to offer guaranteed ride home service for their employees.

Fort Worth's transit agency, "The T," sells about 275 passes per month through the 22 employers participating in its pass program. Currently, to help relieve congestion on the I-35 South corridor, employers in the CBD are targeted. Future target areas for the pass program include the I-35 North corridor and the Dallas-Fort Worth airport area. Employers receive a

discount from the agency of \$2.50 per pass, but are required to pass this discount on to employees. Thus a pass which regularly costs \$27 is sold to an employer for \$24.50, while employees pay only \$22. The T offers monthly and annual passes, and transit vouchers to participating employers. The purchase of transit vouchers is promoted as being the most convenient for companies to administer. Marketing efforts for the program include information literature, posters, participation in transportation fairs, and direct contact with companies.

Houston METRO has created the Corporate RideSponsor program, through which it sells transit passes to employers. There are currently 100 participating employers, with 80 percent of these located in Houston's CBD, 10 percent located in the Texas Medical Center area, 5 percent in the Galleria area, and 5 percent in other locations throughout METRO's service area. METRO estimates that approximately 25 percent of its fare revenue is generated from these pass sales.

METRO offers monthly passes and ticket books to employers, and sells about 17,000 per month through the program. Employers receive a 10 percent discount and are required to subsidize the price employees ultimately pay. METRO's regular prices for passes and ticket books range from \$27 to \$100 per month. Participating companies must purchase at least 25 passes or ticket books each month.

The RideSponsor program is marketed by distributing promotional literature and through direct contact with companies. Other corporate services offered by METRO include guaranteed ride home services, subscription buses, and computerized ridematching. In addition, employers are also encouraged to offer guaranteed ride home services.

VIA, the metropolitan transportation authority of San Antonio, provides monthly transit passes to 13 employers, selling an average of 538 passes per month through this program. Employers pay the regular price for passes, and it is left up to the individual employers whether or not they wish to discount the passes to employees. VIA has no marketing efforts currently underway to promote the employer transit pass program and offers no other forms of corporate services.

There are currently 23 municipal transit systems in the state. Eight provide only specialized transportation services for elderly and disabled individuals or for special events. The 15 other municipal transit systems provide a variety of services, including regular bus routes, downtown circulators, demand response and subscription services, and special event shuttles.

Representatives from the 15 municipal systems providing regular route bus service were contacted to obtain information on transit pass programs for individuals and employers. Table 6 provides the results of this telephone survey. In addition, information was requested on special routes or services to large employers or institutions, such as colleges and universities, military bases, medical centers, and large office complexes.

Table 6. Municipal Transit System Pass Programs

Municipal Transit System	Individual Passes	Employer Pass Program	Special Routes or Services
Abilene, City Link	Yes	Planned	No
Amarillo	No	No	No
Beaumont	Yes	No	No
Brownsville, BUS	No	No	No
Bryan-College Station	Yes	Yes	No
Denton	Yes	No	No
Galveston, Island Transit	Yes	Yes	Yes
Laredo, El Metro	No	No	Yes
Lubbock, Citibus	Yes	Yes	Yes
Port Arthur	No	No	No
San Angelo, ANTRAN	No	No	No
Sherman-Denison-Howe	Yes	No	No
Tyler	No	No	No
Waco	Yes	Yes	No
Wichita Falls	No	No	No

Seven of the municipal systems—Abilene, Beaumont, Bryan-College Station, Galveston, Lubbock, Sherman-Denison-Howe, and Waco—sell individual transit passes for the convenience of their regular riders. Five systems—in Abilene, Bryan-College Station, Galveston, Lubbock, and Waco—offer employer transit pass programs. Three of the state’s municipal transit systems provide special routes or services to employers or areas having large concentrations of potential transit users. Island Transit in Galveston provides shuttle service to the University of Texas Medical Branch. Laredo’s El Metro operates shuttles through the city’s historic district where parking is severely limited. Citibus of Lubbock provides special services to Texas Tech University.

Ridesharing Programs

Currently, six of the seven MTAs operate ridesharing programs. These include the transit agencies in Austin, Corpus Christi, Dallas, El Paso, Fort Worth, and Houston. The rideshare program operated by VIA in San Antonio, called ViaShare, was discontinued in 1992. The services offered by all the programs have been extensively examined in a previous TTI research study (40), but are briefly summarized here.

In general, the types of services available at each agency include ridematching, vanpool programs, employer outreach activities, and some type of provision for a guaranteed ride home program. All of the agencies use a computerized ridematching system. Match lists are provided to interested individuals. Carpool formation is left up to the individuals who are responsible for contacting other people on the list. In addition, most of the MTAs will develop employer specific databases and will provide them with specialized match lists comprised of their employees only. Houston METRO is currently planning to test the use of a real-time carpool matching system as part of the *Smart Commuter* operational test.

The four MTAs in Austin, Corpus Christi, Fort Worth, and Houston provide vanpool programs. All four offer vehicles leased from Van Pool Services, Inc., a third-party vanpool service. The ridesharing programs provide assistance to individuals or employers interested in forming vanpools. Houston METRO is currently considering implementing new vanpool initiatives to help employers in Houston meet the requirements of the 1990 Clean Air Act Amendments.

Other services provided by ridesharing programs around the state include subscription bus routes and assistance to parents in forming carpools to take children to school. These and other services are usually offered when a need has been identified which cannot be satisfied by existing services.

Subscription bus service is offered in Corpus Christi and Fort Worth and was offered by the ViaShare program in San Antonio. The service generally consists of routes and schedules arranged to satisfy the needs of riders who have signed up for the service. The level of service is usually higher than regular line haul transit, with fewer stops, shorter travel times, and more comfortable vehicles. Subscription bus service often focuses on one large employer or a major employment center.

The *SchoolPool* service, offered by the Fort Worth T rideshare program, is aimed at promoting ridesharing among the parents of elementary and junior high students who regularly drive their children to school. In the same way that workers going to a single employment site are encouraged to share rides, match lists are provided for parents whose children attend the same schools so that carpools can be formed for student transportation.

Guaranteed Ride Home Programs

Guaranteed ride home programs are currently provided by three MTAs in the state—Capital Metro in Austin, the T in Fort Worth, and Houston METRO. In most cases, the programs are limited to special groups, such as employers participating in METRO's RideSponsor program or the T's vanpool and subscription bus services. Vouchers for use with local taxi companies are used with the guaranteed ride home programs in Austin and Fort Worth.

In addition, a number of private companies have implemented or are considering starting guaranteed ride home programs. This is especially true of large employers in the Houston area that must meet the trip reduction requirements of the 1990 Clean Air Act Amendments. For example, Dow Chemical and other petrochemical companies located to the southeast of Houston are developing guaranteed ride home programs, as are employers in the Post Oak/Galleria area.

Reverse Commute Services

The use of reverse commute services is currently limited in most cities in Texas. A few of the MTA's have implemented some service to major suburban activity centers, and others have plans for more extensive reverse commute networks. The current experience with this type of service is limited, however.

High-Occupancy Vehicle Facilities

HOV lanes are currently in operation in both Houston and Dallas. Currently, HOV lanes are in operation on five radial freeways in Houston. These facilities account for about 104 kilometers (65 miles) of a planned 160 kilometers (100-mile) HOV system. The HOV lanes are primarily one-lane, reversible facilities located in the freeway median. The lanes are separated from the general purpose lanes by concrete barriers. An extensive system of park-and-ride lots, transit centers, and new bus services support the HOV lanes. The North Freeway (I-45N) currently carries some 1,250 vehicles and 5,560 passengers during the morning peak hour, while the Northwest Freeway (U.S. 290), averages nearly 1,500 vehicles and 4,000 passengers during the same time period. An HOV lane is under design in a sixth corridor and extensions to existing lanes are under construction in several other corridors.

Houston's HOV facilities appear to have had a significant impact on bus ridership. Data from surveys of HOV lane bus riders indicate that the presence of the HOV facility is an important consideration in the decision to use transit. In response to the 1990 survey question, "How important was the opening of the transitway in your decision to ride a bus?" 72 percent of the bus patrons on the Katy Transitway, 73 percent of those on the North Transitway, and 76 percent of riders on the Northwest Transitway answered that it was "very important" (41). Where sufficient data exist for comparison, TTI research has found that peak-period, peak-direction bus ridership has increased in freeway corridors with HOV lanes by more than 150 percent over pre-HOV facility ridership levels (41).

Compared to pre-HOV conditions, average peak-hour bus operating speeds have increased from 42 to 86 kilometers (26 to 54 miles) per hour. This increase in bus operating speeds has resulted in significant cuts to schedule times. Pre-HOV schedule times ranged from 40 to 50 minutes, while 1990 schedule times ranged from 22 to 30 minutes. The reduction in revenue hours of service due to higher operating speeds has resulted in an estimated annual bus operating cost savings of \$4.8 million (41).

In Dallas, a contraflow HOV lane, using a moveable barrier, is in operation on the East R. L. Thornton Freeway (I-30E). The lane, which operates only in the morning and afternoon peak periods, takes a lane in the off-peak direction of travel and designates it exclusively for use by HOVs traveling in the peak direction. The facility represents the first use in the United States of a moveable barrier with an HOV facility. Opened in late 1991, the HOV lane carries an average of 1,200 vehicles and 4,000 passengers during the morning peak hour. The East R. L. Thornton Freeway HOV lanes represent just the first of a number of planned HOV lanes in the Dallas area.

Park-and-Ride Facilities

Park-and-ride and park-and-pool facilities are found throughout Texas. TxDOT has been responsible for constructing park-and-ride lots in rural areas, small communities, and major travel corridors approaching large urban areas. Many transit systems, especially the MTAs, have developed extensive park-and-ride lot networks to support both transit and rideshare activities. The park-and-ride facilities in three urban areas—Austin, Dallas, and Houston—are highlighted.

Austin—Capital Metro currently operates three exclusive park-and-ride lots in the Austin area, providing a total of 650 parking spaces. In addition, eight shared-use lots are in operation. Further, one fringe parking lot, located on the edge of the downtown area, is connected to the downtown “Dillo” circulator service. All of these facilities are oriented toward the bus system. A number of park-and-pool lots, constructed and maintained by the Texas Department of Transportation (TxDOT), are also provided in outlying portions of the metropolitan area. A new park-and-ride facility, which will contain 250 parking spaces is scheduled to open by 1996.

Dallas—The Dallas Area Rapid Transit (DART) currently operates 16 formal and four shared-use park-and-ride lots within its service area. These 20 facilities provide a total of 9,574 parking spaces. Additional park-and-pool lots have been developed in the metropolitan area by the Texas Department of Transportation. Currently, all of these facilities are oriented toward the bus system. An additional three lots with 2,000 spaces are being planned as part of the bus system, and nine park-and-ride lots are being developed with the new LRT system.

Houston—Currently, 38 park-and-ride and park-and-pool lots are in operation in the Houston metropolitan area. These include 27 existing park-and-ride lots and 211 park-

and-pool lots. An additional four park-and-ride and five park-and-pool lots are planned. The park-and-pool lots have been developed by the Texas Department of Transportation (TxDOT), while the park-and-ride facilities have been developed either jointly by TxDOT and the Metropolitan Transit Authority of Harris County (METRO) or by METRO alone. METRO is responsible for operating transit services out of the park-and-ride lots and for maintaining the facilities. All of the park-and-ride lots are exclusive facilities, all focus on bus service, and most are large lots located adjacent to the five operating HOV lanes. As noted previously, 16 major park-and-ride lots, providing approximately 15,000 parking spaces, are in operation along the five HOV lanes. Fourteen of the lots contain spaces for between 950 to 2,246 automobiles each. The largest—the Kuykendahl park-and-ride lot along the I-45 North Freeway—contains parking spaces for 2,246 vehicles. Most of these facilities provide direct access to the HOV lanes. Frequent bus service is provided from most lots, averaging around five minute or less headways during the peak hours.

Innovative Services

Many of the MTAs are planning and implementing more innovative transit service strategies. For example, Houston METRO has expanded suburb-to-suburb services in recent years. As part of the *Regional Bus Plan*, METRO will be expanding these services and will be implementing timed transfer networks focused on transit centers located throughout the city. DART is also revising its route structure to accommodate the new LRT line and to provide additional services. In 1993, the DART Board authorized implementation of a new bus service classification, Non-radial Limited Stop (NLS). Implementation of NLS service began in 1994 and is intended to provide commuters with greater access to more destinations. In addition, other routes are being reoriented to provide enhanced services with the new rail line. DART will also be testing the use of flexible transit routes through a national demonstration project.

Employer Programs

All of the MTAs in the state offer some type of employer outreach program or assistance. In some cases, these programs provide a major focus for the rideshare program and the transit pass marketing efforts. Most of the programs provide a comprehensive program for employers, including specialized ridematching services, assistance in vanpool development, customized employee travel options, and marketing and informational materials.

The Commuter Services program offered by DART provides an example of one of the more comprehensive approaches in the state. Rideshare services offered are computerized ridematching and a comprehensive transportation demand management program for employers. Commuter Services will also prepare a company specific travel demand management (TDM) analysis to determine transportation needs, recommend alternatives, and assist in implementing a mobility program. Through management interviews, employee surveys, and travel pattern analyses, Commuter Services can design a transportation program specifically for the needs of a company's employees. TDM options available to employers include computerized

ridematching for employee carpools and vanpools, discounted monthly transit passes, and assistance in examining and implementing alternative work schedules, such as flextime or compressed work weeks. In addition, Commuter Services offers assistance in parking management, corporate relocation, transit education, and in training Employee Transportation Coordinators. Employers are also encouraged to provide a guaranteed ride home program and preferential parking for employees who carpool and vanpool.

Employer Based Initiatives

As noted in the previous sections, employers in many of the major metropolitan areas in Texas are active in supporting transit use by their employees. The employer based programs of the MTAs provide a wide range of assistance to major companies and businesses. Examples of employer based initiatives include supporting and subsidizing transit passes, promoting ridesharing, providing on-site rideshare or transit coordinators, offering guaranteed ride home programs, providing employee specific travel options, and disseminating information to employees about commute alternatives.

Transportation Management Organizations

A number of employer-based organizations are involved in transit and transportation activities in the major metropolitan areas in Texas. These include recently formed TMOs, as well as regional and area associations that have been in existence for a number of years. In addition, support groups comprised of employers have been formed in some areas to help coordinate responses to the requirements of the Clean Air Act Amendments.

Houston has the largest number of TMOs and other employer based groups supporting transit and transportation projects. Two factors appear to partially account for this. First, traffic congestion has been a major issue in the Houston area over the last 20 years. As a result, many area business associations have historically addressed transportation issues and promoted specific projects in their areas. Further, as a severe air quality non-attainment area, employers in Houston with over 100 employees must meet specific trip reduction requirements. Thus, new groups have been formed in some areas to help employers deal with these requirements.

Two TMOs have been formed in the Houston area. These are the Trip Reduction Efficiency Council (TREC) in the Post Oak/Galleria area and the Clear Lake Transportation Partnership (CLTP) in the Clear Lake/NASA area. Both of these organizations are focusing on similar activities.

The TREC serves the 60,000 - 80,000 employees in the Galleria/Post Oak area and coordinates with the Galleria Chamber of Commerce and the Uptown District. TREC has organized several conferences, seminars, and training sessions for its members. It also conducts educational programs on ridesharing, telecommuting, and alternative work schedules.

TREC has also approached a major taxi company in the area about discounted rates for the members to provide guaranteed ride home programs. The organization is a major coordinator of information on the employer trip reduction program. It has been designated by Houston METRO and the Houston-Galveston Area Council (HGAC) as a Transportation Reduction Assistance Center (TRAC) for the area and regularly provides material and information for companies not belonging to TREC. TREC is also working with Houston METRO to expand transit services and facilities in the area.

The Clear Lake Transportation Partnership is located in the high-tech corridor in and around NASA, which is approximately a 400-square kilometer (250-square mile) area. Currently, the CLTP serves over 60,000 employees in this region; however, the CLTP is projecting a goal of 120,000 employees when funding sources become more secured. Approximately 20 large employers participate in their employer trip reduction activities. Membership dues are based on a rate of \$3.00 per employee.

The CLTP provides information to its members on alternative commute modes and work schedules, and coordinates other activities among its members. The CLTP also is involved in long range mobility planning for the area and is working with METRO on enhancing bus services and the area-wide traffic light synchronization project.

The Central Dallas Association (CDA) is currently the only operating TMO in the Dallas/Fort Worth area. The CDA is part of the larger Central Dallas Business Association (CDBA) which represents employers in downtown Dallas. The CDA currently provides information and limited assistance to members. Plans are underway to expand the range of services offered, however.

In addition to these organizations, other areas in both Houston and Dallas have been identified as possible locations for TMOs. Further, Houston areawide associations—such as the Uptown Houston Association, the South Main Association, the West Houston Association, and the Texas Medical Center Group—perform many of the same functions and offer the same services as a TMO.

Alternative Work Schedules

Although not well documented, it appears that numerous public agencies and private businesses in Texas use different types of alternative work schedules. Information obtained from the transit agencies, TMOs, and area associations indicates that many firms use staggered work schedules, flexible hours, and compressed work weeks.

Congestion Pricing

Outside of toll facilities, there is no use of congestion pricing strategies in Texas. A proposal is being considered in the Houston area, however, that would focus on selling excess capacity in the HOV lanes. The preliminary concept that will be evaluated is allowing vehicles

with 3 or more persons (3+) to use the HOV lanes for free, while charging 2+ carpools and single occupant vehicles. This study is being sponsored by METRO and FHWA, and will be conducted by TTI.

LAND USE PLANNING AND CONTROLS

Land use planning and control techniques have not been used extensively in communities within Texas. Examples of some strategies do exist, however. These include LRT station area planning in Dallas, joint development projects in Houston, Laredo, and Del Rio, and site design activities in Corpus Christi.

Dallas—DART has worked with the City of Dallas and other groups in the development of plans for stations associated with the new LRT system. The station area planning activities have included consideration of traffic issues, pedestrian access, and land use concerns.

Houston—METRO has been involved in public/private joint developments, including the construction of additional space at the Addicks Park-and-Ride facility for use by an intercity bus company. In addition to the commuter parking area, the bus platform, and the passenger waiting areas, METRO constructed a shelter for the intercity buses and ticketing agents. The company is leasing the facility from METRO and also sells METRO passes and tickets at the site. METRO has also completed two small joint development projects at Greenspoint Mall and at a Fiesta grocery store. These have been informal, cooperative ventures, through which METRO has been allowed to operate small transit centers on parts of the privately owned property (28).

Del Rio—The city of Del Rio is moving forward with a joint development project. It involves the complete rehabilitation of an abandoned railroad depot that was built in the 1920s. The city acquired the depot in 1988, preventing its likely demolition. Since the building was purchased, plans have been made for converting it into a joint-use, multimodal transit facility. The renovated depot will serve as a terminal and transfer point for the local bus system, two intercity bus companies, a Mexican bus line, Amtrak rail service, and taxis. This project will provide enhanced facilities for many of those services. The major benefit for the city will be the centralization of the various transportation networks, and the resulting enhancements in available services. Although the depot will produce some revenue from leases, the project is not based on financial motives (28).

Laredo—El Metro, the City's public transit department, is developing a downtown joint-use transit terminal. At the time of this survey, the necessary land was being acquired and financing was being arranged. The facility will be owned and operated by the city, and space will be leased to other public agencies and private businesses. The plans for the transit center call for a five-level structure. Most of the first level will consist of a bus terminal with 24 bus bays. Six of those spaces will be leased to an intercity bus

company, several others will be used by a Section 18 provider, and the rest are intended for El Metro buses. Space on the first level also will be leased to at least one restaurant company. The upper four levels of the structure will house a 500-space parking ramp (42).

Corpus Christi—The Regional Transit Authority (RTA) is working cooperatively with the City of Corpus Christi, the Project for Public Spaces (PPS), and private businesses to develop a series of bus transfer centers. RTA engaged PPS to work on a bus transfer center at City Hall. Serving seven routes, the center opened in February 1994 with new landscaping and an innovative public art project. The Creative Arts Center, a local arts organization, sponsored a project to embellish the bus transfer centers with decorative ceramic tiling, handmade by 1,500 children and adult members of the community. In addition, the Corpus Christi RTA and PPS have initiated a community-based process to identify and serve passenger needs in specific locations in the city, working with local residents and businesses (43).

UNIQUE CHARACTERISTICS IN TEXAS

There are a number of characteristics related to land use and development patterns, physical characteristics, zoning, and institutional arrangements in the state that may influence the use of the techniques and approaches described in this report. These unique features may limit the potential to implement some strategies. They may also provide opportunities to develop other approaches, however. This section summarizes some of these unique characteristics.

Low Density Land Use and Development Patterns—Like other cities in the Southwest, most metropolitan areas in Texas are characterized by low density and dispersed development patterns. These land use patterns are often difficult to serve with traditional regular route transit systems. While this could be viewed as a limiting factor, the experience with HOV lanes in Houston and Dallas and service strategies in other areas indicate that Texans will use transit and ridesharing if it is convenient, safe, and offers travel time savings.

Large Rural Areas—Texas has the largest rural transit service area of any state in the country. This provides significant obstacles to providing transit services in many areas. Coordinating the services operated by different groups and maximizing available resources will be important to adequately address transportation needs in these areas.

Fewer Land Use Controls—In general, communities in Texas have relied less on comprehensive planning, zoning, and other land use controls than urbanized areas in other parts of the country. For example, it is well known that Houston is the only large city in the country without zoning. Although the lack of zoning or land use controls does not prohibit the use of some of the techniques discussed in this report, it may require that more creative approaches be used to implement these strategies.

Stable Transit Funding Sources—The sales tax revenues available to the MTAs in Texas provide a stable source of funding. This makes long-term planning much easier. Thus, the MTAs are in a better position than other transit systems around the country to implement new programs, facilities, and services.

Active Private Sector—The private sector in Texas has been very active in supporting a wide range of projects, including transit and transportation elements. The vanpool program at USAA in San Antonio represents an example of this support. The involvement of numerous companies in the employer outreach programs of the different transit agencies represents another example. It may be possible to enhance existing programs or start new ones by building on current private sector involvement and support.

CHAPTER FIVE

CONCLUSIONS

This report has provided an overview of national and state policies and programs supporting greater use of transit. It has included a review of the national experience with different TDM strategies, land use planning and development controls, and growth management. In addition, detailed case studies were conducted of the approaches used in Portland, Montgomery County, Boulder, and Pleasanton. The current application of these techniques in Texas was also assessed.

The results of the study indicate that a wide range of policies and programs are used throughout the country to encourage greater use of transit, HOVs, other commute modes, and alternative work arrangements. At the national level, TDM strategies in use include education and outreach programs, transit pass programs, ridesharing services, guaranteed ride home programs, HOV and park-and-ride facilities, reverse commute and innovative transit services, employer-based efforts, and parking management programs. In addition, some areas have used land use and development controls and growth management strategies to support transit.

Most of the programs and policies in use within Texas focus on TDM techniques. These include transit and ridesharing services, HOV and park-and-ride facilities, employer programs, guaranteed ride home services, and pass programs. Less use has been made of parking management strategies, land use planning and development controls, and growth management. In addition, some of the unique characteristics associated with the state were identified. These features include low density and dispersed development patterns, extensive rural areas, less use of land use controls, stable transit funding sources for the MTAs, and an active private sector.

The results from this analysis indicate that there are a number of potential policies and programs appropriate for further consideration in Texas. These include strategies that could be pursued by both public agencies and private businesses and developers. Examples of these approaches are summarized next.

Education and Outreach Programs—Although education and outreach programs are underway in many areas, it appears that more extensive efforts are appropriate. These programs could be targeted at both the state level and at specific communities within the state. The state level program could build on the efforts initiated by TxDOT, transit agencies, and other state groups in the *Try Transit Week*. This initial effort could be expanded and enhanced into a visible ongoing education and outreach program. This statewide effort could form the basis for education and outreach programs tailored to individual areas. These programs could focus specifically on the issues, opportunities, services, and strategies in large metropolitan areas, smaller communities, and rural parts of the state.

Comprehensive Programs—The *GO Boulder* program described in Chapter Three provides a good example of the development and implementation of a comprehensive program that includes transit service improvements, employer-subsidized passes, bicycle and pedestrian improvements, and extensive information and outreach activities. This example could be used by MTAs and municipal transit systems in Texas interested in developing similar programs. The U-Pass program at the University of Washington provides another example of a comprehensive program that could be followed.

Innovative Transit Services—Transit systems in the state may want to explore additional reverse commute and innovative service options. The examples in this report provide an indication of the national experience with some of these services. Monitoring the new services METRO and DART are implementing will also assist in identifying how these techniques can be used in Texas.

TMOs—TMOs and TMAs appear to be effective organizational arrangements for promoting private sector participation and encouraging greater use of all HOV modes. Currently, TMOs are only in place in some areas of Dallas and Houston. Developing additional TMOs in these areas, as well as in other communities could be encouraged and promoted. In addition, TMOs could be used to assist smaller communities and rural areas coordinate service delivery and expand mobility options for residents.

Parking Management—Although this technique has not been used extensively within the state, it appears to have a significant impact on commute mode choice. Identifying and implementing a few demonstrations focusing on parking pricing and supply strategies would be one way to test these concepts. The results of these demonstrations could be used to expand or modify parking management programs.

Station Area Planning and Zoning—The station area planning conducted in Portland provides a good example of how land use decisions can be made to support the development of an LRT system. Cities in Texas implementing or considering light rail may wish to follow this example. Further, many of the techniques and concepts could be used with bus systems as well. Integrating transit into new developments can provide benefits to both the transit system and the businesses.

Joint Development Opportunities—A number of transit agencies in the state are moving forward with joint development projects. Opportunities may exist for more joint development efforts among transit agencies, TxDOT, private businesses, and other public agencies. Joint developments can help maximize the resources of all groups and provide multiple benefits.

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