# TRANSIT-ORIENTED DEVELOPMENT CASE STUDY POLICY ANALYSIS: A COMPARATIVE STUDY OF PROGRAMS AND POLICIES ACROSS THE UNITED STATES

By

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To my met match, Nate

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| ABAG | Association of Bay Area Governments |
| BART | Bay Area Rapid Transit |
| BRT | bus rapid transit |
| Caltrans | California Department of Transportation |
| C/CAG | City/County Association of Governments of San Mateo County |
| CMAQ | Congestion Management/Air Quality Act |
| CRA | community redevelopment agency |
| DART | Dallas Area Regional Transit |
| DOT | Department of Transportation |
| HIP | Housing Incentive Program |
| LRT | light rail transit |
| MBTA | Massachusetts Bay Transportation Authority |
| MTC | Metropolitan Transportation Commission |
| MUNI | Municipal Railway |
| PDC | Portland Development Commission |
| TIF | tax-increment financing |
| TIP | Transportation Improvement Program |
| TLC | Transportation for Livable Communities |
| TOD | transit-oriented development |
| TriMet | Tri-County Metropolitan District of Oregon |
| UGB | urban growth boundary |
| U.S. | United States of America |
| VMT | vehicle miles traveled |
| WMATA | Washington Metropolitan Area Transit Authority |

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# TRANSIT-ORIENTED DEVELOPMENT CASE STUDY POLICY ANALYSIS: A COMPARITVE STUDY OF PROGRAMS AND POLICIES ACROSS THE UNITED STATES

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The factors under which transit-oriented development (TOD) projects flourish in the United States are indistinct. Most TOD projects face inimitable challenges, as the developable circumstances vary greatly for each site-specific project. The programs and policies of five highly capitalized TOD projects in this study, serve as a medium for elucidating the planning tools that catalyze TOD. These case studies evaluate an array of qualitative and quantitative variables to determine the physical, political, and sociocultural milieu that both hinders and engenders success. Bus and rail served TOD projects are included in the case studies in order to add an additional layer of comparison.

The study is based on the results of sixteen variable components. Some of the variables are examples of performance metrics of TOD such as public transit ridership, density, and multi-family housing stock. Other variables are TOD catalysts such as congestion, daily vehicle miles traveled (VMT), and fuel costs. The study will conduct a thorough analysis of the sixteen indicator variables for five major U.S. urbanized areas:

(1) Boston, Massachusetts, (2) Dallas, Texas, (3) Portland, Oregon, (4) San Francisco, California, and (5) Washington, D.C. The analysis product will be a theorized summary of what policies and programs may be more effective in fostering TOD projects based on the measured criteria in regard to each individual case study. The study concludes with the summarized importance of TOD-friendly policies such as urban growth boundaries, joint development partnerships, and coordination of local, regional, and state entities.

# CHAPTER 1
# INTRODUCTORY REMARKS

Advocates of transit-oriented development (TOD) claim it is the most efficient solution to accommodating all future urban growth. The same advocates generally refrain from acknowledging the genuine American appeal of single-family detached homes in roomy, low-crime suburban neighborhoods. Despite the historical allure of the suburbs, the United Sates (U.S.) is experiencing a growing trend of more Americans choosing compact, multi-family housing in close proximity to transit-often referred to as TOD. Although it may take years, or perhaps decades for TOD to penetrate the unremitting suburban American housing market, a significant amount of TOD planning and development initiatives are underway (Dittmar & Ohland, 2004). Among the intiatives is this study, which aims to identify what policies and programs may perhaps be more effective in fostering TOD projects based on the measured criteria in regards to each individual case study.

As America's sprawling suburbs mature, they are essentially becoming stand-alone edge cities, which scrupulously blanket a significant amount of the U.S. landscape (Dittmar & Ohland, 2004). The evolution of these sprawling suburbs presents unique planning, growth, and development challenges to preserve natural resource and agricultural land vital to sustaining future American generations. Consequently, after fifty years of relentless suburban development, many towns, cities, and regions have already depleted their ripe-for-development greenfield land, and are now beleaguered to find alternative development solutions to accommodate future growth (Burchell, et al., 2002).

Recently, as more land-consumptive suburban neighborhoods emerge causing developers to recede even further away from urban areas, consequential conflicts have arisen. Although suburban residents traditionally want to remain in the suburbs for their low crime rates and above average school districts, suburban road congestion is a mounting problem, further constricting access to urban amenities, goods, and services. These amenities are rarely within walking distance of suburban neighborhoods because of the segregated, historical single-use land use policies implemented by most local governments in the U.S. The repercussions of these aging, ubiquitous land development policies have caused major growth management quandaries such as insurmountable traffic congestion, higher taxes to expand infrastructure, increased gas expenses, and escalating air and water pollution problems. In order for suburbs to achieve some level of sustainability and congestion relief, they must evolve into something more than just isolated residential "bedroom communities" (Dittmar & Ohland, 2004).

The unintended consequences of suburban sprawl have catalyzed serious discussion and growing interest in TOD. TOD is typically defined as a mix of land uses, including high density commercial, office, and residential development, located within a five to ten minute walking distance or within approximately a quarter-mile of a transit station. Despite the growth-mitigating potential of TOD, many key components must be in place for the alternative concept to flourish in the U.S. Possible hindrances include lack of frequent, easily accessible transit in urban areas, unsupportive real estate markets, obstructive development policies, institutional barriers, and most Americans' content and complacent attitude toward the automobile. To overcome these obstacles,

collaboration and communication have proved imperative to plan and implement successful, thriving TOD projects. Transit authorities and local governments must work together on initiating and proposing viable projects to the public community, developers, and financial stakeholders (Cervero, et al., 2004; Belzer, et al., 2009; Burchell, et al., 2002).

The most pertinent and promising indication TOD may soon be a viable option for more Americans are the robust federal investments currently being made in bus and passenger rail travel. These federal initiatives have motivated local governments across the U.S. to make specific planning efforts to capitalize on the investments, amending dated suburban-oriented land development patterns toward the shifted housing market demand for compact, urban housing in close proximity to frequent public transportation. The renewed interest in expanding bus and passenger rail transportation is promising, and essential for TOD, but the expensive capital infrastructure will take time, as federal funds are limited for transit projects that already have a 50-year waiting list (Dittmar & Ohland, 2004).

Even with adequate transit, without carefully executed planning, TODs can become transit-adjacent due to problematic zoning codes, lack of safe pedestrian access, and excessive parking requirements that consume too much land, detracting opportunities for TOD near transit stations (Dittmar & Ohland, 2004). "Successful TOD needs to be mixed use, walkable, location-efficient development that balances the need for sufficient density to support convenient transit service, with the scale of the adjacent community" (Autler, Dittmar, & Belzer, 2004, p. 4).

Local governments are instrumental in facilitating appropriate land development policies ripe for implanting TOD. Municipalities need to be proactive about their land-use regulations and zoning ordinances, ensuring they are conducive TOD development policies and guidelines. "Without a concerted effort to develop standards and definitions, to create products and delivery systems, and to provide research support, technical assistance, and access to capital, TOD will remain just a promising idea" (Autler, Dittmar, & Belzer, 2004, p. 10). TOD is not necessarily a new concept in urban development, however, the strategy of integrating it into existing urban fabric, and retrofitting our suburbs into vibrant TODs, is.

# CHAPTER 2
# LITERATURE REVIEW

## Introductory Remarks

Since post-World War II (WWII), transit-oriented development (TOD) is a relatively new development concept. While there are not precise instructions that specifically identify tools to implement TOD, there have been progressive initiatives by local, regional, and state governments that have enabled planners, developers, advocates, and local governments to learn from their mistakes, challenges, and accomplishments. This literature review will examine why and how TOD can play an integral role in creating sustainable communities, mitigating growth management problems future generations are certain to face, further articulating the benefits, criteria, challenges, and criticisms.

## 20th Century Land Development Patterns

### Sprawl

In the early 1900s, the streetcar transit system widely served the residential suburbs outside of the urban employment centers, also known as the "streetcar suburbs". This was a notable precursor form of transit-oriented development (TOD), but in the 1930s, streetcar transit systems became obsolete with mass production of the automobile. The automobile ultimately severed the once revered link between housing and mass transit, prompting post-WWII developers to embrace the automobile as a medium to develop and manufacture the American Dream (Dittmar & Ohland, 2004).

The post-WWII era initialized major decentralization in U.S. cities, instigating destructive decline and blight, caused by the automotive exodous to sprawling detached single-family housing and suburban strip malls (Brandes, 2010). American decentralized

growth has persisted through the decades and led to present-day perils such as poor air quality, traffic congestion, loss of open space, storm water runoff pollution, depletion of agricultural land, loss of biodiversity habitats, and high personal transportation costs (Dittmar & Ohland, 2004).

Decentralization rates were thirteen times higher than the population growth rate during the period of 1970-1990, a clear indication of ongoing inefficient land development practices occurring at that time. Moreover, although land consumption rates were generally three times faster than population growth in 1982-1997, vehicle miles traveled (VMT) rates decreased in 1996 (Arrington & Cervero, TCRP Report 128 Effects of TOD on housing, parking, and travel, 2008). This may be a result of Americans adapting their suburban housing choices closer to employment and access to goods; however, as suburban sprawl development continues, so will its repercussions (Dittmar & Ohland, 2004). "For every 1% increase in metropolitan land use, annual VMTs increased by at least 1.25%" (Bernstein, 2004, p. 223).

Despite consumptive development patterns, household sizes in the U.S. have been on the decline since 1965, dropping from 3.3 persons to 2.6 as of 2000. However, despite declining household members, the average size of a home has increased from 1,450 to 2,100 square feet (Dittmar & Ohland, 2004). Sprawl development consumes 10 to 40% more land than compact, dense development (Cervero, et al., 2004). These sprawling development patterns have led to tremendous amounts of low-density development in the U.S. In most U.S. regions population densities have continued to decrease since the post-WWII development boom. Even transit-friendly cities with a long standing history of compact, high-density development such as Boston have seen

population densities decrease due to sprawling fringe-suburban development (Texas A&M University Texas Transportation Institute, 2009).

There are recent examples of sprawling developments that contain medium-density mixed use development, but only as the market progressively has allowed. Despite an increase of density within these suburban developments, the dispersed location of goods that require multiple car trips outweigh the land conserving attempts of a sprawling medium density development (Burchell, et al., 2002).

If development patterns continue to decentralize and disperse growth, the U.S. will spend more than 190 billion dollars to extend water and sewer infrastructure to dispersed land development. If growth continues to occur at the same consumptive rates, the U.S. will convert 18.8 million acres of land by 2025, most of which is agricultural land. On the other hand, contiguous, compact development has the ability to preserve 2.5 million acres of land. Additionally, 1.6 million more acres could remain undeveloped through policies that support strict urban service areas, keeping development contained to existing urban areas (Burchell, et al., 2002). Advocates of smart growth have an uphill battle to combat sprawling land development practices, as the majority of U.S. local government regulatory land development policies are Euclidean-based, which encourage outward, horizontal growth, regardless of the negative consequences or ancillary costs (Bernstein, 2004).

Euclidean zoning is the traditional land development zoning principle used since 1926 when the U.S. Supreme Court reviewed the case Village of Euclid, Ohio vs. Amber Realty Co., where the courts ruled in favor of Euclid, mandating the segregation of land uses to protect property owners from “conflicting” uses adjacent to one another.

The court's primary intention was to protect residential neighborhoods from being located next to noxious industrial land uses, which could harm residents and unsettle communities (Jourdan, 2008). Nevertheless, because of that ruling creating smart growth mixed-use communities has been very challenging in the strong shadow of traditional Euclidean zoning (Belzer, et al., 2009).

Although Euclidean zoning unintentionally catalyzed sprawl, the lack of coordination among adjacent local, regional, and state planning departments has led to an automated process of approving and standardizing the concept of dispersed development. Sprawl transpires mostly at regional levels, where adjacent local governments do not often consult or communicate development plans, goals, or objectives. Therefore, different rules and regulations are applied to adjacent communities, allowing for haphazard, piecemeal development to meander through a submittal process, almost always resulting in approval (Burchell, et al., 2002).

To sustain future generations, there must be a fundamental change in how we, as a country, approach land development practices. Sprawl caters to a fictional scenario, where disposable land and unlimited resources are available anywhere, if there is developer interest. Planners, lanscape architects, architects, engineers, and political leaders need to catalogue our country's stock of resources and allocate them accordingly, adhering to fundamental preservation and sustainable development principles.

**Housing**

The sprawling land development practices that originated in the 1960s were primarily using one-housing prototype, a single-family detached home. The ideology

behind the detached single-family housing unit became inherently linked to the “American dream” of owning a spacious home, complete with a generous amount of lawn -- typically one-half to one acre of land. Typical single-family housing units promote low-density development by design. They are often horizontally spacious by nature, almost never exceeding two or three stories in building height. Given ample property boundaries, single-family housing is a perfect counterpart to the consumptive cycle of sprawl (Burchell, et al., 2002).

The U.S. housing market has averaged 1.7 million new homes per year for the last several consecutive years. Only 20% of those completed units are multi-family consisting of five or more dwelling units, consequently contributing to the saturated market of land consumptive single-family housing. In the current market, the rate of single-family housing production is greater than population growth rates (Renne, Voorhees, & Wells, 2005). "The marketplace is not producing the kinds of housing that can effectively house the population that needs it" (Bernstein, 2004, p. 234). Further, these statistics are noted prior to 2005, exempting consideration for the economic housing crisis, which presumably leaves the housing stock with even fewer choices for multi-family housing.

In the 1990s, when comparing housing supply versus demand, one-third of all U.S. counties had more housing than population growth, one-third had more population growth than housing, and another one-third had housing and population rates that were evenly distributed. The third that had more households than available housing is some of the largest and densest cities in the country, and where most U.S. mass transit systems are located (Dittmar & Ohland, 2004). "This shows a very high and

underserved demand for transit-served communities and implied that, far from being a primary cause of gentrification and displacement, transit-oriented communities are in demand and the market has yet to provide a product at sufficient scale to meet it" (Bernstein, 2004, p. 236).

Contrastingly, if we continue to develop agricultural, ranch and forestlands, the price of housing will remain unaffordable for many, as it costs approximately $50,000 more per dwelling unit to connect infrastructural needs such as water, electricity, and telecommunications (Burchell, et al., 2002). In some aspects, sprawling low-density development is arguably responsible for increased cost of land, as land and resource supplies have been dramatically reduced. According to Reconnecting America, housing costs have risen sharply between 2000 and 2005, causing significant financial challenges for many U.S. households (2007). "America's population is projected to grow by 76 million persons between 2000 and 2030, and at 2.5 persons per household the market will need to produce another 30 million homes to meet this need" (Bernstein, 2004, p. 240). If single-family consumptive land development patterns continue as they did from 1982-1997, there is a high probability that approximately 50 million acres would be consumed to accommodate those 30 million homes (Burchell, et al., 2002). Additionally, single-family homes still comprised for 61.7% of the U.S. housing market as of 2007 (United States Census Bureau, 2007).

**Congestion Costs**

Sprawling, decentralized development has led to major commuter congestion problems, proving to be extremely costly in the U.S. Costs associated with congestion is a relatively new research genre, but is becoming a hot topic given some compelling

recent research findings. Over the last twenty years, congestion has increased exponentially, causing: (1) longer commute times, (2) increased demand for more roads, (3) poorer air quality leading to deteriorated health conditions, (4) increased greenhouse gas emissions that contribute to global warming, (5) wasted gasoline, and (6) wasted time. These negative congestion factors, especially commuting times, have led many Americans, as well as communities, to seek alternatives and generate new ways to improve their quality of life (U.S. Department of Transportation, 2008).

However, some cities and states have failed to realize or address the severity of congestion problems, continuing their daily automobile commute, perpetuating the congestion issue. In the 2005, the Texas Transportation Institute released an alarming report of congestion consequences, highlighting that congestion has increased in 85 U.S. metropolitan areas from 1982 to 2003. Specifically, peak period commutes take about 7% longer (Texas A&M University Texas Transportation Institute, 2009; U.S. Department of Transportation, 2005). Further, congestion is not only a peak-hour commute problem, but in some cities and regions it only slightly dissipates in off-peak commute times during the day, causing travel in these areas to be difficult throughout the entire workday. Additionally, major congestion increases are also occurring on weekends around shopping centers, event venues, and recreational destinations (U.S. Department of Transportation, 2005).

The Federal Highway Administration has conducted an analysis report based on Texas Transportation Institute's findings about the high costs of congestion to identify mitigation strategies. Some proposed strategies include building new roads, widening existing roads to increase traffic capacity, regulating traffic modes on specific

timetables, and the controversial notion of congestion pricing (U.S. Department of Transportation, 2008).

Congestion pricing is a regulatory toll fee taxed on traffic that travels through a specific zone, usually notorious for congestion. This congestion mitigation tactic has been successful in parts of the United Kingdom, Germany, and Stockholm (U.S. Department of Transportation, 2005). “Introducing congestion pricing on highway facilities discourages overuse during rush hours by motivating people to travel by other modes such as carpools or transit, or by traveling at other times of the day” (U.S. Department of Transportation, 2008, p. 1). However, there is a distinct difference between enforcing congestion pricing on transit-rich European countries in comparison to most of the U.S., as Europeans have mass public transportation alternatives to paying the congestion tax, whereas most Americans do not (U.S. Department of Transportation, 2005).

Congestion is a fundamental problem in the U.S., and cannot be solved by building new roads or expanding existing ones. The gas tax in the United States has not been increased since 1993; consequently, it continues to be subsidized by the U.S. government as the cost of oil rises (Gross, 2006). Raising the gas tax to correlate with current inflation rates and actual cost could be a major congestion mitigation strategy (U.S. Department of Transportation, 2005). Congestion solutions or strategies most likely will be costly ones, but more importantly they must address retrofitting our living environments around our community's means and efficient infrastructure capacity.

**Vehicle Miles Traveled**

The number of vehicle miles traveled (VMT) in a region directly affects congestion levels. The more miles automobiles travel, especially commuters, the higher congestion levels will be. Congestion cost the U.S. $78 billion in 2005, wasting fuel and traffic delay costs (U.S. Department of Transportation, 2008).

"For every 1% increase in metropolitan land use, annual VMTs increased by at least 1.25%" (Bernstein, 2004, p. 233). Low-density, sprawling, Euclidean-zoned land development patterns are responsible for the continuous increase of VMTs in most U.S. cities. Large suburban employment centers without access to transit are ripe for automotive commuting and congestion, and are often a major contributer to increased VMTs in a suburban region (Burchell, et al., 2002). The major increases in U.S. VMTs are not incurred by shopping or social trips, they are made by commuting trips. Recent data suggests commuters are willing to drive more miles and spend more time in traffic than ever before. This tolerance for congestion, despite its negative social and financial impacts, has led to a trending, incessant increase in VMTs in most U.S. cities (Arrington & Cervero, TCRP Report 128 Effects of TOD on housing, parking, and travel, 2008).

Arrington and Cervero argue that VMT trends are relative to a housing-transportation cost benefit analysis. For instance, an increase in housing costs near city centers will cause an increase in commuting from lower edge-city, suburban housing costs. The trade off being the increased commuting time for decresed housing costs (Arrington & Cervero, TCRP Report 128 Effects of TOD on housing, parking, and travel, 2008). However, despite this empirical research conducted by Cervero and Arrington, the widest knowledge gap needing to be filled is how transit-oriented development

(TOD) affects trip generation rates. The lack of this knowledge prevents TOD advocates from demonstrating exactly how much VMTs are effectively reduced by TOD (Arrington & Cervero, Vehicle Trip Reduction Impacts of Transit-Oriented Housing, 2008).

## Transit-Oriented Development

### Definition

Transit-oriented development (TOD) is usually defined as compact, high-density mixed use development within a quarter mile walk of a transit station, prioritizes pedestrians and bicyclists while providing frequent, reliable, and accessible transportation service. TOD provides households and individuals with healthier, cleaner, and more affordable living choices, especially when compared to traditional sprawl development (Evans, Kuzmyak, Pratt, & Stryker, 2007).

TOD promotes healthier living by its fundamental concept and design. On average, people who live or work in or near TOD walk and or bike 3.5 times more than people who do not live or work near a TOD (Cervero & Arrington, TCRP Report 128 Effects of TOD on Housing, Parking, and Travel, 2008). Typically, TODs are designed to be inviting to cyclists and pedestrians with generous bicycle lanes, wide sidewalks, highly visible crosswalks, narrow streets, and often have aesthetically pleasing streetscape elements such as landscaped medians, excellent lighting, and street furniture (Renne, Voorhees, & Wells, 2005).

TOD residents are far less likely to commute to work via an automobile when reliable public transportation is easily accesible by a short walk or bike ride, effectively removing more automobiles from roadways. Less automobiles on roadways means less pollution, cleaner air, and decreases automotive excretions found on roadways that

pollute natural water systems in stormwater runoffs (Arrington & Cervero, TCRP Report 128 Effects of TOD on housing, parking, and travel, 2008).

Automobile independent living choices have proven to be cost effective alternatives for a wide variety of demographic population. The household cost of personal transportation was one dollar to every ten dollars in 1950, and has risen to one dollar every ten dollars as of 2000 (Littman, Transportation cost and benefit analysis: techniques, estimates, and implications, 2009). Today, personal transportation is the second highest expense for most American housholds and will continue to increase as peak oil is on this generation's horizon (Bernstein, 2004).

**Housing-Public Transportation Connection**

The relationship between housing and transportation has recently become a frequent topic of discussion and debate among planners, architects, landscape architects, urban designers, engineers, and local governments. A city’s or community’s transportation network usually drives growth, development patterns, and urban form (McDaniel & White, 1999). Suburban development has been the primary residential development model for almost fifty years. During those fifty years, many roads have been paved, extended, and expanded to accommodate and connect edge suburban development to employment centers and other urban centers where goods and services are located.

However, fifty years of building suburban sprawl development has led to residents fighting for space on many arterial roads and highways, as they are accruing high levels of congestion and commute-hour gridlock consecutively each year. U.S. gas taxes are the primary funding sources for building and maintaining roadways. Despite continuous

single-family housing developments being built since the 1950s, the gas tax has not been raised or adjusted since 1993, resulting in the U.S. Department of Transportation to rely on federal funding for supplemental financing of road construction and maintenance (Gross, 2006). Without  a gas tax increase, thus a new revenue increase, the Department of Transportation simply can not afford to widen and or expand even a small %age of roads that endure daily traffic congestion, leaving suburban residents spending increasingly more time on congested roadways (Burchell, et al., 2002).

Congestion and random spikes in gas prices have led to people, especially new generations, wanting to live in communities where housing is located near alternative public transportation options, or transit-oriented development (TOD) (Cervero, et al., 2004). Because TOD housing decreases household vehicle ownership and overall vehicle miles traveled, fewer trips are made in urbanized TOD areas. TOD residents are twice as likely to use public transit as their primary transportation, and therefore not own a car (Cervero, Ferrell, & Murphy, Transit oriented development and joint development in the United States: A literature review, 2002). Given the fundamental definition of TOD is housing and or employment located near transit access, vehicle miles traveled tend to be much lower in TOD districts and neighborhoods. This is contrary to some theories that claim compact, dense development will cause more traffic and congestion regardless of access to transit (Cervero & Arrington, TCRP Report 128 Effects of TOD on Housing, Parking, and Travel, 2008).

The cost benefit analysis of housing and transportation highlights a couple of problems that in reality could become mitigation measures. Clearly, supply and demand play a major role in the housing-transportation cost bebefit analysis. If there was an

ample supply of affordable compact housing near transit, then the demand would decrease, thus housing prices and commuting would decrease (Littman, Transit-oriented development: Using public transit to create more accessible and livable neighborhoods, 2010). If a transit-oriented neighborhood doubled their densities, VMTs would be reduced by 12% (Brandes, 2010).

Transit-served households with frequent service and adequate transit access spend approximately less than $5,500 per year on transportation, while most automobile dependent households spend at least $8,500 on an average medium sized sedan, plus $3,500 dollars per additional car, annually on transportation These costs include insurance, gas, maintenance, and vehicle costs and financing (Litman, 2009).

In order for transit-served communities to function as intended, there must be a frequent level of transit service (short waiting times between transit availability) and cognizant placement of housing in close proximity to transit. The role of location efficiency regarding TOD real estate is imperative but does require supporting density (Littman, Raise my taxes, please! Evaluating houshold savings from high quality public transit service, 2010). Recent research has demonstrated that the primary benefit of having mass transit serve location efficient housing is "reduced dependence on the automobile" (Bernstein, 2004, p. 237). Those households who live in a location efficient area served by transit can save an average of $400 per month by owning one car instead of two. "For each doubling of density within communities and within metropolitan areas, annual vehicle miles traveled are reduced by 20 to 40%" (Bernstein, 2004, p. 233).

From 1970-2000, transit ridership for work trips increased in transit-oriented development zones, but has decreased in metro areas (Littman, Transit-oriented development: Using public transit to create more accessible and livable neighborhoods, 2010). Transit service of ten-minute headways is ideal to sustain a transit lifestyle, maintaining service that has competitive commute times when compared with automobiles. Transit service door to door must be more time efficient, or cost a significantly lesser amount to be a viable option for car-owning TOD households (Cervero & Arrington, Vehicle Trip Reduction Impacts of Transit-Oriented Housing, 2008).

Further, it is critical to locate jobs and employment centers near transit to attract households to TOD. This is also necessary to acquire additional ridership through commuters, giving transit agencies more revenue to provide better, reliable service (Reconnecting America's Center for Transit Oriented Development, 2007). TOD commuters typically use transit two to five times more than other commuters in the region, with heavy rail systems consistently experiencing transit ridership growth associated with TOD (Cervero & Arrington, TCRP Report 128 Effects of TOD on Housing, Parking, and Travel, 2008). Focusing housing and employment center development near transit is viable solution as it provides sustainable alternatives to the land and energy consumption practices associated with typical single-family development (Dittmar & Ohland, 2004).

Today, approximately six million U.S. households are located within a half-mile of adequate transit access, enabling good access to jobs, goods, and services. Reconnecting America’s Center for Transit-Oriented Development is projecting a

quarter of the housing market will demand housing near transit by 2030 (2007). The upcoming generations, consisting mostly of singles and childless couples, are projected to demand lifestyles where you can eat, sleep, and work in a neighborhood, any time of day or night, without needing an automobile (Cervero, et al., 2004).

**Transit-Oriented Development Housing Markets**

Transit-oriented development (TOD) is still a relatively new development product, or "type," and developers in the U.S. are usually wary of the "new" or unknown until the product "type" has proven capable of making a profit. This type of wariness or concern for building a widely untested and unproven development type such as TOD has resulted in limited planned and constructed TODs in the U.S (Belzer, Eaton, Fogarty, & Ohland, 2008).

Further, the recent housing crisis that caused millions of foreclosures across the country has perpetuated developer's reluctance to build an untested or tested development product, effectively halting the construction industry in its tracks. Given TOD is a relatively stagnant development concept in the current economic downturn, presently there is only a small supply of TOD housing inventory in the U.S. for Americans to choose (Belzer, et al., 2009).

As previously mentioned, there is a cost-benefit relationship with the current inventory of TODs in the U.S. Because of the small supply of TOD housing despite the demand continuing to rise, TOD housing is largely unaffordable for U.S. residents. As also discussed previously, 16 million households will desire to live within a half-mile of transit access, "most of whom will be below 50% of the median income level" (Belzer, Eaton, Fogarty, & Ohland, 2008, p. 2). This demand increase has the potential to drive

TOD housing further out of reach for many Americans if more TOD housing is not built in the coming decades (Reconnecting America, Center for Transit-Oriented Development, 2007).

It is crucial for local governments to foster a wide variety of mixed-income multi-family housing associated with TODs. Without policies and regulations from local government development authorities mandating minimum affordable housing requirements, TOD has the potential to be unaffordable for majorities of the population that need transit service to access goods, employment centers, and services (Zimmerman, Anderson, & Finkenbinder, 2009).

**Transit-Oriented Development Economics**

For every dollar a working American family saves on housing, it spends 77 cents more on transportation. In fact, working class families earning less than $50,000 annually spend more on automobile transportation costs than housing in most U.S. metropolitian areas (Reconnecting America's Center for Transit Oriented Development, 2007). These statistics are problematic for America. Transit-oriented development (TOD) has the potential to drastically reduce transportation cost burdens on housholds, particularily low-income households, and provide more livability options across the country (Belzer, et al., 2009).

While the traditional middle-class benefits of living in single-family sprawling suburbs is the savings from decreased housing costs, recent research suggests violatile surges in oil prices have negated cost savings from suburban commnunities, financially straining a struggling major portion of the U.S. housing market. With sprawling suburbs blanketing a significant portion of the U.S. housing landscape, additional surges in oil

prices could financially dehabilitate many working class Americans (Dittmar & Ohland, 2004).

TOD can alleviate these, and many other finacial woes associated with the costs of mobility. As previosly mentioned, TOD housholds can have one fewer car, potentially saving housholds over $300 per month, or $3,600 annually (Litman, 2009). Considering residents of cities with high quality transit pay an average of $119 more in taxes for access to the service, transportation options seemingly equals more disposable houshold income for transit users. This $3,600 per car annual cost to housholds is a conservative one. Each year as congestion rises, commute times increase, and sprawl development patterns persist, the cost of owning a car will rise dramatically, especially for long-distance commuters (Littman, Transit-oriented development: Using public transit to create more accessible and livable neighborhoods, 2010).

Additionally, TOD has the potential to save significant fees and construction costs in the planning and development stages. In many cities, impact fees are waived for TOD projects because they are usually compact development projects located in an urban area capable of accomodating additional utilitiy infrastructure. Moreover, given the lower car ownership rates, additional savings can be attained if the city has relaxed minimum parking standards for TOD projects, saving the developer millions of dollars in structured and surface parking lot costs. The TOD developer's savings are almost always passed down to the housing buyer or renter, which can be significant with pro-TOD development regulation in place (Cervero, et al., 2004).

Transit agencies can gain substantial economic benefits from TODs. Since TOD households are twice as likely to not own a car, or at least one fewer car, transit

ridership typically increases 20 to 40% when new development is placed near a station with frequent fixed-guideway transit service (Cervero & Arrington, TCRP Report 128 Effects of TOD on Housing, Parking, and Travel, 2008). Because there is a high demand for housing located near transit, but not an ample supply, TOD can promote economic development with construction and industry contracts when developers feel comfortable taking risks in the housing market after it heals from the recent economic crisis.

**Federal Programs and Policies**

Since President Obama has taken office, investing in alternative modes of transportation and promoting concepts of transit-oriented development (TOD) is a high priority on his agenda. The president assembled like-minded cabinet members, enacting the American Recovery and Reinvestment Act on February 2009, which allocated billions of dollars into new and old public transit infrastructure projects. Since adopting the bill, the U.S. Department of Transportation has invested approximately 8.4 billion dollars to transit programs and infrastructure (United States Department of Transportation, 2010).

Further, the Obama administration has created a new Office of Sustainable Housing and Communities, designed to act as an agency liaison or partner between the Department of Housing and Urban Affairs, Department of Transportation, and the Environmental Protection Agency, specifically to foster initiatives pertaining to community livability. The program is officially called The Partnership for Sustainable Communities. President Obama continued to emphasize his administration's dedication to sustainable housing and transportation solutions by placing a prominent TOD advocate as the director of the Office of Sustainable Housing and Communities. The

office's primary goal is to assist local governments in creating strong connections between housing and jobs through federal housing and transportation investments (United States Environmental Protection Agency, 2010).

The Partnership for Sustainable Communities aims to achieve six main livability goals: 1) Provide more transportation choices, 2) Promote equitable, affordable housing, 3) Enhance economic competitiveness, 4) Support existing communities, 5) Coordinate and leverage policies and investment, and 6) Value communities and neighborhoods. The partnership has fostered some of these goals through grant and assistance programs such as the DOT TIGER grants, HUD Sustainable Communities grants, and HUD Community Challenge grants, to name a few (United States Environmental Protection Agency, 2010).

The Federal Transit Authority (FTA) has developed financial assistance programs for projects specially geared towards TOD. Recent federal legislation such as the Transportation Equity Act of the 21st Century (TEA-21) and the Intermodal Surface Transportation Act of 1991 (ISTEA) granted more flexibility in what types of transit planning and investments can be funded with federal dollars. Programs such as the New Joint Development Policy, Livable Communities, Transportation and Community and System Preservation Pilot Program (TCSP), New Starts (Section 5309), and Congestion Management/Air Quality Act (CMAQ) are qualified programs to assist with the planning and implementation of TOD projects (Cervero, Ferrell, & Murphy, Transit oriented development and joint development in the United States: A literature review, 2002).

**Barriers, Challenges, and Obstacles**

Despite all of the positive outcomes and benefits transit-oriented development (TOD) can bring towns, communities, and regions, there are still real adverse barriers, challenges, and obstacles TOD projects and advocates may endure. According to Cervero, et al., three major factors act as barriers to TOD: fiscal, physical, and political (2004).

A common fiscal barrier to TOD is lender skepticism. TOD projects are not common development products and are often considered untested for investors, thus more risky, leaving TOD developers with few financing options. Another fiscal barrier to TOD is higher construction costs typically associated with attached-unit, dense nodal development. Multi-story, multi-unit buildings required more building foundation materials, specifically concrete and rebar, to accommodate multi-story buildings' additional bearing loads and weight. These costs can be especially high when structured or underground parking is involved (Cervero, et al., 2004).

Physical barriers to TOD is probably the most common challenge, as it is the dilemma of finding enough blighted or re-developable land in existing TOD-ripe urban areas, as TODs are often land-demanding projects (Belzer, et al., 2009). This can be an even larger dilemma if it involves also finding land needed for transit infrastructure, and is common given TOD's dependence on good access to public transportation. Because physical barriers can discourage developers from putting extra effort into finding land ripe for TOD redevelopment, some local governments such as San Francisco and Portland have TOD managers on staff to work directly with TOD developers, assisting

them in finding land that is zoned and priced for ripe TOD development -- saving a developer marketing research costs (Cervero, et al., 2004).

A final common barrier to TOD is obtaining political consensus between a TOD developer and the local governments and their officials. Many residents who are faced with the possibility of a new multi-story, dense development built in their neighborhood are usually very concerned about increased traffic congestion, property values, and crowded schools (Cervero, et al., 2004). Additionally, sometimes there can be political tension between transit agencies and local governments that can halt TOD projects in their tracks if unresolved.

Finally, a barrier unique to TOD is the conflict between node and place regarding transit stations within TODs. On one hand, a transit station has an obligation to function as a potentially busy transportation node, having the capacity to accommodate transferring passengers, cyclists, taxicabs, para-transit vans, pedestrians, kiss-and-ride drop off areas, and parking (Arrington & Cervero, TCRP Report 128 Effects of TOD on housing, parking, and travel, 2008). On the other hand, it is important for transit stations located in TODs to feel like a place, as it serves as a neighborhood for the surrounding residents. This type of friction has proved to be a challenging for TOD site planners and designers. There is no simple or easy solution to this dilemma, especially because every TOD is site-specific. Thus, solutions must be executed to suit individual TOD conditions (Bernstein, 2004).

**The Case for Transit-Oriented Development**

According to various recent post-economic crisis housing market studies, residential properties accessible to goods, services, and employment centers via public

transportation are in high demand. Despite those reports, the amount of available housing accessible by frequent transit service is minimal in the U.S. (Belzer, Eaton, Fogarty, & Ohland, 2008). Without some measure of reform to more compact, dense development patterns, agricultural and natural resource rich land will diminish at alarming rates-effectively putting a greater strain on where a fast-growing U.S. generation will obtain fresh food, clean breathing air, and water (Burchell, et al., 2002). Well-planned transit-oriented development (TOD) can greatly reduce the adverse impacts of existing sprawl development and guide the U.S. towards a sustainable future (Belzer, Eaton, Fogarty, & Ohland, 2008).

## Summary

In conclusion, there is a great need to reform how land in the U.S. is developed. In most cases, developers are not discouraged from wasteful land development practices that require road, sewer, and school infrastructure, frequently at the expense of local governments and taxpayers. This chapter outlined a body of evidence identifying the strong connections and implications land uses have on transportation demand and intensity. The arguments in favor of building compact, mixed-use development around transit are difficult to ignore, as oil prices increase, agricultural land decreases, and more water and clean air resources continue to be contaminated, arguably initialized and ascertained by America's fascination with the automobile.

# CHAPTER 3
# METHODOLOGY

## Methodology Overview

This study aims to evaluate and assess variable indicative criteria that will perhaps delineate what policies and programs are more likely to foster transit-oriented development (TOD) in five different case studies. A few notable TOD research authors have published this type of research analysis using similar variables, and concluding interesting theories about the effectiveness of individual TOD policies and initiatives. Other research analyzes TOD policies and programs at a site specific scale, but have conceded that since each TOD is very independent, and varies greatly from one site to another; critics have deemed some of these studies as speculative and subjective (Renne, Voorhees, & Wells, 2005). Further, the existing research methods primarily studied transit ridership statistics and land values around transit stations, whereas this study investigates many more factors often related to TOD. Therefore, given the broad scope of TOD policies and programs in the five different case studies, the study will analyze a broad scope of variable indicators in this analysis.

## Research Design

The objective of this study is to demonstrate a hypothesized strategy of measuring the success of transit-oriented development (TOD) programs and policies, thus measuring cause and effect indicators of TOD. The study's research design is a case study comparative policy analysis using quantitative data criteria indicators, but will be analyzed qualitatively using before and after data. The case study criteria values, or indicators, will be aggregated, correlated, and compared among the respective cities, theoretically delineating what indicators are associated with what type of TOD policies

and programs have been implemented, concluding which policies and programs may be more effective than others. The variable data is measured over a seven-year period, from 2000 to 2007.

**Method of Data Collection**

The study's method of data collection is similar to a time series experiment, as all of the data is from the period of 2000 through 2007, ensuring the indicator data is the most comparable. The data is from several different sources; however, the data was collected carefully so that individual indicators for different cities are from the same source to avoid conflict in variable outputs from different sources for the same variable. Additionally, major sources of data originated from national official databases or well-regarded research institutions such as the Texas Transportation Institute, U.S. Census, and the American Public Transportation Association.

**Method of Data Analysis**

For each case study, the research will outline the major programs and policies implemented prior to 2007, designed to promote and foster transit-oriented development (TOD). The study also includes graphs and charts of the variable indicators that were reported for years 2000 and 2007 to analyze trends, patterns, and changes that may have resulted from a case study's TOD programs and policies. Since each case study has considerable ranges in population, the analysis of trends and patterns in the indicator data is based on the percentage of change as opposed to sums of variable data. The analysis ranges for each variable are respective to the minimum and maximum ranges of each case study instead of a standard range for each variable in

each case study, allowing a greater comprehension of even the slightest change in noted patterns and trends.

## Types of Case Studies Selected for This Study

Each case study was chosen based on a few standards necessary to conduct a reasonable comparative analysis of transit-oriented development (TOD) programs and policies. First, each case study had to have an established public transit system with extensive, frequent transit service, as transit is a fundamental component to any development defined as TOD. Secondly, each case study has expressed interest, and or attempted promote TOD on some municipal level through plans, policies, programs, or initiatives. The types of case studies include bus-served and rail-served TODs, outlining and comparing strategies between the two, delineating strengths and weaknesses of both. Finally, case studies were chose from different regions, states, and coasts of the U.S. to discern unique patterns or trends and include the urbanized areas of Boston, Massachusetts; Dallas, Texas; Portland, Oregon; San Francisco, California; and Washington, D.C.

### Indicative Criteria Selected for This Study

The indicator variables selected for this study are all identified in the literature review as having some sort of relationship to transit-oriented development (TOD). Some of the indicators may have stronger associations than others, but the study incorporates a wide variety of indicative criteria to achieve as much independence as possible. A few of the indicators are not applicable to every case study. For instance, one of the case studies only has bus transportation service; therefore, the light rail ridership indicator will not apply to that case study. The missing indicative criteria are only in the ridership data

for which some case studies just have one or two modes of public transportation, and others have four modes.

**Indicator Variables**

- Population: Comparing population totals will determine whether the individual case studies have experienced population growth or decline.
- Urban area: Calculating the change of the urban growth area will establish an idea of how land consumptive the case study is, especially when compared to population growth rates and density.
- Population density: Identifying increased rates of population density can be an important indicator of increasing smart, compact growth-ideal for TOD.
- Daily vehicle miles traveled (VMTs): Identifying whether VMTs have increased or decreased can be a major indication of whether a case study is endorsing or refraining from sprawl development, inferring how strong or weak connections between land use and transportation are.
- Annual public transportation passenger miles: Comparing changes between annual public transportation passenger miles and ridership statistics will identify how well received transit is for each city.
- Number of rush hours per day on major roads: Determining an increase or decrease of daily heavy traffic is key to identifying driving behavior changes.
- Annual fuel consumption: Comparing patterns of annual fuel consumption with daily VMTs can be indicative of land development patterns and practices.
- Annual congestion costs: The Texas Transportation Institute has conducted research that calculates dollars wasted to traffic congestion for major U.S. urban areas. The measured changes would indicate increases or decreases in traffic congestion levels.
- Roadway congestion index: The Texas Transportation Institute has also formulated a method of measuring roadway congestion on an index scale, contributing supplementary conclusions about congestion level patterns for each case study.
- Zero car households: Evaluating changes in households with zero cars may indicate patterns of choice lifestyle changes.
- Multi-Family Housing: Structures containing ten or more housing units to measure trends of multi-family housing construction, demonstrating housing market shifts conducive to TOD.

- Single Family Housing: Structures that are single-family detached dwelling units, used to measure trends of single-family housing construction, demonstrating housing market trends that affect TOD.
- Heavy rail ridership: Delineates increases or decreases in ridership for a few of the case studies that have heavy rail public transit available.
- Light rail ridership: Delineates increases or decreases in ridership for the case studies that have light rail public transit available.
- Commuter rail ridership: Delineates increases or decreases in ridership for a few of the case studies that have commuter rail public transit available.
- Bus ridership: Delineates increases or decreases in ridership for bus public transit.

## Limitations

Since transit-oriented developments (TOD) are usually site specific, it would have been beneficial to look at individual TOD projects within each case study city, mapping out information, patterns, and trends using Geographical Information Systems. However, that geographically- referenced data is only located in U.S. Census block group tables, and currently only available in the 2000 Census Block Group Data Set and not for 2007. Therefore, this study evaluates the variables from 2000 to 2007 to give an idea of trends, changes, and patterns since many of the policies and programs were relatively recent, most stemming from late 1990s.

## Summary

The results of this study will delineate patterns and trends in their respective case study cities, highlighting success and malfunctions of implemented programs and policies relevant to transit-oriented development (TOD). The study will analyze and compare sixteen different variables for five different case studies, providing conclusive data for policy comparison. Some variables will be compared and analyzed more than others, but all of the data will be verified back to its respective city, assimilating it to

TOD policies and programs. The comparisons and conclusions drawn in this study are arguably theoretical in nature, but aim to delineate what policies and programs promote TOD based on the variable criteria analysis in this study.

# CHAPTER 4
# TRANSIT-ORIENTED DEVELOPMENT CASE STUDIES

## Introductory Remarks

Transit-oriented development (TOD) in theory, is not a new concept. When America's first cities were emerging in the late 1800s and early 1900s, long before the mass distribution of the automobile, most cities were TODs, with dense apartment living quarters near goods, shops, services, and streets filled with pedestrians, bicycles, and streetcars. Today, TOD is defined as compact, high-density mixed-use development within a quarter-mile walk of a transit station, prioritizes pedestrians and bicyclists while providing frequent, reliable, and accessible transportation service.

This chapter will examine policies and programs aimed at promoting and fostering TOD in five U.S. case study cities: Boston, Dallas, Portland, San Francisco, and Washington, D.C. For comparison purposes, TOD programs and policies utilizing bus, passenger rail, or both, will be analyzed to hypothesize whether a particular transit mode affects the success of implementation strategies. Additionally, indicative variables will be evaluated in conjunction with each citys' TOD policies and programs to measure what policies and programs promote TOD more than others. The result of this chapter will be an overview of each case study's TOD policies and programs, which will be compared to the other respective case study analyses in the proceeding chapter.

## Boston

### Planning and Development Background

Boston has a long history of transit-oriented development (TOD) patterns, as early settlers built compact multifamily housing located near goods and employment. Nevertheless, like most American cities, Boston experienced a surge in post-WWII

growth, which became a turning point in the city's development history (Urban Land Institute Boston District Council, 2006).

In the 1950s and 1960s, there was significant historical building demolition occurring to accommodate highways and modern monolithic city architecture. This led citizens to voice strong concerns on preserving the traditional neighborhood character of the city, effectively halting construction projects in the early 1970s. Facing the dilemma on how to preserve and modernize their city, government leaders decided to invest heavily in public transit by using Interstate highway funds to improve transit (Cervero, et al., 2004).

Reinvesting in Boston's urban transit system catalyzed revitalization throughout the city. Since urban cores developed prematurely and unconsciously into optimal TODs due to early settlers' dense, walkable and parking-lot free neighborhoods, a redeveloped and more efficient transit system was crucial in revitalizing Boston's traditional urban environments. Moreover, despite rising U.S. automobile ownership rates, city officials minimized roadway expansion projects and parking lot construction to encourage commuters to use the new and improved transit system (Cervero, et al., 2004).

Further, in 1973, the EPA (Environmental Protection Agency) allowed the city to freeze parking requirements for new development, attempting to reduce air pollution. This has resulted in extremely high parking costs for Boston's automobile owners, effectively reducing automobile transportation in the city. Consequently, the freeze increased development activity as developers have higher profit margins since parking construction expenses are unnecessary (Cervero, et al., 2004).

Despite the concerted city preservation and revitalization efforts, along with the existing transit and pedestrian supportive development patterns, edge-city suburban sprawl occurred in the region anyway, and has caused increased traffic congestion and VMTs along with dwindling development densities and declining public transportation ridership (Figure 4-1) (Urban Land Institute Boston District Council, 2006). In fact, from 2000-2007, urban land area increased by 19%, whereas population growth only increased by 8% (Figure 4-1) (Texas A&M University Texas Transportation Institute, 2009). Despite an influx of suburban single-family housing the last five decades, currently, compact multi-family housing is the stronger housing market (Figure 4-2) (United States Census Bureau, 2000). According to Cevero, et al., investors have withdrawn from suburban housing and banal strip mall commercial development, instead looking to revitalize existing neighborhoods and create lasting, sustainable places (2004).

**Transit-Oriented Development Policies and Program Initiatives**

The State of Massachusetts has acknowledged these problems, and has proposed transit-oriented development (TOD) as a valuable mitigating tool in combating the physical effects of sprawl (State of Massachusetts). Table 4-1 lists and describes statewide policies and programs specifically designed to foster TOD, demonstrating Massachusetts commitment to statewide smart growth and development (Anderson & Forbes, 2011).

Statewide programs such as The Commercial Area Transit Node Housing Program, aim to incentivize residential development located in neighborhood commercial areas in close proximity to public transit. The program can be utilized in

unison with affordable housing programs and grants, with a maximum contribution limit of $50,000 per unit (Commercial Area Transit Node Housing Program Guidelines, 2006). Another notable is program Chapter 40R, specifically geared towards local municipalities, encouraging them to designate areas for infill and redevelopment by offering major incentives to promote mixed use, and compact, affordable housing (Chapter 40R and 40S explained: reaping the benefits of compact development, 2004).

Local TOD policies and programs in Boston vary, but a notable one is Article 80 zoning code, which requires transportation mitigation plans for developments greater than 50,000 square feet. This encourages large developments to utilize the existing transit infrastructure. Other local strategies include subsidizing metro passes, bicycle storage, and shuttle busses to major transit stations.

The city's commitment to TOD-focused growth also exists at the neighborhood scale. Boston uses tax foreclosure properties to acquire land for TOD in underdeveloped or blighted communities. The city conducts any repairs, remediation, or demolition work, and sells the land under the condition it will contribute to TOD.

For Boston, the transit investments proved to be the key ingredient to preserving its unique and historically rich urban character of model TOD. From 2000 to 2007, transit ridership increased in all modes except bus (Figure 4-3) (Texas A&M University Texas Transportation Institute, 2009). As a result, almost all of the city's urban cores are located within a quarter-mile of a transit station and command some of the highest rents and property values in the U.S. (Cervero, et al., 2004).

**Silver Line Washington Street bus rapid transit**

The South End of Boston has historically been a low-income neighborhood, but like many cities post WWII, experienced even more decline and degradation. The area

became economically stagnant in the late 1980s, so the Metropolitan Boston Transit Authority (MBTA) removed the elevated orange rail line in 1987 due to extremely poor ridership numbers, and promised to eventually replace it with an a high frequency alternative (Darido, Schimek, & Schneck, 2005).

Poor economic conditions persisted in the Washington Street Corridor, a historical downtown Boston thoroughfare, causing Boston's Waterfront Seaport District to accrue many vacant, crime-ridden, and blighted properties in the 1990s. Finally, in 1997, the Mayor's task force report stated the main priority was to renovate the Washington Street Corridor with upgraded streetscapes and introduce Silver Line, a Bus Rapid Transit system (Jerram & Vincent, 2008).

The MBTA chose a Bus Rapid Transit System over a light or heavy rail because The Federal Transit Administration (FTA) denied a New Starts application for light-rail infrastructure funding, deeming it cost-ineffective. As a result, city officials created The Washington Gateway Main Streets program in 1997 to encourage revitalization along the Washington Street Corridor, capitalizing on opportunities that the upgraded Silver Bus Rapid Transit Line would provide (Jerram & Vincent, 2008).

The City of Boston and the MBTA designated a design committee that made decisions on proposed station locations, shelter designs, and urban design elements. The project's design and construction drawings were completed in early 2001, and construction started later that same year. The Silver BRT Lines were planned for three implementation phases as the first phase, The Washington Street Silver Line, opened in July 2002 (Darido, Schimek, & Schneck, 2005).

The Washington Street Line was completed at grade on a 2.4 mile revitalized streetscape of the Washington Street Corridor. The line connects Downtown Crossing rail station to Dudley Square, a major transfer bus station. It employs 60-foot compressed natural gas buses embellished with stylized silver graphics, distinguishing the fleet from MTBA's regular non-rapid service bus fleet (Jerram & Vincent, 2008). The line also has fewer bus stops than a non-rapid transit route, with some buses equipped with signal priority equipment that shorten route-running times. Despite Boston's 5% decline in bus ridership from 2000-2007 (Figure 4-3) (Texas A&M University Texas Transportation Institute, 2009), these upgraded transit amenities dramatically increased Silver BRT ridership, up 96% on weekdays and 127% on weekends (Darido, Schimek, & Schneck, 2005).

Just as the Washington Gateway Main Streets Program hoped for, increased ridership in the South End sparked development interest. Between 1997 and 2004, the corridor has seen $250 million in new real estate construction and $93 million in rehabilitation, including 1,731 new or rehabilitated housing units, 128,000 square feet of new or renovated retail space, and $7 million in improvements to commercial spaces. This surge in development activity resulted in a 247% tax base increase (Darido, Schimek, & Schneck, 2005). Additionally, in 2005 many more projects were in the planning stages. Other notable renovations include an opera house, several historic houses, and hotels. Further, in 2005 the National Trust for Historic Preservation presented Washington Street with the Great American Main Street Award (Cervero, et al., 2004).

**Silver Line Waterfront bus rapid transit**

With the success of the first phase of the Silver Line, higher expectations and greater investments were made in phase two, The Waterfront Silver BRT Line. In 1999, the Boston Redevelopment Authority adopted the South Boston Waterfront Public Realm Plan, and cited the Silver BRT Line as crucial to revitalizing the corridor. The Waterfront Line opened in 2004 and travels between the Downtown South Station along the Seaport District to Logan International Airport, and employs 32 dual-mode diesel-electric vehicles. Between 1998 and 2006, approximately 4 million square feet of new development occurred in the South Boston Waterfront Area. Moreover, an additional 9 million square feet of development was planned for the area as of 2007 (Chase, Gazillo, Schimek, Smith, & Watkins, 2007).

Major transportation infrastructure supporting the Waterfront Silver Line includes three underground stations and their tunnels, The Courthouse Station, The World Trade Center Station, and South Station, and the one-mile Silver Line Tunnel, built exclusively for the Silver Line BRT fleet. The Courthouse Station and its tunnel was the most expensive to build on the Waterfront Silver Line, with capital costs of $110 million (Darido, Schimek, & Schneck, 2005). The Courthouse station was named for its adjacent close proximity to the John Joseph Moakley Courthouse. The site north of the Courthouse Station is Fan Pier, located on the Boston Harbor. Given its optimum location, Fan Pier is currently one of the largest developments in the Seaport District at with investments totaling $3 billion dollars. Upon completion, Fan Pier will consist of three office buildings, a luxury hotel, over 1 million square feet in luxury residences, more than 300,000 square feet of street-level retail and restaurant space, a neighborhood park, a 6-acre marina, and a 65,000 square foot art museum (Jerram &

Vincent, 2008). Additionally, abutting the Fan Pier site is the 23-acre Seaport Square project, which is in the planning stages for a 20-block, 6.5 million square foot complex, with 2.3 million square feet of residential space, 1.4 million square feet of commercial space, 1.2 million square feet of retail and entertainment space, 600,000 square feet of designated hotel space, and 700,000 square feet of education and cultural space. Further, Seaport Square is also planning to implement streetscape improvements with wider sidewalks and landscaped medians (Chase, Gazillo, Schimek, Smith, & Watkins, 2007).

The land surrounding the Boston World Trade Center Station has seen significant development in the last decade. The most common use has been office, as commercial tenants want their employees to have easy access to transit. The three major adjacent developments are the World Trade Center Complex, Waterside Place, and Boston Convention and Exhibition Center (Chase, Gazillo, Schimek, Smith, & Watkins, 2007).

The Boston Convention and Exhibit Center opened in 2004 as the largest convention center in the northeastern United States, boasting 526,000 square feet of exhibit space. Further, the World Trade Center Complex consists of three office buildings, the World Trade Center Boston, World Trade Center East, and the World Trade Center West, totaling approximately 1.9 million square feet of office space, built for $385 million. Additionally, complimenting the office convention space, there is the flanking 426-room Seaport Hotel, built in 1998 for $120 million (Jerram & Vincent, 2008).

Waterside Place is another project adjacent to the World Trade Center station that is striving to add a retail and residential land use component to the area. The project

was originally going to have a high retail component, but due to the economic decline, the project has shifted to an increase of rental residential space instead. Construction is slated to begin in 2011 and include 234 rental apartment units, 72,000 square feet of retail space, and 14,000 square feet of office space for a cost of $132 million (Boston Redevelopment Authority, 2010).

The MBTA implemented the Boston Silver Line to catalyze development along the bus routes to increase ridership and revitalize the surrounding neighborhoods, promoting transit-oriented development (TOD) in the South End Community. Despite extreme development infrastructure challenges, 3.9 million square feet of development activity had occurred within a quarter mile of Silver Line transit stations as of 2006, with projections of another 5 million by 2010 (Chase, Gazillo, Schimek, Smith, & Watkins, 2007). Moreover, although bus ridership has declining numbers from 2000 to 2007, MBTA is projecting increased ridership with an increase of development activity, expecting to improve with a future economic recovery (Texas A&M University Texas Transportation Institute, 2009).

## Dallas

### Planning and Development Background

According to the literature, many policy makers in the city of Dallas, the surrounding region, and the State of Texas are slightly wary of transit-oriented development (TOD) as a major development prototype or sustainable concept, as it is still a relatively new development alternative-especially in the U.S. Sunbelt region (Cervero, et al., 2004). The lack of TOD policies, programs, or guidelines for Dallas provides strong evidence that almost all of TOD success stories in Dallas can be attributed to the private sector or local government's ”bargaining” initiatives. However,

the research does contain one known program that is perhaps not specific to TOD, but certainly encourages it. The program is funded by the North Central Texas Council of Governments and is known as the Sustainable Development Funding Program for the Dallas and Ft. Worth areas, and serves as a platform for public-private partnerships for transportation and infrastructure agreements (Sustainable Development Funding Program, 2011).

The Dallas-Ft. Worth area has experienced tremendous TOD growth in the last few decades. With population, congestion, and VMTs on the rise from 2000 to 2007 (Figure 4-4), a few Dallas suburban communities are looking for livability alternatives to avoid additional repercussions of these growing concerns and congestion costs growing 85% in seven years (Figure 4-4) (Texas A&M University Texas Transportation Institute, 2009). Dallas Area Rapid Transit (DART) is the transportation primary agency that manages and provides light rail and bus transportation for the Dallas region. Looking to increase ridership, DART has conducted major efforts to seek partnerships with the public and private sector to promote TOD around their stations, mostly in the form of smart, compact multi-family housing and complimentary commercial development (Dallas Area Rapid Transit, 2008).

Similar to many U.S. cities, Dallas has declining population densities but an increasing population (Figure 4-5), similar to other Sunbelt cities, so identifying opportunities for TOD was challenging from the beginning (Ohland, 2004). Despite regional low-intensity development, DART has embraced challenges associated with low density suburban TODs, as they are currently making some of the largest public transportation investments in North America (Dallas Area Rapid Transit, 2008).

As of 2007, DART's rail systems catalyzed more than 4.26 billion dollars in new development. This was especially impressive as DART had only been offering passenger rail service since 1996. The early success of Dallas TOD was aggressively advertised, and confirmed by a University of North Texas real estate market research study in 1999. The study confirmed that properties within a quarter mile of DART stations had 39% higher property values when compared to similar properties outside of the quarter mile radius. A 2003 follow-up study found TOD properties had increased 53% more than similar properties not served by rail (Ohland, 2004).

Further, public transit miles and passenger rail ridership has increased dramatically (Figure 4-6) (American Public Transportation Association ridership report archives, 2011). Since DART's passenger rail initiatives, Dallas has had the most TOD success with two specific projects: Mockingbird and Addison Circle transit stations (Cervero, et al., 2004). This success has prompted a widespread interest in TOD from other local Dallas-area governments in the region including Carrolton, Plano, and Richardson (Dallas Area Rapid Transit, 2008).

**Transit-Oriented Development Policies and Program Initiatives**

**Carrolton**

Carrolton is a northern suburb city of Dallas that is characteristic of an edge-city suburb, developing mostly from greenfield development and annexation of rural land. As the city continued to grow in the 1970s and 1980s, and greenfield land was becoming sparse, city officials realized the need more sustainable development patterns to accommodate future growth. Since DART was making major planning efforts at that time, Carrollton officials decided to plan with DART to promote more compact

development, using transit-oriented development (TOD) as the model goal (Carrollton TOD History and Background, 2010; Cervero, et al., 2004).

The city began concerted efforts to develop new TOD comprehensive plan policies, design guidelines, zoning amendments, and policy language to compliment DART's rapid growth in the region. Efforts began with non-stop express bus service to downtown Dallas in 1984. That same year, voters approved a one-cent sales tax increase to fund additional transit opportunities. Since then Carrolton has continuously voted to increase taxes to fund better transit access and major DART capital improvements (Carrollton TOD History and Background, 2010).

First, the city developed the Old Downtown Carrolton Plan in 1988 to strategize ways to increase the local tax base and revitalize the downtown area, despite the lack of accessible land for development ( Carrollton Transit Oriented Development, 2010). As DART continued to increase transit service in the area, Carrolton realized the potential of increasing densities around transit access points to catalyze development opportunities (Cervero, et al., 2004).

Carrolton streamlined additional TOD planning efforts including an updated Downtown Carrolton TOD Plan in 2002, a TOD Transportation and Parking Master Plan, a TOD Drainage Master Plan, and a TOD Infrastructure Master Plan (Carrollton TOD History and Background, 2010). The Federal Transit Agency rewarded DART's and Dallas' regional TOD initiatives, approving a $700 million Full Funding Grant Agreement (FFGA) that would support a 21-mile northeast-southeast connector line called the green line. Carrolton received approximately $360 million for their portion of

the green connector line, which opened in December 2010 (Carrollton TOD History and Background, 2010; Dallas Area Rapid Transit, 2008).

The City also adopted a new Transit Center Zoning District Ordinance with extensive TOD design guidelines. These land development regulations were created to dissolve tensions between a transit node and place where people live near transit -- often a contentious problem associated with TOD. The code employs specific language about building form and urban design guideline standards, even emphasizing the importance of mixed use, as well as outlining strict standards for parking and drop off areas (Carrollton Transit Center Zoning District, 2005).

Carrollton also updated their comprehensive plan, known as Carrollton by Design, specifically to address the following TOD strategies:

- Promote pedestrian friendly environments
- Encourage diversely designed compact housing
- Provide safe and adequate access to transit stations
- Create and preserve open space throughout the downtown TOD area

The plan also proposes a multitude of parking mitigation strategies, design guidelines, and streetscape standards (Downtown Carrollton Transit Oriented Development Plan, 2008).

Carrollton's substantial TOD planning efforts led to DART joining into a partnership with the city to promote TOD by conducting all of the necessary preparatory work needed to extend the light rail system and construct three transit stations (Carrollton TOD History and Background, 2010). According to a 2010 market study, Carrollton is projected to attract more than 5.9 million square feet of office space, approximately 24,000 residential units, and 4.5 million square feet of retail space in the coming decade

(Leland Consulting Group, 2010). Carrolton's aggressive TOD planning endeavors are likely to provide favorable conditions for future private and public investment in TOD.

**Plano**

Plano is a service-based economy suburb north of downtown Dallas. As suburban sprawl took its course, campus-style office complexes abruptly infiltrated the 72-square mile town in the 1980s, diminishing commercial and residential activity from the already struggling Downtown Plano. Community leaders wanted reorganize the influx of growth, capitalizing on redevelopment opportunities to create development patterns consistent New Urbanism and transit-oriented development (TOD) guiding principles such as compact, pedestrian-friendly development (Cervero, et al., 2004).

The focus was on revitalizing the downtown with a new zoning code that promoted mixed-use, set parking maximums, updated architectural design guidelines, increased density, and reduced setback requirements. On the other hand, officials wanted to conduct planning studies on way to spur downtown development, but not contribute more traffic congestion that already plagued the city at that time (Turner, 2006).

In 1983, DART announced interest to provide light rail service to Plano. Given that service would not begin until 2010, Plano officials had ample time to plan with DART in capitalizing on this new growth opportunity (Cervero, et al., 2004). Initial efforts included $800,000 in streetscape and other aesthetic improvements in the downtown core (Ohland, 2004). The city proceeded to draft the 1991 Downtown Development Plan, adopting policies that recommended preserving and enhancing downtown to create a mixed-use district, and develop primarily through infill and redevelopment projects (Turner, 2006).

To complement the new development plan, a new zoning code was adopted to amend the existing suburban-friendly setbacks, permitting of heavy commercial uses, and generous parking requirements -- all of which are problematic to smart, compact growth. The new zoning code proposed an 80-acre downtown core district, with four-story building heights, limited setbacks, and restrictive parking. The plan recommended additional streetscape enhancements including brick pavers, ornate lighting, and landscaping (Turner, 2006).

In 1995, Plano acquired full-time DART bus service, prompting a strategically placed "destination" platform for transit patrons within a quarter-mile of the mixed-use zoning district. This strategy optimized opportunities for ridership and downtown pedestrian traffic, as the platform essentially became Plano's transit hub, known as Eastside Village (Cervero, et al., 2004).

To ensure future downtown development was a complementary gesture to Phase I, the city drafted supplementary policies and concepts to the original 1991 Downtown Plan. The revised plan, “Downtown Plano: A Vision and Strategy for Creating a Transit Village,” was adopted in 1999 and emphasized how development should be specifically oriented, and easily accessible to the Transit hub at Eastside Village (Turner, 2006).

The transit hub at Eastside Village sparked private sector developer interest almost immediately. The city decided to contract with Robert Shaw, who specialized in large-scale urban infill development projects. Phase I of Eastside Village contains 234 loft apartments and 15,000 square feet of ground-floor commercial space located in three and four-story buildings. Additionally the site has two performing arts centers, a

museum, and a park. While project planning was underway, Plano sought ways to expand it, continuing to capitalize on the DART platform hub (Cervero, et al., 2004).

Eastside Village II plans were underway immediately after the positive market response to the first phase. The same developer purchased the 2-acre adjacent property from an old utility company, conveniently located beside an additional acre of vacant city-owned land. Thus, there were 3-acres available for an Eastside Village expansion project. The second phase of Eastside Village, similar in size to the first phase, contains 229 loft apartments and 25,000 square feet of ground-floor retail. The second phase was completed a year and a half after the first and both are at 98% capacity (Cervero, et al., 2004).

The Eastside Village TOD projects doubled the size of the original downtown area and have been a catalyst for additional redevelopment efforts in the area (Ohland, 2004). The city has continued to implement streetscape improvements with new lighting, street furniture, and decorative pavers. Other promotional development tools used were a TIF district, a "neighborhood empowerment" zone that reduces impact fees, and a historic preservation tax-abatement program. Plano's initiatives have paid off and have resulted in DART extending their red light rail line, providing light rail service to the city of Plano (Cervero, et al., 2004).

**Addison Circle**

Addison Circle is an interesting, untraditional transit-oriented development (TOD) case study in Dallas, as it is only served by bus, not light rail. In the 1970s, the community of Addison was a popular restaurant and entertainment district, but also was subject to degradation and economic decline due to decentralized suburbanization by the early 1990s. To curb further decline and a lacking identity, the town held visioning

exercises, "Vision 2020," to determine how and where to guide future growth. The residents insisted to aim for developing a dense urban neighborhood to attract DART transit services. The visionary concept was refined into policy language in Addison's comprehensive plan update in 1991, which led DART to construct an upscale bus transit facility on the last large greenfield tract of land (Cervero, et al., 2004; Ohland, 2004).

Since developer Robert Shaw of Columbus Realty Trust had built other successful TOD projects in the region, he was a prime candidate for Addison to select for a public-private partnership opportunity to develop the greenfield property into a project that would appease the vision Addison was seeking. Shaw hired RTKL architects and planners to assist the city in drafting a new "urban center" zoning district ordinance and progressive design guidelines adopted in 1995, and was very involved with public meetings conducting citizen input for the project. Addison entered into a joint development agreement with Shaw that required $9 million in public TIF-financed infrastructure improvements including an art exhibit plaza, sidewalks, parks, streets, and streetscape features, and in return, Shaw's company would assume all of the risk, and finance the proposed development (Ohland, 2004; Cervero, et al., 2004).

Addison Circle straddles a linear park and is located near multiple on-site pocket parks, complementing the newly coded ornate European building forms, all of which are very pedestrian friendly. The 80-acre project was built in three phases, and at completion in 2010, is expected to have 4,000 multi-family residential units at 55 units per acre, 4 million square feet of office and commercial, 250,000 square feet of retail space, and a six-level parking garage. Addison Circle has catalyzed additional adjacent

development projects, spurring additional economic growth in Addison. The success of Addison Circle can be attributed to the shared TOD vision between Robert Shaw, RTKL & Associates, and the town of Addison (Cervero, et al., 2004; Ohland, 2004).

**Mockingbird Station**

Mockingbird station is a mixed-use urban center that has emerged as a model suburban transit-oriented development (TOD) project, also serving as a bus and rail transit node. The project was a risk for developer Ken Hughes, considering there was nothing like it in Texas at the time. Additionally, private development dollars financed the project-no public subsidies were used. The developer did not campaign for public funding because he simply wanted the project to be straightforward, not delayed by public-involvement-red-tape. Coincidently, the Mockingbird Station land was zoned mixed-use, thus no land-use change was needed for the project.

Mockingbird Station is comprised of 211 loft-style apartments, 150,000 square feet of office space, a movie theater, and 180,000 square feet of retail space. There are 1,440 parking spaces, most of which are located underground. Additionally, most of the buildings are adaptive reuses and retrofitted to for mixed-use, common in TODs. The only flaws found in the research were Mockingbird's pedestrian connections to the project's surrounding context. However, this matter is currently being addressed with future intentions to widen sidewalks and implement traffic calming strategies.

DART is working with many suburban communities to orient transit service to planned infill and TOD projects. Many of these suburban cities and towns are the proactive players in implanting strategies to attract TOD investment in their communities. DART has complemented their efforts with a TOD Guidelines manual that have specific urban and transportation design guidelines to support TOD (Cervero, et

al., 2004). Despite the widespread low-density development trend prevalent across the southeast, a few Dallas communities have recognized the value-capture opportunities associated with TOD, adopted plans and programs, and essentially becoming a model for other southeastern suburbs in demonstrating what strategies can be utilized to execute and implement TOD.

## Portland

### Planning and Development Background

Portland has had a longstanding ideology that development should occur around transit. The 2040 Growth Management Strategy (Region 2040) focuses on building up-not out, and leverages this ideology with a fixed Urban Growth Boundary (Table 4-2), which focuses growth in existing urban areas. The strategy requires local governments to limit parking and adopt conducive zoning and comprehensive plan changes that are consistent with the growth management strategy (Livable Portland: land use and transportation initiatives, 2010). By 2040, two-thirds of jobs and 40% of households are projected to be located near centers and corridors served by buses and light-rail transit (Cervero, et al., 2004). These efforts are already paying off, as the congestion index has actually decreased by 1% (Figure 4-7), and population density has increased 9% (Figure 4-8) from 2000 to 2007 (Texas A&M University Texas Transportation Institute, 2009). Additionally, “the growing up, not out” (Livable Portland: land use and transportation initiatives, 2010) smart growth initiative can be observed when comparing the region’s ratio of population increase of 17% to additional incorporated urban land increase of only 7% (Figure 4-7) (Texas A&M University Texas Transportation Institute, 2009).

Using community reinvestment as a guiding principle in growth and development initiatives, in 2004 Portland opted to build a major light-rail line along corridors ripe for urban revitalization, instead of locating it within the right-of-ways adjacent to Interstate 5. The decision made intended to support quality development over speed efficiency, further emphasizing Portland's commitment to quality over quantity regarding development (Arrington, Portland's TOD evolution: from planning to lifestyle, 2009).

Almost every light rail station and corridor is a transit-oriented development (TOD) because of Portland's strong commitment to smart growth and development. A major lesson to take from Portland's success with TOD is that planning is not enough; it must include specific strategies to implement TOD projects. Portland's transit authority, TriMet, and Portland's urban renewal agency, Metro (the regional government), and the Portland Development Commission (PDC) are the major policy-making agencies regarding TOD projects in the region (Arrington, Portland's TOD evolution: from planning to lifestyle, 2009). Their main objectives are developing incentives to foster TOD, specifically encouraging projects that have higher densities, more amenities, less parking, and greater affordability (Arrington, Portland's TOD evolution: from planning to lifestyle, 2009; Cervero, et al., 2004).

Additionally, TriMet has been fundamental to Portland's TOD success stories. In addition to sometimes being a direct participant in development, the agency has extensively funded, advocated, and educated about facilitating TOD through the region's vision of "growing up, not out" (Livable Portland: land use and transportation initiatives, 2010). TriMet has no special funding of for TOD and has to improvise with

creative way of financing projects. The agency has utilized TOD as a platform to be a successful organization. Their TOD toolbox includes incentives such as:

- Selecting rail alignments with an eye towards TOD
- Modifying station locations to facilitate supportive development
- Funding local government planning to get supportive policies in place
- Writing down land costs to get better design, density, and affordability into TODs
- Turn park and rides into TODs
- Investing the savings from rail construction to create TODs

These incentives were largely put in place to reduce the need of subsidizing TOD projects and to allow ample opportunity for the private sector to get involved (Arrington, Portland's TOD evolution: from planning to lifestyle, 2009). TriMet‘s efforts have led to escalating rates of transit ridership that have even eclipse increasing population growth and VMTs (Figure 4-7 and 4-9) (Texas A&M University Texas Transportation Institute, 2009).

**Transit-Oriented Development Policies and Program Initiatives**

**The 1972 Downtown Plan**

Like the other cities in this study, Portland experienced downtown decline and degradation in the 1950s, consisting mostly of railroad yards and industrial land uses located along the Willamette River. The city recognized the need for concerted planning efforts to foster downtown reinvestment. The mayor appointed a citizen advisory committee to consultants and city staff in creating the 1972 Portland Downtown Plan. The plan recommended regulations that would preserve a significant portion of the waterfront for public use, and create tax incentives, subsidies, and density bonuses to incentive development in the downtown core (Cervero, et al., 2004; Livable Portland: land use and transportation initiatives, 2010). Other recommendations include creating major public places in the form of downtown squares and plazas. The most compelling

recommendations, especially considering the period in which the plan was created, were to discourage automobile use and called for major public transportation infrastructure investments. Further, the proposed theme in the plan was for Portland to become a 24-hour downtown, with affordable housing and a generous amount of ground floor retail uses (Livable Portland: land use and transportation initiatives, 2010).

**Station area planning**

The Downtown Plan's recommended transportation improvements evolved into the Portland Mall in 1978, providing frequent bus service to most of downtown. Developing the mall solidified Portland's commitment to urban revitalization, and promoted a pedestrian friendly district by making restricting automobile access onto public transit-only streets (History of the Portland mall, 2011).

Portland's Eastside light-rail line was designed in the 1970s, yet the concept of transit-oriented development (TOD) was not considered until station area plans opened for service in 1986. The city considered the TOD potential of the Eastside project when planning the Westside light-rail project. The Westside station alignment locations were strategically placed in areas the city decided future urban development would be most suitable. Although the designated future development areas were literally vacant greenfields, the Westside light-rail line attracted more than 7,000 transit-supportive residential units by 1998. Portland officials have attributed this particular success example to careful station area planning. Core objectives of station-area planning include the following (Arrington, 2009: 110):

- Reinforcing the public's investment in light rail by ensuring (via re-zoning) that only transit-friendly development occurs near stations
- Recognizing that station areas are special places and the rest of the region is available for traditional development

- Seizing the opportunity afforded by rail transit to promote TOD as part of a broader growth management strategy
- Re-zoning the influence area around stations to allow only transit supportive uses
- Focusing public agency investment and planning efforts at stations with the greatest development opportunity
- Building a broad-based core of support for TOD with elected officials, local government staff, land owners, and neighborhoods
- Setting up a self-sustaining framework to promote TOD once the planning is complete

Portland's elected officials, along with visionary guidance from Metro, the region's regulatory planning body, have been involved in fostering TOD since station area planning began for the Eastside project in 1980. Metro has three full-time staff members currently dedicated to the Metro's TOD program, which are responsible for organizing and contracting future TOD projects that will contribute efforts to the Region 2040 vision (Arrington, Portland's TOD evolution: from planning to lifestyle, 2009).

**Statewide policies and programs**

The state of Oregon has adopted many programs, policies, and incentives (Table 4-2) to encourage and foster smart growth principles that encompass planning tools utilized to implement transit-oriented development (TOD) projects. The first major initiative was Senate Bill 100, the Oregon Land Use Planning Program, which established a statewide partnership, leading local governments to define urban growth boundaries in which to restrict development, limiting sprawl and depletion of resources. The state went on to create more programs that incidentally promoted TOD, such as the is the Metropolitan Transportation Improvement Program (MTIP), which funds Metro's TOD Program with a biannual budget of 2.5 million dollars. The MTIP funds are mostly used for site acquisition, allowing the program to write down the land costs to

developers committed to building TOD projects on the site. (Arrington, Portland's TOD evolution: from planning to lifestyle, 2009; Livable Portland: land use and transportation initiatives, 2010).

Another important statewide planning tool is the Transportation Planning Rule (Table 4-2), which outlines goals and objectives to make stronger land use connections with transportation. However, the plan requires strategies to relinquish dependency of the automobiles, emphasizing the importance of public transportation to existing and new development. This plan also calls for target achievements in reducing VMTs, encouraging bicycle and pedestrian friendly environments, and producing transportation plans that outline roadway improvements for non-automotive forms of transportation (Livable Portland: land use and transportation initiatives, 2010).

Additionally, The Transportation and Growth Management Program (Table 4-2) provides a wide variety of technical and financial assistance to local governments to create, adopt, amend, and refine plans to improve smart growth initiatives such through improving transportation plans, land development policies, and urban design standards (Livable Portland: land use and transportation initiatives, 2010). The state also created a tax exemption program in 1995 (Table 4-2) that offers incentives for compact, high-density development. Finally, the Vertical Housing Program (Table 4-2) also offers incentives to developers to build high-density residential development with major property tax breaks for a ten-year period (Livable Portland: land use and transportation initiatives, 2010).

**Regional policies and programs**

The 2040 Growth Management Strategy was adopted in 1994 (Table 4-3), and mandated growth be allocated, redistributed, and redeveloped in exiting urban

communities, or areas within the predefined UGB in close proximity to public transit. The governing body of the UGB is Metro, a regional elected official government with regulatory power regarding growth and development in three counties and twenty-five cities in the Portland region. One of the most successful programs in regard to implementing well-received transit-oriented development (TOD) projects is Metro's TOD Implementation program (Table 4-3). The TOD program was created 1998 and has mastered the challenging task of crafting joint development agreements between developers and local governments to produce vibrant TOD communities (Cervero, et al., 2004). Through the TOD program, Metro has facilitated more than $300 million in development, including 2,100 residential units, 100,000 square feet of retail and 140,000 square feet of office space (Livable Portland: land use and transportation initiatives, 2010).

**Local Portland policies and programs**

Portland's most prominent transit-oriented development (TOD) success story, The Pearl District, would not have been possible without local Portland TOD incentives and programs, despite aggressive regional and statewide efforts. The Pearl District's success can be attributed to a pioneering Master Development Agreement between the city and a private developer (Cervero, et al., 2004).

The developer owned a large amount of land in a contaminated industrial area, which straddled downtown and the Willamette River. For years, the area had been identified as having significant redevelopment potential, and could be a profound catalyst to downtown redevelopment initiatives. The city created an urban renewal district that used Tax Increment Financing (TIF) (Table 4-4) as a vehicle to fund site and infrastructure improvements, leveraging the developer to build at higher densities and

include affordable housing into the project (Cervero, et al., 2004; Livable Portland: land use and transportation initiatives, 2010).

**The Pearl District**

Confident in the transit-supportive development trend by the early 1990s, Portland officials began planning efforts for the Portland Streetcar, with the intention of revitalizing the Central City (Pearl District). Since its opening day in 2001, the Portland Streetcar has catalyzed over 3.4 billion dollars in new development, including more than 10,212 residential units at 120 housing units per acre along the Pearl District route (Cervero, et al., 2004), making it the region's most successful transit-oriented development (TOD) investment (Arrington, Portland's TOD evolution: from planning to lifestyle, 2009). In fact, from 2000 to 2007, multi-family housing stock has increased by an astonishing 54%, with single family housing decreasing by 2% (Figure 4-8) (United States Census Bureau, 2000; United States Census Bureau, 2007).

Once an industrial warehouse and rail yard district, the Pearl District now boasts Portland's densest residential neighborhoods, complemented by vibrant mixed-use development, parks, cafes, galleries, and restaurants. The success of the Pearl District project can be arguably attributed to the site of the project, as it was located where the initial construction of the Portland Streetcar was first began, thus development speculation catalyzed redevelopment on a large scale (Arrington, Portland's TOD evolution: from planning to lifestyle, 2009). Additionally, revitalizing the Pearl District dramatically increased public transit ridership (Figure 4-9) (Texas A&M University Texas Transportation Institute, 2009).

At completion, the city expects Pearl District to have 5,500 residential units, one million square feet of commercial and retail space, and to create 21,000 jobs. The

primary goals desired from the agreement were to promote transit use, increase density, create a vibrant district to attract and support new business, preserve historic buildings, and foster the arts (Cervero, et al., 2004; Arrington, Portland's TOD evolution: from planning to lifestyle, 2009). Cervero, et al., considers Portland to be the model TOD in the U.S., as the city has retrofitted the downtown and area suburbs with compact urban development connected by extensive public transit lines, truly enabling Portland residents to become automobile independent (2004).

## San Francisco

### Planning and Development Background

Plagued with increasing traffic congestion, population, sprawling development (Figure 4-10), and unaffordable housing California has embraced transit-oriented development (TOD) as a major mitigating, smart growth tool (Cervero, et al., 2004; Renne, 2008). The San Francisco Bay Area is developed at higher densities in general when compared to other urbanized regions in the U.S. (Figure 4-10), however, it was not immune to the suburban sprawl phenomenon in the 1960s, and consequently has encountered many of the same difficulties accommodating growth (Dittmar & Ohland, 2004).

The state has invested $14 billion in public transportation in the last 25 years, implementing light rail, heavy rail, and commuter rail systems statewide. California's investment in public transportation was primarily because of increasing concern over air quality and traffic congestion, which can be observed with the increase of fuel sales and VMTs from 2000-2007 alone (Figure 4-10) (Cervero, 1998). The San Francisco Bay Area currently boasts more than 40 different transit agencies that provide bus, light rail, heavy rail, commuter rail, cable car, streetcar, and ferry public transit service. The

region had experienced ridership decline in the late 1980s and 1990s due to decentralization of urban areas, as people were being dispersed farther from transit stations and routes. However, as congestion increased in the last decade, overall transit ridership has increased (Figure 4-12), providing a sturdy platform for future TOD (Cervero, 1998; Texas A&M University Texas Transportation Institute, 2009).

## Transit-Oriented Development Policies and Program Initiatives

### Statewide policies and programs

Given California's significant investment in statewide mass transit, several state policies and programs have been created to capitalize on the state's transportation investments. The Community Based Transportation Planning grant program (Table 4-5) is sponsored by the California Department of Transportation, and allocates up to $3 million annually to local governments, regional planning or transit agencies, and universities to create plans that will strengthen land use and transportation relationships (Statewide transit oriented development study: Factors for success in California, 2002; Anderson & Forbes, 2011).

One of California's most successful transit-oriented development (TOD) strategies is the TOD Housing Program (Table 4-5), sponsored by the California Department of Housing and Community Development. This program provides low-interest loans for rental housing, residential development for developers, and mortgage assistance for aspiring unit homeowners. The housing must be located within a half-mile of an existing or proposed transit station. As of 2007, a total of $285 million in funding was available for three years (Anderson & Forbes, 2011; Transit oriented development housing program guidelines, 2007)

Another state TOD initiative, The 1994 California Transit Village Development Planning Act (Table 4-5) had intentions to provide local governments with financial incentives to create plans that directed new development near transit stations, allowing density bonuses and expedited permit processes as major incentives. The Act was somewhat controversial in the California legislature, and did not ultimately obtain funding for distribution. In fact, since the bill was approved, no major TOD projects have used the Act's guidelines for grant applications (Cervero, 1998).

Another notable TOD policy initiative is the Downtown Rebound Planning Grant Program (Table 4-5), which can be used for TOD, but is also used for urban infill and adaptive reuse for high-density housing projects as well. The California Department of Housing and Community Development sponsors the grant, and in recent years has not had available funding (Renne, 2008).

**Regional policies and programs**

The Bay Area has been serious about public mass transit for decades. However, achieving consensus among nine county and 100 city governments about transportation, growth management, and environmental quality has been challenging (Cervero, et al., 2004). The Association of Bay Area Governments (ABAG) is the regional planning agency of the nine bay area counties including Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo Counties (Association of Bay Area governments overview). In 2000, ABAG facilitated a visioning process with other Bay Area governmental entities, including the Metropolitan Transportation Commission (MTC), to foster sustainable communities in the Bay Area. That planning initiative led to policies focused on promoting a better housing balance, open space preservation, and focusing land development in existing urban areas in close proximity

to transit. ABAG's policies are more goal-oriented as they are not a regulatory agency. ABAG was the principle regional transportation-planning agency for the Bay Area until California State Legislature created the MTC in 1970, alleviating ABAG from project disbursement responsibilities (Cervero, et al., 2004).

In 1988, the MTC founded the Transportation for Livable Communities (TLC) program (Table 4-6), committing funding to projects that had strong land use and transportation implications, "to strengthen the link between transportation, community goals, and land use" (Cervero, et al., 2004, p. 385). The program utilizes community-based input to develop transportation projects that strived to revitalize urban neighborhoods, commercial districts, downtown cores, as well as foster transit neighborhood corridors. Annual funding is approximately $27 million per year to assist in transit adjacent projects, specifically infill-oriented projects (San Francisco Bay Area transit oriented development study: Review of existing transit oriented policies, 2004).

Additionally, the TLC program primarily disperses capital grants, planning grants, and the Housing Incentive Program (HIP). The HIP program (Table 4-6) was modeled after a San Mateo City/County Association of Government's (C/CAG) program, known as the TOD Incentive Program (Table 4-6). The HIP program encourages municipalities to build new development near transit, offering $2000 for every bedroom within one-third of a mile of transit, requiring a minimum density of 40 DU per acre. The C/CAG has had some success with the HIP, using it as a planning tool to incentivize TOD. Moreover, the size and scope of the development coincides with the grant money available to the project (Cervero, et al., 2004).

"TLC capital grants are an excellent example of directing transportation dollars to support smaller-scale capital projects that can help promote transportation choices as well as support land use changes in the form of infill housing and transit-oriented development" (San Francisco Bay Area transit-oriented development study: Review of existing transit-oriented policies, 2004, p. 3). Despite some TOD success with the TLC program, project funding is limited, and more grants and financial incentives are needed to accommodate the transit investments and affordable housing challenges in the Bay Area (Cervero, et al., 2004).

Another notable program, C/CAG's TOD Housing Incentive Program (Table 4-6) strives to foster and promote high-density housing projects with good access to transit services, facilitating better connections with land uses and transportation. Although the title of the program seems housing oriented, the program actually rewards high-density housing projects with funding for transportation projects instead. The grant will provide projects with transportation funding for up to $2000 per bedroom, with an extra $250 per affordable bedroom (Program guidelines for The Transit Oriented Development Housing Incentive Program, 2010).

Finally, the most recent TOD promoting endeavor is the MTC's Policy for Regional Transit Expansion Projects (Table 4-6). This particular program uses urban form and development densities to determine funding needed. Each station must create a station area plan that outlines guidelines regarding density thresholds, parking, and housing, employment, and design standards. The primary focus of the program is to ensure each station is meeting a certain density threshold needed to support surrounding development and ridership. If the mandated conditions are met, the program has

approximately 11.8 billion dollars to expand transit to a proposed station (MTC Resolution 3434: Transit oriented development policy for regional transit expansion projects, 2005).

Despite the many challenges associated with funding, there has been successful implementation of TOD projects in the region. San Francisco is an ideal city to promote TOD considering the wide variety of transit modes available including bus, light-rail, cable car, streetcar, heavy-rail, commuter-rail, and ferry service. The Bay Area Rapid Transit (BART) and the San Francisco Municipal Railway (MUNI) are the two major transit service providers to and from San Francisco (Cervero, et al., 2004).

**Bay Area Rapid Transit Agency**

The Bay Area Rapid Transit Agency (BART) operates 104-mile heavy rail system that services 43 transit stations, mostly in San Francisco and Oakland (BART transit-oriented development guidelines, 2003). Planners have made concerted efforts to include BART stations in transit-oriented development (TOD) planning efforts with variable success. In 2003, BART developed Transit-Oriented Development Guidelines to inform planners, local governments, elected officials, developers, and citizens about physical design criteria conducive to TOD, specifically around BART transit stations. The guidelines also outline suggested principles for transit station and parking design, prioritizing safety to bicyclists and pedestrians (Cervero, et al., 2004; BART transit oriented development guidelines, 2003).

Parking requirements have significantly hindered BART's opportunities to foster well-designed TOD projects (Cervero, et al., 2004; Arrington & Cervero, 2008). The guidelines do not address how to phase existing parking into redevelopment opportunities. This is problematic because the cost of providing parking in a project is

extremely high, especially in San Francisco with expensive land costs. Further, BART has a replacement parking policy of one-to one, adding an additional financial strain on developers that are seeking to redevelop TOD-friendly station parking lots. Moreover, by providing free parking at stations, BART contributes to lowering the cost of personal transportation, effectively hampering efforts made towards promoting TOD. Thus, many BART parking lots that are highly suitable for TOD remain vacant (Cervero, et al., 2004).

Despite some policies that prevent BART from achieving TOD, other endeavors have fostered new TOD growth in the Bay Area (Arrington & Cervero, 2008). BART has engaged in a few joint development agreements that have achieved win-win outcomes with TOD projects. For example, BART has a variety of joint development agreements ranging from ground leases on agency-owned land-swapping agreements, persuading development closer to transit stations (BART transit oriented development guidelines, 2003). BART finally acknowledged the positive potential of joint development agreements, realizing the high ridership and ground leasing possibilities associated with TOD. As a result, BART has campaigned for joint development opportunities with local and regional governments, relying heavily on community vision input. BART's decision to let communities take precedence when determining how and where TOD should be implemented catalyzed some of the most successful TOD projects in the country (Cervero, et al., 2004; Cervero, 1998).

## Washington D.C.

### Planning and Development Background

Cervero, et al., refers to Washington D.C. transit-oriented development (TOD) as a model for the nation (2004). The Washington Metro rail system is the only U.S. transit

system built specifically to organize growth and curb congestion. The congestion problems that plagued Washington D.C. in the 1970s are unique in that congestion was mounting from the sprawling suburban automobile commuters, but also within the District itself. In recent decades Washington D.C. has experienced heartier growth rates than most inner urban areas, prompting the creation of Washington Metropolitan Area Transit Authority (WMATA) in 1967 to plan, manage, and implement a new heavy rail public transportation system to accommodate growth and attempt to alleviate some of the coupled automobile congestion (Cervero, et al., 2004; Leach, 2004).

Today, WMATA is the second largest public transportation agency in the country, providing transit to Washington D.C., Virginia, and Maryland, with a 103 mile, 86-station heavy passenger rail system (Cervero, et al., 2004). The heavy rail system was constructed primarily to curb congestion and improve air quality. In the 1970s, WMATA pioneered and facilitated additional efforts by encouraging development near their stations, further increasing ridership and decreasing automobile congestion. Since WMATA was a multi-jurisdictional transit agency, thus creating ways to foster development around their transit stations was challenging, especially considering the notion was mostly in the realm of land development-not transportation. Regardless of obvious obstacles and challenges, WMATA developed a program that facilitates TOD projects through joint-development ventures, where private developers work with the transit agency to build vibrant TOD projects. WMATA's joint development program catalyzed development along the prosperous Rosslyn-Ballston corridor in the 1970s, and is a major reason WMATA has experienced continuous high ridership numbers (Cervero, et al., 2004).

Most TOD projects in the region were only possible through joint development ventures, which have proven to be exemplary resource implementation tools for often-complex TOD projects. WMATA defines joint development as a program that fosters TOD by marketing WMATA property interests in to developers with the objective of developing TOD projects. Additionally, rather than wait for TOD proposals, WMATA created a real-estate development department to seek, orchestrate, and implement joint development partnerships as well as land acquisitions and holdings. WMATA developed basic TOD guidelines, aiming to increase revenue, attract additional ridership, and expand the local tax base (Cervero, et al., 2004).

WMATA's investment in a major rail system was the catalyst for smart growth and redevelopment for the region and driven by the following principles:

- Public involvement in essential from the beginning
- A predictable development project review process is important for developers and the affected community
- Mix-use development promotes a balanced use of the transportation system
- Density supports transit use
- Design is important; so are pedestrians
- Historic preservation maintains community character
- Economic diversity is important

The region is still experiencing steady regional growth, indicated by increasing population, congestion, and VMTs from 2000-2007 (Figure 4-13). However, despite those increases, urban land area growth rates have not exceeded population growth rates (Figure 4-13), indicating population densities have not decreased (Figure 4-14) like so many other parts of the country (Texas A&M University Texas Transportation

Institute, 2009). These moderate statistics could arguably be attributed to the visionary staff from WMATA, Arlington County, Montgomery County, Virginia, and Maryland, as they realized the incredible potential of orchestrating development opportunities with uncomplicated access to an efficient mass transit system. The concerted efforts by WMATA and local area governments to encourage development near metro rail stations early on was crucial to the success of the thriving high-ridership TOD districts (Figure 4-15) in D.C., Virginia, and Maryland today (Cervero, et al., 2004; Leach, 2004).

**Transit-Oriented Development Policies and Program Initiatives**

**Rosslyn-Ballston corridor**

The earliest redevelopment effort was to revitalize the Rosslyn-Ballston corridor, a 3-mile low-density commercial strip in Arlington, VA that was also serving as a blighted commuting thoroughfare into Washington, D.C. In the 1970s, the area lost more than one-third of its population and many local businesses due to the sprawling suburbanization occurring in the region at that time. As early as the mid-1960s, local officials proposed transit-oriented development (TOD) as the vehicle to revitalize the declining suburban corridor, utilizing WMATA's plans to extend transit service to that area (Leach, 2004).

After discussing many possible concepts to fuel a revitalization campaign for the Rosslyn-Ballston corridor, the county coined the project the "bulls-eye" plan, demonstrating the proposed intensity activity that would occur within a quarter mile of the five planned transit stations and be a fifteen-minute walk from one another. The idea was to increase building heights and development densities at each WMATA transit station and make appropriate hierarchical intensity transitions to and from adjacent low-

density neighborhoods, reciprocating this intensity pattern at each station along the corridor (Cervero, et al., 2004; Leach, 2004).

WMATA's Metrorail transit lines finally extended to the Rosslyn-Ballston Corridor in the late 1970s, providing easy access to many parts of the D.C. region and Reagan International Airport. From 1972 – 2002 there was an 81% increase of assessed land value and improvements including 11,000 residential units, 16 million square feet of office, 1 million square feet of retail, and 1,900 hotel rooms (Leach, 1994). As of 2003, approximately 1.1 million square feet of commercial development and 1,400 housing units were under construction. The progressive persistence of Arlington County officials to redevelop the R-B corridor was instrumental in dissolving early, often-fierce opposition. Today, Arlington County rarely faces community challenge and opposition because of their commitment to maintaining an open dialogue with the existing community about future development decisions. Further, the county diligently seeks future joint development opportunities through a methodical analysis that delineates suitability specific to individual project portfolios.

The success of the Rosslyn-Ballston corridor is the product of a strong, progressive vision integrated with long-range planning. The immaculate attention to urban macro and micro-scale at the station, site, sector, district, and corridor reflects the existing continuity planners were initially striving for. An important lesson learned in Arlington's case is planning cannot start too early. The same planning principles used for the corridor thirty years ago, are used today but are refined to progress with the built environment.

**Arlington County**

County planners developed a methodical transit-oriented development (TOD) site classification system to determine what projects were most ripe via the market and public interest. Level 1 sites have significant private-sector interest and will require little public-sector intervention. Level two properties show some private-sector interest, but carry constraints due to some hesitancy by the local jurisdiction to move forward or to site issues. Level 3 sites suffer from lack of private-sector interest and require substantial public-sector intervention over a long period of time (Cervero, et al., 2004). This classification system helped clarify TOD suitability in terms of market feasibility to all parties involved in WMATA TOD partnerships, clarifying the level of risk for involved parties. The transparency of WMATA's and Arlington County's joint development agreements give developers a certain sense of predictability, thus the most successful TOD project in the country was championed by the two entities.

While successful development projects with high occupancy rates are optimum for economic growth, they can also produce challenges for equitable growth strategies. Arlington County's soaring property values have depleted affordable housing stock in the private market. In 1990, the county created incentives and facilitated partnerships with developers, non-profits, and property owners to build and maintain the availability of affordable housing. Additionally, the county created the "Special Affordable Housing Protection District" (SAHPD) to maintain affordable housing through density bonus incentives and requiring one-for-one replacement of affordable units in the designated areas within the Metrorail corridors (Leach, 2004).

The county also encouraged affordable housing through a program called Community Benefit Units or CBUs, which are housing units owned by nonprofits or

individuals but governed by county agreements that guarantee the units remains affordable up to 30 years. "By the end of 2001, 7.9% of the 22,708 housing units in the corridor were CBUs" (Leach, 2004, p. 135). The county has made concerted efforts to incentivize development of residential housing units since the 1970's. Since there continues to be an incoming supply of housing, attempting to meet demand has helped to maintain the area's housing stock affordability. In fact, in the 1980s new office development surpassed rates of new residential development prompting the county to implement special zoning districts requiring developers to construct residential units before building the maximum allowable of office unit density. These improvised programs enabled Arlington County to capitalize on the constant growth and development, providing a true mixed-use neighborhood with a rare equal ratio of residential housing to retail and office commercial development (Leach, 2004).

Although the county frequently prescribes specific guidelines to ensure optimum development potential, the early core planning guidelines and principles mostly remain the same. Early on, the county created a general land use plan (GLUP) and station area plans, determining where development should occur. After designating areas in the corridor for transit-oriented growth, setbacks, densities, and circulation were outlined to bolster the physical elements of the plan. Additionally, each station had an individual sector plan that addressed land use, zoning ordinances, streetscape standards, urban design, transportation, and open space guidelines within a quarter mile of each station, ensuring unique urban form and efficient function of each station. This type of micro-scale planning design at the macro-scale of transit station planning led to successful completion of station "districts.” Rosslyn, Ballston, and Crystal City serve as business

centers; Court House has emerged as a governmental center; Pentagon City has become a regional shopping center; Clarendon functions as an urban village with shops and restaurants; and Virginia Square has a cultural and educational focus. The planning tools used to create the distinct transit station personalities were targeted infrastructure improvements, incentive zoning, development proffers, and permissive as-of-right zoning (Cervero, et al., 2004; Leach, 2004).

Table 4-1. Massachusetts transit-oriented development policy and program tools

| Statewide Tools | Description |
|---|---|
| Commercial Area Transit Node Housing Program | Sponsored by the Massachusetts Department of Housing and Community Development, this program provides financial assistance to rental housing projects located within a quarter-mile of an existing or proposed transit station. |
| MassWorks Transit-Oriented Development Infrastructure and Housing Support Program | Sponsored by the Massachusetts Department of Housing and Community Development, this program provides grants for pedestrian and bicycle, housing, and parking for mixed use projects that are located within a quarter-mile from a transit station or ferry terminal. |
| Chapter 40R Housing and Smart Growth Incentives | This state program allocates direct funding to cities that create zoning districts to specifically encourage compact housing near transit, requiring 20% be used for affordable housing. |
| Chapter 40 S Smart Growth Cost Reimbursement | Supplementary to Chapter 40R to ensure receiving municipalities can accommodate increases in growth and density that occur from the Chapter 40R program. |

Source. (Anderson & Forbes, 2011)

Table 4-2. Oregon transit-oriented development policy and program tools

| Statewide Tools | Description of Policies |
|---|---|
| Urban Growth Boundary (UGB), 1979 | A central tenet of Oregon's Land Use Planning Program. Ensures a 20-year land supply inside and preserves rural areas outside the urban growth boundary. Portland's urban growth boundary includes 254,000 acres. |
| Transportation Planning Rule, 1991 | Requires metro areas to set targets and adopt actions to reduce reliance on the automobile. Directs them to implement land-use changes to promote pedestrian-friendly, compact, mixed-use development. |
| Transportation & Growth Management Program, 1993 | Promotes high-quality community planning by providing local government grants, Quick Response Teams, and Smart Development Code Assistance. Over $6.7 million in grants from federal transportation funds were provided between 1993-2002. |
| Transit-Oriented Development Tax Exemption, 1995 | Allows eligible projects to be exempt from residential property taxation for up to 10 years, The cities of Portland and Gresham have utilized this program. |
| Vertical Housing Program, 2001 | Encourages mixed-use commercial/residential developments in areas designated by communities through a partial property tax exemption, maximum 80% exemption over 10 years. |

Source. (Arrington, 2009)

Table 4-3. Regional Portland transit-oriented development policy and program tools

| Regional Tools | Description of Policies |
|---|---|
| Regional Growth Management, 1994 | 2040 Growth Concept focuses growth on transit centers and corridors inside a tight urban growth boundary. Local governments must comply with the regional plan requirements by adopting growth targets, parking maximums, minimum densities, and street connectivity standards. |
| TOD Implementation Program, 1998 | Uses a combination of local and federal transportation funds to spur the construction of TOD. The level of involvement in 12 transit-oriented developments has ranged from $50,000 to $2 million. The primary use of funds has been for site acquisition and transit-oriented development easements. |

Source. (Arrington, 2009)

Table 4-4. Local Portland transit-oriented development policy and program tools

| Local Tools | Description of Policies |
|---|---|
| Joint Development, 1997 | TriMet has written down the value of land reflecting "highest and best transit use" to leverage three innovative infill projects along the Westside and Interstate LRT. |
| Tax Increment Financing (TIF) | The city of Portland has used TIF for transit-oriented development in Urban Renewal districts to make public investments, increase density, and secure affordable housing. |
| Westside Station-Area Planning, 1993-1997 | TriMet and Metro funded preparation and adoption of plans by local governments for the area within a half mile of stations. Plans included minimum densities, parking maximums, a design overlay for building orientation to transit, and prohibition of automobile-oriented uses. |

Source. (Arrington, 2009; Cervero, et al., 2004)

Table 4-5. California transit-oriented development policy and program tools

| Statewide Tools | Description of Policies |
|---|---|
| Community Based Transportation Planning Grant Program, California Department of Transportation | Encourages local governments to make better connections between land use and transportation through planning grant assistance. |
| California Transit Village Development Act, 1994 | Legislation that allowed local governments to create transit village plans around rail stations to be qualified for grants. |
| Transit-Oriented Development Housing Program, California Department of Housing and Community Development | Promotes transit-oriented development by providing low-interest loans towards affordable housing, mortgage homeowner assistance, and construction of infrastructure in close proximity to transit. |
| Downtown Rebound Planning Grant Program, California Department of Housing and Community Development | Fund planning grants to local governments for adaptive reuse, or conversion of commercial and industrial space into residential units |

Source. (Anderson & Forbes, 2011; Renne, 2008; Statewide transit oriented development study: Factors for success in California, 2002)

Table 4-6. Bay Area transit-oriented development policy and program tools

| Regional Tools | Description of Policies |
|---|---|
| Transportation for Livable Communities Program (TLC), Metropolitan Transportation Commission | Provides funding for smart growth projects that link transportation closer to housing through capital grants, planning grants, and the Housing Incentive Program |
| Housing Incentive Program (HIP), Metropolitan Transportation Commission | Provides supplemental funding to the TLC Program for higher-density developments and affordable housing units. |
| Transit-Oriented Development Incentive Program, City/County Association of Governments of San Mateo County (C/CAG) | Provides developers financial incentives to build high density ( at least 40 units per acre) transit-oriented development housing projects by funding supporting infrastructure needs. |
| Policy for Regional Transit Expansion Projects (Resolution 3434), Metropolitan Transportation Commission | Mandates all transit stations have according station area plans that meet planned density thresholds to obtain funding for transit extension projects. |
| Bay Area Transit-Oriented Affordable Housing Fund, Metropolitan Transportation Commission | Funding for property acquisition for mixed-income and affordable housing sites located near transit access. |

Source. (Anderson & Forbes, 2011; Renne, 2008; Statewide transit oriented development study: Factors for success in California, 2002; Cervero, et al., 2004; Program guidelines for The Transit Oriented Development Housing Incentive Program, 2010; San Francisco Bay Area Property Aquisition Fund for equitable transit oriented development, 2011).

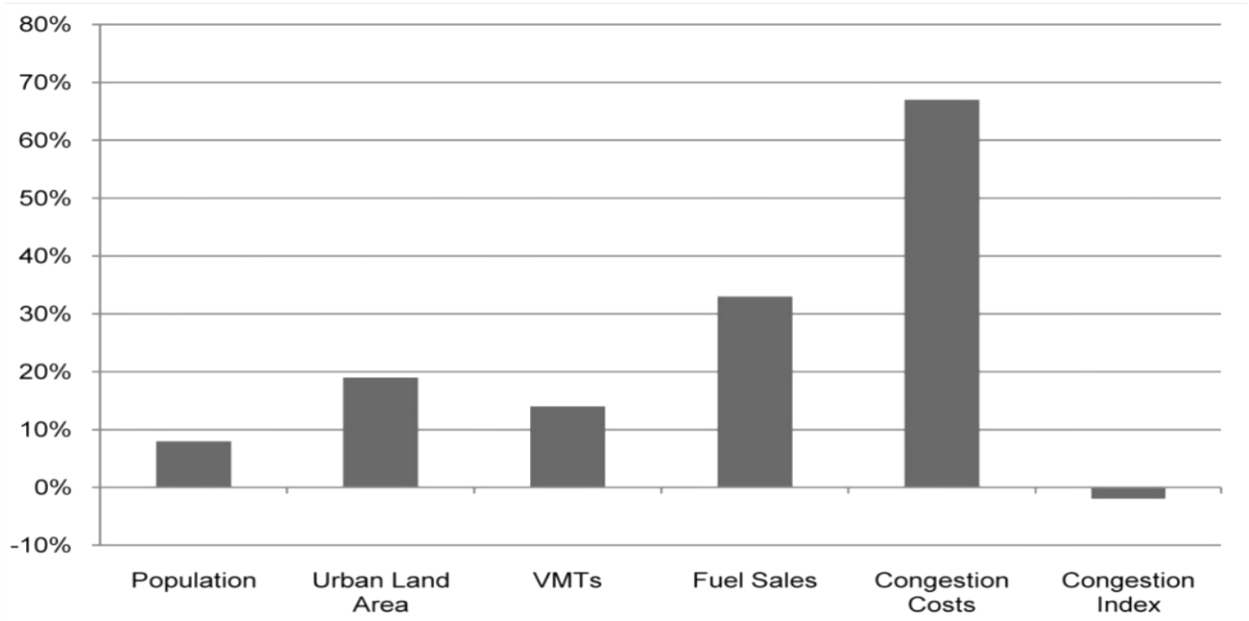



Figure 4-1. Boston growth and congestion patterns, percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban mobility report” by Texas Transportation Institute, 2009.

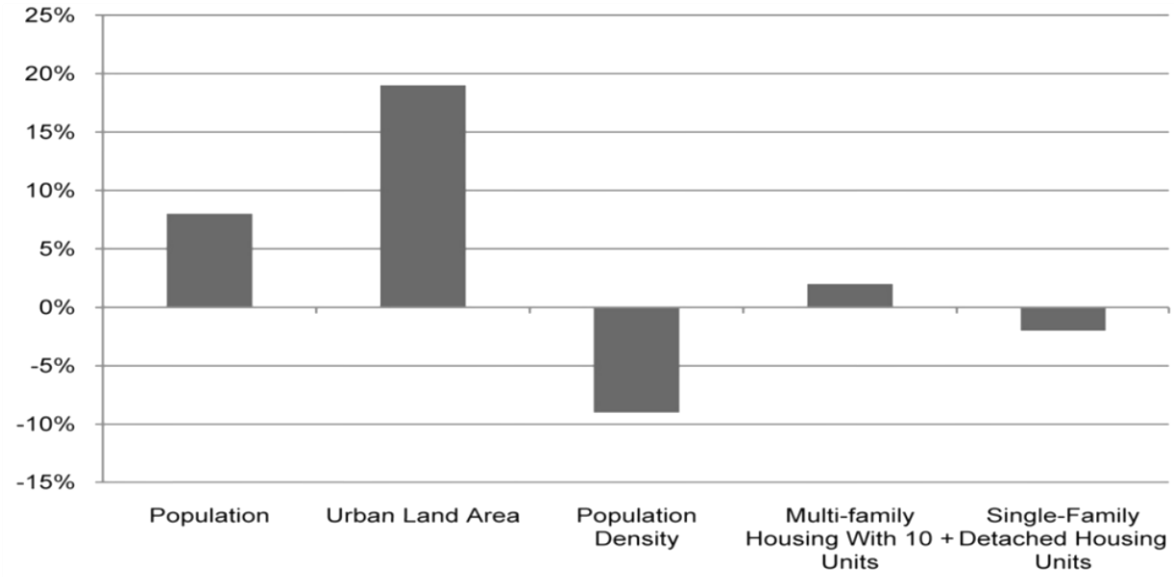



Figure 4-2. Boston housing development patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4-Boston MA-NH-RI urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates-Boston MA-NH-RI urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009.

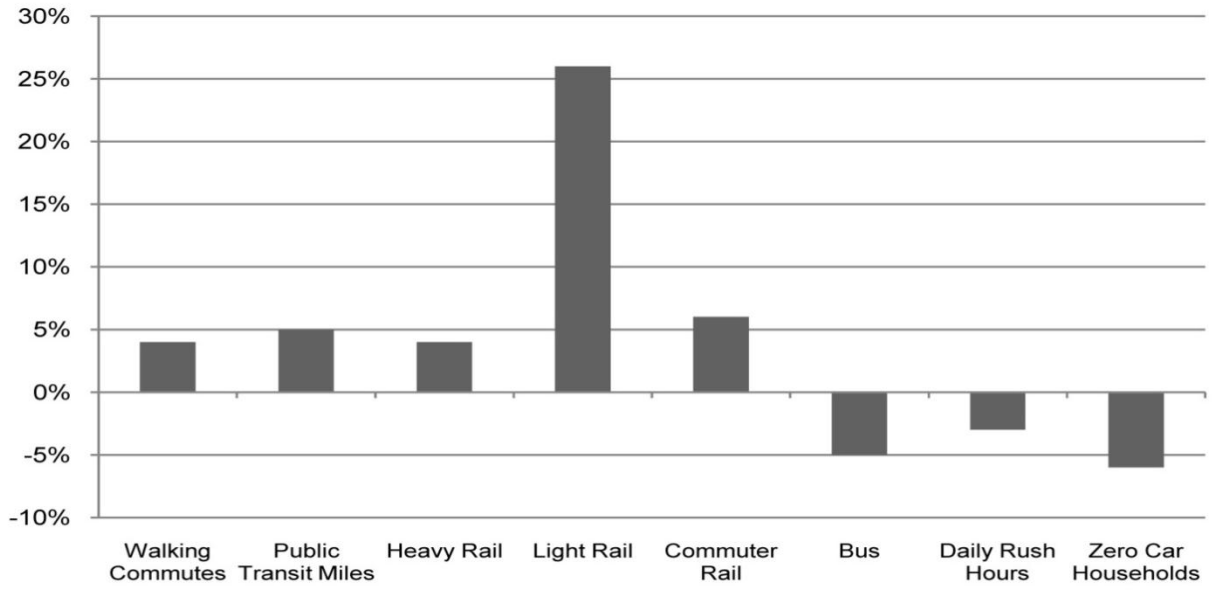



Figure 4-3. Boston ridership and commute patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4-Boston MA-NH-RI urbanized area” by United States Census Bureau, 2000; “Profile of selected economic characteristics: 2000, Census summary file 4-Boston MA-NH-RI urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates-Boston MA-NH-RI urbanized area” by United States Census Bureau, 2007; “Selected economic characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates-Boston MA-NH-RI urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009; 2000 and 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.

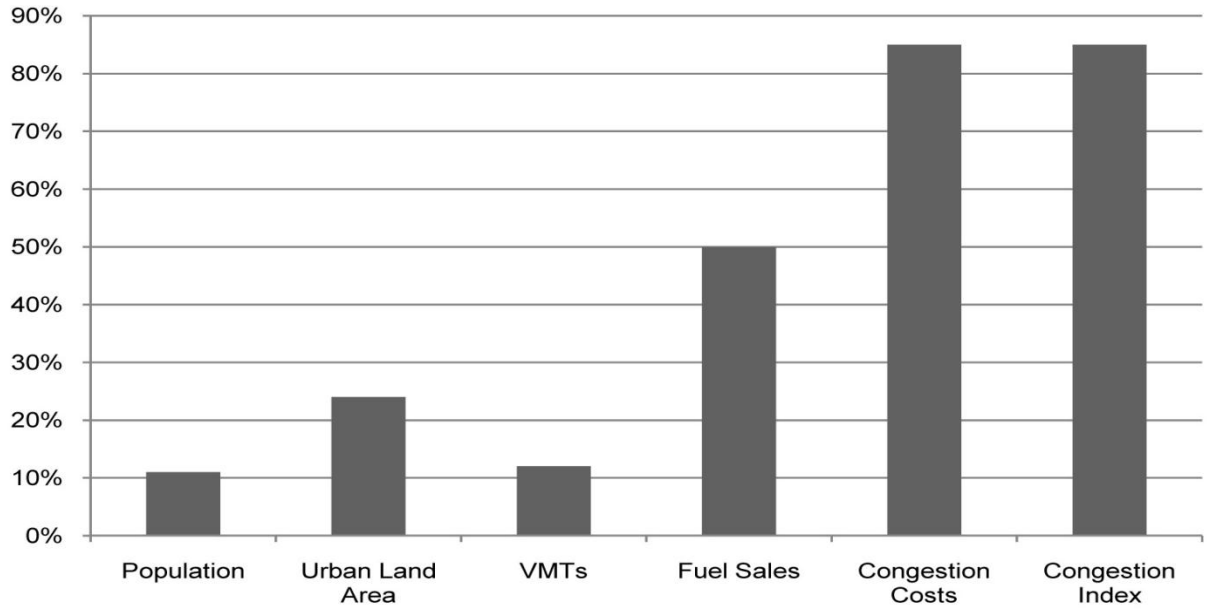



Figure 4-4. Dallas growth and congestion patterns, percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban mobility report” by Texas Transportation Institute, 2009.

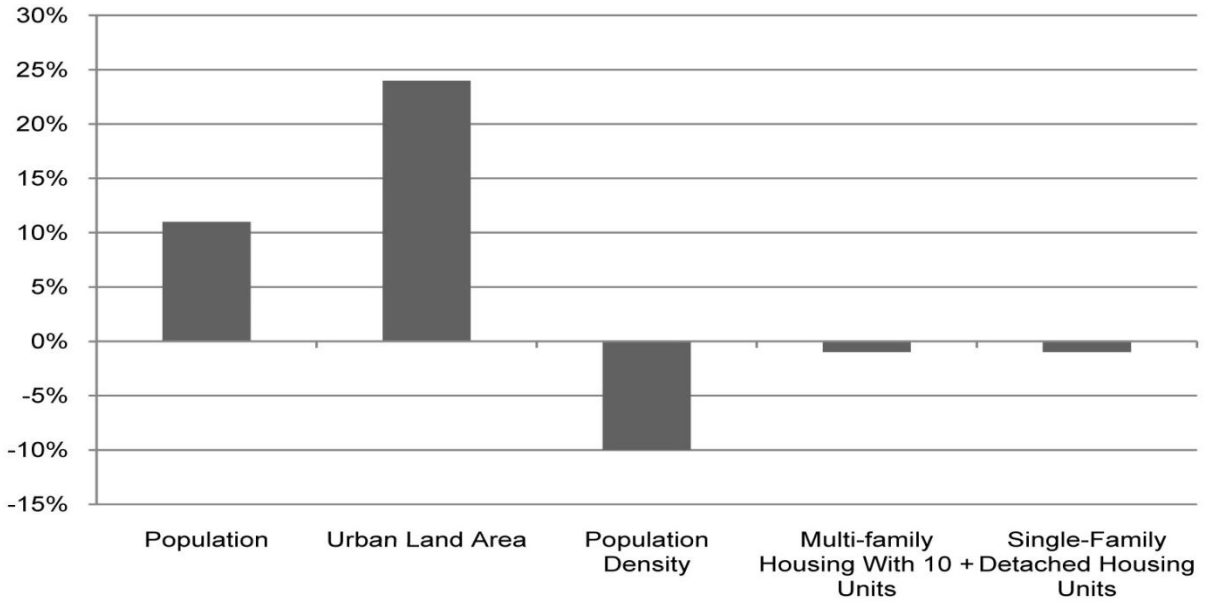



Figure 4-5. Dallas housing development patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4-Dallas-Fort Worth-Arlington, TX urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- Dallas-Fort Worth-Arlington, TX urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009.

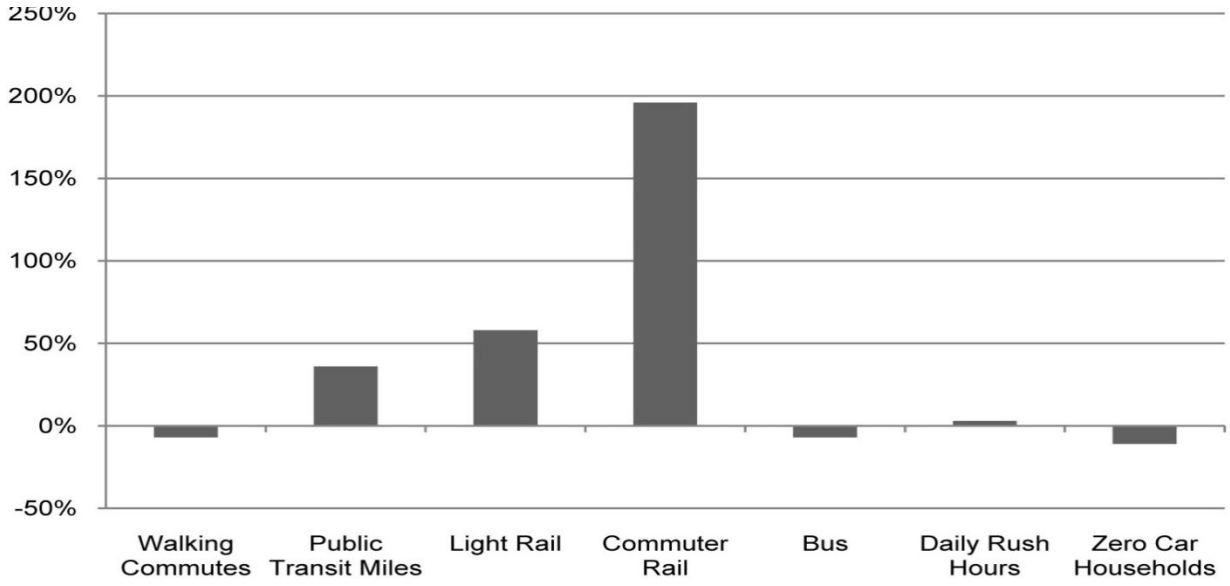



Figure 4-6. Dallas ridership and commute patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4- Dallas-Fort Worth-Arlington, TX urbanized area” by United States Census Bureau, 2000; “Profile of selected economic characteristics: 2000, Census summary file 4- Dallas-Fort Worth-Arlington, TX urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- Dallas-Fort Worth-Arlington, TX urbanized area” by United States Census Bureau, 2007; “Selected economic characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- Dallas-Fort Worth-Arlington, TX urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009; 2000 and 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.

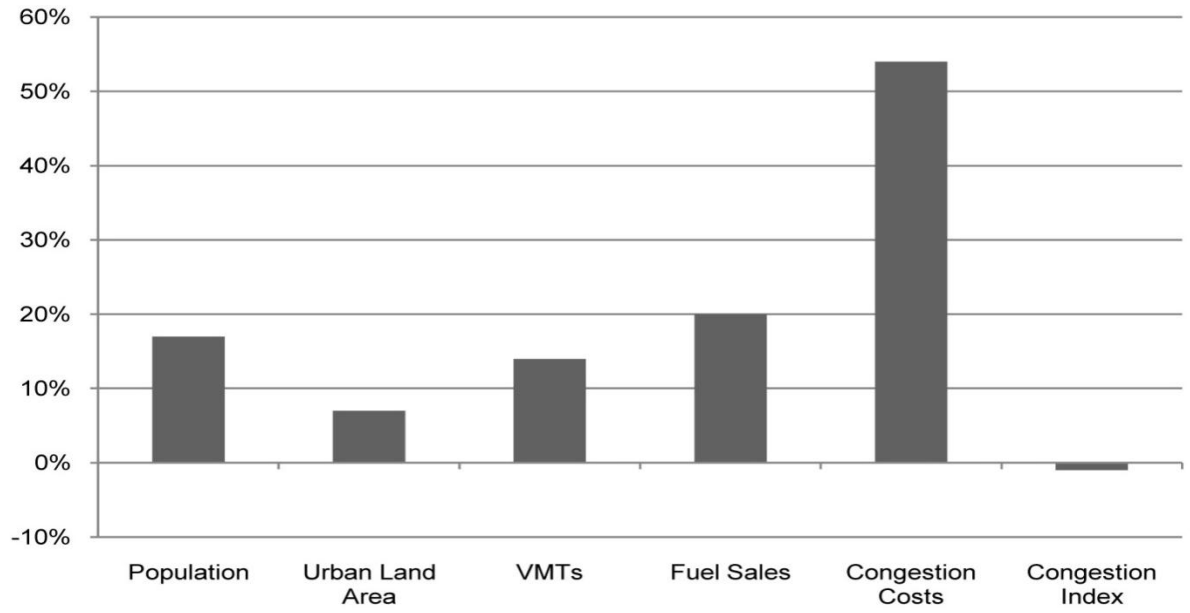



Figure 4-7. Portland growth and congestion patterns, percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban mobility report” by Texas Transportation Institute, 2009.

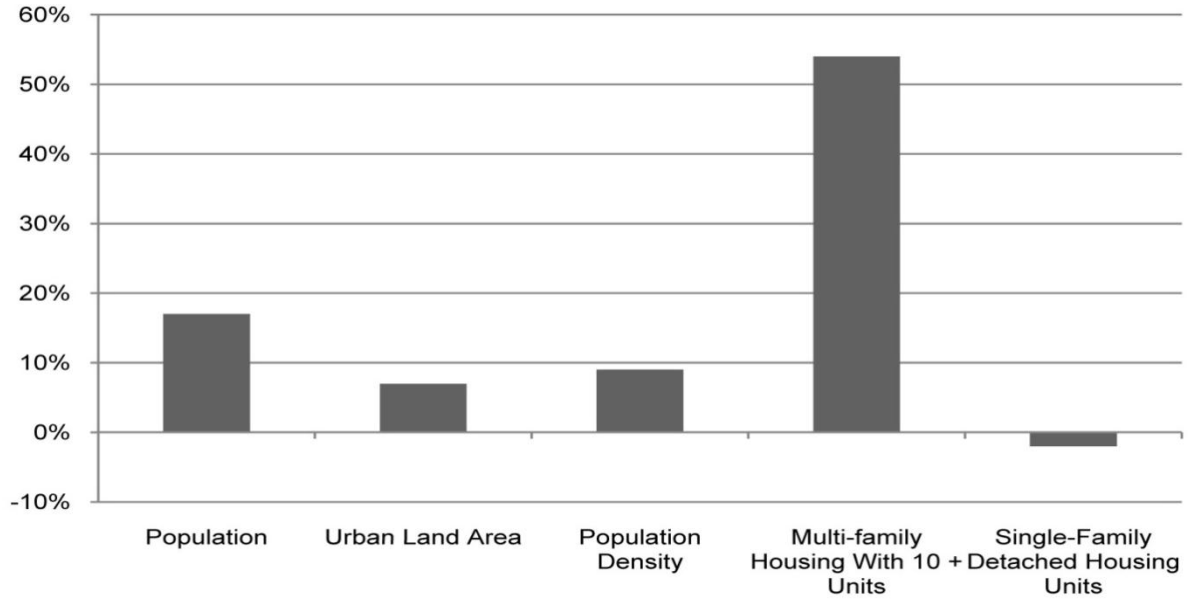



Figure 4-8. Portland housing development patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4-Portland, OR-WA urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates-Portland, OR-WA urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009.

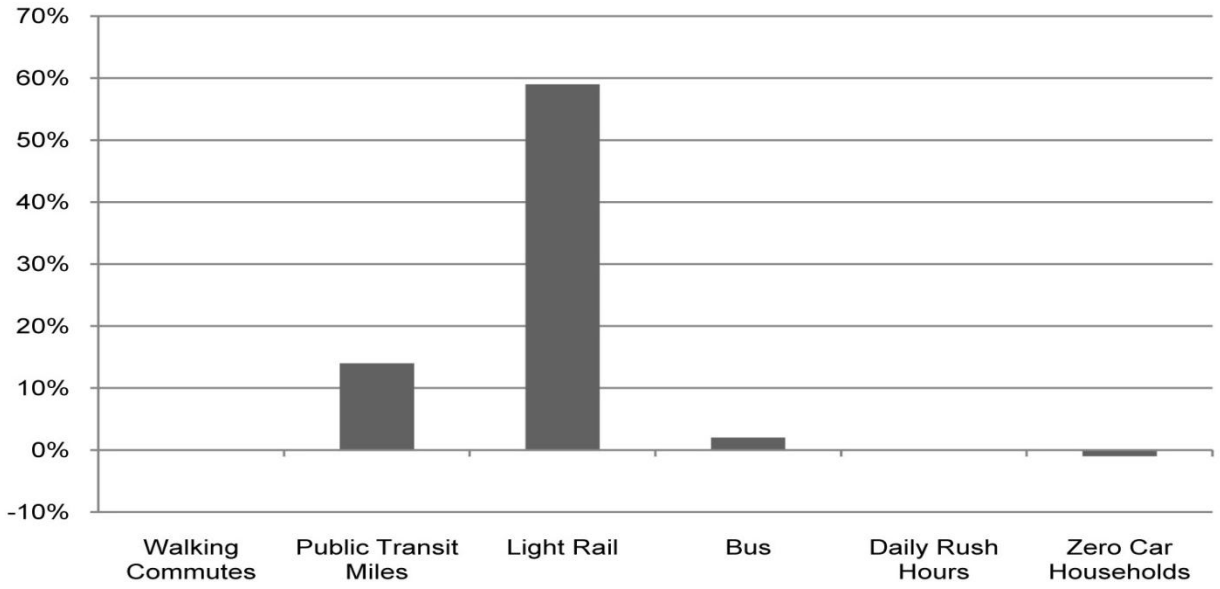



Figure 4-9. Portland ridership and commute patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4- Portland, OR-WA urbanized area” by United States Census Bureau, 2000; “Profile of selected economic characteristics: 2000, Census summary file 4-Portland, OR-WA urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates-Portland, OR-WA urbanized area” by United States Census Bureau, 2007; “Selected economic characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates-Portland, OR-WA urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009; 2000 and 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.

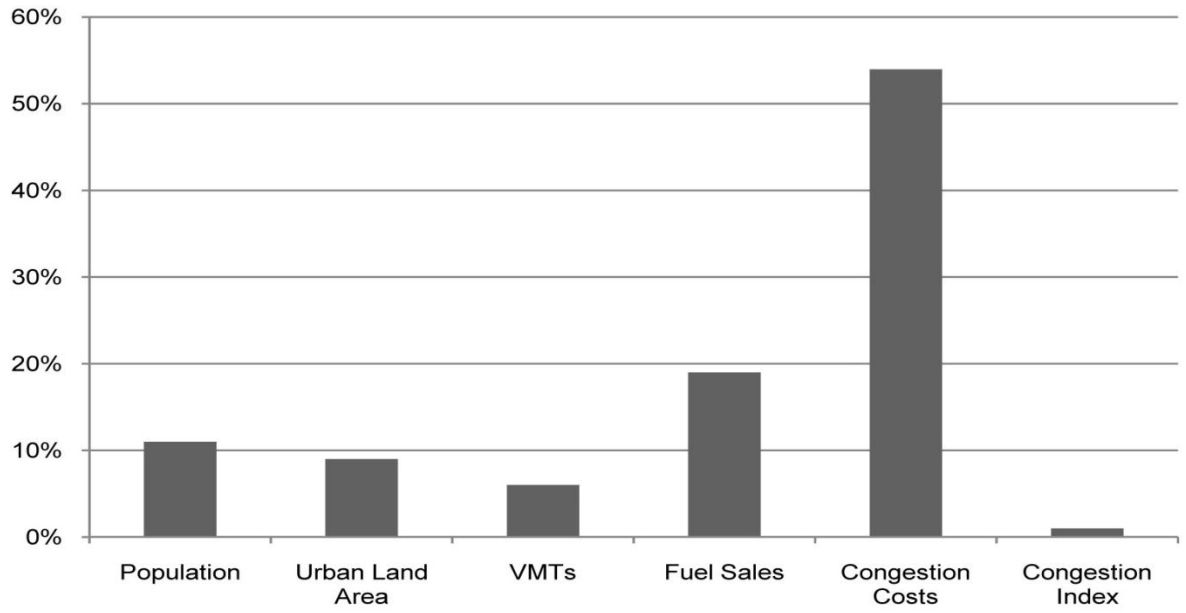



Figure 4-10. San Francisco growth and congestion patterns, percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban mobility report” by Texas Transportation Institute, 2009.

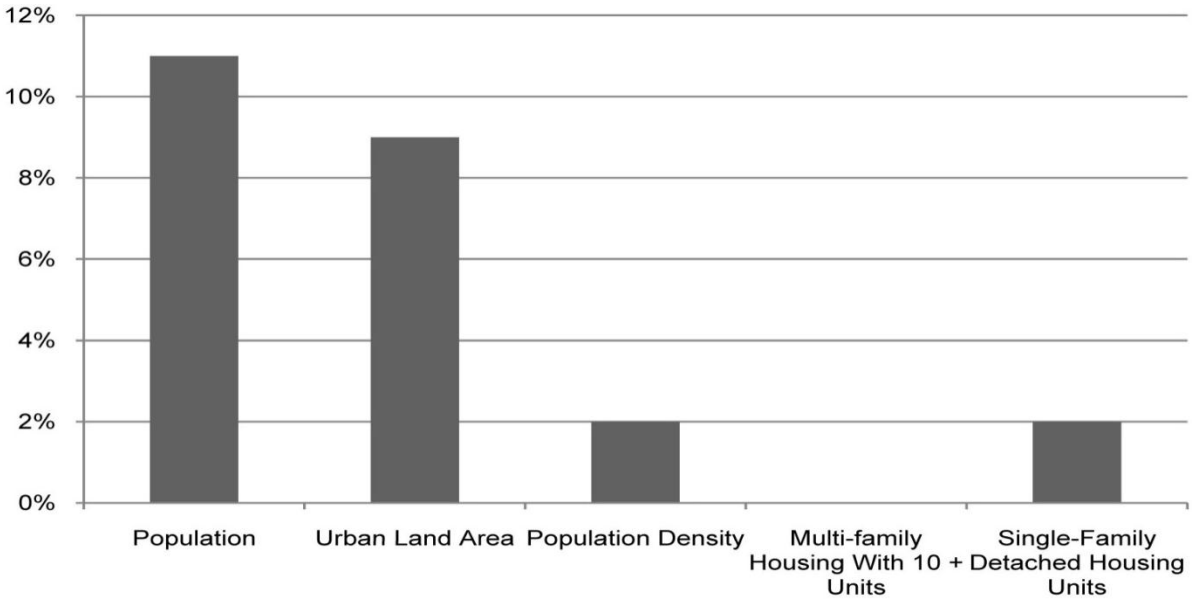



Figure 4-11. San Francisco housing development patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4-San Francisco-Oakland, CA urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- San Francisco-Oakland, CA urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009.

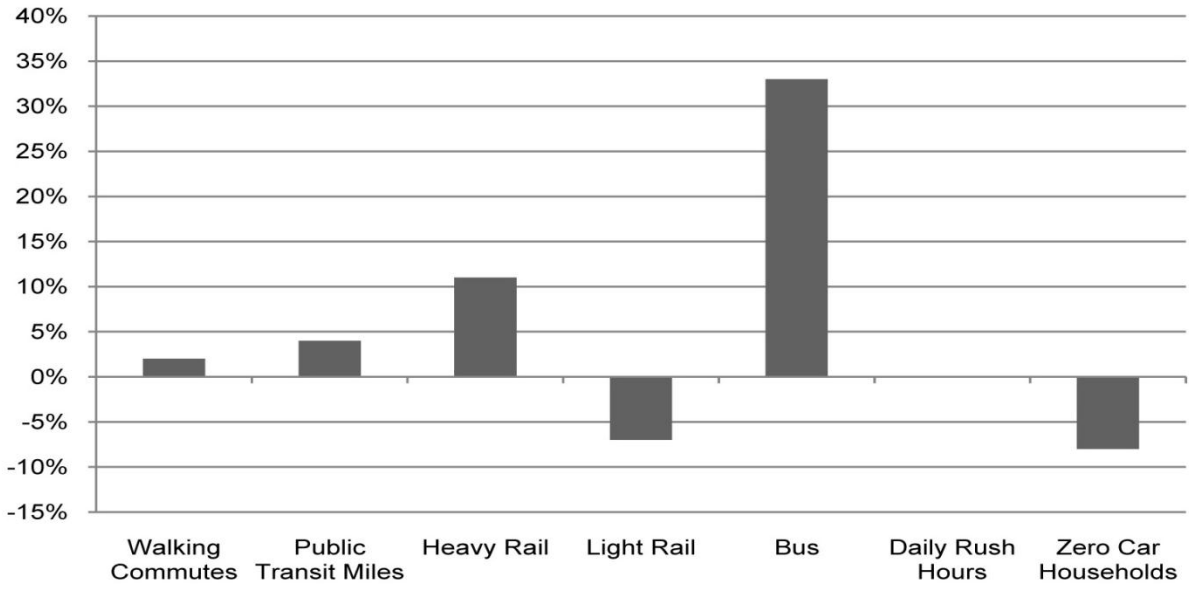



Figure 4-12. San Francisco ridership and commute patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4- San Francisco-Oakland, CA urbanized area” by United States Census Bureau, 2000; “Profile of selected economic characteristics: 2000, Census summary file 4- San Francisco-Oakland, CA urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- San Francisco-Oakland, CA urbanized area” by United States Census Bureau, 2007; “Selected economic characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- San Francisco-Oakland, CA urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009; 2000 and 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.

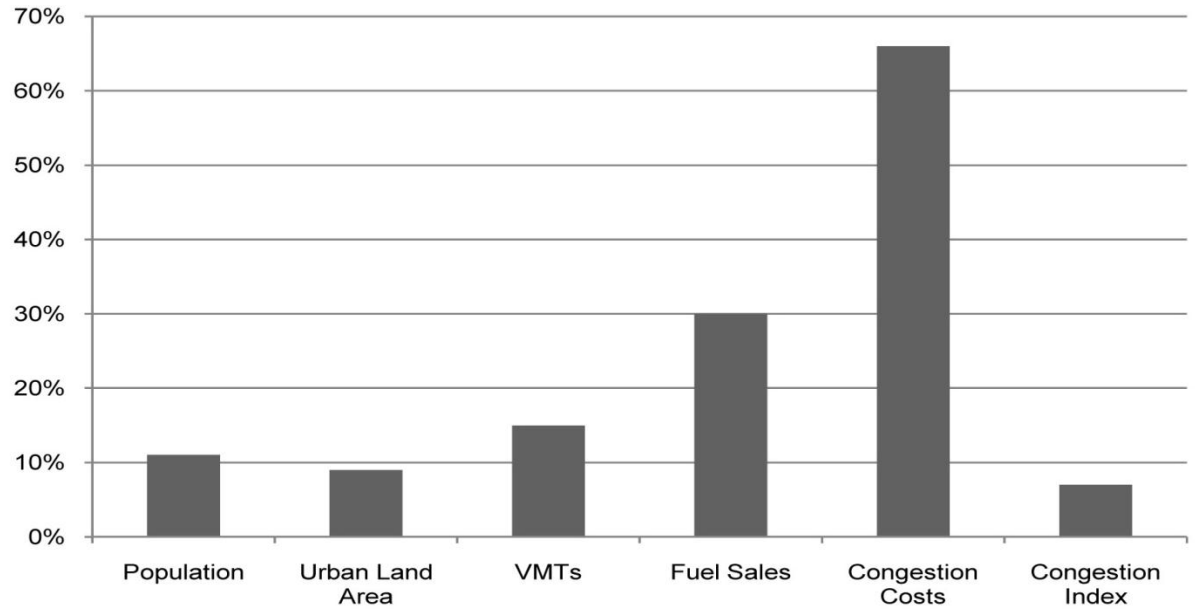



Figure 4-13. Washington, DC growth and congestion patterns, percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban mobility report” by Texas Transportation Institute, 2009.

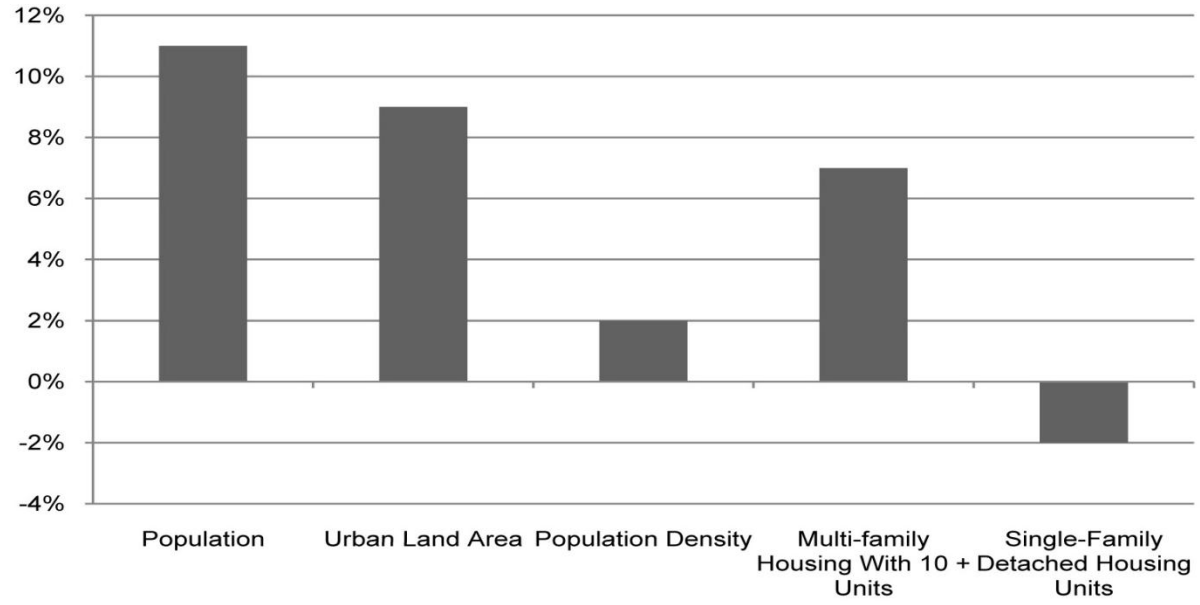



Figure 4-14. Washington, DC housing development patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4-Washington, DC-VA-MD urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- Washington, DC-VA-MD urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009.

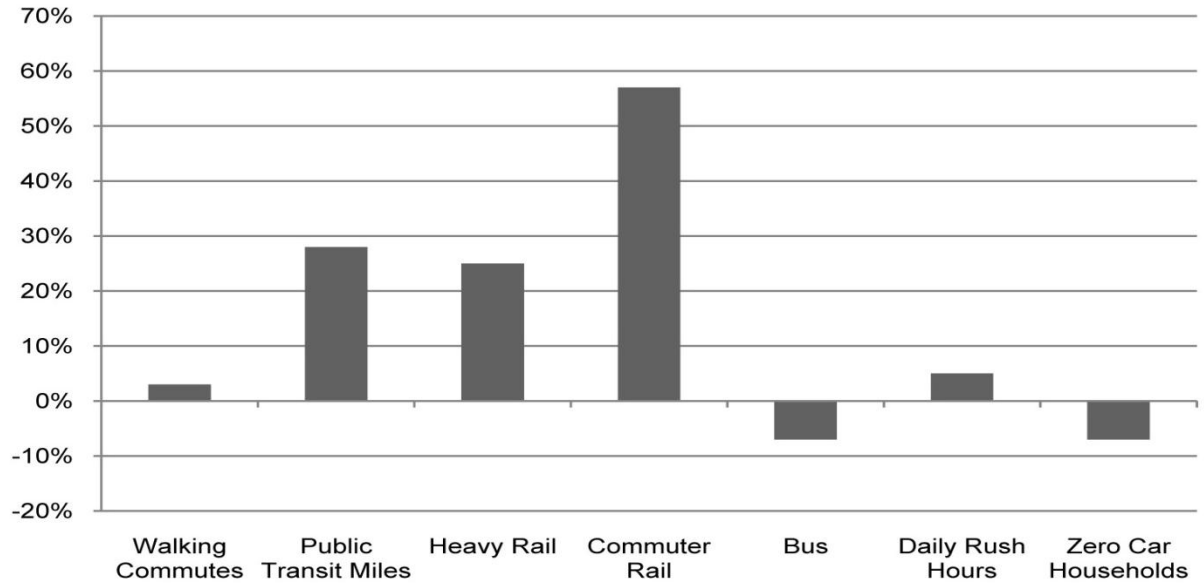



Figure 4-15. Washington, DC ridership and commute patterns, percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4- Washington, DC-VA-MD urbanized area” by United States Census Bureau, 2000; “Profile of selected economic characteristics: 2000, Census summary file 4- Washington, DC-VA-MD urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- Washington, DC-VA-MD urbanized area” by United States Census Bureau, 2007; “Selected economic characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates- Washington, DC-VA-MD urbanized area” by United States Census Bureau, 2007; “2009 Urban mobility report” by Texas Transportation Institute, 2009; 2000 fourth quarter ridership report archives, by the American Public Transportation Association, 2011; 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.

# CHAPTER 5
# COMPARATIVE POLICY ANALYSIS

## Results

### Congestion

One could argue that the automobile has been the most influential invention in the last century, as the vast majority of the U.S. landscape is organized and compartmentalized around automobile access or roads. The concept of building development around the automobile was not threatening fifty years ago when oil was plentifully inexpensive, and America's population was a fraction of what it is today. However, as the U.S. population increases, but U.S. land territory boundaries remain the same, unless major shifts are made towards smarter growth, stifling congestion is a certainty.

Certain U.S. cities are already experiencing alarming congestion levels that are difficult to remedy, despite efforts to build more roads or widen existing ones. Congestion not only causes wasted fuel and time in traffic, it also contributes to more vehicle miles traveled (VMTs) as commuters look for alternative routes that may be longer in distance, but contain lighter traffic flow, enabling a quicker commute. Transit-oriented development (TOD) has been a growth management strategy to specifically remedy congestion problems in China, Europe, and a few progressive cities in the U.S. In this study, congestion is considered a major indicator variable of TOD, as it has potential to act as a catalyst to developing alternative land development and transportation choices to improve the quality of life.

**Population and urban land area growth**

Congestion is a manifestation of colliding circumstances. Theoretically, there is an argument for incorporating land into urban service boundaries at the same, or even preferably a decreased rate as population growth for a particular location. Often, urban land area growth rates are greater than population growth rates, causing an uneven distribution of roadway resources that generally cause increased congestion. This study investigated urban land area and population growth to gain a greater understanding of each city's land development practices and patterns.

All five case study cities experienced increased population, ranging from 8% to 17% increases from 2000 to 2007 (Figure 5-1). Portland had the highest population growth increase of 17%, while Dallas, San Francisco, and Washington D.C. had 11% growth, and Boston increased by only 8% (Texas A&M University Texas Transportation Institute, 2009).

Additionally, all five case study cities also experienced increases in urbanized land area, ranging from 9% to 24% increases from 2000 to 2007 (Figure 5-2). Dallas had the highest urban land area expansion increase of 24%, while Boston increased by 19%, San Francisco and Washington D.C. both had 9% increases, and Portland was the smallest increase at only 7% (Texas A&M University Texas Transportation Institute, 2009).

**Vehicle miles traveled and fuel sales**

Consumptive land development patterns scattered among a growing population will most likely increase VMTs, and fuel consumption to travel to and from randomly developed land uses. All five case study cities experienced increased daily VMTs, ranging from 6% to 15% increases from 2000 to 2007 (Figure 5-3). Washington D.C.

had the highest VMT increase of 15%, while Portland and Boston both had 14% increases, leaving Dallas with 12% and San Francisco with only a 6% increase (Texas A&M University Texas Transportation Institute, 2009).

With an increase of VMTs in all of the case studies, a correlating increase in fuel consumption was observed for each case study ranging from 19% to 50% increases from 2000 to 2007 (Figure 5-4). Dallas had the highest fuel consumption increase of an astounding 50%, while Boston increased by 33%, Washington D.C. increased by 30%, Portland by 20%, and San Francisco only increasing by 19% (Texas A&M University Texas Transportation Institute, 2009).

**Congestion costs and indexes**

This study evaluated the percentage of change in congestion costs and congestion indexes that were originally defined by the Texas Transportation institute (TTI) in its annual urban mobility report. The TTI defines congestion costs as monetary costs associated with wasted time and fuel, while in traffic. The congestion index is a measure of vehicle travel density on major roadways in an urban area. This study measured congestion to make assimilations about whether increased congestion possibly prompts TOD transit-oriented development (TOD) policies and programs, or if congestion decreases with public transit and TOD policies and programs.

All five case study cities had significant congestion cost increases, ranging from 54% to 85% increases from 2000 to 2007 (Figure 5-5). Dallas had the highest congestion cost increase of 85%; Boston had a 67% increase, Washington D.C. had a 66% increase, and Portland and San Francisco both had 54% increases (Texas A&M University Texas Transportation Institute, 2009).

Congestion indexes had variable results, with increases ranging up to 9% and decreases down to 2% from 2000 to 2007 (Figure 5-6). Dallas experienced the highest congestion index increase at 9%, Washington D.C. had an increase of 7%, San Francisco had only a 1% increase, while Portland had a 1% decrease and Boston had a 2% decrease.

**Development Patterns**

Single-family housing was the other key ingredient needed, in addition to the automobile, to create the low-density cookie-cutter sprawling suburbs in the post-Word War II (WWII) development boom. Most post-WWII suburban development consisted of single-family homes on no less than an acre of land. This type of development was not considered wasteful or sprawling when it was built in the 1950s and 1960s. At that time, land resources were seemingly plentiful, with no foreseeable consequences. Today local governments are struggling to accommodate growth as land resources have been depleted, and within most city boundaries, there is simply no more physical space to accommodate growth in low-density single-family housing (Burchell, et al., 2002).

A growing development trend and sustainable alternative to low-density single-family housing is building medium to high-density multi-family housing to accommodate more growth with less land. Full capacity, successful transit-oriented development (TOD) must have access to public transit and the density to support it. By achieving density, a TOD is optimizing conditions for expansion and redevelopment. Some TODs may be more employment- or commercial-oriented, but great TODs have usually contain a mix of land uses with a substantial amount of dense multi-family housing to support all uses (Cervero, et al., 2004).

**Population density**

This study analyzed population density, single-family, and multi-family housing stock patterns to determine what type of residential development is being built in each case. Increasing population density and multi-family housing stock provides more opportunities for smart growth and transit-oriented development (TOD). Decreasing population density and increasing single-family housing stocks are problematic, and not conducive to TOD.

Each case study varied with respect to their population densities, ranging from increases by 9% and decreases down to 10% from 2000 to 2007 (Figure 5-7). Portland had the highest population density increase of 9%, both San Francisco and Washington D.C. had increases of 2%, while Boston decreased by 9% and Dallas decreased by 10% (Texas A&M University Texas Transportation Institute, 2009).

**Housing types**

For the purposes of this study, single-family housing was defined as detached one residential unit. Each case study had similar ranges of change in their single-family housing stock supply, ranging from increases of 2% and a decrease of 2% (Figure 5-8). San Francisco had the highest and only increase at 2%, Dallas had a decrease of 1%, with Boston, Portland, and Washington D.C. all having decreases of 2% (United States Census Bureau, 2000; United States Census Bureau, 2007).

For the purposes of this study, multi-family housing was defined as having ten or more residential units per structure. Each case study greatly varied regarding changes in their multi-family housing stock supply, ranging from increases of 54% and a decrease of 1% (Figure 5-9). Portland had the greatest increase at 54%, Washington D.C. increased by 7%, Boston increased by 2%, while San Francisco experienced no

change, and Dallas decreased by 1% (United States Census Bureau, 2000; United States Census Bureau, 2007).

**Ridership**

In order for transit-oriented development (TOD) to be a plausible development alternative to residential sprawl and the automobile commute, there must be efficient public transportation systems that offer frequent and reliable service. The rising cost of owning personal automotive transportation has surpassed many American families' budgets, arguably contributing to an increase of U.S. public transportation ridership for most travel modes. In fact, from 2000 to 2007, heavy rail ridership increased by 12%, light rail ridership increased by 47%, commuter rail ridership increased by 12%, and bus ridership increased by 6% (American Public Transportation Association ridership report archives, 2011).

**Commuting patterns**

Figure 5-10 depicts the percentage of change in the number of daily rush hours, or peak congestion hours, identifying intensities of daily automobile commuting for each case study. From 2000 to 2007, the changes in daily rush hours ranged from an increase of 5% and a decrease of 3%. Washington D.C. had the highest increase of daily rush hours by 5%, Dallas increased by 3%, both Portland and San Francisco experienced no change, and Boston had a decrease of 3% (Texas A&M University Texas Transportation Institute, 2009).

Overall, each case study had public transit miles increase from 2000 to 2007, ranging from 4% to 36% increases (Figure 5-11). Dallas had the highest increase at 36%; followed by Washington D.C. with a 28% increase, Portland had a 14% increase,

Boston had a 5% increase, and San Francisco had a 4% increase (Texas A&M University Texas Transportation Institute, 2009).

Walking commute patterns of change from 2000 to 2007 varied, but had more increase than decrease among the case studies, ranging from a 4% increase to a 7% decrease (Figure 5-12). Boston had the highest increase of walking commuters at 4%, Washington D.C. had an increase of 3%, San Francisco had an increase of 2%, Portland experienced no change, and Dallas had the only decrease of 7% (United States Census Bureau, 2000; United States Census Bureau, 2007).

Zero car households experienced decline in all of the case studies, decreases ranges from 1% to 11% from 2000 to 2007 (Figure 5-13). Portland had the least amount of zero car household decline with a decrease of only 1%, Boston had a decrease of 6%, Washington D.C. had a 7% decrease, San Francisco had a 8% decrease, and Dallas had an 11% decrease (United States Census Bureau, 2000; United States Census Bureau, 2007).

**Public transit modes**

Heavy rail public transit is an expensive capital investment and is not as common as light rail and commuter rail modes in the U.S. Only three out of the five case studies have heavy rail systems for comparison from 2000 to 2007. Heavy rail ridership increased in all three cities, ranging from a 25% increase to a 4% increase (Figure 5-14). Washington D.C. had the highest heavy rail ridership increase of 25%, San Francisco had an increase of 11%, and Boston had an increase of 4% (American Public Transportation Association ridership report archives, 2011).

Light rail public transportation is also an expensive capital investment, and only four out of the five case studies have light rail transit available. Overall, light rail

ridership increased among the case studies, ranging from a 59% increase to a 7% decrease (Figure 5-15). Portland had the highest increase of 59%, Dallas had an increase of 58%, Boston had an increase of 26%, and San Francisco had a decrease of 7% (American Public Transportation Association ridership report archives, 2011).

Commuter rail is often used to connect inner city areas to more suburban parts of the same urbanized area. Commuter rail is available in four out of the five case studies, and had an overall increase of ridership from 2000 to 2007, ranging from an increase of 196% to an increase of 6% (Figure 5-16). Dallas had the highest increase at 196%, Washington D.C. had an increase of 57%, San Francisco increased by 11%, and Boston had an increase of 6% (American Public Transportation Association ridership report archives, 2011).

Bus ridership had variable changes from 2000 to 2007, ranging from a 33% increase to a 7% decrease (Figure 5-17). San Francisco had the highest increase of 33%, Portland had an increase of 2%, Boston had a decrease of 5%, and while both Dallas and Washington D.C. had a 7% decrease in ridership (American Public Transportation Association ridership report archives, 2011).

## Analysis

This study uses comparable data for sixteen different indicative variables, for five different urbanized city areas, that may hinder or engender efforts towards implementing transit-oriented development (TOD) initiatives. The visual synthesis of variables to their respective case studies (Figure 5-18) is compelling, as it clearly identifies some consistent patterns among the different cities. The chart acts as a visual ratio aid to discern the numerical data into patterns by the following method,

> "The shortest radius a wedge can have is 0, (the smallest value observed at that variable) and the largest radius a wedge can have is 1 (the largest value recorded for that variable). If the value X is observed at a particular variable, where the maximum value recorded at the variable is MAX and the minimum recorded value at the variable is MIN, the radius associated with length X is length = (X - MAX) / (MAX-MIN)" (Holt, 2010).

**Boston**

Despite historical development patterns that organically evolved into a cityscape of transit-oriented development (TOD), Boston is struggling to cope with the consequences of edge city sprawling suburbs. With population, urbanized land area, VMTs, fuel consumption, and congestion costs increasing (Figure 4-1) on one hand, and on the other hand, population density and multi-family housing stock are decreasing (Figure 4-2); suburban development patterns have clearly affected the physical DNA of the region.

The inner core of Boston was built out decades ago, now focusing on precious redevelopment opportunities, as land costs in Boston are some of the highest in the country (Cervero, et al., 2004). However, making convenient physical connections from redevelopment areas to inner Boston and suburban fringes has proved to be an expensive and challenging effort.

The Boston Silver Line BRT systems are good examples of challenging projects that may face major obstacles in returning MTBA's recent substantial bus infrastructure investment. From 2000 to 2007, public transit miles traveled increased by 5% (Figure 5-11), yet bus ridership decreased by 5% (Figure 5-17) over the same period (American Public Transportation Association ridership report archives, 2011). Further, population growth only increased by 8% (Figure 5-1), but urbanized land area increased by 19% (Figure 5-2) (Texas A&M University Texas Transportation Institute, 2009).

The variable data analysis seemingly does not support the MTBA's decision to construct significant BRT-served infrastructure for bus instead of rail, which has experienced increases in ridership, especially suburban serving light rail systems with a ridership increase of 26% (Figure 5-15) (American Public Transportation Association ridership report archives, 2011). However, the data does support several state program initiatives, created to stimulate compact, multi-family residential development near transit stations (Table 4-1), potentially mitigating decreases in population density (Figure 5-7) and multi-family housing construction (Figure 5-9).

Given Boston's long established urban fabric, one can see how compartmentalizing growth on the city's edge would be easier than identifying ways to absorb growth within the existing built-out inner urban core. Unfortunately, accordingly to the variable data, edge-city growth has grossly affected the Boston region, causing congestion and decreasing quality of life. To prepare for future growth, a built-out Boston must seek redevelopment opportunities that already have access to transit, and further maximize those opportunities to the fullest extent possible.

**Dallas**

Using a Sunbelt city as a transit-oriented development (TOD) subject case study would have been unlikely a decade ago, given the lack of efficient public transit systems in the southeastern U.S. But times have changed, as famous-for-sprawling Dallas has built 72 miles of light and commuter rail transit, providing an alternative refuge from the significant increases in area congestion, fuel consumption, and VMTs (Figure 4-4) (Dallas Area Rapid Transit, 2008; Texas A&M University Texas Transportation Institute, 2009). In fact, from 2000 to 2007, regional public transit miles traveled increased by 36% (Figure 5-11), light rail ridership increased by 58% (Figure 5-15), and commuter

rail ridership increased by a whopping 196% (Figure 5-16) (American Public Transportation Association ridership report archives, 2011; Texas A&M University Texas Transportation Institute, 2009)

Dallas Area Rapid Transit (DART) had the challenging task of designing, funding, and building a public transportation system that needed to connect the low-density, sprawling suburbs, requiring an ambitious scope of extensive capital infrastructure to make adequate connections between expansive locations in Dallas. For example, population growth only increased by 11% (Figure 5-1) from 2000 to 2007, but urbanized land area increased by 24% (Figure 5-2), consequently maintaining the most unsustainable development practices out of all five case studies (Texas A&M University Texas Transportation Institute, 2009). In addition, these types of land development patterns are problematic for pedestrians as walking commuters decreased by 7% (Figure 5-12) and zero-car households decreased 11% (Figure 5-13) (United States Census Bureau, 2000; United States Census Bureau, 2007). Further, these sprawling patterns are usually only conducive to single-family residential development and strip mall commercial; yet conflictingly, single-family housing stocks decreased by 1% (Figure 5-8).

Despite Texans' love for the automobile, the plans to build an expansive passenger rail system have already catalyzed development interest at most of the suburban rail stations, including locations that are still under construction and without transit service yet (Ohland, 2004). From the research and the indicator data, developers seem to be straying from the single-family housing product and progressively investing in medium-density multi-family housing stock, a trend especially prevalent around transit

stations (Cervero, et al., 2004). Despite 10+ unit multi-family housing stocks decreasing by 1% (Figure 5-9), multi-family housing containing 3 - 9 units increased by 8% from 2000-2007. The increase of medium multi-family housing is potentially an outcome from the previously noted success with TOD projects in Plano, Mockingbird, Addison's Circle, and Carrolton (United States Census Bureau, 2000; United States Census Bureau, 2007).

Interestingly enough, the most well known Dallas TOD project, Mockingbird Station was funded with almost all private sector investment, with little to no public input, or local government planning or involvement (Ohland, 2004). There were some joint development arrangements between DART, but for the most part, developers carried a tremendous amount of financial burden and risk (Dallas Area Rapid Transit, 2008). On the other hand, Carrolton, Plano, and Addison's Circle all had fairly involved local governments that worked closely with TOD developers in adopting development plans and design guidelines that were consistent with each community's vision (Cervero, et al., 2004). However, all of the Dallas case studies were built without government-sponsored subsidies or loans, revealing real capabilities of private sector initiatives when coupled with public transportation (Cervero, et al., 2004).

**Portland**

Out of all the case studies, when considering the measured data in this study, Portland stands out as having the best policies, plans, and programs to foster transit-oriented development (TOD), most likely due to statewide (Table 4-2), region wide (Table 4-3), and local (Table 4-4) efforts. Despite Portland's significant population increase (Figure 5-1); urban land area (Figure 5-2), fuel sales (Figure 5-4), congestion costs (Figure 5-5), and daily automobile rush hours (Figure 5-10) had only moderate

increases in comparison to the other case studies (Texas A&M University Texas Transportation Institute, 2009).

The most impressive data ratio is the small 7% increase of urbanized land area (Figure 5-2) compared to the 17% population growth (Figure 5-1) (Texas A&M University Texas Transportation Institute, 2009). This sustainable growth ratio is the desired outcome of the first major growth management strategy, the urban growth boundary (UGB). By defining urban edges, and strictly adhering with minimal amendment, the Portland region is easily able to accommodate additional population growth on less land, more so than any other case study. Despite a population increase, the congestion index decreased (Figure 5-6), which is a continued testimony to Portland's result-producing policies and programs (Texas A&M University Texas Transportation Institute, 2009).

Additionally, the thematic growth management policy to grow vertically, not horizontally, has had a major impact on not only where, but what types of development are getting built. The guiding principal of vertical growth has translated to a 58% increase in multi-family housing stock (Figure 5-9) and a 2% decrease of single-family housing (Figure 5-8) proving the strong validity of programs such as the 2001 Vertical Housing Program (Table 4-2) (United States Census Bureau, 2000; United States Census Bureau, 2007). In spite of these efforts, the popularity of the automobile even penetrated Portland, as zero-car households decreased by 1% (Figure 5-13) (United States Census Bureau, 2000; United States Census Bureau, 2007).

TriMet, Portland's regional transit authority has also made major initiatives towards locating development near transit to increase ridership (Cervero, et al., 2004).

Specifically, the agency has engaged in complex joint development agreements (Table 4-4), which are responsible for TOD projects like the successful Pearl District (Cervero, et al., 2004). TriMet's 1997 Joint Development Program demonstrates the power of creating incentives, and leveraging them as powerful TOD planning tools. Another TOD strategy has been the high quality, detail-oriented station are planning, which has led successful TOD endeavors such as the Westside Station Area initiative (Table 4-4), which assisted local governments with adopting stations plans.

Perhaps these are some of the planning programs that have resulted in walking commuter statistics remaining the same (Figure 5-12), but annual public transit miles increasing by 14% (Figure 5-11) (United States Census Bureau, 2000; United States Census Bureau, 2007; Texas A&M University Texas Transportation Institute, 2009). Further, Portland has some of the highest public transit ridership numbers per capita in the U.S., with light rail ridership increasing by 59% (Figure 5-15) and bus ridership increasing by 2% (Figure 5-17) (American Public Transportation Association ridership report archives, 2011).

Almost all of the measured indicator data criteria give praise to the smart growth principles that Portland has strictly followed. In this study, the Portland region conspicuously stands out among the other case studies as the best example of how TOD can allow thriving, clean urban environments to harmoniously co-exist with preserved natural lands-while still accommodating growth in a smart, calculated manner.

**San Francisco**

Since California is one of the largest and most populated U.S. states, maintaining air quality and curbing traffic congestion have been valid struggles since the 1970s

(Cervero, 1998). Consequently, significant regional public transit investments were made in heavy and commuter rail, attempting to mitigate some of the congestion problems and other related issues. Today, the Bay Area has more than 40 different transit agencies providing seven different modes of public transportation. The Bay area has also endured sprawl-induced congestion, especially in the 1980s and 1990s (Cervero, 1998; Cervero, et al., 2004). Perhaps those decades of congestion influenced increases in overall regional ridership statistics; with heavy rail increasing by 11% (Figure 5-14), commuter rail increasing by 11% (Figure 5-16), bus ridership increasing by 33% (Figure 5-17), but with a slight decrease in light rail ridership (Figure 5-15) (American Public Transportation Association ridership report archives, 2011).

Because of those transit investments, the Bay Area region has made progressive strides towards compartmentalizing growth, in notable efforts to foster sustainable development practices. San Francisco has similar data outcomes to Portland in regards to congestion costs (Figure 5-5), fuel sales (Figure 5-4), and urban land area (Figure 5-2) to population growth ratios (Figure 5-1), inferring San Francisco had achieved comparable results with smart growth and transit-oriented development (TOD) friendly development policies (Texas A&M University Texas Transportation Institute, 2009).

State and regional Bay Area housing programs (Table 4-5) have made a notable impact on fostering compact, residential development around transit (Anderson & Forbes, 2011), enabling growth to be accommodated on minimal amounts of land, while recruiting automobile commuters off roads and onto public transit. Analyzing Bay Area housing trends is complicated, as a large portion of the housing stock consists of the Victorian influenced residential architecture, unique to San Francisco. This housing type

is categorized as attached single-family unit row houses, yet can arguably be considered multi-family housing.

Although the study variables identify San Francisco experiencing no change in multi-family housing (Figure 5-9), the variables only measured single structures with ten or more units, not accounting for the prevalent attached row-house units. The increase of compact, attached single-family housing stock from 2000 to 2007 was 9% (United States Census Bureau, 2000; United States Census Bureau, 2007). Looking at the increase of population density, and the population growth to urbanized land area ratio (Figure 4-11); it is clear that the Bay Area is growing, but at higher densities, using less land resources (Texas A&M University Texas Transportation Institute, 2009).

**Washington D.C.**

Decentralization problems that plagued much of the U.S. in the 1960s and 1970s uniquely affected the metropolitan Washington D.C. as development dispersed, splotchy patches of inner urban remained, and eventually began filling in (Cervero, et al., 2004; Leach, 2004). This paradoxical growth trend caused major congestion problems for the region, greatly affecting millions of commuters in Washington, D.C., Virginia, and Maryland, and despite major mitigation efforts, still plagues the region today. From 2000 to 2007, the region's congestion costs increased 66% (Figure 5-5), and the congestion index increased 7% (Figure 5-6) (Texas A&M University Texas Transportation Institute, 2009).

In the face of continuous congestion issues, the region had made tremendous, if not model progress, towards developing sustainable growth patterns. The Washington Metropolitan Area Transit Authority (WMATA) initialized this by constructing a major heavy rail system that connected the employment centers in Washington D.C. to the

residential suburbs in Virginia and Maryland. Transit officials have since catalyzed ridership increases by promoting development near transit stations through joint development agreements, utilizing incentives to engage private developer interest. This strategy is still heavily used today, illuminating the grand possibilities of public-private partnerships (Cervero, et al., 2004). The outcomes of those partnerships have continually increased ridership with annual public transit miles increasing by 28% (Figure 5-11). From 2000-2007, heavy rail ridership increased by 25% (Figure 5-14), commuter rail has increased 57% (Figure 5-16), however, bus ridership decreased by 7% (Figure 5-17) (American Public Transportation Association ridership report archives, 2011).

The successful ridership can arguably be contributed to the model transit-oriented development (TOD) Rosslyn-Ballston Corridor project, which WMATA fostered through relentless joint development efforts and thorough station area planning that emphasized the importance of a station's identity. The study variables indicate sustainable, TOD-friendly growth patterns with walking commuters increasing by 3% (Figure 5-12) (United States Census Bureau, 2000; United States Census Bureau, 2007). For example, unlike most U.S. cities, the region has a higher rate of population growth than urbanized land area increase, and an increase of population density (Figure 4-14) (Texas A&M University Texas Transportation Institute, 2009).

Further, Arlington County's programs, the Special Affordable Housing Protect District and the Community Benefit Units promote and incentive high-density, multi-family residential housing located in Metrorail corridors (Leach, 2004). Examples of measured results include single-family housing stock decreasing by 2% (Figure 5-8)

and multi-family housing increasing by 7% (Figure 5-9) (United States Census Bureau, 2000; United States Census Bureau, 2007).

These growth trends, coupled with the ridership success, has provided an entire region-consisting of three U.S. states, housing, employment, and transportation choices that have the ability to greater improve the quality of lives for all types of family incomes. The region must continue to improve transit access and efficiency in order for traffic and congestion to subside. Clearly, the region is still struggling with the automobile when evaluating statistics such as zero-car households decreased by 7% (Figure 5-13), VMTs increased by 15% (Figure 5-3), and daily rush hours increased by 5% (Figure 5-10) (Texas A&M University Texas Transportation Institute, 2009; United States Census Bureau, 2000; United States Census Bureau, 2007).

## Summary

In summary, Portland was the stand out case study for adopting programs and policies that fostered and implemented transit-oriented development (TOD). The region's urban growth boundary policy has efficiently herded growth into an organized eco-friendly urban center, connected by transit systems that have modernized the city into a regional TOD. Most similar to Portland, San Francisco and Washington D.C. have also provided many housing and public transit options for their residents. Both regions face more congestion problems than Portland, but have the public transit infrastructure, programs, and policies to foster an abundance of future TOD.

On the other hand, Boston lacks a regional vision that drives growth and development patterns. The public and private investments in the two Silver Line BRT systems have been substantial. However, nationwide declining bus ridership may prove costly for the reinvestment made on Boston's waterfront, as there is no close passenger

rail access. Moreover, Dallas has very problematic development patterns to successfully support passenger rail without the use of an automobile. The growth has haphazardly developed along the new passenger rail line and has had some success largely in part because of the massive amount of parking required at the stations.


Figure 5-1. Population growth percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

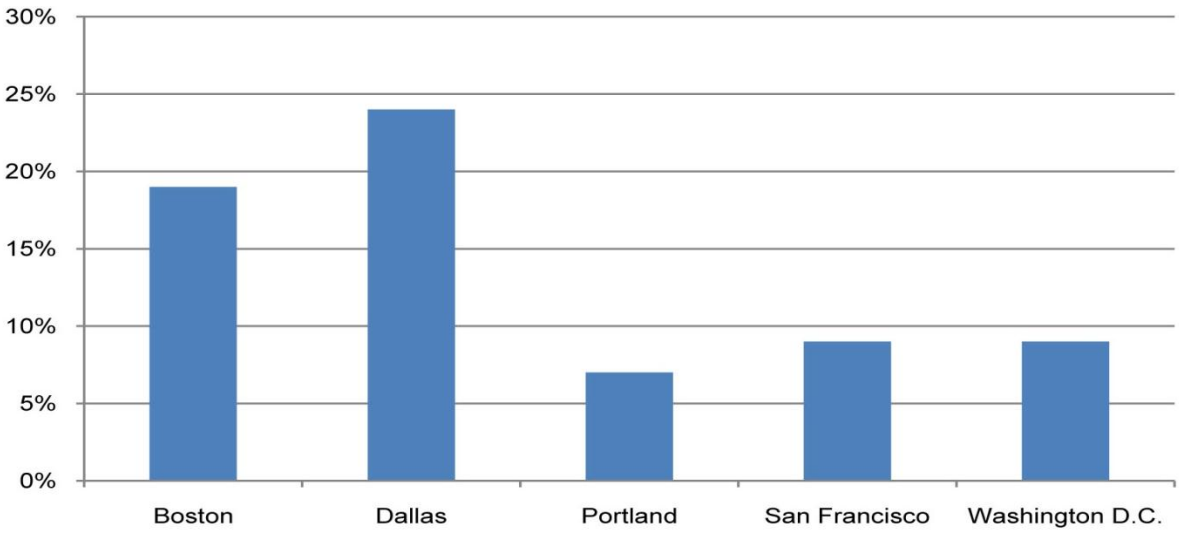



Figure 5-2. Urban land area percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

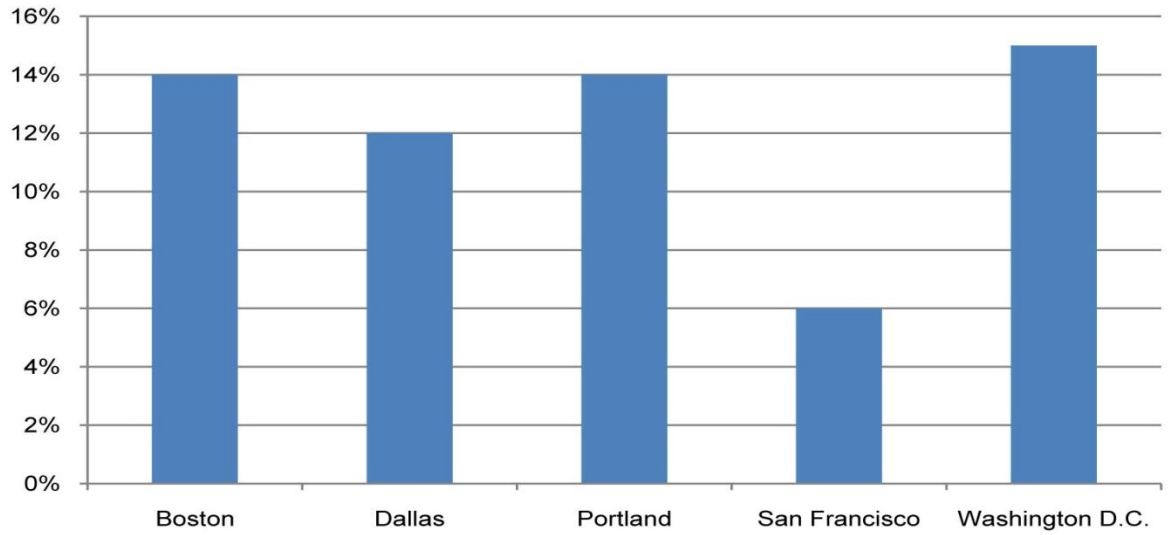



Figure 5-3. Vehicle miles traveled percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

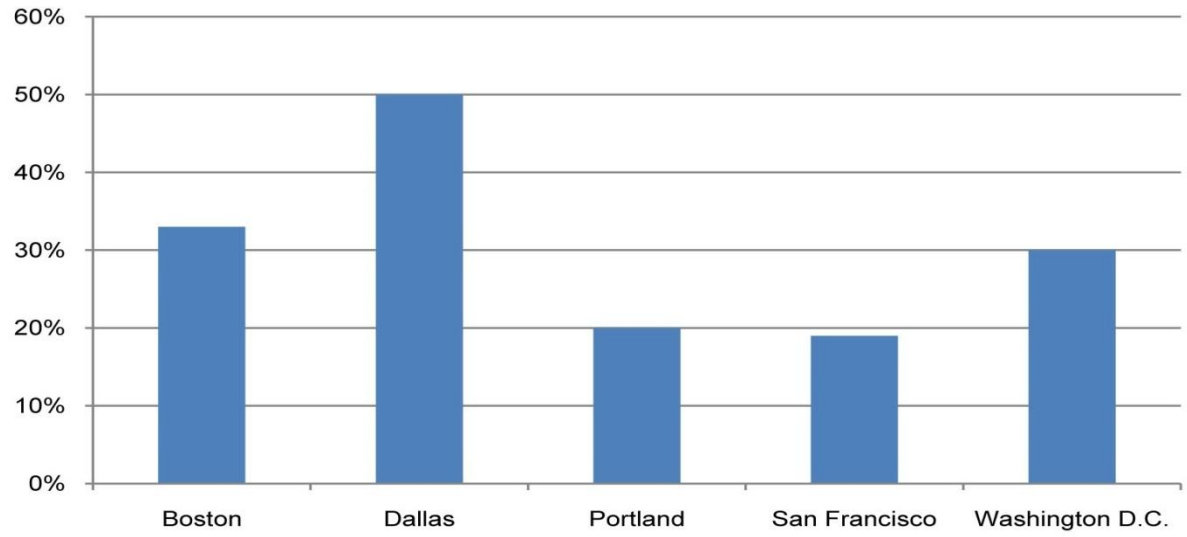



Figure 5-4. Fuel sales percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

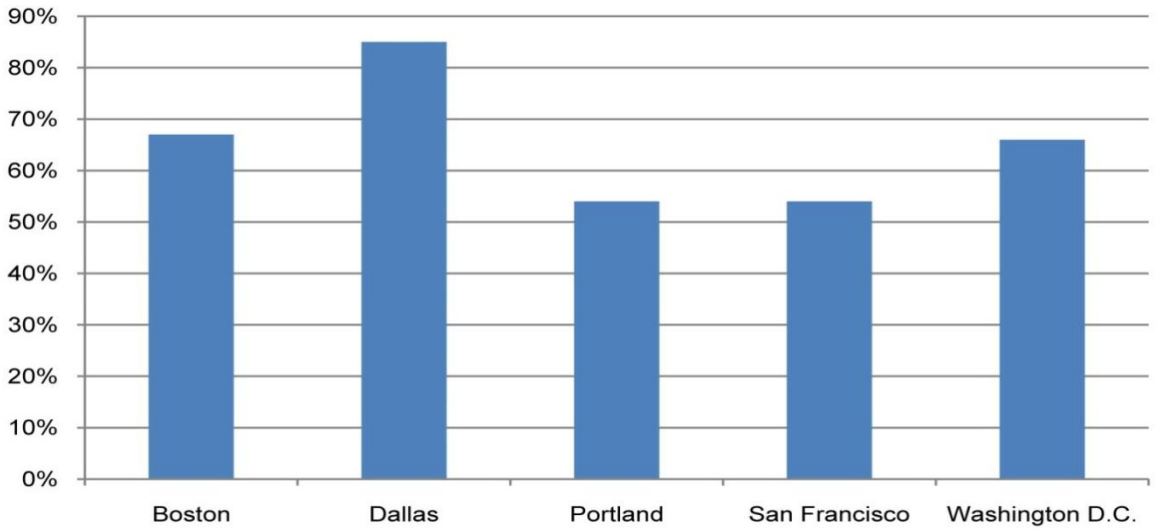



Figure 5-5. Congestion costs percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

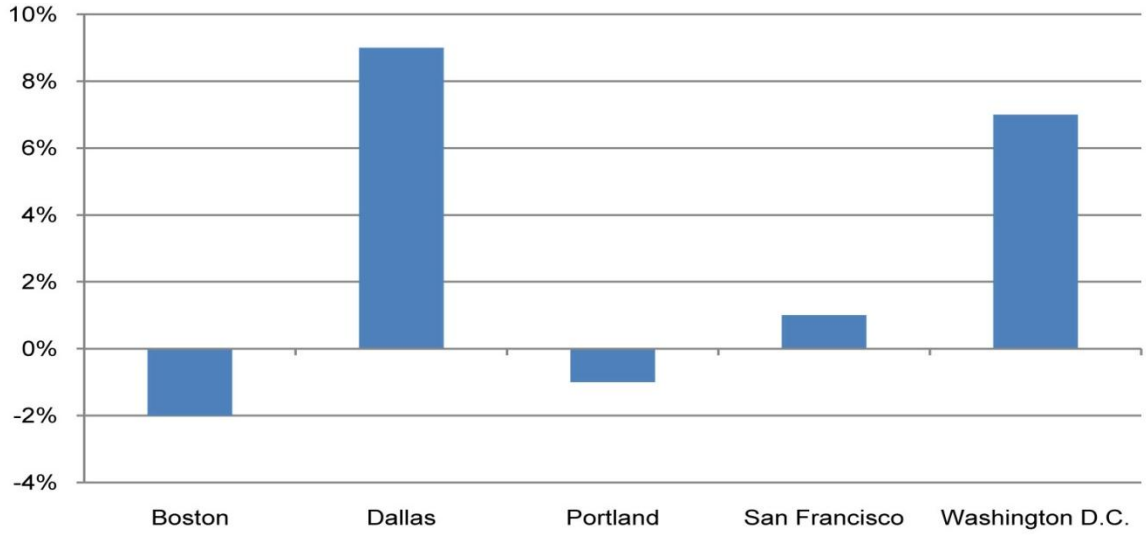



Figure 5-6. Congestion index percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

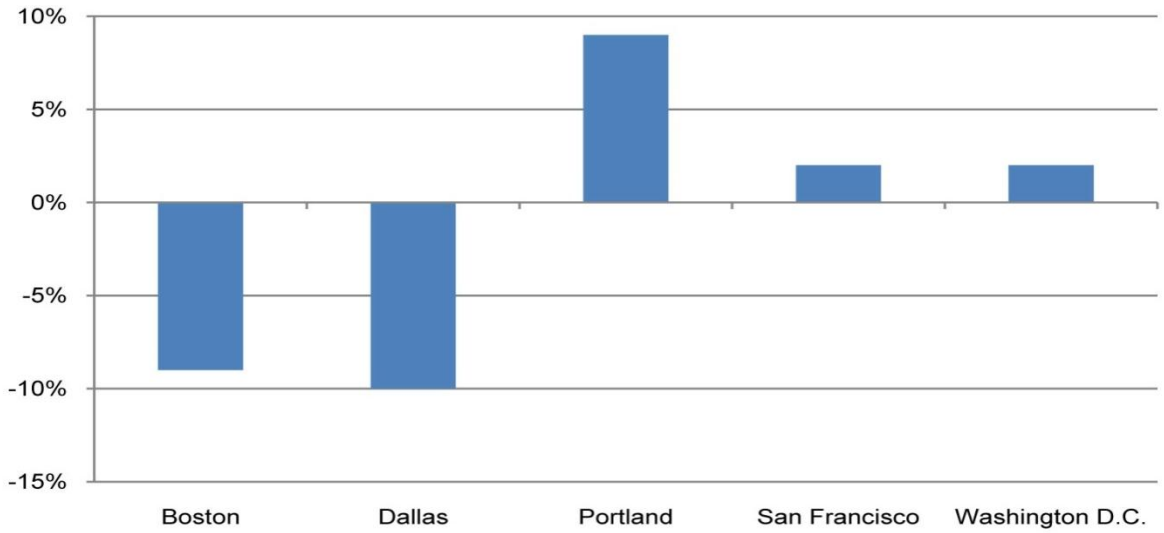



Figure 5-7. Population density (people per square mile) percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

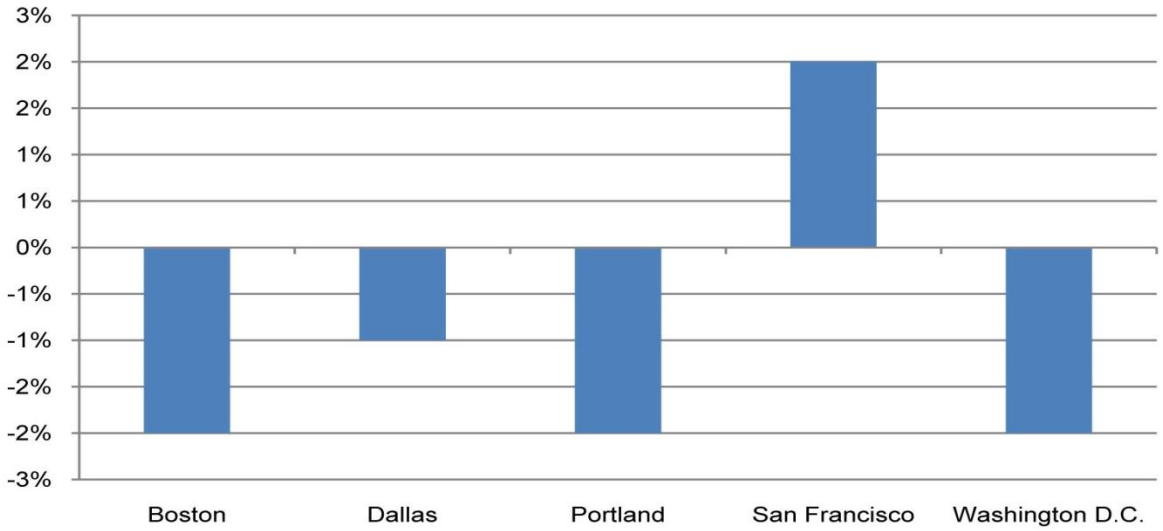



Figure 5-8. Single-family housing stock percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4 urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates urbanized area” by United States Census Bureau, 2007.

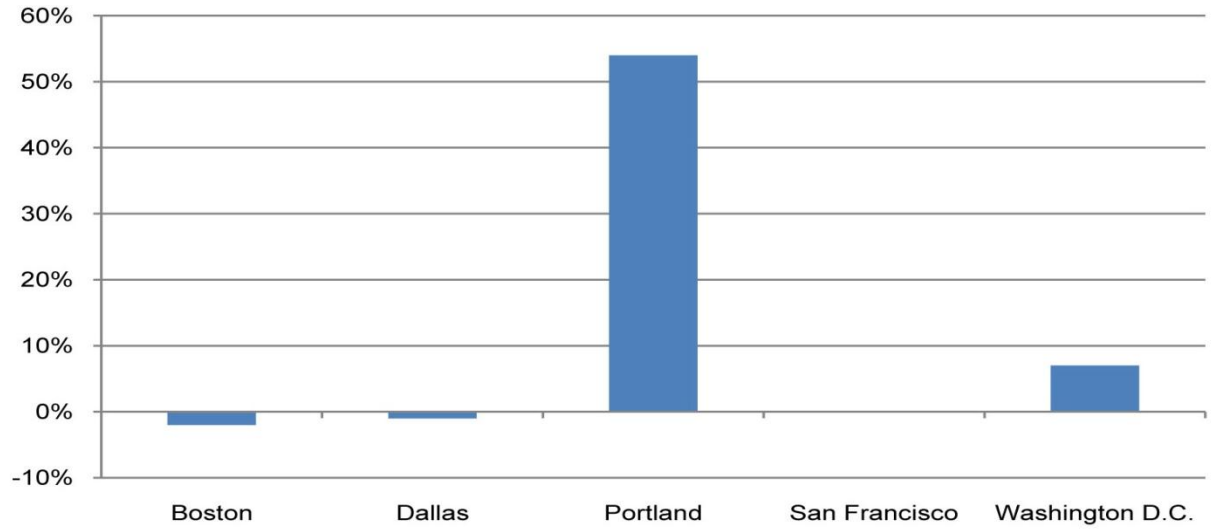



Figure 5-9. Multi-family housing stock percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4 urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates urbanized area” by United States Census Bureau, 2007.

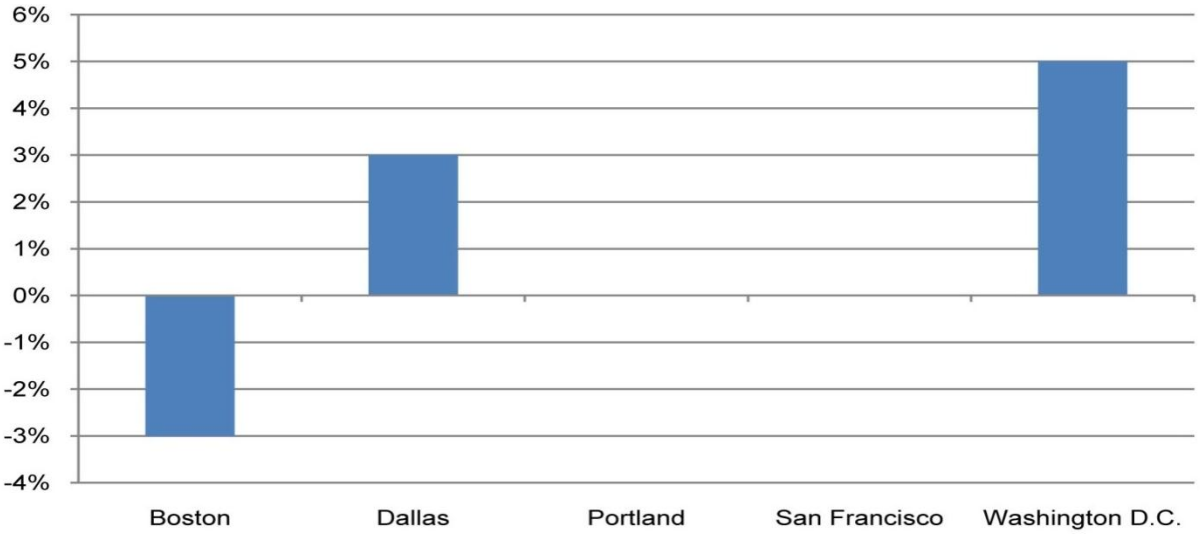



Figure 5-10. Average number of rush hours per day percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

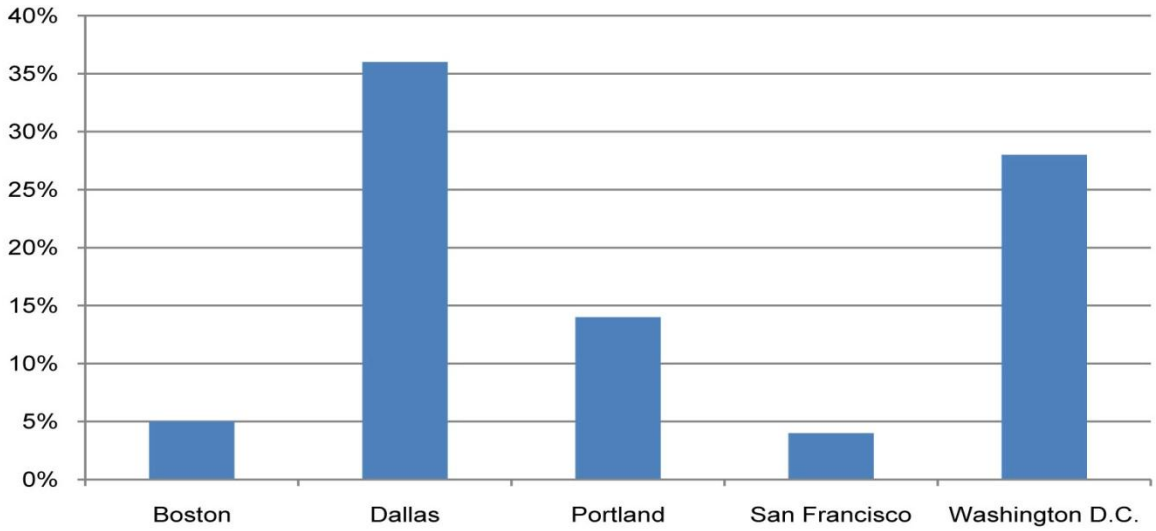



Figure 5-11. Public transit miles percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009.

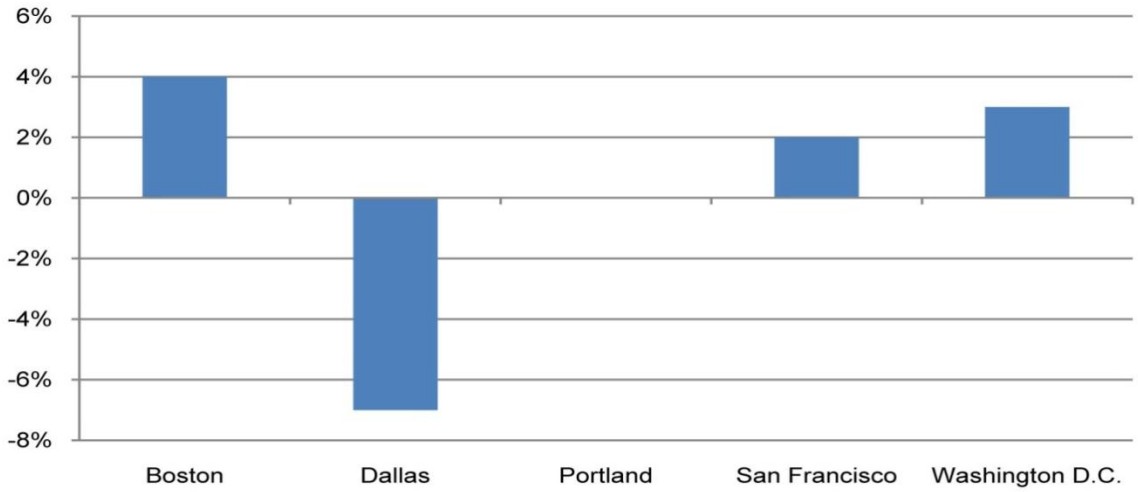



Figure 5-12. People who commute by walking percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected economic characteristics: 2000, Census summary file 4 urbanized area” by United States Census Bureau, 2000; “Selected economic characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates urbanized area” by United States Census Bureau, 2007.

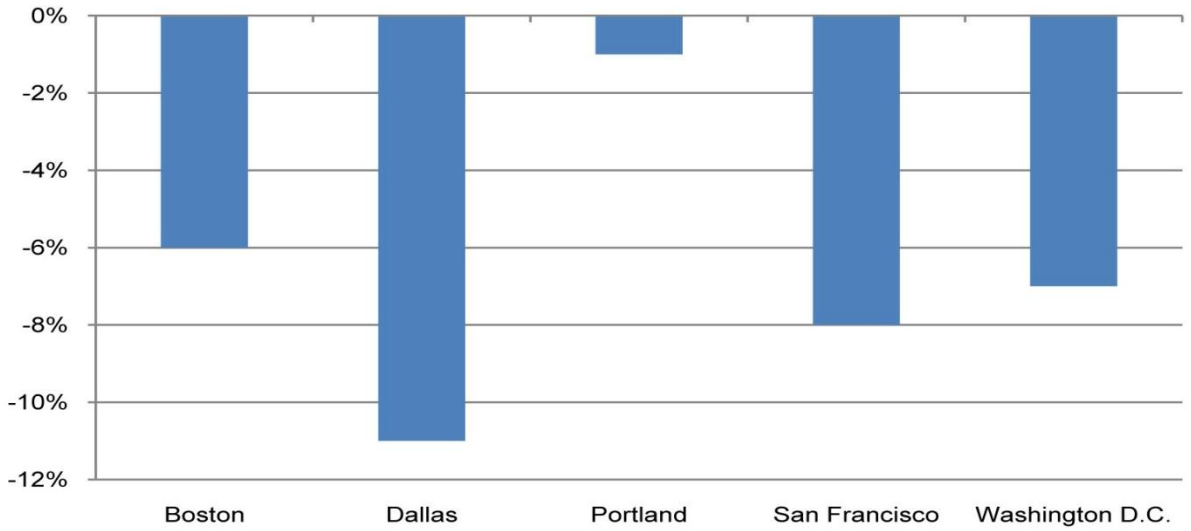



Figure 5-13. Zero-car households percentage of change from 2000 to 2007. Note. Adapted from “Profile of selected housing characteristics: 2000, Census summary file 4 urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates urbanized area” by United States Census Bureau, 2007.

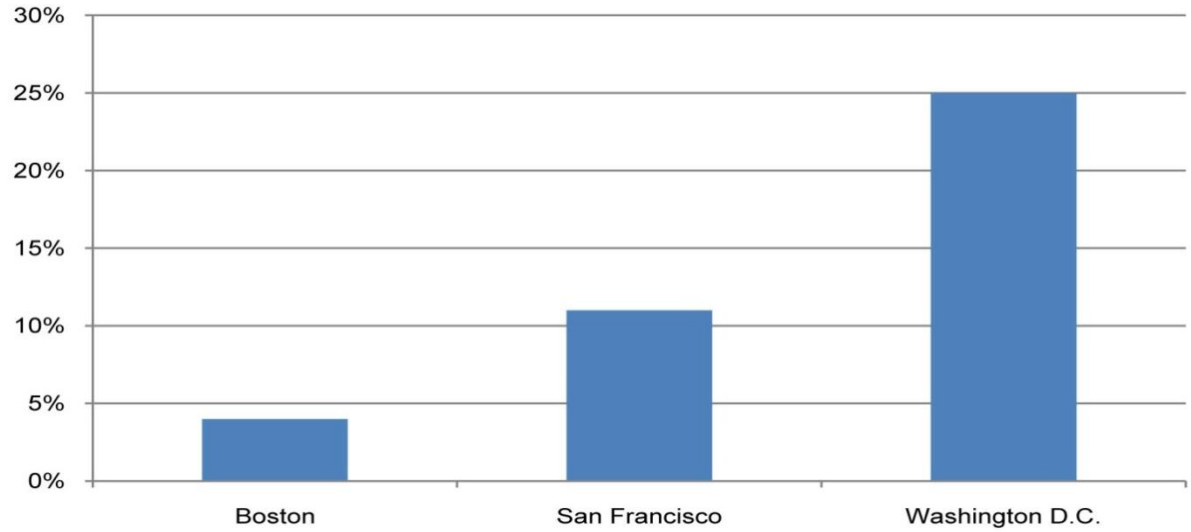



Figure 5-14. Heavy rail ridership patterns, percentage of change from 2000 to 2007. Note. Adapted from 2000 fourth-quarter ridership report archives, by the American Public Transportation Association, 2011; 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.

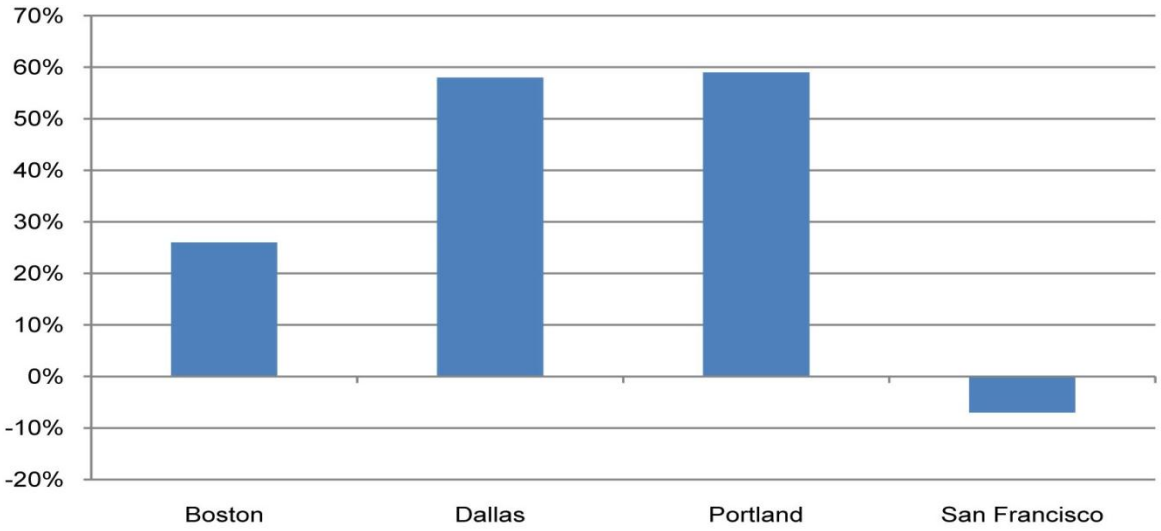



Figure 5-15. Light rail ridership patterns, percentage of change from 2000 to 2007. Note. Adapted from 2000 fourth-quarter ridership report archives, by the American Public Transportation Association, 2011; 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.

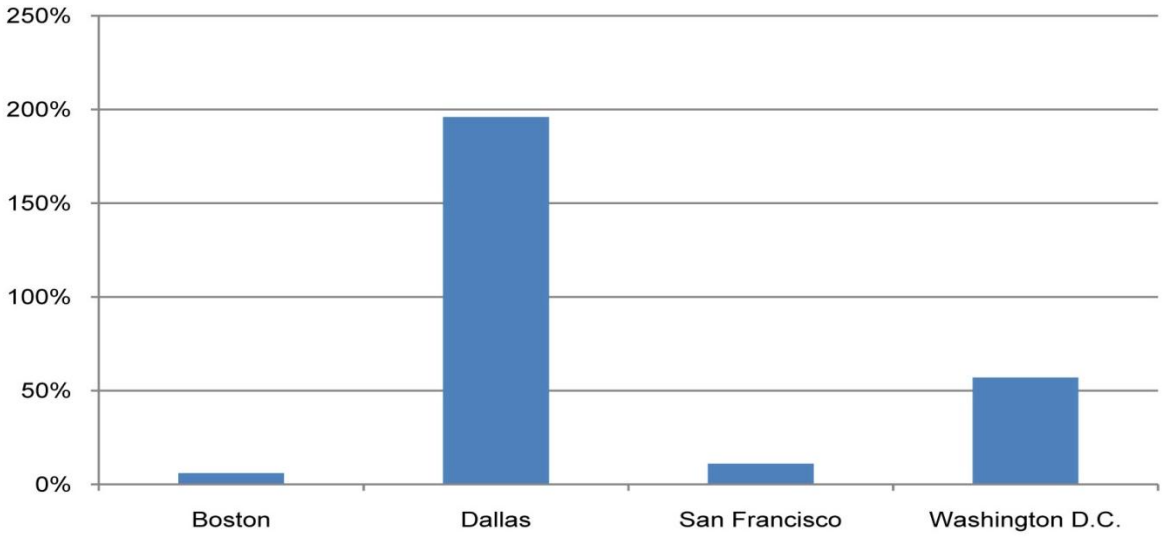



Figure 5-16. Commuter rail ridership patterns, percentage of change from 2000 to 2007. Note. Adapted from 2000 fourth-quarter ridership report archives, by the American Public Transportation Association, 2011; 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.

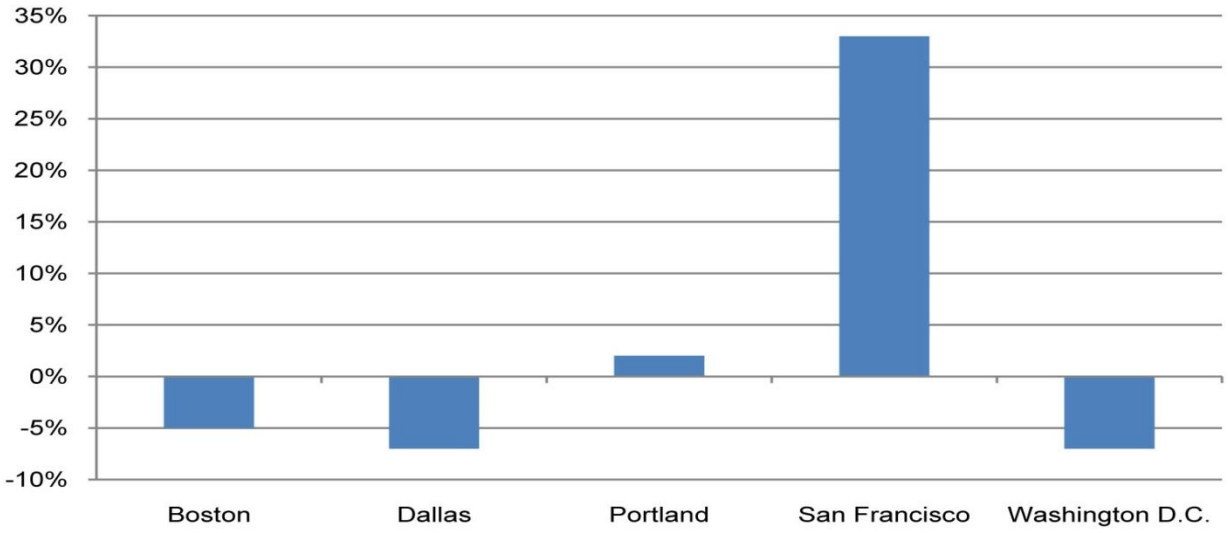
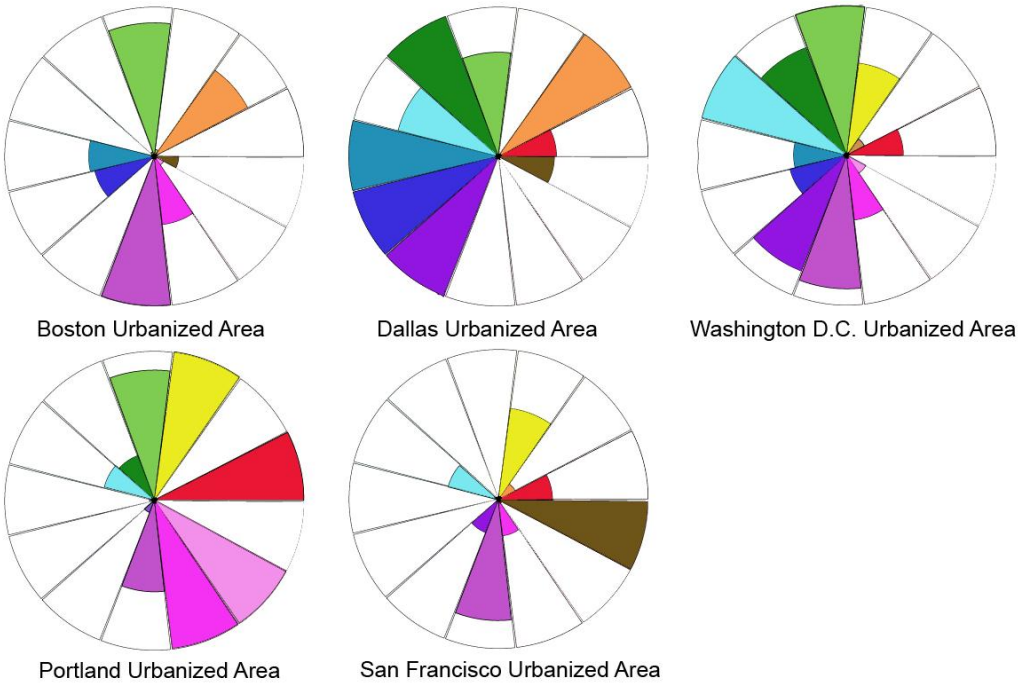



Figure 5-17. Bus ridership patterns, percentage of change from 2000 to 2007. Note. Adapted from 2000 fourth-quarter ridership report archives, by the American Public Transportation Association, 2011; 2007 fourth quarter ridership report archives, by the American Public Transportation Association, 2011.



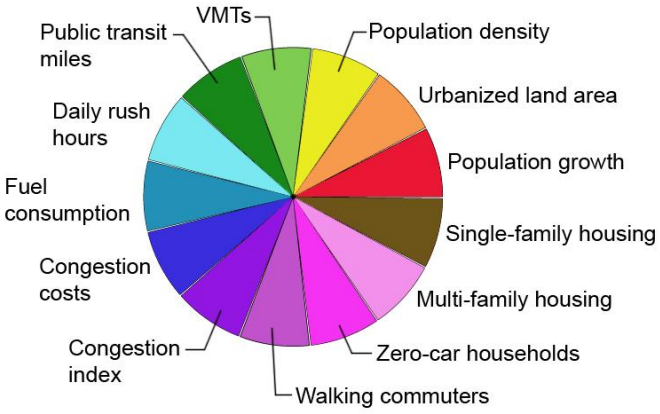




Figure 5-18. Visual indicator of study variable ratios (except ridership variables). Note. Adapted from work of Nate Holt, statistician consultant, 2011.

# CHAPTER 6
# CONCLUDING REMARKS

## Policy Overview

Given Portland's tremendous success with transit-oriented development (TOD), this study can offer few criticisms or recommendations. However, perhaps the region could continuously encourage high densities when given rare infill or redevelopment opportunities in the downtown urban core and intensely developed transit stations. The Portland region has done a superior job of fostering sustainable growth and development through TOD programs, policies and initiatives, thus proving to be the model to follow based on the results in this study.

For the regions of San Francisco and Washington D.C., where despite having adequate public transit, automobile commuting congestion (Figure 6-1) remains to be a major issue; perhaps implementing congestion tax policies through tolling high traffic roadways during commute rush hours could be a viable mitigation tool. This type of policy would increase public transit ridership, reduce air-polluting traffic, and would dramatically increase the market for TOD. This type of policy recommendation would be controversial, however these two regions have made extraordinary efforts to combat sprawl, and improve air quality; and yet the unconscious reliance on the automobile continues to increase congestion, pollute air and water sources, encroach natural areas with roads, causing a variety of other environmental and social degradation problems.

Despite Boston's well-established public transportation system, a historical built-out urban core combined with recent suburban edge city development has inhibited good access to public transit, causing constricting connectivity. From the research, there does not seem to be enough coordination at the regional level. There are several

TOD programs and initiatives at the state level, as well as at the Metropolitan Boston Transportation Authority, but no coordinated regional or citywide efforts. To improve Boston's dwindling ridership and stagnant housing market, a coordinated effort between a Boston-regional "city council" (representing the many suburbs of Boston) and the MBTA should implement a regional plan, where communities could provide input to avoid criticism or neighborhood opposition.

Dallas is making extraordinary efforts to provide the physical framework for TOD to become a viable option with the construction of the 72-mile passenger rail network. However, despite increased ridership, if Dallas truly wants to curb congestion and reduce roadway capital spending used to connect the abundance of low-density development in the region, they must begin planning at the state, regional, and community level. Learning from Portland, there are many advantages to planning early. Dallas needs to decide where and how to grow through calculated planning efforts, instead of approving anything proposed developers at the expense of gaining minimal economic growth for piecemeal, unconnected development that often requires a costly extension of infrastructure.

## Policy Recommendations

After researching and analyzing five different case study policies, programs, and initiatives specifically aimed to foster transit-oriented development (TOD), this study concludes some policies are perhaps more strategic in nature than others. After synthesizing the variables by a collective case study analysis (Figure 6-1; 6-2; 6-3), Portland arguably has the most TOD-friendly measured results in growth and congestion, housing, and ridership. Portland's strategic policy, The Urban Growth

Boundary, was instrumental in physically planning for growth, fostering the compact urban conditions that have allowed TOD to flourish in the region.

Another power policy tool used to implement thriving TOD projects are joint development programs. Dallas, Washington DC, and Portland have had significant success utilizing joint development partnerships to facilitate TOD. Additionally, Washington DC, specifically WMATA, has marketed these partnerships by creating station area identities, or themes that cater to interested developers. This unique approach has worked well in providing developers pre-determined visions, which saves the developer design and visioning expenses. Pre-determined station identities give developers a sense of security knowing they are building exactly what WMATA wants, minimizing the chance of conflict or discontent from the local governments.

Finally, concerted planning efforts at the local, regional, and state levels are imperative to set the policy stage for TOD implementation efforts. There must be site specific planning at the local level to identify the most suitable areas appropriate for TOD. At the regional level, transit agencies and regional planning councils or similar entities, must correlate regional development goals and objectives to those of surrounding local governments. Further, state planning or growth administrations must coordinate with regional planning entities and transit agencies to ensure that available funding and resources are utilized to the coordinated goals and objectives. This study has concluded that coordination is the most important tool used in all of the recommended policies, as TOD is not a product of a single agency or even a departmental effort, but a collective, coordinated collaboration of individuals,

departments, and agencies trying to provide smarter opportunities for us to grow as a nation.

## Future Research and Limitations

The variable data used in this study was measured from 2000 to 2007. Given the current economic crisis, especially in housing, conducting the same type of research in the post-economic crisis future may give more accurate results. Further, when Census 2010 block group data is available later this year, this study's methodology could be microscoped to study transit-oriented developments (TOD) at the block, neighborhood, or community scale.

The limitation of this study was the broad scale in which the data variables are measured. In order to obtain uniform information for the same period of time, the study had to use data at the urbanized scale. In some ways this was helpful, as many transit systems serve suburban areas, but categorize data for the urbanized area as a whole. However, the lack of available data at a fine-grained scale to conduct a time period analysis, for often site-specific TOD projects, imposes limits on the strength of the conclusions.

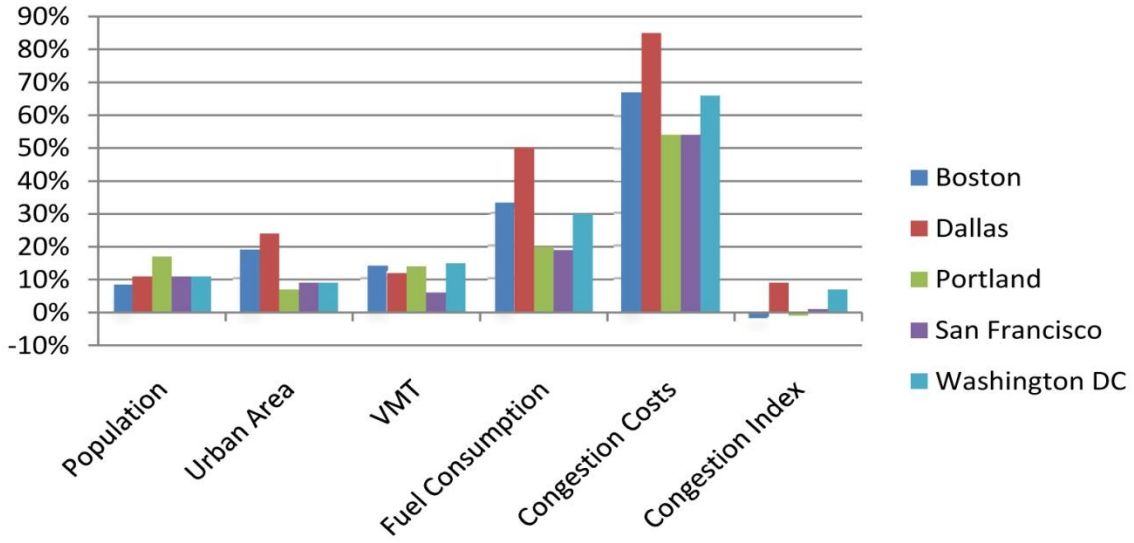



Figure 6-1. Case study growth and congestion patterns, percentage of change from 2000 to 2007. Note. Adapted from "2009 Urban mobility report" by Texas Transportation Institute, 2009.

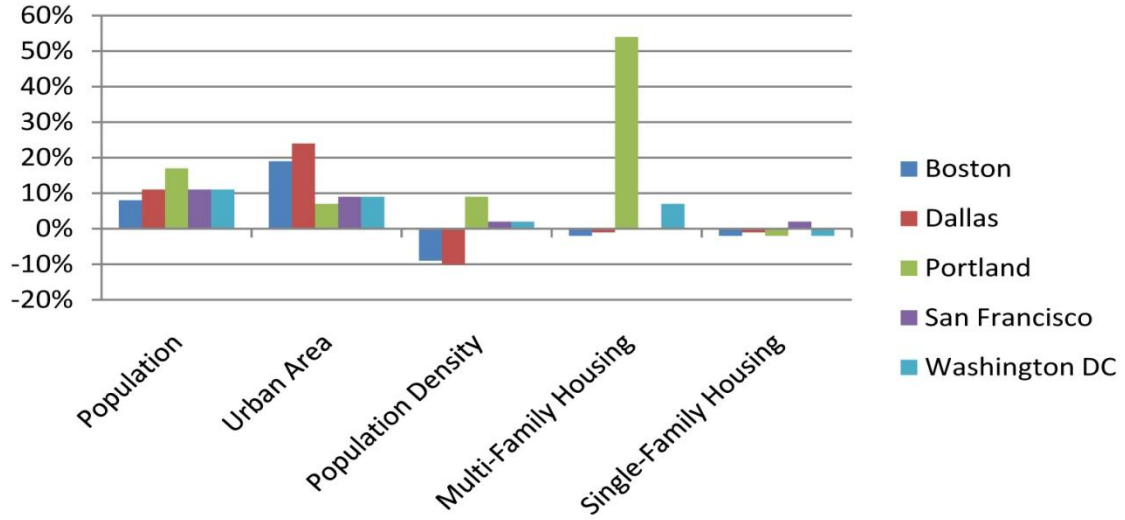



Figure 6-2. Case study housing development patterns, percentage of change from 2000 to 2007. Note. Adapted from "2009 Urban Mobility Report" by Texas Transportation Institute, 2009, "Profile of selected housing characteristics: 2000, Census summary file 4 urbanized area" by United States Census Bureau, 2000; "Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates urbanized area" by United States Census Bureau, 2007.

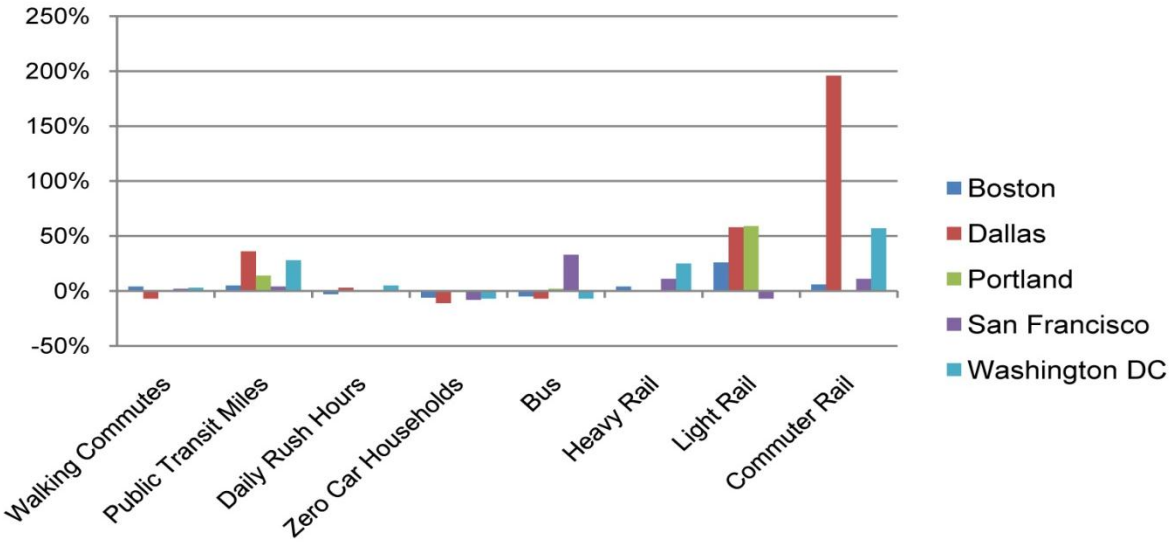



Figure 6-3. Case study commuting patterns, percentage of change from 2000 to 2007. Note. Adapted from “2009 Urban Mobility Report” by Texas Transportation Institute, 2009, “Profile of selected housing characteristics: 2000, Census summary file 4 urbanized area” by United States Census Bureau, 2000; “Selected housing characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates urbanized area” by United States Census Bureau, 2007, “Profile of selected economic characteristics: 2000, Census summary file 4 urbanized area” by United States Census Bureau, 2000; “Selected economic characteristics: 2005-2007, 2005-2007 American community survey 3-year estimates urbanized area” by United States Census Bureau, 2007.

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Christen Hutton is pursuing her Master of Arts in Urban and Regional Planning at the University of Florida. She previously received a Professional Bachelor of Arts in Landscape Architecture, also at the University of Florida. Currently, Christen is working with the Florida Department of Community Affairs and Treasure Coast Regional Planning Council in developing a transit-oriented development guidebook for Florida.