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Transit-Oriented Development in the Texas Triangle Megaregion: An Inventory of Planning Practices and Infrastructure, and a Synthesis of Stakeholder Perspectives

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Transit-Oriented Development in the Texas Triangle Megaregion: An Inventory of Planning Practices and Infrastructure, and a Synthesis of Stakeholder Perspectives

by

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Abstract

Transit-Oriented Development in the Texas Triangle Megaregion: An Inventory of Planning Practices and Infrastructure, and a Synthesis of Stakeholder Perspectives

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While most Texas Triangle planning agencies at the state, regional, and local level agree that transit-oriented development (TOD) would benefit their communities, less than ¼ report having even adopted a definition for TOD for their jurisdiction. As a result, most of the region's 181 TOD-ready sites remain underdeveloped. Planning agencies need guidance in developing policies and guidelines that support the construction of quality TOD at rapid transit stations. This research set forth to inventory TOD in the Texas Triangle, as well as identify the reasons for successes and failures around the megaregion. Through desktop research, surveys, and interviews, this research found that public agencies crucially need guidance on new and useful Texas value capture mechanisms—especially TIRZs and TRZs—which could fund needed capital projects for station areas and for transit lines. Additionally, planning agencies need access to best practices for TOD-specific land development codes. Quality codes can both guide development to these sites and depoliticize the agonizing approval process reported by all parties for density-increasing TOD projects. Planners and developers were largely supportive of form-based codes which allow for higher densities and for developer flexibility, often identified as key to realizing progress at TOD sites. With an increase in quality partnerships and improvements in demonstrated public investment and TOD-specific development codes, TOD in the Texas Triangle holds tremendous yet-unrealized potential.

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Chapter 1. Introduction: Transit-Oriented Development at the Megaregional Scale in the Texas Triangle

1.1. Introduction to Megaregions

America's metropolitan regions are expanding at a rapid pace. As these regions grow, they connect and overlap with their neighboring regions until the boundaries between regions are no longer clear. Already, one may find it challenging to draw a boundary between the New York and Philadelphia metropolitan regions, or between the San Diego and Los Angeles metropolitan regions. This new scale of geography is known as the megaregion.

According to the Regional Plan Association (RPA), Texas is home to two megaregions, each of which has a rapidly-increasing number of residents. The first, most prominent megaregion for the state of Texas is the Texas Triangle. The well-known Texas Triangle is naturally a triangle, bound at three corners by Dallas/Fort Worth to the north, San Antonio to the southwest, and Houston to the southeast. To the northeast of San Antonio is Austin, the megaregion's fourth-most populous metropolitan area. This megaregion encompasses all of the area within this triangle--from San Marcos to Waco; from Bryan to Killeen. Overall, this megaregion was home to over 17 million people in 2010, nearly 6% of the population of the United States. By 2050, RPA posits that the Texas Triangle will be home to 70% of Texans, numbering more than 38 million in population.[1]

While the Texas Triangle megaregion is an accepted megaregion by most planning scholars, less-universally agreed upon is RPA's identification of a Gulf Coast megaregion. This megaregion overlaps with the Texas Triangle in shared ownership of Houston, but also houses major metropolitan areas such as New Orleans, Baton Rouge, Corpus Christi, and Brownsville. In 2010, this megaregion was home to more than 13 million people, roughly 4% of the population of the United States. By 2050, RPA expects 23 million Americans to call the Gulf Coast megaregion home.[2]

[1] Regional Plan Association. (2016). Texas Triangle. *America 2050*.
[2] Regional Plan Association. (2016). Gulf Coast. *America 2050*.

1.2. Transportation Challenges in Megaregions

Naturally, the growth of megaregions has generated many unique transportation challenges. In a previous era, a city could generally rely on predictable and relatively homogenous movements. In general, in the morning workers would travel to the central business district (CBD) for work. These commuters would utilize public transit or active transportation if their trips originated from within the city limits, or they would drive personal vehicles from the suburbs to the CBD, demanding quick travel times and efficient parking when they arrived. In the evening, this trip would be reversed, and workers would leave the CBD for exclusively-residential areas in the periphery of the city limits.

However, changes in living and working preferences, as well as an increasingly complex mixture of land uses around metropolitan areas, has changed these old commute patterns. In the 21st century, it is unsurprising to come across someone who lives near a city's CBD and commutes to a suburban office park utilizing a personal vehicle. The most common commute pattern in the United States is no longer suburb to CBD, but rather suburb to suburb. Many of these trips involve crossing over several suburbs or even the CBD to reach a destination, and as a result, the vast majority of these trips involve personal vehicles.

One of the most significant transportation challenges within megaregions is the rapidly-increasing number of "super commuters", especially prominent in megaregions. By definition, a super commuter is travelling at least 90 minutes and at least 50 miles each way between home and work. National statistics show that these long-distance commutes are on the rise. Within megaregions, this type of commuter has become known as "megacommuter". Megacommuters are especially prominent in megaregions as they often travel from a residence in one metropolitan area to an entirely separate metropolitan area, placing very strong demands on transportation systems, especially interregional.

The phenomenon of the megacommuter has grown for several reasons. At an individual level, telecommuting has risen dramatically in prominence, and as a result, some may "megacommute" a few days a week while telecommuting the rest of the week, rationalizing the act as "breaking even" with standard weekly commute times. In addition, at the level of the family unit, more

households have dual earners than ever before. While one partner may live and work in the same metropolitan area, the second partner may be employed in another metropolitan area. Finally, at the most macro level, metropolitan areas continue to grow and are overlapping more than ever, creating megaregions like we've never seen before.

Like the majority of commuters in the United States, megacommuters are generally using single-occupant personal vehicles as their primary (and often only) means of transportation. Unsurprisingly, vehicle miles travelled (VMT) is on the rise in the United States, reaching an all-time peak of 3.17 trillion miles in 2016, double the number of miles driven in 1982.[3] In spite of an increase in personal vehicle usage, evidence of the unsustainability of personal vehicles has become clear. Environmentally, light vehicles represent 61% of US transportation-based emissions.[4] Economically, traffic is estimated to cost Americans $300 million in wasted fuel and lost productivity.[5] From the perspective of equity, personal vehicles often have a high cost of entry, and as a result many poor Americans are not able to count on a reliable personal vehicle to get them to and from work.

One clear answer to this issue is diversification of our transportation portfolio, especially through improved public transit services both at an intrametropolitan-region level and intermetropolitan-region level. Quality public transit can address the aforementioned issues with personal-vehicle reliance, and more. From an environmental perspective, a simple bus--the most basic of public transit options in the United States--can take more than 50 vehicles off the road with every trip. From a productivity perspective, quality public transit services with their own rights-of-way and optimized stop spacing may reduce travel times when compared to personal vehicles. In addition, it may allow for greater productivity by its riders than the rider would have been able to achieve if driving. Finally, from an equity perspective, transit may provide a clear cost savings to owning a personal vehicle. Given that the average personal vehicle costs nearly $23 per day to own and

[3] U.S. Department of Energy. (2016). *U.S. Department of Energy.*
[4] Miotti, Marco, Geoffrey Supran, Ella Kim, Jessika Trancik. (2016). Personal Vehicles Evaluated against Climate Change Mitigation Targets. *Environmental Science and Technology.*
[5] Rahim, Zamira. (2017). Here's How Much Sitting in Traffic Is Costing You. *Time Magazine.*

operate in the United States,[6] public transit often has a far-lower barrier to entry than a personal vehicle.

In spite of the clear benefits of public transit, the case for investing in public transit can be a rocky one. In 2017, virtually all transit operators in the United States saw a decrease in ridership.[7] One of the key barriers to improving ridership is the United States' car-dominated environment and lack of development which is supported by—and supportive of—public transit. Developers remain drawn to suburban low-risk projects that promote single-use sprawl in areas with low land value. And, importantly, the majority of the public remains willing to drive to virtually all of their destinations, regardless of ever-increasing traffic on American roadways.

1.3 Transit-Oriented Development as a Solution in the Texas Triangle

Transit-oriented development is a possible solution to megaregions' transportation woes. This development style, known as "TOD", entails deliberate, dense development oriented towards transit stations in a manner that support transit services and enhances community livability through the design of compact, walkable, and mixed-use environments. TOD almost always requires a fixed-guideway system of high caliber, generally involving premium rail- or bus-based rapid transit systems. The most successful TOD sites are connected to a network of TOD that covers a large area within a city or metropolitan region.

While transit-oriented development certainly has the potential ease a megaregion's transportation woes, it also has the potential to improve environmental quality, neighborhood quality, public health, and costs of living, among other measures of livability for a city. It can be surprising, then, that TOD has not been well established in much of the United States, even where fixed-guideway systems have been constructed.

Forming a possible foundation for transit-oriented development, each of the four major cities in the Texas Triangle—Austin, Dallas, Houston, and San Antonio—is experimenting with rapid transit technologies to cope with rapid growth, hoping to both improve conditions for non-

[6] Reed, Philip, Nicole Arata. (2018). What Is the Total Cost of Owning a Car? *Nerdwallet.*
[7] Siddiqui, Faiz. (2018). Falling Transit Ridership Poses an "Emergency" for Cities, Experts Fear. *Washington Post.*

personal vehicle users and to drive sustainable development at specific nodes or corridors. Not surprisingly, these cities' unique selections of rapid transit modalities are as diverse as the cities themselves. Around the Texas Triangle, on top of standard bus and paratransit operations one may also find heavy rail, light rail, streetcars, and bus rapid transit (BRT).

In spite of these rapid transit stations' position in the Texas Triangle, TOD has only been practiced locally by a limited number of communities and transit agencies, and where it is practiced there is often little development, regardless of TOD-friendly regulations. This research set forth to understand both why station areas remain underdeveloped, and how Texas Triangle planners may improve conditions to entice greater TOD development—if, in fact, they would like to see more TOD in their jurisdictions.

1.4 Research Outline

This report consists of 8 chapters. After this introduction, Chapter 2 "Research Methods" examines the research methods utilized in the generation of this report. Following this, Chapter 3 "Literature Review of TOD Practices" examines literature from around the Texas Triangle megaregion and the nation to discuss best and worst practices of TOD at several levels of implementation: local, regional, and state. After that, Chapter 4 "Transit Technologies in the Texas Triangle" examines all of the rapid transit technologies employed in the Texas Triangle's most prominent cities. Chapter 5 "TOD Typologies in the Texas Triangle" generates typologies—idealized, planned, and realized—for areas surrounding rapid transit stations in the Texas Triangle. Next, Chapter 6 "Surveys of Public Agencies and Developers" discusses the creation of a survey and its findings: a breadth of opinions on TOD practices at several levels of governance around the Texas Triangle. Following this, Chapter 7 "Interviews of Austin, TX TOD Stakeholders" utilizes survey findings to dive deeper into the opinions of a single cohort of stakeholders bound by the same TOD-related realities to examine the differences in their perspectives. Finally, Chapter 8 "Conclusions and Recommendations" discusses necessary next steps in improving the state of TOD in the Texas Triangle.

Chapter 2. Research Methods

2.1. Research Tasks

This study inventories the state of transit-oriented development (TOD) in the Texas Triangle megaregion, from the perspective of existing and planned rapid-transit infrastructure and from the perspective of TOD planning initiatives at state, regional, and local levels. Following this inventory, this study attempts to understand why station areas are often underdeveloped through surveys and interviews of planning agencies and developers with and without interests in TOD. Finally, this study synthesizes opinions of developers and planning agencies from around the Texas Triangle, with the hope of fostering a newfound mutual understanding of current advantages and disadvantages to TOD for different types of stakeholders.

Research Questions

1. How have higher-level TOD ideas been received by various public agencies tasked with implementation, e.g., MPOs, TxDOT, transit operators, cities or other local communities in Texas?
2. What types of planning practices exist in communities of various sizes and with various transit technologies?
3. What factors—financial, institutional, and legal—have affected further adoption and implementation of TOD or similar ideas?
4. How do planners at various levels of governance and property developers differ in their identification of barriers o TOD implementation? How do these identified barriers differ among different jurisdictions?

Research Tasks

In pursuit of answers to these research questions, five research tasks were identified.

1. Summarize types and service characteristics of transit systems in the Texas Triangle, especially rapid transit systems around which TOD has the greatest potential.
2. Review literature on TOD to identify best practices at the regional, state, and national level.
3. Design a survey of organizational practices and opinions on TOD implementation.

4. Interview key TOD stakeholders of select metropolitan regions.
5. Develop TOD typologies for potential and existing sites within the Texas Triangle.

This research builds upon research performed for the USDOT Tier-1 University Transportation Center (UTC) Cooperative Mobility for Competitive Megaregions (CM2), "Regional Opportunities and Challenges for Transit-Oriented Development: The Case of the Texas Triangle," co-authored by Dr. Ming Zhang and Brendan Goodrich. The public agency survey described in Chapter 6 "Surveys of Public Agencies and Developers" was administered in Dr. Ming Zhang's Megaregion Transportation Practicum in the Fall of 2017. Several students assisted in the writing and administration of the public agency survey.[8] In addition, students assisted in the review of some of the literature discussed in Chapter 3 "Literature Review of TOD Practices".[9] The UTC-funded research report can be found in its original format in "Regional Opportunities and Challenges for Transit-Oriented Development: The Case of the Texas Triangle", available on CM2's website.

2.1.1. Transit Inventory

A preliminary task in this research was to closer-examine transit systems in the four main metropolitan regions of the Texas Triangle: Austin, Dallas, Houston, and San Antonio. As one may expect, each of the metropolitan regions offers a portfolio of city bus lines and paratransit services. While there are some distinctions between different cities' service—such as with the strength of Houston's commuter bus network—generally there is little differentiation among cities for these core services. In addition, these bus services rarely attract transit-oriented development. As a result, the inventory consists exclusively of rapid transit systems.

Two core headlines were noted regarding rapid transit systems of the Texas Triangle. First, each metropolitan area is experimenting with its own distinct portfolio of rapid transit system—these systems prove as diverse as the cities themselves. Second, each metropolitan area in the

[8] Assisting in the creation and administration of the public agency survey were Dr. Ming Zhang, Sadra Dehghanhosseinab, Gregory Grant, Aysha Minot, Sydney Sepulveda, Raj Shah, Kelsey Veazey, Arman Rajaeian, and Caleb Roberts.
[9] Assisting in the generation of a section of an earlier version of Chapter 3 "Literature Review of TOD Practices" were Aysha Minot and Sydney Sepulveda.

megaregion has recently invested in rapid transit. While the Dallas metropolitan area was the first to implement rapid transit in the megaregion with its light rail system, it continues to invest heavily in that system's expansion while continuing to construct several new rail lines. Each of the metropolitan areas of the Texas Triangle has implemented a rapid transit system within the last ten years.

The completed rapid transit inventory includes basic transportation background for each of the metropolitan areas examined, as well as system characteristics and history for each rapid transit system that the metropolitan area currently operates. In addition, a GIS inventory was generated of all rapid transit stops and land uses around rapid transit stops in the Texas Triangle. This was utilized to generate the inventory of TOD sites.

2.1.2. Literature Review

The second preliminary research task involved a literature review of best practices of TOD development at the national, regional, and local levels. This literature review would inform the remainder of the research tasks. Plans at all levels of governance were reviewed as well as published research. Differences of opinions were explored regarding the following core elements of TOD planning practice:

- The central purposes of TOD planning
- Definitions of TOD for different authors
- Plans' stated benefits of TOD
- TOD practice (including transit modalities, land use and intensity, and environmental considerations)

2.1.3. Survey

A core component of this research, the public agency survey was generated in Dr. Ming Zhang's Megaregion Transportation Practicum in the Fall of 2017 utilizing findings of the literature review—both published academic works as well as regulations at the national, regional, and local levels. The survey provided a general definition of TOD – deliberate development oriented

towards transit stations in a manner that supports transit services and enhances community livability through the design of compact, walkable, and mixed-use environments – but also encouraged agencies to utilize their own definitions of TOD if they had adopted a definition. While some agencies' practices reflect the definition above, this survey was also intended to capture practices that focus on compact development and walking- and cycling-friendly designs near transit, even if the practice is not branded "TOD."

The survey consists of 26 questions, divided into five sections: Background Information, Concepts and Perspectives, Current Practices of TOD or Similar Development and Design near Transit, Barriers to TOD Implementation, and Effectiveness of Strategies to Overcome Barriers to the Implementation of TOD. The survey was administered through Typeform and took approximately 30 minutes to complete. In the fall of 2017, the survey was open for one month, and one attempt was made every week, in email or call form, to send the survey to our list of contacts in order to maximize survey responses. In the spring of 2018 the survey was opened for several months and attempts were made via email to contact all who had been identified as possible survey participants that did not complete the survey. In an attempt to secure responses from all large organizations in the Texas Triangle, several employees were contacted at larger organizations from which no response had been received.

When the survey closed, respondents' answers to the survey questions were coded using a database approach. In the database, variables were used (abbreviated expressions) to represent survey questions which usually come in long sentences. For questions allowing multiple selections, each answer was represented by one variable.

The public agency survey was sent to three specific groups within the Texas Triangle. First, it was sent to regional and state offices of planning: metropolitan planning organizations (MPOs), councils of government (COGs), and the relevant state department of transportation, TxDOT. Second, the survey was sent to all registered public transit providers in the Texas Triangle. Third, all municipal planning agencies in the Texas Triangle which had some form of public transit service were sent the survey. Some surveys were sent to multiple contacts for each agency, generating multiple responses from a single organization. In these cases, all responses were

coded and given equal weight. Responses were received from a broad array of agencies with jurisdictions large and small from around the Texas Triangle. Public transit was the least-well represented group in the survey, with a lower response rate than any other population.

As a follow-up to this survey succeeding the conclusion of the Megaregion Transportation Practicum, in the spring of 2018 a similar survey was administered to for-profit and nonprofit developers around the Texas Triangle. Similar to the public agency survey, this survey was adapted nominally to gauge and compare developers' opinions and practices with transit-oriented developments to those of the planners with whom they work. With a much larger target population, this survey was administered with convenience sampling. All of the largest developers with operations in the Texas Triangle were contacted, as well as all of the largest trade organizations representing developers in the Texas Triangle. Additionally, dozens of developers in the Texas Triangle that had projects in transit-oriented developments were contacted. Unfortunately, few developers completed the survey.

2.1.4. Interviews

Following the surveys, interviews were conducted of planners, developers, and community groups around the Austin metropolitan region to ground survey results and allow for an examination of Austin's TOD progress at a site-specific level. These interviews utilized a combination of convenience sampling and snowball sampling. First, several planners and developers in the Austin region were identified as having an interest or stake in TOD and were contacted. One of the first developers that was interviewed contacted the research team to request an interview when he received a survey request. Following each interview, subjects were asked if they would like to share names of others in Austin with whom the research team should speak about TOD in Austin. Interviews were conducted in the City of Austin and in Leander, a suburban city with its own distinct planning practices.

2.1.5. TOD Typologies

The final research task involved developing TOD typologies for all TOD stations in the Texas Triangle. The purpose of this task was twofold. The first purpose was to identify and categorize

existing development patterns. The second purpose of these typologies was to provide a guide to assist planners in implementing specific kinds of TOD development pattern at specific sites.

In identifying TOD typologies in the Texas Triangle, the first task was to inventory all rapid transit stations in the Texas Triangle and generate buffers around stations areas to capture demographics and land use utilizing GIS. Following this, built-environment data which captures the current state of TOD sites was examined. Then, to generate an understanding of future expectations for TOD sites as well as their relationships with other sites in a network, formal plans for sites were studied. With this information, Texas Triangle-specific typologies were identified, and these typological assessments were applied to all rapid transit stations in the Texas Triangle to form an inventory.

Chapter 3. Literature Review of TOD Practices

Transit-oriented development (TOD) has created a joint development opportunity with public entities and private developers. TOD allows for more compact and sustainable development that, when done properly, can reduce the frequency of private vehicle trips for individuals who use live or work within a TOD. Although approaches to TOD vary across regions, there are some common and best practices that have been identified for TOD development.

This review's first goal is to examine basic definitions and stated purposes of TOD. Through these self-ascribed definitions transit authorities, planners, municipalities and developers can utilize common language to work collaboratively to determine what TOD should be in their environment. The review will then address different transit modalities and how this affects types of TOD that are possible at a given location. Finally, this review will examine strategies for implementation that have been successful in regions throughout the United States. We will use this information to inform applicability to Texas Triangle TOD.

3.1. Central Purposes of TOD Planning

TOD guidelines for regional, state, and national levels serve varying purposes; however, based on an analysis of a plethora of documents from diverse perspectives, it is clear that most guidelines serve a common purpose: to address TOD as a means to create more livable, sustainable communities.

Many TOD documents provide goals or purposes for TOD within a given jurisdiction, and these often vary from one jurisdiction to the next. For example, the ultimate goal of Cleveland's regional TOD plan is to "promote vibrant and livable station areas"[10] for their customers, while San Diego's strategy focuses on creating "vibrant, healthy communities that are accessible to transit.[11] Other strategies focus on using TODs to address future challenges based on current trends. For example, the state of California identifies TOD as one of several "livable

[10] Greater Cleveland Regional Transit Authority. (2007). Transit Oriented Development Guidelines. *Reconnecting America.*
[11] SANDAG. (2015). Transit Oriented Districts: A Strategy for the San Diego Region. *SANDAG.*

communities" strategies to address California's ongoing growth challenges, particularly traffic congestion.[12] Indiana also uses their regional TOD Strategic Plan to address and plan for long-term projections of regional population, household and employment changes through 2040, and what effects these projections will have on the demand for transit-oriented development.[13]

In addition to addressing future projections, a few state and regional TOD plans identify specific goals and the ability for TOD to contribute to accomplishing these goals. The state of Florida, in an attempt to veer away from automobile dependence, uses its guidelines as an avenue to transition from an auto-oriented state towards a state with more compact, livable environments generated by TOD.[14] San Diego's guidelines also identify specific goals in its statement of main purpose. These include reduction of greenhouse gas emissions, increase in transit ridership, walking, and biking, and the provision of a greater mix of housing and employment opportunities for all residents of the region.[15]

Many guidelines also identify valuable and useful resources for the planning and implementation of TOD. The Greater Cleveland guidelines establish a plan for public involvement in the TOD planning process, identifying ways for stakeholders to understand the planning tools available to meet stated objectives and developing a plan that will allow stakeholders to take ownership of TOD projects.[16] Delaware Valley also uses guidelines as a "toolkit" designed to provide public officials, planners, transit operators, developers, and citizens with resources that can encourage public and private investment at rail stations.[17] Additionally, San Diego's regional TOD strategy also includes the use of "tools" that local jurisdictions can use to implement transit-oriented development.[18]

[12] California DOT. (2002) Statewide Transit-Oriented Development Study: Factors for Success in California. *California DOT.*
[13] Indy Connect. (2015). Transit Oriented Development Strategic Plan. *Indy Connect.*
[14] Florida Department of Transportation (FDOT). (2012). Florida Transit Oriented Development Guidebook. *Florida Department of Transportation.*
[15] SANDAG. (2015). Transit Oriented Districts: A Strategy for the San Diego Region. *SANDAG.*
[16] Greater Cleveland Regional Transit Authority. (2007). Transit Oriented Development Guidelines. *Reconnecting America.*
[17] Delaware Valley Regional Planning Commission (DVRPC). (2007). On Track: Progress Toward Transit-Oriented Development in the Delaware Valley. *Delaware Valley Regional Planning Commission.*
[18] SANDAG. (2015). Transit Oriented Districts: A Strategy for the San Diego Region. *SANDAG.*

While TOD guidelines throughout the United States form diverse perspectives, all see the potential of TOD to benefit their jurisdictions. With these benefits in mind, most planning agencies are utilizing these guidelines in an attempt to foster quality TOD development. These context-adaptive "toolkits", specific to cities, regions, or states, are vital components in planners' advocacy for TOD in their jurisdictions.

3.2. Definitions of TOD

In order to create a coherent TOD strategy or implementation plan, it is important to first generate a jurisdiction-specific, adjudicated and approved definition TOD. These jurisdiction-specific definitions—both those which acknowledge that they are jurisdiction-specific and those that see their definition as universal—can reveal differing aspirations, goals, or perceived benefits each region seeks through TOD implementation. These definitions prove vital in jurisdictions' generation of "mutual understanding" amongst different parties with interests in TOD.

Common among all definitions of TOD in official guidelines and strategic plans were three core components: density, mixed uses, and walkability. California's definition of TOD offers a representative example of how other states and regions may define TOD as well. California's definition states, "Transit-oriented development (TOD) is moderate to higher-density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment and shopping opportunities designed for pedestrians without excluding the auto".[19] This definition highlights three common core components to these definitions: "moderate to higher-density development," a major transit stop accessible by an "easy walk," and a mixed-use environment containing a variety of live, work, and play opportunities.[20]

The first common core characteristic of a TOD definition relates to density, in particular the relatively-higher density associated with TOD. California and Delaware Valley define this as

[19] California DOT. (2002) Statewide Transit-Oriented Development Study: Factors for Success in California. *California DOT*. 10.
[20] Ibid.

"moderate to high density".[21] Chicago guidelines for density rely on an interpretable "dense and compact" nature.[22] Other definitions rely on interpretation relative to surroundings, including Maryland's guidelines' definition that TOD is development of "relatively higher density"[23], and Cleveland's description of that density as "elevated".[24]

In addition to defining TOD in terms of its relatively higher density, definitions also included a description of TOD in terms of its mixed-use nature. California, Cleveland, Chicago, Delaware Valley, Indiana, and Maryland, all include mixed-use as a core component of TOD. Some guidelines, such as those of California and Delaware Valley, define this mixture of uses more explicitly, stating that, "Mixed uses include residential, commercial, and office, or some combination."[25]

The third core concept of TOD definitions—walkability—is included in virtually all TOD guidelines. Similar to California's definition, most state and regional TOD guidelines define transit-oriented development in terms of pedestrian orientation, or as Cleveland puts it, "pedestrian circulation and accessibility".[26] Chicago, San Diego, and Indiana discuss the ability to "walk to and from a transit station" as a result of higher densities and close proximities. Furthermore, California, Delaware Valley, and Maryland define this as an "easy walk".

In addition to these three commonly-included core concepts, some TOD definitions also include references to a reduced dependence on private vehicles and to the better transit choices that come with TOD. For example, Chicago's definition of TOD describes benefits of destinations in TODs that are within "easy and affordable access at a fraction of the cost of using an automobile".[27]

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[21] California DOT. (2002) Statewide Transit-Oriented Development Study: Factors for Success in California. *California DOT.* 10.
[22] Center for Neighborhood Technology (CNT). (2013). Transit-Oriented Development in the Chicago Region: Efficient and Resilient Communities for the 21st Century. 5. *Center for Neighborhood Technology.* 5.
[23] Maryland DOT. (2003). Purple Line Transit-Oriented Development Guidelines and Principles. *Maryland DOT.*
[24] Greater Cleveland Regional Transit Authority. (2007). Transit Oriented Development Guidelines. *Reconnecting America.* 5.
[25] Delaware Valley Regional Planning Commission (DVRPC). (2007). On Track: Progress Toward Transit-Oriented Development in the Delaware Valley. *Delaware Valley Regional Planning Commission.*
[26] Greater Cleveland Regional Transit Authority. (2007). Transit Oriented Development Guidelines. *Reconnecting America.* 5.
[27] Center for Neighborhood Technology (CNT). (2013). Transit-Oriented Development in the Chicago Region: Efficient and Resilient Communities for the 21st Century. 5. *Center for Neighborhood Technology.*

Similarly, Delaware Valley defines TOD as enabling "residents and workers to drive their cars less and ride mass transit more"[28] while Indiana's definition emphasizes "reduced dependency on vehicles that generate greenhouse gases".[29]

Whether prescribing greater mobility choices, reducing dependence on private vehicles, or emphasizing pedestrian-oriented, mixed-use environments built at higher densities, it is evident that state, regional, and local TOD definitions all shape how TOD is conceptualized and implemented in a given jurisdiction, highlighting the importance of a concerted, deliberate effort in generating a quality definition of TOD.

3.3. Plans' Stated Benefits of TOD

Planning agencies do not advocate for TOD without reason—leading to agencies' advocacy is a realization that the benefits of TOD may be significant for a given jurisdiction. Often, the discussion of these perceived benefits is explicit within the published TOD guidelines.

The main benefits identified by guidelines of TOD implementation generally involve increased transit ridership, increased property values, and health and environmental benefits that are seen as deriving from a more pedestrian- and cyclist-oriented environment dependent less on personal vehicle ownership. In the latter category, benefits often include greater daily physical activity and improved air quality due to reduced personal vehicle use. Figure 3.1 from the Transit Cooperative Research Program reviews the internal weight of stated goals of TOD from the perspective of transit agencies. These goals generally align with non-transit agencies goals for TOD as well.[30]

[28] Delaware Valley Regional Planning Commission (DVRPC). (2007). On Track: Progress Toward Transit-Oriented Development in the Delaware Valley. *Delaware Valley Regional Planning Commission.*
[29] Indy Connect. (2015). Transit Oriented Development Strategic Plan. *Indy Connect.*
[30] Transit Cooperative Research Program (TCRP). (2004). Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects. *Transit Cooperative Research Program.*

Figure 3.1. Relative Frequency of Stated Transit-Agency Goals for TOD Projects[31]

Unsurprisingly for an inventory of transit agency benefits of TOD, increased transit ridership holds more weight as a stated goal of TOD than any other goal. While the potential for property tax increase ranks lowest among goals of transit agencies, one may assume that these increases are far more important for municipal agencies. While the Transit Cooperative Research Program recorded different weights for each stated goal, most guidelines reviewed mention most (if not all) of the stated goals in this chart.

[31] Transit Cooperative Research Program (TCRP). (2004). Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects. *Transit Cooperative Research Program.*

Undoubtedly, an increase in transit ridership can result in a decrease in vehicle miles traveled (VMT), an important root of the perceived environmental benefits of TOD. California states that TOD "reduces air pollution and energy consumption rates,"[32] while other guidelines such as those of Chicago noted that TOD results in "lowered regional congestion, air pollution, and greenhouse gas emissions".[33] Outside of the commonly-mentioned realm of potential air quality improvements, guidelines of California and Cleveland also note TOD's potential improvement of the conservation of open space, or at least the reduction in consumption of existing open space. As California guidelines discuss, TOD consumes less land than conventional, low-density dispersed development thus "[reducing] pressure to convert prime farmland and other resource lands to urban uses and allows agricultural land to be used more productively".[34]

Hand-in-hand with guidelines' discussion of reduced personal vehicle usage and increased transit ridership, virtually all TOD guidelines also address TOD's inherent fostering of walkable environments. High-caliber, deliberate "walkability" in a TOD brings many benefits, including an increase in public safety. As the guidelines of California discuss, TOD can promote public safety by creating places that are busy during the day and at night, placing eyes on public spaces even during off-peak times. Additionally, TOD design principles require deliberate infrastructure for pedestrians and bicyclists with the goal of improving their safety and comfort. By reducing automobile dependence—especially within the boundaries of TOD sites—TOD can also contribute to a reduction in accident injury rates, as noted in Maryland's TOD guidelines.

Leaving the realm of transportation, many TOD guidelines also note TOD's potential boost for economic development and propensity to increase property values. Guidelines of California discuss TOD's potential to increase households' disposable income as a result of reduced automobile expenditures. TOD also has the potential to result in a revitalization of depressed activity centers and neighborhoods, an enhanced tax base and reduction in government spending per capita, and a decrease in new infrastructure needs through the implementation of more

[32] California DOT. (2002) Statewide Transit-Oriented Development Study: Factors for Success in California. *California DOT.*
[33] Center for Neighborhood Technology (CNT). (2013). Transit-Oriented Development in the Chicago Region: Efficient and Resilient Communities for the 21st Century. 5. *Center for Neighborhood Technology.*
[34] California DOT. (2002) Statewide Transit-Oriented Development Study: Factors for Success in California. C*alifornia DOT.* 43.

compact development patterns.[35] Similarly, Cleveland's regional plan recognizes TOD's role in revitalizing neighborhoods, increasing homeownership rates, and generating higher tax revenues from increased retail sales and property values. It also notes TOD's role in improving an area's economic health through a generation of new employment and its resulting new income generation at TODs, as well as a purported higher rate of return for developers.[36]Chicago, Indiana, and Florida also recognize these economic development benefits, particularly the increase in tax revenue through higher property values.

Finally, TOD guidelines often identify an improvement in housing diversity as one of the core benefits of TOD. For example, guidelines of California and Cleveland note a potential for more affordable housing in TOD environments. In addition, many argue that affordable housing that does exist in TODs can be more truly affordable than non-TOD affordable properties, as relatively-low cost transportation options often exist in abundance at TOD sites.

All of these benefits offer persuasive arguments for quality TOD's capacity to strengthen states, regions, and communities that implement TOD. Transit-oriented development can address a plethora of pressing issues, especially when its discussion of benefits is generated for specific contexts. Whether a setting's most pressing problems are environmental, social, economic, or otherwise, TOD guidelines are easily tailored to offer solutions to specific issues.

[35] California DOT. (2002) Statewide Transit-Oriented Development Study: Factors for Success in California. *California DOT.*
[36] Greater Cleveland Regional Transit Authority. (2007). Transit Oriented Development Guidelines. *Reconnecting America.*

3.4. TOD Practice

All TOD guidelines are not created equal, nor do their creators desire them to all be the same. An apt set of guidelines should be directly applicable to a specific context, be that context site-level, network-level, city-level, state-level, or even federal-level. For this literature review, several guidelines were analyzed that encompass more than just the jurisdiction of one municipality. Much like TOD guidelines' discussions of benefits, significant differences were discovered in their proposed "practice" of TOD, especially in terms of transit, land use and intensity, and environmental considerations such as walkability and engineering standards. The different approaches to the creation of TOD guidelines can inform a Texas planning agency's construction of their own guidelines.

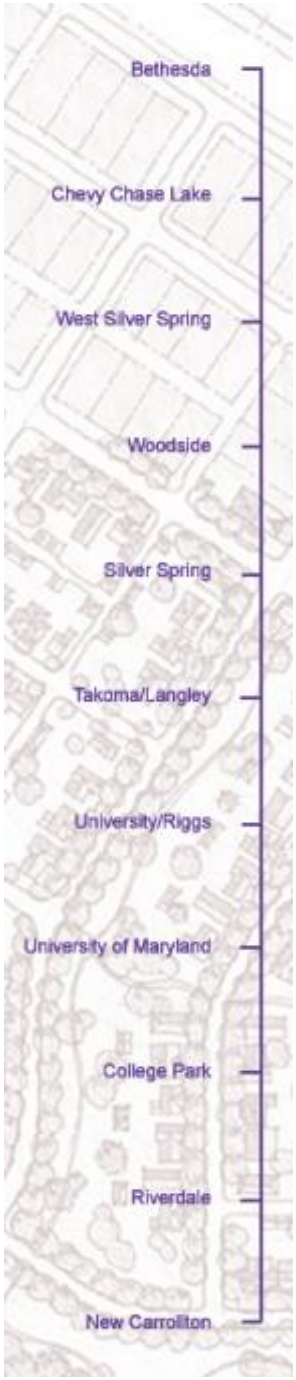


Figure 3.2. Maryland's guidelines are for specific stop locations

3.4.1 Transit Modalities

One of the clearest differentiators of TOD guidelines are their treatment of transit modalities. While some guidelines are clearly geared towards TODs for higher-investment fixed-guideway systems, others acknowledge the benefits of TODs for relatively low-investment projects, such as those which utilize buses. Some TOD guidelines are even geared towards specific in-process flagship capital investment programs, such as the TOD guidelines for Maryland's Purple Line light rail system. For a Texas-wide approach, the consideration of high level bus service (often referred to as "BRT-Lite" service; see Appendix A) is apt, as many areas within the Texas Triangle are not considering fixed guideway systems. In Austin for example, while there are areas with extremely dense bus service, there are currently no in-process plans for fixed guideway systems. To consider Austin's current condition or Waco,

which spatially is prime within the megaregion although has a relatively small operating budget, one should not prescribe TOD only to municipalities investing in infrastructure costing hundreds of millions of dollars.

The Maryland Purple Line's 2003 set of TOD guidelines predates final funding consideration of the Purple Line project by a large margin, and as of 2017 ground has not yet been broken for this new transit line. However, the benefits of developing relatively specific guidelines in an early stage are clear, and the conclusions made in the guidelines were likely a part of the argument in the final stretches for acquisition of capital investment. The first and foremost of benefits for this type of guidelines are that they may be used to reference a specific environment that are already known. For example, Maryland's Purple Line guidelines note the specific towns in which the Purple Line will stop, even though the exact stop locations were not known when the guidelines were created (see Figure 3.2).[37] These locations are not discussed in this document in-depth, which is a lost opportunity, but they were known and likely considered when other recommendations were made. This type of guidelines may also state with confidence development goals with specific transit ridership goals in mind, minimizing ambiguity for recommendations and maximizing overall utility of the land and transit system.

While line-specific TOD guidelines are certainly valuable, there are some areas which aspire to TOD which do not yet anticipate significant development in transit, or, more commonly, there is a major planning body (such as at the state level) providing guidelines on TOD for all of their constituents, even those outside of areas where fixed-guideway systems are cost effective. For example, Florida's DOT TOD guidelines are applicable to the entire state of Florida in spite of the fact that Florida is indisputably categorized as generally auto-oriented, even in cities. To make its guidelines useful, Florida offers clear guidelines for different transit types (light rail, commuter rail, buses, etc.) as they apply to TOD. For example, the guidelines discuss headways of specific transit types, and roughly how much transit-oriented development may be planned for these given headways. The guidelines suggest "premium levels of service" are ideal for TOD, which may be perceived differently by different areas of Florida. Even though these guidelines can sometimes be specific, they almost universally add sections explaining from a basic level the

[37] Maryland DOT. (2003). Purple Line Transit-Oriented Development Guidelines and Principles. *Maryland DOT.*

concepts of TOD for those who are not familiar with TOD. In these sections, writers discuss TOD at a very high level, explaining non-specifically what TOD is and how it can be applied in the broadest of senses. This may also be valuable to the creation of a Texas Triangle-level set of guidelines, as jurisdictions within the megaregion may be unfamiliar with the concept, especially if they do not have significant transit.

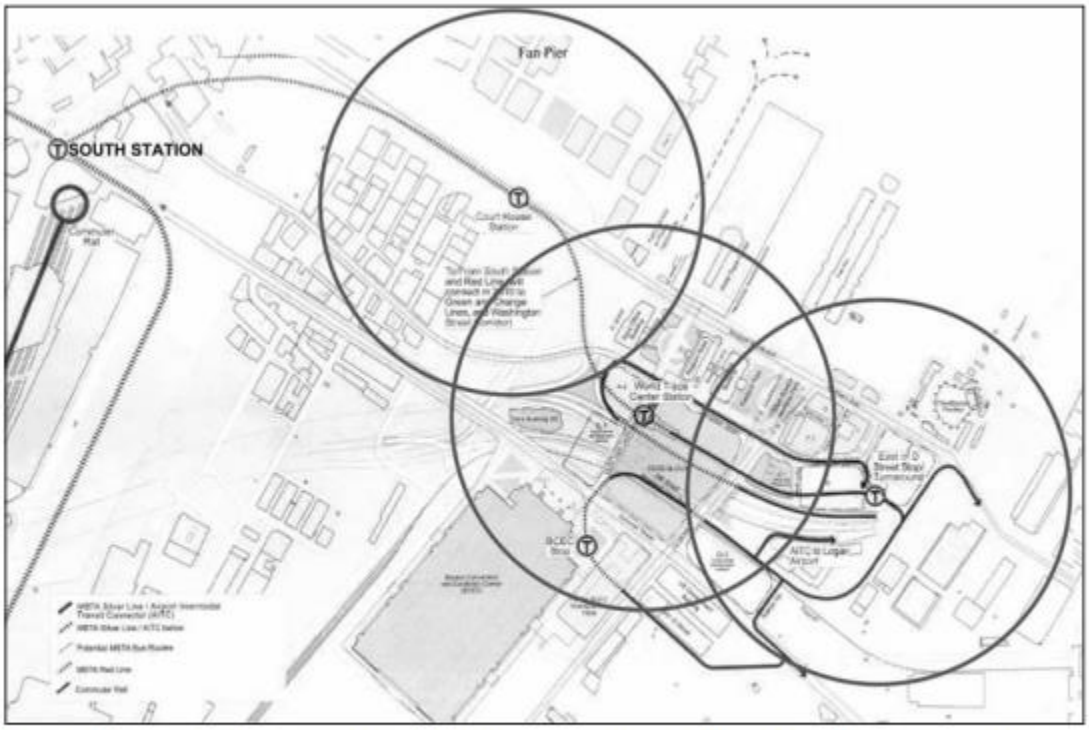
Federal Transit Administration New Starts Application Statistics

	Length (miles)	Number of Stations	Ridership (000)	New Riders (000)	Station Spacing (miles)	Ridership per mile	Ridership per station
COMMUTER RAIL							
Tri-Rail (South Florida)	71.1	19	68	30	3.7	1,000	3,600
Harrisburg Corridor One Rail	37.4	7	1.6	NA	5.3	NA	200
Orlando Commuter Rail	31.0	12	7.4	3.7	2.6	200	600
Minneapolis North Star	40.0	6	5.6	1.3	6.7	100	900
Salt Lake Weber County	43.0	8	11.8	6.1	5.4	300	1,500
Nashville East Corridor	32.0	6	1.9	1.9	5.3	100	300
Raleigh-Durham Regional Rail	28.1	12	NA	NA	2.3	NA	NA
Average Commuter Rail	**40.4**	**10.0**	**16.1**	**8.6**	**4.5**	**340**	**1,183**
LIGHT RAIL TRANSIT (LRT)							
Sacramento South Corridor	4.3	4	11.3	2.6	1.1	2,600	2,800
St Paul/Minneapolis Central Corridor	11.0	16	43.3	6	0.7	3,900	2,700
Charlotte Northeast Corridor	10.7	14	10.5	3.5	0.8	1,000	800
Salt Lake Mid-Jordon	10.6	9	9.5	3.7	1.2	900	1,100
Norfolk, VA	7.4	11	6.5	1.6	0.7	900	600
Los Angeles Exposition Corridor	9.6	8	NA	NA	1.2	NA	NA
Orange County, CA Centerline	9.3	16	NA	NA	0.6	NA	NA
Denver West Corridor	12.1	12	28.7	4.7	1.0	2,400	2,400
Tampa Bay Regional Rail	20.1	26	NA	NA	0.8	NA	NA
Portland South Corridor	8.3	15	46.5	9.4	0.6	5,600	3,100
Dallas Northwest/Southeast	20.9	16	45.9	10.7	1.3	2,200	2,900
Average LRT	**11.3**	**13.4**	**25.3**	**5.3**	**0.9**	**2,438**	**2,050**
BUS RAPID TRANSIT (BRT)							
Houston North Corridor	5.4	8	11.4	3.1	0.7	2,100	1,400
Houston Southeast Corridor	6.0	11	13.9	3.3	0.5	2,300	1,300
Kansas City Troost Corridor	9.0	25	9	1.2	0.4	1,000	400
Springfield Pioneer Parkway	7.8	14	3.7	0.4	0.6	500	300
King County Pacific South	10.4	14	8.2	NA	0.7	800	600
Fort Collins Mason	5.3	17	5.9	1.1	0.3	1,100	300
Kansas City South town	9.7	33	4.4	NA	0.3	500	100
Average BRT	**7.7**	**17.4**	**8.1**	**1.8**	**0.5**	**1,186**	**629**

Figure 3.3. FTA New Starts Statistics, as provided by FDOT for application to Florida[38]

[38] Florida Department of Transportation (FDOT). (2012). Florida Transit Oriented Development Guidebook. *Florida Department of Transportation.*

One step further in general applicability was TCRP's TOD guidelines, one of the only published federally-funded (and federal-level) TOD guidelines in existence. Unsurprisingly, this set of guidelines offers little advice for specific types of projects. It does however make excellent use of examples (see Figure 3.4), and its writers have chosen what they believe are the most prime examples of TOD successes around the country. The goal with this document is for planners to use it generally (especially those less familiar with TOD) and then to complete further research on more specific comparable guidelines as they see fit. This document is particularly apt for its reach: nearly all planners can benefit from its clear layout of TOD information and generalized ideas about TOD. That being said, those tasked with TOD for a specific area will need more specific guidance along the line.



Map 10.3. Walkable ¼-Mile Radii Surrounding Silver Line Transit Stations in the Seaport District. The line will connect the isolated Seaport District with multimodal South Station. *Source:* MASSPORT.

Figure 3.4. TCRP's federal guidelines make use of examples, such as stations around Boston[39]

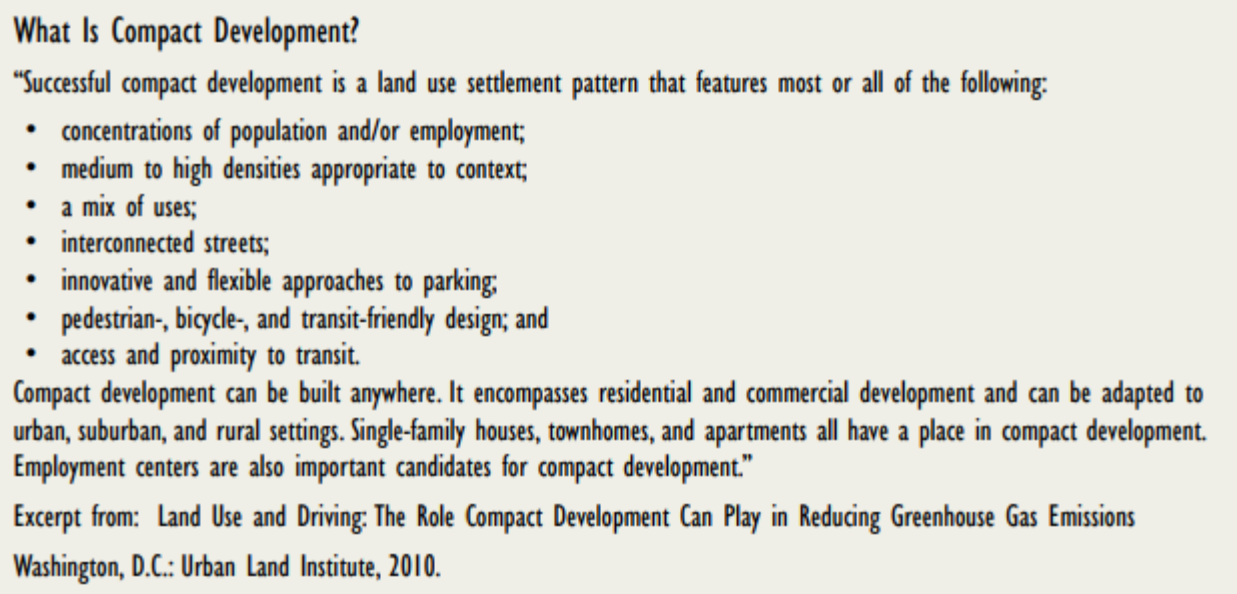
[39] Transit Cooperative Research Program (TCRP). (2004). Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects. *Transit Cooperative Research Program.*

One element that virtually all TOD guidelines have is a justification for increased transit spending for infrastructure, stated either directly or indirectly. Nearly all cite goals for TOD that are likely their goals for their transit system as a whole as well. For example, nearly all guidelines cite decreased VMTs or decreased car trips as a goal or benefit of TOD, usually accompanied by a goal of reducing congestion increases or curbing emissions and pollution. These goals are the same goals as almost any transit investment in the United States. Some also cite a benefit of TOD as means to decrease overall infrastructure spending. This again may be applied generally as a goal of most transit systems which compete with auto users, especially when considering regional transit investment competing with regional personal-vehicle oriented highway investment.

3.4.2. Land Use and Intensity

Generally, TOD guidelines offer non-specific advice for land use within the TOD, and that non-specific advice is essentially universal, found in any set of guidelines. All guidelines state that development should be mixed-use, and all guidelines discuss the benefits to vertical and horizontal mixed uses. They also discuss that densities should be either "middle" or "high", although some note that these descriptors are relative to the community around the station. This distinction seems apt—while "high" density may exist in a city center a neighborhood TOD would likely only strive for "higher" density if surrounded by existing single family or low density commercial land uses.

Commonly, these land-use guidelines mirror—often directly—compact development guidelines. Sometimes, one may wonder if TOD guidelines set forth are a proxy for compact development guidelines, as is the case with the Florida (See Figure 3.5). However, planners may acknowledge in these cases that compact development cannot reach its full utility potential without access to quality regional transit. It may be possible that the joint discussion of compact development guidelines with TOD guidelines maximizes efficiency of operations and maximizes the results of attempts at either compact development or TOD, essentially rendering these ideas undivorceable in practice.



What Is Compact Development?

"Successful compact development is a land use settlement pattern that features most or all of the following:

- concentrations of population and/or employment;
- medium to high densities appropriate to context;
- a mix of uses;
- interconnected streets;
- innovative and flexible approaches to parking;
- pedestrian-, bicycle-, and transit-friendly design; and
- access and proximity to transit.

Compact development can be built anywhere. It encompasses residential and commercial development and can be adapted to urban, suburban, and rural settings. Single-family houses, townhomes, and apartments all have a place in compact development. Employment centers are also important candidates for compact development."

Excerpt from: Land Use and Driving: The Role Compact Development Can Play in Reducing Greenhouse Gas Emissions

Washington, D.C.: Urban Land Institute, 2010.

Figure 3.5. Compact development is so prominent to Florida's TOD strategy that the concept is specifically defined in the TOD guidelines[40]

Some guidelines state more clear metrics for appropriate land use. For example, Indianapolis's guidelines discuss the benefits of "employment density" as a chief metric over all else in predicting success of a project.[41] Maryland also calls for a calculation of employment and residential densities during the planning process, although doesn't opine about the use of one metric over another.[42] Some, including Chicago's plan, call for affordable housing—either maintenance of existing affordable housing in the TOD, or creation of new, non-market rate housing within the TOD.[43]

3.4.3. Environment

TOD guidelines shine in their discussion of the environment surrounding TODs with discussion of walkability, civil engineering around the station, etc. One universal in all guidelines is that cyclists and pedestrians should receive priority over personal auto users in any TOD, especially

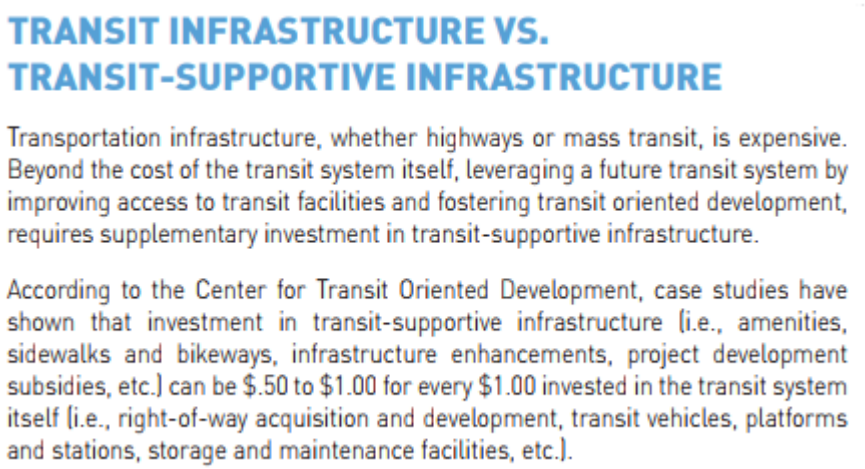
[40] Florida Department of Transportation (FDOT). (2012). Florida Transit Oriented Development Guidebook. *Florida Department of Transportation.*
[41] Indy Connect. (2015). Transit Oriented Development Strategic Plan. *Indy Connect.*
[42] Maryland DOT. (2003). Purple Line Transit-Oriented Development Guidelines and Principles. *Maryland DOT.*
[43] Center for Neighborhood Technology (CNT). (2013). Transit-Oriented Development in the Chicago Region: Efficient and Resilient Communities for the 21st Century. 5. *Center for Neighborhood Technology.*

compared to conditions in non-TOD sites surrounding the area. The methods for reaching this condition and for reaching other environment conditions deemed ideal vary from document to document.

Compelling in guidelines are location-specific recommendations, especially for environmental conditions. Even though its guidelines are state-wide, Florida DOT recommends architecture and landscaping particularly for the Florida context.[44] The guidelines note Florida's propinquity for daily storms (often severe), and intense heat. If Florida is to curb its "auto-oriented culture", developers must develop networks of spaces that can be used 12 months of the year, as many (if not most) cannot cope with the extremes of the Florida climate without some sort of protection. While this type of location-specific recommendation was missing from northern examples, one may posit that a TOD in an intense winter climate must provide wind-blocking facilities, snow-removal friendly surfaces, etc. For the Texas Triangle, it may be important to note the intense heat that overwhelms the region in the summer. Additionally, an apt set of guidelines will also need to address Texas's propinquity to flood, severely as was the case in Houston during Hurricane Harvey in 2017. Explicitly acknowledging these realities for the region will only make guidelines more compelling.

[44] Florida Department of Transportation (FDOT). (2012). Florida Transit Oriented Development Guidebook. *Florida Department of Transportation.*

As with other TOD planning sections of guidelines, many examples go in-depth to validate and explain their rationale for possibly-controversial suggestions, which may also be important in Texas, as many are averse to government spending that goes against the state's supposed Liberalist roots. Prior to making specific recommendations for sidewalk length, etc., Indianapolis offers a disclaimer that transit-supportive infrastructure is vital to the success of the project, even offering a specific, attainable number for that spending compared to transit infrastructure spending (see
Figure 3.6). The document then goes on to explain necessary improvements to things such as sidewalks and pathways, bike routes, and (ideally) a connected street network to connect all locations well to the station area.[45]



TRANSIT INFRASTRUCTURE VS. TRANSIT-SUPPORTIVE INFRASTRUCTURE

Transportation infrastructure, whether highways or mass transit, is expensive. Beyond the cost of the transit system itself, leveraging a future transit system by improving access to transit facilities and fostering transit oriented development, requires supplementary investment in transit-supportive infrastructure.

According to the Center for Transit Oriented Development, case studies have shown that investment in transit-supportive infrastructure (i.e., amenities, sidewalks and bikeways, infrastructure enhancements, project development subsidies, etc.) can be $.50 to $1.00 for every $1.00 invested in the transit system itself (i.e., right-of-way acquisition and development, transit vehicles, platforms and stations, storage and maintenance facilities, etc.).

Figure 3.6. Indianapolis offers this specific number for supportive infrastructure spending prior to discussion of infrastructure spending that will be needed.[46]

[45] Indy Connect. (2015). Transit Oriented Development Strategic Plan. *Indy Connect.*
[46] Ibid

Chapter 4. Transit Technologies in the Texas Triangle

4.1. Introduction

The four major cities in the Texas Triangle--Austin, Dallas, Houston, and San Antonio--are experimenting with different rapid transit technologies to cope with their rapid growth. Each of these cities offer standard buses and paratransit service as one may find in virtually any American city. However, each of these four cities has found that these non-rapid forms of public transit are not moving people quickly enough through their rapidly-expanding cities. Standard buses are often unable to compete with personal vehicles in the Texas Triangle, and importantly are not guiding these cities' swift development in meaningful ways. To both improve conditions for non-personal vehicle users and to drive sustainable development at specific nodes or corridors, each of these cities is investing significantly in rapid transit infrastructure. Not surprisingly, these cities' unique selections of rapid transit modalities are as diverse as the cities themselves.

For a list of all counties served by public transit in the Texas Triangle, and the transit providers which operate within these counties, see Appendix B "Public Transit in the Texas Triangle".

4.2. Austin

The capital of the state of Texas is a city encumbered by traffic congestion. While all other major cities in the Texas Triangle have at least 2 (generally) controlled-access beltways forming rings around their cities, Austin does not have any completed beltways, and has no existing plans for a beltway to be completed.

This lack of a beltway has created a reliably linear development pattern in Austin, unique in the Texas Triangle. Development has sprawled north and south along Austin's two main highway corridors--I-35 to its east and Loop One (Mopac) to its west. Generally, this development is driven by low-density residential construction. Many of Austin's jobs have remained downtown, leaving many areas of Austin's central business district without necessary residences. Austin's

downtown has over 86,000 employees[47] and The University of Texas at Austin employs another 21,000,[48] generating significant traffic congestion from north and south to the central business district. The city's main transit provider is Capital Metropolitan Transit Authority, or CapMetro. The Austin metropolitan region has a population of approximately 2 million.

The Austin metropolitan region currently has no plans to construct new rapid transit routes or systems.

4.2.1. Capital Metro MetroRail Commuter Rail

CapMetro's commuter rail service—MetroRail—was commenced in 2010 along an active freight line owned and operated by CapMetro. The agency's first foray into rapid transit in its history, MetroRail was a source of great fanfare, but also of significant nationwide public ire as cost overruns grew dramatically and ridership projections were not met.[49]

The MetroRail service forms the backbone of Austin's transit-oriented development ambitions. Stations proximate to downtown have transit-oriented development plans and have seen transit-oriented development generated, although these TOD sites have seen varying levels of success. Most stations in the northern suburbs of the Austin metropolitan region have seem some development, and development for yet-underdeveloped station areas continues to grow. Ridership in FY2017 was approximately 820,000 boardings over the line's 32 miles of track.[50]

4.2.2. Capital Metro MetroRapid BRT-Lite

In 2014, CapMetro began experimenting with bus rapid transit (BRT), with a pair of decidedly "BRT-lite" routes. The agency noted potential in their two most heavily-ridden standard bus routes and developed a BRT-lite parallel service to augment the standard routes. MetroRapid routes chart courses similar to those of the standard routes on which they are based, but stops are spaced ¼ mile to ½ mile apart.

[47] Pritchard, Caleb. (2017). Austin's Next Mobility Challenge: Free Parking. *Austin Monitor*.
[48] Drake, Sarah, et al. (2012). UT is Austin's Largest Employer. *Austin Business Journal*.
[49] Beyer, Scott. (2016). Austin's Commuter Rail is a Monument to Government Waste. *Forbes*.
[50] Capital Metro. (2017). Monthly Ridership Report: Fiscal Year End 2017. *Capital Metro.*

While not approaching the quality of a full BRT system, MetroRapid utilizes reduced interpretations of several core BRT-specific strategies. MetroRapid buses utilize some dedicated rights-of-way in the central business district and have basic signal preemption technology. These buses also have options for off-board fare collection through the use of CapMetro's mobile app. The stations along MetroRapid routes are branded and significant, offering basic shelter, seating, and real-time departure information. Most importantly, MetroRapid buses have a decidedly high on-peak frequency of service. For more information on BRT-lite systems in the Texas Triangle, see Appendix A.

While no TOD-specific regulations have been enacted around MetroRapid-only stations, transit planners with CapMetro have developed an inventory of TOD-related site conditions around all MetroRapid stations with the goal of attracting semi-planned transit-oriented development along MetroRapid corridors. MetroRapid operates two routes that travel a total of 34.5.miles[51] on Austin's arterial streets, and annual ridership in FY2017 was approximately 3,400,000 boardings, over 4 times the frequency of MetroRail boardings.[52]

4.3. Dallas

The Dallas-Fort Worth Metroplex is the Texas Triangle's largest Metropolitan Statistical Area with over 7 million inhabitants. While the metropolitan region is comprised of several smaller cities which occasionally employ some autonomy over their own public transit systems, the core transit authority in the metropolitan region is Dallas Area Rapid Transit, or DART.

There are several significant hubs of residential and employment activity around the Dallas-Fort Worth metropolitan region, generating a complex web of commute patterns. Notably however, Dallas also has a large population of inner-city residents who also work in the inner-city. Over 900,000 people both live and work in Dallas County, highlighting the importance of intracity rapid transit in the Dallas area.[53]

[51] Federal Transit Administration. (2018). MetroRapid Bus Rapid Transit Project Before-And-After Study. *Federal Transit Administration.*
[52] Capital Metro. (2017). Monthly Ridership Report: Fiscal Year End 2017. *Capital Metro.*
[53] Dallas Chamber. (2017). Commuting Patterns; Getting to Work. *Dallas Economic Development Guide.*

In addition to existing rapid transit systems in the Dallas-Fort Worth area, a 27-mile commuter rail named the TEXRail is under construction and will link Dallas-Fort Worth International Airport and downtown Fort Worth.

4.3.1. Dallas Area Rapid Transit (DART) Light Rail

The DART Light Rail operates 4 routes around the Dallas area, forming the largest light rail network in the United States as measured by track length. The system opened in 1996 and has regularly expanded into far-reaching suburban cities around the metropolitan area. Many of the cities served by DART light rail have generated their own transit-oriented development plans for station areas, although many cities are still planning station areas and hoping to generate transit-oriented development. Researchers at the University of North Texas estimate that around $10.8 billion worth of public projects and privately funded transit-oriented development was constructed between 1999 and 2018 along the light rail line.[54]

There are plans to extend all four of DART's light rail lines by 2030. In FY2017, ridership on the light rail network was 30.1 million passenger trips over 93 miles of tracks.[55]

4.3.2. Trinity Railway Express Commuter Rail

Based on a joint partnership between Dallas Area Rapid Transit and the Fort Worth Transportation Authority, Trinity Railway Express (TRE) forms the transit connection between downtown Dallas and downtown Fort Worth. Originally opened in part in 1996, the heavy rail line finally connected Dallas to Fort Worth in 2001. Several municipalities have introduced TOD plans for their station areas, including Richland Hills.[56] In FY2017 Trinity Railway Express had 2.1 million passenger trips over the line's 34 miles.[57]

[54] Sneider, Julie. (2018). DART's Light Rail System Is About to Get Even Longer. *Progressive Railroading.*
[55] Dallas Area Rapid Transit. (2017). DART Facts. *Dallas Area Rapid Transit.*
[56] URS Urban Design Studio. (2009). Richland Hills Trinity Railway Express (TRE) Station. *Richland Hills.*
[57] Dallas Area Rapid Transit. (2017). DART Facts. *Dallas Area Rapid Transit.*

4.3.3. Denton County Transportation Authority (DCTA) A-train Commuter Rail

The Denton County Transportation Authority's A-train is a commuter rail line operating in Denton County. The A-train overlaps with the DART Light Rail Green Line at two stations along shared tracks before continuing north, acting as a de facto extension of the Green Line. The commuter rail service opened in 2011; contemporary ridership data for the 21-mile line is not publicly available.

4.4. Houston

The Houston metropolitan region is the Texas Triangle's second-largest metropolitan region with a population of nearly 7 million. While Houston's population within its city limits make it the most populated city in the southern United States, Houston is also a city with significant sprawl. Houston is known for its suburban growth, driven in part by loose development restrictions that form a unique part of the identity of the Houston metropolitan area.

Most of the Houston metropolitan region is served by the Metropolitan Transit Authority of Harris County, better known as METRO, although some areas within Harris County are also served by Harris County Transit.

In addition to existing rapid transit systems in the Houston metropolitan area, a 4.7-mile bus rapid transit (BRT) route named the Uptown Line is under construction and will serve Houston's Uptown when it opens in 2019.

4.4.1. METRORail Light Rail

Houston's METRORail is a 23-mile light rail system that operating on 3 lines. The system was opened to riders in 2004. No rail extensions are to this line are currently under construction, however the Uptown Line, originally planned as a light-rail extension, is currently under construction as a bus rapid transit (BRT) line. While Houston has identified several stations with noteworthy potential for TOD development, many stations were built around existing dense

development. Between 2014 and 2016, Houston's METRORail experienced some of the most significant ridership increases of any rail rapid transit system in the country, while most rail systems in the United States were losing ridership.[58] METRORail ridership in calendar year 2016 was over 18 million boardings.[59]

4.5. San Antonio

San Antonio sits in the southwestern corner of the Texas Triangle, with a metropolitan area population of over 2 million. San Antonio is the only major metropolitan region in the Texas Triangle without any form of intracity rail service,[60] making San Antonio one of the largest cities in the United States without rail service. San Antonio's transit operator is VIA Metropolitan Transit.

The San Antonio metropolitan region currently has no plans to construct new rapid transit routes or systems.

4.5.1. VIA Primo BRT-Lite

VIA Primo, a BRT-lite, limited-stop bus is San Antonio's only foray into rapid transit service. The service, which now offers two routes that traverse the San Antonio metropolitan area, commenced in 2012. The service's Primo 100 route offers several reduced interpretations of some core BRT-specific strategies. The Primo 100 route offers significant stop infrastructure with branding and designated seating areas, as well as real-time departure information. However, the service it does not utilize designated rights-of-way. In addition, buses along Primo routes do not utilize a high frequency of service, which is one of the core elements of BRT-lite systems. For more information on BRT-lite systems in the Texas Triangle, see Appendix A. Ridership in FY2016 was roughly 2 million for VIA Primo routes.[61]

[58] Rowlands, DW. (2018). Metrorail is No Longer the Second-Busiest Rapid Transit System in the Country. *Greater-Greater Washington.*
[59] American Public Transportation Authority. (2017). Public Transportation Ridership Report, Fourth Quarter 2016. *American Public Transportation Association.*
[60] Express-News Editorial Board. (2018). No Rail in Transit Plan? No Problem. *My San Antonio.*
[61] My San Antonio. (2016). A Primo Reason for More VIA Funding. *My San Antonio.*

Chapter 5. TOD Typologies in the Texas Triangle

5.1. Methodology

TOD typologies for the Texas Triangle were generated based on three factors: regional location, transit technology, and whether or not the rapid transit station is a "special destination." First, stations were designated based on 4 regional location-based classifications:

1. The urban core of the city,
2. "High urban" which is a node of urban development that may feasibly develop into a regionally-important urban core,
3. "Medium urban" which is a node of urban development which is unlikely to develop into a regionally-important urban core, and
4. Suburban, which is a station lying outside of urban areas.

Note that there are no rapid transit stations in the Texas Triangle that are considered rural.

The station area typologies resulting from these regional locations are as follows:

- Urban Core = Urban Core Typology
- "High Urban" = Town Center Typology
- "Medium Urban" = Neighborhood Center Typology
- Suburban = Suburban Typology
- Special Destination = Special Destination Typology

Applying transit technologies to these typologies is challenging in the Texas Triangle. While most megaregions offer numerous rapid transit technologies that interact, each serving a specific need within the megaregion, rapid transit technologies in the Texas Triangle are not necessarily employed utilizing the highest-and-best use of the technology. Many cities in megaregions utilize a portfolio of specifically-chosen transit technologies to accomplish fundamentally different tasks. For example, while the Washington, D.C. metropolitan region is smaller in population than Houston or Dallas, the region has the following portfolio of rapid transit systems:

- Washington Metro—a high-capacity metro rapid transit, serving Washington, D.C., Northern Virginia, and Central Maryland along several lines, all of which are situated underground while traversing dense urban areas
- DC Streetcar—a growing streetcar network serving medium-density neighborhoods
- MARC Trains—a heavy commuter rail with limited stops between Maryland, Washington, D.C. and West Virginia along several lines
- Virginia Railway Express—a heavy commuter rail from Washington, D.C. to Virginia
- Amtrak—a hybrid service operating both as heavy, limited-stop commuter rail for some passengers, as well as an intercity transit connection to the rest of the northeast megaregion, offering some high-speed technologies
- Metroway—a bus rapid transit route from Pentagon City to Crystal City in Northern Virginia

In stark contrast, Houston merely employs light rail to realize all of its rapid transit goals, and Dallas employs light rail and one commuter rail line. This proves challenging in defining typologies for Texas Triangle TOD sites because the rapid transit technologies being utilized aren't necessarily employed in utility-maximizing manners. For example, while a suburban park-and-ride facility far outside of a CBD would generally be a candidate for a quick and efficient commuter rail line, in Austin some stations of this type utilize BRT-lite (ex: Tech Ridge Station).

In examining how different transit technologies interact with the aforementioned TOD station area typologies, it was found that rail technologies—regardless of specifics of that technology—usually generate the same forms of TOD in the Texas Triangle. As a result, a general rail subcategory of typologies was identified for Urban Core and Town Center station area typologies. This subcategory is contrasted with the BRT subcategory for these station area typologies. For Neighborhood Centers and Suburban Destinations, no significant distinctions were found between rail technologies and BRT technologies in the eventual TOD production at these sites.

Apart from these more standard typologies, stations were also designated Special Designation (without regard to their rapid transit technology) if they formed a special destination for the area

they serve. Generally, these stations experience fluctuating demand, either throughout the day, such as with an airport, or throughout the year, such as with fairgrounds or a stadium. These stations are typically not suitable for standard TOD-style residential or commercial development as a result of the intense land uses that are usually found at these sites, further highlighting the importance of a unique classification.

5.2. Typologies

This process led to the development of the following TOD typologies:

- Urban Core – Rail
- Urban Core – BRT
- Town Center – Rail
- Town Center – BRT
- Neighborhood Center
- Suburban
- Special Destination

Detailed discussion of these typologies follows. In addition, an inventory of all rapid transit systems in the Texas Triangle and their corresponding typologies follows in "5.3. Inventory of Texas Triangle Rapid Transit Station Typologies".

It is important to note that these station area classifications are not intended to be permanent for all station areas. In fact, many station areas may be expected to rise to higher typologies, especially as these areas see development pressure. For example, while a station may currently be Suburban, planners may seek to increase development at a later date to generate a Neighborhood Center.

Table 5.1. Typologies of Rapid Transit Stations in the Texas Triangle

TOD Typology	Land Use and Scale	Transit Modes	Connections with Transit	Texas Example
Urban Core(s) ***(Rail-Based)*** 1 in Austin 4 in Dallas 12 in Houston	-The highest density in the metropolitan area. High-rises and some mid-rises. -Highest density of employment in the metropolitan area -Intense mixed-use development horizontally and vertically, with increasing residential options -Key cultural and civic institutions are served by major stations	-Fixed-guideway rail service -Grade-separation at key congestion points (or fully grade-separated throughout the core, if not throughout the network) -Core urban bus routes stop directly at transit stations frequently and utilize dedicated transit lanes	-The vast majority of riders will walk or bike from stations to their destination -Urban environment should envelop transit stations -No park-and-rides and minimal transfers to personal vehicles to reach destinations -Surface parking should be nonexistent around stations	Houston's UH-Downtown
Urban Core(s) ***(BRT-Based)*** 6 in Austin 11 in S Antonio		-Dedicated transit lanes throughout urban core -Core non-BRT bus routes stop directly at transit stations frequently and utilize dedicated transit lanes, but can be passed when stopped		Austin's Republic Square

Table 5.1 Continued. Typologies of Rapid Transit Stations in the Texas Triangle

TOD Typology	Land Use and Scale	Transit Modes	Connections with Transit	Texas Example
Town Center ***(Rail-Based)*** 1 in Austin 4 in Dallas 3 in Houston	-Urban nodes of density surrounding the urban core(s) -Nodes generally radiate ¼-½ mile from stations -Generally mid-rise construction with a focus on residential, but some vertical mixed-use and significant horizontal mixed use	-Fixed-guideway service with direct connections to the CBD and urban core(s) -Bus connections exist, yet minimally disrupt the environment and minimally impede active transportation	-Most riders will walk or bike to their destinations -Surface parking around station should be virtually nonexistent -Park-and-rides and transfer facilities for personal vehicles are secondary or nonexistent	Dallas' Mockingbird
Town Center ***(BRT-Based)*** 3 in Austin 3 in S Antonio		-Service with direct connections to the CBD and urban core(s) utilizing transit lanes at significant congestion points -Local bus connections exist, yet minimally impede active transportation		San Antonio's Ewing Halsell

Table 5.1 Continued. Typologies of Rapid Transit Stations in the Texas Triangle

TOD Typology	Land Use and Scale	Transit Modes	Connections with Transit	Texas Example
Neighborhood Center 33 in Austin 42 in Dallas 21 in Houston 9 in S Antonio	-Nodes of density as the area transitions from urban to suburban, these areas are less connected to the urban core(s) than Town Centers -Generally, higher density areas within residential neighborhoods, although may be employment-intensive -Strong concentration of multi-family with some dense single-family areas -Service-oriented businesses create mixed use, generally horizontally along a "Main Street"	-BRT-based or rail-based, should offer direct connection to the CBD -Commuter bus stops destined for employment centers, likely passing through other neighborhoods on the route -Local buses serve destinations throughout the neighborhood and radiate outwards	-Stops for connecting transit vehicles should keep in mind likely transfer paths -Most transit users will walk or bike to their final destination, although transfers will be common. Some may drive to their final destination. -Minimal infrastructure exists at stations to ensure smooth transitions to neighborhoods -Park and rides may exist, especially on parcels that are zoned for denser development when demand rises	(Dallas') Downtown Plano

Table 5.1 Continued. Typologies of Rapid Transit Stations in the Texas Triangle

TOD Typology	Land Use and Scale	Transit Modes	Connections with Transit	Texas Example
Suburban 5 in Austin 15 in Dallas 3 in Houston	-Park and Ride is the primary use adjacent to stations and should be sized maximally. -Some commercial uses serving transit users are ideal -New construction in the area is encouraged on the outskirts of the park-and-ride	-BRT-based or rail-based, trips may involve connections to the CBD and urban core(s) -Local buses should be timed with other transit modes and should stop adjacent to the station. Buses will radiate outwards -Commuter buses radiating out from the suburbs should utilize the transit station exclusively for suburban trips	-Some will bike to their final destination, few will walk -Protected bike parking is encouraged, as are bike facilities radiating from the station -Traffic patterns are encouraged to highlight kiss-and-ride facilities at station's edge over parking facilities -Parking may be free or priced depending on parking demand and utilization of the transit service. Off-peak use may be priced independently	Austin's Leander Station

Table 5.1 Continued. Typologies of Rapid Transit Stations in the Texas Triangle

TOD Typology	Land Use and Scale	Transit Modes	Connections with Transit	Texas Example
Special Destination 5 in Dallas	-Regionally-significant institutions. Some destinations affect demand in a "pulse" pattern, such as a sports or entertainment venue. Others pulse but are steadier, as with an airport -Land use around the station is likely commercial -Development is dependent upon the destination, and will experience demand pulses with the destination	-BRT-based or rail-based, depending on peaking intensity of demand -Local buses should not serve this destination if it is inefficient in off-peak seasons or times -Event shuttle service may be employed depending on the destination and demand. This may be through the transit provider or a private contractor	-Virtually all will walk to their final destination -Station should open directly onto the destination or should connect positively with the destination, minimally conflicting with vehicles -Station should not be positioned such that it generates a hazard when it is over-capacity -Large parking areas for the destination may be utilized as park-and-ride facilities when the destination is not in use	Dallas' Fair Park

5.3. Inventory of Texas Triangle Rapid Transit Station Typologies

Table 5.2. Austin Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
Organized (roughly) from North to South, West to East				
Austin	BRT	801	Tech Ridge	Suburban
Austin	BRT	801	Chinatown	Neighborhood Center
Austin	BRT	801	Masterson	Neighborhood Center
Austin	BRT	801	Rundberg	Neighborhood Center
Austin	BRT	801	North Lamar Transit Center	Neighborhood Center
Austin	BRT	801	Brentwood	Neighborhood Center
Austin	BRT	801	Triangle	Town Center
Austin	BRT	801	Hyde Park	Neighborhood Center
Austin	BRT	801	Audiorium Shores	Neighborhood Center
Austin	BRT	801	SoCo	Neighborhood Center
Austin	BRT	801	Oltorf	Neighborhood Center
Austin	BRT	801	St. Edward's	Neighborhood Center
Austin	BRT	801	South Congress Transit Center	Neighborhood Center
Austin	BRT	801	Little Texas	Neighborhood Center
Austin	BRT	801	Pleasant Hill	Neighborhood Center
Austin	BRT	801	Southpark Meadows	Neighborhood Center
Austin	BRT	803	Domain	Neighborhood Center
Austin	BRT	803	UT Research Campus	Neighborhood Center
Austin	BRT	803	Crossroads Station	Neighborhood Center
Austin	BRT	803	Ohlen	Neighborhood Center
Austin	BRT	803	Northcross	Neighborhood Center
Austin	BRT	803	Justin	Suburban
Austin	BRT	803	Allandale	Neighborhood Center
Austin	BRT	803	North Loop	Neighborhood Center
Austin	BRT	803	Sunshine	Town Center
Austin	BRT	803	Rosedale	Neighborhood Center
Austin	BRT	803	West 38th	Neighborhood Center
Austin	BRT	803	Barton Springs	Neighborhood Center
Austin	BRT	803	Lamar Square	Neighborhood Center
Austin	BRT	803	Oltorf West	Neighborhood Center
Austin	BRT	803	Bluebonnet	Neighborhood Center
Austin	BRT	803	Brodie Oaks	Neighborhood Center

Table 5.2 Continued. Austin Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
Austin	BRT	803	Seaholm	Town Center
Austin	BRT	803	Westgate	Neighborhood Center
Austin	BRT	803 / 801	UT Dean Keaton	Urban Core
Austin	BRT	803 / 801	UT West Mall	Urban Core
Austin	BRT	803 / 801	Museum	Urban Core
Austin	BRT	803 / 801	Capitol	Urban Core
Austin	BRT	803 / 801	Austin History Center	Urban Core
Austin	BRT	803 / 801	Republic Square Park	Urban Core
Austin	CRT	Red Line	Leander	Suburban
Austin	CRT	Red Line	Lakeline	Suburban
Austin	CRT	Red Line	Howard	Suburban
Austin	CRT	Red Line	Kramer	Neighborhood Center
Austin	CRT / BRT	Red Line / 801	Crestview	Town Center
Austin	CRT	Red Line	Highland	Neighborhood Center
Austin	CRT	Red Line	MLK	Neighborhood Center
Austin	CRT	Red Line	Plaza Saltillo	Neighborhood Center
Austin	CRT	Red Line	Downtown	Urban Core

Table 5.3. Dallas Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
Organized (roughly) from North to South, West to East				
Dallas	LRT	Orange	DFW Airport Station	Special Destination
Dallas	LRT	Orange	Belt Line	Suburban
Dallas	LRT	Orange	North Lake College	Neighborhood Center
Dallas	LRT	Orange	Irving Convention Center	Special Destination
Dallas	LRT	Orange	Las Colinas Urban Center	Neighborhood Center
Dallas	LRT	Orange	University of Dallas	Suburban
Dallas	LRT	Green	North Carrollton / Frankford	Suburban
Dallas	LRT	Green	Trinity Mills	Suburban
Dallas	LRT	Green	Downtown Carrollton	Neighborhood Center
Dallas	LRT	Green	Farmers Branch	Neighborhood Center
Dallas	LRT	Green	Royal Lane	Neighborhood Center
Dallas	LRT	Green	Walnut Hill / Denton	Neighborhood Center
Dallas	LRT	Green	Deep Ellum	Neighborhood Center
Dallas	LRT	Green	Baylor University Medical Center	Neighborhood Center
Dallas	LRT	Green	Fair Park	Special Destination
Dallas	LRT	Green	MLK Jr.	Suburban
Dallas	LRT	Green	Hatcher	Suburban
Dallas	LRT	Green	Lawnview	Suburban
Dallas	LRT	Green	Lake June	Suburban
Dallas	LRT	Green	Buckner	Neighborhood Center
Dallas	LRT	Orange / Green	Bachman	Neighborhood Center
Dallas	LRT	Orange / Green	Burbank	Neighborhood Center
Dallas	LRT	Orange / Green	Inwood / Love Field	Special Destination
Dallas	LRT	Orange / Green	Southwestern Medical District / Parkland	Town Center
Dallas	LRT	Orange / Green	Market Center	Neighborhood Center
Dallas	LRT / CRT	Orange / Green / TRE	Victory	Neighborhood Center
Dallas	LRT	Orange / Green / Red / Blue	West End	Urban Core

Table 5.3 Continued. Dallas Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
Dallas	LRT	Orange / Green / Red / Blue	Akard	Urban Core
Dallas	LRT	Orange / Green / Red / Blue	St. Paul	Urban Core
Dallas	LRT	Orange / Green / Red / Blue	Pearl / Arts District	Urban Core
Dallas	LRT	Orange / Red / Blue	Cityplace / Uptown	Neighborhood Center
Dallas	LRT	Orange / Red / Blue	Mockingbird	Neighborhood Center
Dallas	LRT	Orange / Red	Lovers Lane	Neighborhood Center
Dallas	LRT	Orange / Red	Park Lane	Neighborhood Center
Dallas	LRT	Orange / Red	Walnut Hill	Neighborhood Center
Dallas	LRT	Orange / Red	Forest Lane	Neighborhood Center
Dallas	LRT	Orange / Red	LBJ / Central	Neighborhood Center
Dallas	LRT	Orange / Red	Spring Valley	Neighborhood Center
Dallas	LRT	Orange / Red	Arapahao Center	Neighborhood Center
Dallas	LRT	Orange / Red	Galatyn Park	Neighborhood Center
Dallas	LRT	Orange / Red	Bush Turnpike	Neighborhood Center
Dallas	LRT	Orange / Red	Downtown Plano	Neighborhood Center
Dallas	LRT	Orange / Red	Parker Road	Neighborhood Center
Dallas	LRT	Blue	Downtown Rowlett	Suburban
Dallas	LRT	Blue	Downtown Garland	Neighborhood Center

Table 5.3 Continued. Dallas Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
Dallas	LRT	Blue	Forest / Jupiter	Neighborhood Center
Dallas	LRT	Blue	LBJ / Skillman	Neighborhood Center
Dallas	LRT	Blue	Lake Highlands	Neighborhood Center
Dallas	LRT	Blue	White Rock	Suburban
Dallas	LRT	Blue	Morrell	Neighborhood Center
Dallas	LRT	Blue	Illinois	Neighborhood Center
Dallas	LRT	Blue	Kiest	Neighborhood Center
Dallas	LRT	Blue	VA Medical Center	Neighborhood Center
Dallas	LRT	Blue	Ledbetter	Suburban
Dallas	LRT / CRT	Blue / Red / TRE	Union Station	Town Center
Dallas	LRT	Blue / Red	Convention Center	Neighborhood Center
Dallas	LRT	Blue / Red	Cedars	Suburban
Dallas	LRT	Blue / Red	8th and Corinth	Suburban
Dallas	LRT	Red	Dallas Zoo	Special Destination
Dallas	LRT	Red	Tyler / Vernon	Neighborhood Center
Dallas	LRT	Red	Hampton	Neighborhood Center
Dallas	LRT	Red	Westmoreland	Neighborhood Center
Dallas	CRT	TRE	T & P Station	Neighborhood Center
Dallas	CRT	TRE	Fort Worth ITC	Neighborhood Center
Dallas	CRT	TRE	Richland Hills	Neighborhood Center
Dallas	CRT	TRE	Bell	Neighborhood Center
Dallas	CRT	TRE	Centreport / DFW Airport	Neighborhood Center
Dallas	CRT	TRE	West Irving	Suburban
Dallas	CRT	TRE	Downtown Irving / Heritage Crossing	Neighborhood Center
Dallas	CRT	TRE	Medical / Market Center	Town Center

Table 5.4. Houston Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
Organized (roughly) from North to South, West to East				
Houston	LRT	Red	Northline Transit Center / HCC	Neighborhood Center
Houston	LRT	Red	Melbourne / North Lindale	Neighborhood Center
Houston	LRT	Red	Lindale Park // Graceland Station	Neighborhood Center
Houston	LRT	Red	Cavalcade	Neighborhood Center
Houston	LRT	Red	Moody Park	Neighborhood Center
Houston	LRT	Red	Fulton / North Central // Boundary Station	Neighborhood Center
Houston	LRT	Red	Quitman / Near Northside	Neighborhood Center
Houston	LRT	Red	Burnet Transit Center / Casa de Amigos	Neighborhood Center
Houston	LRT	Red	UH-Downtown	Town Center
Houston	LRT	Red	Preston	Urban Core
Houston	LRT	Red	Central Station Main	Urban Core
Houston	LRT	Red	Main Street Square	Urban Core
Houston	LRT	Red	Bell	Urban Core
Houston	LRT	Red	Downtown Transit Center	Urban Core
Houston	LRT	Red	McGowen	Town Center
Houston	LRT	Red	Ensemble / HCC	Town Center
Houston	LRT	Red	Wheeler Transit Center	Neighborhood Center
Houston	LRT	Red	Museum District	Neighborhood Center
Houston	LRT	Red	Hermann Park / Rice U	Neighborhood Center
Houston	LRT	Red	Memorial Hermann Hospital / Houston Zoo	Urban Core
Houston	LRT	Red	Dryden / TMC	Urban Core
Houston	LRT	Red	TMC Transit Center	Urban Core
Houston	LRT	Red	Smith Lands	Neighborhood Center
Houston	LRT	Red	Reliant Park	Neighborhood Center
Houston	LRT	Red	Fannin South	Suburban
Houston	LRT	Green / Purple	Theater District // Smith Station Pair	Urban Core
Houston	LRT	Green / Purple	Central Station Capitol // Fannin Station	Urban Core
Houston	LRT	Green / Purple	Central Station Rusk // Fannin Station	Urban Core
Houston	LRT	Green / Purple	Convention District // Crawford Station	Urban Core

Table 5.4 Continued. Houston Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
Houston	LRT	Green / Purple	EaDo / Stadium // Bastrop	Neighborhood Center
Houston	LRT	Green	Coffee Plant / Second Ward // York	Neighborhood Center
Houston	LRT	Green	Lockwood / Eastwood // Lockwood	Neighborhood Center
Houston	LRT	Green	ALTIC / Howard Hughes	Neighborhood Center
Houston	LRT	Purple	Leeland / Third Ward	Neighborhood Center
Houston	LRT	Purple	Elgin / Third Ward	Neighborhood Center
Houston	LRT	Purple	Robertson Stadium / UH / TSU	Neighborhood Center
Houston	LRT	Purple	UH South / University Oaks // Cullen	Neighborhood Center
Houston	LRT	Purple	MacGregor Park / MLK Jr.	Suburban
Houston	LRT	Purple	Palm Transit Center	Suburban

Table 5.5. San Antonio Triangle Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
Organized (roughly) from North to South, West to East				
San Antonio	BRT	100	Ewing Halsell Station	Town Center
San Antonio	BRT	100	Medical Center Transit Center	Neighborhood Center
San Antonio	BRT	100	University Hospital Station	Neighborhood Center
San Antonio	BRT	100	Callaghan Station	Neighborhood Center
San Antonio	BRT	100	Crossroads Station	Neighborhood Center
San Antonio	BRT	100	De Chantle Station	Neighborhood Center
San Antonio	BRT	100	Babcock Station	Neighborhood Center
San Antonio	BRT	100	Mary Louise Station	Neighborhood Center
San Antonio	BRT	100	Huisache Station	Neighborhood Center
San Antonio	BRT	100	Centro Plaza	Town Center
San Antonio	BRT	100	Buena Visa & Pecos	Town Center
San Antonio	BRT	100	Dolorosa & Santa Rosa	Urban Core
San Antonio	BRT	100	Dolorosa & S. Main	Urban Core
San Antonio	BRT	100	Market & S. St. Mary's	Urban Core
San Antonio	BRT	100	Market & Alamo	Urban Core
San Antonio	BRT	100	Market / Front of Convention Center	Urban Core
San Antonio	BRT	100	E Houston & Under I-37	Urban Core
San Antonio	BRT	100	Bowie Opposite Blum	Urban Core
San Antonio	BRT	100	Commerce & Navarro	Urban Core
San Antonio	BRT	100	Commerce & Flores	Urban Core

Table 5.5 Continued. San Antonio Rapid Transit Station Typologies

City	Technology	Transit Line	Station Name (During Line Construction)	Typology
San Antonio	BRT	100	Commerce & San Saba	Urban Core
San Antonio	BRT	100	W. Commerce & Frio	Urban Core
San Antonio	BRT	100	Ellis Alley Park & Ride	Neighborhood Center

5.4. TOD Readiness Scores of Texas Triangle Rail Stations

Following typological classifications of rapid transit stations, assessment of rail stations' "TOD readiness" was completed on a 4-point scale. This task was divided into two parts. First, an assessment was performed of "supply-side indicators", which is most aptly applied to indicate a site's readiness for new TOD development activity. These indicators include average block size and percent of land that is vacant. Next, indicators of "demand-side" were assessed. These indicators are most appropriate for analysis of TOD sites after development has been begun, but these indicators may also be used to analyze a station area preceding denser development. Demand-side indicators include population density and employment density. Overall, all 4 points should be considered in an analysis of "readiness"; a TOD site that is largely-vacant, relatively dense, and has short blocks may be the ideal candidate for a developer seeking low risk and a high potential for return.

While the indicators utilized for this scoring system are common, TOD guidelines from around the United States offered little assistance in defining ideal indicator values that could be utilized in the Texas Triangle. Generally, guidelines are not attended to be applied outside of their intended contexts. As city compositions in Texas result in vastly different densities, vacant land amounts, and block sizes than may be found elsewhere in the United States, the values of these indicators needed to be uniquely evaluated.

To capture the uniqueness of the Texas Triangle context, indicators for rapid transit stations were simply compared to indicators of other stations around the Texas Triangle with the same typology. This comparison is fitting, as many developers have projects throughout the megaregion. For each indicator, a station received one point if its value was greater than the average value for its specific typology. With four indicators, there was a maximum potential of 4 points.

Utilizing this ratings system, the stations most ready for development under this system are:

- Cedars (Dallas)
- Central Station Capitol (Houston)
- Central Station Rusk (Houston)
- Cityplace / Uptown (Dallas)
- Deep Ellum (Dallas).
- MacGregor Park / MLK Jr. (Houston)
- Preston Station (Houston)
- Smith Lands (Houston)
- Victory (Dallas)

To confirm the validity of this scoring system, these highest-rated stations were inspected with a closer look. To the trained observer, these stations seem to hold a high potential for TOD development, suggesting validity of this 4-point rating system.

Table 5.6. TOD Readiness Scores of Texas Triangle Rail Stations

City	Station Name (During Line Construction)	Typology	Points
Dallas	Cedars	Suburban	4
Dallas	Cityplace / Uptown	Neighborhood Center	4
Dallas	Deep Ellum	Neighborhood Center	4
Dallas	Victory	Neighborhood Center	4
Houston	Central Station Capitol // Fannin Station	Urban Core	4
Houston	Central Station Rusk // Fannin Station	Urban Core	4
Houston	Convention District // Crawford Station	Urban Core	4
Houston	MacGregor Park / MLK Jr.	Suburban	4
Houston	Preston	Urban Core	4
Houston	Smith Lands	Neighborhood Center	4
Austin	MLK	Neighborhood Center	3
Dallas	8th and Corinth	Suburban	3
Dallas	Akard	Urban Core	3
Dallas	Belt Line	Suburban	3
Dallas	Convention Center	Neighborhood Center	3
Dallas	Downtown Plano	Neighborhood Center	3
Dallas	Fair Park	Special Destination	3
Dallas	Ledbetter	Suburban	3
Dallas	Lovers Lane	Neighborhood Center	3
Dallas	Market Center	Neighborhood Center	3
Dallas	MLK Jr.	Suburban	3
Dallas	Morrell	Neighborhood Center	3
Dallas	Pearl / Arts District	Urban Core	3
Dallas	St. Paul	Urban Core	3
Dallas	T & P Station	Neighborhood Center	3
Dallas	Union Station	Town Center	3
Dallas	West End	Urban Core	3
Dallas	West Irving	Suburban	3
Houston	ALTIC / Howard Hughes	Neighborhood Center	3

Table 5.6 Continued. TOD Readiness Scores of Texas Triangle Rail Stations

City	Station Name (During Line Construction)	Typology	Points
Houston	Bell	Urban Core	3
Houston	Central Station Main	Urban Core	3
Houston	Coffee Plant / Second Ward // York	Neighborhood Center	3
Houston	Downtown Transit Center	Urban Core	3
Houston	Fannin South	Suburban	3
Houston	Fulton / North Central // Boundary Station	Neighborhood Center	3
Houston	Main Street Square	Urban Core	3
Houston	McGowen	Town Center	3
Houston	Moody Park	Neighborhood Center	3
Houston	Museum District	Neighborhood Center	3
Houston	Quitman / Near Northside	Neighborhood Center	3
Houston	Reliant Park	Neighborhood Center	3
Houston	Theater District // Smith Station Pair	Urban Core	3
Houston	UH South / University Oaks // Cullen	Neighborhood Center	3
Houston	UH-Downtown	Town Center	3
Houston	Palm Transit Center	Suburban	3
Austin	Downtown	Urban Core	2
Austin	Plaza Saltillo	Neighborhood Center	2
Dallas	Baylor University Medical Center	Neighborhood Center	2
Dallas	Bush Turnpike	Neighborhood Center	2
Dallas	Dallas Zoo	Special Destination	2
Dallas	Downtown Carrollton	Neighborhood Center	2
Dallas	Downtown Rowlett	Suburban	2
Dallas	Fort Worth ITC	Neighborhood Center	2
Dallas	Galatyn Park	Neighborhood Center	2
Dallas	Hampton	Neighborhood Center	2
Dallas	Hatcher	Suburban	2
Dallas	Inwood / Love Field	Special Destination	2
Dallas	Kiest	Neighborhood Center	2

Table 5.6 Continued. TOD Readiness Scores of Texas Triangle Rail Stations

City	Station Name (During Line Construction)	Typology	Points
Dallas	Lake June	Suburban	2
Dallas	Lawnview	Suburban	2
Dallas	North Carrollton / Frankford	Suburban	2
Dallas	Park Lane	Neighborhood Center	2
Dallas	Southwestern Medical District / Parkland	Town Center	2
Dallas	Spring Valley	Neighborhood Center	2
Dallas	Trinity Mills	Suburban	2
Dallas	Tyler / Vernon	Neighborhood Center	2
Dallas	Walnut Hill	Neighborhood Center	2
Dallas	Westmoreland	Neighborhood Center	2
Dallas	White Rock	Suburban	2
Houston	Burnet Transit Center / Casa de Amigos	Neighborhood Center	2
Houston	Cavalcade	Neighborhood Center	2
Houston	Dryden / TMC	Urban Core	2
Houston	EaDo / Stadium // Bastrop	Neighborhood Center	2
Houston	Ensemble / HCC	Town Center	2
Houston	Hermann Park / Rice U	Neighborhood Center	2
Houston	Lindale Park // Graceland Station	Neighborhood Center	2
Houston	Lockwood / Eastwood // Lockwood	Neighborhood Center	2
Houston	Melbourne / North Lindale	Neighborhood Center	2
Houston	Robertson Stadium / UH / TSU	Neighborhood Center	2
Houston	TMC Transit Center	Urban Core	2
Houston	Wheeler Transit Center	Neighborhood Center	2
Austin	Highland	Neighborhood Center	1
Austin	Howard	Suburban	1
Austin	Kramer	Neighborhood Center	1
Austin	Lakeline	Suburban	1
Austin	Leander	Suburban	1
Dallas	Bachman	Neighborhood Center	1

Table 5.6 Continued. TOD Readiness Scores of Texas Triangle Rail Stations

City	Station Name (During Line Construction)	Typology	Points
Dallas	Bell	Neighborhood Center	1
Dallas	Buckner	Neighborhood Center	1
Dallas	Burbank	Neighborhood Center	1
Dallas	DFW Airport Station	Special Destination	1
Dallas	Downtown Garland	Neighborhood Center	1
Dallas	Downtown Irving / Heritage Crossing	Neighborhood Center	1
Dallas	Farmers Branch	Neighborhood Center	1
Dallas	Illinois	Neighborhood Center	1
Dallas	Irving Convention Center	Special Destination	1
Dallas	Lake Highlands	Neighborhood Center	1
Dallas	Las Colinas Urban Center	Neighborhood Center	1
Dallas	LBJ / Central	Neighborhood Center	1
Dallas	LBJ / Skillman	Neighborhood Center	1
Dallas	Medical / Market Center	Town Center	1
Dallas	North Lake College	Neighborhood Center	1
Dallas	Parker Road	Neighborhood Center	1
Dallas	Royal Lane	Neighborhood Center	1
Dallas	University of Dallas	Suburban	1
Dallas	VA Medical Center	Neighborhood Center	1
Dallas	Walnut Hill / Denton	Neighborhood Center	1
Houston	Elgin / Third Ward	Neighborhood Center	1
Houston	Leeland / Third Ward	Neighborhood Center	1
Houston	Memorial Hermann Hospital / Houston Zoo	Urban Core	1
Houston	Northline Transit Center / HCC	Neighborhood Center	1
Austin	Crestview	Town Center	0
Dallas	Arapahao Center	Neighborhood Center	0
Dallas	Centreport / DFW Airport	Neighborhood Center	0
Dallas	Forest / Jupiter	Neighborhood Center	0
Dallas	Forest Lane	Neighborhood Center	0

Table 5.6 Continued. TOD Readiness Scores of Texas Triangle Rail Stations

City	Station Name (During Line Construction)	Typology	Points
Dallas	Mockingbird	Neighborhood Center	0
Dallas	Richland Hills	Neighborhood Center	0

Chapter 6. Surveys of Public Agencies and Developers

6.1. Public Agency Survey

A core component of research completed in Dr. Ming Zhang's Megaregion Transportation Practicum,[62] the public agency survey was created utilizing findings of the literature review as well as an understanding of regulations at the national, regional, and local levels. It was distributed to dozens of public agencies around the Texas Triangle megaregion.

6.1.1 Public Agency Survey Methods

The survey provided a general definition of TOD – deliberate development oriented towards transit stations in a manner that supports transit services and enhances community livability through the design of compact, walkable, and mixed-use environments – but also encouraged agencies to utilize their own definitions of TOD if they had adopted a definition. While some agencies' practices reflect the definition above, this survey was also meant to capture practices that focus on compact development and walking- and cycling-friendly designs near transit, even if the practice is not branded "TOD."

The survey consists of 26 questions, divided into five sections: Background Information, Concepts and Perspectives, Current Practices of TOD or Similar Development and Design near Transit, Barriers to TOD Implementation, and Effectiveness of Strategies to Overcome Barriers to the Implementation of TOD. The survey was administered through Typeform and took approximately 30 minutes to complete. In the fall of 2017, the survey was open for one month, and one attempt was made every week, in email or call form, to send the survey to our list of contacts in order to maximize survey responses. In the spring of 2018 the survey was opened for several months and attempts were made via email to contact all who had been identified as possible survey participants that did not complete the survey. In an attempt to secure responses from all large organizations in the Texas Triangle, several employees were contacted at larger organizations from which no response had been received.

[62] See Section 2.1 "Research Tasks" for a discussion of the generation of the public agency survey in the Megaregion Transportation Practicum.

When the survey closed, respondents' answers to the survey questions were coded using a database approach. In the database, variables were used (abbreviated expressions) to represent survey questions which usually come in long sentences. For questions allowing multiple selections, each answer was represented by one variable.

The public agency survey was sent to three specific groups within the Texas Triangle. First, it was sent to regional and state offices of planning: metropolitan planning organizations (MPOs), councils of government (COGs), and the relevant state department of transportation, TxDOT. Second, the survey was sent to all registered public transit providers in the Texas Triangle. Third, all municipal planning agencies in the Texas Triangle which had some form of public transit service were sent the survey. Some surveys were sent to multiple contacts for each agency, generating multiple responses from a single organization. In these cases, all responses were coded and given equal weight. Responses were received from a broad array of agencies with jurisdictions large and small from around the Texas Triangle. Public transit was the least-well represented group in the survey, with a lower response rate than any other population.

6.1.2. Public Agency Survey General Findings

At the risk of stating the obvious to those who have lived, worked, or played in the state of Texas, Texas is a pointedly auto-dominated state. Unsurprisingly, one of the key public agency survey findings is that agencies are greatly inhibited in their quest for TOD development by Texas's orientation towards private vehicles. In pursuit of many of the basic elements which allow for TOD development—quality rapid transit, density, etc.—public agencies in Texas report encountering significant barriers, even though internally most planning agencies strongly support the principles which drive TOD development. Surprisingly, reported barriers are often not the result of federal or state laws and regulations, but rather policy decisions at the more local level.

Quality rapid transit is one of the core elements of TOD, yet most jurisdictions in the Texas Triangle do not have access to any rapid transit service. Unsurprisingly, most jurisdictions interviewed have access to a non-rapid bus transportation system as well as a paratransit service. On top of these services, approximately 30% reported having light rail transit, 25% reported having commuter rail transit, and less than 10% reported having commuter rail transit services.

Many of the rail services in the Texas Triangle may be described as commuter rail services utilizing light or heavy rail technology, and many classified their services utilizing both descriptors. In addition to these services, over 10% of respondents reported having bus rapid transit (BRT) service, although all of these services may be more aptly defined as "BRT-lite" (see Appendix A).

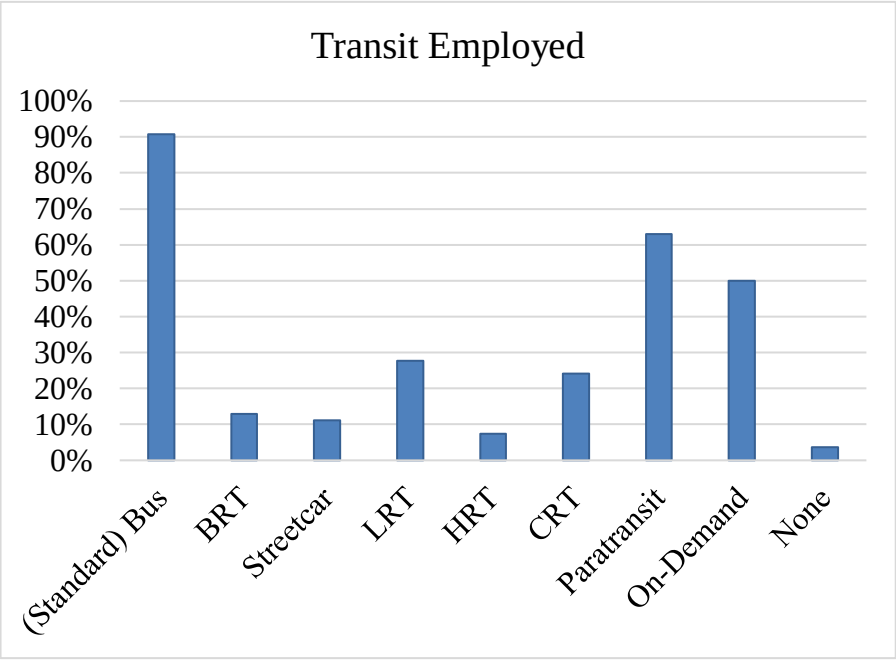


Figure 6.1. Transit employed within the jurisdictions of the respondents of the public agency survey

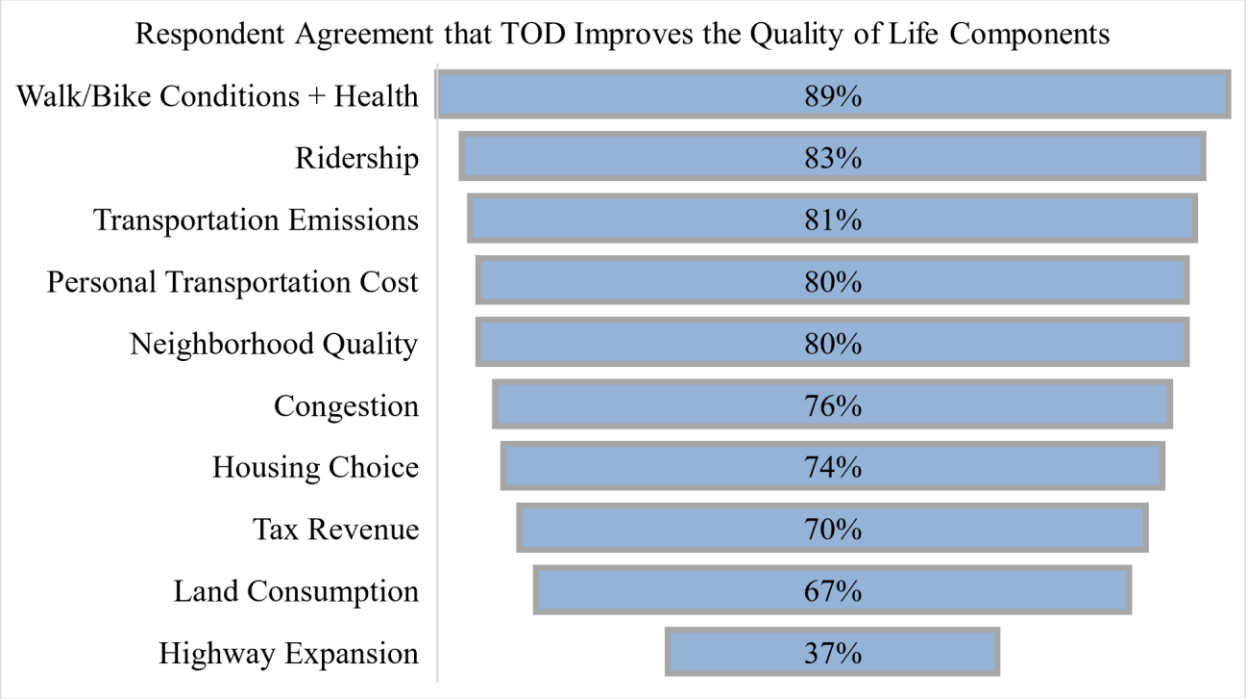


Figure 6.2. Percentage of respondents that either agree or strongly agree that TOD improves specific quality of life components. Respondents could also state that they disagree, somewhat agree, or are unsure that TOD improves the aforementioned quality of life components.

While many public agencies lack access to the quality rapid transit systems they desire, they remain strong proponents of TOD patterns and ideals. Most agencies responding reported that TOD improved several metrics of quality of life, from environmental quality and character to increased tax revenues. Public agencies also foresaw a growth in interest in TOD sites within their jurisdictions. While the vast majority of respondents only believe there is current TOD potential at 0-5 sites within their jurisdictions, over 1/3 of respondents see future TOD potential at 6 or more sites in their jurisdictions.

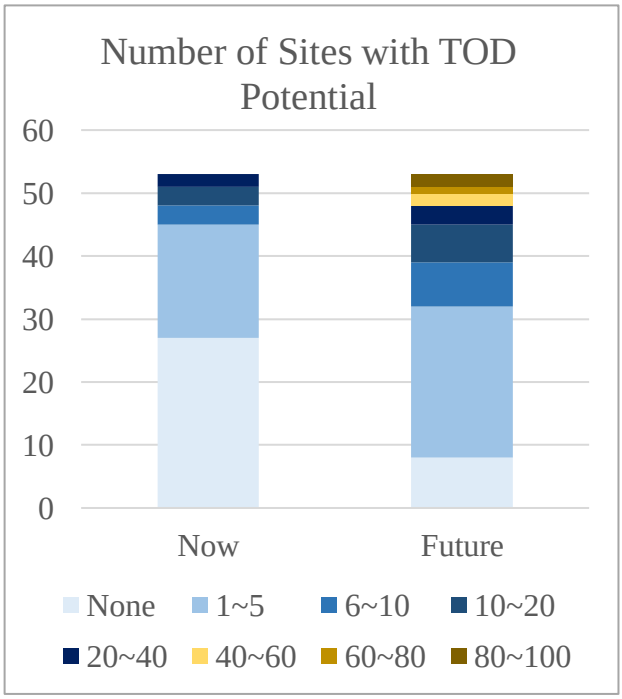


Figure 6.3. Number of sites with TOD potential

Somewhat surprisingly, agencies stated that federal and state regulations were not significant barriers to TOD implementation. Over ¾ of respondents stated that constraints on TOD caused by federal regulations were either "none" or "minimal", and a similar percentage of respondents state that constraints on TOD caused by state regulations were either "none" or "minimal". Transit agencies were most likely to respond that federal and state regulations were impeding TOD, most likely as a result of federal and state funding decisions that are seen as supporting highway capital projects over public transit capital projects.

Rather than seeing federal and state agencies as constraining development, most agencies saw partnerships with these agencies as a valuable tool for TOD development. Most respondents saw state and federal grants as important or very important. While federal grants were more important to agencies than state grants, agencies report partnerships with agencies at the state-level as more important than partnerships with federal agencies. Over ¾ of respondents reported these partnerships as either important or very important to TOD implementation. Agencies also stated that partnerships with regional governance were important, such as with metropolitan planning organizations (MPOs) or councils of government (COGs), both of which can be sources of necessary funding for TOD projects. The most important partnerships of all, though, are rated as the partnerships with transit agencies and developers. The vast majority of agencies surveyed stated that quality partnerships with transit agencies and with developers are either important or very important to the success of a TOD project.

6.1.3. Value Capture Findings

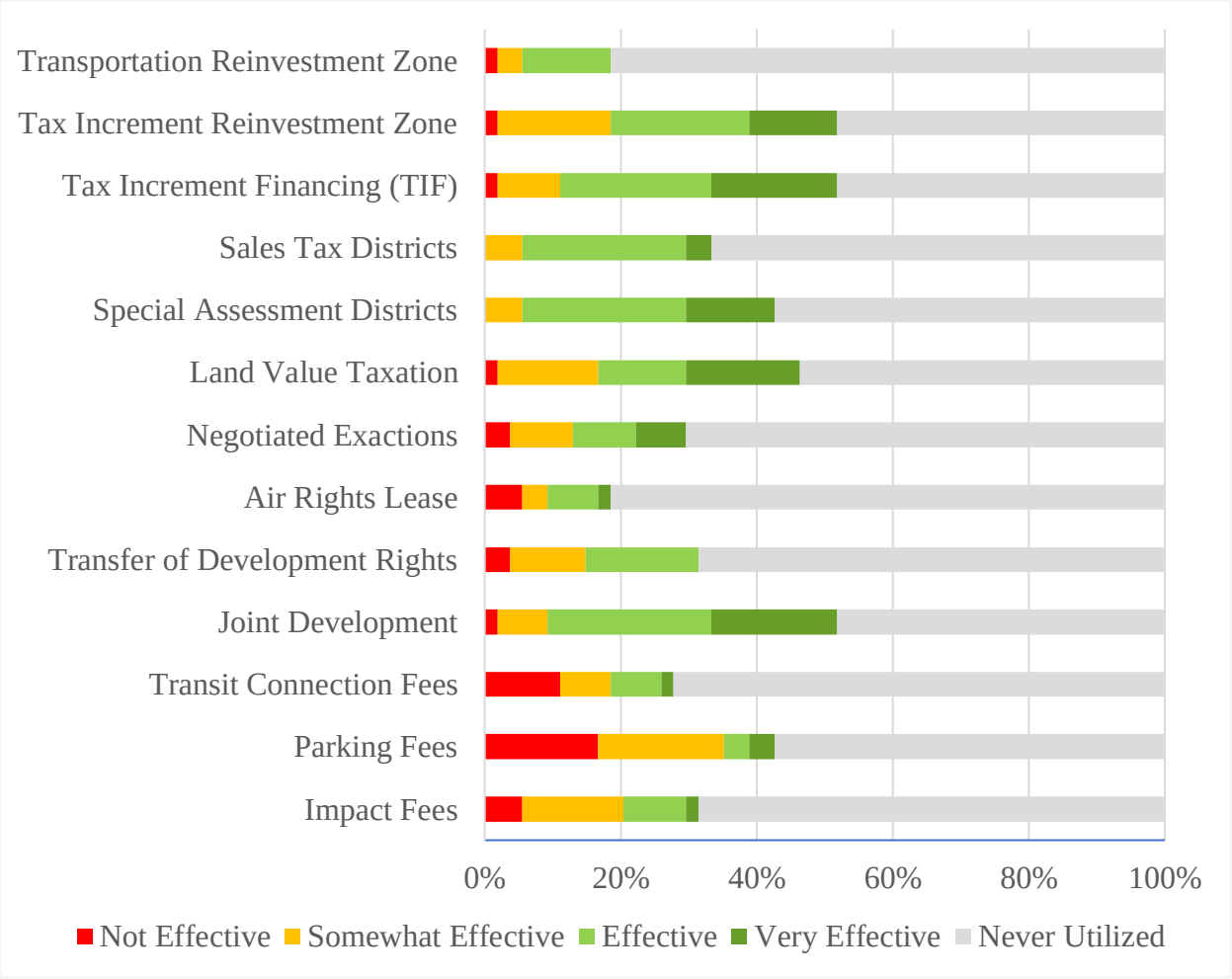


Figure 6.4. Ratings of value capture mechanism effectiveness by survey respondents

One of the most striking findings of the public agency survey was the lack of understanding of different value capture techniques accessible in the state of Texas. Survey respondents rarely utilize value capture techniques, yet most report both an interest in value capture as an effective tool and that capital funding is one of the most significant barriers to TOD implementation. Figure 6.4 examines both agencies' ratings of effectiveness of all value capture tools available in the Texas Triangle, as well as their reported usage by surveyed agencies. Joint development and land value taxation measures (including tax increment financing, etc.) are perceived as very effective, and have been utilized considerably.

6.1.4. Planning Tool Effectiveness Findings

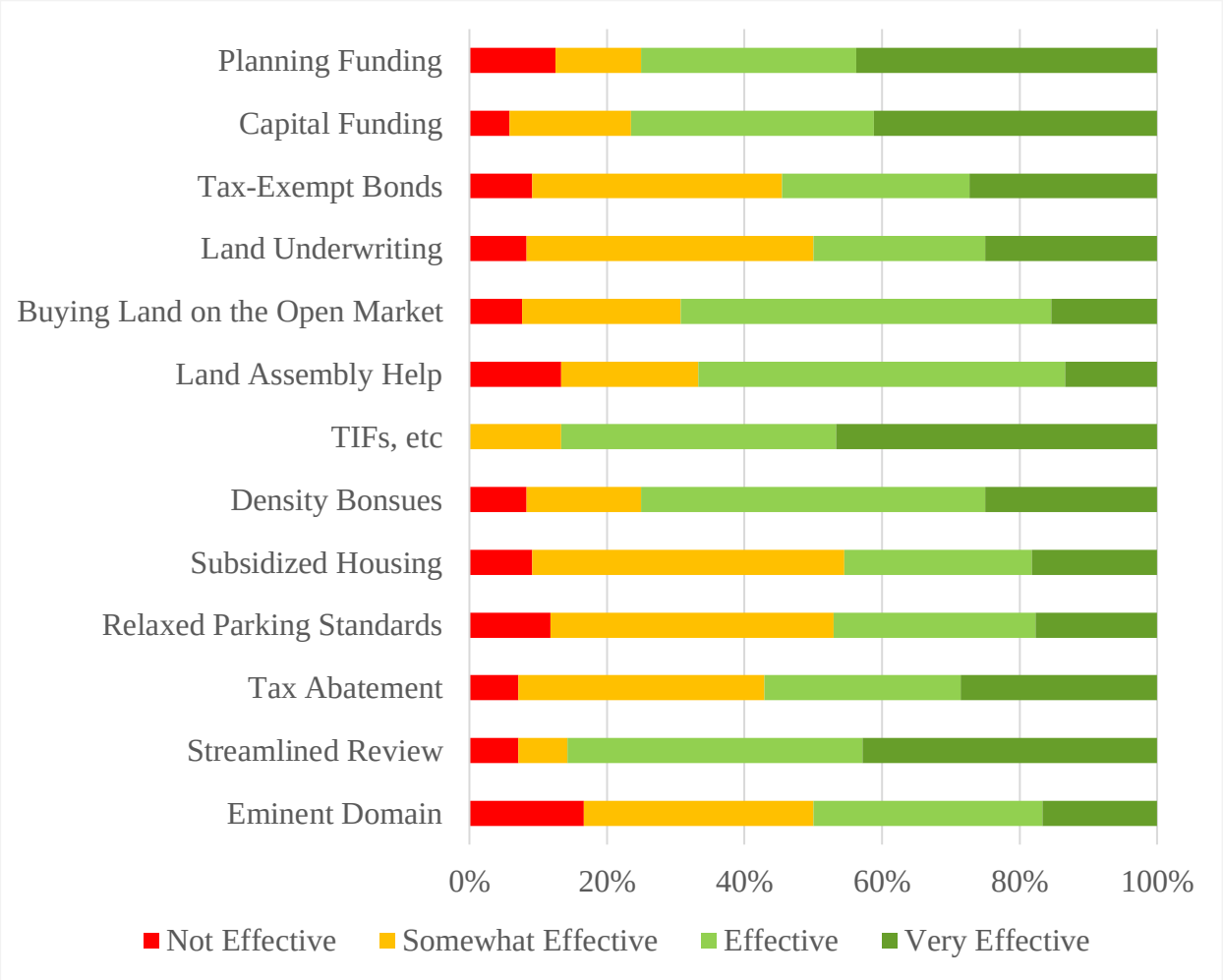


Figure 6.5. Survey respondents' rating of planning tool effectiveness in implementing TOD

Another important area of exploration was public agencies' perceptions of the planning tools available to them. The perceived effectiveness of design qualities was generally what one may expect: generally, planners agree that TOD is enhanced if bikeability and walkability are improved (although, notably, less than 1/5 agree that a reduced block size improves TOD). However, the effectiveness of planning tools such as land assembly help, streamlined review, etc. were also examined. The perceived effectiveness of each tool is shown in Figure 6.5. The most well-received tools are tax increment financing (TIFs) and streamlined review.

6.1.5. Public Agency Survey Conclusion

Most Texas Triangle planning agencies agree that TOD would benefit their communities, but less than 1⁄4 report having even adopted a definition for TOD. Agencies need direction on new and useful value capture mechanisms—especially TIRZs and TRZs—which could fund needed capital projects for station areas and transit lines. Planners also must recognize the value in cooperation—while many agree that partnerships are helpful, many opportunities for collaboration are lost among different agencies. Planners also need access to TOD best practices—while many report successes in utilizing specific tools or methods in TOD development, other agencies which may benefit from those same tools or methods falter without a confident understanding of what may work and what may not work.

6.2. Developer Survey

As a follow-up to the public agency survey, in the spring of 2018 a similar survey was administered to for-profit and nonprofit developers around the Texas Triangle.

6.2.1. Developer Survey Methods

Similar to the public agency survey, this survey was adapted nominally to gauge and compare developers' opinions and practices with transit-oriented developments to those of the planners with whom they work. With a much larger target population, this survey was administered with convenience sampling. All of the largest developers with operations in the Texas Triangle were contacted, as well as all of the largest trade organizations representing developers in the Texas Triangle. Additionally, dozens of developers in the Texas Triangle that had projects in transit-oriented developments were contacted.

Unfortunately, the survey response rate for developers proved significantly worse than the response rate for public agencies. Dozens of real estate development and investment firms were contacted individually, either by email, on the phone, and in person. In addition, several organizations representing specific developer-related interests (such as the Texas Association of Community Development Corporations) were contacted, many of whom sent survey prompts to

their listservs of members. In spite of these efforts, only 5 responses were recorded, and as a result these findings are not representative of the studied population, even if responses were generated by respondents who had worked in all major metropolitan regions of the Texas Triangle and are either developing or have developed TOD sites. While not representative, these responses informed interviews with developers and public agencies in subsequent phases of research.

6.2.2. Findings

An everlasting criticism of TOD is the paradoxical result of its deployment: while it increases density meaningfully around transit stations, it also increases the cost of living of an area, tending to push away transit-dependent populations who are most likely to supply transit ridership.[63] Nonprofit developers appear to recognize this trend, identifying transit and TOD as a major opportunity for their development of below-market rate apartments. Surveyed nonprofits rate the importance of transit connections in choosing property more highly than for-profit developers, rating importance as a 5 out of 5 versus a 3 out of 5. Conversely, for-profit developers rate the importance of driver-friendliness in choosing a site a 5 out of 5, while nonprofits rate it less. Survey results would suggest that nonprofit developers have a greater appreciation for the "transit" of TOD than for-profit developers.

Most developers, regardless of profit interest, agree on several elements that foster TOD progress. All would like to see increased density around station areas in which they've worked in the Texas Triangle, generally as a way of overcoming prohibitive land costs of station areas. Most also agree that designated staff for TOD and clear guidelines for TOD sites would improve their abilities and interests in developing. Most also agree that partnering both with transit agencies and regional governance (MPOs, COGs, etc.) would yield better TOD progress—however, no surveyed developer has ever partnered with either a transit agency or regional body of government, in spite of seeing the value in that partnership. Not all partnerships are desirable to developers, however: surveyed developers have very low interest in engaging neighborhood groups and in public engagement processes more generally.

[63] Jones, Craig E., and David Ley. (2016). Transit-Oriented Development and Gentrification Along Metro Vancouver's Low-Income SkyTrain Corridor. *The University of Toronto Cities Centre.*

There also exists a consensus among respondents regarding the reasons TOD sites have faltered. First and foremost, developers see the lack of funds for capital improvements at stations as a major detractor for development. In addition, developers also struggle to secure their own funding, citing a lack of lender interest as a very strong detractor to their work. Developers also cite questionable demand for these areas both from residents and commercial tenants. There is no denying that units generally command a premium in TOD, and developers see the lack of interest (or at least lack of sustained interest) in paying that premium as a very strong detractor.

6.2.3. Developer Survey Conclusion

Many developers in the Texas Triangle have a strong interest in developing TOD sites, yet they also recognize several detractors to work at these complicated sites. Recognizing the often-prohibitively high costs of land acquisition, developers are unsure they can see the returns necessary for their investment, especially if they aren't able to build as densely around station areas as they would like. Developers also see opportunities in improving TOD development conditions, most notably in building new partnerships with transit agencies and regional government agencies (MPOs, COGs, etc.). Developers similarly appreciate designated planning staff for TOD, as well as clear guidelines for TOD sites.

While findings of this survey are severely limited by a low response rate, responses to this survey proved vital in guiding interviews of planners and developers in later stages of research.

Chapter 7. Interviews of Austin, TX TOD Stakeholders

7.1 Background

Following the assessment of public agency and developer survey results, interviews were developed for planners, developers, and community groups around the Austin metropolitan region to ground survey results and allow for an examination of Austin's TOD progress at a site-specific level.

Austin proves an excellent metropolitan area in which to take a closer look at TOD practices and stakeholder opinions. First and foremost, Austin has transit technologies which should foster TOD development. The most important of these technologies for TOD is Austin's commuter rail service, MetroRail, augmented by CapMetro's BRT-lite system, MetroRapid. Second, Austin's rail stations are governed by a breadth of land development regulations in several distinct jurisdictions. Third, Austin's rail stations have seen varied development, currently at various stages of completion. Close to Austin's core, Plaza Saltillo has developed significantly around its rail station. Farther north, around Lakeline Station development has occurred, but it is unguided by a station area plan, and is decidedly disjointed in its development patterns. At the northernmost end of the rail line, Leander has seen no transit-oriented development come to fruition, although significant plans have recently been released and some construction is underway.

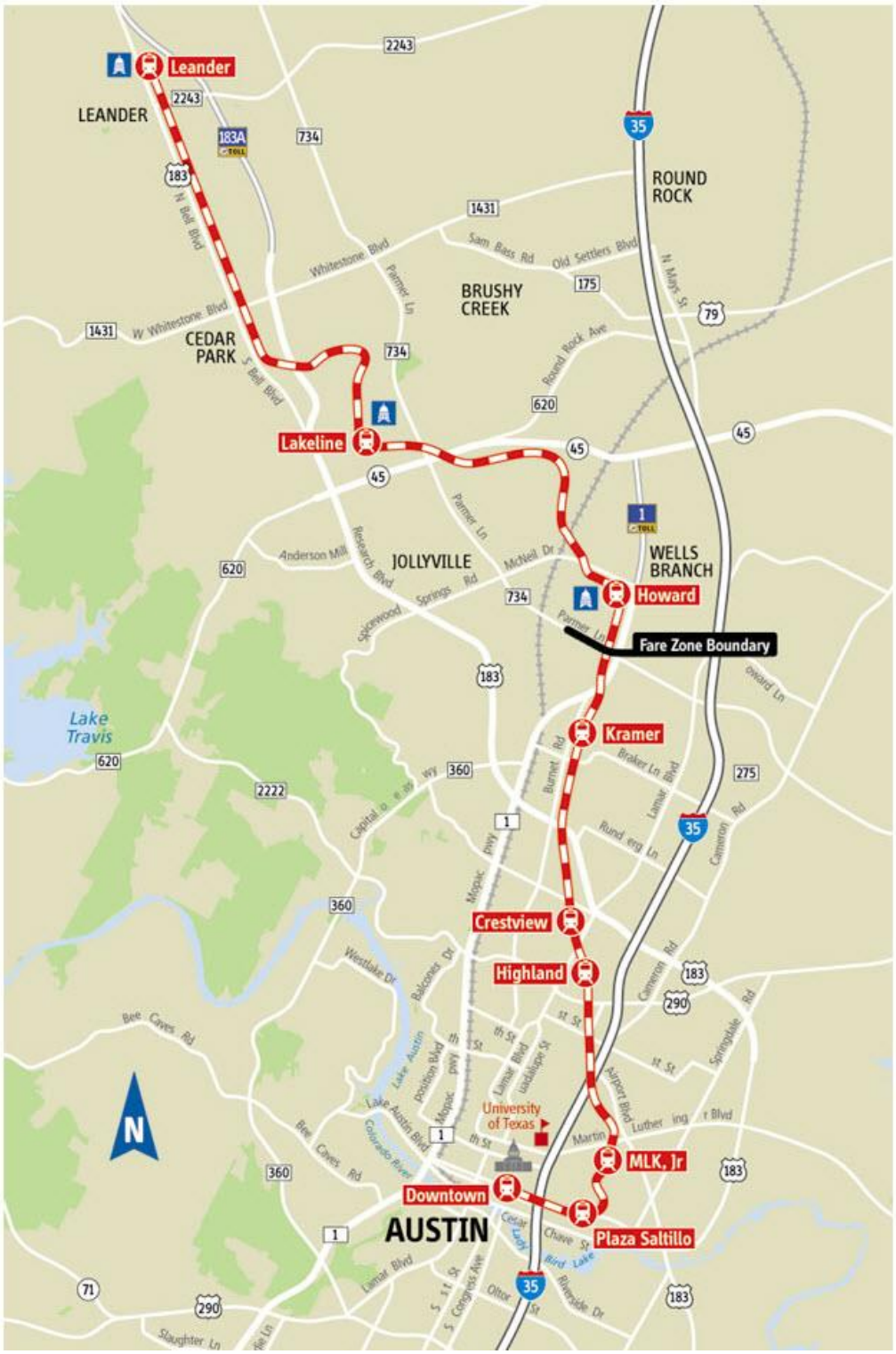


Figure 7.1. Map of CapMetro MetroRail Red Line[64]

[64] Railfan Guides of the U.S. (2015). Todd's Railfan Guide to Austin, TX Capital MetroRail Commuter Line. *Railfan Guides.*

The following TOD stakeholders around the Austin metropolitan area were interviewed:

- Alex Tynberg, Tynberg LLC
- Anne-Charlotte Patterson, Crestview Neighborhood Association
- Anne Milne, City of Austin
- Greg Anderson, Habitat for Humanity
- Jolinda Marshall, Capital Metro
- Shayne Calhoun, Capital Metro
- Terry Mitchell, Momark Development
- Tom Yantis, City of Leander

The insights gained from these stakeholders fall into five categories: Transportation, Funding, Partnerships, Land Development Codes, and Neighborhood Opposition.

7.2. Methods

These interviews utilized a combination of convenience sampling and snowball sampling. First, several planners and developers in the Austin region were identified as having an interest or stake in TOD and were contacted. One of the first developers that was interviewed contacted the research team to request an interview when he received a survey request. Following each interview, subjects were asked if they would like to share names of others in Austin with whom the research team should speak about TOD in Austin. Interviews were conducted in the City of Austin and in Leander, a suburban city with its own distinct planning practices.

7.3. Transportation

One of the most strongly-held opinions of all interviewed planners and developers was the value of Austin's MetroRail line. Always comparing the investment in the rail line to the investments in highways of the region, these official and unofficial rail advocates see tremendous potential in MetroRail's eventual success if station areas are developed appropriately. All parties also note the expandability of rail in the face of demand, compared to their observations of a lack of expandability of highways. In keeping with this opinion, many are also eagerly looking forward

to the MetroRail's eventual double-tracking nearer to its southern terminus, noting the bottleneck that single-tracking creates.

Developers also note the importance of parking and vehicular access to sites—especially important with for-profit developers. One developer said that he would love to get rid of parking, allowing him to build more cost-effectively and more densely, but also noted that there aren't many places in Austin that have durable demand for residences or commercial spaces without parking, leading him to believe that he wouldn't be able to find tenants for developments without adequate parking. Alex Tynberg of Tynberg LLC, with plans to develop Leander's TOD site, has embraced vehicular access, claiming that easy highway access to the site was a significant attractor to this site. In keeping with survey results of developers, Greg Anderson, nonprofit developer with Habitat for Humanity, would most eagerly do away with parking requirements in dense areas. Greg Anderson would rather utilize sparse spatial and financial resources to build more housing for low-income residents than build expensive parking spaces for his properties, especially those in transit-rich areas.

The most significant disagreement between planners and developers in regard to transportation revolves around the development attractiveness of bus routes. CapMetro's TOD team has developed a TOD tool for both the MetroRail and the MetroRapid service, a BRT-lite service, hoping to attract TOD progress for both systems. They are hopeful that developers will be attracted to the BRT-lite system, stating that the agency's investment in the MetroRapid system should make it clear that routes are permanent fixtures of the corridors they serve. Developers are not in agreement, however, and no interviewed developer would consider developing in a TOD style as a result of a bus route, either with a standard-service route or a BRT-lite route. All developers agree that there is value to good bus services but also note the ease with which one may change a bus route after development has occurred. Terry Mitchell of Momark Development discussed a recent project along the #5 bus route in Austin—a route he describes as one of Austin's most important—in which the bus was rerouted far from his property after development was completed. "Can you imagine," he said, "if I hadn't built a bunch of parking at that site?"

7.4. Funding

One of the most significant challenges for developers of TOD is acquiring financing for the vertical mixed-use that's generally required for TOD sites. While conditions are improving for financing of these types of projects, challenges remain, and this proves as one of the biggest detractors of these sites for developers. In Leander, Alex Tynberg intends on completing vertical mixed-use projects with his own team and his own financing while secondary partners build dense yet homogenous residential or commercial space around the site.

Alex Tynberg also has the benefit of a tax increment financing (TIF) mechanism at the Leander TOD. While all developers and planners agree that TIFs would increase development dramatically around TOD sites, Austin has never utilized a successful value capture mechanism around TOD sites. Leander, however, has instituted a tax increment reinvestment zone (TIRZ), a specialized TIF mechanism, on over 2,000 acres of land around the MetroRail station. Alex Tynberg and Tom Yantis of the City of Leander agree that this is a major attracting feature of the site, aiding developers in the creation of infrastructure such as sewers, roads, sidewalks, etc. The City of Leander hopes that these funds may be utilized to maintain growth momentum as development intensifies.

7.5. Partnerships

Planners of public agencies and developers have a strong interest in fostering relationships amongst themselves, especially when it comes to more complex undertakings such as TOD. From the interested developers' perspectives, planners provide an excellent resource in how transit systems will develop over time, as well as how individual station areas are expected to develop over time. While it is important for any developer to understand how their environment can be expected to change as time progresses, it is especially important for TOD-focusing developers to understand how the specific transit routes into which they are buying will be developed over time. In addition, planners often find themselves cheerleading development at TOD sites. Alex Tynberg noted that his interest in Leander's TOD site was spurred by the anchor projects that the City of Leander fought hard to acquire for their site: campuses of St. David's Hospital and of Austin Community College. Without Leander planners' acquisition of these

anchor properties and their efforts in finding a developer capable of linking the space between these anchor institutions, Leander's station would likely have no development plans.

From public agencies' perspectives, relationships also provide an opportunity to ensure that developers that are interested in the site and willing and able to develop in keeping with TOD design best practices. As Tom Yantis of the City of Leander has examined, "not many developers have developed TOD or know how to develop TOD", even among those who expressed initial interest in TOD sites. In addition, planners also have an interest in acquiring developers who are interested in investing long-term in a site. Tom Yantis noted that full development of a TOD project may take upwards of 25 years, requiring an abnormally strong commitment on the part of the developer.

While neighborhood groups report having a strong interest in working with planners and developers for TOD sites, their interest is often viewed as adversarial to TOD by planners and developers. Neighborhood groups' notable opposition to TOD projects in Austin is examined in 7.7 "Neighborhood Opposition".

7.6 Land Development Codes

All TOD stakeholders in Austin agree that Austin's land development codes are, at the very least, less than ideal when it comes to TOD development. Often full of obtuse hurdles through which developers must jump, the land development codes are also often misaligned to market conditions at TOD sites, and are lacking in flexibility necessary to allow for TOD to progress. Leander's form-based codes offers a corollary to Austin's obtuse land development requirements, but are form-based codes better suited to TOD?

Austin's lack of clear entitlements for developers isn't made clearer with a visit to planning staff, as planners in Austin are siloed, often not in communication with each other. In order to successfully develop TOD in Austin, planners and developers agree that one must be an established developer with access to strong legal assistance and the financial ability to hold properties for a significant amount of time while projects are debated, reworked, and eventually

granted approval. According to Jolinda Marshall of CapMetro, most TOD projects in Austin call for planned unit developments (PUDs), each of which must be intensely adjudicated, forcing out all but established and large developers. As Greg Anderson of Habitat for Humanity states, "We need permissive regulations that capture common benefits and are predictable and calculable." Without this, only the largest, often-national developers may partake in TOD, and according to many planners, they are often disinterested in creative and collaborative TOD.

Austin's TOD land development codes also face sharp criticism from all stakeholders in its lack of alignment with market conditions. Virtually all planners and developers state that densities should be much higher at rail stations around Austin. As land values increase, the likelihood of development being economically feasible decreases if developers are not able to recuperate land investments with higher densities, which is the most important reason why many planners and developers see relatively-low development interest at several rail stations around Austin. In addition to higher densities, planners and developers would also like to have lower parking requirements for transit-rich areas—which they see as providing ridership for transit as well as reducing construction costs—and often would like to see an allowance for smaller residential units than are currently allowed in Austin.

Virtually all planners and developers interviewed would also like to have clear density bonuses present for specific areas of the city around which density should be higher. While planners appreciate density bonuses as a means to improve spaces that can be beneficial to communities—such as with park space or affordable housing, the latter of which cannot be required under Texas regulations—developers also appreciate clear density bonuses as they tend to depoliticize development plans and approval processes, and as a result make investments more predictable. Anne Milne of the City of Austin has found that density bonuses are often out of touch with development interests. For example, she states that the intense development along East Riverside Drive allowed for high densities but didn't utilize worthwhile density bonuses, resulting in very few explicit benefits to the community at large, such as affordable housing.

Finally, developers desire flexibility in development, allowing them to tailor the specifics of their properties to their own readings of the market. For example, Terry Mitchell of Momark

Development sees a high need for more office space and more commuter parking at several station areas around Austin. However, there exists little to no flexibility to tailor development at Austin's rail stations in this way. On the other hand, Alex Tynberg of Tynberg LLC has found that form-based codes in Leander can allow for more flexibility.

Form-based codes are generally a source of agreement for planners and developers. Allowing for predictable expectations for certain elements of development (such as building heights or streetscapes), form-based codes can also allow for flexibility in other regards, such as building use. The combination of predictability and necessary flexibility are what makes form-based codes popular among interviewees. However, Alex Tynberg has found that these too can be problematic. For example, he has found it challenging to appropriately phase development in Leander with the city's form-based codes. Generally, the codes have not allowed for decisions such as the creation of surface parking lots, designed to be adapted later into more useful structures. However, Alex and all will agree that form-based codes that are based on market conditions and allow for flexibility in design and in phasing are an asset to TOD sites.

As a corollary to many intensely-planned TOD sites in Austin, Lakeline Station has gone forth merely with market-driven development. Many developers and planners in Austin find this station a mixed-bag. While it was among the first stations to see development, that development is now be considered by some to be too-low in density, pushing newly market-demanded dense properties farther from the rail station. On the other hand, a well-designed TOD site generally has its densest and most meaningful development directly adjacent to the transit station. With several acres of yet-undeveloped land surrounding this station, in the future it will be interesting to note differences between Lakeline's development speed and quality with that of other, more planned station areas.

7.7 Neighborhood Opposition

Neighborhood groups and their voices which generally fall in opposition of TOD draw ire from developers and planners around Austin. There is strong consensus among developers and

planners that neighborhood groups are the source of what developers and planners see as undesirably-low densities around transit stations.

In addition, neighborhood groups are not seen as representative of any communities which they claim to represent, being seen by many as dominated by older and wealthier residents of neighborhoods who are opposed to changes in their neighborhoods. According to planners and developers, this is no noble cause in a city which doubles in population roughly every 20 years, and results in undue burdens of redevelopment in neighborhoods which are not as strongly connected, unified, and with the financial and political means to fight development as the neighborhood groups which dominate voices of the citizenry of Austin. In addition, neighborhood groups are not seen as representative of the neighborhoods which they claim to represent. For example, the Crestview Neighborhood Association has virtually no attendees of its meetings that live in the Crestview TOD, which is home to thousands of residents. Anne-Charlotte Patterson of the Crestview Neighborhood Association recognizes this as an issue and is attempting to more strongly engage younger demographics (who are often more pro-compact development) with CNA's online presence, in search of a CNA that can more accurately claim to represent the population of Crestview. In spite of this, at one CNA meeting patently-inaccurate comments were made to strong agreement in the room such as "Why would anyone actually take transit in Austin. You aren't going to convince me that anyone's out there waiting in the heat!"

Most planners and developers agree that different approaches should be taken with neighborhood outreach. Anne Milne of the City of Austin would like to see planning staff educate citizens on the issues facing their communities and realistic solutions to those issues in lieu of asking people to voice opinions which may not be productive to solving the issues at hand. All interviewees see some criticisms by community associations as valid—such as those of density-created parking woes (to a certain extent)—but also would like TOD opposition to know that there are clear solutions to many of these problems, such as parking permits for residential streets that are bogged by density.

Chapter 8. Conclusion and Recommendations

The Texas Triangle megaregion is rife with new rapid transit infrastructure investment. New systems—both rail-based and rubber-tire based—were constructed both to offer a needed alternative to personal vehicles and to guide regional development around the Triangle's booming core cities—Austin, Dallas, Houston, and San Antonio.

Unfortunately, many of these infrastructure investments remain underutilized, as evidenced both by often-low ridership figures and by significant underdevelopment around many of the megaregion's 181 rapid transit stations. Better transit-oriented development (TOD) based on national best practices is needed around the megaregion both to drive citizens out of their personal vehicles and guide development in compact, efficient, and sustainable manners. As many states and regional governmental agencies around the country have realized, higher levels of governance have a key role in generating integrated, successful TOD within their jurisdiction—especially important in growing TOD beyond individual sites at transit stations and into networks of TOD throughout a region.

Most Texas Triangle planning agencies—at the state, regional, and local level—agree that TOD would benefit their communities, but less than 1⁄4 report having even adopted a definition for TOD. Generally, surveyed and interviewed public agency planners in the Texas Triangle wish their jurisdictions were better equipped to implement TOD. Surveyed and interviewed developers and planners agree that demand often exists to construct around rapid transit investments, but both parties agree that TOD plans for station areas need to be better suited to market conditions for progress to boom—generally entailing significantly higher density than is allowed now, as well as abilities for developers to be flexible with their development.

Of all identified issues plaguing TOD progress in the Texas Triangle, the most pressing is the lack of funding for capital projects related to transit infrastructure and infrastructure more generally that surrounds transit stations. Agencies need direction on new and useful Texas value capture mechanisms—especially TIRZs and TRZs—which could fund needed capital projects for station areas and for transit lines.

Additionally, planning agencies need access to best practices for TOD-specific land development codes. Quality codes can both guide development to these sites and depoliticize the agonizing approval process reported by all parties for density-increasing TOD projects.

State and regional planning agencies hold the key to disseminating best practices for all of these areas of issue—with rapid transit technologies, land use strategies, value capture mechanisms, and more—and would likely see great success in generating TOD guidelines for their large-scale jurisdictions. These guidelines should be generic enough to apply to a breadth of station typologies suited to local interests, but specific enough to provide guidance to relevant local agencies. In addition, state and regional agencies can deliberately utilize funds in manners that are clearly supportive of TOD development. Regional smart growth maps that utilize the principles of TOD networks, often published by regional planning agencies, are an excellent start in disseminating how funds will be utilized, and where planners and developers from around the region should concentrate their interests.

With an increase in quality partnerships, valuable TOD-specific development codes, and improvements in demonstrated investment, the case of TOD in the Texas Triangle megaregion is a case of tremendous and yet-unrealized potential.

Appendices

Appendix A: Texans and the Very Fancy City Bus: An Analysis of Potential and Actual Ridership of U.S. BRT-Lite Systems

Summary

Several midsized Texas cities are placing their bets on BRT-lite systems—but are Texans leaving their cars (and transit *démodé)* to ride on city buses which happen to have some characteristics of BRT systems? An analysis was performed of all BRT-lite systems in the Continental United States for which data was publicly available. It was found that while Texans in midsized cities are as likely to utilize transit as citizens of similar cities in other states, they are far less likely to use their BRT-lite systems than those of other states. This may be because Texas BRT-lite systems are overly saturated with residences surrounding their stops and lacking in access to destinations (employment, retail, etc.). Alternatively, it also may be because the denser areas of these Texas cities where BRT-lite has been placed do not have transit-dependent populations.

1. Introduction

In the 2000s, American cities began adopting Bus Rapid Transit (BRT) systems, especially popular among midsized cities without significant rail networks. Transit operators generally promised bus systems that would be cost-effective alternatives to light rail with many similar operating characteristics. However, several of these systems never achieved full "BRT" status. Best practices highlight several "basics"[65] of BRT systems[66]:

- **Dedicated Rights-of-Way**
  - Buses flow independently of congestion caused by other road users
- **Busway Alignment**
  - Buses travel in the center of the roadway or in bus-only corridors
- **Off-Board Fare Collection**
  - Allowing for quick, all-door boarding
- **Intersection Treatments**

[65] Institute for Transportation & Development Policy. (2017). The BRT Standard. *Institute for Transportation & Development Policy.*

[66] Adapted from the ITDP publication of "BRT Basics" to include an element regarding frequency of service and additional descriptions of the elements, all based upon the ITDP's own BRT Scorecard.

- Bus priority at intersections

- **Platform-Level Boarding**
  - At-level boarding allows for quicker and more accessible boarding at each station
- **High Frequency**
  - At least 4 buses per hour at all times of the day

1.1 BRT-Lite System Characteristics

Of BRT systems in the United States, there are generally two types. First, there are systems faithful to the original definition of BRT. Second, there are systems with some key BRT characteristics that may be considered BRT-lite. Some cities, recognizing that they may benefit from true BRT implementation in the future, have redacted their self-imposed classifications as BRT-lite, instead referring to these systems as "express buses". However, all of the studied systems have at some point been called "BRT".

All BRT-Lite systems share the following characteristics[67]:

- **Some Dedicated Rights-of-Way**
  - Transit lanes at select points along the route
- **Options for Off-Board Fare Collection**
  - All-door entry allowed for prepaid customers, but cash is still accepted at the front of the bus
- **Intersection Treatments**
  - Buses communicate with signals to allow for occasional extended green signals and may have some transit priority signals along routes
- **Branded and Significant Bus Stop Infrastructure**
  - Shelter and real-time departure information at recognizable bus stops
- **High On-Peak Frequency**
  - At least 4 buses per hour on-peak, and service at some level 7 days per week

[67] Based upon research findings of this project.

1.2. BRT-Lite Systems in Texas

Several midsized cities in Texas have placed their bets on BRT-lite, converting or augmenting their most significant transit lines with branded BRT-lite systems.

The first city to complete its system was San Antonio with its VIA Primo service, commenced with Route 100, which remains the only bus with BRT characteristics in San Antonio. With service beginning in 2012, the route connects the South Texas Medical Center—one of San Antonio's most significant employment centers—to Downtown San Antonio. VIA Primo is notable as having the most extensive station infrastructure of any BRT-lite system in Texas.

In 2014, Austin's CapMetro introduced its BRT-lite system, which now has two routes—the MetroRapid 801 and MetroRapid 803. The combination of these two routes forms Texas's most significant BRT-lite system by a significant margin. The MetroRapid 801 runs from the south of Austin to the north along a spine of activity, while the MetroRapid 803 runs from the southwest of the city to The Domain, a major hub of activity in the northwest.

El Paso introduced its BRT-lite system – the Sun Metro Brio – in 2014 as well. While the Brio network only contains one corridor—its original "Mesa Corridor" which runs from downtown for 8.6 miles to the city's west side, the system is notable for being the most invested in branding and a unique ridership experience. The system has always had named 4 corridors planned, and 2 more corridors are currently under construction.

This study examines whether or not these systems live up to their potential when compared to other BRT-lite systems of the Continental United States.

2. Related Studies

2.1 *Direct Ridership Model of Bus Rapid Transit in Los Angeles County*

The first related study forms the root of this research. Robert Cervero, with *Direct Ridership Model of Bus Rapid Transit in Los Angeles County* (June 2009), sets forth to estimate station- and corridor-specific ridership utilizing a variety of functions.[68] Cervero argues that direct models—which utilize station-specific or corridor-specific data to generate ridership estimates—are both easier to accomplish and more accurate than the utilization of mode choice results of large scale surveys. While research preceding this study had been completed on many modes of transit around the country and world, this was the first research examining bus rapid transit through this lens.

Cervero examined a wide variety of attributes of specific stations around Los Angeles BRT and BRT-lite systems in search of an appropriate model. The first variables were BRT service attributes, such as frequency of vehicles, presence of dedicated lanes, and number of perpendicular transit options. Second, Cervero examined ½ mile buffers around stations to examine location and neighborhood attributes. The attributes examined included densities of population and employment, as well as street connectivity. Finally, Cervero examined bus stop attributes, which included elements such as parking presence at the station, number of benches, etc.

Cervero found that the best predictors for BRT ridership were the following:

1. Service intensity
2. Level of intermodal connectivity
3. Surrounding population densities
4. Surrounding employment density *only* in presence of exclusive BRT lanes

For this research on BRT-lite systems, service intensity was held constant—roughly 4 buses per hour, with service 7 days per week. No BRT-lite systems utilize exclusive BRT lanes apart from

[68] Cervero, R., Murakami, J., & Miller, M. A. (2009). Direct Ridership Model of Bus Rapid Transit in Los Angeles County. *Transportation Research Record.*

occasional transit lanes in central business districts or other congested areas of their routes. As a result, employment density would not be a valid indicator for this research, according to Cervero. Intermodal connectivity is an untested element of these systems, however, and it would be interesting to examine further. Generally, BRT-lite systems in midsized cities are not augmenting significant rail lines or other significant perpendicular infrastructure, although some systems examined may have those characteristics.

Cervero's findings indicate that the most significant indicator that could be used to compare similarly-operating BRT-lite systems across state lines is population density at ½ mile buffers around stations, validating this research's approach to comparing BRT-lite systems across state lines.

2.2. *Bus Rapid Transit (BRT): An Efficient and Competitive Mode of Public Transport*

With Cervero's 2013 work, *Bus Rapid Transit (BRT): An Efficient and Competitive Mode of Public Transport*, the breadth of options available in implementing BRT is discussed.[69] BRT-lite characteristics are discussed and defined, as are characteristics of the highest-performing BRT systems.

Cervero discusses the value of low-quality BRT systems but reiterates the importance of dedicated rights-of-way. An ideal BRT-lite system, according to Cervero, serves lower-density suburban areas that cannot support rail systems. The value of BRT-lite, according to Cervero, is that it can transition from designated rights-of-way downtown and in urban areas to operating as a feeder service in areas where those designated rights-of-way are infeasible or not valuable. Despite this, Cervero does not define BRT-lite systems as requiring designated rights-of-way. According to Cervero, the following are differentiators between "full-service BRT" and BRT-lite:

[69] Cervero, R. (2013), Bus Rapid Transit (BRT): An Efficient and Competitive Mode of Public Transport. *Berkeley Institute of Urban and Regional Development.*

Table A.1. Differences Between BRT Systems

	High-End BRT/ Full-Service	Low-End BRT/ BRT "Lite"/ Moderate-Service
Running Ways	Exclusive Transit-ways; Dedicated Bus Lanes; Some grade separation	Mixed Traffic
Stations/Stops	Enhance Shelters to large temperature-controlled transit centers	Stops, sometimes with shelter, seating, lighting, and passenger information
Service Design	Frequent services; integrated local and express services; timed transfers	More traditional service designs
Fare Collection	Off-vehicle collection; smart cards; multi-door loading	More traditional fare media
Technology	Automated Vehicle Location (AVL); passenger information systems; traffic signal preferences; vehicle docking/guidance systems	More limited technological applications

While this research proved valuable in defining BRT-lite as seen in the United States, it was very clear that BRT-lite systems in the United States have a higher minimum quality than BRT-lite systems around the world. In researching all BRT-lite systems in the United States, it was clear that the vast majority have, for example, high-quality shelters and unique branding, even if those aren't necessarily present in BRT-lite systems around the world. Discussion of BRT-lite characteristics ("Introduction") are of the higher-level minimums as seen in United States BRT-lite systems.

3. Study Method

As was discussed in the Cervero reading on direct ridership modeling, the most apt indicator of estimated ridership of BRT is population density in a ½ mile buffer around BRT stations. Therefore, to evaluate ridership of Texas BRT-lite systems, there was a three-step process:

1. Identify all BRT-lite systems in the United States and attain stop and ridership information for both the BRT network and the transit network as a whole
2. Utilize buffers in TransCAD to attain demographics within ½ mile buffers of BRT stations

3. Utilize buffers in TransCAD to attain demographics within 1 mile of all transit stops in the transit agency's area
4. Compare population over ridership for all BRT networks and all transit networks

The first step was to identify all BRT-lite systems in operation in the Continental United States. This list only includes systems which are primarily intracity systems, as the characteristics for intercity, primarily park-and-ride based BRT (such as Denver's Flatiron Flyer) would be very different. While many are partially under construction or nearly completed, the following are all BRT-lite systems in the United States which have been operating for at least one year:

1. Austin, TX's Capital Metro MetroRapid
2. El Paso, TX's Sun Metro Brio
3. San Antonio, TX's VIA Primo
4. Albany, NY's CTA BusPlus
5. Cincinnati, OH's Metro Metro*Plus*
6. Chicago, IL's CTA Jeffrey Jump
7. Kansas City, MO's KCATA Metro Area Express*
8. Los Angeles, CA's Metro Metro Rapid (704, 720, 733, 744, 745, 754)
9. Minneapolis, MN's Metro Transit A-Line
10. Orlando, FL's Lynx Lymmo
11. Reno, NV's RTC Rapid
12. San Bernardino, CA's RTA San Bernardino Express*
13. Santa Clara, CA's VTA Rapid 522

** denotes a transit system without publicly available route and stop data, which therefore was not analyzed in this research.*

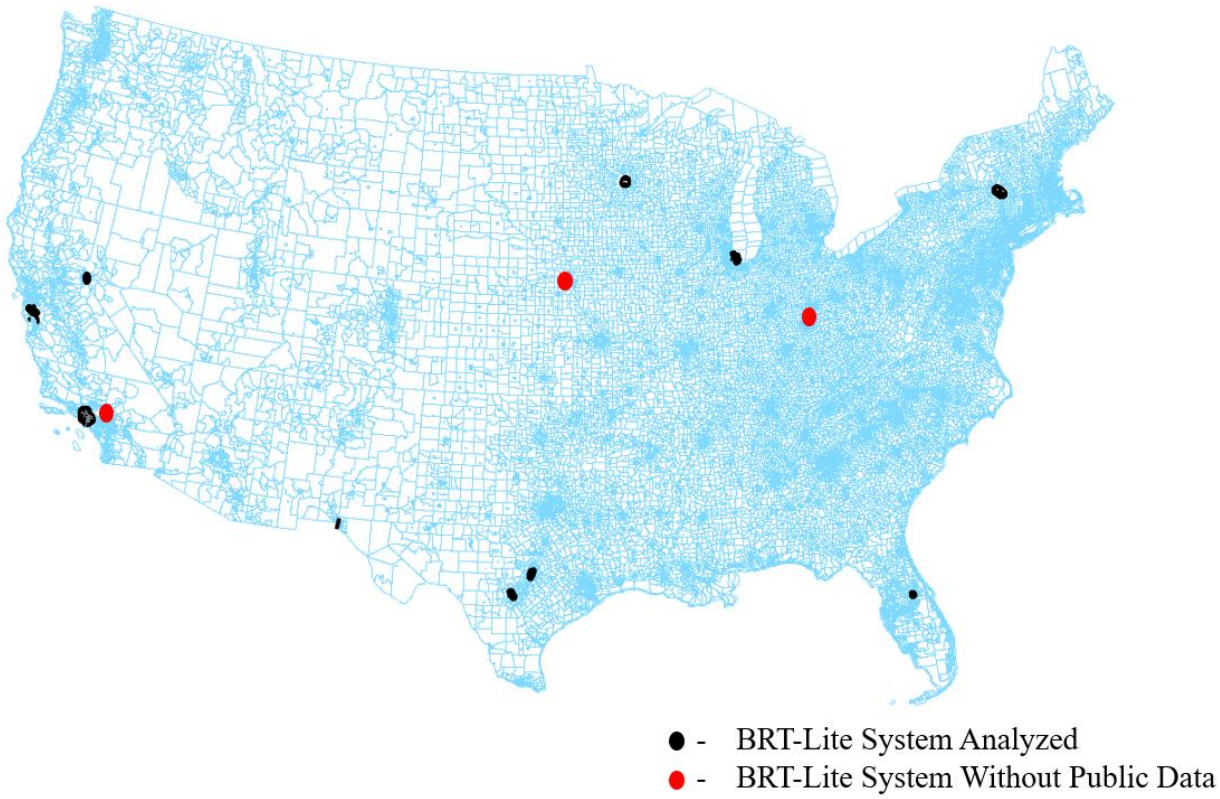


Figure A.1. BRT-Lite Systems Operating > 1 Year

All of these bus networks have similar operating characteristics—4-6 buses per hour at peak times, and service 7 days per week. These networks are also all in midsized cities, save for Chicago and Los Angeles. Therefore, while these systems were analyzed for population density and ridership, they were not part of the comparison to midsized Texas cities' population density and ridership.

The second step was to attain the TransCAD data necessary for these comparisons. Nearly all of the route and stop data was sourced directly from official websites. Some came from MPO data, others from municipalities, and others still came from the transit agencies themselves. El Paso, TX did not publish GIS data on transit stops and routes, so that data was attained on a third-party website and verified using official transit maps.

Buffers of ½ mile were run against the US Census Bureau's census tract Shapefile for all BRT station areas. That data was then compiled. Buffers of 1 mile were then run around transit agencies stops as a whole, and that data was then compiled as well.

Once this data was compiled, ridership data was needed. While some transit agencies published this data clearly, others did not. However, all ridership information necessary was able to be found through a combination of official documents, press releases, and news articles (both in favor of and opposed to these BRT-lite systems).

Figure A.2. Side-By-Side Comparison of Austin BRT Buffers and General Transit Buffers

4. Findings

4.1 Demographics

The first phase of the study that was analyzed was the demographic data of BRT station areas versus the demographic data of the transit agency's jurisdiction as a whole. Somewhat surprisingly, there were no notable points of distinction in age or race between BRT areas and the transit areas as a whole. This may be the result of homogenous populations of the cities, dispersed evenly, or (more likely) is the result of the transit corridor traversing a broad range of neighborhoods in the city. Table 4.1 shows highlights of the demographic data from the Austin, TX buffers:

Table A.2. Demographics of BRT and Overall Transit Buffers of Austin, Texas

	% White	% Black	% Asian	% Hispanic	Age (Med)	% Own
Austin BRT	75.5%	4.6%	5.8%	28.9%	31.03	32.1%
Austin Overall	69.3%	8.8%	5.2%	33.8%	32.67	44.8%

Only one city had dramatically different demographics around its BRT system versus its transit network as a whole – Albany, NY, as seen in Table 4.2.

Table A.3. Demographics of BRT and Overall Transit Buffers of Albany, New York

	% White	% Black	% Asian	% Hispanic	Age (Med)	% Own
Albany BRT	55.2%	29.4%	4.4%	10.1%	34.02	32.09%
Albany Overall	79.3%	11.6%	3.6%	5.4%	37.96	56.58%

When viewed as a whole, the demographic comparisons of the BRT areas to the transit areas overall provided no true insights into the planning or performance of BRT-lite systems.

4.2. Population

Of more consequence was the data on population density surrounding BRT stations. Somewhat surprisingly, BRT-lite systems are quite regularly placed along corridors that are, in fact, significantly denser than the city's transit area overall. The most significant BRT density advantage over the city's transit area overall is in Albany, NY, which has 4.06x denser surroundings of its BRT than it has in other urban areas of the city. The lowest by far is Chicago, which is not surprising as the Jeffrey Jump BRT line is merely one, relatively-small line in the extremely-dense Chicago metropolitan area.

Table A.4. Density Surrounding BRT and Overall Transit Area

	Pop / Acre	BRT Density Advantage
Albany BRT	4482.00	4.057117284
Albany Overall	1104.72	
Austin BRT	5292.50	1.885371508
Austin Overall	2807.14	
Chicago BRT	10349.00	1.053119449
Chicago Overall	9827.00	
El Paso BRT	5293.09	1.94488562
El Paso Overall	2721.54	
Los Angeles BRT	15642.63	1.984865167
Los Angeles Overall	7880.95	
Minneapolis BRT	4965.18	2.283852364
Minneapolis Overall	2174.04	
Orlando BRT	4318.56	2.113823414
Orlando Overall	2043.01	
Reno BRT	5503.95	2.159384845
Reno Overall	2548.85	
San Antonio BRT	4757.57	1.695303177
San Antonio Overall	2806.33	
Santa Clara BRT	9771.43	1.987612889
Santa Clara Overall	4916.16	

4.3. Ridership

Finally, the ridership of BRT systems and transit systems as a whole were calculated in consideration of the population living within the buffer zones. Chicago and Los Angeles were not included in these calculations, as they are unlike the other cities in the list and comparisons merely on the basis of population involving cities of such different scale would not be apt. First, somewhat surprisingly, the data clearly shows that Texans in midsized cities living in transit-served areas are nearly as likely to use transit as those living in midsized cities in other states. Of the buffered population in other states, there are 25.30 rides per person. In Texas, that number is 28.86—very similar, and somewhat unexpected.

Second, the core of this research was to compare BRT-lite ridership in Texas to that of other states. In other states, there are 39.77 rides per person on BRT-lite routes. In Texas, that number is 21.05, which is dramatically lower. San Antonio's score is higher than average in Texas, although it is a park-and-ride heavy service, and as a result its score in this comparison may be abnormally high. Austin's score is also higher than the average, although remains considerably lower than the average for BRT-lite services around the country.

Table A.5. Annual Ridership for BRT and Overall Transit Area

	Annual Ridership	Rides / Population
Albany BRT	1,900,000	25.59
Albany Overall	17,000,000	28.03
Austin BRT	3,422,588	27.34
Austin Overall	27,354,704	35.83
Chicago BRT	3,296,024	34.69
Chicago Overall	479,400,000	145.99
El Paso BRT	624,000	6.367
El Paso Overall	16,580,000	25.05
Los Angeles BRT	22,523,179	15.09
Los Angeles Overall	397,491,365	51.15
Minneapolis BRT	1,570,670	30.71
Minneapolis Overall	81,927,422	34.52
Orlando BRT	1,213,502	76.46
Orlando Overall	24,892,887	18.91
Reno BRT	1,262,587	54.23
Reno Overall	7,794,621	26.61
San Antonio BRT	1,787,400	29.44
San Antonio Overall	38,094,452	25.69
Santa Clara BRT	2,239,001	11.88
Santa Clara Overall	38,189,131	18.39

4.4. Discussion + Future Research

When accounting for population surrounding transit lines, Texans in midsized cities living in transit-served areas are nearly as likely to use transit as those living near transit in midsized cities in other states. However, Texans are far less likely to use nearby BRT-lite than citizens of other cities that have implemented similar systems.

There are several possible roots of this finding. The first possibility is that Texas BRT-lite systems may be poorer connectors to destinations than other BRT-lite systems. An additional analysis could be completed to test for density of employment, retail, etc. It's important to note that research has shown that employment data is not an apt predictor of BRT performance when there isn't a dedicated lane for the BRT system—however, this information could still be insightful outside of attempts to predict BRT-lite success.

Another, more plausible root of this finding is that midsized Texas cities may be less likely to have transit users in denser areas of the city. While racial and age demographics were similar for BRT-serving areas and overall transit-serving areas for Texas cities, an additional analysis could be completed to test for income. Texas is one of just a few states that bars requirements for construction of affordable housing in new development, and as a result new construction appearing alongside these transit lines may have an inordinately high number of relatively-wealthier citizens who do not rely on transit.

Conclusion

BRT-lite systems are an excellent bridge between the ultra-high investment of rail systems and the generally-low quality and image of standard city buses. These systems generally move more people more quickly and in greater comfort than standard city buses and are far more adaptable and inexpensive than rail systems. However, BRT-lite systems may have trouble attractive non-transit dependent populations--especially in Texas--and their success may dwindle if transit-

dependent populations are not protected along BRT-lite corridors. More research is necessary into opinions of Texans regarding BRT-lite buses.

Appendix B: Transit Agencies in the Texas Triangle

Transit agencies registered to operate in the Texas Triangle, organized by operating counties.

1. Atascosa
    a. San Antonio, ART (Alamo Area Council of Governments, Alamo Regional Transit)
    b. Seguin, CCSCT (Community Council of South Central Texas)
2. Austin
    a. Columbus, CVT (Colorado Valley Transit)
3. Bandera
    a. Hondo, MCPT (Medina County Public Transportation)
    b. San Antonio, ART (Alamo Area Council of Governments, Alamo Regional Transit)
4. Bastrop
    a. Austin, CARTS (Capital Area Rural Transportation System)
5. Bell
    a. Killeen, The HOP (Hill Country Transit District, HCTD)
6. Bexar
    a. SAIA (San Antonio International Airport), Ground Transportation
    b. San Antonio, VIA (VIA Metropolitan Transit)
7. Brazoria
    a. Galveston, Connect Transportation (Gulf Coast Center, CT)
8. Brazos
    a. Bryan, The District
    b. College Station, TAMU (Texas A & M University Transit Services)
9. Burleson
    a. Bryan, The District
10. Caldwell
    a. Austin, CARTS (Capital Area Rural Transportation System)
11. Chambers
    a. Anahuac, FUMC (First United Methodist Church)
12. Collin
    a. Allen, TAPS Public Transit
    b. McKinney, TAPS Public Transit
13. Colorado
    a. Columbus, CVT (Colorado Valley Transit)

14. Comal
    a. Hondo, MCPT (Medina County Public Transportation)
    b. San Antonio, ART (Alamo Area Council of Governments, Alamo Regional Transit)
    c. San Marcos, ASA (Austin San Antonio Intermunicipal Commuter Rail District)
15. Cooke
    a. Sherman, TAPS (Texoma Council of Governments, Texoma Area Paratransit System)
16. Coryell
    a. San Saba, Central Texas Hop
17. Dallas
    a. Balch Springs STAR Transit
    b. Dallas, DART (Dallas Area Rapid Transit Authority);M-Line (McKinney Avenue Transit Authority); TRE (Trinity Railway Express); DDPWT (City of Dallas Department of Public Works & Transportation)
    c. DFWIA (Dallas/Fort Worth International Airport), Ground Transportation
    d. DLFA (Dallas Love Field Airport), Ground Transportation
    e. Garland, Mobility Dallas (MB)
    f. Grand Prairie, GPT (City of Grand Prairie Transportation Department, Grand Prairie Transit, Grand Connection)
    g. Irving, LCP (Las Colinas People Mover)
    h. Mesquite, STAR Transit
    i. Seagoville, STAR Transit
    j.
18. Delta
    a. Texarkana, TRAX (Arkansas-Texas Council of Governments)
19. Denton
    a. Denton, Commuter Express; DCTA Connect; SPAN Transportation (Services Program for Aging Needs); DCTA (Denton County Transportation Authority); Rail DCTA
    b. Lewisville, LDAR (City of Lewisville Dial-a-Ride)
20. Ellis
    a. Corsicana, CTS (Community Transit Service)
21. Falls
    a. Waco, Waco Transit System
22. Fayette
    a. Austin, CARTS (Capital Area Rural Transportation System)
23. Fort Bend
    a. Stafford, FBSC (Fort Bend Senior Citizens)

24. Freestone
    a. Waco, Waco Transit System
25. Galveston
    a. Galveston, Connect Transportation (Gulf Coast Center, CT); Island Transit (IT); Ferry (run by TXDOT)
    b. Houston, Commute Solutions (CS)
    c. Texas City, Connect Transit
26. Gonzales
    a. Victoria, R Transit (Golden Crescent Regional Planning Commission)
27. Grayson
    a. Denison, TAPS Public Transit
    b. Sherman, TAPS Public Transit
28. Grimes
    a. Bryan, The District
29. Guadalupe
    a. San Antonio, ART (Alamo Area Council of Governments, Alamo Regional Transit)
    b. Seguin, CCSCT (Community Council of South Central Texas)
30. Hardin
    a. Nederland, SETT (Southeast Texas Regional Planning Commission, South East Texas Transit)
31. Harris
    a. Baytown, HCLF (Harris County Lynchburg Ferry)
    b. Bryan, The District
    c. GBIA (George Bush Intercontinental Airport), Ground Transportation
    d. Houston, Metro (Metropolitan Transit Authority of Harris County, MTAHC); RUSS (Rice University Shuttle System); TrekExpress (TrekExpress to Greenway Plaza); Uptown Shuttle (Uptown Houston Improvement District, US); BATP (Bay Area Transportation Partnership); Commute Solutions (CS); Houston Transtar (HT)
    e. WPHA (William P. Hobby Airport), Ground Transportation
32. Hays
    a. Austin, CARTS (Capital Area Rural Transportation System)
    b. San Marcos, ASA (Austin San Antonio Intermunicipal Commuter Rail District); San Marcos, CAT; SMT (San Marcos Transit); TxTram (Texas State-San Marcos TxTram Shuttle System)
33. Henderson
    a. Kilgore, ETRTD (East Texas Council of Governments, East Texas Rural Transit District)

34. Hill
    a. Waco, Waco Transit System
    b. Whitney, WDAR (Whitney Dial-a-Ride)
35. Hood
    a. Glen Rose, Hood County Committee on Aging; TTS (The Transit System)
36. Houston
    a. Bryan, The District
37. Hunt
    a. Greenville, The Connection (Hunt County Committee on Aging, HCCOA); Senior Center Resources and Public Transit
38. Jefferson
    a. Beaumont, BMT (Beaumont Municipal Transit System)
    b. Nederland, SETT (Southeast Texas Regional Planning Commission, South East Texas Transit)
    c. Port Arthur, PAT (Port Arthur Transit)
39. Johnson
    a. Cleburne, Cletran (City of Cleburne Cletran & City County Transportation)
40. Kaufman
    a. Combine, STAR Transit
    b. Cottonwood, STAR Transit
    c. Crandall, STAR Transit
    d. Elmo, STAR Transit
    e. Forney, STAR Transit
    f. Grays Prairie, STAR Transit
    g. Kaufman, STAR Transit
    h. Kemp STAR Transit
    i. Mabank, STAR Transit
    j. Oak Grove, STAR Transit
    k. Oak Ridge, STAR Transit
    l. Post Oak Bend, STAR Transit
    m. Rosser, STAR Transit
    n. Scurry, STAR Transit
    o. Talty, STAR Transit
    p. Terrell, STAR Transit
41. Kendall
    a. Hondo, MCPT (Medina County Public Transportation)
    b. San Antonio, ART (Alamo Area Council of Governments, Alamo Regional Transit)
42. Lavaca
    a. Victoria, R Transit (Golden Crescent Regional Planning Commission)

43. Lee
    a. Austin, CARTS (Capital Area Rural Transportation System)
44. Leon
    a. Bryan, The District
    b. Waco, Waco Transit System
45. Liberty
    a. Bryan, The District
46. Limestone
    a. Waco, Waco Transit System
47. Madison
    a. Bryan, The District
48. McLennan
    a. Waco, Waco Transit System
49. Medina
    a. Hondo, MCPT (Medina County Public Transportation)
    b. San Antonio, ART (Alamo Area Council of Governments, Alamo Regional Transit)
50. Milam
    a. San Saba, Central Texas Hop
51. Montgomery
    a. Bryan, The District
    b. The Woodlands, TCE and TCE (Woodlands Town Center Improvement District, Town Center Express)
52. Navarro
    a. Corsicana, CTS (Community Transit Service); Navarro County Senior Citizens Services
53. Orange
    a. Nederland, SETT (Southeast Texas Regional Planning Commission, South East Texas Transit)
    b. Orange, OCT (Orange County Transportation, Holiday Transit Service)
54. Parker
    a. Mineral Wells,PTS (Public Transit Services, Palo Pinto County Transportation Council)

55. Rockwall
    a. Fate, STAR Transit
    b. Glen Hill, STAR Transit
    c. Greenville, The Connection (Hunt County Committee on Aging, HCCOA)
    d. Heath, STAR Transit
    e. McClendon-Chisolm, STAR Transit
    f. Mobile City, STAR Transit
    g. Rockwall, STAR Transit
    h. Royse City, STAR Transit
56. San Jacinto
    a. Bryan, The District
57. Somervell
    a. Glen Rose, Somervell County Committee on Aging; TTS (The Transit System)
58. Tarrant
    a. Arlington, Handitran (City of Arlington)
    b. Dallas, TRE (Trinity Railway Express)
    c. DFWIA (Dallas/Fort Worth International Airport), Ground Transportation
    d. Fort Worth, The T (Fort Worth Transportation Authority, Northeast Transportation Service, NETS, FWTA); FWTA (Fort Worth Light Rail Project)
    e. Grand Prairie, GPT (City of Grand Prairie Transportation Department, Grand Prairie Transit, Grand Connection)
    f. Watauga, WSCP (City of Watauga Senior Citizens Program)
59. Travis
    a. ABIA (Austin-Bergstrom International Airport), Ground Transportation
    b. Austin, Capital Metro (Capital Metropolitan Transportation Authority, CMTA); CARTS (Capital Area Rural Transportation System); ACPRT (Austin Citizens for Personal Rapid Transit); ASACR (Austin-San Antonio Commuter Rail Feasibility Study); CATC (Capital Area Transportation Coalition); ASG (Capital Metropolitan Transportation Authority All Systems Go! Project); CMTA (Cellular Mass Transit for Austin); LRNA (Light Rail Now! Austin)
    c. San Marcos, ASA (Austin San Antonio Intermunicipal Commuter Rail District)
60. Walker
    a. Bryan, The District
61. Waller
    a. Columbus, CVT (Colorado Valley Transit)
62. Washington
    a. Bryan, The District
63. Wharton
    a. Columbus, CVT (Colorado Valley Transit)

64. Williamson
    a. Austin, CARTS (Capital Area Rural Transportation System); Capital Metro (Capital Metropolitan Transportation Authority, CMTA)
    b. San Marcos, ASA (Austin San Antonio Intermunicipal Commuter Rail District)
65. Wilson
    a. San Antonio, ART (Alamo Area Council of Governments, Alamo Regional Transit)
    b. Seguin, CCSCT (Community Council of South Central Texas)
66. Wise
    a. Decatur, Wise County Committee on Aging
    b. Sherman, TAPS (Texoma Council of Governments, Texoma Area Paratransit System)

Appendix C: Public Agency Survey Respondents

Response #	Agency Name	Agency Type	Date Completed
1	Abilene MPO	Region or State	11/16/2017
2	Alamo Area MPO	Region or State	10/30/2017
3	Brazos Valley COGs	Region or State	10/27/2017
4	Bryan-College Station MPO	Region or State	11/15/2017
5	Capital Metro	Transit	11/14/2017
6	City of Arlington Community Development and Planning - 1	City	completed offline
7	City of Arlington Strategic Planning, Community Development and Planning - 2	City	11/2/2017
8	City of Austin Planning and Zoning	City	11/16/2017
9	City of Bastrop Planning and Development	City	10/26/2017
10	City of Baytown Planning and Development Services	City	2/2/2018
11	City of Carrollton	City	11/6/2017
12	City of Dallas Planning and Urban Design - 1	City	11/1/2017
13	City of Dallas Planning and Urban Design - 2	City	10/27/2017
14	City of Forney Community Development	City	10/27/2017
15	City of Fort Worth Transportation and Public Works	City	11/20/2017

16	City of Garland - 1	City	10/27/2017
17	City of Garland Planning and Community Development - 2	City	10/26/2017
18	City of Harker Heights - 1	City	10/26/2017
19	City of Harker Heights - 2	City	10/26/2017
20	City of Harker Heights Planning and Development - 3	City	10/26/2017
21	City of Irving - 1	City	10/27/2017
22	City of Irving Planning and Community Development - 2	City	10/26/2017
23	City of Marble Falls Development Services	City	11/6/2017
24	City of Richardson - 1	City	11/14/2017
25	City of Richardson - 2	City	11/14/2017
26	City of Round Rock Planning and Development Services - 1	City	10/26/2017
27	City of Round Rock Planning and Development Services - 2	City	10/31/2017
28	City of Rowlett Community Development	City	10/27/2017
29	City of San Antonio Planning Department - 1	City	11/2/2017
30	City of San Antonio Planning Department - 2	City	completed offline
31	City of Temple	City	10/31/2017
32	City of Victoria	Region or State	10/27/2017
33	Farmers Branch Planning Department	City	11/7/2017

34	Fort Worth Transportation Authority	Transit	11/20/2017
35	GoBus	Transit	10/30/2017
36	Golden Crescent Regional Planning Commission	Region or State	10/27/2017
37	Heart of Texas COGs	Transit	10/27/2017
38	Hidalgo County MPO	Region or State	10/31/2017
39	Houston-Galveston Area Council - 1	Region or State	11/17/2017
40	Houston-Galveston Area Council - 2	Region or State	11/15/2017
41	LRGVDC - Valley Metro	Transit	10/26/2017
42	North Central Texas COGs - 1	Region or State	11/15/2017
43	North Central Texas COGs - 2	Region or State	11/15/2017
44	REAL, Inc.	Transit	10/26/2017
45	San Angelo MPO	Region or State	11/14/2017
46	STAR Transit	Transit	10/30/2017
47	Sun Metro	City	12/27/2017
48	Texarkana MPO	Region or State	11/17/2017
49	Texas Department of Transportation (TxDOT) - Dallas District	Region or State	10/27/2017
50	Tyler Area MPO	Region or State	11/14/2017
51	VIA Metropolitan Transit Special Projects and Project Development Dept.	Transit	11/17/2017
52	Waco MPO	Region or State	11/2/2017
53	City of Houston	City	completed offline
54	Capital Area MPO	Region or State	2/27/2018

Appendix D: Developer Survey Respondents

Response #	Agency Name	Agency Type	Notes	Date Completed
1	New Hope Housing, Inc.	Non-Profit Developer		3/8/2018
2	Western Securities	For-Profit Developer		3/12/2018
3	Accessible Housing Austin!	Non-Profit Developer		3/13/2018
4	Travis County	Government	Taken in error	3/13/2018
5	AREA Real Estate, LLC	For-Profit Investor		3/14/2018
6	City of Huntsville	Municipality	Taken in error	3/19/2018
7	Proyecto Azteca	Non-Profit Developer		4/3/2018

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