



Southwest Region University Transportation Center

Getting the Parking Right for Transit-Oriented Development

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16. Abstract Increasingly MPOs in Texas are incorporating Transit-Oriented Development (TOD) or similar concepts into their long-range plans for the purpose of achieving sustainable transportation. One major challenge to implementing these TOD-type strategies is parking. The conventional parking policies likely produce excessive parking, undermining the expected community benefits of TOD and could even cause the TOD initiative to fail. Getting the parking right is essential to ensure the desirable form and functionality of TOD. There are few studies of the topic on Texas cities. The main objective of this study is to report the state-of-the-knowledge on parking regulations and practice influencing the planning, design, and implementation of TOD. The report first offers a narrative review of the published works on TOD-Parking. Based on the review findings it then presents a matrix of best parking practices for TOD. Finally, the report provides an annotated bibliography of TOD-Parking studies. Appendix 1 assembles parking regulations and practice policies in selected cities in the Austin-Round Rock Metropolitan Statistical Area.					
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Getting the Parking Right for Transit-Oriented Development

by

Ming Zhang, Ph.D.

Associate Professor

Community and Regional Planning

The University of Texas at Austin

Austin, TX 78712

Tel: 512-471-1922

Fax: 512-471-0716

Email: zhangm@mail.utexas.edu

Katie Mulholland, Jane Zhang, and Ana J. Gomez-Sanchez

Research Assistants

Community and Regional Planning

The University of Texas at Austin

Austin, TX 78712

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Executive Summary

Increasingly MPOs in Texas are incorporating Transit-Oriented Development (TOD) or similar concepts into their long-range plans for the purpose of achieving sustainable transportation. One major challenge to implementing these TOD-type strategies is parking. The conventional parking policies likely produce excessive parking, undermining the expected community benefits of TOD and could even cause the TOD initiative to fail. Getting the parking right is essential to ensure the desirable form and functionality of TOD. There are few studies of the topic on Texas cities. The main objective of this study is to report the state-of-the-knowledge on parking regulations and practice influencing the planning, design, and implementation of TOD.

The first generation of TOD analyses focus on physical-design elements such as walkable communities, connectivity, and pedestrian-friendly designs. Parking was viewed as one more design feature that needs to be considered when building walkable communities. Despite the rich literature on TOD physical-design and parking, few studies addressed the human dimension of TOD as it relates to parking standards.

Best practices for TOD-Parking include: 1) Reductions: Parking requirements can typically be reduced around 20 and up to 50% in areas with good transit. Deregulate parking to allow developers to assess parking demand, provide market-priced parking to meet average demand, and use shared parking to accommodate peaks. 2) Design: Designing for pedestrians is an important component to parking. 3) Location: Parking should not be located near station, but out of sight and/or farther away (5-7 minute walk). 4) Management: To develop parking policies, cities need parking databases to understand supply and demand and to develop programs that allow the city to track the impacts of adjustments. 5) Pricing: Pricing can be used to improve monitoring, increase enforcement, reduce spillover, and make improvements in parking district. 6) General: Parking at TODs in suburban areas can be used to land bank but it can't be a sea of parking.

The report provides an annotated bibliography of TOD-Parking studies. Appendix 1 assembles parking regulations and practice policies in selected cities in the Austin-Round Rock Metropolitan Statistical Area.

1. Introduction

Increasingly MPOs in Texas are incorporating Transit-Oriented Development (TOD) or similar concepts into their long-range plans for the purpose of achieving sustainable transportation. An example from central Texas is CAMPO's (Capital Area MPO) "Activity Centers" concept. In north central Texas, NCTCOG (North Central Texas Council of Governments) has been expanding its TOD program along the DART (Dallas Area Rapid Transit) system that is planned to nearly double by 2030. In the greater Houston area, H-GAC (Houston-Galveston Area Council) is planning and implementing a "Livable Centers" project that cluster jobs, shopping, entertainment, and/or housing.

One major challenge to planning and implementing these TOD-type strategies is parking. While it is neither feasible nor reasonable to eliminate all parking in a TOD district, applying the conventional parking ratios to TOD projects would undermine the expected community benefits of TOD and could even cause the TOD initiative to fail. This is because the conventional parking standards have a serious suburban bias and are based largely on low-density single land uses (Shoup 2005). The standards likely generate excessive parking in the TOD area. By these standards, the parking lots or garages would take the limited prime locations and spaces near the station, increase project costs to the developer, and impede access to the transit by walking, biking, or feeder services. Getting the parking right is essential to ensure the desirable form and functionality of TOD. There are few studies of the topic on Texas cities.

The main objective of this study is to report the state-of-the-knowledge on parking regulations and practice influencing the planning, design, and implementation of TOD. The remaining part of the report consists of three sections. Section Two offers a narrative review of the published works on TOD-Parking. Based on the review findings Section Three presents a matrix of best parking practices for TOD. Finally, Section Four provides an annotated bibliography of TOD-Parking studies. Appendix 1 assembles parking regulations and practice policies in selected cities in the Austin-Round Rock Metropolitan Statistical Area.

2. TOD and Parking: A Narrative Review

Transit-oriented development (TOD) is most commonly defined as compact, pedestrian-friendly, high density development near transit stations. The top goals for TOD include: improving transit accessibility, transit ridership, and economic development (Willson 2005; Cervero, Murphy, Ferrell, et.al 2004; Lund, Cervero, & Wilson 2004; Cervero, Ferrell, & Murphy 2002). Other goals of TOD include enhancing livability, broadening housing choices, improving safety, reducing parking requirements, improving intermodal integration, and increasing pedestrian-friendly development (Higgins 2007; Willson 2005; Cervero, Murphy, Ferrell, et.al 2004; Lund, Cervero, & Wilson 2004; Cervero, Ferrell, & Murphy 2002). Successful integration of parking is vital for capturing the benefits of TODs and achieving all its goals (Boroski, Rosales, & Arrington 2005). For most TOD's, parking standards are subject to several factors, including local parking codes, diversity of land uses, residential demographics, pedestrian accessibility, types of transit services available, physical-design attributes, TOD project finances, and stakeholder perceptions. Applying suitable parking standards in TOD's can improve the overall performance of the TOD and shape travel behavior, community design, and development economics (Willson 2005).

Striking a balance between parking supply and development is a crucial challenge in developing the character of TOD. Nonetheless, there are few studies that have addressed parking design for TOD. TOD has been explained in terms of system design and siting, development control issues, and public finances, but rarely in terms of parking (Willson 2005; Loukaitou-Sideris & Banerjee 2000; Boarnet and Crane 1998). Mainstream data suggest that developers often rely on established parking codes to calculate parking requirements for TOD's, which can lead to parking and traffic problems, obstruct land development, and reduce the impact in transit use. In addition, experience has shown that strict adherence to local parking codes often creates an oversupply parking at TOD's (Boroski, Rosales, & Arrington 2005). Failing to adequately address the role of parking in TOD's prevents developers from maximizing investment potential and stimulating the multiple benefits of TOD.

The report examines parking as the major challenge for TOD planning and implementation. The study assumes that TOD performance can be improved by merging parking standards with physical-design attributes of the TOD. In addition, TOD often has a human dimension that relates to residential demographic and stakeholder perceptions. The physical-design attributes and the human dimension are useful in determining project finances and calculating parking demand. A qualitative literature review on parking for TOD will provide a synthesis of relevant research in the topic, identify gaps, and justify the need for further research. Case studies will review the experiences in the United States and abroad on innovative parking programs and the conditions for their success. These two exercises capture the multiple attributes of TOD, summarize major findings, and develop relevant information about parking for TOD. Ultimately, this report will explore best practices integrating parking into TOD's. The report can be used to guide developers and policy-makers in their TOD project proposals.

The report acknowledges that TOD parking needs vary greatly across localities, and are conditional to local dynamics and growth patterns. Thus, it does not attempt to draw conclusions about parking models, parking needs, and demands. Instead, this report attempts to explore

general findings through the literature review and case studies, and to provide relevant information to be strengthened with additional research that accounts for local dynamics that influence parking.

2.1 Physical Design for TOD Parking

Over the years several physical design principles have been explored to improve the functionality of TOD's. Most of them involve improving mixed-uses, and promoting a pedestrian-friendly environment, open space, and utilities upgrades. While there are many areas of agreement in the elements that are most important to TOD projects, parking is still held as a conflict (Boroski, Rosales, & Arrington 2005; Cervero, Murphy, Ferrell, et.al 2004; Cervero, Ferrell, & Murphy 2002). Calthorpe (1993) is among the first researchers that framed and developed best design practices for TOD by applying design elements found in new urbanism. For Calthorpe, TOD's offer an opportunity to improve connectivity and safe walkways for the betterment of communities (Calthorpe 1993). In improving walkability, Calthorpe (1993) opted to define TOD functionality in terms of the distance that people are willing to walk to access transit and services. Walking distance can be extended by building appropriate pedestrian-friendly designs (Cervero, Ferrell, & Murphy 2002). To achieve pedestrian-friendly design for TOD, Calthorpe (1993) suggested a minimum floor-area ratio that minimizes dead space created by parking lots (Cervero, Ferrell, & Murphy 2002). Among his statements, he outlined non-automobile forms of mobility and walkways to TOD design, but he did not focus in parking design functionality to encourage safe walkable communities. Inadequate parking can be considered an obstacle to achieving TOD safety pedestrian design principles.

Angel (1968), Wilson and Kelling (1982), and Loukaitou-Siders (1999) have explored the relationship between pedestrian circulation, safety, and parking. Angel (1968) and Loukaitou-Sideres (1999) argued that parking is a land use with specific physical characteristics that provide opportunities for crime to occur. Along those lines, parking discourages pedestrian circulation and become a safety concern for urban transit settings including TODs. Most TOD developers realize that spatial proximity is important, but so is *"making sure that the walk between a project and a station portal is safe and reasonably attractive"* (Cervero, Ferrell, & Murphy 2002: S-4). Thus, parking design plays a key role in making safe pedestrian-friendly communities.

Consistent with Calthorpe, Cervero (1993) examined physical-design principles behind TOD and its relationship to transit ridership. He found that TOD residents' proximity to a rail station *"was a much stronger determinant on transit use than land-use mix, or quality of walking environment"* (Cervero 1993; Lund, Cervero, & Willson 2004:6). Thus, residents will use transit as long as they live near a transit station regardless of the physical-design factors. In understanding parking, Cervero found that transit ridership declines if residents have access to a private vehicle and parking is free at a resident's workplace. The relationship of parking functionality, proximity to transit station, and TOD performance was not explored.

In understanding TOD physical-design and transit ridership, Ewing (1995) focused more on density, non-motorized travel such as walk and bike, and transit ridership. Collectively, these factors influence the vehicle miles traveled (VMT) which is an indicator of TOD performance (Ewing 1995; Cervero, Ferrell, & Murphy 2002). For Ewing, density promotes walkability and

transit use. Urban design elements such as sidewalks, narrow streets, and visual enclosure encourage pedestrian circulation and density (Ewing 1999). High density distribution and transit ridership are intrinsically related to land use development. However, in analyzing TOD density distribution and land use development, no emphasis was given to parking as an obstacle to develop land around transit stations, and as a physical-design attribute that hinders walkability and encourages auto-dependency. Ewing (1997) indicated the importance of allocating park and ride lots in long commute terminal stations, but no information was provided in regard to transit ridership in park-and-ride stations.

In 1997, following his initial research, Cervero was among the first researchers that studied TOD urban design for a specific setting – parking, concluding that parking layouts have the potential to detract TOD from quality of walking and undermine TOD regional land use benefits (Cervero & Landis 1997; Cervero, Ferrell, & Murphy 2002). Parking layouts have a direct impact on parking functionality, as well as TOD character and performance. In a later study, Cervero (2002) argued that quality of public environments, particularly for pedestrians, along with design considerations are fundamentally related to parking and access management. The “3Ds” as Cervero calls them- density, diversity, and design - embody the core strategic principles for TOD (Cervero & Kockelman 1997; Cervero, Ferrell & Murphy 2002). His research concluded that strict parking requirements are a major impediment to the design goals of TOD plans, especially for those projects with significant office and retail components (Cervero, Ferrell, & Murphy 2002). For Cervero, parking standards for TOD are unique in nature, and if done right, enable residents to get by with fewer automobiles, and they improve safe pedestrian circulation and influence land use development. In theory, fewer automobiles means greater transit use and free parking significantly reduces rail ridership rates (Cervero, Ferrell, & Murphy 2002). However, parking and transit ridership were not the primary focus of the research.

In 2004, Cervero, in collaboration with a group of researchers, conducted an extensive report on *Transit-Oriented Development in the United States*. The findings of the report concluded that reducing parking space is a must for TOD projects, however, for many developers “*parking is also an effective marketing tool that can make or break a project*” (Cervero, Murphy, Ferrell, et.al 2004; Cervero, Ferrell, & Murphy 2002: S-4). Thus, Cervero suggested that the decision regarding how much parking space is required for TOD should be made by the private sector. In urban settings, developers can rationalize parking policies in relation to TOD plans, access routes, and desired development. This measure aims to reduce conflict over whether land goes to parking or development. Cervero also concluded that “*if not properly dealt with, parking can be a huge obstacle to TOD, separating stations from the community, diminish walkability, hindering land development*” (Cervero, Murphy, Ferrell, et.al 2004; Cervero, Ferrell, & Murphy 2002: S-12). That same year, Lund, Cervero & Willson published a research report about the *Travel Characteristics of TOD in California* that explored the relationship between parking and transit use. The study was built upon previous studies and measured travel behavior through a set of surveys allocated to transit users. The data collected detail on-site physical-design factors that affect the likelihood of using transit and modeled those factors in relation to TOD location, mode choice, transit accessibility, and road congestion. Lund, Cervero & Willson (2004) study concluded that the presence or absent of a number of physical-design features considerably influence the ability of TOD to increase transit ridership. Parking design, as physical feature of TOD, is key in commuter mode choice. The research recommends lowering parking requirements, unbundling parking from rent payments, and establishing shared parking, or

parking cash-out. Both Cervero, Murphy, Ferrell, et.al (2004) and Lund, Cervero & Willson (2004) are among the most complete and comprehensive research reports designed to align TOD physical-design attributes to parking and transit ridership. As for parking rationalization, the reports highly emphasized local policy changes to meet TOD particular parking needs. This approach marks a transition point from the private-sector parking supply method to a public-private collaboration.

In a follow up study, Willson (2005) analyzed parking policies for transit oriented development. His research included case studies and a set of surveys of travel behavior and parking characteristics. He developed a formal link between TOD parking physical design, supply, and transit ridership. Parking physical-design is measured through local policies that allow parking flexibility for TODs. Supply becomes the result of parking policies and affects transit ridership. However, Willson was unable to test a significant correlation between parking supply and transit ridership. Most TOD followed initial conventional parking standards; hence, there is plenty of parking supply. The data provided by Willson was not sensitive to transit share due to the large amount of parking supply. Regardless of the lack of statistical significant correlation, the research concluded that TOD parking supply and policies are rarely structured to support transit ridership goals.

2.2 The Human Dimension of TOD Parking

Though most of the research conducted so far has focused on physical-design, the human dimension is an important component in TOD parking analysis. Human factors are for the most part related to residential demographics and stakeholder collaboration. Residential demographics are important in understanding TOD parking supply needs. Stakeholder collaboration is key when aiming for local policy modifications.

In 2002, Cervero described the demographics working in favor of TODs (Cervero, Ferrell, & Murphy 2002). For the most part TOD consumer market include *“an increasing shares of childless couples, single professionals, influxes of foreign immigrants (many of whom came from countries with a heritage of transit-oriented living), and growing numbers of empty nesters seeking to downsize their living quarters”* (Cervero, Ferrell, & Murphy 2002:2). These demographic groups tend to gravitate around mixed-use and compact development with accessible transportation. The combination of demographic trends and increasing transit usage is conducive to low car ownership rates. Thus, conventional parking codes are not required since many spaces sit empty invoking an automobile-oriented development pattern. Cervero (2002) argued that each parking code needs to be challenged for every TOD project to represent the TOD nonstandard consumer market. Critics on TOD often argued that TOD parking is usually oversupplied (Boroski, Rosales & Arrington 2005; Willson 2005). The common one-to-one replacement parking policy becomes obsolete and dysfunctional when the TOD character calls for transit-served node. Cervero (2002) did not focus on the relationship of specific demographic characteristics to transit ridership or explored alternative replacement parking policies as they affect TOD performance. Cervero’s 2002 research is one of the few that acknowledges the importance of understanding the consumer market characteristics to maximize TOD outreach.

On the other hand, Cervero (2002) argued that *“successful TOD typically involve carefully crafted collaborations between the many individuals, organizations, and institutions vested*

interest in outcomes” (Cervero, Ferrell, & Murphy 2002:10). To this extent, the lack of stakeholder collaboration can become a barrier for the overall TOD project. Cervero (2002) explained that perhaps the biggest challenge to collaboration is non-supportive government policies. Non-supportive government policies are more noticeable when addressing parking supply for TOD. In his analysis, Cervero (2002) found that in the fixation for automobile-oriented design, park and ride lots are usually prioritized in North America over passenger-generating land uses near transit stations. Cervero (2002) concluded that collaboration is essentially in engaging actions towards more transit-supportive development policies. Transit-supportive policies will allow higher densities and fewer parking spaces than the norm. Cervero’s (2002) research did not focus on collaborative dynamics, inclusionary factors, or degrees of engagement.

Considering Cervero’s findings, Willson (2005) incorporated the relationship between parking ratio and parking cost to stakeholder collaboration. Developers are strongly influenced by pricing policies. By carefully drafting the TOD around minimum parking requirement, savings can be ensured on parking development and passed onto residents through TOD amenities. Collaboration between the City, the community, and developers needs to exist in order to build up flexible parking requirements. Willson (2005) concluded that parking in TOD’s have a critical connection with design characteristics and transit behavior; however, stakeholders were not engaged. Partnership and collaboration between local governments, transit agencies, developers, and community is critical to implement parking strategies. Although supported with case studies, the Willson (2005) study did not examine the degrees of collaboration, dynamics, and factors that influence policies addressing parking.

In 2007, Higgins explored parking for TOD from the stakeholder perspective. Higgins (2007) argues that in encouraging TOD and developing flexible parking policies, communities are revising conventional parking codes and parking prices. Collaborative review of TOD parking policies is vital for the adoption and implementation of the policies. *“Without acceptance from policy makers, developers, neighborhood residents, transit operators, and other stakeholders, TOD parking policies will not be adopted or if adopted, may face sluggish or stymied execution”* (Higgins 2007:15). In his study, Higgins collected local TOD plans and parking policies from case studies. He assessed stakeholder points of views by conducting phone interviews or in person interviews in particular case study cities. The interviews described parking strategies of interest, the stakeholder experiences with the strategy, and stakeholder perception of the pro and cons of the strategies. Higgins (2007) data proves to be revealing and considerable variations were found across city planners, developers, transit managers, residents, and business representatives. Higgins concluded that acceptance and successful implementation of parking policies are going to depend on the community’s ability to negotiate and commit to trade-offs, particularly on economic matters. Parking pricing, innovation, and revenue distribution are top priorities for stakeholders in rationalizing parking strategies. A credible expenditure plan combined with design concepts is important for community acceptance. Parking strategies such as unbundling and shared parking are attractive economic concepts to stakeholders (Higgins 2007). However, unbundling represent a concern for *“state regulators overseeing affordable housing who may view parking pricing as outside state guidelines for low income housing rents”* (Higgins 2007:20). Higgins research did not explore transit ridership as a variable that can potentially influence stakeholders’ perceptions on TOD parking strategies.

2.3 Summary

The first generation of TOD analyses focus on physical-design elements such as walkable communities, connectivity, and pedestrian-friendly designs. Parking was viewed as one more design feature that needs to be considered when building walkable communities. For Calthorpe (1993), Ewing (1995,1997,1999) parking was related to walkability and pedestrian-friendly designs. For Cervero (1997) parking was influential to transit ridership rates. As TOD's were being built, TOD research shifted from physical-design basis to a performance- based approach. In analyzing TOD performance, parking functionality becomes critical, as empirical evidence suggests that conventional parking standards can compromise the TOD character and benefits. Cervero (2002) was among the first researchers that analyzed parking as a specific setting within TOD that functions separately but was complementary to TOD performance. Cervero (2004) and Lung, Cervero, & Willson (2004) went one step forward as to consider parking an indicator of TOD performance and intrinsically related to transit ridership. Finally, Lung , Cervero, and Willson (2004) explored the importance of local policies in rationalizing parking standards for TOD. Willson (2005) focus primarily in parking policies for TOD analyzing travel behavior and parking characteristics as they related to parking design, parking supply, and transit ridership. On the other hand, none of the researchers presented in this literature review analyzed TOD parking supply and transit ridership in terms of trip generation. Trip generation is one of the best methods to measure travel behavior and transit ridership, and it can potentially measure TOD performance and parking supply needs. Future research in the relationship between trip generation and TOD parking will strengthen current studies and can potentially influence TOD parking dynamics.

Despite the rich literature on TOD physical-design and parking, few studies addressed the human dimension of TOD as it relates to parking standards. Cervero (2002) introduced TOD demographics and consumer market. In understanding TOD performance, demographics become essential to maximizing TOD benefits, and target population. Later, Willson (2005) explored the dynamics between TOD parking policies and parking cost, making specific reference to the need for collaboration. Collaboration between stakeholders was required to develop coherent and flexible TOD parking policies. Higgins (2007) was one of the first researchers that explored TOD parking from stakeholders' perspective. Through case studies and a series of interviews, Higgins concluded that the acceptance and successful implementation of parking policies is going to depend on careful negotiation and trade-offs between the different stakeholders. Parking pricing, expenditure plan, and revenues distribution are top priorities for community acceptance. Most of the literature on the human dimension of TOD parking does not focus in transit ridership as it relates to transit-users perceptions and parking policies. As for future research, one path might be to develop models in which transit ridership can be linked to specific parking policies and assessed with stakeholder perceptions. It will be interesting to evaluate the degree of involvement of different stakeholders and develop patterns to be identified in different case studies.

2.4 Case Studies

Case studies are an important element in understanding TOD parking performance and functionality. Now that TOD's are getting built, empirical evidence is a valuable tool in assessing TOD parking programs and their influence over the TOD project. For this purpose, three TOD localities, (two U.S. examples and one international example), were selected: 1) Curitiba, Brazil; 2) Orenco, Oregon; and 3) Arlington County, Virginia. TOD parking conditions were analyzed in terms of spatial, fiscal, and institutional. These factors are essential in determining the TOD parking program success.

Curitiba, Brazil

Transit oriented development uses a variety of transit services to mobilize and connect people such as commuter rail, light rail, tramways, and bus rapid transit (BRT). Bus rapid transit is a system of buses that provide a faster and more efficient service than ordinary buses. The goal is to approach a service similar to rail, but keeping the cost savings and flexibility of bus transit¹. Curitiba, Brazil is considered the birth place for BRT and the service includes the following features: bus only right-of-way (bus lanes), comprehensive coverage, diverse user market, bus preferential treatment (over other modes of transportation including private vehicle), frequent high capacity, integrated single-fare system, improved security for bus riders, and enclosed high quality bus stations (tube stops). The Curitiba bus system “*exemplifies a model of BRT and plays a large role in making Curitiba a livable city*” (Goodman, Laube, & Schwenk 2006:75).

Curitiba has one of the most used, low cost, transit systems in the world. Around 70%-75% of commuters use the BRT to travel to work resulting in congestion reductions, and superior air quality (Levinson, Zimmerman, Clinger, et.al 2011; Goodman, Laube, & Schwenk 2006). Thirty years ago, Curitiba integrated and organized transportation into its urban planning and developed TOD policies to accommodate high density development. Curitiba TOD literature focuses exclusively on its urban form and the BRT system. Parking management is analyzed in terms of its functionality to the BRT System. Limited information is available about the parking management system.

The 1965 City Master Plan allowed Curitiba to grow along designated corridors in a linear form and encouraged by TOD zoning and land use policies. Downtown Curitiba became a transit hub, mass transit became the primary transportation mode, and the wide boulevards previously designed for vehicle use became bus lanes. The main idea was to develop high density only around four main boulevards, now called corridors (Levinson, Zimmerman, & Clinger, et.al 2011). These corridors would provide high mobility for both private vehicles and buses. The concept is called trinary structural axes, where three main roads give access to a central business district and one leads out of the central business district. The two central roads are exclusive bus lanes with limited parallel “*traffic lanes for non-through movements and service access to the frontage development*” (Levinson, Zimmerman, & Clinger, et.al 2011). About one block from the center roads, two external one-way roads, of three to four lanes, were designed for private vehicles use. Of the external roads, one leads to the business district and the other one away from it. Figure 1 shows an image of Curitiba Trinary Structural Axis.

¹ NY Metropolitan Transit Authority. <<http://www.mta.info/mta/planning/sbs/whatis.htm>>. Retrieved on November 15, 2011.

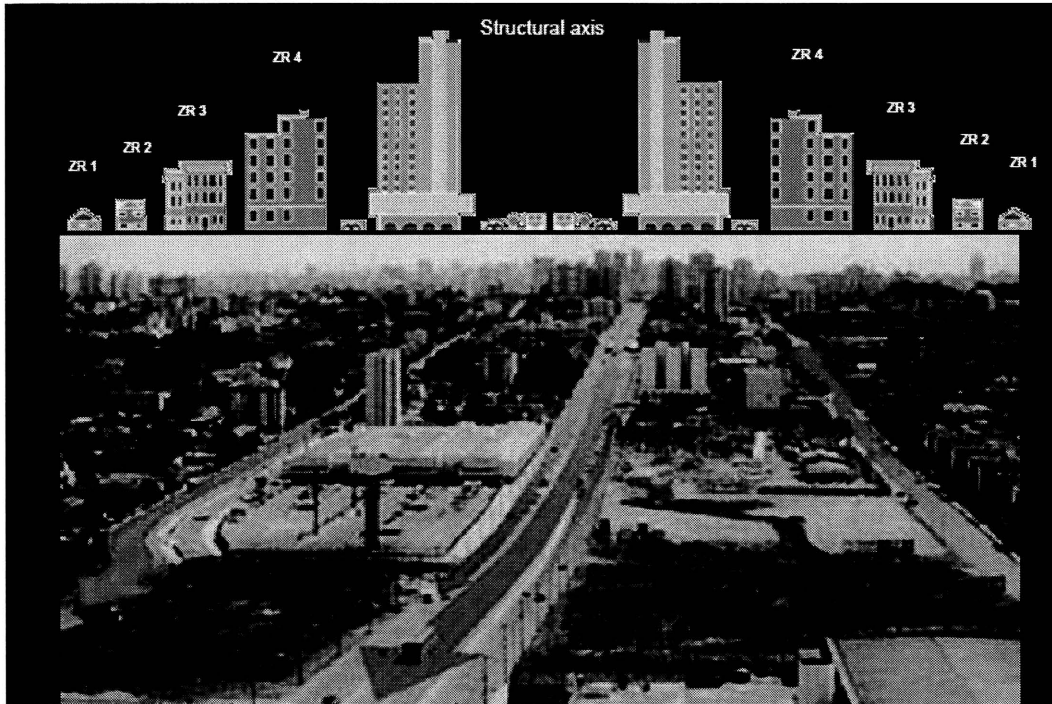


Figure 1. Curitiba, Brazil Trinary Structural Axis.

Source: Fragomeni, L. (2008). Transit Oriented Development: Curitiba's Experience
 <http://www.niagararegion.ca/living/smartgrowth/pdf/SNS_08_Fragomeni.pdf> Retrieved November 20, 2011

As for parking, Rabinovitch in 1996 declared that parking areas are not allowed in Curitiba, but in other areas parking requirements are necessary for building permits and commerce (Ziemann 2006). In addition, Cervero (1998) stated that Curitiba off-street parking was privately owned and expensive; income and not urban density seemed to be determinant of parking demand in Curitiba (Cervero 1998). In 2006, Goodman, Laube, & Schwent argued that “*very limited public parking is available in downtown area, and most employers offer transportation subsidies, especially to low-skilled and low-paid employees*” (2006:76). ICLEI-Local Governments for Sustainability in its EcoMobility magazine stated that by promoting a pedestrian-friendly community, with BRT system and low car parking availability, Curitiba has successfully reduced the overall travel of its residents². In 2011, the Transit Cooperation Research Program (TCRP) developed an extensive report on Bus Rapid Transit which analyzed different case studies including Curitiba, Brazil. The TCRP Report #90 concluded that on-street parking is limited in location and duration and is well enforced, especially in the downtown area. Although off-street parking is available, it is expensive and the permissions to develop off-street parking are restrictive in nature, not matching the increasing demand from growth in vehicle ownership

² EcoMobility Magazine.

<http://www.ecomobility.org/fileadmin/template/project_templates/ecomobility/files/Publications/Case_stories_EcoMobility_Curitiba_PDF_print.pdf> Retrieved on November 15, 2011

(Levinson, Zimmerman, & Clinger, et.al 2011). Parking in downtown is limited based on the quality of space; however, the city central area is for the most part close to vehicular traffic. Curitiba's effort to grow linearly plays a key role. The design of the BRT system does not allow access and parking of private vehicles in the area of the BTR, giving the buses the right-of-way. The limited spaces assigned for parking and the pedestrian-friendly environment reinforce the BTR ridership and the concept of a walkable community. Figure 2 shows Curitiba BRT stops and pedestrian circulation.



Figure 2. Curitiba BRT stops.

Source: American Museum of Natural History. The Built Environment. Community Planning
<http://amnh.ws/exhibitions/climatechange/?section=making_a_difference&page=community_planning> Retrieved November 20, 2011

Curitiba parking is divided into on-street (paid and unpaid), off-street private parking lots, and off street private parking spaces for customers. There are very few off-street public parking lots, with the exception of city buildings and terminals with guest parking spaces. Paid on-street parking is the norm in downtown; however, there are on-street free parking spaces available outside the trinary system (Levinson, Zimmerman, & Clinger, et.al 2011; Ziemann 2006). Private off-street lots are available in downtown. Businesses offer parking to costumers and this parking is usually underground or adjacent. Businesses usually lease parking spaces from neighboring parking lots in a dynamic that resemble shared parking/district parking programs.

Parking policies have shaped BTR ridership by adopting minimum parking requirements, limiting parking location, controlling parking time, and charging high parking prices. Minimum

parking requirements were developed for different land uses based on a study (Decree 582) produced by the IPPUC and the Secretariat of Urbanism in 1990 (Ziemann 2006). The city opted to eliminate parking from the trinary axes. Parking policies limited existing parking in the downtown area. However, there are no laws regulating new parking prices, maximum supply, or limiting parking spaces as long as they project is approved by the Secretariat of Urbanism. Regulated new parking policies apply to on-street parking in non-motorized zones, BRT only streets, and pedestrian-friendly streets and malls (Ziemann 2006). In the downtown new buildings needing new parking (or additional parking) are required by law to lease and/or share nearby parking lots to meet their needs. As for parking programs, the city uses private parking, and a dynamic that can be considered shared/district parking. For areas with free on-street parking availability, local policies allow the city to convert free parking to pay parking at the request of the district to support high demand. Curitiba parking policy promotes BRT ridership; however, the parking policies seem to be the result of measures to reduce congestion rather than BRT planning (Levinson, Zimmerman, & Clinger, et.al 2011; Ziemann 2006).

The municipal company Urbanizacao de Curitiba SA (URBS) controls the bus service, taxis, parking, bus terminals, shopping areas, and even markets. They are in charge of collecting fares, developing roads, and contracting bus operators. The URBS also encourages low-income riders to collect waste from inaccessible areas in exchange for bus travel tokens, promoting transit ridership (Levinson, Zimmerman, & Clinger, et.al 2011). The BRT system integrated a single-flat fare and “*is reported to operate without subsidy*” (Levinson, Zimmerman, & Clinger, et.al 2011:10). The fare is designed to cover operations, maintenance, administration, replacements, and to ensure that the average worker pays no more than 10% of their income in transport (Levinson, Zimmerman, & Clinger, et.al 2011). The remuneration to operations cover vehicle replacement cost and even allows operators to make profit. Business and government sponsor BTR passes for their employees, especially low-paid employees

Since the BRT is self-sustained, the city enjoys from the flexibility to finances many sustainable development projects to improve the pedestrian-friendly environment, open space, and green areas. As for parking, public parking is subsidized by the government and the URBS, while private parking is subsidized by the private sector. Individual income influences parking prices and quality of parking. Areas with higher income have higher parking rates and high quality of parking, offering additional services such as valet parking and car wash for an extra fee (Ziemann 2006). Since shared parking program dynamics are often applied, office parking and empty areas are used by nightclubs and bars at night providing financial benefits. Hourly parking is the norm, but monthly parking programs are also available in downtown. At the end, regardless of the different features and programs parking is expensive in Curitiba TOD. Outside the TOD trinary system, parking prices decrease.

Orenco Station, Portland, Oregon

Orenco Station is located at the Orenco Stop of the Westside light rail line in Hillsboro, Oregon. In the 1980s, the city of Hillsboro created an urban renewal district to consolidate land ownership and promote economic development and used the light rail to boost Orenco neighborhood development (Charles & Barton 2003). PacTrust and Intel, the two corporations working on the urban renewal, began planning a high density, mixed-use development near the light rail using TOD Principles. “*The City and TriMet (Public Transportation for the Portland*

Metro Area) imposed existing planning restrictions in the area, mandating high densities near the rail station” (Charles & Barton 2003:1). The Westside light rail opened in 1998; however, land surrounding the rail remained vacant until recent years. The relationship between the light rail, urban development, and rail ridership has become the justification factor for the rail expansion in Portland and TOD development. However, “the Orenco Station has largely proven to be a disappointment” (Charles & Barton 2003:1). Regardless of its TOD title, Orenco resembles an auto-oriented development that enjoys substantial mixed-use development and economic development. Orenco TOD has not been able to accomplish some of the benefits TOD is expected to give residents, which include reduced traffic congestion, and affordable land development. This is the result of the free park-ride system that encourages auto dependency, expensive pedestrian parkways, and local companies providing free shuttles to employees. In addition, zoning in Orenco mandates for high density, but a high financial cost for developers and residents makes development very impractical and slow.

In regard to parking, PacTrust initially started developing auto-oriented apartments. In this case, the apartment complexes were 0.5 to 1.0 miles away from the light rail station and within walking distance from the Intel facility (Charles & Barton 2003). Although business supported TOD principles, there were many concerns on making Orenco an auto-friendly TOD over a pedestrian-friendly community. As for rail ridership and parking, Charles & Barton (2003) argued that Orenco station ridership is completely dependent on the free Tri Met park-and-ride with the majority of the riders arriving by car and only 23.7 percent arriving by foot or other means. Without the park-and-ride system, “*there would be only about 15-20 boardings per hour at the peak*” (Charles & Barton 2003:23). Figure 3 shows Orenco park-and-ride lot.



Figure 3. Orenco Park-and-ride lot

Source: Bottineau Partnership. Photos of Portland. Orenco Station.
<<http://www.bottineaupartnership.org/attracting/PortlandPhotos.htm>>
Retrieved November 20, 2011

The most noticeable feature of Orenco is its retail downtown center with more than four blocks designed to resemble San Francisco mixed use development. The multi-story buildings that comprise downtown have ground floor retail stores and top floor residential units. The concept of live-work homes was opted with two story homes above and office-retail space at street level (Charles & Barton 2003). In the residential neighborhood areas outside downtown, cottages were developed along with luxurious row-houses, and three-story brownstone homes. On the south side of the rail station, Pac Trust developed “The Crossroads”, a commercial center with mixed retail-office spaces. This complemented Orenco’s development, however, it is located about 0.7 miles from the rail station making it highly unwalkable. Figure 4 shows Orenco downtown center.



Figure 4. Orenco Downtown Center

Source: KettleMoraine. November 18, 2007.

<<http://www.flickr.com/photos/pdxfan/2081724150/>> Retrieved November 20, 2011

Since its initial stage, Orenco opted for auto-friendly TOD practices and thus developed good road systems. The City of Hillsboro has minimum parking requirements, and to get more parking, Pac Trust developed additional off-street parking for single family houses. Thus, from the 1 parking space per single family house required by the city, Pac Trust opted for 2 parking spaces. In addition, Pac Trust designed 405 additional on-street parking through the TOD with most main streets offering parking. *“Pac Trust also took advantage of several discretionary*

sections of the city code to increase their parking levels above those deemed the maximum by city planners” (Charles & Barton 2003:1). According to the city code, it is at the developer’s discretion to include on-street parking within its parking supply calculations if the project aims for new streets or reconstruction of existing streets adding on-street parking. In this case, Pac Trust chose not to include them in their calculations for maximum allowable parking. Ultimately, in spatial terms, Pac Trust developed more parking and larger parking lots than the ones required. In addition, developers demonstrated a preference to build near roads and not near the rail since the north and south adjacent lands to the light rail station were undeveloped until recently. The new developments near the light rail do follow some TOD principles such as open space, green areas, and a pedestrian-friendly environment. However, the auto-oriented approach remains as part of the design as well. This factor represent a concern for TODs advocates since it certainly does not embody TOD core values. Figure 5 shows Orenco new development near the rail station.



Figure 5. Orenco New

Source: Source: Bottineau Partnership. Photos of Portland. Orenco Station.
<<http://www.bottineaupartnership.org/attracting/PortlandPhotos.htm>> Retrieved November 20, 2011

Orenco shows that high density projects require extensive government involvement. Because of its auto-oriented approach, minimum parking regulations were implemented and conventional parking standards were applied. No program such as shared parking, satellite parking, carpool parking, unbundling parking, or in-lieu parking was implemented. Pac Trust succeeded in building large amounts of parking due to the Hillsboro codes that allowed for these types of structures. On the other hand, Simpson Housing, in charge of developing land north of the LTR station, had several parking problems by developing less than the city standard parking ratios of 1.5 per unit (Charles & Barton 2003). The neighborhood association has filed complaints to the city and is looking to implement parking permits for residents to avoid future problems. On the other hand, the city TOD zoning set minimum and maximum limits for off-street parking. The

code yields “*a minimum requirement of 396 parking spaces but a maximum of only 383 spaces*” (Charles & Barton 2003:27). Because of this code, some developments like Arbor Gardens south of the LRT Station are affected by having a 1.35 parking ratio which is below the minimum of 1.5 recommended for the Orenco Station. Most developers filed a variance for on-street parking and addressed the benefits of on-street parking to the city.

Orenco TOD Station has received federal and local funding alike. Orenco station was subsidized by the federal funds, \$1,000,000 from the county Traffic Impact Fund (TIF), small subsidies from local governments and several grants. In 1991, the Intermodal Surface Transportation Efficiency Act (ISTEA) developed a Congestion Mitigation Air Quality (CMAQ) program. The grant aims to provide funding for projects that contribute to air quality and traffic congestion reduction efforts. Pac Trust applied for the grant for the Orenco Station TOD project and received a \$500,000 CMAQ grant for pedestrian improvements (Charles & Barton 2003). However, the money went to finance parking lots by TriMet while Pac Trust built pedestrian improvements out of their own funds. The money facilitated the creation of a park-and-ride lot.

Initially The City of Hillsboro did not qualify for federal funding due to lack of projected rail ridership. Thus, in 1996, TriMet decided to link local land use decisions to funding agreements as to guarantee the necessary density required to qualify for federal funding (Charles & Barton 2003). In the end, in exchange for high density around Westside Stations, “TriMet received \$530,276,986 in Federal Transit Funds” (Charles & Barton 2003:18). The agreement to receive the federal funds was subject to the enactment of the current version of the Region 2040 Concept Plan (1995) that establishes land-use development and transportation planning guidelines, and mandates high density development near transit corridors. This later was used to justify parking ratios that would otherwise have been unrealistic (Charles & Barton 2003). On the other hand Intel, Sitel, and Norm Thompson subsidized transit passes for employees that opted to park-and-ride. These companies also have extensive subsidized private shuttles programs for employees - from the TRL station to the work place and back - that served to improve the overall transit ridership rates.

Arlington County, Virginia

Arlington County, located across the Potomac River from Washington DC, has one of the most outstanding TODs in United States. Under their bull’s eye vision, Arlington County has opted for mix-used development along their Metrorail transit corridors: The Rosslyn-Ballston axis and Jefferson Davis Corridor (that include Pentagon City and Crystal City). Figure 6 shows a map of Arlington County that include the Rosslyn-Ballston and Jefferson Davis Corridors.

Rosslyn-Ballston corridor has been the main focus of TOD research. Through a collaborative effort with stakeholders and intense investment in infrastructural improvements, Arlington County transformed the Rosslyn-Ballston corridor into a transit-supportive development that encompassed Rosslyn, Courthouse, Clarendon, Virginia Square, and Ballston Metrorail stations (Cervero 2006). Each Metrorail station represents an urban village with medium to high density mix uses and surrounded by low-to-moderate density neighborhoods. The five urban villages are supported by a variety of multi-modal transportation facilities including pedestrian pathways, bicycle lanes, bus services, and the Metrorail. The five urban villages experience high rate of transit ridership. The increase in ridership seems to be boosted by the office-retail development

around and a walking distance from the Metrorail stations. “Models estimated that every 100,000 square feet of additional office and retail floor increased average daily boardings at stations by around 50 costumers”(Cervero, Murphy & Ferrell et.al 2004:S-4). Parking reduction plays a key role in shaping the five urban villages and develops a walkable community.

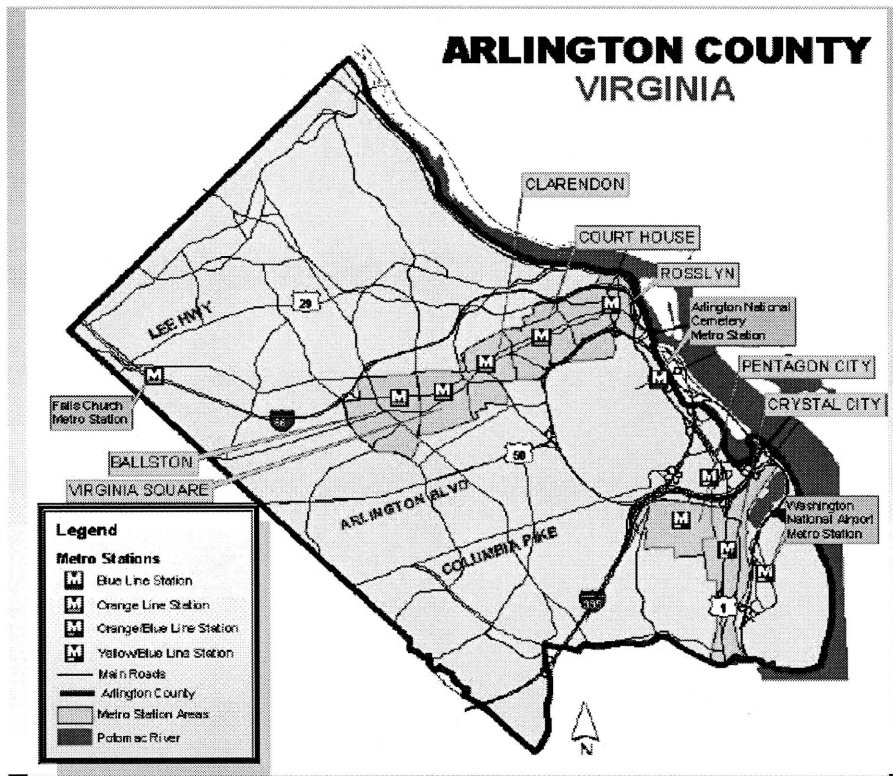


Figure 6. Arlington County.

Source: Tumlin, J. (2006). Parking for Transit Oriented Development.
 Nelson/Nygaard.<www.nelsonnygaard.com/Documents/.../ITE_Parking_for_TOD.pdf> Retrieved on
 November 10, 2011.

Arlington County has a total of eleven Metrorail stations with mixed-use development within 0.5 miles from most of the stations. Both the Rosslyn-Ballston and Jefferson Davis corridors have about 29.7 million square feet of office space, 4 million square feet of retail, and about 26,500 residential units (Cervero, Murphy & Ferrell et.al 2004). Rosslyn-Ballston’s five urban villages encompass a variety of landuses including mixed office, hotel, restaurant nodes, commercial nodes, urban mid-rise office, high-rise office, retail, housing, and civic uses. These urban villages are considered joint development which is a form of TOD “that is often project specific, taking on, above, or adjacent to transit-property” (Cervero, Murphy & Ferrell et.al 2004:S1). The Metrorail is managed by the Washington Metropolitan Area Transit Authority (WMATA), an agency model of multi-jurisdictional coordination. In 1996, to effectively manage development and the limited resources, WMATA engaged with private-real estate firms to analyze potential development sites. Surface parking lots around the Metrorail was given priority

for development. The private sector showed particular interest in these ideas and thus development required little public-sector involvement. One-for-one parking replacement was not required in most cases, giving an incentive to developers to venture in the projects. In 2002, a task force was developed to continue promoting TOD design concepts and looking for potential parking-lot infill possibilities (Cervero, Murphy & Ferrell et.al 2004). The Arlington County TOD design assisted in shaping transit ridership. “Only one station in the county – East Falls Church Station- has parking” (Cervero, Murphy & Ferrell et.al 2004:241). Mixed land uses and the pedestrian-friendly environment encourage most of the riders to arrive by foot or through bus transit. Arlington County Bus Transit is part of the WMATA network for transportation mobility and it works in coordination with the Metrorail services. Most of the large-scale retail stores were not located adjacent to the Metrorail. This measure helped save the land near the transit stations exclusively for moderate mixed-use developments. Large-scale retail stores usually include on-site parking and easy access to the corridors. Figure 7 shows Arlington County Clarendon Station mixed-use development.



Figure 7. Rosslyn-Ballston Corridor. Clarendon Station Mixed-Use development.

Source: We-Love-DC blog. < <http://www.welovedc.com/2010/06/18/where-we-live-clarendon/>> Retrieved November 20, 2011

Arlington County codes allow for the successful development of the urban villages. Shared parking programs were promoted near the transit stations to accommodate pedestrians as well as drivers. Political leadership devoted efforts to protect the low-density neighborhoods surrounding the urban villages. Thus zone-parking areas were established and parking was not allowed in residential neighborhoods. Only residents with valid permits were allowed to park in residential areas.

In addition, the county reduced its parking requirements and developed flexible parking standards with low-cost parking. WMATA viewed parking as good interim use (Cervero,

Murphy & Ferrell et.al 2004). Therefore, some of the best developments around transit stations were previous parking lots built for commuters. On the other hand, the county does not allow park andride facilities near the transit stations. The urban villages provide parking brochures with the location of all public on/off-street parking and information on alternative modes of transportation (Tumlin 2006).

Arlington County advocated for joint development. It is through joint development grants and a strong private-public partnership that the urban villages became a success. Most joint development projects used a variety of tools for financial rewards including the leasing of group space and air rights. Ballston station is “an example of air-rights lease (mostly office space) above the rail station” (Cervero, Murphy & Ferrell et.al 2004:241). High tax yields from development and balanced-flow ridership payoffs have been an important attribute to financially support the urban villages. Zoning and density bonuses, as well as relaxed parking standards have provided capital for streetscape and pedestrian enhancements. The reduction of parking requirements lowered project costs, allowing for higher returns. In addition, all parking charged at market-rate and prepaid Park Smart debit cards can be used to pay metered parking. Overall, parking is usually inexpensive or free.

2.5 Summary of Case Studies

TOD	Parking Programs	Major Findings	Conclusions
Curitiba, Brazil	<ul style="list-style-type: none"> • Shared parking program dynamic in downtown. • Expensive on-street and off-street parking in downtown. • Transit passes 	<ul style="list-style-type: none"> • Minimum parking requirements • No parking in the four main roads of the trinary structural axis. • No park-and-ride focus • Restricted off-street parking in downtown • Limited to none on-street parking in downtown • Priority to busses. Buses-right-of-way. • Strict enforcement of parking policies • Priority given to pedestrian roadways. • Self-subsidized transportation system • Employers transit passes programs • Public transportation highly affordable with low flat fares. 	<ul style="list-style-type: none"> • Improved ridership • Improved pedestrian-friendly environment • Improved air quality • Improved transit safety • Improved aesthetics • Reduced traffic congestion • Improved local economic returns • Reduced parking • Improved green space and open space development • Beneficial to low-income houses without car
Orengo Station, Portland, Oregon	<ul style="list-style-type: none"> • Transit passes • Park -and- ride 	<ul style="list-style-type: none"> • Not exactly a TOD • Minimum parking requirements • City variances that allow additional parking • Flexible parking code that allow additional on-street parking. • Priority given to park-and-ride 	<ul style="list-style-type: none"> • Improved ridership conditional to park-and-ride • Questionable TOD status. • Auto-oriented development

		<ul style="list-style-type: none"> • Park-and-ride lots necessary for transit ridership • Employers transit passes programs • Free park-and-ride lot and cheap on-street parking • Private shuttles from station to workplace and back • Slow development in adjacent areas 	<ul style="list-style-type: none"> • Excessive parking • Significant peak period traffic congestion • Reduced pedestrian accessibility
Arlington County, Virginia	<ul style="list-style-type: none"> • Shared parking programs • Transit passes 	<ul style="list-style-type: none"> • TOD Joint Development • Minimum Parking Requirements • No park-and-ride allowed. • Restrictive parking around stations • Restrictive parking around residential areas • Employer Transit passes • Priority given to pedestrians • Public-Private collaboration • Strong real-estate involvement • Affordable public transportation 	<ul style="list-style-type: none"> • Improved transit ridership • Improved pedestrian-friendly environment • Reduced traffic congestion • Improved local economic returns • Improved air quality • Reduced parking • Beneficial to Low-income houses without a car.

2.6 Conclusion

According to Cervero, Murphy, Ferrell, et.al (2004) there are over 100 TODs of various shapes and sizes in United States. Most of them are joint developments and nodal in nature. However, some localities have been pursuing TOD around corridors and at regional scale such as Arlington County. Rail is the most common transit system used for TOD development and it is usually complemented by some type of bus system or bus rapid transit. Park-and-ride lots infill are often used to develop TODs (Cervero, Murphy, Ferrell, et.al 2004). In that case, park-and-ride lots around transit stations are converted into mixed-uses. *“Parking lot conversion have been encouraged by the federal Transit administration’s new and more permissive joint development ruling, as well as the raising value of agency-owned land”* (Cervero, Murphy, Ferrell, et.al 2004:445). However, replacing parking at a one-to-one ratio still remains a challenge since it increases the project cost. In the case of settings such as Arlington County, one-to-one parking replacement is evaluated individually to determine whether the policies are applicable or not.

Some of the most successful TOD projects have started their vision, design, and planning early and thus they have more time to work on development decisions and funding allocation. Curitiba and Arlington County are a good example of good planning and good timing. Stakeholders’ coordination is also essential for TOD success. First, institutional coordination has a direct effect over land development and transit-service delivery (Cervero, Murphy, Ferrell, et.al 2004). Institutional coordination embraces the creation of more permissive and enabling zoning and parking regulations to support TODs. This will also allow for infrastructural enhancements, high density development, and zoning overlays. Second, incorporating the public through an inclusive

participatory process is essential through the design and planning of the TOD. Curitiba and Arlington County were able to successfully manage all their stakeholders and develop the necessary regulations to support the TOD. Orenco Station was also able to successfully manage their stakeholders which were supportive of a more auto-oriented development. Orenco was also able to design policies to support additional on-street/off-street parking and a park-and-ride lot.

Transit ridership is also a good indicator of a successful TOD. Density seems to be the most important factor in promoting ridership (Cervero, Murphy, Ferrell, et.al 2004). Both Curitiba and Arlington County opted for mixed-use development and zoning overlays around transportation corridors to promote high density. High density along with restrictions in parking was the catalyst for higher transit-ridership. Orenco Station's high transit ridership is due to the park-and-ride lot.

Curitiba, Brazil, and Arlington County, Virginia provide good quality-transit combined with mix-use development and a pedestrian-friendly environment. Both cases presented improvements in traffic congestion and pedestrian accessibility where parking reduction played a key role. Although parking policies in Curitiba were not the result of the BRT, they certainly have a direct effect on it. Curitiba's restrictive parking policies, shared parking dynamics, transit passes, and expensive on-street /off-street parking gave no option to Brazilians but to use the BRT. In addition, the BRT is safe, considerably inexpensive, and efficient. The self-sustaining BRT system allowed for the city to financially support other projects such as their waste management and recycling program.

Arlington County bull's-eye articulated the TOD vision and resulted in prosperous economic development for the area. Early planning and programming, intense public-private partnership, secured funding, and parking infill contributed to the success of the urban villages. Flexible parking policies, restrictive parking in transit stations (none in many cases), shared parking programs, and pedestrian-friendly environments contributed to increasing in transit ridership and reducing traffic congestion.

On the other hand, data presented in this report suggest that Orenco Station in Oregon does not exactly follow essential TOD principles. Regardless, the station does show high transit-ridership, but this is mostly due to the park-and-ride lot. Adjacent land to the station is recently being developed, yet under an auto-oriented approach. Mainstream data indicates that park-and-ride lots have little effect in improving air quality and are not pedestrian-friendly. Orenco station parking policies are inconsistent allowing for the development of more parking than required in some places and less parking than required in others. Additional research is required to determine the TOD status of Orenco Station and possible areas of improvement.

3. Best Practices for TOD-Parking

Best practices for TOD-Parking are categorized and presented in the matrix table below. In summary, they include:

- Reductions
 - Parking requirements can typically be reduced around 20 and up to 50% in areas with good transit.
 - Less than full replacement of P&R parking paired with increased density increases ridership and revenue.
 - Create demand-based, locally calibrated TOD parking requirements that reflect transit shares and auto ownership
 - OR
 - Deregulate parking so developers assess parking demand, provide market-priced parking to meet average demand and used shared parking to accommodate peaks.
 - Reducing parking requirements requires improving transit. The best way to reduce requirements is to combine parking policies and strategies works (e.g., subsidized transit passes, priced parking, residential parking programs, parking enforcement).
- Design
 - Designing for pedestrians (e.g., reduce number and size of curb cuts, separate parking & roads from pedestrians, build up, design first level of structures so interesting, build as multi-purpose space) is an important component to parking.
 - Use hierarchical multimodal design to grown non-auto modes to station.
 - Parking can be used as a community asset and connect (rather than sever) connections.
 - Design options: wrap parking around buildings, place retail art on first level, use landscaping to screen and as a reserve, use grasscrete.
 - Create incentives or regulations for parking design to improve quality.
- Location
 - Parking should not be located near station, but out of sight and/or farther away (5-7 minute walk).
 - Offices near station are most important for increasing transit trips for work. Therefore offices should be located within 500-1000 feet of the platform/station. Retail mix and residential proximity are not as important to increasing work trips by transit. Developers view reducing office parking easier than residential.
 - However, residential proximity does increase chance will use transit. (Recommendation is within a half-mile.) AND
 - Mixed uses at TODs increase non-work trips (the sector that has the largest potential to grow) and which can increase work trips by allowing riders to chain or internalize trips they would normally take with a car. Especially important at stations are daycares, personal care businesses

(e.g., salons, dry cleaners, drug stores) and restaurants. However, retail alone cannot support TOD.

- Affordable housing near transit is important as low-income riders make up core of transit riders.

- Management

- To develop parking policies, cities need parking databases to understand supply and demand and to develop programs that allow the city to track the impacts of adjustments.
- TOD health should be evaluated based on modal split, mixing of uses and trip internalization.

- Pricing

- Price on-street parking to encourage use by preferred population (e.g., short term customers) and to encourage commuters to take transit or purchase off-street parking.
- Pricing can be used to improve monitoring, to increase enforcement to reduce spillover and to make improvements in parking district (e.g., street cleaning, furniture, light fixtures). In-lieu fees finance parking structures and monitoring.
- Free and plentiful parking anywhere drastically reduces transit use.

- General

- Parking at TODs in suburban areas can be used to land bank but it can't be a sea of parking. Certain amount of mixed use is required or will have to use car for non-work trips. Each TOD needs to be a origin AND destination.

3.1 Parking Location/Type

Downtown	Suburb	Park & Ride	On-/Off-Street Parking
<p>• Regional, city center & transit neighborhood strategies: TRANSIT SUPPORTIVE POLICIES: transit incentive programs, transit friendly parking design, transit supportive zoning, carsharing, walkability and wayfinding, PARKING REQ: reduced and TOD-friendly parking requirements, parking maximums, shared parking; PRICING: on-street pricing, variable rate pricing, coordinated off-street and on-street pricing, unbundled parking, cash-out; PARKING MANAGEMENT: payment technology, database, real-time info; PARKING DISTRICTS: assessment districts, revenue districts, residential permit parking; FINANCING: in-lieu, risk fund, occupancy tax, tax by space, tax exemptions and variable rate tax. (Boroski, 2007,p.6 -Reforming)</p>	<p>• Suburban & Town Center strategies: TRANSIT SUPPORTIVE POLICIES: transit incentive programs, transit friendly parking design, transit supportive zoning, walkability and wayfinding, PARKING REQ: reduced parking requirements, shared parking; PRICING: on-street pricing, variable rate pricing, coordinated off-street and on-street pricing, cash-out; PARKING MANAGEMENT: payment technology, database, real-time info; PARKING DISTRICTS: assessment districts, revenue districts, residential permit parking; FINANCING: in-lieu, risk fund, tax by space. (Boroski, 2007,p.6 -Reforming)</p>	<p>• TODs can use park-and-ride lots as a form of land banking to secure federal capital funds then transition to joint development which offers increased ridership (by generating off-peak and reverse-commute riders) and revenue (due to leased developed land). p.2. However, this plan for parking replacement policies (p.3) (including the benefits) must be communicated to increase political feasibility from affluent, suburban P&Riders who may be displaced or treated less preferentially and provide alternative ways of reaching the station (p.11) (Tumlin, 2006, p.2-3,11- ITE)</p>	<p>• Increases in on-street parking prices to discourage long-term commuter parking require complementary actions such as: clear travel alternatives for downtown employees (e.g., discount transit passes), new revenues to stay within the district for improvements, (e.g., maintenance, security,), enforcement of new regulations, improved signage regarding parking rates, hours and availability, and monitoring the effects of price changes for future decisions. (Higgins, 2007, p.19-20 - Stakeholder).</p>

<ul style="list-style-type: none"> • Regional center TOD (parking demand model): res: .25-1.00/dwelling, office: .10-.75 per 1000 sq ft; retail: .50-1.00 per 1000 sq ft; restaurant: 1.00-2.00 per 1000 sq ft. (Borosoki, 2007, p.47 - Reforming) 	<ul style="list-style-type: none"> • Suburban/Town center TOD (parking demand model): res: 1.00-1.50/dwelling, office: 2.00-3.00 per 1000 sq ft; retail: 1.50-2.50 per 1000 sq ft; restaurant: 3.00-5.00 per 1000 sq ft. (Borosoki, 2007, p.47 - Reforming) 	<ul style="list-style-type: none"> • Rural/Small Town TOD (parking demand model): res: 1.25-2.50/dwelling, office: 3.00-4.00 per 1000 sq ft; retail: 3.00-4.00 per 1000 sq ft; restaurant: 8.00-12.00 per 1000 sq ft. (Borosoki, 2007, p.47 - Reforming) 	<ul style="list-style-type: none"> • San Francisco, CA is considering restricting the number of on-street permits to the number of spaces available, charging market price and using the revenue to make neighborhood improvements and transit. (Millard-Ball, 2002, p.19 - ParkCaps)
<ul style="list-style-type: none"> • City center/Urban Neighborhood TOD (parking demand model): res: .50-1.25/dwelling, office: .25-1.25 per 1000 sq ft; retail: 1.00-2.00 per 1000 sq ft; restaurant: 1.00-3.00 per 1000 sq ft. (Borosoki, 2007, p.47 - Reforming) 	<ul style="list-style-type: none"> • Transit Neighborhood TOD (parking demand model): res: 1.25-2.25/dwelling, office: 2.25-3.33 per 1000 sq ft; retail: 2.50-4.00 per 1000 sq ft; restaurant: 4.00-8.00 per 1000 sq ft. (Borosoki, 2007, p.47 - Reforming) 	<p>Contrary to Washington DC which has mixed use and increased transit use, Atlanta, GA has had a declining mode share, likely due to the fact that stations consist of office space surrounded by large parking lots. (Arrington, 2008, p.9 - Effects)</p>	

		<ul style="list-style-type: none"> • Commuters choose only a few park-and-ride facilities within a narrow region, therefore we must be careful when planning and designing P&R. p.702. • From this region in, commuters will use rail, and from this point out they will only use highway. P.692• • Increasing parking charges at P&R will greatly reduce traffic at the P&R, but will also induce some demand for the railway system. P.704. (Liu, 2009 - P&R) 	
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3.2 Land Use Type

Residential	Office	Retail/Commercial	Mixed / Industrial
<ul style="list-style-type: none"> • Proximity of residence to transit important in determining if take transit (both Washington, D.C. and Bay Area studies). P.44. Station-area residents more likely to rail-commute if offices are also near transit, 	<ul style="list-style-type: none"> • Developers view in lieu fees, unbundled and shared parking as better suited to office developments than residences, since office parking can more easily be moved away from the building or mixed with other uses. (Higgins, 2007, p.18-20 - Stakeholder). 	<ul style="list-style-type: none"> • Retail, which requires specific location, market and design, cannot be the justification for TOD Development. (Dunphy, 2003, p.14 - TenPrinciples). 	<ul style="list-style-type: none"> • Mixed land uses that include banks, restaurants, drug stores, food marts and/or groceries, childcare, personal and business retail, recreation will support employee and residential transit use. (Daisa, 20054,

<p>especially if could park for free. P.43. (Cevero, 2006, p.43-44 - OfficeCommute)</p>			<p>p.117 - Traffic)</p>
<ul style="list-style-type: none"> • In San Francisco, CA, reducing off-street parking decreased condo costs by more than 10%. P.10. <i>Research</i> shows residential off-street parking may be reduced by ~20%, although calculations should be done on a case-by-case basis. p.10. (Parker, 2002, p. 10 -Statewide SUM) 	<ul style="list-style-type: none"> • Encourage office site designs, including arrangement and supply of parking, which promote transit. (Cevero, 2006, p.53 - OfficeCommute) 	<ul style="list-style-type: none"> • San Diego parking survey method (choose lowest-highest mode share for widest range (p51)). Commercial Min: 3.0 spaces; max: 6.0 spaces per 1000 ft²; will need peak holiday plan (p53). (Higgins, 1993, p.51,53- ParkReq) 	<ul style="list-style-type: none"> • Important to have mixed land uses near stations to allow for walking trip-chaining (e.g., personal/professional midday errands: daycare, shopping, eating, etc.). (Cevero, 2006, p.50 - OfficeCommute)
<ul style="list-style-type: none"> • Oversupply of parking drives up residents' (occupancy) costs since parking is bundled in rent (developers dislike sharing due to control of access issues), lowers return on investment, decreases buildable area, and encourages developers to build larger units to spread out parking costs. (Willson, 2005, p.82 - Lessons) 	<ul style="list-style-type: none"> • San Diego parking survey method (choose lowest-highest mode share for widest range (p51)). Office: Min: 2.0 spaces; max: 4.0 spaces per 1000 ft²; except corporate offices max: 3.0, or if alt. modes approach 50%, reduce max to 2.5 (p.53). (Higgins, 1993, p.51,53- ParkReq) 	<p>Commercial parking is effected by employee demographics, retail sales volume and employee densities and therefore is more complex. (Boroski, 2002, p.7-8 Statewide TOD).</p>	<ul style="list-style-type: none"> • San Diego parking survey method (choose lowest-highest mode share for widest range (p51)). Industrial Min: 1.0 spaces; max: 3.0 spaces per 1000 ft²; if alternative approaches 40% or employee densities are 3.0 persons or less per 1000ft sq, reduce to 3.5 spaces (p53). Does not include overlap from shift changes (p.54). (Higgins, 1993, p.51,53, 54 - ParkReq)

<ul style="list-style-type: none"> • San Francisco is proposing a base parking maximum of .75 space per unit to encourage developers to unbundled parking and better match households to housing based on parking needs. (Millard-Ball, 2002, p.18 - ParkCaps) 	<ul style="list-style-type: none"> • Develop employment opportunities as close to transit as possible (within 500 to 1000 feet). (Daisa, 2004, p.120 - Traffic) 	<ul style="list-style-type: none"> • While retail owners in Berkeley were concerned that parking constraints may limit economic growth, the majority of customers are downtown workers and residents, the majority of which arrive by non-auto means. (Deakin, 2004, p124 - Berkeley) 	
<ul style="list-style-type: none"> • Provide cash grants for TOD housing within 1/3 mi of rail stations. (Cevero, 2006, p.53 - OfficeCommute) 	<ul style="list-style-type: none"> • Access to high quality transit is becoming increasingly important to firms trying to attract creative class workers. (Arrington, 2008, p.1 - Effects) 	<ul style="list-style-type: none"> • Develop contingency plans for peak-season parking. (Daisa, 2004, p.122 - Traffic) 	
<ul style="list-style-type: none"> • In a small city with an extensive transit system and limited priced parking, residents self-select to live in downtown Berkeley (TOD), having lower auto-ownership and higher transit use. (Deakin, 2004, p128 - Berkeley) 	<ul style="list-style-type: none"> • Two contrasting trends: offices are "hoteling" or requiring all employees to come to the home office, with some of them going out into the field for part of the day. In addition, high rents in dense metro areas are forcing employers to squeeze more workers into less space, thereby increasing densities (increasing possible numbers for transit and/or parking as well). (Boroski, 2002, p.8 - Statewide TOD) 		

<ul style="list-style-type: none"> • Preserv/expanding affordable housing near transit is important b/c lower-income transit users often represent core ridership. Consider linking transit funding to affordable housing so they can reinforce one another. (Dunphy, 2003, p.21-TenPrinciples) 	<ul style="list-style-type: none"> • "Transit travel times and their comparison to private car travel times is the strongest predictor of transit ridership...The more accessible trip origin is to jobs by transit (relative of auto) the more likely the trip is to be made by transit." (Arrington, 2008, p.13 - Effects) 		
<ul style="list-style-type: none"> • Develop residential within a quarter to a half-mile. (Daisa, 2004, p.120 - Traffic) 	<ul style="list-style-type: none"> • "Availability, price and convenience of parking strongly determine whether or not those working in TODs take transit" (Arrington, 2008, p.16 - Effects) 		
<ul style="list-style-type: none"> • ARTICLE re how lower income households have a more elastic demand to increased parking pricing. 	<ul style="list-style-type: none"> • "...proximity to rail stations is a stronger determinant of transit useage for work trips than land-use mix or quality of walking environment." "four variables - employment density, employment proximity to transit, commute behavior at the worker's previous job, and occupation" explain modal split (Arrington, 2008, p.16 - Effects referencing Cervero, 1994) 		
<ul style="list-style-type: none"> • ARTICLE on giving up a car? 			

3.3 Parking Management

Parkng Districts	Land Banking	Residential/Overspill Programs	Information/Technology
<ul style="list-style-type: none"> • Develop district-based approach to assessing parking demand and require shared parking and/or in-lieu fees for creating district parking facilities. (Willson, 2005, p.90 - Lessons) 	<ul style="list-style-type: none"> • Use parking in underdeveloped stations to land bank for later conversion into structures or development. (Dawes, 2005, p.36 - FasTracks) 	<ul style="list-style-type: none"> • To reduce potential spillover from parking reductions, these cities have set up and enforced residential parking programs, limits and meters. P.19. (Millard-Ball, 2002 - ParkCaps) 	<ul style="list-style-type: none"> • San Francisco's pre-trip and en-route Smart Parking program shifted drive alone and carpoolers to BART for both on- and off-site locations, which increased the average number of BART trips per month, decreased total commute time and decreased total vehicle miles traveled. p.11. At the same time, the smart parking also increased drive alone access to BART from other modes, which offset some of the commute time reductions. p.11 (Rodier, 2007, p.11 - SmartPark)
<ul style="list-style-type: none"> • Manage on-street parking to control spill-over and encourage on-street turn over. (Willson, 2005, p.90 - Lessons) 	<ul style="list-style-type: none"> • Locations with high land values have been able to replace surface parking with decked parking to free up half or more of the lot for infill urban development (land banking strategy). (Dunphy, 2003, p.11 - TenPrinciples) 	<ul style="list-style-type: none"> • Residential preferential parking programs or parking meters should be used to prevent potential spillover. (Higgins, 1993, p.50- ParkReq) 	<ul style="list-style-type: none"> • Seattle, WA moved to multi-space pay & display and increased revenue by 40% (without increasing fees) due to 62% of motorists using credit cards to buy maximum parking period. (Boroski, 2007, p.36 - Reforming)

<ul style="list-style-type: none"> • To determine district supply estimates: survey parking demand during different times of the day on normal and busiest days to determine averages and peak times, use shared methodology to determine supply, compare demand with supply to determine surpluses. Prioritize certain (e.g., short term) parkers, etc. (Boroski, 2002, p.11 - Statewide TOD) 	<ul style="list-style-type: none"> • "Under Fed. Transit Admin. regulations for joint development, transit agencies may sell off surface parking lots , as long as they are transformed into transit-supportive developments without having to pay back the federal treasury, (which typically covered 80% of the cost of building parking for rail systems)." (Dunphy, 2003, p.11 - TenPrinciples). 		<ul style="list-style-type: none"> • Berkeley, CA is introducing three tier parking info system which: 1. directs visitors to downtown or university district, 2.routes them to neighborhood destination, 3. informs of spaces and rates of facility. (Boroski, 2007, p.36 - Reforming)
<ul style="list-style-type: none"> • Created parking management associations fo address underutilized facilities. (Daisa, 2004, p.122 - Traffic) 	<ul style="list-style-type: none"> • "Park and ride lots often are viewed as land banking for TOD." (Arrington, 2008, p. 21 – Effects) 	In-lieu Fees	<ul style="list-style-type: none"> • Parking needs to function efficiently (Dawes, 2005, p.36 - FasTracks).
<ul style="list-style-type: none"> • Researchers recommend improved parking enforcement (e.g., preventing overtime parking and meter feeding by employees) and better use of off-street spaces to address the problem of tight parking. (Deakin, 2004, p124 - Berkeley) 		<ul style="list-style-type: none"> • In-lieu fees must be planned with parking code requirements (high) to encourage them as an option and to meet any state low-income housing regulations. (Higgins, 2007, p.20 - Stakeholder). Ideally, in-lieu parking fees should be charged all at once and utilized promptly. (Higgins, 2007, p.18 - Stakeholder). 	

<ul style="list-style-type: none"> • Old Pasadena, CA used variable rate off-street pricing (first 90min free, \$2/hr, \$6 max; \$5 flat rate from 10pm-5pm) and business improvement district which reinvests parking revenues into street improvement plan and maintenance. (Boroski, 2007, p.38 - Reforming). 		<ul style="list-style-type: none"> • Pasadena, CA's Parking Credit Program allows developers to pay a \$115/space in lieu fee (which lower than the cost to construct parking) to reducing parking and to pool funds for off-street parking. (Boroski, 2007, p.42 - Reforming) 	
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Pricing			
<ul style="list-style-type: none"> • Charge for transit parking as an additional source of revenue, e.g., to help finance parking structures. (Dunphy, 2003, p.11 - TenPrinciples) 	<ul style="list-style-type: none"> • Variable rate parking can be used for seasonal and special event parking, e.g., to encourage turn-over and carpooling. (Boroski, 2007, p.30-Reforming) 	<ul style="list-style-type: none"> • Parking pricing has high potential effectiveness to reduce parking demand, about 5-30%. (Boroski, 2007, p17 - Reforming) 	<ul style="list-style-type: none"> • Parking price increase resulted in 97% of increase in transit use. (Hensher/King, 2001, 193 - Sydney)
<ul style="list-style-type: none"> • <i>Transit users had the highest daily average parking charges for work trips, about 25% more. (Hess, 2001, p.26 - EffectsOfFree).</i> 	<ul style="list-style-type: none"> • New York's Mid-Town posted variable rates (\$2/1hr, \$5/2hr, \$9/3hr, \$12/4hr) decreased ave. parking 4 to 6hrs to 90min), decreased occupancy rates (120% to 85%) and increased funds (\$3.5mil to \$6.4mil). (Boroski, 2007, p.32 - Reforming) 	<ul style="list-style-type: none"> • "Shifting from free to cost-recovery parking (pricing that reflect the full cost of providing parking facilities) typically reduces automobile commuting by 10-30%, particularly if implemented with improved travel options and other TDM strategies." (Arrington, 2008, p.20 - Effects) 	<ul style="list-style-type: none"> • "High parking charges and/or constrained parking supply will increase ridership" and are the second most important predictor of TOD ridership (after transit service levels and prices). (Arrington, 2008, p.19 - Effects)

- People most sensitive to parking rate (even over in-vehicle cost and travel time in mode choice). Individuals who pay for their own parking (e.g., commuters, people on social trips and self-employed bus owners) are more sensitive and more likely to park farther out to save on costs. Higher-income or individuals on business are more likely to park closer in (e.g., to save time, because the trip may be tax deductible). In addition, those that park as close as possible to final destination are least sensitive to rate changes. Those parking elsewhere (between close to CBD and fringe) (e.g., shoppers) are most sensitive to increases in parking prices. (Hensher/King, 2001, 190-191 - Sydney).

- *Origin-Destination Parking Pricing (ODPP) calibrates parking charges based on origin and destination (i.e., different fares and parking tickets for violators in each zone), only penalizing users who do not take available transit to force the modal split). P.35.*

- *In general, parking fares produce an increase in transit use, but increase transit travel time, decrease road travel time and decrease accessibility due to higher costs. P.44.*

- *Although ODPP provides higher number of road users, it lowers average hourly parking fares and therefore increases accessibility. P.43, p.44. Therefore, it is most practical to offer P&R facilities that connect to inside fare zones through a high quality transit system, conciliating high outsider fares with equally high transit accessibilities. P.38. (me: therefore fares should improve transit.) (D'Aciero, 2006, p.35,38,43,44 - ODPP)*

- Because the relationship between parking taxes, transit use, land rents and community size is not monotonic (not linear but parabolic) p.54, there is a small optimal parking tax margin that maximizes CBD size and land values. P.45. Too low taxes results in excessive auto use, roads and congestion which reduces community size and land values. P.45. In such places, an increase in parking taxes can actually increase land value, including for parking lot owners. P.45.

- While increasing parking taxes will increase the transit subsidy per person, it will reduce auto travel (thereby reducing the number of people who ultimately pay the subsidy due to mode shift or choosing to

- Raising work site parking costs and decreasing travel time by transit in relation to drive alone time (by improving service and decreasing headway) will reduce drive alone mode share for driving to work. (Hess, 2001, p.35 - EffectsOfFree).

		<p>work where parking is free). P.56. Therefore too high taxes can also result in smaller community size and lower land values. P.45. The tax that maximizes land values is less than the tax that maximizes community size. P.55.</p> <p>4. "Adverse consequences of underpricing congestion (i.e., too low taxes) increase with strength of agglomeration economies." P.45. (Voith, 1998 - BalanceFees)</p>	
<ul style="list-style-type: none"> • <i>“Shifting from free to cost-recovery parking ... typically reduces automobile community by 10 to 30%, particularly if implemented with improved travel options and other TDM strategies.” (Arrington, 2008, p.20 - Effects)</i> 	<ul style="list-style-type: none"> • <i>“The 1993 California study found the availability of free parking to be the biggest deterrent to transit riding among those living and working near transit (Dill, 2005).” (Arrington, 2008, p.20 - Effects)</i> 	<ul style="list-style-type: none"> • <i>“A strong case can be made for using sliding scale impact fees” which “might result in lowering estimated trip generation rates within a quarter mile of a station and with continuous sidewalk access in a mixed-use neighborhood by a fixed percent, such as 20%.” (Arrington, 2008, p.26 – Effects)</i> 	

3.4 Parking Regulation

General	City Codes	ITE Manual	Fed Transit Administration
<ul style="list-style-type: none"> Portland, OR had its regional parking maximums mandated to it by the state's Department of Environmental Quality to meet ozone standards; 30 cities and counties have adopted them. (Millard-Ball, 2002, p.16-17 - ParkCaps) 	<ul style="list-style-type: none"> Denver is reducing parking requirements for developers within walking distance of transit stations and having transit operators share parking. (Dawes, 2002, p.34 - FasTracks) 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> Some sites require employers to complete annual surveys as part of local trip-reduction ordinance to comply with air quality issues. (Higgins, 1993, p.51- ParkReq) 	<ul style="list-style-type: none"> Develop more appropriate (less single use, suburban) parking standards to preserve pedestrian connections/amenities. (Dunphy, 2003, p.13 - TenPrinciples). 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> Revise auto-centric level of service standards to include ped & bike accessibility and reflect the unique, multimodal nature of TODs. (Daisa, 2004, p.120 - Traffic) 	<ul style="list-style-type: none"> Vancouver allows a 14-28% parking reduction for new multifamily projects near transit stations, although some condo projects initially had insufficient parking which caused problems. (Boroski, 2002, p.5 - Statewide TOD). 	<ul style="list-style-type: none"> The greatest differential between TOD and ITE trip generations occurred for TOD housing closest to CBDs and for AM trips. (Arrington, 2008, p.38 – Effects) 	
<ul style="list-style-type: none"> TOD performance should be measure based on modal split, trip internalization and the mix of land uses. (Daisa, 2004, p.123-124 - Traffic) 	<ul style="list-style-type: none"> Portland, OR has no min. park req. for sites within 500 ft of transit street with 20min peak hr service. (Mukjija/Shoup, 2006, p.298 - QuantvQual) 	<ul style="list-style-type: none"> “ITE regression equation for apartments overstates traffic impacts of transit-oriented housing by 39%.” (Arrington, 2008, p.40 – Effects) 	

<ul style="list-style-type: none"> • City of Oakland S-15 zoning regulation (Chapter 17.100S-15) was created to produce high-density transit-oriented development. 	<ul style="list-style-type: none"> • West Hollywood has a la carte point system for designing quality parking. (Mukjija/Shoup, 2006, p.301 - QuantvQual). 	<ul style="list-style-type: none"> • “Suburban TOD stations averaged weekday vehicle trip generation roughly one-quarter less than the number predicted by the ITE manual.” (Arrington, 2008, p.38 – Effects) 	
<ul style="list-style-type: none"> • Top three variables that affect transit ridership are: station proximity, transit quality and parking policies, respectively. High parking charges and/or limited supply increase transit demand; free or low-cost parking significantly reduces demand. Parking policies (e.g., transit pass programs, parking reductions and car sharing) improve ridership. (Arrington, 2008, p.3 - Effects) 	<ul style="list-style-type: none"> • Berkely, CA code (Section 23.D12.060) allows joint off-street parking for AUP if the spaces are located within 800 feet of the uses to be served, if the times of use do not substantially conflict and if th spaces are not already being used to meet requirements for other uses at simliar times. R-4 and R-5 districts may use joint off-street parking if those spaces represent less than 20% of parking of required parking and the spaces are either located on teh same lot as the offices or within 300ft of property owned by the same owner (Boroski, 2007, p29 - Reforming) 	<ul style="list-style-type: none"> • “TOD-housing projects generated around 47% less vehicle traffic that predicted by the ITE manual (3.55 trips per dwelling unit for TOD-housing versus 6.67 trips per dwelling unit by ITE estimates.” (Arrington, 2008, p.36 – Effects) In Washington D.C., “vehicle trip generation rates were more than 60% below that predicted by the ITE manual” due to the “region’s successful effort to create a network of TODs...[which] are not isolated islands but rather nodes along corridors of compact mixed-use walking- 	

		friendly development.” “Synergies clearly derive from having transit-oriented housing tied to transit-oriented employment and transit-oriented shopping.”(Arrington, 2008, p.36-38 – Effects)	
<ul style="list-style-type: none"> • Portland, OR has parking maximums for its CBD as well as non-CBD areas based on availability of transit service. Lower max are set for areas within .25 mi walk of bus stops with frequent service or .5 mi of transit stations. (Boroski, 2007, p.28 - Reforming) 	<ul style="list-style-type: none"> • Redwood City, CA has an ordinance (section 20.120) which allows .25 adjustments in downtown meter rates to better reach target of 85% utilization, as well as creation of a parking database and an annual utilization study on rates. Meter price can't exceed \$1.50 per hour. (Boroski, 2007, p.32- Reforming) 	<ul style="list-style-type: none"> • ITE may underestimate reductions in auto use at TOD housing by average of 44%. Parking therefore may be overstated by same order of magnitude. (Arrington, 2008, p. 4- Effects) 	
<ul style="list-style-type: none"> • Santa Monica, CA's required parking cash-out (to meet Emission Reduction Plan) reduced parking at employer sites by 20% and solo driving by 7-8%. (Boroski, 2007, p.33 - Reforming) 	<ul style="list-style-type: none"> • Arlington County, VA has no P&R facilities, shared, priced and structured parking near stations (p.4-5) and innovative form-based codes which distinguish between and encourage shared parking while discouraging reserved spaces to promote “Park Once” mentality. (p.10) (Tumlin, 2006, p.4-5, 10- ITE) 	<ul style="list-style-type: none"> • “Vehicle trip generation rates tend to be higher for TOD projects with more plentiful parking.” (Arrington, 2008, p.43 – Effects) 	

<ul style="list-style-type: none"> • “Trip reduction benefits of TODs call for other development incentives, like lower parking ratios, flexible parking codes,... streamlining the project review and permitting process, and investments in supportive public infrastructure.” (Arrington, 2008, p.54 – Effects) 			
<ul style="list-style-type: none"> • “A major obstacle to TOD implementation on transit agency owned parking lots” are “parking replacement policies that result in one-to-one replacement of park-and-ride spaces.” (Arrington, 2008, p.21 – Effects) 			

3.5 Parking Reduction Strategies

General			
<ul style="list-style-type: none"> • TODs should pair limiting the supply of parking (by either setting requirements (p.8) or letting the market determine the appropriate amount of spaces (p.9)) with residential parkng programs to 	<ul style="list-style-type: none"> • Deregulate or limit number of parking spaces, e.g., in downtowns, near transit (Portland,OR), off-street (Carmel,CA), for infill (LosAng, CA), or in surface lots (SanFran, CA). (Mukjija/Shoup, 2006, p.297-299 - QuantvQual) 	<ul style="list-style-type: none"> • Less than full replacment of commuter parking at transit stations increases ridership and revenues (e.g., over \$1 million per year per station of 	<ul style="list-style-type: none"> • Replacement parking numbers are dependant on station context (location of station, access to alternative modes of transit). Less than one-for-one replacement increases ridership and

<p>reduce spillover onto streets, priced parking and Transportation Demand Management (TDM) measures to reduce demand (p.10). (Tumlin, 2006, p.9-10 - ITE)</p>		<p>continuing revenue at BART station) as well as makes development easier. Alternatives to replacement parking include moving parking off-site or to underused stations and investing in improving access to non-automobile modes. (Willson, 2005, p.89 - Lessons)</p>	<p>revenues vs. full replacement and makes development easier. .88. Therefore convert park-and-ride surface lots to TODs will less than 1:1 replacement. P.91. (Willson, 2005, p.88,91 - Lessons)</p>
<p>• There is no ridership loss when reducing full replacement of parking at TODs. Ridership loss only occurs if density is not increased and parking is currently full. (Willson/Menotti, 2007, p124 - Commuter). In addition, no ridership loss is predicted at the TOD scenario with parking charges as station demand will replace any riders lost (e.g., commuters). (Willson/Menotti, 2007, p122 - Commuter).</p>	<p>• At an urban TOD, all scenarios that increased density demonstrated more positive ridership outcomes than the status quo of full replacement of TOD parking and little development. In addition, those that reduced parking had improved fiscal health. Even the scenario of medium intensity development with full parking replacement, which produced negative ground rents, had an overall fiscally sound project due to increased ridership revenue. (Willson/Menotti, 2007, p124 - Commuter).</p>	<p>• Create demand-based, locally calibrated TOD parking requirements that reflect expected transit shares and auto ownership that support transit use and access. P.90. OR Deregulate parking so developers have to assess market demand, set market prices. (P.90.), and supply for actual average demand and use shared parking to accommodate peaks. P.91. (Willson, 2005, p.90-91 - Lessons)</p>	<p>• Willson's methodology, which demonstrates the revenue and ridership tradeoffs between different amounts of parking and types of access (p.6), and Cervero's research, which determines the density of joint development needed to create more riders than surface lot it displaces, help arm planners and traffic engineers with cost-benefit information to reduce parking requirements (p.1) (Tumlin, 2006, p.2, 6 - ITE)</p>

<ul style="list-style-type: none"> • Reduced parking requirements has medium potential effectiveness to reduce parking demand, about 10-15% reduction in parking. (Boroski, 2007, p17 - Reforming) 	<ul style="list-style-type: none"> • Reducing parking can increase savings 5-36% on residential projects (after taking into account increases in increased of units to be parked - potential 20-33% increase in density of residential TOD). (Arrington, 2008, p.4 - Effects) 	<ul style="list-style-type: none"> • Recommendations include setting a desirable and achievable modal split goal and establishing commuter parking policies that match its supply to that goal. (Morrall, 1996, p.33-34 - Supply) 	<ul style="list-style-type: none"> • In Vancouver, 20% parking reductions were most feasible with multifamily rental units with smaller households and where many resident workers used transit to key employment centers. (Boroski, 2002, p.5 - Statewide TOD)
<ul style="list-style-type: none"> • Plentiful parking takes priority over proximity of transit to workplace in determining commuter choice. P.47. Probability of office workers rail-commuting decreased as supply of parking relative to workforce size increase. P. 49. (Cervero, 2006, p.47,49 - OfficeCommute) 	<ul style="list-style-type: none"> • While increased free parking is associated with reduced transit use, (P.85) more parking was also associated with less transit use, it was not statistically significant (i.e., projects with higher transit use did not have statistically significant lower parking supplies). P. 82. 	<ul style="list-style-type: none"> • “In the survey conducted for H-27 survey, reduction of parking requirements was cited as one of the most common incentives offered by local governments to accomplish TOD.” However, respondents rated it only a “marginally effective strategy to encourage TOD, since developers rarely use it.” (Arrington, 2008, p.26 – Effects) 	<ul style="list-style-type: none"> • “Trip reduction effects of transit-oriented housing are thought to come from three major sources: 1) residential self-selection (Cervero, 2007)... 2) the presence of in-neighborhood retail sited between residences and stations that promote rail-pedestrian trip-chaining (Cervero, 1996)... and 3) car shedding (Holtzclaw, et al., 2002). (Arrington, 2008, p.30 – Effects)
<ul style="list-style-type: none"> • Parking reductions can increase the number of potential units in a TOD by 20-33%. (Arrington, 2008, p.48 – Effects) Increasing the potential number of residential units in a TOD also can be 			

expected to increase transit ridership. (Arrington, 2008, p.50 – Effects)			
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Shared Parking	Unbundling/Cash-Out	Transit Improvements	Transit Passes
<ul style="list-style-type: none"> • Share transit parking with patrons who use it during different parts of day. E.g., San Diego shares commuter parking (weekday) with multiplex theater (evening/weekend). (Dunphy, 2003, p.11 - TenPrinciples). 	<ul style="list-style-type: none"> • Developers are willing to unbundle parking when tenants have designated stalls (non- competition) and parking is scarce (all stalls are sold). However, guards against spillover, such as the enforcement of residential parking program, will likely be required. (Higgins, 2007, p.19-20 - Stakeholder). 	<ul style="list-style-type: none"> • Increased frequency of feeder bus service increased rail commuting. (Cervero, 2006, p.49 - OfficeCommute) 	<ul style="list-style-type: none"> • In addition to high-quality feeder buses, provide deeply discounted transit passes to employers, even those near stations. (Cervero, 2006, p.41, 53 - OfficeCommute)
<ul style="list-style-type: none"> • The success of shared parking also depends on the land uses involved. Reducing and/or sharing parking at transit stations must mitigate spillover. (Higgins, 2007, p.18-19 - Stakeholder). 	<ul style="list-style-type: none"> • When Ottawa stopped offering free parking to civil servants, commuters switched to transit, reducing SOV. (Morrall, 1996, p.33 - Supply) 	<ul style="list-style-type: none"> • Longer travel time by auto on highway increased rail transit use. (Cervero, 2006, p.48 - OfficeCommute) 	<ul style="list-style-type: none"> • Cambridge, MA adopted an ordinance in 1998 to reduce automobile use that requires developers to meet the standards by creating transportation demand management plans, subsidizing transit passes and charging for(off-street) parking; violating facilities can be fined or shut down. (Millard-Ball, 2002, p.17 - ParkCaps)

<ul style="list-style-type: none"> • Design transit stations and parking to encourage convenient, walkable access to transit and, when possible, to share parking. P.91. Form partnerships with transit agencies to share station-area parking. (Willson, 2005, p.90 - Lessons) 	<ul style="list-style-type: none"> • Unbundled parking charges from lease agreements for residential and office buildings so residents and employee no longer experience "free" parking. P.90. Cash-out parking for office developments. (Willson, 2005, p.90 - Lessons) 	<ul style="list-style-type: none"> • Grow non-auto access modes (e.g., bus, bike, ped) to stations (design). (Willson, 2005, p.91 - Lessons) 	<ul style="list-style-type: none"> • Transit passes are most effective after a move (e.g., new project) and more effective than transit improvements to increase ridership and reduce parking. (Boroski, 2002, p.12 - Statewide TOD)
<ul style="list-style-type: none"> • Shared parking may benefit from restriction on hours, which shifts rather than reduces parking. (Boroski, 2002, p.14 - Statewide). 	<ul style="list-style-type: none"> • Unbundling and Cash-out options have medium potential effectiveness to reduce parking demand, about 10-15% reduction in parking. (Boroski, 2007, p17 - Reforming) 	<ul style="list-style-type: none"> • "Off-peak frequency improvements can improve ridership more than other strategies" for non-work trips. (Arrington, 2008, p14 - Effects) 	<ul style="list-style-type: none"> • Transit passes and incentives have low potential effectiveness to reduce parking demand, about 5-10% reduction in parking. (Boroski, 2007, p17 - Reforming)
<ul style="list-style-type: none"> • Shared parking has high potential effectiveness to reduce parking demand, about 10-20% reduction in parking. (Boroski, 2007, p17 - Reforming) 			

3.6 Parking Design

General	Location	Connectivity	Wrapping Around Parking
<ul style="list-style-type: none"> • Parking should be community oriented and connect (rather than sever) parking to transit and greater community (Dawes, 2005, p.36 - FasTracks). 	<ul style="list-style-type: none"> • Choose (station) locations that can grow over convenient locations that can't (e.g., don't put parking where want growth). (Dunphy, 2003, p.3, TenPrinciples) 	<ul style="list-style-type: none"> • Since most reail-commuters finish journey on foot (78%, p47) and walk to close midday trips (96% of those within .25mi, 	<ul style="list-style-type: none"> • Wrap parking with stores to make walk more interesting, also allows riders to take care of errands and builds in clientele for businesses. E.g., Glendale, CA used ped.

		p50), street connectivity is important to increasing ridership. (Cevero, 2006, p.47,50 - OfficeCommute)	Design and arcade w/ped amenities to link to shopping plaza. (Dunphy, 2003, p.11 - TenPrinciples)
<ul style="list-style-type: none"> • Avoid building commuter rail stations with simple platforms surrounded by parking. (Dunphy, 2003, p.vii, TenPrinciples) 	<ul style="list-style-type: none"> • Move parking away from platform; Five to seven-minute walk opens prime real estate for development. (Dunphy, 2003, p.10 - TenPrinciples). 	<ul style="list-style-type: none"> • Commuter use of transit based on walking distances (i.e., not willing to walk more than a few blocks), although depends on quality of service, typical weather and perceived risks of walking. (Higgins, 1993, p.50- ParkReq) 	<ul style="list-style-type: none"> • Wrap buildings around parking (may require mechanical vs. natural ventilation) with retail on first floor so looks like reg building. P.303. (Mukjija/Shoup, 2006, p.303 - QuantvQual).
<ul style="list-style-type: none"> • Use "build-to" lines (opposite of setbacks) to bring buildings up to same plane, e.g., sidewalk. (Mukjija/Shoup, 2006, p.301 - QuantvQual). 	<ul style="list-style-type: none"> • Residence distance to light rail station and pedestrian connectivity surrounding residence do not affect mode choice. (Hess, 2001, p.41 - EffectsOfFree). 	<ul style="list-style-type: none"> • A pedestrian scale street grid that focuses on a hierarchical multimodal design (ped & bike over auto) and connects to a regional network will encourage mode shift to non-auto choices. (Daisa, 2004, p.120 - Traffic) 	
<ul style="list-style-type: none"> • Plan for alternative uses (e.g., basketball, ped. space). (Mukjija/Shoup, 2006, p.303 - QuantvQual). 	<ul style="list-style-type: none"> • Orient buildings to sidewalk by moving parking below, behind, beside, providing access from sidestreet or rear. (Mukjija/Shoup, 2006, p.299 - QuantvQual). 		

<ul style="list-style-type: none"> • Parking demand depends on local variables (e.g., tenants (employee density p.54), price of parking and gas, state of economy, proximity to transit, barriers to access (p.54) attractiveness of off vs. on-street parking, regulations requiring employee traffic reduction programs). (Higgins, 1993, p.50- ParkReq) 	<ul style="list-style-type: none"> • Maximize separation of pedestrians from vehicle travel ways. (Mukjija/Shoup, 2006, p.303 - QuantvQual). 		
<ul style="list-style-type: none"> • In Berkeley, tolerable congestion and a tight, priced parking supply along with an extensive transportation system create a favorable environment for alternative modes. (Deakin, 2004, p.129 - Berkeley) 	<ul style="list-style-type: none"> • Design and position station to foster creation of activity center (for development) that surrounds station on all sides. (I.e., don't let parking inhibit development) (Dunphy, 2003, p.12 - TenPrinciples). 		
<ul style="list-style-type: none"> • Use colorful (light) surfaces and decorative perimeters or walls to screen/make more attractive. (Mukjija/Shoup, 2006, p.303 - QuantvQual). 	<ul style="list-style-type: none"> • Early planning re alignment, where to put stations and layout of transit facilities can be the difference between a successful TOD and an unsuccessful one. P.12. (Parker, 2002, p. 12 - Statewide SUM) 		
<ul style="list-style-type: none"> • Marin TPLUS TOD toolkit includes Structured Parking Design guidelines. (Boroski, 2007, p.23 - Reforming) 			

<ul style="list-style-type: none"> • "Urban design variables exert a stronger influence for station area workers than station area residents... That said, good urban design treatments probably make living at higher densities more attractive" (Arrington, 2008, p.16 - Effects) 			
<ul style="list-style-type: none"> • "Auto restraint measures, like traffic calming and car-free streets, likely have some marginal influence on ridership to the degree walking becomes safer, easier and more enjoyable." Although "TOD land-use features are more likely to affect travel behavior for shorter distance, nonwork trips." "Quality of the walking environment significantly influences travel choices for nonwork travel." (Arrington, 2008, p.17 - Effects) 			
<ul style="list-style-type: none"> • No incentives for better parking design p.296; planners should deregulate amount of parking and start regulate design, use in-lieu fees & reductions to fund p.307. (Mukjija/Shoup, 2006, p.296,307 - QuantvQual) 			

<ul style="list-style-type: none"> • Moving parking away from the platform allows stations to “balance the need for parking to generate ridership while preserving the opportunity to capture additional ridership from TODs within an interesting and attractive walk to the station.” (Arrington, 2008, p.21 – Effects) 			
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Landscape Banking	Size/Shape
<ul style="list-style-type: none"> • Use landscape to screen, e.g., W. Hollywood requires 1 canopy tree for every 8 spaces, and impervious surfaces, e.g., grasscrete. (Mukjija/Shoup, 2006, p.302-303 - QuantvQual). 	<ul style="list-style-type: none"> • Limit overall size of lots. (Mukjija/Shoup, 2006, p.302 - QuantvQual).
<ul style="list-style-type: none"> • Create landscape reserves. (Daisa, 2004, p.122 - Traffic) 	<ul style="list-style-type: none"> • Restrict garage door, and/or driveway widths to one car; allow more depth to locate garage behind (or stepped back from house). Maximize separation of pedestrians from vehicle travel ways. (Mukjija/Shoup, 2006, p.303-304 - QuantvQual).

3.7 Consumer Characteristics			
General	Income	Car Ownership	Commuter Behavior
<ul style="list-style-type: none"> • TOD residents are: tired of traffic and willing to give up a second car (not the first), seniors who want to be more auto-independent (Dunphy, 2003, p.21 - TenPrinciples). 	<ul style="list-style-type: none"> • Higher-income commuters have "a more inelastic demand for driving (to work when there is a parking charge" (i.e., they are less likely to stop driving as parking charges increase). (Hess, 2001, p.40 - EffectsOfFree). 	<ul style="list-style-type: none"> • Less car ownership yields more transit use. (Willson, 2005, p.81 - Lessons) 	<ul style="list-style-type: none"> • While transit use markedly declined for metro areas surrounding TODs, transit ridership for work trips increased in TOD zones. (Arrington, 2008, p.1 - Effects)
<ul style="list-style-type: none"> • Higher transit times, more vehicles per household and higher income increased probability of SOV over transit when commuting to work. Reduced transit times, increased parking and decreased income increased probability of transit use. (Hess, 2001, p.39 - EffectsOfFree). 	<ul style="list-style-type: none"> • "Lower-income commuters are less likely to drive to work if they have to pay for parking." If lower-income commuters park, they do it for free. If they have to pay for parking, they don't drive. (Hess, 2001, p.40 - EffectsOfFree). 	<ul style="list-style-type: none"> • 2. TOD households are twice as likely to not own a car and own roughly half as many cars as comparable households not living in TODs. (Arrington, 2008, p.1 - Effects). 	<ul style="list-style-type: none"> • If need to drive to midday destinations, will drive to work/not take transit. (Tri-chaining) (Cevero, 2006, p.52 - OfficeCommute)
<ul style="list-style-type: none"> • Character of employment type (e.g., office workers versus professionals) affect parking. Professional workers require more parking stalls than office workers because they travel during the day more than their office counterparts. (Morrall, 1996, p.33 - Supply) 	<ul style="list-style-type: none"> • Auto ownership highly influenced by household income, size (I.e., number of people & square footage) even when transit is good. (Boroski, 2002, p.5 - Statewide TOD) 	<ul style="list-style-type: none"> • In Vancouver, average TOD household size was 1.66 and had 1.26 vehicles per household vs. non-TOD residents with household sizes of 2.4 and 1.64 vehicles per household. About 70% of TOD residents owned fewer than two cars. Highest income residents owned twice as many cars as lower 	<ul style="list-style-type: none"> • "One of the best times to encourage transit use is when there is a change in home or job location." (Arrington, 2008, p.19 - Effects)

		income residents. (Boroski, 2002, p.5 - Statewide TOD)	
<ul style="list-style-type: none"> • Attractors for potential TODs residents: neighborhood design, home prices, perceived value and transit proximity. (Arrington, 2008, p.1 - Effects). 	<ul style="list-style-type: none"> • Lower income households may also have high ownership, e.g., if job sites are not centralized. (Boroski, 2002, p.6 - Statewide TOD). 	<ul style="list-style-type: none"> • TOD residents own fewer cars due to smaller family sizes (young professionals, empty nesters) and proximity to transit. Top three reasons TOD residents move in are: housing/neighborhood design, housing cost, and proximity to transit, respectively. (Arrington, 2008, p.3-4 - Effects) 	
<ul style="list-style-type: none"> • “According to CTOD, 2005, firms and workers are increasing exhibiting a preference for 24-hour neighborhoods” influenced by “the rise of the creative class and the increasing importance of technology and talent in a region’s economic development strategy.” (Arrington, 2008, p.27 – Effects) “ULI (2003) reiterates that... when transit is viewed as a tool for recruiting scarce talent... companies will list good transit access as a criterion in site selection 	<ul style="list-style-type: none"> • Lund, et al., 2004 found that “proximity to transit was ranked third among factors influencing households to move to TOS, behind the cost and quality of housing.” (Arrington, 2008, p.26 – Effects) 	<ul style="list-style-type: none"> • “TOD households typically own fewer cars because they have smaller households ... and may forgo extra cars due to transit proximity” (Arrington, 2008, p.22 – Effects).” “Renne (2005) found that TOD households own an average 0.9 cars compared to 1.6 cars for comparable households not living in TODs.” (Arrington, 2008, p.26 – Effects) TOD households are almost 	

choices.” (Arrington, 2008, p.28 – Effects)		twice as likely to not own a car and own almost half the number of cars of other households.” (Arrington, 2008, p.22 – Effects)	
• TOD resident ridership due to self-selection. (Cevero, 2006, p.42 - OfficeCommute)		• “Gossen (2005) found that car ownership falls with distance from a station, e.g., average vehicles per person were: .05 (<1/4 mile); 0.54 (1/4 to 1/2 mile); 0.61 (1/2 to 1 mile); 0.75 (>1 mile – low density suburbs)”. (Arrington, 2008, p.25 – Effects)	

3.8 Miscellaneous

General	Development	Planning	Financing
<ul style="list-style-type: none"> • However, because most cities have little data on parking, more intermediate options may be to abolish parking minimums to let the market decide (p.20) and/or limit the amount of land developers can build parking on (p.17). Other steps include setting up overlay zones (p.16-17) and working with stakeholders, 	<ul style="list-style-type: none"> • Goal should be to create greatest land value as a whole (e.g., development) to protect all invested, including community, transit and landowners/developers (Dawes, 2005, p.36 - FasTracks). 	<ul style="list-style-type: none"> • Use integrative/comprehensive planning process and station area development plan to avoid parking problems (Dawes, 2005, p.35-36 - FasTracks). 	<ul style="list-style-type: none"> • Developer impact fees should reflect goals of TOD, e.g., encourage development. E.g., San Jose and Orlando have used smart pricing to modify their impact fee programs. (Dunphy, 2003, p.13 - TenPrinciples).

<p>including developers, real estate and lenders, to set up parking policies (p.20).</p>			
<ul style="list-style-type: none"> • Parking requirements add 20 percent to the cost of each unit and reduce the number of units that can be built on a site by 20%." (p17-18) (Millard-Ball, 2002 - ParkCaps) 	<ul style="list-style-type: none"> • Attract mix of uses, of socio-economic classes, and of large companies especially those that have many lower-wage employees (e.g., call centers, BellSouth in Atlanta, GA). (Dunphy, 2003, p.22, TenPrinciples) 	<ul style="list-style-type: none"> • Develop contingency plans for peak-season parking. (Daisa, 2004, p.122 - Traffic) 	<ul style="list-style-type: none"> • Increased design costs may be mitigated by reduced min reqs (me: and in-lieu fees?). (Mukjija/Shoup, 2006, p.307 - QuantvQual).
<ul style="list-style-type: none"> • Future tasks/challenges include developing a typology of TODs, using traffic and parking surveys to generate data, creating methodology for analyzing TODs, and creating interdisciplinary knowledge by cross-training traffic and parking professional. (Daisa, 2004, p.128 - Traffic) 	<ul style="list-style-type: none"> • TODs need to make development attractive and remove obstacles, e.g., lack of market potential, environmental constraints, inadequate infrastructure or neighborhood opposition. (Dunphy, 2003, p.vi, TenPrinciples) 	<ul style="list-style-type: none"> • Decreasing parking demand can cost less than increasing parking supply - e.g, \$1 on transit passes can save \$23-\$337 on parking capital costs in Silicon Valley. (Boroski, 2002, P.13-14 - Statewide TOD) 	<ul style="list-style-type: none"> • Risk funds guarantee lot owners/operators revenue in exchange for short term parking to encourage efficient use of resources. (Boroski, 2007, p.41 - Reforming)
<ul style="list-style-type: none"> • More downtown vacancies increased commuting because fewer people had to compete for the roadway and parking spaces. Therefore, increased vacancy can increase parking supply, depress parking charges, and encourage auto-use. (Morrall, 1996, p.34 - Supply) 	<ul style="list-style-type: none"> • "Most effective strategy to increase TOD ridership is to increase development intensities in close proximity to transit. (Arrington, 2008, p. 13- Effects) 	<ul style="list-style-type: none"> • Developing morintoring program prior to implimenting changes, collect baseline of "before" conditions, if possible impliment changes so can monitor effects of each, annually collect parking data, analyze data in context 	<ul style="list-style-type: none"> • Parking occupancy taxes tax paid parking and can be used to monitor and enforce parking program. (Boroski, 2007, p.41 - Reforming).

		of community changes. (Boroski, 2007, p.51 - Reforming)	
<ul style="list-style-type: none"> • Alone TDM measures yield small (but significant) results. Together, however, they can have significant result. (Boroski, 2002, p.12 - Statewide TOD). 	<ul style="list-style-type: none"> • Curitiba, Brazil and Ottawa, Canada have extensive experience developing around express bus services (e.g., creating permanence so developers can bank on future). (Dunphy, 2003, p.vii, TenPrinciples) 	<ul style="list-style-type: none"> • Burlingame, CA collects annual surveys re parking occupancy and makes changes to pricing and time limits based on results for public on- and off-street parking. (Boroski, 2007, p.51 - Reforming) 	<ul style="list-style-type: none"> • Tax exemptions/variable rate taxes offer special discounts to parking operators who provide access for priority users (e.g, short-term customers). (Boroski, 2007, p.41)
<ul style="list-style-type: none"> • For TOD residents, free parking at workplace reduces ridership while employer transit passes (or contribution) increase ridership; land-use variable and connectivity not major variables for work trips. (Arrington, 2008, p.7 - Effects) 	<ul style="list-style-type: none"> • Cost savings related to lower parking ratios is most pronounced with higher density development prototypes where structured parking is used. (Arrington, 2008, p.49 – Effects) 		<ul style="list-style-type: none"> • Los Angeles, CA is considering parking occupancy tax on paid parking to increase monitoring and enforcement of off-street parking as well as a small annual tax on free or bundled parking (Boroski, 2007, p.43 - Reforming).
<ul style="list-style-type: none"> • Good parking laws, quality transit, well-designed parking structures and political commitment support downtown parking strategies in Canada. (Morrall, 1996, p.34 - Supply) 			<ul style="list-style-type: none"> • Reduce impact fees (e.g., for road improvements/ widening), increase speed of approval, increase density as incentives to encourage developers to reduce parking. (Arrington, 2008, p.5 - Effects)

- Parking databases should include space inventory (on, off, public, private, time limits, fees, loading zones, specific use, etc.), occupancy survey (cars parked at any given time of day, by hour), land use inventory (building type, size, note major vacancies (>10-15%)), other transportation info (e.g., transit, bike routes, pedestrian connections). (Boroski, 2007. p.46 - Reforming)

Land Value	Car Sharing
<ul style="list-style-type: none"> • Developments near transit have higher rent premiums over nearby properties. Cervero 1998-9 found multifamily residential projects within .25 miles of light rail stops rented for \$9 per sq ft more and commercial properties rented for \$4 per sq ft more. p. 6. Caltrain commuter stops doubled land values and residential for-sale properties had a 17% premium. (Dunphy, 2003, p.7 - TenPrinciples) 	<ul style="list-style-type: none"> • Car-sharing most popular in areas with good transit systems and used as a substitution for owning a second car. Demographics for CarSharing Portland are small households with no children, educated, higher income households that rent rather than own housing and use transit even lthough they earn enough to afford a vehicle. (Boroski, 2002, p.16 - Statewide TOD).

<ul style="list-style-type: none"> • Substantial land value premiums for property (residential, office, retail) within half mile of transit stations. (Dawes, 2002, p.34 - FasTracks). 	<ul style="list-style-type: none"> • Carsharing has low potential effectiveness to reduce parking demand, about 3-50% reduction in parking. (Boroski, 2007, p17 - Reforming)
	<ul style="list-style-type: none"> • “Trip reduction also suggests TODs are strong markets for car-sharing.” (Arrington, 2008, p.54 – Effects)
	<ul style="list-style-type: none"> • “Those that participate in carsharing programs lower their car ownership levels around 10%, with higher vehicle-shedding rates among those living near rail stations (Cevero, Golub, and Nee, 2007).” (Arrington, 2008, p.26 – Effects)

4. Annotated Bibliography of TOD-Parking Studies

- 1) Angel, S. (1968). *Discouraging Crime through City Planning*. Working Paper, #75. Berkeley, CA: Center for Planning and Development Research.

The article is part of Angel's PhD thesis and was a study of street crime in Oakland, CA. In it he states "The physical environment can exert a direct influence on crime settings by delineating territories, reducing or increasing accessibility by the creation or elimination of boundaries and circulation networks, and by facilitating surveillance by the citizenry and the police." He asserted that crime was inversely related to the level of activity on the street, and that the commercial strip environment was particularly vulnerable to crime because it thinned out activity, making it easier for individuals to commit street crime.

Angel discusses the existence of "Critical Intensity Zones" which he defines as areas where pedestrian circulation is intermediate (Angel 1968). Intermediate circulation refers to areas that have enough potential crime victims but not enough as to provide an adequate surveillance function. As intensity of use increases and streets become more populated, they become safe again (Angel 1968). These zones tend to have specific physical environmental characteristics and land uses that provide opportunities for delinquents to commit a criminal offense; creating a perfect setting conducive to criminal mischief. Some examples are: open parking lots in isolated areas, commercial areas backing residential areas, and structures that provide poor pedestrian circulation.

- 2) Arrington, G.B. (2008) *Effects of TOD on Housing, Parking and Travel*. Transportation Research Board Washington, D.C.

Authors performed a literature review on how housing and parking affects TOD as well as a study of travel in 17 TODs. The literature review findings include that while surrounding metro areas have lost transit share, TODs have increased transit ridership. In addition, TOD households own half as many cars as their counterparts and are twice as likely not to own a car. While TOD residents are attracted by neighborhood design, home prices, perceived value and transit proximity, access to high quality transit (proximity, connectivity, and travel times) can be an attractant for firms with creative class workers.

TOD commuters, who self-select to live near transit, use transit two to five times more frequently than non-TOD residents. Again, the extent of the transit network, level of service, and travel times (as compared to auto) were to greatest influencers for encouraging non-auto travel. Parking supply and availability and transportation demand management were the next most important variables. For example, high parking charges and/or limited parking supply increase ridership, while abundant, free or low-cost parking is a major deterrent to transit use. In addition, employment density and proximity to transit at trip ends were more important to ridership than residential population/density at origins. A mix of uses was important for both commuter and non-work trips. However, the greatest opportunity to increase ridership is for non-peak trips (e.g., non-work trips), which favor design and connectivity.

The author's travel study found that ITE's auto-trip generation may overestimate parking by up to 50%, especially in areas with a high quality transit network that utilizes TDM. By reducing parking, residential density could be increased by 20-30% and save 5-36% on residential parking costs. Therefore, parking supply, impact fees and the development process should be designed to encourage TOD.

- 3) Bertaud, A. (2002). Note on Transportation and Urban Spatial Structure. *ABCDE conference*. Washington, DC.

The article describes the physical attributes of urban transport and the urban forms that constitute the spatial networks. It emphasizes in the importance of defining urban land use and calculates population density. Land use is the product of the interaction between markets and regulations. TOD is described as a way to optimize transit networks and make land use more compatible with growth patterns. In addition, TOD is considered a catalyst of high density which can be easily served by transit services. The article concludes urban structures are dependent on the interaction of land market with regulations. But ignoring the land market to rely entire on regulations to optimize land use has serious side effects. City current spatial structures (dominantly polycentric) call for TOD as a way to mitigate traffic congestion and pollution while optimizing land use.

- 4) Boarnet, M. and Crane, R. (1998). Public Finance and Transit-Oriented Planning: New Evidence from Southern California. *Journal of Planning Education and Research*, Vol. 17, pp. 206-219.

The article suggests that local governments seem to be continually strapped for funds. While the revenue-generating role of their planners is often discussed, it is rarely investigated in any detail. The article addresses this research gap by considering the fiscal nature of land use policy in TOD. According to the article, a massive and influential literature has explored the potential for leveraging rail system investments by locating high density residential developments near commuter rail stations. The feasibility and focus of these strategies have been questioned, however, in the face of evidence that local government support for these projects is mixed at best. To explain this behavior, the article examines the role basic fiscal conditions play in the decision to zone land near all existing and proposed commuter rail stations in southern California. The analysis described indicates that station area zoning depends significantly on community public finances. The article concludes with results that underscored how the practice of TOD must account not only for travel behavior and the broader goals of any given urban design, but also for the self-interested nature of municipal planning. (Source: abstract)

- 5) Boroski, (2007), Reforming Parking Policies to Support Smart Growth: Toolbox/Handbook: Parking Best Practices & Strategies for Supporting Transit Oriented Development in the San Francisco Bay Area by Metropolitan Transportation Commission

Article is a handbook to help cities, towns and neighborhoods identify the typology of TOD best suited to their community, the potential strategies (and examples of best practices) that have worked at that scale, and guidelines for implementation.

Handbook assists community in identifying goals and defines six parking terms:

- TOD-supportive policies (e.g., transit incentive programs, car sharing, design, overlay zones, walkability and way finding)
- Pricing, (on-street, coordinated on- and off-street, variable rate pricing, unbundling, cashing-out)
- Management strategies (payment technology, database, real-time info)
- Districts,
- Financing (in-lieu fees, risk fund, occupancy tax, tax exemptions, tax by space)
- Requirements (reducing minimums, setting maximums, shared)

A chart highlights the effectiveness of each parking reduction strategy followed by examples of communities that have created best practices. For implementation, handbook recommends, involving stakeholders, collecting and dispensing parking information, performing parking analysis, reviewing best practices, and monitoring parking before and after the program in order to fine-tune for the future and build support for the future.

- 6) Boroski, J.,Faulkner, T., Arrington, GB.,et.al.(2002). *Statewide Transit-Oriented Development (TOD) Study Factors for Success in California*. Special Report Parking and TOD: Challenges and Opportunities. California Department of Transportation.

This major study was led by staff of the California Department of Transportation, with input from two advisory committees. It was approved for distribution in September 2002 by the State's Business, Transportation and Housing Agency. The Final Report defines transit-oriented development (TOD) and its successful components; explores and summarizes the benefits of TOD, including effects on travel; provides an overview of TODs in the U.S. and California (including 12 'profiles'); determines what is working well to implement TOD in California; and identifies major barriers and impediments to the wider implementation of TOD. The study concludes with recommendations for state actions (14 actions) to facilitate transit-oriented development in California.

- 7) Boroski, John, Jennifer Rosales and GB Arrington (2005.) *Developing TOD Parking Strategies*. Transportation Planning 30(1) pp 1-2, 4-5, 8-9

Article summarizes different parking strategies at TODs including using shared parking, parking districts, satellite parking, carpool parking, transit pass program, unbundling, car sharing, and mechanized parking. Authors highlights parking program for West Hyattsville TOD in Maryland which uses enforcement of a residential parking program, efficient use of all structured parking, the metering of on-street parking, a transit pass program, encouragement of car-sharing programs through agreements and reserved spaces and coordinated bus service. Switched maximums to minimums, and used distance based parking strategy where the parking requirements within a quarter mile of transit (and transit passes) are reduced by 5 percent and another 5 percent when car sharing begins. Off-street requirements are also reduced if there is a credit of on-street parking.

- 8) Calthorpe, P. (1993). *The Next American Metropolis: Ecology, Community and the American Dream*. Princeton: Princeton Architectural Press.

A practitioner of New Urbanism, Peter Calthorpe, offers in his book a persuasive argument to move United States away from urban sprawls and towards walkable, mix-use compact communities. This book starts from the premise that development in metropolitan areas is reaching a critical point limiting regional social, environmental, and economic growth. The book advocates for a change in building patterns and provide principles for better community planning. The book aims to guide urban planners in shaping communities with alternative development methods. It discusses housing planning, transport, environmental, and social planning. In addition, it also warns the reader about the negative consequences of urban sprawls and the need for sustainable actions. The book concludes by advocating for walkable sustainable communities surrounded by mix-land uses, and served by public transport. These communities will be socially and economically diverse, integrated, and equipped with a transport network that calls for higher accessibility at a low cost.

- 9) Charles, J.,and Barton, M. (2003). *The Mythical World of Transit-Oriented Development: light rail and the Orenco neighborhood*. Hillsboro, Oregon. Cascade Policy Institute.

The article describes the experience of Orenco Neighborhood TOD in Portland, Oregon. Oregon has encouraged the creation of a number of transit oriented developments (TODs) in the past several years. These land use and transportation solutions (light rail) were designed to help decrease traffic congestion, improve air quality, and increase use of public transit. However, for Orenco Station, the article suggests a different conclusion. In addition, the article tries to define development patterns near the Orenco Station, public subsidies involved in the development, the role of the local government, indicators of transit use, and project performance as a TOD. The article concludes by describing Orenco TOD planning, community perception, and assessing the actual quality of the TOD.

- 10) Cervero, R. (1993). *Ridership Impacts of Transit-Focused Development in California*. Monograph 45. Berkeley: Institute of Urban and Regional Development, University of California.

This report examines large-scale developments near rail stations in California. It emphasizes in the relationship between development and transit ridership. Ridership is analyzed for residential, office, and retail types of development and factors that account for travel mode choice. The study concludes by explaining the factors that influence travel choice of people living, working, or shopping near the rail stations.

- 11) Cervero, R. (1993). *Transit-Supportive Development in the United States: Experiences and Prospects*. Washington, D.C.: Federal Transit Administration.

This report examines transit-supportive developments and their impact in transit demand through case studies. Transit ridership is analyzed in terms of individual site, neighborhood, and communities. The report analyzes markets regulations and their influence over transit-supportive developments, land use, and site design. The study concludes that landscape characteristics, excessive parking, segregated land uses, and street layouts are physical design attributes that

promote auto-dependency. A transit-supportive development should account for all of these factors to truly improve mobility, and accessibility.

- 12) Cervero, R. (1994). *Rail Transit and Joint Development: Land Market Impacts in Washington, D.C. and Atlanta*. Chicago: IL: APA Journal 60(1): 83-94.

The article focuses on how joint development between transit authorities and private developers can increase land values and economic growth. Although it does not specifically address parking issues, economic growth is important for successful TODs. The article demonstrates how the average annual rents of commercial space at transit stations increases with regional ridership. It also stresses the importance of permissive zoning for higher densities and connectivity from the station to buildings (e.g., pedestrian plazas, street improvements).

- 13) Cervero, R. (1998). *Transit Metropolis: A Global Inquiry*. Washington, DC: Island Press.

The Transit Metropolis: A Global Inquiry by Professor Robert Cervero of the University of California at Berkeley is must reading for public transportation practitioners who believe they can glean useful experience from colleagues around the world.

The ability to gain lessons from abroad in operating and improving transit systems is precisely the operating philosophy of the federally supported International Mass Transit Study Program. Over the past five years, this program has given more than a hundred managers a close look at many of the cities selected by Cervero for his masterful analysis. He homes in on what it takes to provide world-class urban transit that is cost-effective, conserves resources, and provides a reasonable alternative to the personal mobility of the private car.

Based on three years of research, the book explores the successful innovations of 12 metropolitan areas he calls the "transit metropolis": in effect, an urbanized region where a hand-to-glove fit exists between transit services and settlement patterns. These cities are set apart by their commitment to bucking the trend toward auto dependency and restructuring themselves to design and provide sustainable transit services.

Against the background of insights and policy lessons drawn from such profiled cities as Stockholm, Sweden; Singapore; Zurich, Switzerland; Adelaide and Melbourne, Australia; Curitiba, Brazil; Karlsruhe, Germany; and Vancouver, B.C., Cervero reviews the efforts and challenges facing North American cities such as Houston, San Diego, and St. Louis in mounting effective and responsive public transit programs.

(Source: <http://www.apta.com/services/intnatl/intfocus/cervero.cfm>)

- 14) Cervero, R. (2001). *Walk-and-Ride: Factors Influencing Pedestrian Access to Transit*. *Journal of Public Transportation*, Vol. 3, No. 4, pp. 1-23.

The article discusses the problems pedestrians face in accessing transit, especially in auto-oriented communities. The article focuses in San Francisco Bay Area's compact, mixed-use development and Montgomery County, Maryland, pedestrian-friendly urban design. In both settings, street dimensions, wide sidewalks, and landscape design encourage walk-and-ride. The

paper concludes by providing recommendations for improving walkability and the positive benefits to transit.

- 15) Cervero, R. (2006). *Public Transport and Sustainable Urbanism: global lessons*. Science Council of Japan Conference Paper. University of California in Berkeley.

TOD is a viable model for transportation and land-use integration in many rapidly developing cities of the world, including those in Asia. TOD is a straightforward concept: concentrate a mix of moderately dense and pedestrian-friendly development around transit stations to promote transit riding, increased walk and bicycle travel, and other alternatives to the use of private cars. In a way, Asian cities have historically been transit oriented; featuring fine-grain mixes of land uses, plentiful pathways for pedestrians and cyclists, and ample transit services on major roads. However, the recent ascendancy in car ownership and rising incomes are unraveling the historical transit-supportive urban forms of many Asian cities, giving rising to an increasingly car-dependent built form. By focusing new construction and redevelopment in and around transit nodes, TOD is viewed as a promising tool for curbing sprawl and the car dependence it spawns. By channeling public investments into struggling inner-city settings, some hope TOD can breathe new life and vitality into areas of need. And by creating more walkable, mixed-use neighborhoods with good transit connectivity, TOD is thought to appeal to the lifestyle preferences of a growing demographic, like childless couples, young professionals, and empty. (Source: abstract)

- 16) Cervero, R (2006). "Office Development, Rail Transit, and Commuting Choices." *Journal of Public Transportation* 9(5). p. 41-55.

Researcher describes variables that affect commuter and midday travel choices for office workers at ten suburban rail stations in California. His main findings include that higher quality feeder buses, discounted transit passes to employers, and high density and street connectivity near office increase rail ridership. Plentiful parking offset these transit benefits. In addition, physical barriers to walking to midday trips (e.g., distance, lack of street connectivity), especially for childcare, shopping, personal business and eating errands, increase the likelihood of driving to work. Additional recommendations include incentivizing TOD residential development within 1/3 mi of transit and office site designs that support mixing of uses and connectivity, including reducing and arranging parking.

- 17) Cervero, R., Ferrell, C., and Murphy, S. (2002). *Transit-Oriented Development and Joint Development in the United States: a literature review*. *TCRP Research Results Digest # 52*. University of California in Berkeley: Institute of Urban and Regional Development.

This comprehensive report explores the different TOD definitions and Joint Development as a form of TOD. It analyzes the different institutional problems in developing TODs and emphasize in the importance of collaboration and partnership between stakeholders. It also addresses the need for supportive public policies for mix-use development, zoning, and parking. Particular focus is given to physical design characteristics and their impact over the TOD project. The report concludes with recommendations for developers and planners in assessing TOD projects.

- 18) Cervero, R., P. Hall, and J. Landis. (1992). *Transit Joint Development in the United States*. Monograph 42. Berkeley: Institute of Urban and Regional Development, University of California.

This report examines the link between Joint Development and transit. It also focuses on the role of the Federal Transit Administration (FTA) in shaping Joint Developments. Several case studies were used to address and describe joint developments in terms of location, design pattern, and size. Joint developments financial impact is considered as a benefit to transit agencies and an incentive for supportive policies. The study finalizes with the results of a survey administered to transit officials. In the survey, they describe their experience with joint development, effects over their agencies, and necessary conditions for success. The report also provides recommendations to developers, planners, and FTA officials that include institutional and market conditions that facilitate joint developments in United States.

- 19) Cervero, R., and Kockelman, K. (1997). Travel Demand and the 3Ds: density, diversity, and design. Transportation Research Part D. *Transport and Environment*. Vol. 2, Issue 3, pp 199-219.

The article starts from the premise that the built environment is thought to influence travel demand along three principal dimensions - density, diversity, and design. The paper examines how the “3Ds” affect trip rates and mode choice of residents in the San Francisco Bay Area. Using 1990 travel diary data and land-use records obtained from the U.S. census, regional inventories, and field surveys, models are estimated that relate features of the built environment to variations in vehicle miles traveled per household and mode choice, mainly for non-work trips. The research finds that density, land-use diversity, and pedestrian-oriented designs generally reduce trip rates and encourage non-auto travel in statistically significant ways, though their influences appear to be fairly marginal. Compact development was found to exert the strongest influence on personal business trips. In addition, those living in neighborhoods with grid-iron street designs and restricted commercial parking were found to average significantly less vehicle miles of travel and rely less on single-occupant vehicles for non-work trips. The research shows the relationship between the 3Ds and travel demand. The paper concludes by recommending more compact, diverse, and pedestrian-oriented neighborhoods. (Source: abstract)

- 20) Cervero, R. and Landis, J. (1997). Twenty-Years of the Bay Area Rapid Transit System: Land Use and Development Impacts. TCRP *Transportation Research A*, Vol. 31, No. 4, pp. 309-333.

The report describes BART urban rail system, compact development around the stations, and growth patterns. The initial BART impact study, conducted a few years following the systems 1973 opening, concluded that BART played a fairly modest, though not inconsequential, role in shaping metropolitan growth and land-use patterns. This paper summarizes findings from an update of the original BART impact study, examining BARTs influences on urban development patterns 20 years after services started. In general, the research findings are similar to those of the original impact study. Over the past 20years, land-use changes associated with BART have been largely localized, limited to downtown San Francisco and Oakland and a handful of suburban stations. Elsewhere, few land-use changes have occurred, either because of

neighborhood opposition or a lackluster local real estate market. While BART appears to have helped bring about a more multi-centered regional settlement pattern, such as inducing midrise office development near the Walnut Creek and Concord stations, it has done little to stem the tide of freeway-oriented suburban employment growth over the past two decades. Indeed, recent office additions near East Bay stations pale in comparison to the amount of floor space built in non-BART freeway corridors. Near several suburban stations, the most notable change has been the addition of multi-family housing. In most instances, local redevelopment authorities helped leverage these projects by providing various financial incentives and assistance with land assemblage. Statistical analyses reveal that the availability of vacant and developable land is an important predictor of whether land-use changes occurred near stations. BART, in and of itself, has clearly not been able to induce large-scale land-use changes, though under the right circumstances, it appears to have been an important contributor. If the Bay Area is to achieve the compact, multi-centered built form that was originally envisaged, stronger public policy initiatives will be needed to channel future regional growth to BART corridors. (Source: abstract)

- 21) Cervero, R., Murphy, S., Ferrell, C., et al. (2004). Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects. *TCRP Report #102*. Washington, DC.

The comprehensive report analyzes TOD benefits and challenges in United States. Joint Development is described as a form of TOD that is project oriented. The study describes physical design and institutional standards that facilitate TOD. Policies and financial feasibility are also considered in the development of TODs. The report focus in 10 case studies analyzed in terms of urban forms, design patterns, institutional collaboration, and community support. The report concludes that all these factors are essential in measuring the success of the TOD. Particularly focus is given to land use and private-public collaboration. In addition, the report gives recommendations to planners and developers in the elaboration of TOD projects.

- 22) Curitiba, A model of Transit Oriented Planning. EcoMobility Magazine. ICLEI-Local Governments for Sustainability. <http://www.ecomobility.org/fileadmin/template/project_templates/ecomobility/files/Publications/Case_stories_EcoMobility_Curitiba_PDF_print.pdf> Retrieved on November 15, 2011

This article describes Curitiba TOD and emphasizes in its sustainability efforts. Curitiba's urban development strategy is a model for cities around the world. Accessible public transportation is prioritized when choosing housing and commercial building locations. The public transportation system is exceptional in terms of its affordability for customers, the use of enclosed prepay stations, and the integration of transfer terminals. The article finalizes by describing the success of Curitiba urban planning and the future expansion of Curitiba transportation system.

- 23) Currie, G. (2006). Bus Transit Oriented Development-Strengths and Challenges Relative to Rail. *Journal of Public Transportation, Vol. 9, No. 4*.

While rail has been the focus of most planning for Transit Oriented Development (TOD), there has been recent interest in bus-related TOD with an emphasis on new bus rapid transit (BRT)

systems in North and South America and Australia. This article takes a critical look at the strengths and challenges of bus-based transit systems compared to rail in relation to TOD. It includes a review of the literature and an assessment of TOD-related developments. The performance of BRT systems in relation to TOD is considered with specific reference to BRT systems in Australia. In addition, TOD related to local suburban bus service is examined. The article describes the general concept of TOD and how this relates to features of transit modes, outlines the literature relevant to bus-based TOD, and identifies the strengths and challenges of bus-based transit systems in relation to TOD. It concludes by summarizing the relative strengths and challenges of BRT and local bus services compared to rail. The findings of the review are used to identify ways in which bus-based TOD might be better planned and implemented. (Source: abstract)

24) D'Aciero, L., Gallo., and Montella, B. (2006). Optimization models for the urban parking pricing problem. *Transportation Policy* 13: 34-48.

Authors argue that, in contrast to Destination Parking Pricing (DPP) which bases parking charges on destination zone and penalizes suburban drivers (e.g., parking charges near CBD rates are higher than suburbs), Origin-Destination Parking Pricing (ODPP) can calibrate parking charges based on origin and destination, penalizing only users that don't take transit where available. In general, parking pricing increases transit use and decreases road travel time but also decreases accessibility (due to higher parking fares) and total transit travel time. By setting different parking fares (and tickets for violators) for each zone based on origin and destination, ODPP lowers average hourly parking fare and increases accessibility although it also increases number of road uses. Therefore, ODPP is most practical where low fared P&R facilities connect to higher fare inside zones through high quality transit, whereby higher fares provide higher accessibility.

25) Daisa, J. (2004) Traffic, Parking, and Transit-Oriented Development. In *New Transit Town*: p114-129.

Author provides TOD design and parking guidelines as well as highlights some of the future tasks for improving TODs. Guidelines focus on increasing density and diversity and improving design to reduce parking and encourage alternative modes of transportation. (p.118) Recommendations include developing employment opportunities as close to transit as possible (within 500 to 1000 feet) and residential within a quarter to a half-mile. (p.120) Mixed land uses that include banks, restaurants, drug stores, food marts and/or groceries, childcare, personal and business retail, recreation will continue to support employee and residential transit use. (p.117). A pedestrian scale street grid that focuses on a hierarchical multimodal design and connects to a regional network will encourage mode shift to non-auto choices. Revising level of service standards, which are typically auto-centric, to reflect the unique, multimodal nature of TODs will also prevent auto dominant designs. (p.120) while author mentions reducing parking standards, direct or indirect parking charges, and designs that do not impeded pedestrians, he does not go into detail in this chapter. (p.121) Other innovative ideas noted were using landscape reserves, creating up parking management associations address underutilized facilities, developing contingency plans for peak-season parking, utilizing on-street parking and creating parking districts. (p.122) TOD performance should be measure based on modal split, trip internalization and the mix of land uses. (P.123-124) Future tasks include developing a typology of TODs, using

traffic and parking surveys to generate data, creating methodology for analyzing TODs, and creating interdisciplinary knowledge by cross-training traffic and parking professional. (P.128)

26) Dawe, P. (2005). Parking's Key Role in FasTracks. National Parking Association. 32-37.

Discusses general parking lessons the city of Denver has learned or is implementing.
Recommendations include:

- a. Using an integrative planning process and station area plan to address and avoid built-in parking problems,
- b. Reducing parking requirements within walking distance of transit stations.
- c. Using parking management techniques.
- d. Having transit stations share parking.
- e. Prioritizing development to protect community, transit and developer investments.
- f. Ensuring parking facilities function efficiently.
- g. Prioritizing certain riders (e.g., those that walk, bike and take transit) over drivers.
- h. Making the station area interesting and friendly to pedestrians.
- i. Designing parking so that it connects rather than severs the community from transit.
- j. Using parking lots in underdeveloped areas for land banking.

While the article's recommendations are should it does not specify how the city plans to go about meeting these goals (e.g., how and with whom will it share parking, what parking management techniques will it implement, when and how does a city convert land banked parking to structure or development).

27) Deakin E; Bechtel A; Crabbe A; Archer M; CAIRNS S; Kluter A; Leung K; Ni (2004). Parking Management and Downtown Land Development in Berkeley, California. Transportation Research Record (1898) p. 124-129.

Author conducted surveys of employees, residents and retail owners in downtown Berkeley to determine policy recommendations for parking.

Main findings include that Berkeley has high parking occupancy at 80-90% (p.127), that it moves traffic smoothly through the downtown (p.126), and that it has a favorable mode split due to a strong transportation network (p.127). As a result, the study found that the new residents of housing development with limited parking had self-selected to live in a TOD and had lower automobile ownership and higher transit use than neighbors. (p.128) while retail owners were concerned that parking constraints may limit economic growth, the majority of customers are downtown workers and residents, the majority of which arrive by non-auto means. (p124) As a result researchers recommend improved parking enforcement (e.g., prevent overtime parking and meter feeding by employees) and better use of off-street spaces to address the problem of tight parking (p.124). Tolerable congestion and a tight, priced parking supply along with an extensive transportation system create a favorable environment for alternative modes. (p.129)

28) Dittmar, H., and Ohland, G. (2004). *The New Transit Town: best practices in transit-oriented development.* Washington, DC: Island Press.

This book brings together narrative from Bernstein, Calthorpe, Daisa, Feigon, Greenberg, and many others. The different writers discuss topics related to sustainable design, transportation, and urban planning. Overall, the book examines the first generation of TOD projects and the need to maximize access to public transportation, improve pedestrian walkway, and optimize high density land uses. The book presents several case studies that describe development forms, project proposal, context, scales, the planning, policy framework, financial obstacles, parking programs, and stakeholders. Case studies include Arlington County, Dallas, Chicago, Atlanta, San Jose, and San Diego. The book concludes with lessons from the case studies and recommendations for the second generation of TODs in United States.

29) Dunphy, R., Myerson, D., and Pawlukiewicz, M. (2003). *Ten Principles for Successful Development Around Transit.* Washington, DC: ULI- The Urban Land Institute.

The article covers ten general principles for developing around TODs. #4 is to "Get the Parking Right" which stresses five tactics: moving it away from the platform, sharing it with complementary land uses, decking it (into structures), wrapping it with stores, and using it as a land banking strategy for future development, especially in areas with high land values. To encourage development, parking should not cover the valuable land surrounding commuter rail stations or sever pedestrian connections, but be moved five to seven minutes away walking. Impact fees (e.g., smart pricing used in San Jose, CA and Orlando, FL) should also reflect the development goals of TODs. While the article mentions charging for transit parking, it does not address how this sensitive subject should be addressed nor does it provide guidelines for what "more appropriate" parking standards would be. Lastly, since people moving to TOD residences are tired of traffic and willing to give up a second car, including seniors, mixing in affordable housing near transit will strengthen transit ridership.

30) Ewing, R. (1995). Measuring Transportation Performance. *Transportation Quarterly*, Vol. 49, pp. 91-104.

This article analyzes the physical-design attributes that encourage transit use. It focuses in urban design, development patterns, density, land use mix, roadway connectivity, pedestrian-friendly environments, and parking design. It concludes with recommendations on design principles that increase transit use.

31) Ewing, R. (1996). *Best Development Practices.* Chicago: Planners Press.

This book focused in Florida development policy and practice. According to the author, without guidance Florida growth will take the form of urban sprawls. Currently, urban sprawls are Florida's dominant development patten. The book describes best community development forms emphasizing in transit-oriented development. The book concludes with physical design recommendations for land use, transportation, environmental and housing planning.

32) Ewing, R. (1997). *Transportation and Land Use Innovations*. Chicago: Planners Press.

As our overstressed highways become increasingly snarled, America's love affair with the automobile continues to exact a frightening toll on our roadways, environment, and quality of life. This handbook, written especially for nontechnical readers, shows that you don't have to be a transportation engineer to effectively combat traffic congestion and automobile dependence. General planners and decision makers can set a new course by adopting broader transportation performance standards that incorporate mobility, livability, accessibility, and sustainability. Ewing demonstrates how manageable, affordable, and incremental changes in traffic patterns, road and intersection design, transit schedules, walkways and bikeways, and other factors can shrink vehicle miles and vehicle hours traveled. He uses examples from Florida and elsewhere to show how to implement complementary short- and long-term strategies tailored to your community's travel environments that will significantly reduce auto travel and its associated ills. Ewing emphasizes five tools: land planning, travel demand management, transportation system management, enhanced transit service, and pedestrian- and bicycle-friendly design. He demonstrates how proactive land planning, with an eye to mitigating the demand for auto travel, is the key element in a successful long-term approach. The book is extensively illustrated with easy-to-understand graphs, charts, drawings, and other visual aids. Generous endnotes will assist transportation professionals who may want to dig deeper. (Source: Google books description)

33) Ewing, R. (1999). *Pedestrian and Transit-Friendly Design: A Primer for Smart Growth*. Smart Growth Network.

This primer is based on Pedestrian and Transit friendly Design, a manual prepared for the Florida Department of transportation and the American Planning Association. From the longer list of the 23 pedestrian and transit friendly features in the FDOT/ APA manual, this primer highlights 12. [Of these the top ten are the following essential features: 1) medium to high densities, 2) mix of land uses, 3) short to medium length blocks, 4) transit routes every half-mile, 5) two- or four-land streets, 6) continuous sidewalks, 7) safe crossing, 8) appropriate buffering from traffic, 9) street-oriented buildings, 10) comfortable and safe places to wait wide enough for couples]. They are described in detail, and illustrated with photos from walkable places and with graphics reproduced from award-winning design manuals. The other 11 features are simply acknowledged by name. The 12 highlighted features seem to relate more to pedestrians than transit users. But since virtually all transit users are pedestrians at one or both ends of their trips, the distinction is illusory. Pedestrian friendly features are also inherently transit-friendly. They set the context in which transit operates and, as transit operators are discovering, have as much to do with ridership as do service headways, fare levels, and other transit operating characteristics. (Source: author's introduction)

34) Ewing, R. (2000). Asking Transit Users about Transit-Oriented Design. *Transportation Research Record 1735*, Transportation Research Board of the National Academies, pp. 19-24.

Visual-preference surveys are becoming popular in "visioning" projects, design charrettes, and other physical planning activities in which intensive public involvement is desired. In a survey, transit users, nonusers, and professionals were shown a series of paired slides of bus stops, asked to choose the stop from each pair at which they would prefer to wait, and asked to rate each stop

chosen as a place to wait. Slides then were analyzed for content, with 19 features of bus stops and surroundings measured and quantified. Subsequent analysis showed that transit-oriented design features most affecting both choices and ratings are a bus shelter at the stop, trees along the street leading to the stop, a vertical curb at the stop, the setback of the stop from the street edge, and a continuous sidewalk leading to the stop. Such a survey may help transit planners choose the best transit-stop locations and devote financial resources to the most promising transit-stop amenities, given the inevitable trade-offs involved. (Source: abstract)

- 35) Goodman, J., Laube, M., and Schwenk, J. (2005). Curitiba's Bus System is Model for Rapid Transit. *The Race, Poverty, and the Environment: Journal for Social and Environmental Justice*. Winter, pp 75-76.

This article describes in detail the Bus Rapid Transit system in Curitiba, Brazil. It focuses on the role that the BRT plays in making Curitiba a livable community. It narrates the evolution of the BRT and the interaction between land use planning and transit. It finalizes with a review of Curitiba BRT successful accomplishments.

- 36) Hensher, D., and King, J. (2001) Parking demand and responsiveness to supply, parking and location in the Sydney central business district. *Transportation Research Part A* 35: 177-196.

Authors used nested logit model and stated preference (SP) analysis to determine door-to-door mode and choice parking for trips to Sydney business district. Surveyed participants were casual parkers during weekdays that did not have a guaranteed parking spot which was priced (e.g., shoppers, sales/business people, and people going to social-recreational trips). Researchers provided hypothetical options, including increased parking pricing and limited parking hours (9:30AM curfew) and monitored six choices alternatives: to park close in (1 min), park elsewhere in CBC (7 min), park at fringe of CBD (15min), park outside CBD and take transit in, switch to transit, forego trip.

The article's main findings include individuals who pay for their own parking (e.g., commuters, people on social trips, and self-employed business owners) were more likely to park farther out (e.g., to save on costs). Conversely, higher-income individuals or those on business were more likely to park closer in (e.g., to save time, because the trip was tax deductible). Shoppers, preferring to drive into the CBD but also prepared to walk, would park elsewhere. An increase in parking price greatly increased public transit use with virtually no loss of travel to the CBD, and with those parking elsewhere with the most elastic demand. The 9:30AM curfew decreased the probability of drivers choosing to park close in and resulted in mostly a relocation of parking with a slight switch to transit.

- 37) Hess, D. (2001). Effects of Free Parking on Commuter Mode Choice: Evidence from Travel Diary Data. *Journal Transportation Research Record* 1753: 35-42.

The article creates a multinomial logit model to determine what variables affect commuter mode choices (SOV, carpool, transit) to work in Portland. Of the explanatory variables of the cost of commuting, lands use surrounding the residence, household resource and driver preference, the author found that parking costs and relative travel time by transit, as well as vehicle ownership

and income, are the main factors affecting mode choice. Specifically, raising work site parking costs and decreasing travel time by transit (by improving service and decreasing headway) will reduce SOV mode share, especially for lower-income commuters (who have a higher elasticity to increased parking prices). Lower-income households are less likely to drive if the parking is priced. The author also determined that neither the distance to the light rail station nor pedestrian connectivity surrounding the residence affected mode choice.

38) Higgins, T. (1993) Parking Requirements for Transit-Oriented Developments. Transportation Research Record 1404: p50-54.

Using annual employee surveys from San Diego, CA, author created a methodology to determine parking requirements for office, commercial and industrial developments location based on their proximity to transit station and stops. Model set parking requirements by choosing the “lowest and highest percent mode share for range” but does not include hospitals, post offices, hotels, banks or entertainment. Findings include: for offices: a minimum of 2.0 to a maximum of 4.0 spaces per 1,000 ft. sq (except corporate offices, which should have a maximum of 3.0 spaces per 1,000 ft. sq); for commercial: 3.0 to 6.0 spaces per 1,000 ft. sq., although a plan will be needed for meeting peak holiday demand; for industrial, 1.0 to 3.0 spaces per 1,000 ft. sq. but may require staggered shifts if overlapping occurs. Since parking demand depends on a number of local variables including: tenants, price of parking and gas, state of economy, proximity to transit, attractiveness of parking, traffic reduction programs, barriers to access, employee density, the model should be used with caution, with results monitored and fine-tuned and residential preferential parking programs and parking meters to reduce potential spillover.

39) Higgins, T. (2007). Parking for Transit Oriented Development: Stakeholder Perspectives. The Parking Professional. International Parking Institute. 15-20.

Through interviews with stakeholders at a suburban (Union City, CA) and downtown (Berkeley, CA) TOD, the article highlights potential challenges and the more subtle points to successfully implementing parking policies, including reducing parking requirements, offering in-lieu fees to building parking, unbundling parking, increasing on-street parking prices, etc. Key findings include:

- In-lieu fees must be planned with code requirements to encourage them as an option (e.g., increase parking requirements) as well as so they meet any state low-income housing regulations. Ideally, in-lieu parking fees should be charged all at once and utilized promptly.
- Developers are willing to unbundle parking when tenants have designated stalls (non-competition) and parking is scarce (all stalls are sold). However, guards against spillover, such as the enforcement of residential parking program, will likely be required.
- The success of shared parking also depends on the land uses involved. Reducing and/or sharing parking at transit stations must mitigate spillover.
- In general, developers view all three parking policies (in lieu fees, unbundled and shared parking) as better suited to office developments than residences, since office parking can more easily be moved away from the building or mixed with other uses.
- Revisions to on-street parking prices to discourage long-term commuter parking

require complementary actions such as: clear travel alternatives for downtown employees (e.g., discount transit passes), new revenues to stay within the district for improvements, (e.g., maintenance, security, enforcement, improved signage regarding parking rates, hours and availability, and monitoring the effects of price changes for future decisions.

- 40) Holtzclaw, J. (2004). Curitiba-A model for Sustainable Development. San Diego, CA. <<http://www.sdearthtimes.com/et0408/et0408s7.htm>> Retrieved on November 5, 2011.

This article reviews Curitiba sustainable development and successful story. It describes initiatives such as recycling, pedestrian friendly streets, zoning, and the public transportation planning. It focuses particularly in the BRT system and physical designs that encourage a pedestrian friendly environment. It concludes that Curitiba successful public transit depends on several symbiotic factors such as pedestrian friendly environment, mix uses, broad sidewalks, transit stations' conditions, quick boarding, cheap fares, high capacity buses, and few parking locations.

- 41) Knepper, V. (2007). Developing Parking Policies to Support Smart Growth in Local Jurisdictions: Best Practices. Metropolitan Transportation Commission Best Practices.

Article outlines best practices for parking policies based on TODs in Pacific area (e.g., California, Oregon). Parking management strategies work best when paired with non-automobile centered transportation modes, which must be made prior to parking reductions. Parking reductions can be linked to proximity to transit and quality of pedestrian infrastructure. Before reducing or eliminating parking requirements communities must examine economic issues and local site characteristics as well as current parking occupancy.

Residents self-select to live at TOD locations for accessibility to job sites. Residents within a half mile of TODs are less likely to own a car and more likely to own only one. BART TODs reduce parking demand by about 23%; however reductions may range from 12-60%.

Off-street parking policies make it difficult to create effective parking programs (e.g., reductions, shared parking) and make new development more difficult. Since on-street parking drives off-street parking, both types of parking should be coordinated to ensure users choose parking locations based on duration of their stay (e.g., prioritize short term over long term parking). Parking policies should be designed so users can opt-out (e.g., cash out parking) and make alternative travel decisions. Parking pricing should also prioritize parking for desired users, use variable pricing and emphasize utilization (e.g., 85%).

Strategies include:

- Improving transit service is one of the best ways to increase ridership and reduce reliance on SOV. Other supportive strategies include bus stop improvements (e.g., proving shelters, benches) and transit subsidies (e.g., employers pay, free zones, visitor, and pass programs).
- Car sharing can help residents eliminate one or more vehicles and prevent future purchases, especially at universities.

- Transit friendly parking design should encourage non-auto forms of transit by improving street connectivity, reducing the visibility of parking lots by placing surface parking behind or to the side of buildings, and encourage active ground floor uses.
- Transit-supported overlay zones allow more density and reduce parking requirements but must be paired with transportation demand management (TDM), shared parking and/or density bonuses.
- Landscaping can be used to bank future parking in case parking reductions are too stringent.
- Technologies such as meters with credit card payment options and phone notification systems can improve utilization, convenience and fees.
- Parking benefit districts provide guiding principles, action plans and the financial base (e.g., in-lieu fees, parking fees) to improve parking efficiency and the local neighborhood environment.
- Parking occupancy taxes can be used to fund transit or infrastructure improvements; however it may encourage free parking and bundled leases to avoid paying the tax. An alternative is a parking tax by space for both free and paid parking. A tax break could be given for owners who provide access to priority users.

42) Landis, J., R. Cervero, and P. Hall. (1991). Transit Joint Development in the USA: An Inventory and Policy Assessment. *Environment and Planning C, Vol. 9, No. 4, pp 431–452*

The joint development of urban mass transit facilities and private real estate projects has become a popular practice throughout the United States. As of October 1990, 114 transit joint-development projects had been constructed in more than two dozen US cities, although the vast majority of projects have been concentrated in just five cities: New York City, Washington, DC, Philadelphia, Atlanta, and Boston. Of completed joint-development projects 58% have occurred at or near heavy-rail transit stations; another 18% of projects have been developed around commuter rail facilities. Transit joint-development activity can be classified into two basic forms: (1) *revenue-sharing arrangements*, and (2) *cost-sharing arrangements*. Of the joint-development projects completed to date, 40% have involved cost-sharing, and 25% have involved revenue-sharing. The remaining projects have involved both types. Joint-development projects have yet to generate very much income to local transit operators, either through capital contributions or through yearly lease payments. Except in New York City, capital contributions from joint development have generally amounted to less than 1% of yearly capital expenditures. This study reveals that there are four conditions necessary for successful joint-development projects. First, the local real estate market must be active and healthy. Second, the agency with the lead responsibility for pursuing joint development must have an entrepreneurial bent. Third, coordination is essential when joint-development projects involve more than one public agency. Fourth, sponsoring agencies need to understand that there are benefits to joint development that go beyond generating revenues. To date, in fact, the direct revenue benefits of joint development have been quite small. The best joint-development projects are those that encourage greater transit usage, create more interesting station environments, and reinforce other planning and development goals. (Source: abstract)

- 43) Levinson, H., Zimmerman, S., Clinger, J., et.al. (2003). *Bus Rapid Transit. Volume 1: Case Studies in Bus Rapid Transit. TCRP Report # 90.* Washington, DC.

This extensive report focus in several BRT systems and provides information in terms of application, planning, implementation, system description, operations, and performance measures. It defines BRT, its elements, and features. It focus in various requirements for BRT success that includes: station designs, pedestrian friendly environments, vehicles, and service patterns. The report draws the experience of 26 BRT in United States, Australia, Europe, and South America. Curitiba is the first case study and considered the most successful BRT experience in terms of revenue series, and development patterns. Information is provided for each case study about institutional requirements, system design, operations, usage, cost, parking conditions. The report finalizes with the potential benefits of BRT and a set of useful recommendations for policy-makers, officers, and managers.

- 44) Lindau, L., Hidalgo, D., and Facchini, D. (2010). Curitiba, the cradle of Bus Rapid Transit. *Transport Research Laboratory. Built Environment Serial. Vol. 36:3, 274-282.*

Curitiba is the only city in Brazil that has directed its growth by integrating urban transportation, land-use development and environmental preservation. Since the 1970s Curitiba's administrators have constantly achieved innovations with the city's bus-based transit system through performance and capacity improvements. Originally, the bus system evolved from conventional buses in mixed traffic to bus ways, which were later fitted with at-level boarding, prepayment and articulated buses, creating the first full bus rapid transit system in the world. Later, the city introduced high capacity bi-articulated buses and the electronic fare ticketing systems. In 2009 the integrated bus system was upgraded, again, with the introduction of the Green Line, its sixth BRT corridor which includes the operation of 100 per cent bio-diesel articulated buses. System operation will be further enhanced with advanced traffic management and user information systems. (Source: abstract)

- 45) Liu, T., Huang, H., Yang, H., et.al. (2009). Continuum modeling of park-and-ride services in a linear monocentric city with deterministic mode choice. *Transportation Research Part B* 43: 692-707.

Authors develop a deterministic continuum equilibrium model which proves that commuters only use a few park-and-ride locations within a narrow region, therefore it is important to carefully plan and design park-and-ride locations. From this general region commuters will mainly choose transit into the city and the highway system outside of the city. Increasing parking charges at park-and-ride will greatly reduce traffic at the P&R, which will induce some demand for the railway system.

- 46) Litman, T. (2006). Using Parking Strategies to Manage Traffic in Transit Oriented Development. *2006 ITE Annual Meeting and Exhibit Compendium of Technical Papers.* BC, Canada: Victoria Transport Policy Institute.

This paper describes how parking management refers to various policies and programs that result in more efficient use of parking resources and the paper also describes the role of parking

management in transit oriented development. Parking management allows more compact, walkable communities; increases the affordability of development in dense urban areas; helps accommodate park-and-ride trips; and helps encourage transit ridership. Conversely, Transit Oriented Development supports many parking management strategies and reduces per capita vehicle ownership and use. Parking management is important in most transit oriented developments

(Source: abstract)

- 47) Loukaitou-Sideris, A. (1999). Hot Spots of Bus Stop Crime: the Importance of Environmental Attributes. *Journal of the American Planning Association* 65, 395-411

This study focused on bus stop crime and sought to identify the environmental attributes that can affect the bus rider's security while at the bus stop. Following the argument of criminologists that certain place characteristics can affect the incidence of crime, the study used direct observation, mapping, interviews, and surveys to examine the physical and social environment around the 10 most crime ridden bus stops in Los Angeles during 1994 and 1995. It found an abundance of "negative environmental attributes and a general lack of defensible space" elements. It also found that different types of crime tend to occur under different environmental conditions. The use of four control cases of low-crime bus stops in matched pairs with four high-crime bus stops in close proximity showed that the low-crime bus stops typically lacked negative environmental attributes, while offering better surveillance opportunities from surrounding establishments. The article discusses design responses as an approach to crime prevention at bus stops. Parking lots are considered to provide physical environmental conditions for crime to occur. (Source: abstract)

- 48) Lund, H., Cervero, R., and Willson, R. (2004). Travel Characteristics of TOD in California. Caltrans. <<http://www.drcog.org/documents/Travel%20Characteristics%20of%20CA%20TOD.pdf>> Retrieved on November 15, 2011

This report is a comprehensive study of TOD sites in California. The study focused in San Diego Trolley, Los Angeles Blue Line, San Jose VTA, Sacramento, Los Angeles Red Line, BART, San Diego Coaster, LA Metrolink, and Caltrain. The data collected consist of travel surveys to residential (questionnaire), offices (employer-administered questionnaire), retails (intercept survey), and hotels (employer-administered questionnaire). Other data collection methods included site data and station area characteristic evaluation. Findings of the report demonstrated that TOD residents, TOD office workers, and hotel patrons in TODs all use rail transit more frequently than the average for the same cities. The report concludes that TODs have much greater transit ridership, BART TODs have the highest transit ridership, commute ridership is higher than other non-work ridership, transit commuting is related to place of residency, mode choice is influenced by other transportation services, and ridership is influenced by work policies. The report provides information on station characteristics, demographics, employment characteristics, residential location, commuting cost and transportation incentives for TOD sites.

- 49) Millard-Ball A. (2002). "PUTTING ON THEIR PARKING CAPS: affordable housing, transit-oriented development, smart-growth, better water quality, reduced congestion, and more walkable, livable communities" *Planning* 68(4). p. 16-21.

Article examines the cutting edge parking policies of innovative U.S. Cities including Cambridge, MA, San Francisco, CA and Portland, OR. For example, Cambridge, MA, which has had parking maximums for 20 years, adopted an ordinance in 1998 to reduce automobile use that requires developers to meet the standards by creating transportation demand management plans, subsidizing transit passes and charging for parking. Violating facilities can be fined or shut down.

San Francisco, CA is considering restricting the number of on-street permits to the number of spaces available, charging market price and using the revenue to make neighborhood improvements and transit. It is also proposing a base parking maximum of .75 spaces per unit to encourage developers to unbundled parking and better match households to housing based on parking needs. To reduce potential spillover from parking reductions, these cities have set up and enforced residential parking programs, limits and meters. However, because most cities have little data on parking, more intermediate options may be to abolish parking minimums to let the market decide and/or limit the amount of land developers can build parking on. Other steps include setting up overlay zones and working with stakeholders, including developers, real estate and lenders, to set up parking policies.

- 50) Millard-Ball, A. (2005). Getting Parking Right for TOD. Nelson/Nygaard Consulting. San Francisco, California. < www.railvolution.org/rv2005_pdfs/rv2005_306d.pdf> Retrieved on November 15, 2011.

This PowerPoint is part of Nelson/Nygaard Consulting Firm presentation on parking standards for TOD. The presentation highlights the importance of getting the parking right in TOD projects. It provides information on parking requirements purposes through case studies. It shows graphs and statistical data to backup the information described in the presentation. The presentation finalizes by giving recommendations on tailoring parking for TOD, incentives in reducing parking spaces, abolishing minimum parking requirements, and combating spillover.

- 51) Morrall, J., and Bolger, D. (1996, February). The Relationship between Downtown Parking Supply and Transit Use. ITE Journal: 32-36.

Authors use two surveys (of US and Canadian city composition and of 6 Canadian agencies responsible for park-and-rides) to examine the relationship between downtown modal split and parking supply in Canada. General findings include that while larger cities have smaller ratios of long stay parking stalls per CBD employee, but there is no clear relationship between city size and ratio of park-and-ride stalls. Morning peak modal splits increase with city size. In addition, both the character of employment type (e.g., office workers versus professionals) and the number of downtown vacancies affect parking. First, professional workers require more parking stalls than office workers because they travel during the day more than their office counterparts. Second, more downtown vacancies increase commuting because fewer people must compete for the roadway and parking spaces. Therefore, increased vacancy can increase parking supply, depress parking charges, and encourage auto-use.

Canada has more compact and higher density downtowns, greater control over land use and development, fewer cars per capita and 2.5 transit times more transit-use than Americans. Therefore, when Ottawa stopped offering free parking to civil servants, they switched to transit.

In addition, good parking laws, quality transit, well-designed parking structures and political commitment support downtown parking strategies in Canada. Recommendations include setting a desirable and achievable modal split goal and establishing commuter parking policies that match its supply to that goal.

- 52) Mukhija, V., and Shoup, D. (2006). Quantity versus Quality in Off-Street Parking Requirements. *Journal of American Planning Association* 72 (3): 296-308.

Article highlights how minimum parking requirements that lack incentives for design create large amounts of poor quality parking and boring, highly-interrupted, unwalkable and even dangerous streetscape for pedestrians. These requirements create a self-perpetuating cycle where plentiful parking encourages people to buy and drive more cars. Authors offer five strategies to move incentives to fewer but better quality parking spaces: 1.) deregulate or limit the amount of parking, 2.) orient buildings to pedestrians not automobiles by moving parking below, behind, or beside buildings, and 3.-5.) improve the design of surface and structured parking as well as residential garages. By worrying less about quantity (market will balance) and more about incentivizing quality, planners can better address the parking issue.

- 53) Nieweler, S. (2004). *Transit-Oriented Development for the Greater Toronto Area: an international policy perspective*. University of Toronto: Department of Geography.

This report describes current transport and land use problems in the Greater Toronto Area. It analyzes some of the main barriers to the implementation of TOD that include zoning, land use economics, policy, stakeholders, and parking codes. It review planning tools required for the successful implementation of TOD and the need to improve collaboration between government, developers, and citizens. It review several international best practices in policy for TOD including flexible zoning codes, flexible parking standards, tax incentives, joint ventures, and density bonuses. It concludes with recommendations for planers, developers, and government officials on promoting TOD.

- 54) Parker, T., and Arrington, G B. (2002). STATEWIDE TRANSIT-ORIENTED DEVELOPMENT (TOD) STUDY: FACTORS FOR SUCCESS IN CALIFORNIA: Executive Summary. (Business, Transportation and Housing Agency, California Dept of Transportation)

Article highlights benefits of, barriers to, and strategies for implementing TODs. As an Executive summary on TOD, the authors do not go into much detail regarding parking policies. The only mentions of parking are two examples: of how reduced off-street parking decreased condominium costs by more than 10% in San Francisco and of how studies have show that off-street residential parking may be reduced by about 20% although the authors don't mention the source and are quick to state that calculations should be performed on a case-by-case basis. The special report on "Parking and TOD: Challenges and Opportunities" should have more specific information.

- 55) Rabinovitch, J. (1996). Innovative Land Use and Public Land Use and Public Transport Policy: The case of Curitiba, Brazil. *Land Use Policy Journal*. Vol. 13, Issue 1, pp 51-67.

This paper examines the land use policies implemented in the city of Curitiba, Brazil from 1965 to the present (1996). Curitiba used land use planning, the hierarchy of the road network, an economic development policy, and public transport to coordinate the parameters for the location and density of homes, work, recreation, services, and commerce. The city was planned as an integrated structure for living and working. Curitiba was also the fastest-growing city in Brazil during the 1970s, which demonstrates that the above approach has been successful as an effective instrument to control and direct rapid urban growth while contributing to sound environmental management. The paper describes the integration of land use/transportation policies and the instruments that contributed to its enforcement and attempts to draw selected lessons from the experience. (Source: abstract)

- 56) Rodier C., Shaheen S., and Smirti, M. (2007). "Transit-Based Smart Parking in the United States: Behavioral Analysis of San Francisco Bay Area Field Test." Transportation Research Board 86th Annual Meeting Transportation Research Board. Washington. 14p

Article outlines results from literature review and survey of participants to use the first smart parking program to offer pre-trip and en-route parking service.

Survey respondents could be characterized as being highly educated, of upper to middle socioeconomic status, middle-aged and with families. While over half didn't have to be to work at a certain time, most worked during normal business hours five days per week with unpaid on and off-site parking. Key findings from the survey include: that the Smart Parking program shifted drive alone and carpoolers to BART for both on- and off-site locations, which increased the average number of BART trips per month, decreased total commute time and decreased total vehicle miles traveled. At the same time, the smart parking also increased drive alone access to BART from other modes, which offset some of the commute time reductions.

- 57) Taylor, B., and Fink, C. (2003). The Factors Influencing Transit Ridership: a review and analysis of the ridership literature. UTCT Working Paper. UCLA: Department of Urban Planning. <www.uctc.net/papers/681.pdf>. Retrieved on November 10, 2011.

The report reviews the literature behind transit ridership and analyzes factors that influence transit use. It provides a detail evaluation of the literature review around transit ridership and includes a matrix comparing the different approaches. It highlights the weakness and gaps find in the literature review. In describing the factors affecting ridership, it focuses in the following factors: socio-economics, spatial, public finances, pricing, service quality, and service quantity. The report finalizes with recommendations to better understand transit ridership.

- 58) Tumlin, J. (2006). Parking for Transit Oriented Development. Nelson/Nygaard Consulting Firm. <www.nelsonnygaard.com/Documents/.../ITE_Parking_for_TOD.pdf> Retrieved on November 10, 2011.

This PowerPoint presentation describes the effects of parking in TODS. Excessive parking can bring traffic congestion, reduce transit ridership, and affect revenue generations. The presentation shows graphs and statistical data to sustain the need to improve parking standards for TOD. It relates land use density to transit and uses case studies such as Arlington County

urban villages and South Hayward BART Station to describe parking incentives. The report concludes with lessons for each case study and parking standards scenarios.

- 59) Tumlin, J., and Millard-Ball, A. (2006). Parking for Transit-Oriented Development. 2006 ITE Annual Meeting and Exhibit Compendium of Technical Papers Institute of Transportation Engineers. Milwaukee. 12p.

Article discusses TODs can use park-and-ride lots as a form of land banking to secure federal capital funds then transition to joint development which offers increased ridership (by generating off-peak and reverse-commute riders) and revenue (due to leased developed land). Researchers have developed methodologies to determine the joint development densities needed to create more riders than surface parking and provide traffic engineers and planners with cost-benefit criteria for calculating parking supply. TODs should pair limiting the supply of parking (by either setting requirements or letting the market determine the appropriate amount of spaces) with residential parking programs to reduce spillover onto streets, priced parking and Transportation Demand Management (TDM) measures to reduce demand.

- 60) Voith, R. (1998) Parking, Transit, and Employment in Central Business District. *Journal of Urban Economics* 44: 43-58.

Article outlines how policy makers must balance increasing parking prices to shift modal split while preventing decreases in land values and community size. Taxes that are too low result in excessive roads, auto use, and, congestion which reduce equilibrium rent (i.e., land values) and community size. "These adverse consequences ... increase with the strength of agglomeration economies" (e.g., community size and land values will decrease quickly) p.45. In such places, an increase in parking taxes can actually increase land value, including for parking lot owners. Because increasing parking taxes increases the transit subsidy per person it also reduces auto travel (e.g., the number of people who pay the subsidy), and if too high, can also reduce land values, community size, and transit subsidies.

Because the relationship between parking taxes, transit use, land rents and community size is not linear, there is a margin for optimum parking prices which maximize CBD community size and land values. However, the margin to tax auto commuters through parking fees is small because auto commuters can change mode choice and/or work location (e.g., in suburb with free parking) in response to increased parking taxes.

- 61) What is Bus Rapid Transit? Bus Service website, NY Metropolitan Transit Authority. <<http://www.mta.info/mta/planning/sbs/whatis.htm>>. Retrieved on November 15, 2011.

This website describes BRT service in New York City and describes international scenarios such as Curitiba. It defines the basic concepts behind the BRT system.

- 62) Willson, R. (2005). *Replacement Parking for Joint Development: an access policy methodology*. San Francisco, CA: BART Department of Planning and Real Estate.

This report analyzes methods for developing access and replacement parking strategies at BART's joint developments. It describes the joint development context and identify major

problems associated with current parking practices. The approach provides different levels of solutions and uses performance-based principles to account for issues such as ridership, system capacity, and local regulations. It emphasizes in the need for collaboration between cities, transit agencies, and developers. The report concludes with recommendations on access/replacement of parking for BART joint developments.

63) Willson, R (2005) "Parking Policy for Transit-Oriented Development: Lessons for Cities, Transit Agencies, and Developers" *Journal of Public Transportation*: 8(5) pp 79-94.

Article reviews studies of parking supply and policy at both residential and office TODs to provide recommendations. Key findings include less car ownership increases transit use and increased *free* parking reduces transit use. However, while *more* parking reduces transit use, it is not statistically significant (i.e., TOD projects with higher transit use did not have statistically lower parking supplies).

Recommendations include to create demand-based TOD parking requirements that support transit use and access and that reflect local transit shares and auto ownership, or deregulate parking so developers assess demand and set market prices; develop parking districts to assess demand and require shared parking and/or in-lieu fees to build district facilities; unbundle parking charges from both residential and office lease agreements and cashing out parking at office developments to prevent residents and employees from experiencing "free" parking at TODs; manage on-street parking to encourage turn-over and reduce spill-over; convert P&R surface lots to TODs with less than 1:1 replacement (based on location and alternative modes of transit) and design transit stations and parking to encourage non-auto modes of access and shared station parking.

Less than full replacement of commuter parking at transit stations increases ridership and revenues (e.g., over \$1 million per year per station of continuing revenue at BART station) as well as makes development easier. Alternatives to replacement parking include moving parking off-site or to underused stations and investing in improving access to non-automobile modes.

64) Willson, R., and Menotti, V. (2007) "Commuter Parking Versus Transit-Oriented Development Evaluation Methodology" *Transportation Research Record: Journal of the Transportation Research Board*, No 2021, Transportation Research Board of the National Academies, Washington DC p. 118-125.

Authors developed a model to demonstrate the tradeoffs that occur between ridership and financial viability under a variety of TOD parking scenarios. Major findings include that at more urban locations, scenarios that used less than full replacement of parking resulted in positive financial outcomes. Higher intensity development paired with access improvements and aggressive parking policies demonstrated the overall greatest benefit (i.e., in ridership, fiscal health). However, even medium intensity development with full parking, which produced negative ground rents, had an overall fiscally sound project due to increased ridership revenue. Although the model couldn't be tested against before and after TOD scenarios due to a lack of examples, it has been adopted by BART to inform policy makers. Authors warn that the model should be used with market feasibility and pro forma analysis to better describe local situations.

65) Ziemann, C. (2006). *Parking Management in Curitiba, Brazil*. Carolina Papers in International Development, No 13 (thesis dissertation). University of North Carolina: University Center for International Studies. Retrieved from the University of North Carolina Database.

This report is a master thesis dissertation focusing in Curitiba Parking Management. It analyzes in detail current parking regulation, demand, and availability. It describes Curitiba parking urban form, supply, socio-demographics, density, land uses, prices, policies, and regulations. It analyzes the influence of parking policies over transit ridership. It concludes with a summary of the major findings and how the different variables helped shape the BRT system. However, the author concludes that parking standards are the result of congestion reduction efforts and not the BRT system.

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Appendix 1: Local Parking Policies in the Austin – Round Rock MSA

List of Communities

Austin

Bastrop

Cedar Park

Georgetown

Lakeway

Leander

Lockhart

Pflugerville

Round Rock

San Marcos

Taylor

AUSTIN

Contact: Molly Scarbrough, Principal Planner, (512) 974-3515,
molly.scarbrough@ci.austin.tx.us
Ross Clark, GIS Supervisor, (512) 974-2764, ross.clark@ci.austin.tx.us

Summary: Austin restricts parking amount, size, location and design at TODs. Parking requirements can be reduce by 10% if unbundled from rent or by 20 spaces if a car share program is used.

Documents:

1. ORDINANCE 20061005-0526

- For buildings with setbacks of 15 ft or less, **parking is prohibited between front lot line and building** (except with director's permission).⁶

2. ORDINANCE 20071108-1207

- City should manage amount and location of parking so it doesn't dominate environment.⁷

3. ORDINANCE 20050519-0088

- Ordinance allows residential use above first floor of commercial building (doesn't specify if retail = commercial and if commercial can go over it).⁸
- Parking lot must permit future driveway and **sidewalk connections**.⁸
- "Station area plan: shall include an **analysis of the need for public parking**."⁸
- Minimum off-street parking requirement for TOD district is **60%** of Land Use Code (Appendix A Tables of Off-Street Parking and Loading Requirement).⁸

4. SUMMARY OF TOD ORDINANCE9

- Gateway should "provide **pedestrian-oriented retail uses and employment or residential uses in upper floors**."
 - (Doesn't specify that should be predominantly office, followed by retail and then residential. Later states residential above retail or offices closest to station.)
- Midway and transition zones should be predominantly residential but may include retail and offices. Within .25 miles of station.
- Prohibits auto-dominant uses (e.g., auto sales and washing, drive-in services, equipment repair and sales) and low density residential near station.
 - (Does not mention parking programs (e.g., transit passes, shared parking, in-lieu fees) or design specifications, e.g., structures vs. surface lots).

5. PLAZA SALTILLO TOD REGULATING PLAN

- Off-street commercial parking cannot exceed one acre in size, be located within 100 ft of corner, or have more than one per block.
- Head-in and angled parking are prohibited.
- On-street parking is encouraged but subject to approval of director.
- Max. driveway width ranges between 18-35 ft and discouraged along active edges.
- Can reduce parking by 10% if unbundle parking.
- Can reduce by 20 spaces if have car share.
- Diagram includes tree buffer between pedestrians and parking. (Could add multiple uses, e.g., basketball court.)
- (Doesn't mention if parking is paid or free.)

6. CITY OF AUSTIN PARKING RATIO REQUIREMENTS

(COA Parking Requirements.doc)

Land Use	Parking Ratio
Single Family Residential	2 spaces/dwelling unit
Duplex or Single Family Attached (Standard)	2 spaces/dwelling unit
Duplex or Single Family Attached (Greater than 4,000 sq. ft. or more than 6 bedrooms)	1 space per bedroom
Townhouse Residential	2 spaces/dwelling unit
Lodginghouse Residential (Bed and Breakfast)	1 space/dwelling unit plus 1 space/rented room
Land Use	Parking Ratio
Multifamily or Condominium	
Efficiency	
One Bedroom	1.0 spaces/unit
Two Bedroom	1.5 spaces/unit
Three Bedroom	2.0 spaces/unit
Each Addn Bedroom	2.5 spaces per unit
	0.5 spaces per bedroom per unit

Group Residential (Boarding House)	1 space/dwelling unit plus 1 space per 2 lodgers or tenants
---------------------------------------	--

BASTROP

Contact: Viviana Hamilton, Admin. Assistant, (512) 321-0457,
vhamilton@cityofbastrop.org
<http://cityofbastrop.org/departments/planning/index.html>

Summary:

Most of the city's parking is common to the area: is off-street and all of it is unmetered. However, Bastrop does have some concessions for mixed use developments. Mixed use buildings calculate the parking requirement for the most intensive use and have the ability to share parking with up to 50% of spaces. (p.21) However, on-street parking space only counts as half an off-street parking space for uses in the CBD." (p.21-22)

Documents:

1. **ZONING ORDINANCE** (<http://codes.franklinlegal.net/bastrop-flp/>)

D. Parking Regulations

1. Single Family Dwelling Unit - A minimum of two (2) covered spaces behind the front building line on the same lot as the main structure.
2. Other - See Section 38, Off-Street Parking and Loading Regulations.

2. **ZONING ORDINANCE, SECTION 38**
(<http://codes.franklinlegal.net/bastrop-flp/>)

Minimum Parking requirements:

1. Assisted Living Facility: Three-quarter (.75) space per unit.
2. Automobile parts sales (indoors): One (1) space per five hundred (500) square feet of indoor floor area plus one (1) space for each two thousand (2,000) square feet of outside sales area.
3. Automobile sales or service: See Motor-Vehicle Sales[.]
4. Bank, savings and loan, or similar institution: One (1) space per two hundred (200) square feet of gross floor area.
5. Bed and breakfast facility: One (1) space per guest room in addition to the

requirements for a normal residential use. The type of pavement for the required parking can be similar to what exists for the home. If cement the additional parking must be cement, if gravel the additional parking can be gravel, etc.

6. Bowling alley or center: Six (6) parking spaces for each alley or lane.
7. Bus or truck repair, storage area, or garage: One (1) space for each five hundred (500) square feet of floor area and repair garage with a minimum of five (5) spaces.
8. Business or professional office (general): One (1) space per three hundred (300) square feet of gross floor area except as otherwise specified herein.
9. Car wash (self-serve): One (1) space per washing bay or stall in addition to the washing area or stall themselves; Car wash (full service): One (1) space per one hundred fifty (150) square feet of floor area.
10. Church, rectory, or other place of worship: One (1) parking space for each three (3) seats in the main auditorium/sanctuary.
11. College or university: One (1) space per three (3) day students.
12. Community center, library, museum or art gallery: Ten (10) parking spaces plus one (1) additional space for each three hundred (300) square feet of floor area in excess of two thousand (2,000) square feet. If an auditorium is included as a part of the building, its floor area shall be deducted from the total and additional parking provided on the basis of one (1) space for each four (4) seats that it contains.
13. Commercial amusement (indoor): One (1) space per one hundred (100) square feet of gross floor area, or as follows:
 - a. Racquetball or handball courts - Three (3) spaces for each court.
 - b. Indoor tennis courts - Six (6) spaces for each court.
 - c. Gymnasium, skating rinks, and martial arts schools - One (1) space for each three (3) seats at a maximum seating capacity, plus one (1) space for each two hundred (200) square feet.

- d. Swimming pool - One (1) space for each one hundred (100) square feet of gross water surface and deck area.
 - e. Weight lifting or exercise areas - One (1) space for each one hundred (100) square feet.
 - f. Bingo parlors - One (1) space for three (3) seats (design capacity) or one (1) per one hundred (100) square feet of total floor area, whichever is greater.
 - g. Indoor jogging or running tracks - One (1) space for each one hundred (100) linear feet.
 - h. Motion picture theaters (which do not include live performances): a) one (1) space per three and one-half (3-1/2) seats for single-screen theaters; b) one (1) space per five (5) seats for motion picture theaters with two (2) or more screens.
 - i. Amusement Center - One (1) space for each game table and one (1) space for each amusement device.
 - l. All areas for subsidiary uses not listed above or in other parts of this section (such as restaurants, office, etc.), shall be calculated in with the minimum specified for those individual uses.
14. Commercial amusement (outdoor): Ten (10) spaces plus one (1) space for each five hundred (500) square feet over five thousand (5,000) square feet of building and recreational area.
15. Commercial use: One (1) space per two hundred fifty (250) square feet of floor area.
16. Convenience store (with gasoline pumps): One (1) space per two hundred (200) square feet of floor area, plus one (1) space for each three (3) gasoline pump units (a unit may have up to six (6) nozzles for gasoline disbursement). Spaces in pump areas qualify as spaces for the parking requirement. If no gasoline sales are provided, then the parking requirements shall be the same as for a retail store.
17. Dance hall, aerobics, assembly or exhibition hall without fixed seats: One (1) parking space for each one hundred (100) square feet of floor area

thereof.

18. Day nursery: One (1) space per ten (10) pupils plus one (1) space per teacher, plus one (1) space for each bus or van. A minimum of four (4) stack (loading) spaces is required. One (1) additional stack space shall be provided for each five hundred (500) sq. ft. over one thousand (1,000) sq. ft.

19. Defensive driving school/class: One (1) space for each classroom seat.

20. Elderly Housing: One and one-half (1-1/2) spaces per unit.

21. Flea market: One (1) space for each two hundred (200) square feet of floor or sales area. Dirt or gravel parking lots are not permitted.

22. Fraternity, sorority or dormitory: One (1) parking space for each two (2) beds on campus, and one and one-half (1-1/2) spaces for each two (2) beds in off campus projects, plus one (1) space for each one hundred (100) sq. ft. of floor area exclusive of sleeping areas.

23. Furniture or appliance store, hardware store, wholesale establishments, clothing or shoe repair or service: Two (2) parking spaces plus one (1) additional parking space for each three hundred (300) square feet of floor area over one thousand (1,000).

24. Gasoline station: One (1) space per two hundred (200) square feet of floor area. Adequate space shall be provided for waiting, stacking, and maneuvering automobiles for refueling.

25. Golf course: Four (4) parking spaces per hole or green plus requirements for retail, office, and club house areas and one (1) space per each two (2) employees.

26. Golf driving range: One and one-half (1-1/2) spaces for each driving tee.

27. Health club, health spa or exercise club: One (1) space per one hundred fifty (150) square feet of floor area.

28. Hospital: One (1) space for each two (2) beds or examination room whichever is applicable.

29. Hotel: One (1) space per room for the first two hundred fifty (250) rooms and .75 space per room for each room over two hundred fifty (250), plus one (1) space per five (5) restaurant/lounge area seats, plus one (1) space per one hundred twenty-five (125) square feet of meeting/conference areas.
- a. One and one-tenth (1.1) spaces per room which contains kitchenette facilities, plus parking for restaurant and meeting areas per ratio stated in this paragraph.
- b. Two (2) spaces per guest room provided with kitchen facilities plus parking for restaurant and meeting areas per the ratio stated in this paragraph.
30. Industrial (light) uses: One (1) space for each one thousand (1000) square feet of floor area.
31. Institutions of a philanthropic nature: Ten (10) spaces plus one (1) space for each employee.
32. Library or museum: Ten (10) spaces plus one (1) space for every three hundred (300) square feet.
33. Lodge or fraternal organization: One (1) space per two hundred (200) square feet.
34. Lumber yard: One (1) space per four hundred (400) square feet display area, plus one (1) space per one thousand (1,000) square feet of warehouse.
35. Machinery or heavy equipment sales: One (1) space per five hundred (500) square feet of gross floor area.
36. Manufacturing, processing or repairing: One (1) space for each two (2) employees or one (1) space for each one thousand (1,000) square feet of total floor area, whichever is greater.
37. Medical or dental office: One (1) space per two hundred (200) square feet of floor area. Facilities over twenty thousand (20,000) square feet shall use the parking standards set forth for hospitals.
38. Mini-warehouse: Four (4) spaces per establishment plus one (1) additional space per ten thousand (10,000) square feet of storage area.

39. Manufactured/mobile home or manufactured/mobile home park: Two (2) spaces for each manufactured/mobile home plus additional spaces as required herein for accessory uses.
40. Mortuary or funeral home: One (1) parking space for each two hundred (200) square feet of floor space in slumber rooms, parlors or individual funeral service rooms.
41. Motel: One (1) parking space for each sleeping room or suite plus one (1) additional space for each two hundred (200) square feet of office or retail floor area contained therein.
42. Motor-vehicle sales and new or used car lots: One (1) parking space for each five hundred (500) square feet of sales floor for indoor uses, or one (1) parking space for each one thousand (1,000) square feet of lot area for storage, sales and parking area, whichever is greater.
43. Nursing home, convalescent home, or home for the aged: One (1) space per six (6) beds and one (1) parking space for each one thousand (1,000) square feet of lot area for outdoor uses, plus one (1) space for each self-contained dwelling unit.
44. Office (administrative or professional): One (1) space for each three hundred (300) square feet of floor area.
45. Outdoor display: One (1) space for each six hundred (600) square feet of open sales/display area.
46. Places of public assembly not listed: One (1) space for each three (3) seats provided.
47. Race track, horses or dogs: One (1) for each three (3) seats plus one (1) space for each employee. Stable areas shall provide storage areas for horse trailers according to Section 37.4 [38.4].
48. Real estate office: One (1) space for each two hundred (200) square feet.
49. Retail or personal service establishment, except as otherwise specified herein: One (1) space per two hundred (200) square feet of gross floor area.

50. Retirement home: One and one-half (1-1/2) space for each dwelling unit.
51. Restaurant, private club, night club, cafe or similar recreation or amusement establishment: One (1) parking space for each one hundred (100) square feet of seating or waiting area or one (1) space for every three (3) seats under maximum seating arrangement, whichever is greater.
52. Rooming or boarding house: One and one-half (1-1/2) parking space for each sleeping room.
53. Sanitarium or similar institution: One (1) parking space for each six (6) beds.
54. School, elementary (grades K-6): One parking space per classroom, plus one (1) space per four (4) persons based upon maximum capacity for the place of assembly. If there is no place of assembly (auditorium/cafeteria etc.), then the parking requirement shall be one and one-half (1-1/4) spaces per employee.
55. School, secondary or middle (grades 7-8): One parking space per classroom, plus one (1) space per four (4) persons based upon maximum capacity for the place of assembly. If there is no place of assembly (auditorium/cafeteria etc.), then the parking requirement shall be one and one-half (1-1/2) spaces per employee.
56. School, high school (grades 9-12): One parking space per classroom, plus one (1) space per three (3) persons based upon maximum capacity for the place of assembly. If there is no place of assembly (auditorium/cafeteria etc.), then the parking requirement shall be one (1) space per three (3) persons based on maximum capacity.
57. Storage or warehousing: One (1) space for each two (2) employees or one (1) space for each one thousand (1,000) square feet of total floor area, whichever is greater.
58. Telemarketing: One (1) space for each two hundred fifty (250) square feet of space.
59. Theater, indoor or outdoor (live performances), sports arena, stadium, gymnasium or auditorium (except school auditorium): One (1) parking space for each four (4) seats or bench seating spaces.

60. Truck stops: One (1) truck parking space for each ten thousand (10,000) square feet of site area plus one (1) vehicle parking space per two hundred (200) square feet of building area.

61. Veterinarian clinic: One (1) space per three hundred (300) square feet of gross floor space.

62. Warehouse or wholesale type uses: One (1) space for each five hundred (500) square feet of office area, plus one (1) space for each five thousand (5,000) square feet of gross floor area, minus office space.

63. Women's Shelter: One (1) parking space per unit for residents, one (1) parking space for each employee, and (1) parking space per four (4) unit[s] for guests, with a minimum of at least five (5) guests spaces being provided." (p.10-20)

- "For buildings which have mixed uses within the same structure (such as retail and office), the parking requirement shall be calculated for the most intensive use." (p.21)
- "Shared parking may be allowed in the case of mixed uses (different buildings) under the following conditions. Up to fifty (50) percent of the parking spaces required for a theater or other place of evening entertainment (after 6:00 p.m.), or for a church, may be provided and used jointly by banks, offices, and similar uses not normally open, used, or operated during evening hours." (p.21)
- "Each on-street parking space along the lot frontage may be counted as one-half (1/2) of an off-street parking space for uses in the CBD." (p.22)

3. **ZONING ORDINANCE, SECTION 12**

(<http://codes.franklinlegal.net/bastrop-flp/>)

Has 2 hour parking restrictions on a few streets.

4. **SIGN ORDINANCE NO. 2006-21** ("Ordinance 2006-21 .pdf:" from: <http://67.20.65.208/ordinances/ord2106.htm>)

Mentions different types of signs re to parking.

CEDAR PARK

Contact: Tom Gdala, Transportation Planner, tom.gdala@cedarparktx.us, 512-401-5064
Emily Barron, Senior Planner, epizalate@leandertx.gov, 512-401-5054
Amy Link, Senior Planner, amy.link@cedarparktx.us, 512-4015056
http://www.cedarparktx.us/cp/comp_plan.aspx

Summary:

1. All development is designed to be approved to capture all parking on-site and outside of the public right-of-way and on private property (i.e., off-street parking). As a result, almost 100% of parking in commercial and industrial areas in Cedar Park is off-street. However, on-street parking can occur if it is not prohibited and/or not obstructing the right-of-way, mainly in residential areas.
2. Currently, all public parking is free of charge and not metered. The event center is the only private entity that has paid parking.
3. While Cedar Park hasn't completed any parking studies and currently has no plans to start a parking management plans, its Transportation Master Plan has an action item to develop a parking plan. The Downtown Corridor requires shared parking.

Documents:

1. CEDAR PARK CODE OF ORDINANCES

(Cedar Park LDC 14 Parking Policies.doc)

- o Section 14.05.005 –
 - “All mixed use development in the downtown corridor is required to utilize shared parking based on a shared parking analysis provided by the applicant.” (p.2)
 - “The off-site parking area must be on adjacent property to the property served or within one hundred (100) feet of the structure they serve if not located on the property adjacent to the site.” (p.5,6)
 - “Not more than fifty (50) percent of the off-street parking spaces required for theaters, bowling alleys, night clubs, restaurants or similar uses may be provided and used jointly by uses not normally open, used or operated during the same hours;” (p.6)

- “Not more than eighty (80) percent of the off-street parking spaces required for a church, school auditorium or similar uses may be provided and used jointly by uses not normally open, used or operated during the same hours;” (p.6)
- “A parking analysis shall be required for each development and shall be a part of the site development submittal.” (p.7)

○ Minimum Parking Requirements:

Residential	
Single-family dwelling	2 off-street per dwelling unit, having a width of no less than 10 ft. and a depth no less than 20 ft.
Duplex	2 off-street per dwelling unit, having a width of no less than 10 ft. and a depth no less than 20 ft.
Apartments	1-1/2 for the first bedroom plus 1/2 parking space for each additional bedroom
Condominium	1-1/2 for the first bedroom plus 1/2 parking space for each additional bedroom, having a width of no less than 10 ft. and a depth no less than 20 ft., guest parking shall be provided at a ratio of 20 percent of the total number of units.
Townhouse	2 off-street per dwelling unit, having a width of no less than 10 ft. and a depth no less than 20 ft., guest parking shall be provided at a ratio of 20 percent of the total number of units.
Amenity center	1.5 per 250 square feet of gross floor area
Hotel or motel	1 per guest room, 1 for every 400 sf. of public meeting space
Institutional and Special Uses	
Church or place of worship	1 space per 100 sf. for sanctuary + school, etc.
College or university	1 per faculty and staff, plus 1 per every 5 residents & 1 per every 5 commuter students

Public community, health, or welfare center	1 per 250 sf. of gfa
Day camp, kindergarten, or child-care facility (public or private)	1 per 6 pupils, plus 1 per 2 staff members
Fraternity or sorority house	1 per residence, plus 1 for every 2 additional active members
Hospital, extended care facility, intermediate care facility, long-term care facility	2 for each bed, plus 1 for each 2 employees on the largest shift at full design capacity.
Ambulance service	2 for each ambulance vehicle
Doctors', nurses' & allied health staff quarters	1 per unit
Medical educational institution	1 per each faculty member, plus 1 for each 3 students
Institution, religious, charitable, or philanthropic organization	1 per 200 sf. of gfa
Trade schools	1 per 200 sf. of gfa
Nursing or convalescent homes	1 per 5 beds, plus 1 for each day staff member
Institutional home for the elderly	1 per 5 residence units, plus 1 per each day staff member
Residence home for the elderly	1 per dwelling unit
Place of public assembly	1 per 50 sf. of gfa
School, elementary	1 space per 300 sf. classroom and office
School, middle	1 space per 300 sf. classroom and office
School, high	1 space per 200 sf. classroom and office
Lodge or fraternal organization	1 per 100 sf. of gfa
Food and Beverage Services	

Drive-in, fast food, or take-out (service to auto)	1 per 100 sf. of seating area
General restaurant or cafeteria	1 per 100 sf. of gfa
Take out only	1 per 200 sf. of gfa
Office, Professional, or Financial Uses	
Bank or savings and loan office	1 per 300 sf. of gfa
Clinic or doctor's office	1 per 200 sf. of gfa
General office	1 per 300 sf. of gfa
Dance, drama, or music studio	1 per 200 sf. of gfa
Personal Service and Retail Uses	
Personal service establishments	1 per 200 sf. of gfa
Retails stores/shops in buildings	1 per 250 sf. of gfa
Shopping centers	1 per 200 sf. of gfa
Outdoor retail sales	1 per 400 sf. of site area
Recreation, Social, and Entertainment Uses	
Commercial amusements	1 per 100 sf. of enclosed gfa
Bowling alley	6 per lane
Theater	1 per 5 seats
Night club	1 per 100 sf. of gfa up to 2,000 sf., then 1 per 50 sf. of gfa.
Pool hall	1 space per 125 sf.

Outdoor Uses	
Stadium	0.2 space per seat + restaurant, etc.
Team sports (volleyball, baseball, soccer, etc.)	9 per field or court
Driving Ranges	0.5 space per tee
Golf Course	4 spaces per green
Court (tennis, racquetball, etc.)	2 per court
Amusement Park	1 per 500 sf. of public area
Mini-golf	1 space per hole + arcade, etc
Motor Vehicle and Machinery Uses	
Carwash	1 per 500 sf. of gfa
Automobile sales	1 per 400 sf. enclosed space, 1 per 2,000 sf. outside display area
Auto repair, garage, or shop	1 per 200 sf. of gfa
Machinery sales, repair – indoor	1 per 500 sf. of gfa
Machinery sales, repair – outdoor	1 per 2,000 sf. of gfa
Storage, Wholesale, and Manufacturing Uses	
Brick or lumber yard	1 per 2,000 sf. of site area
Storage of sand, gravel, petroleum products, etc – outdoor	1 per 2,000 sf. of site area
Wholesale or manufacturing operation	1 per 1,000 sf. of gfa or 1 per each 2 employees on the larger shift

Warehouse and enclosed storage	1 per 600 sf. of gfa
Mini-storage complex	1 per 30 sf. of office area

2. TRANSPORTATION MASTER PLAN

(TMP REVISED-FINAL.pdf)

- a. “Objective 2.8: Ensure the safe parking of vehicles on roadways.
 - i. Action 2.8.1: Develop a parking plan to identify vehicles on roadways. acceptable on-street parking policies.
 - ii. Action 2.8.2: Periodically review the parking plan for implementation and enforcement.
 - iii. Action 2.8.3: Properly mark and enforce prohibited parking areas.
 - iv. Action 2.8.4: Encourage the development of adequate off-street parking facilities.” (p. 19)
- b. On-street Parking Design
 - i. Plan prefers parallel parking, with lanes between seven and eight feet in width as a traffic calming measure. It also mentions diagonal parking and suggests including on-street parking on new roads rather than retrofitting existing roads to reduce the expense. (P.44-45)
 - ii. “Encourage residential building orientation to the street by providing for on street parking wherever possible, and by encouraging on-site parking access via alleys. Consolidate multiple driveways on arterial streets into single access points.” (p.45)
 - iii. “More formal programs, such as transit passes, subsidized parking fees or discounts for not driving to work, and rideshare programs, etc., have been successfully implemented in other cities. However, a critical mass of cyclists or at least a willing ‘champion’ is necessary to sustain and develop such programs.” (p.58-59)
 - iv. Plan mentions using satellite parking to reduce burden on close-in parking lots (p.76) and circulating shuttles to access the satellite parking. (p.83)

3. US 183 ENHANCEMENT

(US 183 Corridor Enhancement Plan_2005.pdf)

- v. Suggests using landscaping to improves parking aesthetics (p.14) and increasing in access points between businesses (while reducing driveway access) to improve pedestrian safety. (p.20-21)

4. US 183 ENHANCEMENT PLAN DESIGN GUIDELINES

(US 183 Corr Enh Plan_Atthmt A_graphics_all.pdf)

- vi. “Access to properties should occur from the side or rear when possible, especially on corner properties. This access should work in concert with rear parking...” (p. 23)

GEORGETOWN

Contact: Valerie Kreger, principal planner, vkreger@georgetowntx.org, (512) 930-3578.
Michael S. Elabarger, Planner III, Mike.Elabarger@georgetown.org (512) 931-7746
<http://www.georgetown.org/contact/staffdirectory.php>

Summary:

Georgetown's central core has both on and off-street parking, including a few parking garages and lots (located northeast (1 block), northwest (2+ blocks) and southeast (1 & 2 blocks) of courthouse are free). Georgetown increased the parking time limit around courthouse from 2 to 3 hours to reduce fines. The rest of the city has predominantly off-street parking, although on-street parking is allowed in residential areas.

The city has parking requirements are minimums but the maximum parking may exceed parking if additional landscaping or trees is provided. A mixed use ordinance allows for off-street parking reductions through on-street utilization and parking management plans/districts.

Documents:

1. CHAPTER 9: OFF-STREET PARKING AND LOADING REQUIREMENTS

(Chapter-9-Parking.pdf)

- Minimum Requirements requires approval for reductions
 - “Existing parking and loading spaces may not be reduced below the requirements established in this Section without **approval of an Alternative Parking Plan** by the Director. Any change in use that increases applicable off-street parking or loading requirements shall use the provisions in Chapter 14, Non-Conformities to determine the necessary improvements Alternative Parking Plan. (Chapter 9, p.3-4)
- Exceeding Maximums:
 - If parking is provided in excess of ~~100~~ 110% of the parking spaces required in the Off-Street Parking Requirements Table, additional landscaping and tree canopy area shall be provided equivalent to ~~25~~ 10% of the ~~parcel~~ lot's impervious cover, notwithstanding the requirements of Table 8.02.010. Parking in excess of 125% of the spaces required in the Table shall require additional landscaping and tree canopy equivalent to 25% of the lot's impervious cover, notwithstanding the requirements of Table 8.02.010.

- Parking Requirements by Land Use

2. GATEWAY OVERLAY PROPOSAL

(gateway-overlay-proposal2.doc)

Parking Restricted

- “Intersections and parking lot entrances should be highlighted with ornamental **plantings and color to visually enhance the aesthetic appearance** of the higher activity zones.” (Gateway Overlay Proposal, p2)
- “Site design proposals along the Highway Gateways shall **break up large masses of parking and pavement with well planned open space components**... Strategically placed tree groupings should be located to frame desired views while screening parking areas.” (Gateway Overlay Proposal, p2)
- “Parking is prohibited between the front building line and edge of the Gateway landscape buffer.” (Gateway Overlay Proposal, p3)
- “As established in Section 4.08.040, parking is prohibited between the Gateway landscape buffer and the front building line.” (Gateway Overlay Proposal, p6)

3. CHAPTER 8 LANDSCAPE BUFFERING

(udc-08landsscapingandbuffering.pdf)

Section 8.09.010 Parking Lot Screening

A. All parking must be screened from public rights-of-way using screening methods as described below.

B. All parking lot screening will be maintained at least 36 inches in height, and be achieved through one of the following methods:

1. A berm;
2. A planting screen (hedge);
3. A wall; or
4. A combination of any of the above along with trees.

C. Live screening shall be capable of providing a solid 36-inch screen within two years, as determined by a landscape architect or other licensed professional, and shall be planted in a prepared bed at least three feet in width.

D. Screening shall be off set at least six feet every 60 linear feet.

Parking Lot Screening Calculations:

Select one (Berm, hedge, wall or combination)

Hedge calculation is 1 evergreen shrub per 3 linear feet.

____ linear feet of parking area / 3 feet = ____ evergreen shrubs

4. **CHAPTER 3 - LAND USE ELEMENT (2030-chapter-3-land-use-element-3b-rev.pdf)**
 - “Along our major highway corridors we have...
 - Promoted development compatible with safe, efficient traffic circulation through sound standards for access management, limited installation of curb cuts, and parking facility connectivity;” (Chapter 3, p.10)
 - 1.B. Promote more compact, higher density development (e.g., traditional neighborhoods, Transit-Oriented Development, mixed-use, and walkable neighborhoods) within appropriate infill locations.
 - Establish guidelines and incentives for infill locations, including:
 - Flexible requirements such as dimensional criteria, impervious coverage, and parking to address local contexts. (Chapter 3, p.13)
 - Revise zoning/development codes, the permitting process, and other applicable City policies by identifying and removing impediments to infill, adaptive re-use, historic preservation and redevelopment, including:
 - Overlay districts (where specific requirements could be modified to allow established character to be maintained; e.g., buildings pulled up to the street, credit for on-street/shared parking, etc.). (Chapter 3, p.16)
 - 2.D. Continue to promote diversification and strengthening of downtown Georgetown and its in-town historic neighborhoods.
 - Maintain a proactive program of City initiatives to promote downtown development through:
 - Capital investments to streets, streetscapes, infrastructure, and parking. (Chapter 3, p.18)
 - Actively support private initiatives consistent with the City’s policies to promote downtown investment by:
 - Adjusting capital improvement programs to target streets, infrastructure and parking as necessary to promote and support desired private investment. (Chapter 3, p.18)
5. **OVERALL TRANSPORTATION PLAN (not saved)**

- Studies transportation in Georgetown, but does not include parking.

6. **CHAPTER 9**
(Chapter-9-Parking.pdf)

Table 9.02.030 Off-Street Parking Requirements*		
Use Category	Specific Use	General Requirement
Residential Uses		
Household Living	Multifamily - Senior	1 per dwelling unit
	All other household dwellings	2 per dwelling unit
Group Living	Nursing Home/ Hospice/Assisted Living	.5 per bedroom
	All other Group Living	1 per bedroom
Civic Uses		
Educational and Day Care Facilities	Family Home Day Care	2 per home
	Group Day Care	6 per home
	Commercial Day Care	1 per 400 ft ² GFA
	Elementary or Middle Schools	1.5 per classroom + 1 per 2.5 seats of capacity for auditoriums and flexible seating areas
	All other Educational Facilities	10 per classroom + 1 per 2.5 seats for flexible areas
Government and Community Facilities	Government/Post Office	1 per 250 ft ² GFA + 1 per fleet vehicle
	All other Government, etc. Facilities	1 per 250 ft ² GFA
Medical and Institutions Facilities	Hospitals	1 per 2 patient beds
	All other Institutions	1 per 250 ft ² GFA

Parks and Open Spaces	Golf Courses and Country Clubs	3 per hole + 1.5 per 250 ft ² GFA of clubhouse
	Neighborhood Amenity Center	1 per 300 ft ² GFA + 1 additional for every 300 ft ² GFA over 1800 ft ² GFA
	All other Parks and Open Spaces	Determined by Director
Places of Worship	Religious Assembly	1 per 100 ft ² GFA of sanctuary, classrooms, flexible seating areas
Commercial Uses		

Mixed-Use Retail Center* (optional)	Commercial Centers less than 10,000 sq. ft. including all Commercial Uses (except Self-storage, Ag. or Landscape Supply, Funeral, Repair, and Commercial Sales and Service)	1 per 150 ft ² GFA
Automotive Sales and Services	Car Wash	1 per 200 ft ² GFA (does not include self-service facility) + 2 spaces
	All other Automotive Sales and Services (except Fuel)	1 per 400 ft ² GFA (indoor only) + 1 additional per 1000 ft ² GFA of outdoor lot, storage and repair bay area
Overnight Accommodations	Bed and Breakfast/Inn	1 per guest room + 2 additional spaces
	All other Overnight Accommodation	1 per guest room + 1 per 250 ft ² GFA of office/conference space
Food and Beverage Establishments	All Restaurants/Bar/Brewery/Winery	1 per 100 ft ² of Designated Seating Area/Entertainment Area + 4 additional spaces
	Food Catering Services	1 per 400 ft ² GFA
Entertainment and Recreation	Theaters and Stadiums	1 per 400 ft ² GFA + 1 per 4 capacity seating
	All other Entertainment and Recreation	1 per 250 ft ² GFA + 1 additional per 500 ft ² GFA up to 50,000 ft ² GFA
Health Services	Home Health Care	1 per 400 ft ² GFA
	All other Health Services	1 per 200 ft ² GFA
Professional and	Professional Office	1 per 300 ft ² GFA

Business Offices	All other Offices and Services	1 per 400 ft ² GFA
Consumer Retail Sales and Services	Funeral Home	1 per 150 ft ² GFA
	Self Storage (all)	1 per 300 ft ² GFA office space
	Small Engine Repair	1 per 400 ft ² GFA
	Farmer's Market, Agricultural and Landscape Supply Sales	1 per 400 ft ² GFA+ 1 additional per 2,500 ft ² indoor and outdoor storage or staging area
	All other Consumer Retail	1 per 250 ft ² GFA for first 20,000 ft ² GFA. 1 per 500 ft ² GFA from 20,000 ft ² GFA up to 100,000 ft ² GFA
Commercial Sales and Service	All Commercial Sales and Service	1 per 300 ft ² GFA of office/showroom area + 1 additional per 2,500 ft ² indoor and outdoor storage or staging area

7. MIXED USE ORDINANCE - SECTION 4.11.070

(UDCSection41170110MixedUseOrdinance.23Apr08.pdf)

- Allows for reductions for on-site parking through:
 - Curbside parking at a ratio of 1:1, with a minimum of 4 spaces provided.
 - Parking ratio buy-down through the creation of a parking management area (e.g., district parking fund, reduction of payment per space). (p.1)

- Allowable Mixed Use Parking Ratios
 - Residential -Efficiency
 - From Georgetown Code of: 1.5 per unit, + 5%
 - To MU District of: 1 per unit Multi-family
 - Residential –
 - From: 1 Bedroom 1.5 per unit ,+ 5%
 - To: 1.33 per unit Multi-family
 - Residential - 2 Bedroom, or 1 Bedroom plus den
 - From: 2 per unit + 5%,
 - To: 1.66 per unit
 - Residential - 2+ Bedroom
 - From: 2.5 per unit + 5%,
 - To: 2 per unit Multi-family
 - Residential - SFD, SFA
 - Same for both: 2 per unit, In garage

- Live/work unit - same as residential
 - Hotel
 - From: 1 per room + 1.5 per, 2 employees
 - To: 1 per room
 - Office
 - From: 1 per 250 SF
 - To: 1 per 350 SF
 - Office - Medical
 - From: 1 per 200 SF
 - To: 1 per 250 SF
 - Retail
 - From: 1 per 250 SF
 - To: 1 per 300 SF
 - Restaurant, Bar
 - From: 1 per 75 SF
 - To: 1 per 100 SF
 - All other uses per Chapter 9 of the Georgetown Code
-
- Ordinance allows for shared parking with criteria for reductions.
 - Design guidelines of surface lots and structured parking places them away from and out of view from the street.

LAKEWAY

Contact: Shannon Burke, Director, ShannonBurke@lakeway-tx.gov, (512) 314-7542
<http://www.cityoflakeway.com/index.aspx?NID=67>

Summary:

The majority of parking in the city is off-street in commercial areas and free. On-street parking is permitted in residential areas. The city's current parking standards (in the land development code) were adopted last year after reviewing requirements of other cities in central Texas. Currently, the city does not see a need to develop a city or district-wide parking management plan.

Documents:

1. LAKEWAY PARKING REQUIREMENTS: SEC. 28.09.006 PARKING
(Lakeway Parking Requirements.doc)

- “(1) All single-family residential structures and dwellings of any type shall be located on lots so as to provide sufficient off-street parking for a minimum of four (4) standard size automobiles for each dwelling unit (e.g. two spaces in garage or carport and two spaces on driveway, clear of the private or public street).” (p.1)

2. PARKING ORDINANCE 99-07-19-1
(Lakeway_Parking_Ordinance.pdf)

- “No parking on paved surface of any street, unless on shoulder, with up to 18 inches encroachment into paved surface. Exception does not apply to: Lakeway Boulevard, Lakeway Drive, Lohmans Crossing Road or Hurst Creek Road. (p.1)

3. PARKING AMENDMENT 2001-09-24-1
(Lakeway_Parking_Ordinance_Amend.pdf;
<http://www.lakeway.org/general.htm>)

- Cannot park in fire lane.

LEANDER

Contact: Ellen Pizalate, epizalate@leandertx.gov, (512) 528-2750.
Robin Griffin, rgriffin@leandertx.gov, (512) 528-2763
http://www.leandertx.gov/page.php?page_id=22

Summary:

Parking objectives and recommendations focus on loosening current parking policies by reducing parking, using shared parking or implementing other alternatives (e.g., public improvement districts). Policies also address sustainable design of parking with reducing light pollution and incorporating green spaces.

The majority of Leander's parking is located off-street. There is no metered or paid parking in the city.

Documents:

1. LEANDER COMPOSITE ZONING ORDINANCE, ARTICLE VI, SECTION 3

- “Development built to a Type 1 site standard is eligible for a five percent (5%) parking requirement reduction in addition to any other parking reduction such as that permitted for shared parking or building square footage above the first story.” (p.91)
- Multi-Family Development – Type 1
 - “At least eighty-five percent (85%) of the units are required to have at least one enclosed garage parking space and such garages are required to be leased, rented or sold with the applicable units.” (p.91)
 - “Garage doors shall not be located on the front of the building.” (p.91)
- Multi-Family Development – Type 2
 - “At least thirty-five percent (35%) of the units are required to have at least one enclosed garage parking space and such garages are required to be leased, rented or sold with the applicable units.” (p.93)
- Landscape standards are used to shade and screen parking space from view. (p.105)
- Parking Minimum Requirements:
 - Single Family
 - See Use District
 - Multi-Family

- 1 1/2 for one bedroom plus 1/2 for each add. bdr.
- Fraternity House, Sorority House, Dormitory, Rooming House, Boarding House
 - 1 per each two beds
- Restaurant as a single use or comprising more than twenty percent of a mixed retail center
 - 1:100 sq. ft.
- Hotel, Motel
 - 1 per room plus 1:200 sq. ft. of Comm. Floor Area
- Medical / Dental Clinic/ Office, Personal Service, Mixed Use Retail Center less than 20,000 sq. ft.
 - 1:200 sq. ft.
- Mixed Use Retail greater than 20,000 sq. ft.
 - 1:225 sq. ft.
- Studio, Bank, Retail
 - 1:250 sq. ft.
- Business / Professional Office
 - 1:275 sq. ft.
- Furniture, Appliance or Hardware Store; Wholesale sales, Establishment, Machinery / Equipment Sales & Service, Clothing / Shoe Repair, Service Shop, Comm. Center, Library, Museum, Art Gallery, Manufacturing, Industrial, Research, Testing,
 - 1:300 sq. ft.
- Warehouse, Storage Buildings and Yards, Lumber Yard, Printing Shop, Plumbing Shop, Church, Theater, Auditorium (except school),
 - 1:600 plus spaces for business vehicles
- Sports Arena, Stadium, Gymnasium, Funeral Home
 - 1:4 seats
- Hospital, Sanitarium, Convalescent Home
 - 1:4 beds
- Dance / Assembly / Exhibition Hall, Restaurant, Night Club, Lodge or Country Club
 - 1:100 sq. ft.

- Motor Vehicle Salesrooms and Used Car Lots
 - greater of 1:800 sq. ft. of sales floor or lot area
- Vehicle Repair Garage
 - 1:400 sq. ft.
- Mini-Warehouse Self Storage
 - parking required only for office
- Golf Courses
 - 3:hole
- Bowling Alleys
 - 5:alley
- Elementary Schools
 - greater of 1:4 seats in auditorium or 2:classroom
- Secondary Schools, colleges
 - greater of 1:4 seats in auditorium or 10:classroom
- Leander uses the City of Austin’s Transportation Criteria Manual for parking design criteria. (p.108)
- Shared parking is possible, if using Smart Code or Urban Land Institute criteria. (p.108)
- 5% reductions (in addition to any other type of parking reduction) are available for:
 - “Non-residential building square footage above the first floor...” (p.109)
 - “Developments utilizing Type 1 development standards “ (p.109)
 - “Projects within three hundred (300) feet of a public transit stop” (p.109)

2. LEANDER COMPREHENSIVE PLAN UPDATE
 (“Final Adopted Leander Comp Plan 12-3-2009 (r).pdf”)

Goal 4.2-3: Protect the Old Town area and assure that it maintains a pedestrian-oriented atmosphere, with a greater flexibility of land-uses as well as unique local retail services.

Objective: 4.2-3.5 Develop a parking plan and identify public parking facilities for Old Town. (p.19)

Goal: 4.2-5 Find suitable districts for industrial development so that the City may recruit additional employers and avoid locating industrial development near neighborhoods without adequate buffering.

Objective: 4.2-6.3 Encourage pockets of green space within parking areas, with shade structures or tree plantings. (p.20)

Goal: Adopt standards that will enhance public safety.

Objective: 6 Adopt signage and lighting standards for streets, parking and public spaces that considers limited night sky impact. (p.30)

Goal 5.2-1 Provide for adequate and appropriate multi-modal transportation options to support the growth of Leander.

Objective 5.2-1.1 Develop a policy for public parking that recognizes on-street capacity and provides incentives for shared facilities. (p.34)

E.g., “relax the parking requirement (count on-street parking)” at Town Centers to “encourage density and a mix of uses.” (P.25)

Goal: 6.2-1 Identify ways to include art in public places

Objectives: 6.2-2.1 Identify joint uses of parking, parks and recreation. Include trail connections between schools for safe non-motorized connectivity. (p.41)

Recommendation: “Identify where civic infrastructure can both be shared and located to the benefit of local business, such as parking, open space development, etc.;” (p.63)

“A Public Improvement District may be formed to perform:...4. Parking improvements.” (p.80)

LOCKHART

Contact: Dan Gibson, City Planner, dgibson@lockhart-tx.org, 512-398-3461 ext.236
Christine Banda, Planning Technician, cbanda@lockhart-tx.org
<http://www.lockhart-tx.org/web98/citydepartments/devservices.asp>

Summary:

Lockhart currently doesn't have any public off-street parking or on-street parking meters. They do have zoning standards for off-street parking on private property outlined in their chapter 74 of their code of ordinances, including minimum requirements for residential and commercial uses, in Appendix I and II respectively.

Documents:

1. COMPREHENSIVE PLAN

("Lockhart2020plannomap.pdf")

Parking is not mentioned in Lockhart's Comprehensive Plan for 2020 or Future Land Use map.

2. LOCKHART UNIFIED DEVELOPMENT CODE SECTION 34

("Lockhart UDC 34.pdf", from:

<http://library.municode.com/showDocumentFrame.aspx?clientID=11173&docID=2>)

"A minimum parking area of 150 square feet per manufactured home space shall be provided in a common area for storage of boats or vehicles in excess of two per manufactured home space, and for visitors' vehicles, to minimize on-street parking and to facilitate movement of emergency vehicles into and through the park." (para 10)

3. LOCKHART UNIFIED DEVELOPMENT CODE SECTION 64

("Lockhart UDC 64.pdf", from:

<http://library.municode.com/showDocumentFrame.aspx?clientID=11173&docID=7>)

In general, off-street parking must be located on-site, but there are provisions for locating it off-site.

"Each single-family and duplex dwelling unit shall have at least one off-street parking space with unobstructed access to the public right-of-way, except that new single-family and duplex dwelling units on a lot greater than 65 feet in

width shall each have at least two off-street parking spaces with unobstructed access to the public right-of-way.” (p.7)

**4. LOCKHART UNIFIED DEVELOPMENT CODE SECTION 64 -
APPENDIX I**

(http://library.municode.com/HTML/11173/level3/PTIICORR_CH64ZO_AXISPREREDETY.html)

APPENDIX I. - SPECIFIC REQUIREMENTS FOR RESIDENTIAL DEVELOPMENT TYPES <i>Development Type</i>	<i>Max. Dwell ing Units Per Struct ure</i>	<i>Min. Lot Area (sq. ft.)</i>	<i>Max. Dwelling Units per Gross Acre (Note 4)</i>	<i>Min. Lot Dimensio ns (ft.) Width Depth</i>	<i>Max. Percent Lot Coverage With Buildings</i>	<i>Min. Building Setback From Property Line (ft.)</i>			<i>Max. Height Stories Feet</i>	<i>Min. Off- Street Parking Spaces per Dwelling Unit</i>	<i>Remarks</i>
						<i>Street (Note 10)</i>	<i>Side (Note 2)</i>	<i>Rear</i>			
SF-1 Single-family 1	1	8,500	5	65 120	30	25	7.5	10	2.5 stories	2, plus 1 for each additional bedroom over 3 per dwelling unit	When a corner lot, the street setback shall be 25 ft. minimum on one street, and 15 minimum on the other.
SF-2 Single-family 2	1	5,500	7	50 105	40	20	5	Same as above	Same as above	Same as above	When a corner lot, the street setback shall be 20 ft. minimum on one street, and 15 ft. minimum on

											No. 90-30.
CF-1 Combined family-1	4	12,000	8	95 125	Same as above	Same as above	20	25	<u>2.0</u>	2, plus 1 for each 4 dwelling units	When a corner lot, the street setback shall be 20 ft. minimum on one street and a 15 ft. minimum on the other.
CF-2 Combined family-2	4	8,000	12	60 125	50	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above
TH-1 Townhouse-1	6	15,000	6	120 125	40	15	10 ft. for exteri or walls	Same as above	<u>2.5</u>	Same as above	Each story of a dwelling unit shall be a portion of that unit. When a corner lot, the street setback shall be a 15 ft. minimum on each street.
TH-2 Townhouse-2	6	15,000	12	Same as above	50	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above
CM-1 Condominium-1	6	15,000	6	Same as above	40	Same as above	Same as above	Same as above	Same as above	Same as above	When a corner lot, the street

											setback shall be a 15 ft. minimum on each street.
CM-2 Condominium-2	12	15,000	12	Same as above	50	Same as above	Same as above	Same as above	<u>3.5</u> 35	Same as above	When height exceeds 2.5 stories the side building setback and the rear building setback shall be increased 10 ft. for each additional story when adjoining any other R district. A minimum 6-ft. high opaque fence or screen is required along any line common to any other R district. When a

											corner lot, the street setback shall be a 15 ft. minimum on each street.
MF-1 Multifamily-1	12	15,000	12	Same as above	40	Same as above	15 or 20 if abutting other R district	Same as above	Same as above	Same as above	Same as above
MF-2 Multifamily-2	24	20,000	24	160 126	50	Same as above	Same as above	Same as above	<u>4.5</u> 45	Same as above	Same as above

(Ord. No. 90-03, pt. 2, 3-6-90; Ord. No. 94-03, pt. 1(10), 2-1-94; Ord. No. 99-03, § VI, 2-16-99)

5. LOCKHART UNIFIED DEVELOPMENT CODE SECTION 64 - APPENDIX I

(http://library.municode.com/HTML/11173/level3/PTIICOOR_CH64ZO_APXIISPRECODI.html)

APPENDIX II. - SPECIFIC REQUIREMENTS FOR COMMERCIAL DISTRICTS District	Minimum Lot area (sq. ft.)	Minimum Lot Dimensions (ft.) <i>Width</i> <i>Depth</i> (Note 1)	Maximum Lot Coverage with Structures	Minimum Building Setback from Property Line (ft.)			Maximum Height <i>Stories</i> <i>Feet</i> (Note 5)	Off-Street Parking Spaces Required (Note 7)	Remarks
				Street	Side (Note 2)	Rear			

CLB Light Business	7,500	60 <i>125</i>	75	25	20 ft. when adjoining any R dist.	20	<i>1.5</i> 25	1 per shift person and 1 per each 300 sq. ft. of floor area	Note 6
CCB Central Business	3,000	30 <i>100</i>	90	None	None	10	5 <i>60</i>	On-street except any structure over 3 stories shall be same as above	Minimum 10 ft. alley connecting to street at each end.
CMB Medium Business	6,000	60 <i>100</i>	75	25	20 ft. when adjoining any R dist.	20	5 <i>60</i>	1 per shift person and per each 300 sq. ft. of floor area	Note 6
CHB Heavy Business	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above	3 <i>40</i>	Same as above	Same as above
SPECIFIC REQUIREMENTS FOR ALL OTHER DISTRICTS									
AO Agricultural-Open Space	1 acre	<i>200</i> 200	30	See Note 8	See Note 8	See Note 8	3 <i>30</i>	2, plus 1 for each additional bedroom over 3 per dwelling unit	
PI Public and Institutional	N/A	N/A	N/A		N/A	N/A	N/A	N/A	Specific requirements will be determined by the commission and/or council for each use permitted.
H or HL Historical Designation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Appropriate concurrent historic designation to be attached per historic

									districts and landmarks chapter.
MH Manufactured Home (Note 9)	7,000	65/100	30	25	7.5 each side abutting another lot	10	2	2, plus 1 for each additional bedroom over 3 (Note 3)	On corner lots, the street setback shall be 25 ft. minimum on one street and 15 ft. minimum on the other street. See Chapter 34, Code of Ordinances for manufactured home parks.
IL Industrial-Light	6,500	60 105	50	25	10	10	40	1 per each 1,000 sq. ft. of gross floor area	Note 6
IH Industrial-Heavy	8,000	70 110	50	1 per each 1,000 sq. ft. of gross floor area	15	15	60	1 per each 1,000 sq. ft. of gross floor area	Note 6
PDD Planned Development	5 acres	N/A	N/A	N/A	N/A	N/A	N/A	N/A	See section 64-199.

(Ord. No. 90-03, pt. 2, 3-6-90; Ord. No. 93-20, pt. 2, 10-19-93; Ord. No. 94-03, pt. 1(9), 2-1-94; Ord. No. 95-07, pt. 1(G), 11-7-95; Ord. No. 97-21, § VI, 10-7-97; Ord. No. 97-34, § II, 12-16-97)

ROUND ROCK

Contact: Taylor Horton, Planner, 512-341-3175, thorton@round-rock.tx.us
John Dean, Transportation Planner, 512-218-6617, jdean@round-rock.tx.us
<http://www.roundrocktexas.gov/home/index.asp?page=865>

Summary:

Development projects are reviewed to ensure that the minimum requirements are met based. Currently, no parking in Round Rock is metered (including the City Parking Garage). Land development code has traditional parking minimums but does allow for shared parking. The downtown plan encourages on-street parking to increase supply, calm traffic, and to improve pedestrian safety.

Documents:

5. LAND DEVELOPMENT CODE: CHAPTER 11

(ordinances_ch_11.pdf)

- Off-Street Parking Requirements
 - Single Family Lots:
 - “A minimum of two garages-enclosed parking spaces shall be provided for each dwelling unit. Parking for other uses shall be provided in accordance with Section 11.502.” (p.80-81)
 - Multifamily (minimum):
 - 1.5 Spaces per 1-bedroom unit*
 - 2 spaces per 2-bedroom unit*
 - 2.5 spaces per 3+ bedroom unit*
 - “*Plus additional 5 percent of total spaces required.” (p.110)
 - Parking shall be located on the sides or rear of buildings. Note: “Sites with 50 percent or greater frontage on an arterial are not required to meet the standard.” (p.135)
- Multi-Use la District
 - “Parking shall be accessed by an alley or rear driveway. When this is not available, an alternative access shall be provided, as allowed by the Transportation Director.” (p.202)
 - “Required non-residential parking may be provided off-site provided all parking is within 600 feet of the lot.” (p.202)
 - “Where a new commercial use is established in conjunction with a new or existing residential use, on-site parking shall be provided for the residential component, in addition to meeting the necessary parking requirements for the commercial use.”

- Single family detached: 2 spaces
 - Residential units:
 - 1 bed-room” 1 space
 - 2 bedrooms or more: 2 spaces
 - Studios under 800 sq. ft.: 1 space
 - Studios of 800 sq. ft. or more: 2 spaces (p.202-3)
 - Non-residential Requirements
 - Except as provided below, one (1) space shall be provided per 400 ft² Gross Floor Area (GFA) of all nonresidential uses.
 - Eating establishments shall be required to provide one (1) space per 200 ft² GFA and shall also include parking for any outdoor seating or customer waiting areas at the same parking ratio. (p.203)
 - Shared parking may be permitted in accordance with Section 11.502(3)(b) of this Code. (p.203)

- 11.423 SUPPLEMENTARY USE STANDARDS
 - Commercial parking in the MU-1a District shall be subject to the following additional standards.
 - “(i) Commercial parking shall be screened from view, in accordance with the landscaping requirements provided for in Section 11.501.” (p.229)
 - “(iii.) Parking garages shall be screened with a fifteen (15) foot landscape buffer as measured between the garage and the sidewalk abutting any public right-of- way, or in lieu of a landscape buffer, the garage may have commercial uses incorporated into the ground floor that are accessible at the street level. The landscape buffer shall include one (1) medium tree per thirty (30) linear feet and one (1) large shrub per four (4) linear feet.” (p.229)
 - “(iv) The length of a parking garage wall facing a public street shall be broken into smaller planes. Wall planes shall not extend more than an average of thirty-five (35) feet without an interruption by a pilaster or structural frame. The parking garage shall have a uniform design and building materials.” (p.229)
 - (v) Vehicles within a parking garage shall be screened from public view.” (p.229)
 - Single level Mixed Use:
 - The residential unit shall have on-site resident parking which shall be separate from customer or employee

parking, reserved for residents' use only, and shall be clearly marked for such purposes. (p.240)

- Mixed Use la District
 - “(ii) Parking, including garages or carports, shall not face a public street. Parking, including garages or carports, is permitted to face an alley.” (p.240)
- In the C-1, C-1a and C-2 districts, separate designated parking spaces for use by the residential units are required. Shared parking calculations shall not be permitted. (p.241)
- Perimeter Parking Lot Landscaping design guidelines (p.261)
- Interior Parking Lot Landscaping design guidelines (p.263)
- 11.502 OFF-STREET PARKING AND LOADING
 - Off-Street Parking Requirements (p.274-278)
The following table lists minimum off-street parking requirements by land use category.

Off-Street Parking Requirements

Use - General Requirement - Additional Requirement

Residential Uses

- SF; detached 2 per dwelling unit 2 garage enclosed parking spaces
- SF; zero lot line 2 per dwelling unit 2 garage enclosed parking spaces
- Village residential 2 per dwelling unit 2 garage enclosed parking spaces
- SF; attached 2 per dwelling unit 2 garage enclosed parking spaces
- Townhouse 2 per dwelling unit 2 garage enclosed parking spaces
- Apartment
 - 1.5 per 1-bedroom unit
 - 2 per 2-bedroom unit
- per 2+ bedroom unit
 - Additional 5 percent of total number of required spaces
- Upper story residential 1.5 per bedroom
- Group homes of six or less persons na
- Group homes of more than six persons 1 per 2 bedrooms 1.5 per 2 employees
- All other Group Living 1 per 2 bedrooms 1.5 per 2 employees

Public and Civic Uses

- Community Service 1 per 250 ft² GFA
- In-home day care of six or fewer children na
- Day Care 1 per eight pupils
- Elementary Schools 3 per classroom
- Middle Schools 3 per classroom
- High Schools 10 per classroom
- All other Educational Facilities 20 per classroom
- Government Facilities 1 per 250 ft² GFA 1 per fleet vehicle
- Hospitals 1 per 4 patient beds
- Institutions 1 per 250 ft² GFA 1.5 per 2 employees
- Community Parks varies
- Parking requirement based on uses in park; must be reviewed and approved by Zoning Administrator
- Amenity Centers 1.5 per 250 ft² GFA
- Linear Parks/Linkages Trailheads varies
- Parking requirement based on uses in park; must be reviewed and approved by Zoning Administrator
- Golf courses and Country clubs 4 spaces per hole 1.5 per 250 ft² GFA of accessory use structures
- Cemeteries, Columbaria, Mausoleums, Memorial Parks, and Crematoria 1 per 50 internment plots (cemeteries and memorial parks); 1 per 350 ft² GFA (mausoleum and crematorium)
- Funeral Home 1 per 100 ft² GFA Minimum of 20 spaces
- Park and Ride Facility na
- All other Passenger Terminals 2 per 250 ft² GFA
- Place of Worship 1 per 3 seats
- Place of Worship with 2500 sq. ft. or less of accessory uses 1 per 3 seats in place of worship Spaces necessary to accommodate accessory use based on requirement for accessory use
- Place of worship with more than 2500 sq. ft. of accessory uses 1 per 3 seats in place of worship Spaces necessary to accommodate accessory use based on requirement for accessory use

- Wireless Transmission Facilities none
- Major Utilities 1 per facility 1 additional per 250 ft² GFA; 1 per fleet vehicle
- Intermediate Utilities none
- Minor Utilities none

Commercial Uses

- Eating Establishments 1 per 100 ft² GFA (includes any outdoor seating and waiting areas)
- Entertainment, Outdoor 1 per 250 ft² GFA structural area 1 per two seats
- Office 1 per 250 ft² GFA
- Medical Office Building 1 per 200 ft² GFA
- Bed and Breakfast 1 per bedroom 1.5 per 2 resident owners
- All other Overnight Accommodation 1 per bedroom 1.5 per 2 employees; 1 per 150 ft² conference space
- Parking, Commercial none
- Indoor entertainment activities 1 per 250 ft² GFA or, 1 per 4 seats for theaters 1 additional per 500 ft² GFA up to 50,000 ft² GFA; 1 per 1000 ft² thereafter, excluding theaters
- Heavy equipment sales and leasing 1 per 250 ft² GFA 1 additional per 500 ft² GFA up to 50,000 ft² GFA
- Shopping Centers larger than 100,000 ft² 1 per 225 ft² GFA
- All other Retail Sales and Service 1 per 250 ft² GFA
- Self-Service Storage 1 space per 50 storage units
- Car wash, full service 1 per 150 ft² GFA Shall meet off-street stacking space requirements from this Section.
- Car wash, self-service 1 per facility Shall meet off-street stacking space requirements from this Section.
- Vehicle repair and body shop facilities 2 per service bay Shall meet off-street stacking space requirements from this Section.
- Auto service facilities 2 per service bay Shall meet off-street stacking space requirements from this Section.
- Vehicle sales, rental or leasing facilities 1 per 500 ft² GFA indoor facility 1 additional per 1000 ft² GFA outdoor lot area
- All other Vehicle Sales and Service 1 per 250 ft² GFA 5 per service bay

Industrial Uses

- Light Industrial Service, Manufacturing, and Assembly 1 per 500 ft² GFA indoor facility, except indoor storage 1 additional per 1000 ft² GFA outdoor facility; 1 per 2,500 ft² indoor storage area
- Warehouse and Freight Movement 1 per 500 ft² GFA

indoor facility, except indoor storage 1 additional per 1000 ft2 GFA outdoor facility; 1 per 2,500 ft2 indoor storage area

- Mineral Extraction 1 per 300 ft2 GFA indoor facility 1.5 per 2 employees
 - Waste-Related Service 1 per 250 ft2 GFA 1 additional per 1000 ft2 GFA outdoor facility; 1 per 2,500 ft2 indoor storage area
 - Wholesale Trade 1 per 300 ft2 GFA indoor facility, except indoor storage 1 additional per 1000 ft2 GFA outdoor facility; 1 per 2,500 ft2 indoor storage area
 - (Ordinance No. Z-05-06-23-13C3 of June 23, 2005 as amended by Ordinance No. Z-05-08-11-10D4 of August 11, 2005)
- Alternative Parking Plan
 - “An alternative parking plan may be approved by the Zoning Administrator for specific developments that are deemed to require a different amount of parking than the standards shown in the Off-Street Parking Requirements table.” (p.278)
 - “(i) The use of the building is specific and occupied by a single user.” (p.278)
 - “(ii) The applicant provides a detailed breakdown of his or her parking requirements indicating employee counts, shift distribution and visitor or customer needs.” (p.278)
 - “(iii) The applicant provides a site plan showing how additional parking to meet standard requirements would be provided if the use changed or parking needs increase.” (p.278)
 - Shared parking requirements (p. 279)
 - Exceptions for Downtown Development, which may be met with on-street parking given certain criteria met. (p.280-281)
 - “Required off-street parking spaces shall have minimum dimensions of 9 feet in width by 18 feet in length.” (p.282)

1 PARKING CHAPTER (5) OF ROUND ROCK'S SOUTHWEST DOWNTOWN PLAN (ch5_parking_planning_.pdf)

5.1 Parking Plan Objectives

“The parking plan presented in this chapter seeks to meet the following objectives:

- Residential parking should be provided on-site.
- On-street parking should be utilized to increase the availability of parking, to slow traffic, and to improve pedestrian safety.
- Surface parking lots should be located in the neighborhood to accommodate nearby businesses within a one- to two-block radius. Required parking for non-residential establishments could then be provided within five hundred feet of a business.
- Structured parking should be located underground or be designed to resemble a street-level building.
- Access to parking via alleys is appropriate where possible. Locating on-site parking at the rear of buildings is preferable in all cases.
- Alleys should remain clear and passable at all times.
- Generally, off-street parking should be located at the side or rear of buildings to ensure that entering and exiting vehicles do not interrupt pedestrian movement at the front of a building.
- The construction of new sidewalks and on-street parking will mean that existing parking areas in the street yard of properties in the Plan Area will no longer be accessible.
- Shared parking lots and shared parking access drives should be designed where feasible.”

Required Off-Street Parking Spaces

Residential

“Single-family detached homes

2 spaces

Townhomes, upper-story residential units:

one bedroom 1 space

two or more bedrooms 2 spaces

Efficiencies and lofts without defined bedrooms (including residential portion of live/work unit):

under 800 sq ft 1 space

800 sq ft or more 2 spaces

For special residential uses, such as senior or assisted living facilities, the Zoning Administrator may adjust requirements as appropriate for their populations.”

Required Off-Street Parking Spaces

Non-Residential

“Restaurants

1 space / 200 sq ft GFA*

All other non-residential uses (office, retail, etc.)

1 space / 400 sq ft GFA*

The GFA of a building at the time of the adoption of this ordinance is exempted from this parking requirement.

**Gross Floor Area (GFA) - The total area in square feet of all floors of a building measured from exterior walls”*

PFLUGERVILLE

Contact: Autumn Speer, aspeer@cityofpflugerville.com, 512.990.6300.
<http://www.cityofpflugerville.com/index.aspx?nid=1053/>

Summary:

98% of parking in the city is off-street at commercial sites. The remaining two percent is on-street in the downtown. On-street parking is also allowed in residential areas. All parking is free and without time limit.

Pflugerville has parking minimums for land uses for the city. The downtown, which comprises only a small are of the city, is different in that there is more flexibility with parking minimum parking requirements (e.g., reduce parking or shared parking). A parking study was performed in central business district (CBD).

Parking standards address minimum space sizes, landscape requirements, and segmentation requirements. The current update to the comprehensive plan has no mention of parking.

Documents:

1. PARKING STUDY

("Pflugerville Parking Study.pdf")

Hand-drawn diagram of current and proposed on- and off-street parking in CBD. Appendix A.

2. UNIFIED DEVELOPMENT CODE

("Pflugerville UDC Main.pdf")

Subchapter 10 Parking, Mobility and Circulation

- "No Reduction below Requirement... without the approval of an alternative parking plan by the Administrator." (p.156)
- "...if parking is in excess of 100 percent of the Parking Spaces required by Table 1 is provided, landscaping area equivalent to 25 percent of the parcel's Impervious Cover must be provided." (p.156)
- **Table 1: Required Parking Ratio** (p.156-160)

(Specific Use: Parking Spaces, Additional Requirement)

- Household Living
 - Single-Family, detached: 2 per dwelling unit, NA
 - Singly-Family, attached: 2 per dwelling unit NA
 - Two Family: 2 per dwelling unit, NA
 - Townhouse: 2 per dwelling unit, NA
- Multifamily dwelling
 - 1.5 per 1-bedroom unit*
 - per 2-bedroom unit: 2.5 per 2+ bedroom unit*
 - *Additional 5 percent of total number of required spaces for visitor use
- Group Living
 - Group home (6 or fewer residents): 2 per dwelling unit, 1.5 per 2 employees
 - Group home (7 or more residents): 1 per 2 bedrooms, 1.5 per 2 employees
 - Nursing or convalescent home: .5 per resident bed, 1 per 2 employees
 - Retirement center apartment
 - .5 per 1-bedroom unit, Additional 5 percent of total number of
 - required spaces for visitor use
 - 1 per 2-bedroom unit, NA
 - 1.5 per 2+ bedroom unit, NA
 - All other Group Living: 1 per two bedrooms, 1.5 per 2 employees
- Community Service: 1 per 250 sq.ft. GFA, NA
- Day Care
 - Family home day care: NA, NA
 - Commercial Day Care: NA, NA
 - Group Day Care: NA, NA
- Educational Facilities
 - Elementary Schools: 1 per classroom. 1 per 2.5 seats of maximum seating capacity in any flex space
 - Middle Schools: 1 per classroom 1 per 2.5 seats of maximum seating capacity in any flex space

- High Schools: 10 per classroom, 1 per 2.5 seats of maximum seating capacity in any flex space
 - All other Educational Facilities: 10 per classroom, NA
- Government Facilities: 1 per 250 sq.ft. GFA, 1 per fleet vehicle
- Medical Facilities Hospitals: 1 per 4 patient beds
- Institutions: 1 per 250 sq.ft. GFA, 1.5 per 2 employees
- Parks and Open Areas
 - Neighborhood parks: Determined by Administrator, NA
 - Community Parks: Determined by Administrator, NA
 - Regional and Metropolitan Parks: Determined by Administrator, NA
 - Linear Parks/Linkages: 2 per access point, Additional determined by Administrator
 - Golf Courses and Country Clubs: 4 spaces per hole, 1.5 per sq.ft. of accessory use structures
 - Cemeteries, Columbaria, Mausoleums, Memorial Parks, and Crematoria: 1 per 150 interment plots and 1 per 350 sq.ft. building GFA, NA
- Passenger Terminals
 - Airports and Heliports: 1 per 400 sq.ft. passenger terminal area, 1.5 per 2 employees
- All other Passenger Terminals: 2 per 250 sq.ft. GFA, NA
- Places of Worship
 - Place of Worship: 1 per 3 seats
 - Place of Worship with 2000 sq.ft. or less of accessory uses: 1 per 3 seats in place of worship, Spaces necessary to accommodate accessory use based on General Requirement for accessory use
 - Place of Worship with more than 2000 sq.ft. of accessory use: 1 per 3 seats in place of worship, Spaces necessary to accommodate accessory use based on General Requirement for accessory use
- Utilities
 - Major Utilities: 1 per facility, 1 additional per 250 sq.ft. of GFA; 1 per fleet vehicle
 - Minor Utilities: none, NA
- Eating Establishments: 1 per 75 sq.ft. GFA (includes any outdoor seating and waiting areas), NA
- Entertainment
 - Bar or Tavern: 1 per 100 sq.ft. GFA, NA

- Indoor entertainment activities: 1 per 250 sq.ft., GFA or, 1 per 3 seats for theaters, 1 additional per 500 sq.ft. GFA up to 50,000 sq.ft. GFA; 1 per 1,000 sq.ft. thereafter, excluding theaters
 - Entertainment, Outdoor: 1 per 250 sq.ft. GFA structural area, 1 per 2 seats
- Office
 - Office: 1 per 250 sq.ft. GFA, NA
 - Medical Office Building 1 per 200 sq.ft. GFA, NA
- Overnight Accommodation
 - Bed and Breakfast: 1 per bedroom, 1.5 per 2 employees
 - All other Overnight Accommodation: 1 per bedroom, 1.5 per 2 employees
- Parking, Commercial: NA, NA
- Retail Sales and Service
 - Shopping Centers larger than 100,000 sq.ft.: 1 per 225 sq.ft. net
 - retail floor area, NA
 - All other Retail Sales and Service: 1 per 250 sq.ft. FA for first 20,000 sq.ft. net retail floor area, 1 additional per 500 sq.ft. FA up to 50,000 sq.ft. net retail floor area
- Self-Service Storage: 1 per 250 sq.ft. office space, NA
- Vehicle Sales and Service
 - Self-service car wash: 2 per facility, Must meet off-street stacking space requirements from this section
 - Full service car wash: 1 per 150 sq.ft. GFA, Must meet off-street stacking space requirements from this section
 - Vehicle repair and body shop facilities: 5 per service bay, NA
 - Auto service facilities: 6 per service bay, NA
 - Vehicle sales, rental or leasing facilities: 1 per 500 sq.ft. GFA indoor facility, 1 additional per 1,000 sq.ft. GFA outdoor lot area
 - All other vehicle sales and service: 1 per 250 sq.ft. GFA, 5 per service bay
- Heavy Industrial: 1 per 700 sq.ft. GFA indoor facility, except indoor
- Storage, 1 additional per 1,000 sq.ft. GFA outdoor facility; 1 per 2,500 sq.ft. indoor storage area

- Light Industrial Service: 1 per 600 sq.ft. GFA indoor facility, except indoor storage, 1 additional per 1,000 sq.ft. GFA outdoor facility; 1 per 2,500 sq.ft. indoor storage area
 - Warehouse and Freight Movement: 1 per 500 sq.ft. GFA indoor facility, except indoor storage, 1 additional per 1,000 sq.ft. GFA outdoor facility; 1 per 2,500 sq.ft. indoor storage area
 - Waste-related Service: 1 per 250 sq.ft. GFA, 1 additional per 1,000 sq.ft. GFA outdoor facility; 1 per 2,500 sq.ft. indoor storage area
 - Wholesale Trade: 1 per 300 sq.ft. GFA indoor facility except indoor storage, 1 additional per 1,000 sq.ft. GFA outdoor facility; 1 per 2,500 sq.ft. indoor storage area
 - Agriculture
 - Farm Stand: 2 per facility, NA
 - Kennel: n/a, NA
 - Resource Extraction/ Mineral Extraction: 1 per 300 sq.ft. GFA indoor facility, 1.5 per 2 employees
- “(b) Eligible Alternatives. A number of specific parking and access alternatives may be considered, including off-site and shared parking. The Administrator may consider and approve any alternative to providing off-street Parking Spaces on the site of the subject Development. An alternative plan must demonstrate to the satisfaction of the Administrator that the proposed plan will benefit surrounding neighborhoods and improve City-wide traffic circulation or urban design more than strict compliance with off-street parking standards in this Code.” (p. 163)

“(i) Off-site parking must be located within 1,000 feet of the primary entrance of the Use served.” (p.163)

- Shared Parking. Efficient use of land and resources by allowing users to share off-street parking facilities is encouraged whenever feasible. Developments or Uses that have different operating hours or peak business periods may share off-street Parking Spaces if approved by the Administrator based upon the following standards:
- (a) Location. Shared Parking Spaces must be located within 1,000 feet of the primary entrances of all Uses served.
 - (b) Zoning Classification. Shared parking spaces serving Uses located in nonresidential Districts must be located in a District that is at least as restrictive as the more restrictive of the Uses applying for shared parking spaces. Shared parking spaces serving Uses in

residential Districts may be located in residential or nonresidential Districts.

3. CHAPTER 155: SITE DEVELOPMENT SUBCHAPTER B: CENTRAL BUSINESS DISTRICT

(“SITE DEVELOPMENT SUBCHAPTER B.pdf”;

<http://codes.franklinlegal.net/pflugerville->

[flp/lpext.dll/Infobase/...0044/heading%20200050.htm?fn=content_doc.htm&f=templates&2.0#LPTOC1](http://codes.franklinlegal.net/pflugerville-flp/lpext.dll/Infobase/...0044/heading%20200050.htm?fn=content_doc.htm&f=templates&2.0#LPTOC1))

Parking Structures

- “(i) Primary vehicular access to parking structures should consider the location of pedestrian routes and avoid using a major pedestrian thoroughfare such as a primary street.” (p.11)
- “Exterior architectural treatment should be divided into 30-foot increments to better integrate the parking structure with the scale and character of adjacent buildings and to provide the visual breaks to hold the interest of walkers passing by.” (p.12)
- “Design parking structures so that they create a visually attractive and active pedestrian environment through the use of retail/commercial wrap. The wrap shall be compatible with surrounding buildings.” (p.12)
- “(ii) New parking structures shall have retail, commercial, or office uses at the first level of all street frontages.” (p.12)
- “(iii) Where aboveground structured parking is located at the perimeter of a building, this shall be screened in such a way that cars are not visible from adjacent buildings or the street.” (p.12)
- “Underground parking structure standards. Underground parking, either fully or partially below grade, allows more intense use of street-level and above grade areas, or more landscaped area. These enhance the life of Pflugerville and offer greater convenience and amenity for building users, as well as allowing for more floor area to lease or sale.” (p.12)

SAN MARCOS

Contact: Sophie Nelson, Planner, 512.393.8230, snelson@sanmarcostx.gov.
Matthew Lewis, Assistant Director, 512.393.8230,
Planning_Info@sanmarcostx.gov
<http://www.ci.san-marcos.tx.us/departments/planning/developmentservices.html>

Summary:

All on and off-street parking spaces are unpaid with the exception of the university (e.g., which has off-street garages). The city has only performed studies for whether or not a parking garage was necessary. Parking downtown is adequate although there is a perception of shortage and limited development. The city is currently working with parking consultants on starting parking management program.

Documents:

1. **DOWNTOWN MASTER PLAN, NOVEMBER 2007 WORKSESSION: TOPIC SUMMARY FROM DOT EXERCISE**
(DOT Topic Workshop Nov09.pdf; <http://www.ci.san-marcos.tx.us/departments/planning/Docs/DowntownMasterPlanMarketAnalysis-Final.pdf>)

“Parking Management

Create a parking strategy that includes installing meters and land acquisition for surface lots and future mixed use development with parking garage.” (p.1)

2. **DOWNTOWN MASTER PLAN**
(09July_masterplan.pdf;
<http://www.sanmarcostx.gov/departments/planning/DowntownMasterPlan.htm>)

Onerous parking requirements and height restrictions, paired with a large number of landowners downtown, have made redevelopment difficult. Parking requirement reductions, paired with in-lieu fees and building height increases, increase the economic feasibility of redevelopment and provide for parking (in structures) downtown.

In addition, although there is a perception of inadequate parking, parking supply is well matched to demand. However, some Texas State students part in commercial lots without patronizing businesses.

3. SAN MARCOS TOMORROW, CHAPTER 4

(Ch-4_Tomorrow.pdf;

http://www.sanmarcostx.gov/departments/planning/comprehensive_planning.htm)

Amount of parking:

“Goal 6 - Parking

Provide additional public parking throughout the city especially in the downtown/university area.” (p.4-9)

Citizen’s concerned about “adequate” (p.4-12), plan calls for “suitable” parking.

Shared parking:

“Policy LU-6.13: The City shall encourage linear commercial districts be located based on the following criteria:

c. on large parcels with single ownership, or on smaller parcels whose owner are organized into an association and have the ability to share parking or entrances;” (p.4-46)

Increased off-street parking:

“Policy D-1.2: The City shall encourage an increase in the number of off-street parking spaces, accessibility, code enforcement, and the redevelopment of public areas.” (p.4-79)

Urban design:

“Policy D-3.2: The City shall prepare an urban design plan as part of the comprehensive CBD plan. The plan shall include the following to improve the character of the CBD:

- _ parking improvements
- _ landscaping of sidewalks and parking areas;” (p. 4-80)

D-5. Parking:

“Policy D-5.1: The City shall, in conjunction with Hays County and Southwest Texas State University, develop a Parking Management

Plan which will evaluate short and long term parking demand, and strategies for implementing parking improvements in the Central Business District.

Policy D-5.2: The City shall work to reduce the amount of angle parking on major thoroughfares that impedes the flow of traffic, and shall to the extent possible, relocate the parking elsewhere.

Policy D-5.3: The City shall encourage short-term on-street parking and long-term off-street parking that is convenient, well lighted and safe.

Policy D-5.4: The City shall support implementation of the SWT Master Plan which call for on-campus parking garages, street circulation and on-street parking changes to encourage students to park on-campus rather than the CBD.

Policy D-5.5: The City shall evaluate the possibility of city or privately owned parking lots or structures in the CBD.” (p.4-82)

4. SAN MARCOS ACTION PLAN CHAPTER 5

(Ch-5_Action_Plan.pdf;

http://www.sanmarcostx.gov/departments/planning/comprehensive_planning.htm)

“The City will prepare a Transportation System Management Plan which includes improvements such as removing on-street parking where feasible...” (p.5-2)

“The City will prepare a Downtown Parking Management Plan in conjunction with Hays County and Southwest Texas State University.” (p.5-9)

TAYLOR

Contact: Bob VanTil, AICP, CEcD, Director, bob.vantil@taylortx.gov, 512-352-5990, ext. 16

John Elsdon AICP City Planner, john.elsden@taylortx.gov, 512-352-3675 ext. 24
<http://taylortx.gov/index.aspx?nid=22>

Summary:

Require parking research study if don't have a minimum requirement standards. Taylor doesn't have downtown off-street parking requirements because of density. Downtown is met on-street. The rest of city has predominantly off-street parking. All parking is free with no time limits. No structured parking/garages. Currently, Taylor hasn't talked about parking management parking, although it is working on a downtown plan, which may change parking near city hall.

Documents:

1. PARKING STANDARDS

(<http://taylortx.gov/documents/Community%20Development/parkingstandards.htm>)

**TABLE 6.1
OFF-STREET PARKING
NUMBER OF SPACES REQUIRED**

USE TYPE	NUMBER OF SPACES REQUIRED
RESIDENTIAL	
Single-Family Dwelling	2 per dwelling unit
Two-Family Structure	2 per dwelling unit
Three-Family Structure	1.25 per efficiency unit
Four-Family Structure	1.75 per one-bedroom unit
Multi-Family Structure	2.25 per two-bedroom or larger unit
Manufactured or Industrialized Home	2 per dwelling unit
CIVIC/INSTITUTIONAL	
Airport	See Required Parking Study (Section 6.7)
Assisted Care Centers	1.75 per one-bedroom unit
Club or Lodge	- See Required Parking Study
College or University	See Required Parking Study
Day Care Center	1 per 10 students
Dormitory	1 per 2 residents
Hospital	1 per 4 beds patient capacity, plus 1 per 2 employees
Nursing Home	1 per 4 beds patient capacity, plus 1 per 2 employees
Park and Recreation, Public	See Required Parking Study

Public Service	See Required Parking Study
Religious Assembly	1 per eight seats in main assembly area
School, Elementary or Secondary	See Required Parking Study
Utility, Minor	None
Utility, Major	Spaces to be provided pursuant to see "Other"
COMMERCIAL	
Bank	1 per 200 square feet, plus stacking spaces per Section 6.2.3
Boarding House	2 per dwelling unit, plus 1 per guest room
Broadcasting Studio	Spaces to be provided pursuant to see "Other"
Commercial Recreation, Indoor	
Theaters	1 per three seats
Other	1 per 400 square feet
Commercial Recreation, Outdoor	See Required Parking Study
Communication Tower	None
Contractor Service	Spaces to be provided pursuant to see "Other"
Country Club	4 per hole, plus spaces required for restaurant and bar area
Eating and Drinking Establishments	1 per 100 square feet or 1 per 4 seats, whichever is less.
Funeral Home	1 per four-person capacity
Hotel/Motel	1 per guest room, plus 1 per 10 guest rooms, plus required spaces for restaurant, assembly and other uses within hotel/motel
Medical Service	1 per 200 square feet
Office, General	1 per 300 square feet
Parking Lot, Commercial	None
Personal Service	1 per 200 square feet
Personal Improvement	1 per 200 square feet
Retail Sales and Service	See Required Parking Study, plus stacking spaces per Section 6.2.3

2. COMPREHENSIVE PLAN

(“Comprehensive Plan 2004 Combined.pdf,”
<http://taylortx.gov/documents/Community%20Development/Comprehensive%20Plan/Comprehensive%20Plan%202004%20Combined.pdf>)

“Lack of Parking - There is a perception of inadequate parking throughout many areas of the City. Appropriate signage and new parking spaces may address the problem.” (p. 117)

“Parking other than on street parking is not obvious to residents or visitors.” (p.503)

“Both on- and off-street parking are available in the CBD. There are approximately 265 on-street spaces, however not all are marked or the markings have faded. Both angle and parallel spaces are present. There are potentially 571 off-street spaces in lots around the CBD generally associated with public facilities or banks. There are private lots, some of which are fenced.” (p.506)

“Parking should be well labeled and adequate for the retail and office needs. Requiring more parking than is needed may discourage redevelopment and can create unnecessarily large parking lots.” (p.63)

Design standards:

- “1. All outdoor parking areas having spaces for more than twenty (20) vehicles shall have landscaping within the perimeter of the parking area equal in area to not less than five (5%) percent of the total paved area.
2. No parking space shall be located more than seventy (70) feet from a portion of the required landscaping.
3. One tree of at least two (2) inch caliper in size shall be provided within the perimeter of the parking area for each two hundred fifty (250) square feet of landscaping required.” (p.243)

