Volume 1: The Role of Transit in a Growing Region

Needs Assessment

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Prepared for

VIA

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1.0 Introduction

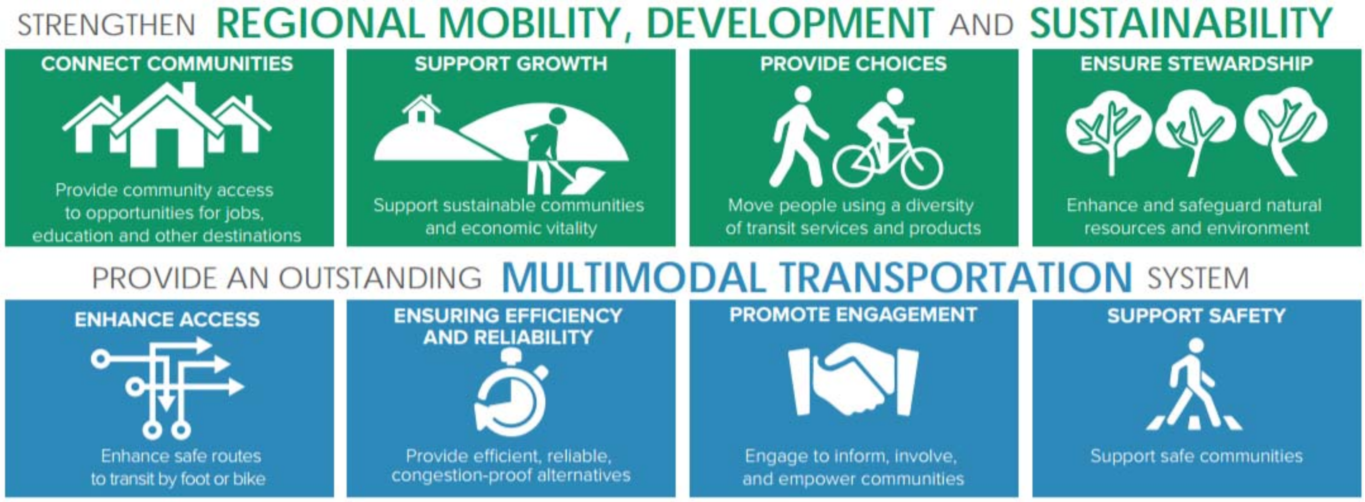
VIA Metropolitan Transit (VIA) updates its long range plan every five years to reassess the region's transportation needs and establish a strategic framework to guide transit investment in the region. This report summarizes the region's transit needs through 2040, taking into account a technical review of updated demographic projections, expected future land use, the resulting travel demand, and public and stakeholder input on the community's transit priorities. *Understanding VIA's Role in History, VIA's Role in the Community, and VIA in Comparison to Peer Agencies* in *Volume 1: The Role of Transit in a Growing Region* also provides additional detailed information on VIA's history and growth, existing system performance trends, and comparisons to peer transit agencies to inform the needs assessment. By characterizing the region's future transportation needs and challenges, these documents help explain the need for additional investment in public transportation and serve as the foundation for the VIA Vision 2040 Long Range Plan.

1.1 Vision 2040 Goals and Objectives

Through public engagement, VIA identified two clear goals for the Vision 2040 Long Range Plan: **strengthen regional mobility, development, and sustainability**, and **provide an outstanding multimodal transportation system**.

A series of public meetings, surveys, and information sessions helped to refine these goals, leading to the development of measurable objectives that reflect community needs (Figure 1.1). For a detailed description of the public involvement process, see *Stakeholder Involvement Summaries* one through four in *Volume 2: Developing Vision 2040*.

Figure 1.1 Vision 2040 Goals and Objectives



1.2 Key Findings

This report summarizes public transportation needs in the Greater San Antonio Region based on four key concepts:

1. **The Greater San Antonio Region is growing and changing.** Section 2.0 describes the demographic changes anticipated in the region by 2040, highlighting both regionwide trends and key activity centers where high growth is anticipated.

   The San Antonio-New Braunfels Metropolitan Statistical Area (MSA) is composed of Bexar County and the seven counties surrounding it. The population in this region is expected to grow by 1.6 million residents between 2010 and 2030; this is equivalent to about 146 new persons arriving every day. Bexar County, which contains the City of San Antonio and several other municipalities, is expected to grow by 64 percent, while the seven outlying counties are expected to grow by an average of 122 percent.

   This growth could have substantial effects on the demand for transit service in the area, as the makeup of the population changes. Members of both the "baby boomer" and "millennial" generations are more likely to use transit service than other age groups. The proportion of residents over the age of 65 (including the "baby boomers") is expected to increase by seven percentage points to 18 percent across the MSA; millennials moving to the area for jobs and family will demand a high-quality public transit system.

2. As the region grows, **moving vehicles will become more challenging.** Section 3.0 summarizes regional travel patterns and identifies which sections of the transportation network will potentially be strained by population growth.

The amount of traffic on the region's roads is expected to increase at an even faster rate than the population. By 2040, the number of daily miles traveled per vehicle is projected to be twice the amount traveled during 2010; time spent driving is projected to triple over the same time period. As a result, it will take each person longer to travel the same distance. The transportation network in key activity centers is projected to become especially congested, including the City of San Antonio's Central Business District, the northwestern suburbs (including the areas around San Antonio International Airport and the South Texas Medical Center), and along the I-35 corridor.

3. **Communities demand outstanding transportation solutions** to enhance their livability. Section 4.0 identifies needs related to the relationship between VIA, the community, and local stakeholders.

   An online survey with over 4,000 responses showed frequency and reliability to be key features of VIA's service for people of all demographics. Respondents highlighted the ability to link homes, jobs, and entertainment ("live-work-play") as the most important factor in making travel convenient. The top three choices for improving public transportation in the region were enhanced local service, rail service, and providing safe routes to transit. Continued efforts by VIA to involve and inform the community are critical to build support and shape the direction for an outstanding transportation network. Finally, VIA's network should integrate seamlessly with other modes of transportation, allowing drivers, pedestrians, and cyclists to safely and efficiently access VIA services.

4. **The transportation network needs to be efficient and integrated to accommodate growth.** Section 5.0 describes the challenges and opportunities facing VIA, and how it can best serve the needs of the community, customers, and its own operations.

   In order to provide outstanding transportation choices, VIA needs to ensure that its planning process is integrated with regional service providers and national/international transportation gateways. Innovative funding mechanisms for both local and expanded regional service will need to be explored and identified. Coordination with municipal governments, peer agencies, and community groups is critical to ensure that VIA services are efficient and address the needs of all stakeholders.

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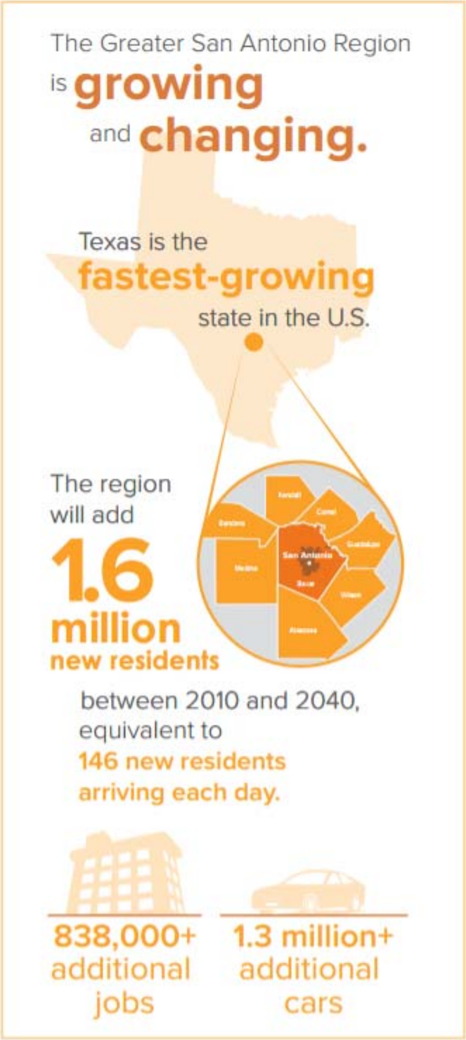
2.0 The Greater San Antonio Region is Growing and Changing

This section provides context for the needs assessment by characterizing the region's forecasted population and employment growth. The Greater San Antonio Region is defined for the Vision 2040 Long Range Plan as the eight-county San Antonio–New Braunfels Metropolitan Statistical Area (MSA).



The Greater San Antonio Region is projected to be one of the fastest growing in the country.

The San Antonio MSA is expected to grow by 1.6 million additional residents between 2010 and 2040, an increase of 76 percent (Figure 2.2). The majority of this growth is in Bexar County, which is expected to expand by 1.1 million residents between 2010 and 2040, a rate equivalent to 100 new people arriving every day for 30 years. On a percentage basis, Comal and Guadalupe Counties are predicted to grow even faster (142 and 154 percent, respectively) between 2010 and 2040, driven by growth in the cities of New Braunfels and Seguin.

Job growth in the region will attract more employees.

Between 2010 and 2040, the total number of employees in the Greater San Antonio Region is predicted to nearly double, from 0.9 million to 1.7 million, as shown in Figure 2.3. This increase is primarily in Bexar County, with an additional 675,000 employees. Comal and Guadalupe Counties also will increase by more than 150 percent each, with an additional 65,000 and 60,000 employees, respectively.

Most population and employment growth will be concentrated in key activity centers.

In addition to population and employment growth by county, understanding the approximate locations of where this growth is expected to occur is beneficial for selecting transportation strategies. For this purpose, a total of 23 key activity centers were identified throughout the Greater San Antonio Region, shown in Figure

2.4. Activity centers were identified by the VIA Planning Team as areas serving major employment and transportation activity, drivers of the regional economy, and/or areas that accommodate future growth.[1] Both population and employment within these activities centers are projected to increase over the next 25 years, as shown in Figure 2.5 and Figure 2.6. New Braunfels is expected to have the greatest total population increase in 2040 with over 56,000 new residents. Strong population growth also is predicted to occur in the Stone Oak, Highway 151–Loop 1604, and Schertz-Selma-Cibolo activity centers.

[1] The City of San Antonio initiated several studies (Comprehensive Plan Initial Studies Components 1 through 3) to understand which areas in the city limits of San Antonio have the highest potential to capture employment growth within the city, and are the most conducive areas for mixed-use and higher-density development with the potential to support transit. The research led to the identification of 13 activity centers that represent the nodes of employment activity within the City of San Antonio. Using a similar methodology, VIA identified 10 additional activity centers that represent the nodes of employment activity within the surrounding counties of Bandera, Comal, Guadalupe, Kendall, and Medina, for a total of 23 activity centers.

Figure 2.1 Vision 2040 Study Area

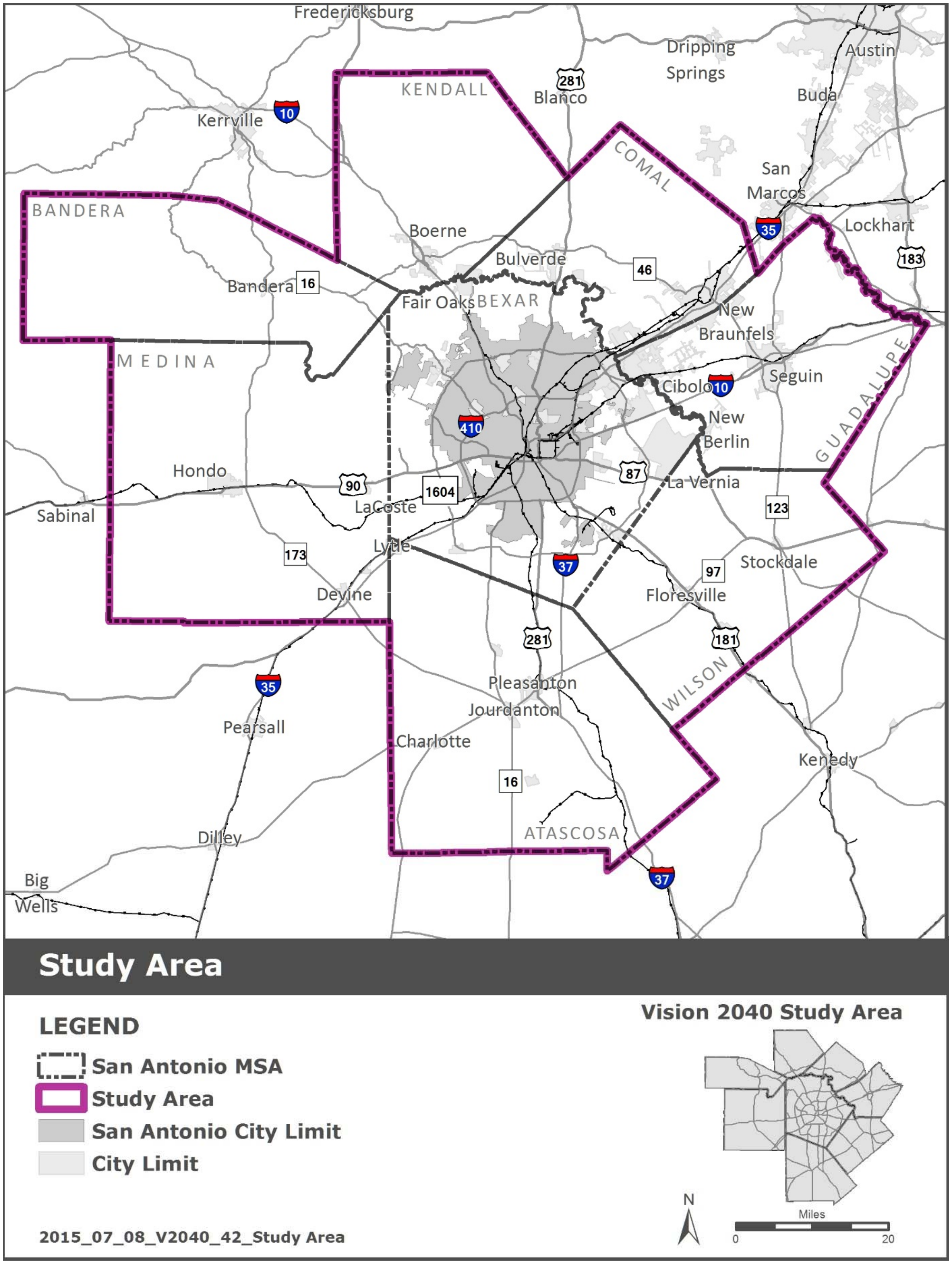
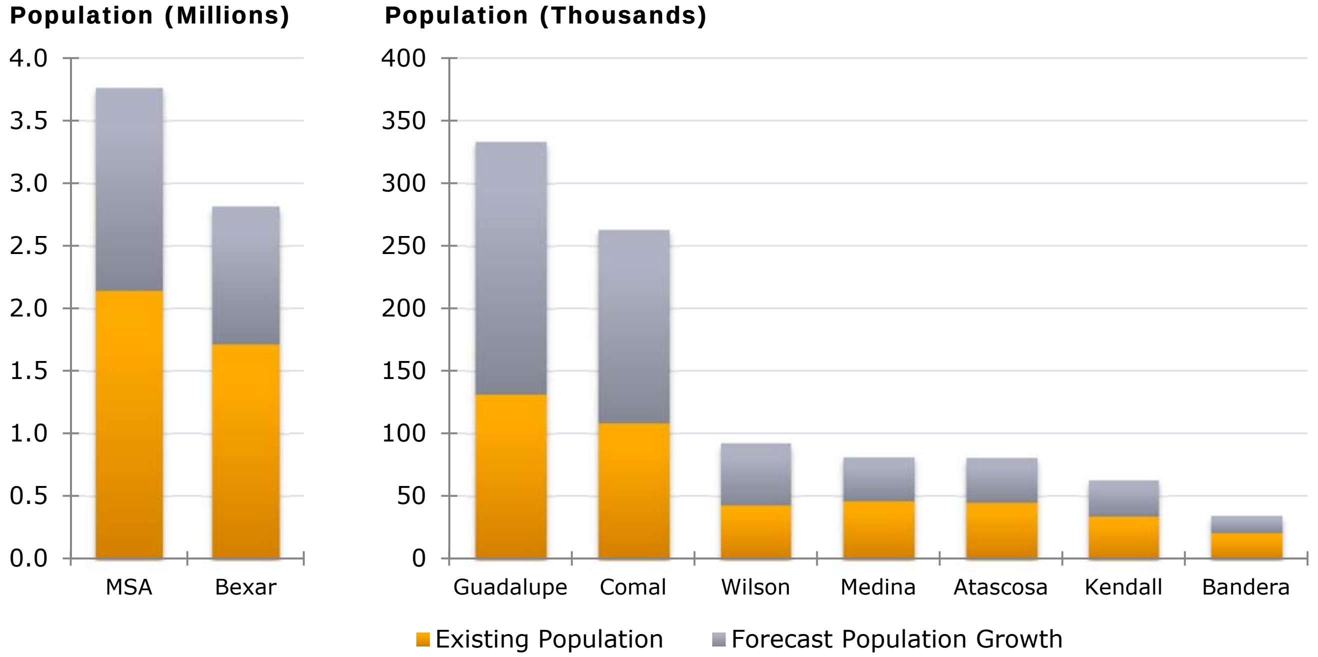
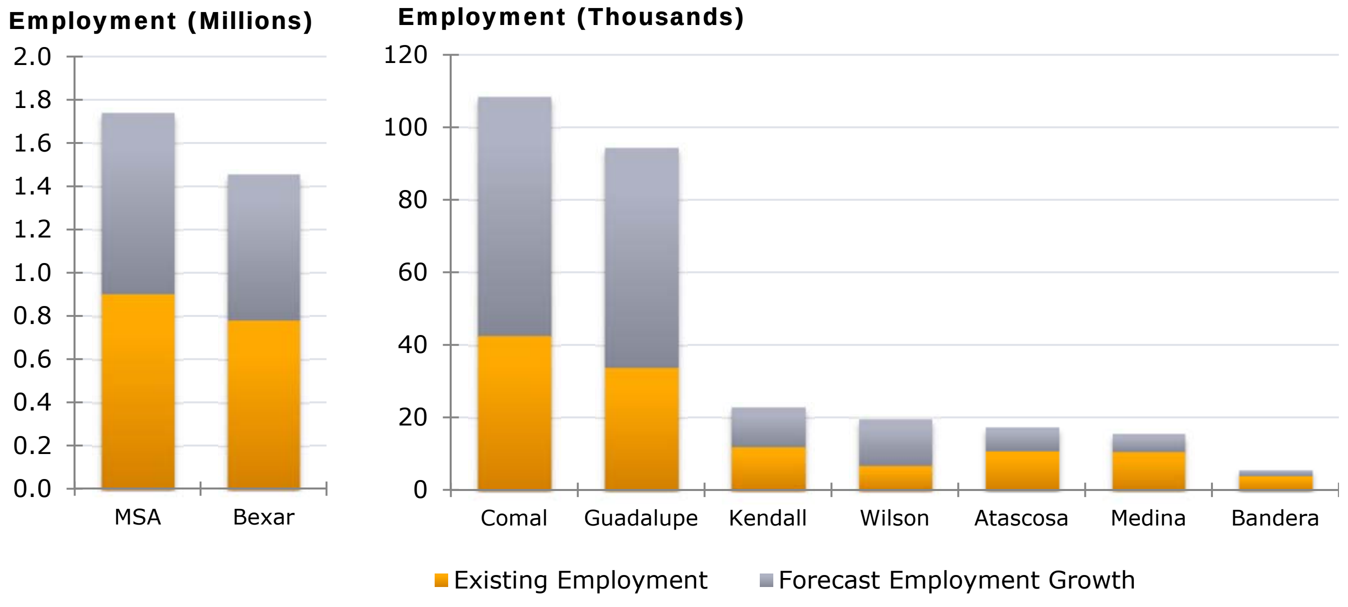


Figure 2.2 County Population Growth, 2010 to 2040



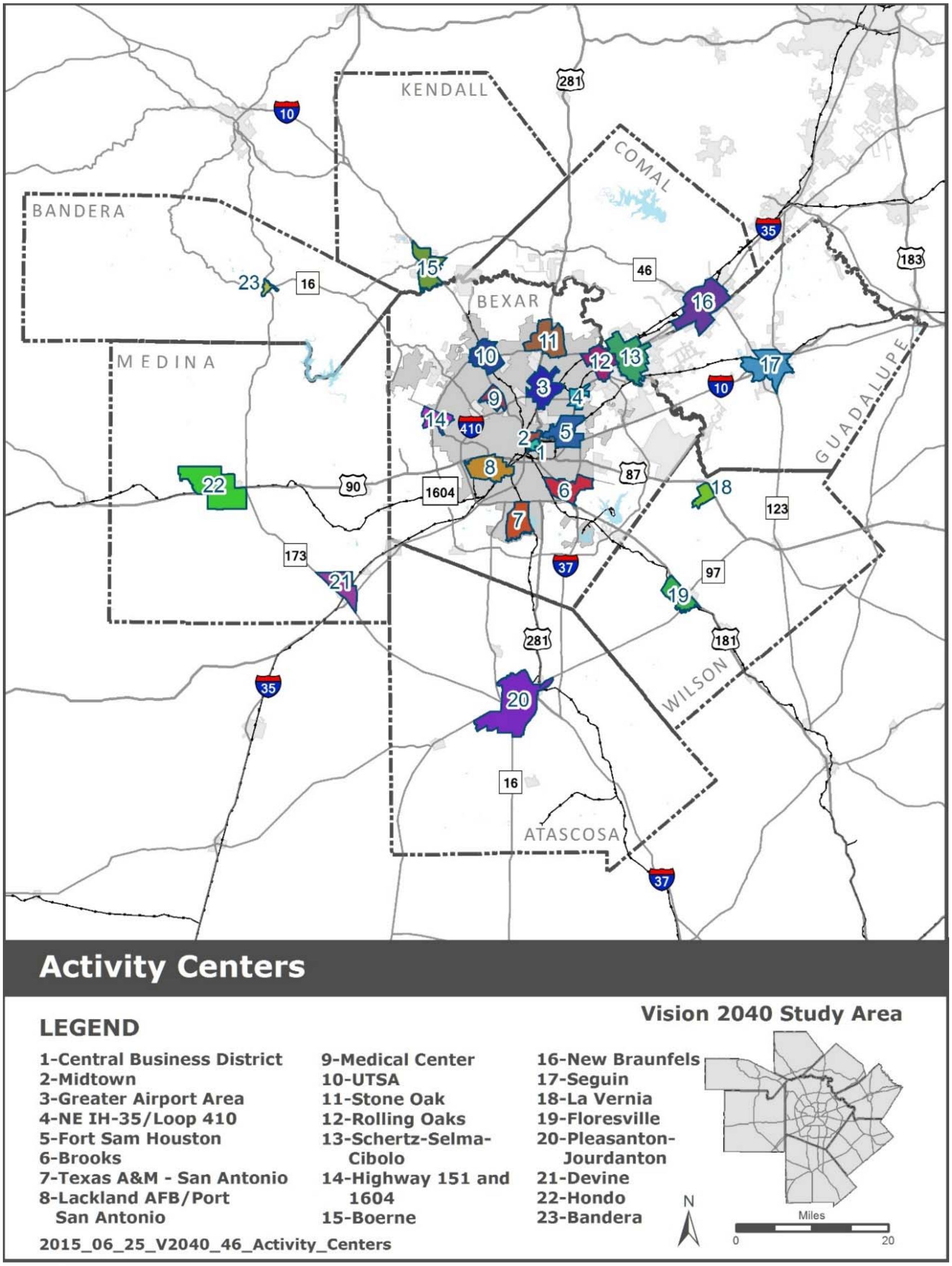
Source: Alamo Area Metropolitan Planning Organization (AAMPO) Model, Texas Department of Transportation (TxDOT) Statewide Analysis Model (2014).

Figure 2.3 County Employment Growth, 2010 to 2040



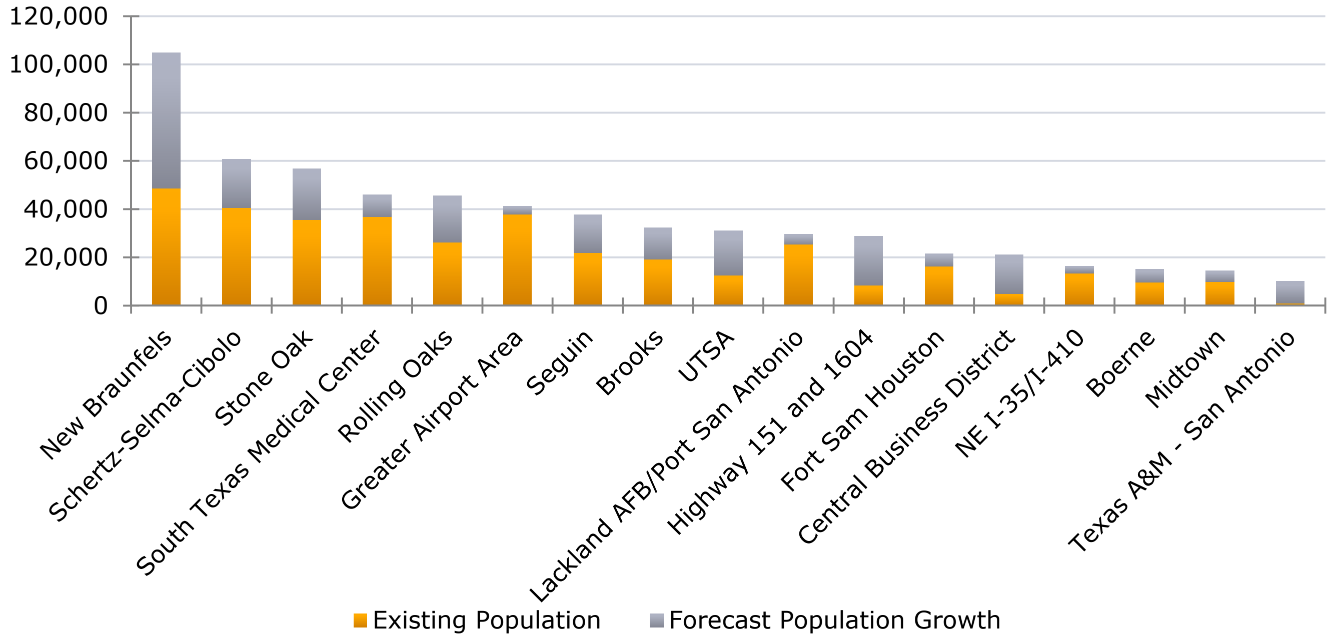
Source: AAMPO Model, TxDOT Statewide Analysis Model (2014).

Figure 2.4 2040 Activity Centers



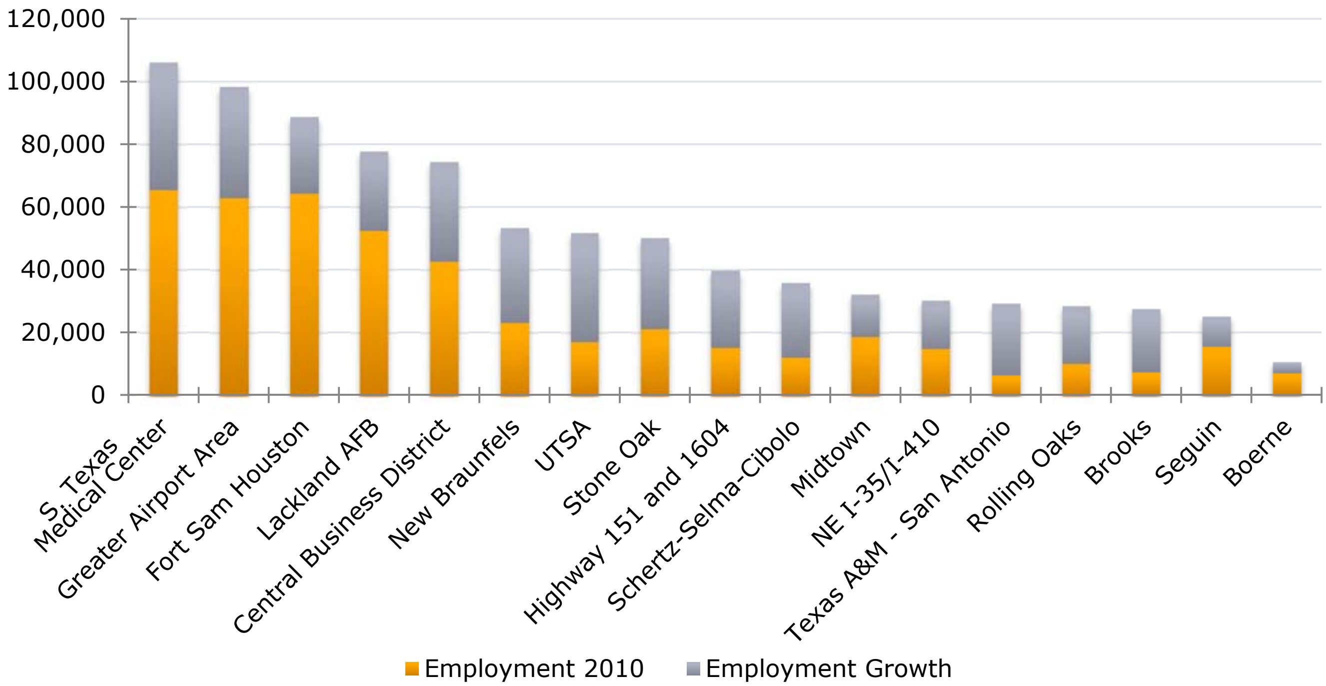
Source: City of San Antonio, VIA Metropolitan Transit (2015).

Figure 2.5 Population Growth by Activity Center



Source: AAMPO Model (2014).

Figure 2.6 Employment Growth by Activity Center



Source: AAMPO Model (2014).

In terms of employment, the South Texas Medical Center is leading the predicted growth among all activity centers.[2] Overall, an increase of 40,000 jobs is expected in this area, bringing the total employment within the South Texas Medical Center activity center to 100,000 by 2040. Other areas with high employment growth include Greater Airport Area, University of Texas at San Antonio (UTSA), and the San Antonio Central Business District; each of which are expected to add more than 30,000 employees.

2.1 Demographic Profile

The Greater San Antonio Region's transportation needs are as diverse as its population. Demographic characteristics such as age, income, and car ownership all help determine individual transportation needs and choices. Considering these varying and changing needs is critical to understanding how the region's transportation network should evolve in response to changing demographics.

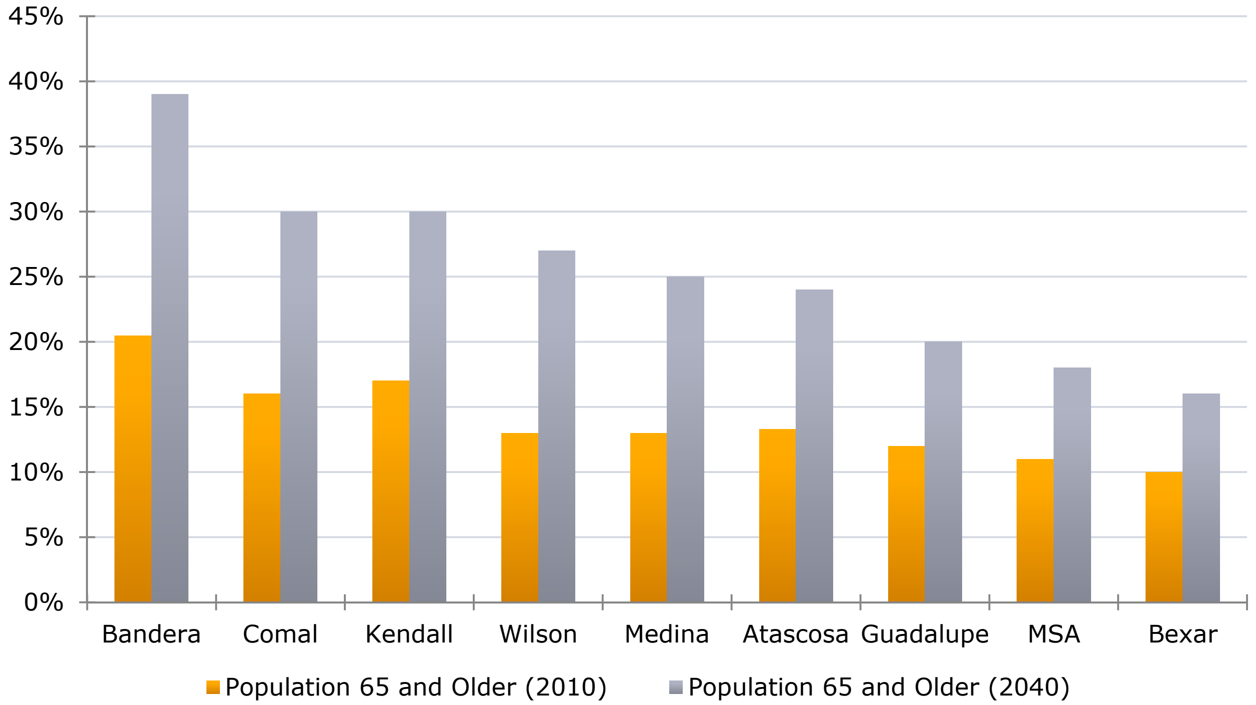
The region's population is aging.

For the Greater San Antonio Region, the substantial projected increase in residents over the age of 65 is certain to impact future transit service demand. Scheduled and demand-responsive transit service can allow older residents to maintain mobility and independence even after they stop driving. Between 2010 and 2040, the number of residents over 65 is expected to increase by approximately 451,000, accounting for 18 percent of the total population in the region (Figure 2.7); this figure reflects nationwide trends. Approximately one-half of these new residents will live in Bexar County, representing 16 percent of the total projected county population. However, residents over 65 years old represent an even higher portion in Bandera (39 percent), Comal (30 percent), and Wilson (27 percent) Counties.

Some activity centers already have a high percentage of residents over 65. As of 2010, Bandera and Boerne have the highest percentage of residents over 65, at 27 and 26 percent, respectively. In fact, the majority of activity centers outside of Bexar County have a higher percentage of residents over 65. Both VIA and the Alamo Area Council of Governments (AACOG, which provides rural demand-responsive transit services in the region) will need to anticipate and respond to the increasing transit needs of this population.

[2] Although the study area has 23 activity centers, only 17 (those falling within Bexar, Kendall, Comal, and Guadalupe Counties) are included in the model used to generate the demographic projections in this document.

Figure 2.7 Percent of Population Age 65 and Older



Source: Texas State Data Center, Population Projections Tool (2015).

Driving Habits are Changing.

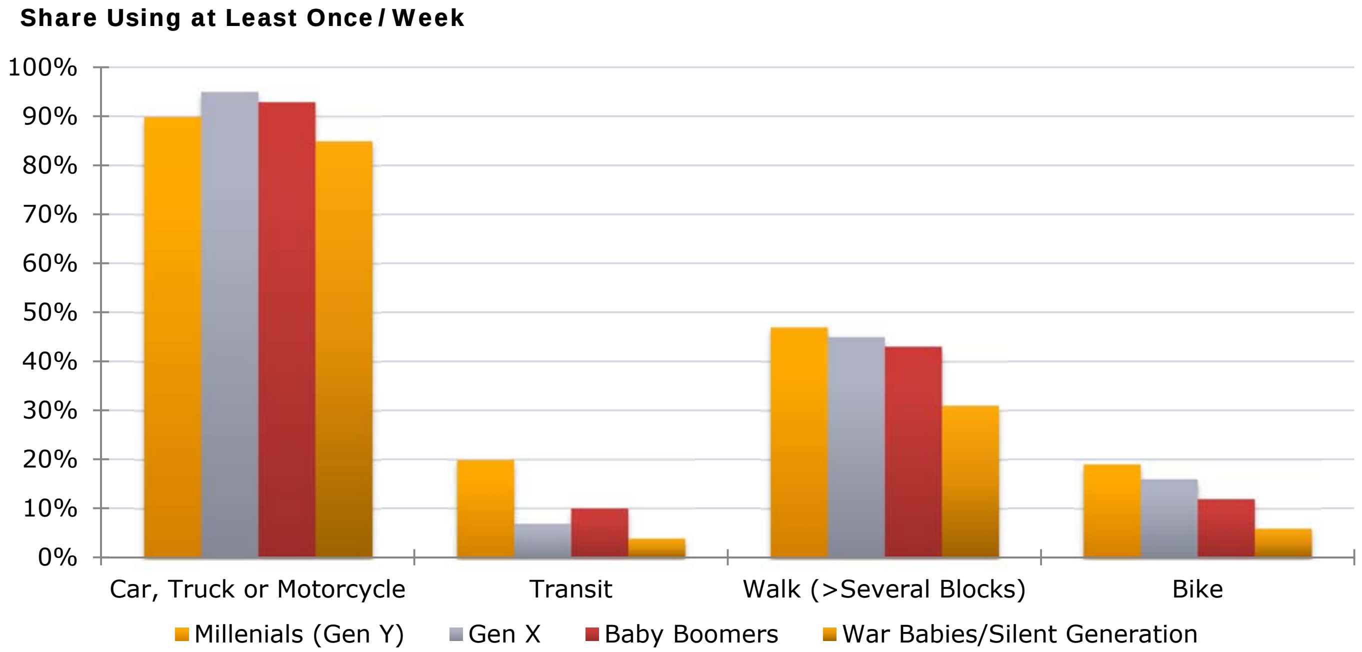
Areas with a high percentage of households either without a vehicle or below the poverty line typically demand more transit service than wealthier households with multiple cars. The activity center with the highest percent of residents below the poverty line is Lackland AFB (22 percent); in comparison, on average eight percent of households in the San Antonio-New Braunfels MSA are below the poverty line. Areas with the highest concentration of zero-car households include Midtown and the San Antonio Central Business District (16 and 14 percent, respectively). For more information on demographics and transit demand, see *Appendix A: Demographic Profiles*.

Younger residents of cities, or "millennials," are more likely to use transit in conjunction with ridesharing, short-term rentals, and nonmotorized transportation (American Public Transit Association, 2014).[3] Between 2001 and 2009, the average number of miles driven by persons between the ages of 16 and 34 decreased by 23 percent (Dutzik, T., Inglis, J., & Baxandall, P., 2014; Figure 2.8). In 1996, 85 percent of high school seniors had a driver's license; in 2010, that number had dropped to

[3] The term "millennials" refers to persons from the last age cohort before the year 2000; this term is somewhat synonymous with "Generation Y." Generally includes children born between the early 1980s and early 2000s.

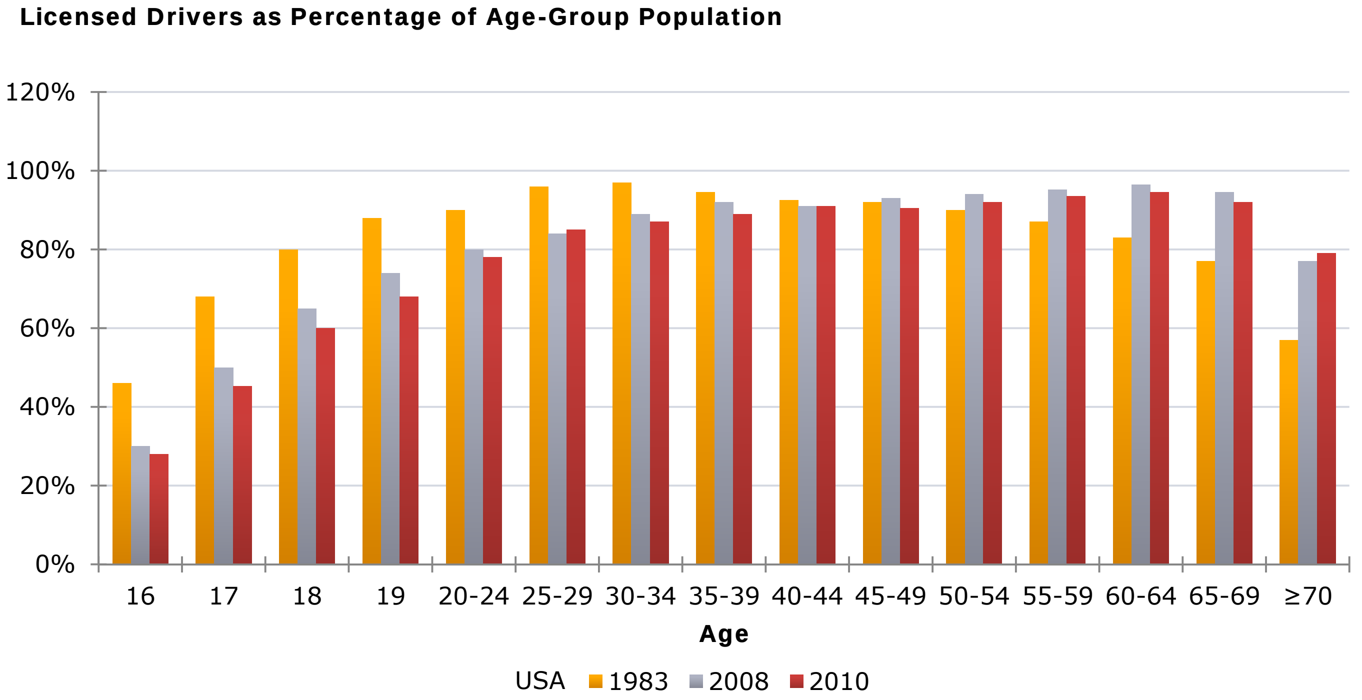
73 percent (Sivak, M. and Schoettle, B., 2012; Figure 2.9). Transit services and amenities to accommodate these residents will be increasingly important as driving habits continue to change.

Figure 2.8 Transportation Habits by Cohort



Source: Dutzik, T., Inglis, J., & Baxandall, P. (2014).

Figure 2.9 Licensed Drivers as a Percent of Age Group Population



Source: Sivak, M. and Schoettle, B (2012).

3.0 As the Region Grows, Moving Vehicles will Become More Challenging

This section describes the impact that population and employment growth will have on the region's transportation network. Two modeling approaches were used to estimate the existing (2010) and future (2040) demand for travel options in the region; these results were then compared with transportation infrastructure to assess where the current system will be most strained as the region grows.[4] Results from the modeling exercises were supplemented with feedback from a community survey about the current conditions and desired improvements to VIA service.

The first model used was a *travel demand model*, which uses demographic information (discussed above and in Appendix A) and infrastructure information to estimate traffic flows on roadways.[5] The second model used was the *transit propensity analysis* method, which uses statistical methodology to estimate how likely residents are to take transit if it is available to them. *Appendix B: Origins, Destinations, and Travel Corridors* provides additional detailed technical documentation regarding the travel demand modeling process, while *Appendix C: Transit Gap Analysis* focuses on the methodology behind the transit propensity analysis.

3.1 Traffic Flows

Traffic flows to/from Bexar County will increase as the populations of surrounding counties grow.

While Bexar County is the primary generator of transportation activity in the area, there is significant flow between Bexar County and Comal, Guadalupe, and Kendall Counties (Figure 3.1). Much of this

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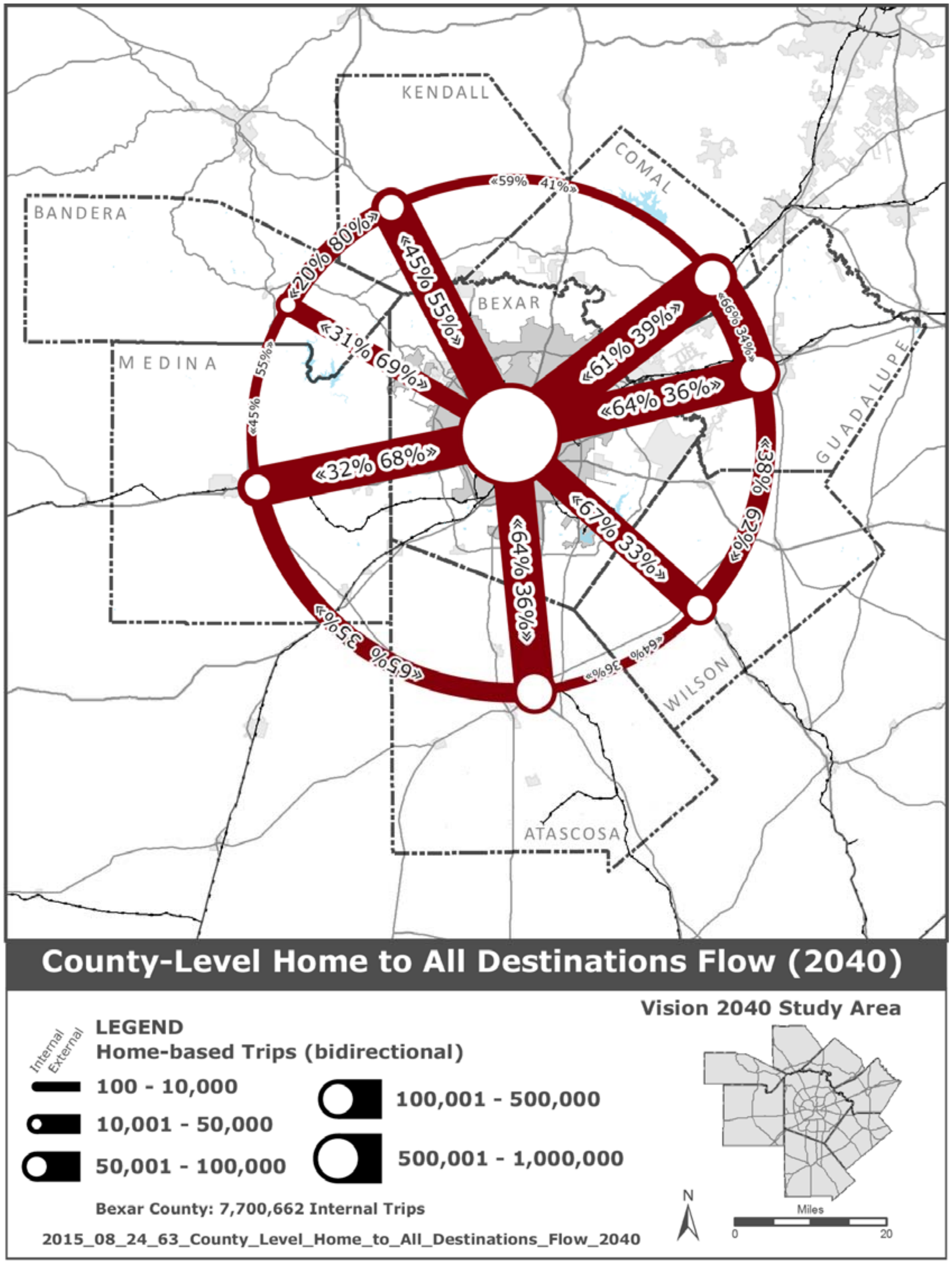
[4] The modeling approach used to estimate total traffic flow uses both existing and committed transportation infrastructure for its 2040 estimates. The modeling approach used to compare demand for transit with current allocation of bus service compares present-day service patterns with future demographics. Refer to *The Visioning Process* in *Volume 2: Developing Vision 2040* for more detailed information on the network assumptions and demographic forecasts built into the regional travel demand model.

[5] Traffic flows are categorized by mode (e.g., private vehicle or transit) and purpose. In this document, home-based total (HBT) flows are used to show trips that start or end at a residence: trips to and from work, shopping, or school. Not included are trips that neither start nor finish at home, such as a short shopping trip conducted from the office, or commercial travel moving between industrial areas.

intercounty travel is driven by trips starting in New Braunfels and Seguin, located along I-35 and I-10, respectively, and traveling to Bexar County (Figure 3.1).

Figure 3.1 County-to-County Trips (2040)



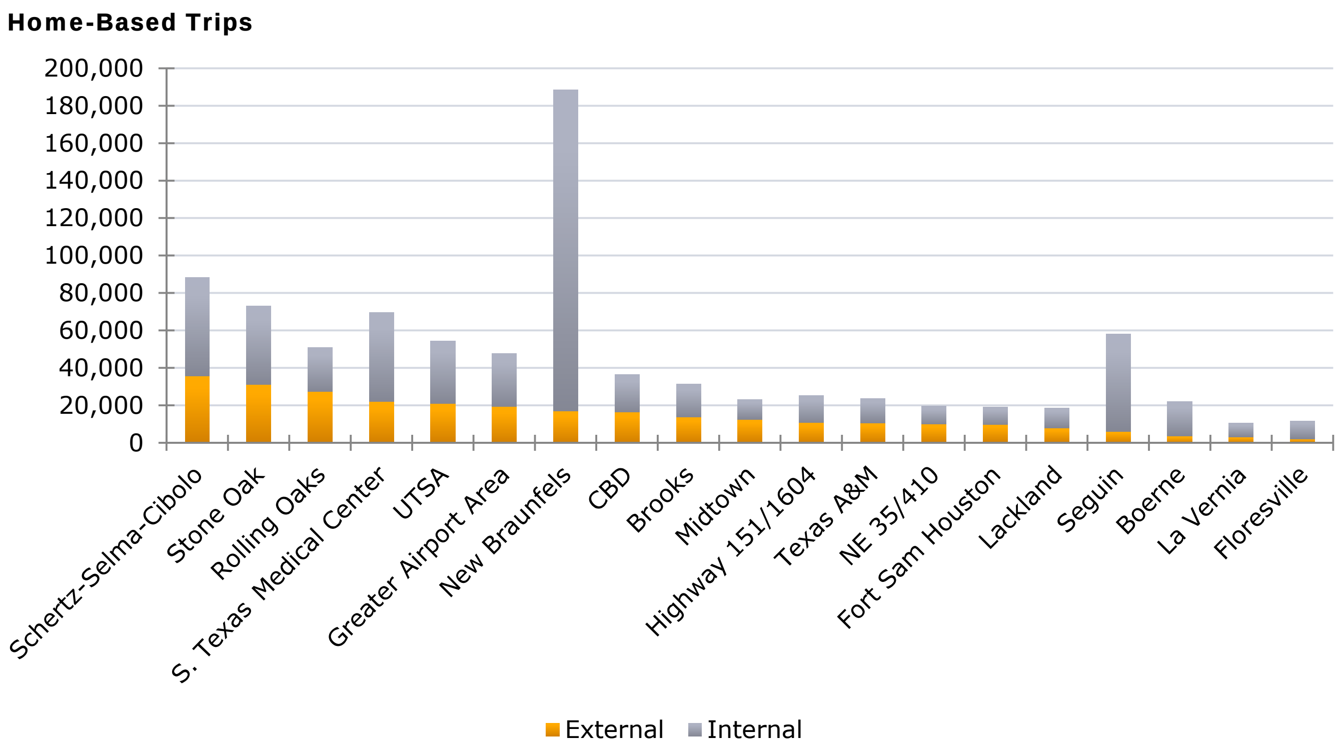
Source: Texas Department of Transportation (TxDOT) Statewide Analysis Model (2014).

Traffic flows between key activity centers will increase substantially by 2040.

Estimating traffic flows at the activity center level allows identification of key traffic flows within and between activity centers. (Figure 3.2 and Figure 3.3). Transportation demand, both in terms of overall travel flows and specific demand for transit, is highest in the northern and central Bexar County area.

The New Braunfels area generates more trips than any other designated activity center, but 91 percent of these trips start and end within the activity center itself. The activity centers from which the highest number of trips originate are Schertz, Stone Oak, Rolling Oaks, and the South Texas Medical Center (Figure 3.2). The areas that attract the most trips from other activity centers include South Texas Medical Center, the San Antonio Central Business District, the Greater Airport area, and Midtown (Figure 3.3). An illustration of the flow of people to the San Antonio Central Business District from other activity centers is shown in Figure 3.4.[6] Illustrations and tables of flow between other activity centers can be found in Appendix B.

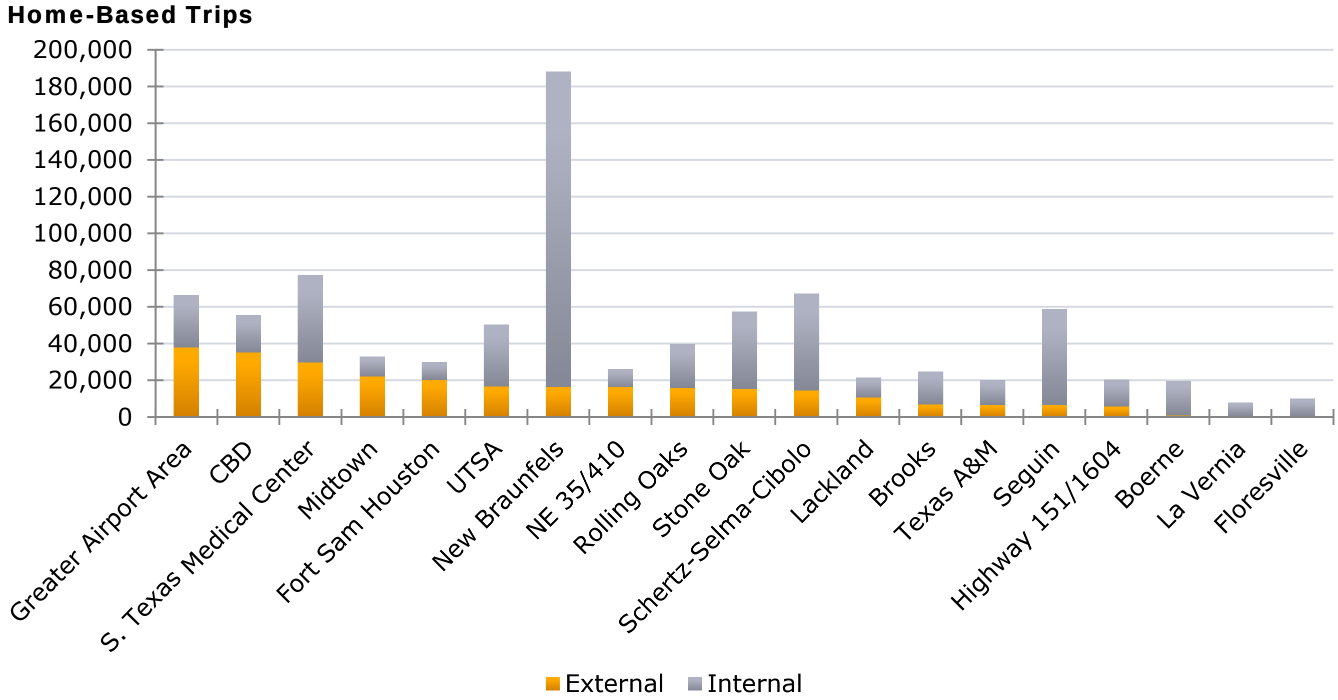
Figure 3.2 Activity Center Trips by Origin
All Home-Based Trips



Source: Alamo Area Metropolitan Planning Organization (MPO) Model (2014).

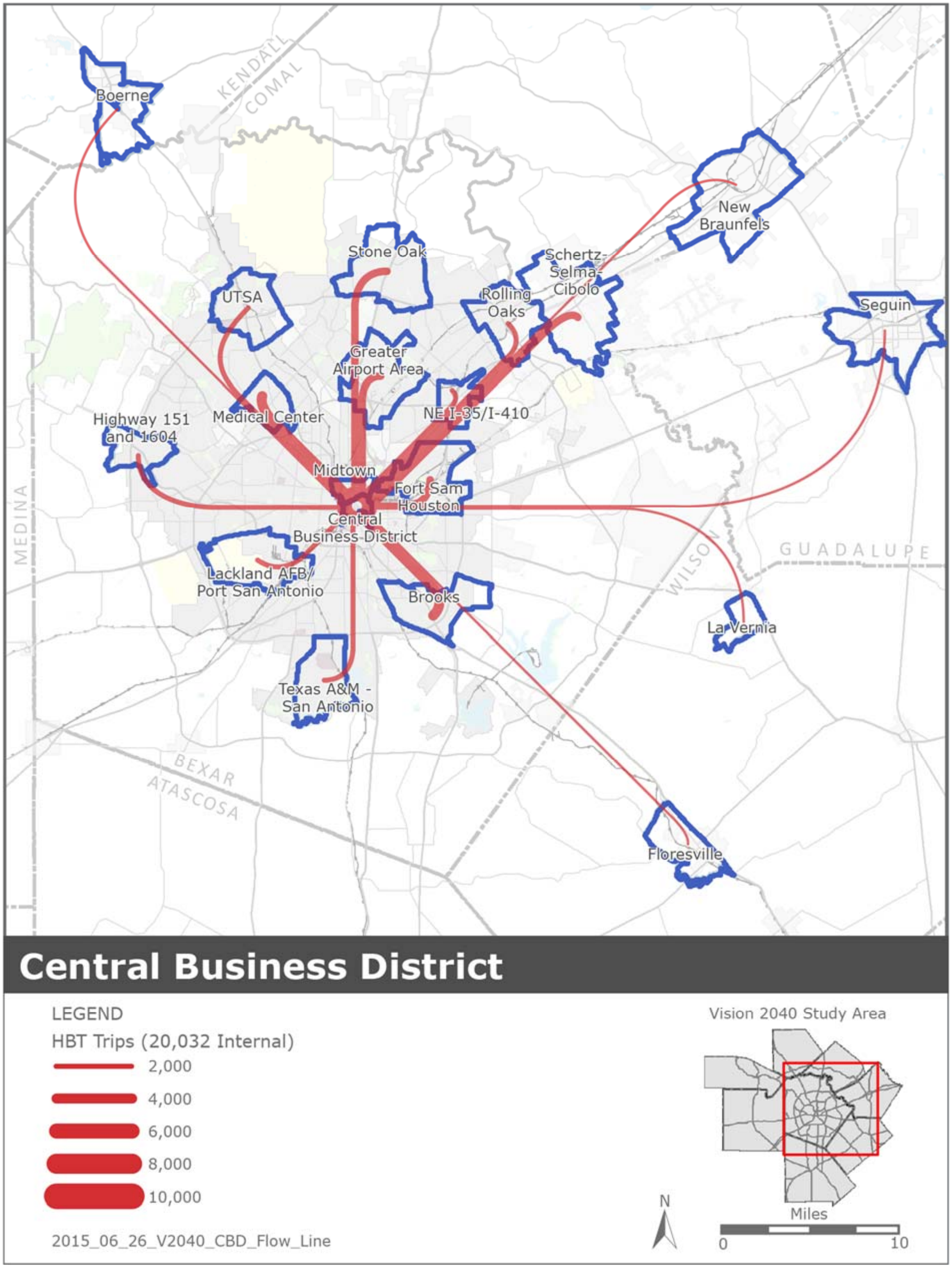
[6] Selected for illustration here due to its central location and relative balance of trips from activity centers across the region.

Figure 3.3 Activity Center Trips by Destination
All Home-Based Trips



Source: AAMPO Model (2014).

Figure 3.4 2040 Flow to San Antonio Central Business District



3.2 Roadway Conditions

Regional growth will increase congestion along major corridors.

As population and employment centers grow, the number of trips taken to connect them increases, causing strain on transportation facilities. Network strain is expressed as the relationship between volume of traffic and the number of vehicles that the network can accommodate. The ratio of daily flow to design capacity is called the volume-to-capacity ratio (Table 3.1).

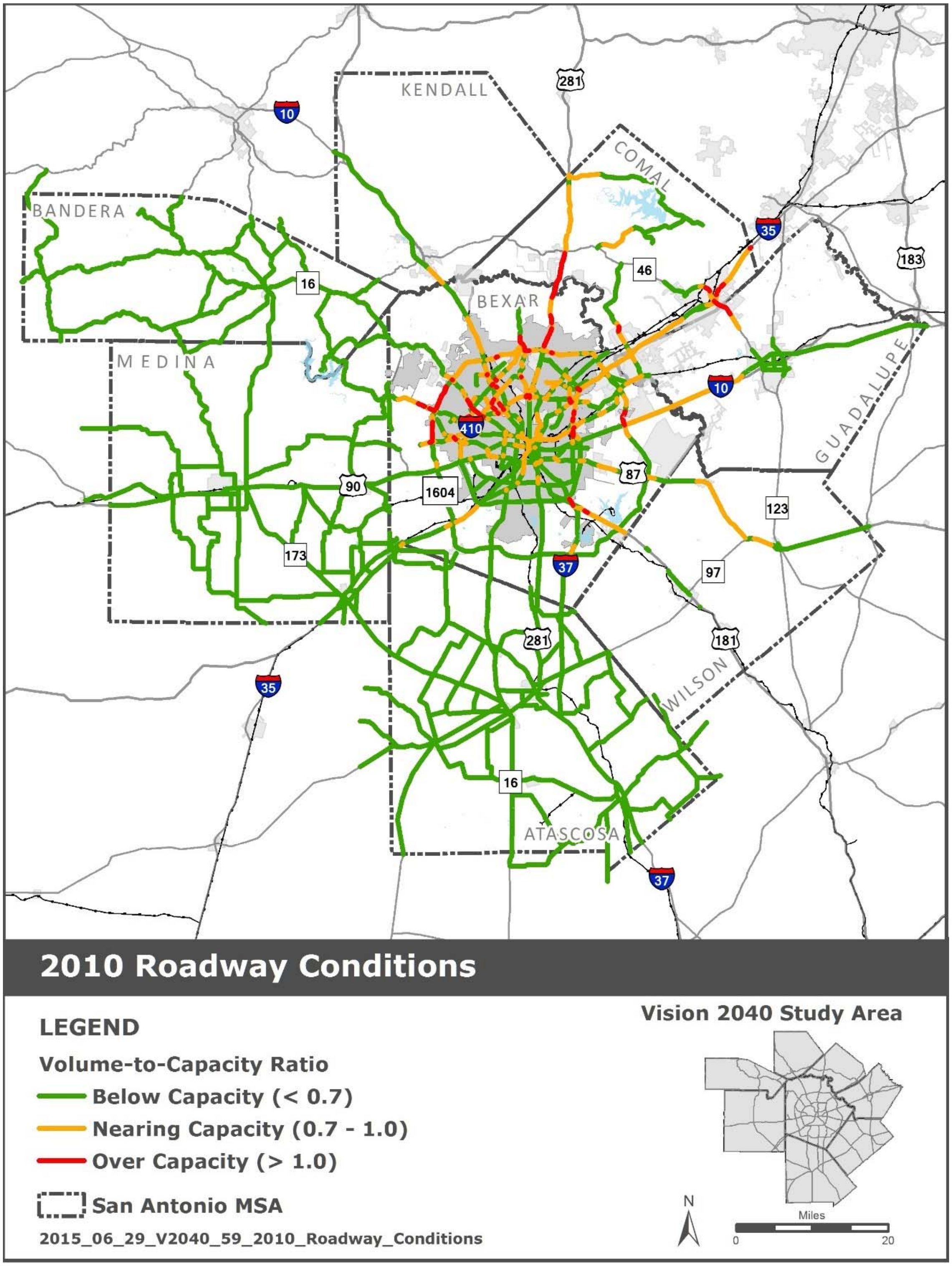
Table 3.1 Volume-to-Capacity Ratios

Volume-to-Capacity Ratio	Travel Speed	Roadway Conditions
0–0.5	Free-flow	No impediments
0.5–0.7	Near-free flow	Some restrictions on ability to maneuver
0.7–1	Reduced, minor disruptions may cause queuing behavior	Ability to maneuver impaired, merging becomes difficult
>1	Severely reduced, traffic may move slowly or not at all	Virtually no gaps in traffic, ability to maneuver severely restricted

While the Greater San Antonio Region currently experiences moderate congestion along its major corridors (Figure 3.5), projected population and employment growth through 2040 is expected to exacerbate congestion in three main areas of the region (Figure 3.6). First, congestion in the high-density Midtown and San Antonio Central Business District centers grows substantially, with nearly all major roadway facilities over capacity. Second, links between downtown San Antonio and the northwestern suburbs, including the South Texas Medical Center, University of Texas at San Antonio (UTSA), and the Highway 151–Loop 410 area are mostly over capacity, reflecting high growth in these areas. Finally, connections between Bexar County and Wilson, Guadalupe, and Comal Counties are strained, with many key segments of the roadway network over capacity.

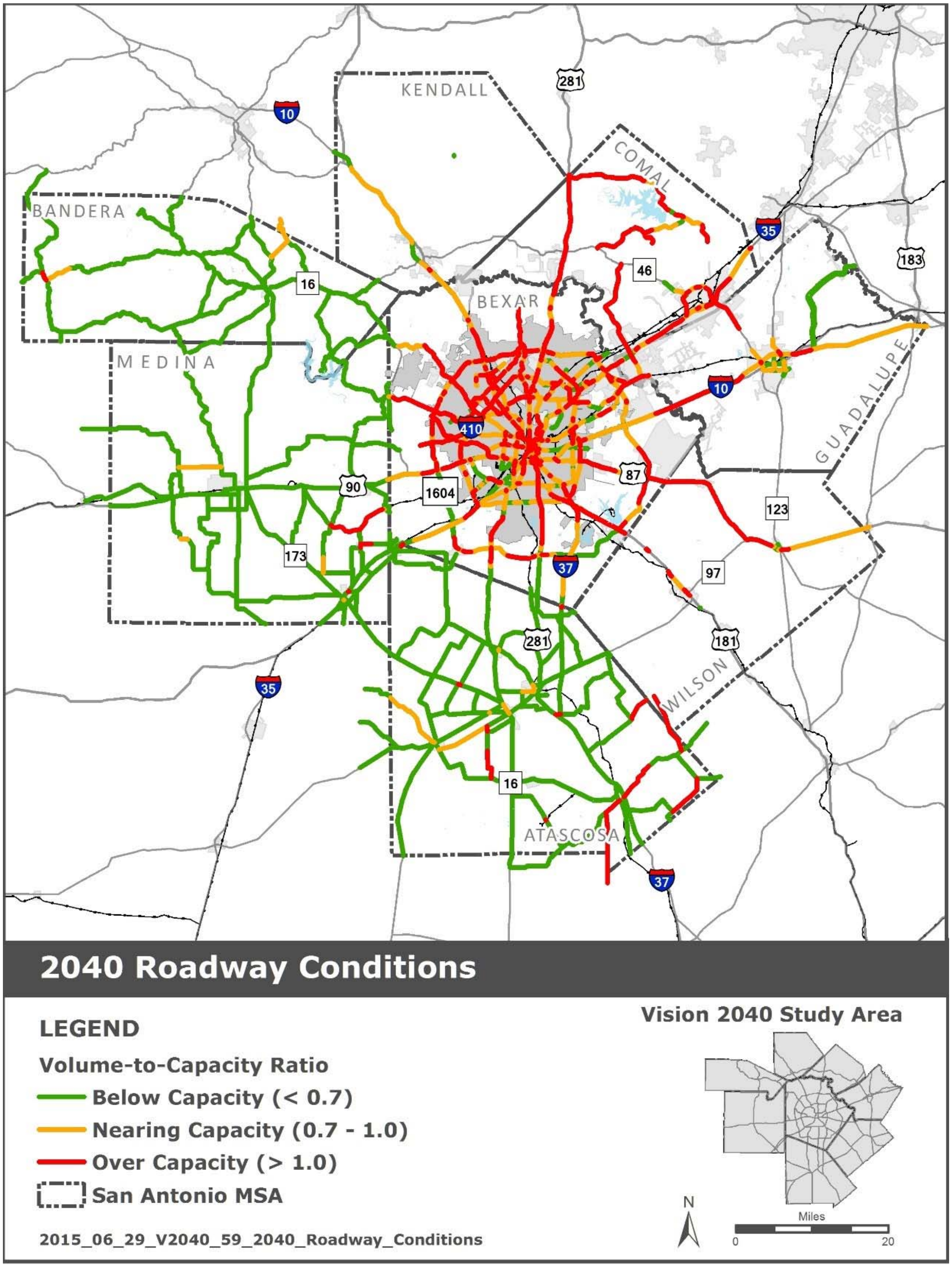
A detailed look at projected congestion levels in Bexar County shows that areas projected to see the highest amount of population and employment growth by 2040 also are likely to experience the most congestion. The northwestern suburbs between Loop 1604 and Loop 410, as well as key links between downtown San Antonio and the rest of the city, are all expected to exceed capacity by 2040 (Figure 3.7).

Figure 3.5 2010 Roadway Conditions



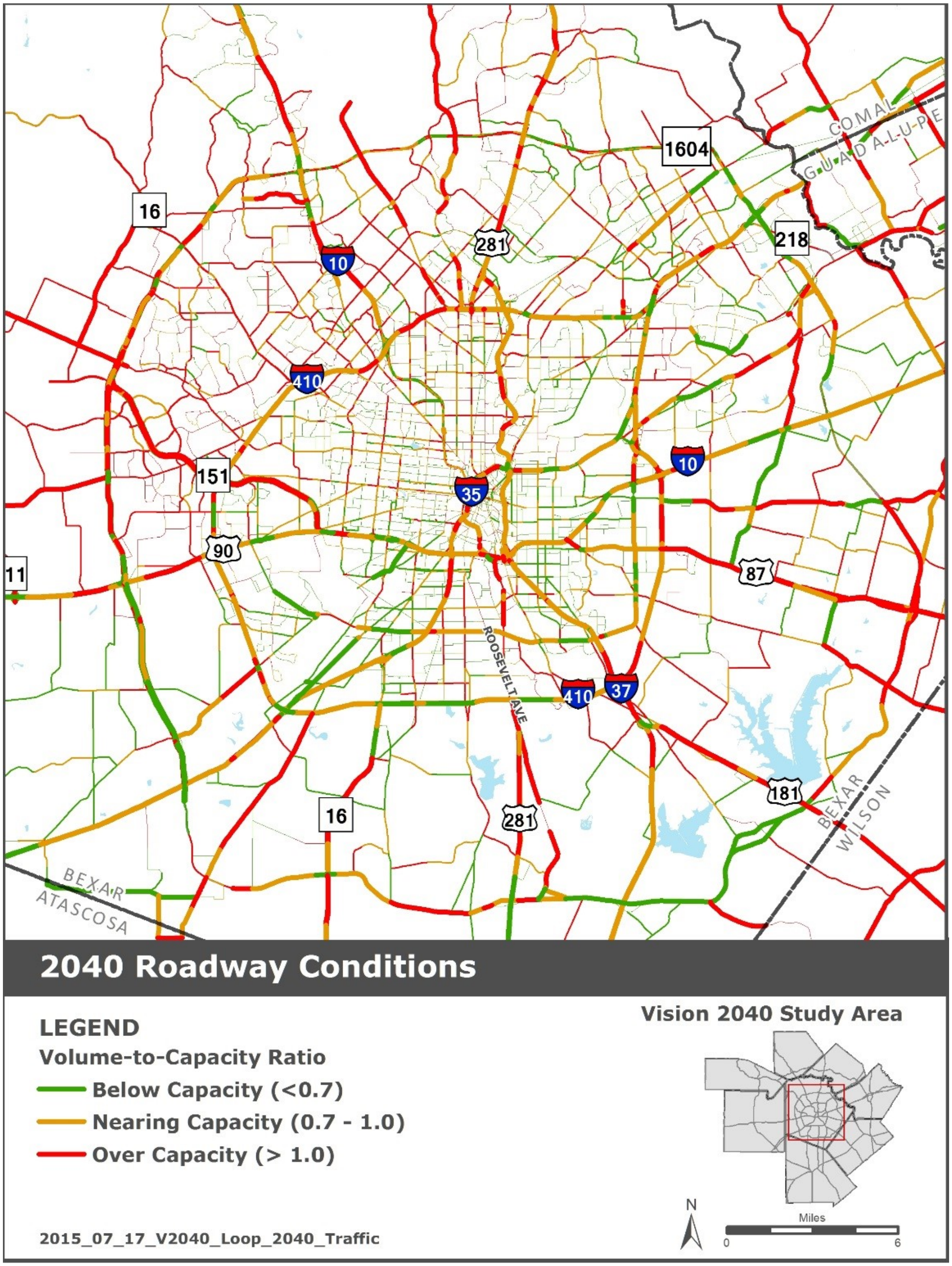
Source: AAMPO Model, TxDOT Statewide Analysis Model (2014).

Figure 3.6 2040 Roadway Conditions



Source: AAMPO Model, TxDOT Statewide Analysis Model (2014).

Figure 3.7 2040 Roadway Conditions
Loop Zoom



Source: AAMPO Model (2014).

While the region-wide population is expected to grow by approximately 76 percent, the average number of miles traveled per vehicle is expected to double by 2010. Time spent traveling per vehicle is expected to more than triple over the same time period, meaning average travel speeds will decrease by over 30 percent systemwide (Table 3.2).[7]

Table 3.2 County-by-County Congestion Increases

	Vehicle-miles Traveled (VMT)			Vehicle-hours Traveled (VHT)			Average Speed (mph; VMT/VHT)		
County	2010	2040	% Diff.	2010	2040	% Diff.	2010	2040	% Diff.
AAMPO	48,204,893	96,366,617	100%	1,668,259	5,170,033	210%	28.9	18.6	-35%
Bexar	38,154,534	73,242,427	92%	1,358,361	3,770,755	178%	28.1	19.4	-31%
Guadalupe	3,472,346	8,386,054	142%	100,981	470,677	366%	34.4	17.8	-48%
Comal	4,415,744	9,406,802	113%	144,807	621,469	329%	30.5	15.1	-50%
Wilson	1,045,341	2,976,220	185%	33,959	201,748	494%	30.8	14.8	-52%
Kendall	1,116,928	2,355,114	111%	30,151	105,384	250%	37.0	22.3	-40%

Source: AAMPO Model.

Congestion impacts travel time reliability.

Because VIA buses share right-of-way with passenger vehicles and trucks, congestion affects both drivers and VIA passengers by increasing travel times. A congested network is also likely to experience inconsistencies in travel times from day to day or across different times of the day, resulting in reduced travel time reliability. This makes it difficult for drivers and transit riders alike to plan their trips.

Reliability, however, is an important characteristic of high quality transit service. In the first round of public involvement, frequency and reliability were consistently prioritized by respondents as important features of VIA service (Figure 3.8).[8] Older respondents tended to emphasize frequency and safety, while younger respondents tended to emphasize reliability slightly more often (Table 3.3). Transit vehicles serving areas with high congestion will be hampered in their ability to provide frequent and reliable service. If transit service is inadequate, then people are less likely to use it, putting more cars on the road and exacerbating congestion further. Maintaining the transit reliability that respondents emphasized in the community survey will require strategies that give transit an advantage over congested traffic, such as operating transit vehicles in their own lane or giving transit vehicles priority at intersections.

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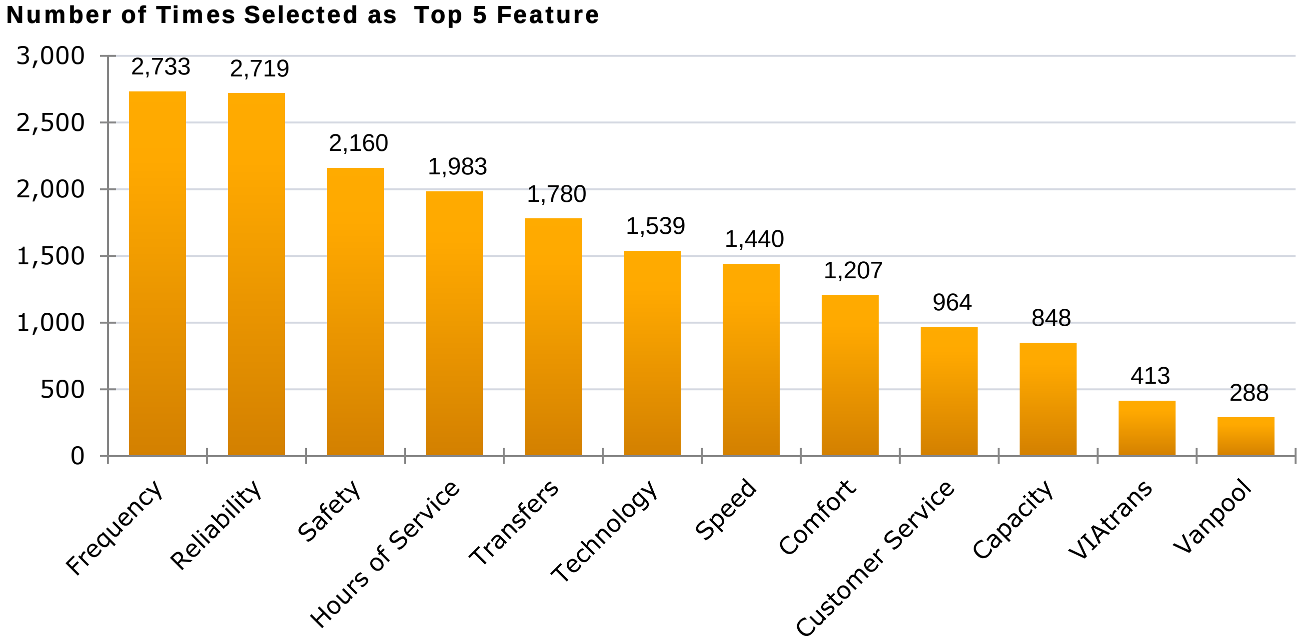
[7] The Alamo Area MPO (AAMPO) travel demand model has high-resolution modeling output for the five counties found in Table 3.3; while the Texas-wide Statewide Area Model has all eight counties, there are far fewer roads included, making it difficult to draw conclusions about travel patterns at the county level.

[8] See *Phase 1 Stakeholder Involvement Summary* in *Volume 2: Developing Vision 2040*.

Figure 3.8 What features of VIA Metropolitan Transit service are important to you?"



Source: VIA Vision 2040 Community Survey Round 1 (Summer 2015).

Table 3.3 Top Three Most Important Transit Features by Age of Respondent

Age Range	13-20	21-30	31-45
Most common response	Reliability	Frequency	Frequency
Second most common response	Frequency	Reliability	Reliability
Third most common response	Speed	Hours of Service	Safety

Source: VIA Vision 2040 Community Survey Round 1 (summer 2015).

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4.0 Communities Demand Outstanding Transportation Solutions

To meet the growing demand for local and regional public transit and transportation services, VIA requires an understanding of where gaps in service exist, identification of reliable funding sources, and community support. Due to transportation's direct effect on the region's economy, productivity, and quality of life, coordination between VIA and the municipalities currently in its service area, as well as municipalities that could potentially join in the future, is needed to ensure continued growth and prosperity of the region.

4.1 Transit Demand and Supply

In order to identify areas of future transit need, future transit demand for the year 2040 was calculated and compared with current levels of transit supply:

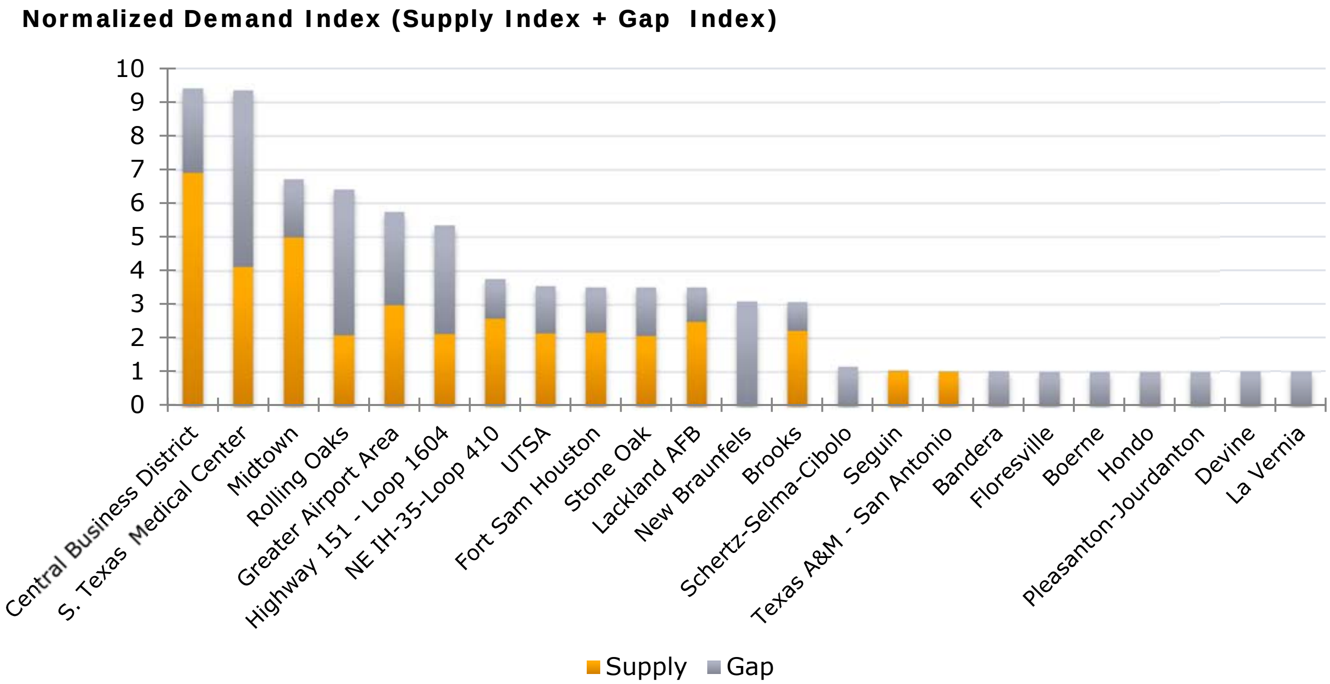
- **Transit demand** was calculated based on demographic information across the region. Because use of transit is most highly associated with density, the most important elements of the model are density of population and employment. These results were then weighted by the presence of key subpopulations whose presences are strongly associated with transit use: households without a vehicle, population over 65, and households with incomes below the poverty line. The demand index was then adjusted to remove the influence of current transportation infrastructure on ridership levels, allowing estimation of how many people would ride transit if sufficient service was available.

- **Transit supply** refers to both the frequency and distribution of transit service. While many factors affect the quality of transit service, the most important is the quantity of service provided. Service was measured by calculating the number of bus stops in an area, along with the frequency of transit service to those stops.

A detailed description of the transit gap analysis methodology used can be found in *Appendix C: Transit Gap Analysis*.

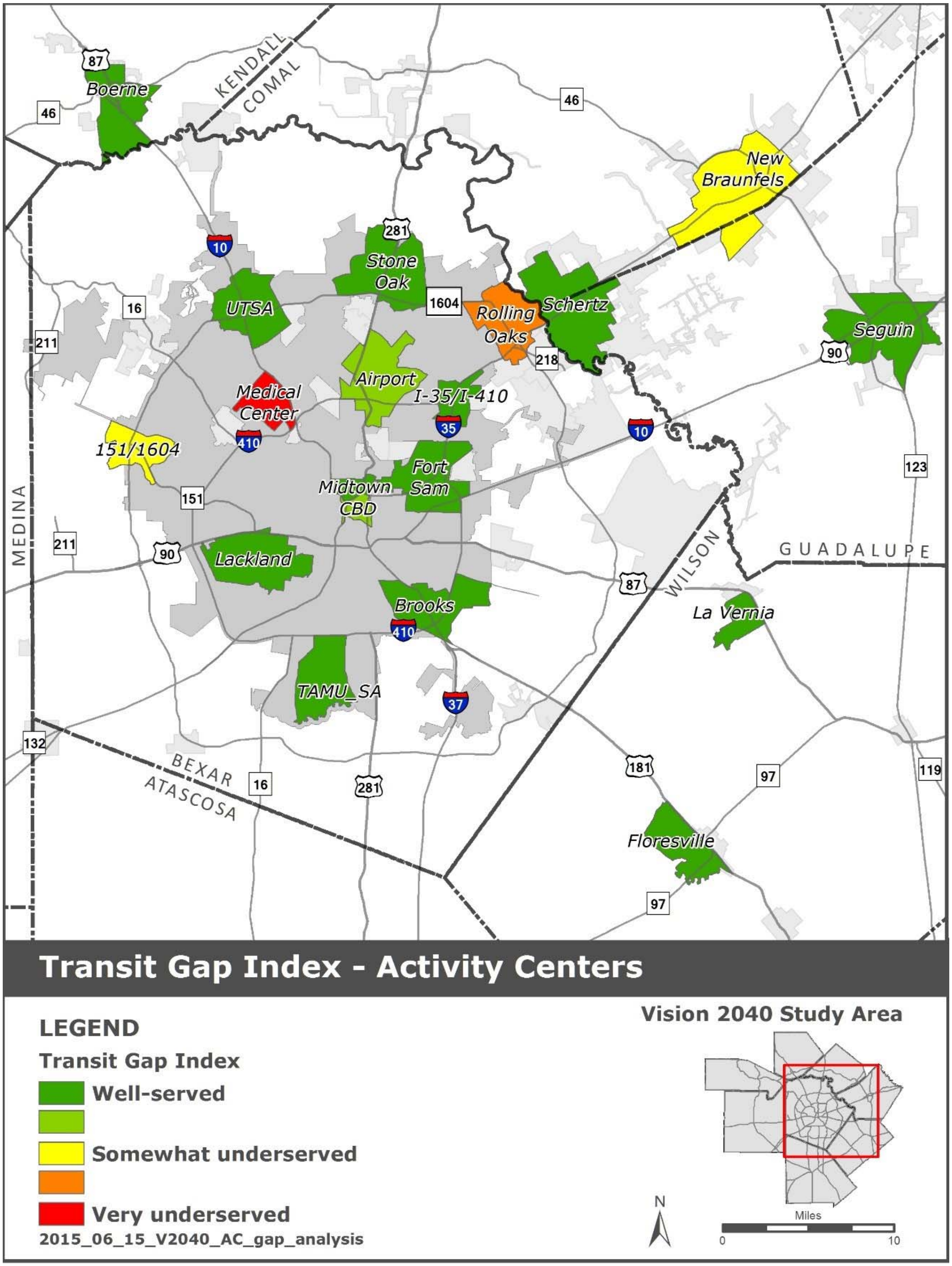
Comparing the supply and demand of transit service at each activity center allows centers with a disproportionate demand relative to their supply to be identified (Figure 4.1, Figure 4.2). For example, the San Antonio Central Business District and Greater Airport Area have high demand, but also have high supply. On the other hand, the South Texas Medical Center, Highway 151–Loop 1604 area, and Rolling Oaks have high demand, but very low supply, revealing a substantial gap in their future transit service. New Braunfels has a moderate demand and low transit supply, and therefore has a moderate transit gap. In general, areas underserved by transit are largely located in the same areas projected to experience heavy congestion by 2040: the northwestern regions of the Cities of San Antonio and New Braunfels.

Figure 4.1 Average Transit Demand and Gap by Activity Center



Source: Cambridge Systematics, Inc. (2014).

Figure 4.2 Transit Gap Index: Activity Centers



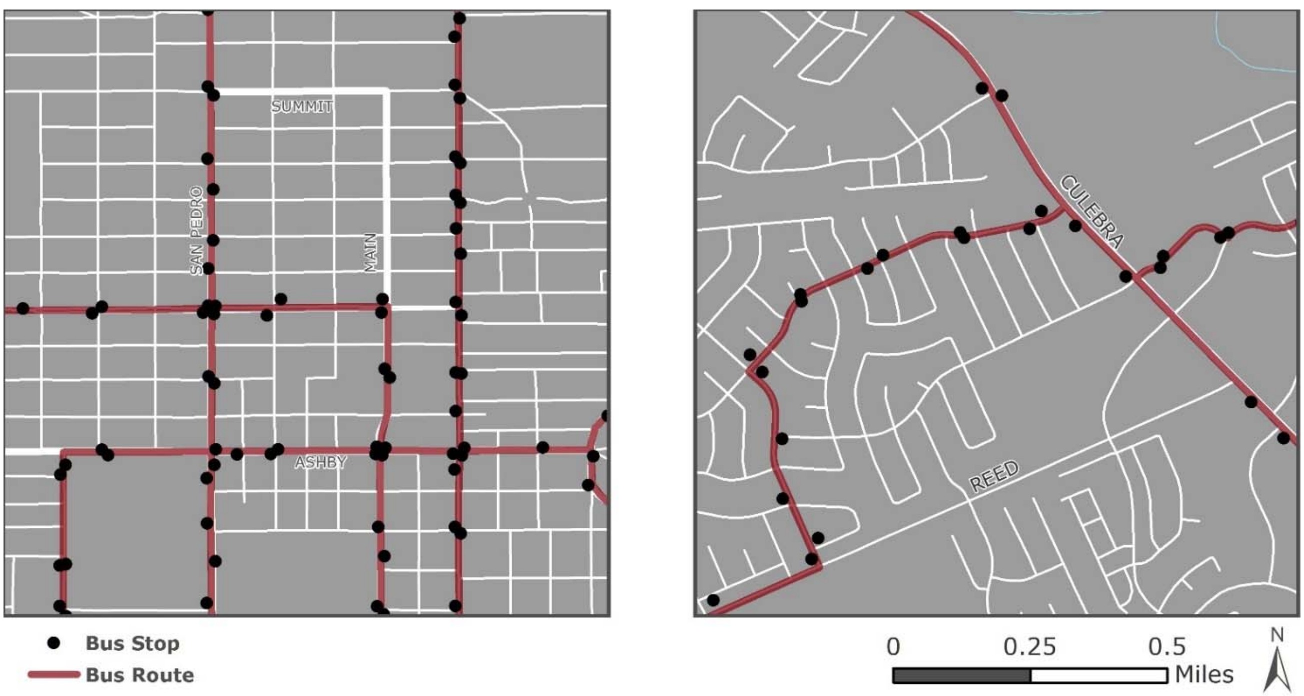
4.2 Community Needs

The community needs to develop and enforce transit supportive land use policies.

High-quality transit service benefits from high concentrations of population and employment. As more people travel along the same corridor, higher frequency and high-capacity services are more economical and often are supplemented by concentrated developments. As the Greater San Antonio Region increases by 1.6 million residents over the next 25 years, additional development and transportation options are needed to supplement the growth.

Neighborhood design can have substantial impact on the ability of transit to provide high-quality service to residents. In Figure 4.3, approximately one square miles is shown from two different residential neighborhoods in the City of San Antonio. The neighborhood on the left is located in the Midtown area north of the San Antonio Central Business District, and is typical of the neighborhoods located within Loop 410. It has an interconnected street grid, relatively high population density (though still composed primarily of single family homes), and supports multiple transit lines, with most houses within a few blocks of a bus stop. The neighborhood on the right typifies newer development between Loop 410 and Loop 1604, with discontinuous streets and lower population density that limit the ability of transit routes to provide effective service. Some neighborhoods are cut off completely from the local street grid, requiring pedestrians and bicyclists to traverse major roads to reach transit.

Figure 4.3 Transit and Roadway Design



The street design shown on the right in Figure 4.3 is found in most of the activity centers with a significant transit gap in Figure 4.1. It will be more difficult for VIA to provide effective service to these rapidly-growing areas without coordinated land use planning that maximizes accessibility of transit service in these areas. Discontinuous street networks, large block sizes, and limited-access developments that prohibit transit vehicles all pose challenges to bus service design, as well as pedestrian accessibility (VIA, 2015d). Transit Supportive Land Use (TSLU) policies help establish a vision for how to coordinate transportation and community development to support more accessible and livable communities. TSLU increases mobility options and provides efficient access to shops, recreational opportunities, and key destinations. VIA needs to continue to refine, develop, and support TSLU to ensure the type of transit is appropriate for the planned development and further support pedestrian-friendly environments and mixed-use development.

VIA needs to help support the goals and objectives of member cities and partner agencies.

Public transportation is an important component of many member cities' plans, transportation studies, and master plans. Common goals of these plans include improving regional transportation connectivity and expanding multimodal transportation. Some cities, such as Alamo Heights, Cibolo, and St. Hedwig, identified high-capacity transit as a strategy to improve connectivity. Other cities, such as Shavano Park and Balcones Heights, desired better bicycle, pedestrian, and other multimodal access to support high-density development. *SA Tomorrow*, the comprehensive plan for the City of San Antonio, includes a substantial multimodal transportation section which details relationship between transportation and land use. Coordination among VIA and its member cities will support the area's goals and objectives, further serving the community.

In 2014, the Alamo Area Metropolitan Planning Organization (AAMPO) approved the region's long range multimodal transportation plan or Metropolitan Transportation Plan (MTP), "Mobility 2040." Mobility 2040 stated that without effective public transit, the region's forecasted automobile volume and ensuing congestion would decrease economic productivity, increase emissions of air pollutants, and significantly decrease quality of life for many residents. Mobility 2040 stated that the predominant pattern of suburban development in the Greater San Antonio Region poses a challenge for the efficient operations of public transit service. The region's poor street connectivity, low-quality pedestrian facilities, low-density development patterns, limited access urban highways, and one-way frontage roads all make transit a less viable option for many potential customers. The integration and development of public transportation with regional planning can support AAMPO's goal of mitigating and preventing these transportation challenges. The success of public transportation extends past VIA's service area and has opportunities to influence regional congestion and connectivity.

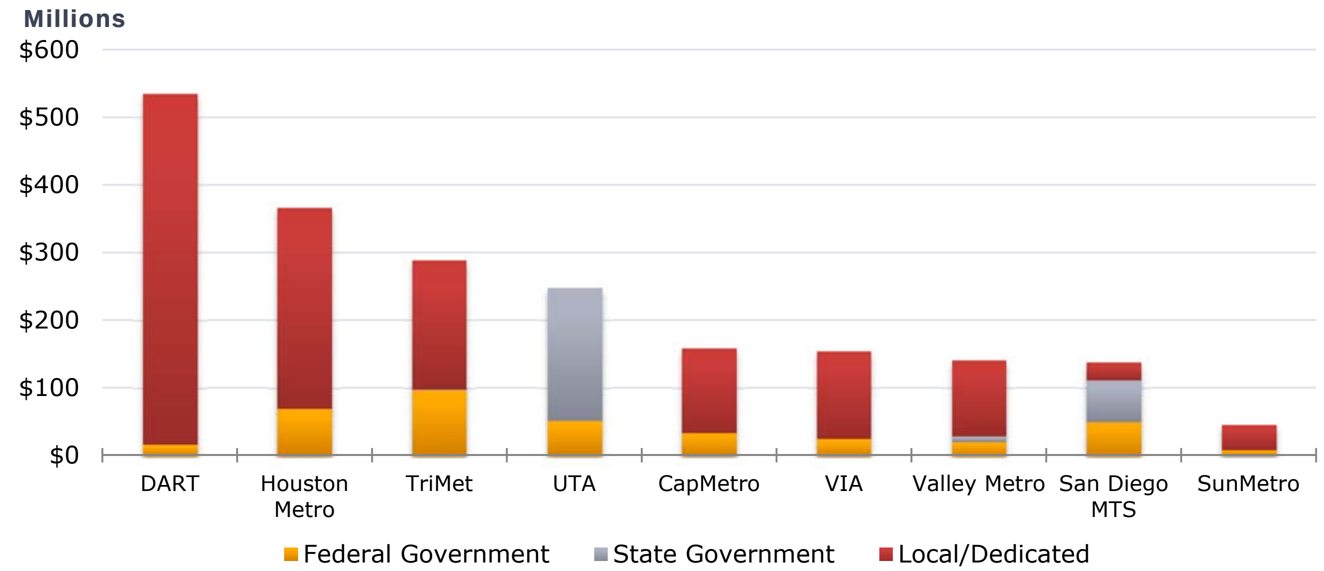
4.3 VIA Needs

VIA needs revenues to meet growing operating and capital requirements.

VIA relies on a variety of revenue sources to fund its operations, capital projects, and planning activities. Revenue for operating expenses in 2013 was about $153 million (Figure 4.4). VIA's comparatively low revenue forecasts through 2040, especially compared to other cities in Texas (e.g., Dallas’ DART and Houston’s METRO systems) will provide only limited options to fund expanded transit services, including high-capacity, fixed-route, and demand response.

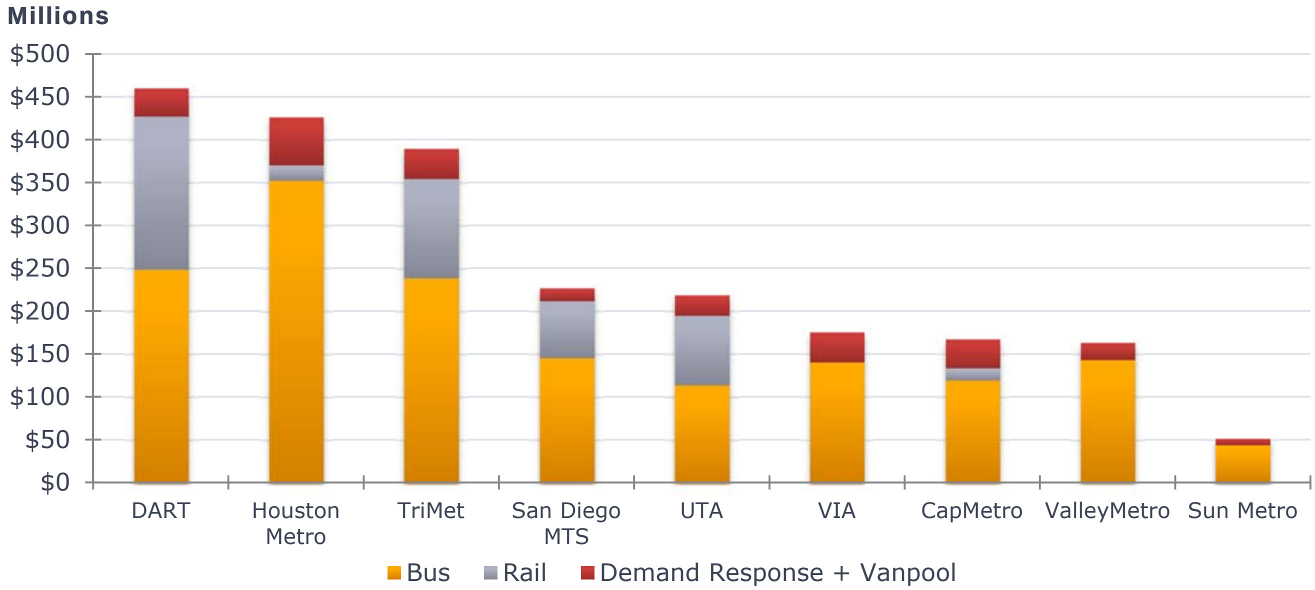
VIA does not receive any state funds for operating expenses (Figure 4.5), and typically the Texas Department of Transportation (TxDOT) does not provide state funds for large scale public transportation projects in its large urban areas (however, TxDOT approved $35 million for buses and bus passenger amenities for VIA in 2014). Future TxDOT funding opportunities remain uncertain; at present, no additional state funding currently is budgeted for VIA in the coming years.

Figure 4.4 Operating Funds by Source
2013



Source: National Transit Database (2014).

Figure 4.5 Operating Expenses by Mode
2013



Source: National Transit Database (2014).

VIA recently sold bonds for the first time in its history. VIA successfully received a favorable AAA bond rating and was able to issue $73 million in bonds to pay for a large-scale vehicle purchase in addition to a variety of capital improvements. VIA's bond capacity is capped until 2025.

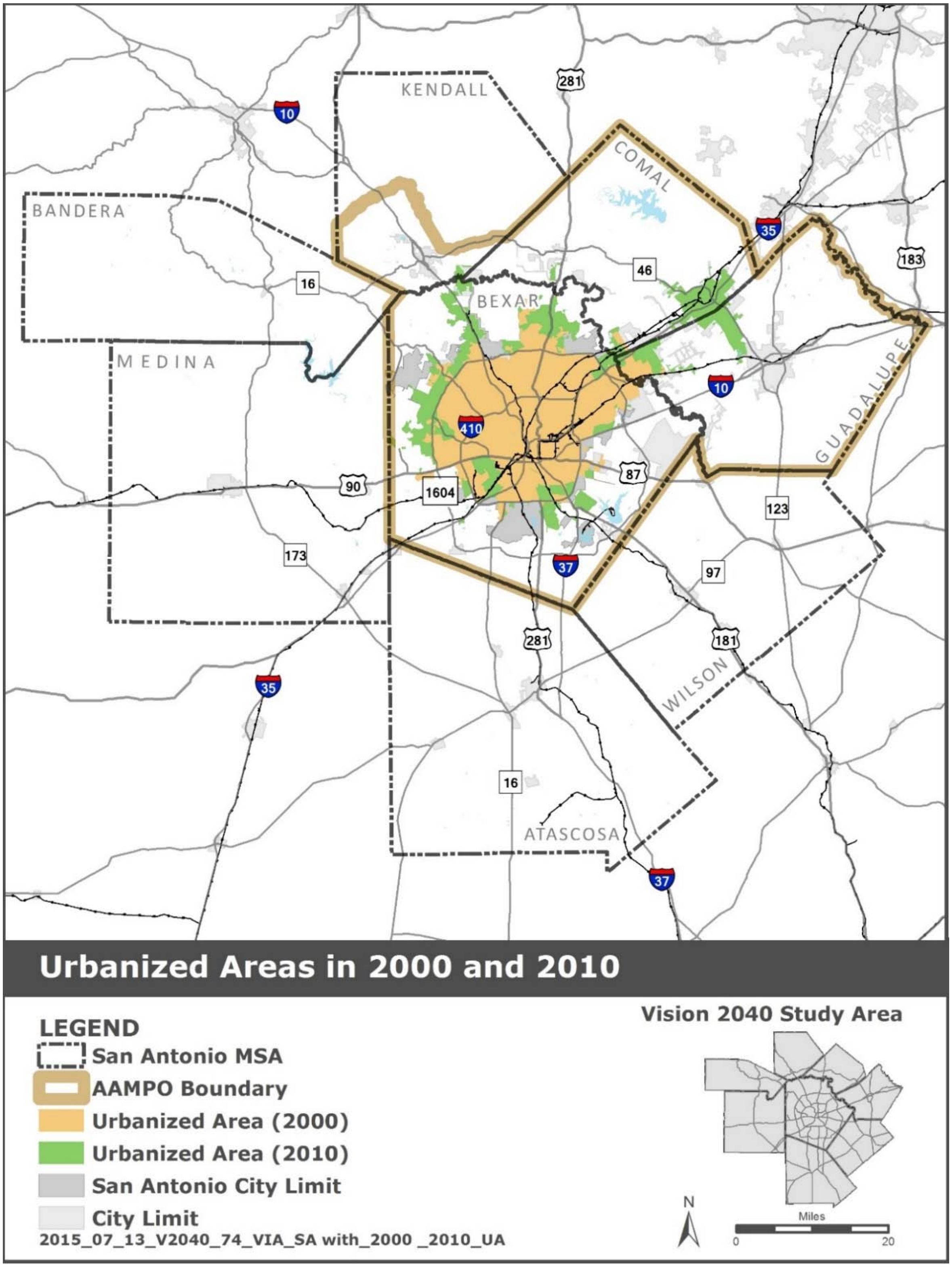
Future capital and operating funds will need to be generated from Federal, state, and local funding sources. Local sources will generate the most revenue for VIA and will need significant ongoing public support and potential voter authorization. In some cases, state legislation may be required to secure additional local funding sources. For a more detailed discussion of transit funding options, see *Evaluation of Funding Mechanisms and Financing Techniques* in *Volume 3: Defining Projects and Plans*.

VIA needs to overcome institutional barriers to expand service into areas not currently served.

The San Antonio urbanized area (UZA) has expanded outward in the past 10 years, as shown in Figure 4.6. The Cities of New Braunfels, Cibolo, Marion, Schertz, Selma, and Garden Ridge, as well as the census designated place of McQueeney became part of the San Antonio UZA, and with that lost eligibility for rural transit funding. As part of the San Antonio UZA, these cities are now eligible for Federal funds apportioned to VIA using a formula that includes factors for population, population density, and low-income individuals. Due to the UZA expansion, a portion of the Federal Transit Administration (FTA) formula funds to VIA can be attributed to the population from these nonmember jurisdictions that are now part of the UZA. However, these cities do not belong to the existing VIA service area.

The Texas Transportation Code states that a jurisdiction can be incorporated into a transit authority service area, but the jurisdiction is required to adopt a dedicated local sales tax. Many cities in the Greater San Antonio Region are not able to adopt an additional sales tax because they already collect the maximum allowable local sales tax of two percent. As population and employment continue to grow in these jurisdictions, new strategies and policies to fund and develop public transportation services in these areas are needed. Additional information regarding this need is discussed in *Service Area Guidelines – Options for Serving Gaps in Urban Public Transit* in *Volume 1: The Role of Transit in a Growing Region*.

Figure 4.6 VIA Service Area with 2000 and 2010 Urbanized Area



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5.0 An Efficient and Integrated Transportation Network is Essential to Accommodate Growth

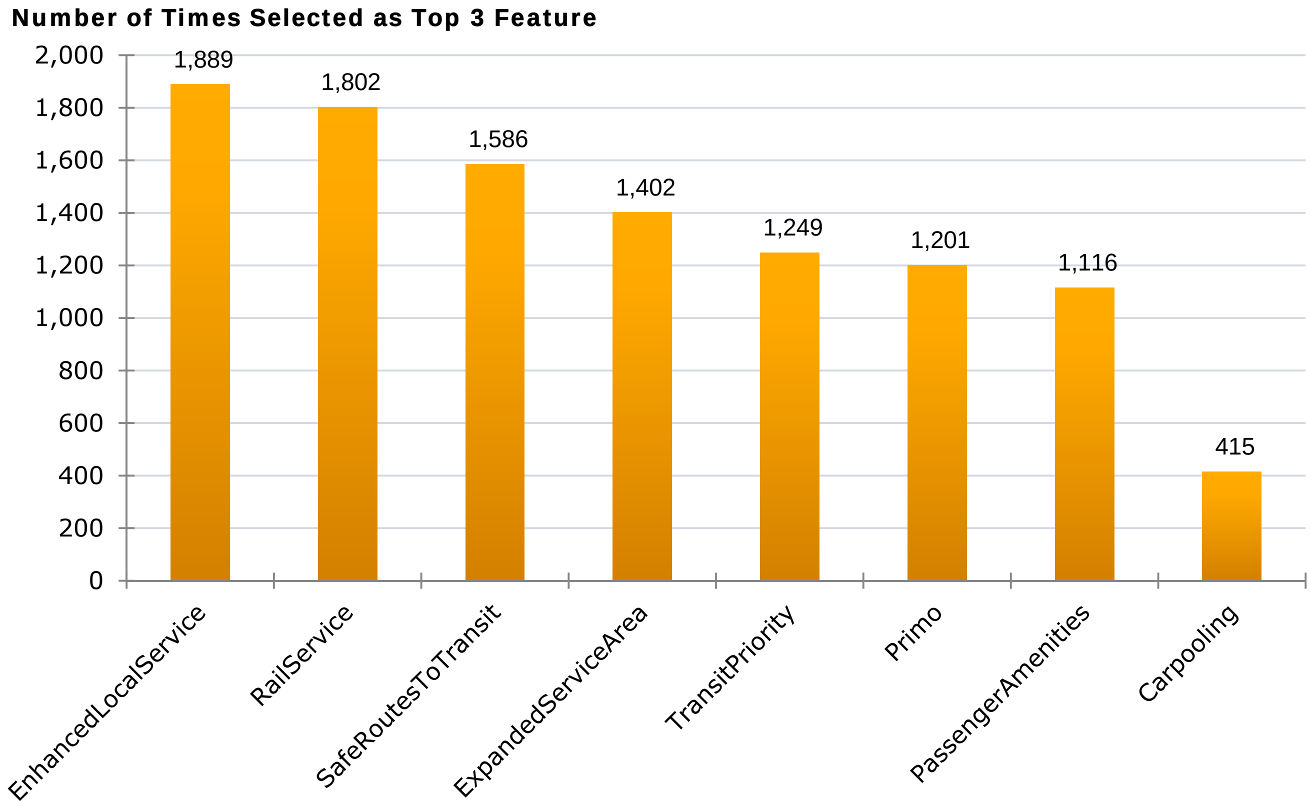
The region's transportation network must be seamless, integrating multimodal choices and transportation infrastructure into a single coherent system and allowing consumers to spend more time at their destinations and less time on the road. Strengthening the transportation network requires regional integration of information, as well as identifying customer preferences, potential barriers to using transit, and resident's expressed needs for transit in the Greater San Antonio Region. This section examines these demands from three perspectives: 1) those of the community, reflecting the impact of transit service on riders and non-riders alike; 2) those of the customer, describing the components of an excellent transit service; and 3) the needs of VIA as an institution in order to provide reliable and efficient service.

5.1 Community Needs

The community needs high-quality transit service to accommodate anticipated population and employment growth.

When asked "what do you think will most improve public transportation in the [Greater] San Antonio Region?" respondents most often selected enhanced local bus routes, rail service, and safe access to transit (Figure 5.1). Older respondents tended to emphasize enhanced local bus services and expanded service areas, while younger respondents prioritized safe routes to transit and the addition of rail service (Table 5.1).

Figure 5.1 What do you think will most improve public transportation in the [Greater] San Antonio region?
All Respondents



Source: VIA Vision 2040 Community Survey Round 1 (summer 2015).

Table 5.1 Top Three Most Important Improvements by Age of Respondent

Age Range	13-20	21-30	31-45
Most common response	More Amenities for Passengers	Rail Transit	Rail Transit
Second most common response	Safe Routes to Transit	Enhanced Local Service	Enhanced Local Service
Third most common response	Enhanced Local Service	Safe Routes to Transit	Safe Routes to Transit

Source: VIA Vision 2040 Community Survey Round 1 (summer 2015).

The community needs reliable, "congestion-proof" transit connections between growing activity centers.

Growth in the region will strain the performance of the regional transportation system. System congestion increases automobile and bus travel times, which have cascading effects on the economic competiveness and quality of life of the region. While daily vehicle miles traveled (VMT) are expected to double between 2010 and 2040, vehicle hours traveled (VHT) are forecasted to triple to 5.2 million vehicle-hours per day, indicating a decrease in mean vehicle speed of over 30 percent (AAMPO, 2014). From a transit perspective, congestion risks future transit performance by impacting system reliability (on-time performance), travel times, and overall operational efficiency.

By 2040, many key sections of the region's transit network are projected to be over capacity (Figure 3.6). Activity centers serve as important anchors within the transportation system; over the next 25 years, 15 percent of the regional population growth and 48 percent of employment growth will take place in all activity centers. In response, there is a need to provide "congestion-proof" transit options along congested routes between these activity centers in order to give patrons a reliable transportation option. High-capacity transit with dedicated right-of-way or priority treatment in high-volume corridors would offer a more reliable service than local buses operating in mixed traffic. However, the region's geographically dispersed activity centers are challenging to serve by transit and require a range of services (including high-occupancy express lanes for buses and/or vanpools, demand response, light and commuter rail, and intercity passenger rail) to serve different parts of the region effectively and reliably.

Community residents and visitors need efficient connections to regional, state, and international gateways.

The Greater San Antonio Region is a popular tourist destination and an economic hub of statewide, national, and international significance. Annually, millions of passengers use the intercity transportation options that connect the region to other domestic and international cities. VIA currently serves the intercity bus and rail stations with several routes in the San Antonio Central Business District, which results in frequent service. VIA will need to continue to provide high level of service to the intercity bus and rail stations to meet the intercity travel needs.

There are opportunities to improve the transit connectivity to San Antonio International Airport (SAT). The airport saw 3.78 million passenger boardings and approximately 41,000 flights in 2014 (Bureau of Transportation Statistics, 2015), which makes it the 44th busiest in the nation. VIA currently offers one route to the airport; in addition, San Antonio International Airport's "GO" Airport Shuttle transports travelers from the airport to downtown. With over 3.78 million boardings and the future growth in other activity centers, there is a need to serve other areas of the region to connect residents and visitors to the airport, particularly employment centers like the South Texas Medical Center.

Strengthening existing intercity and intra-city connections will increase regional accessibility and improve multimodal transportation options for residents. New intercity transportation options, such as Lone Star Regional Rail will provide further regional connectivity; VIA should ensure that planning efforts are coordinated with these projects.[9]

There are opportunities for VIA services to integrate its service with other regional transportation service providers. For example, the Alamo Area Council of Governments' (AACOG) Alamo Regional Transit (ART) provides curb-to-curb transit services to 12 rural counties surrounding the City of San Antonio and a fixed-route circulator bus in Seguin. VIA currently coordinates with AACOG to offer VIA vanpool's "Guaranteed Ride Home" feature, but otherwise there is a gap in connectivity and coordination between existing VIA services and regional transportation services.

The community needs public transit that serves residents over age 65.

The region's population of adults age 65 and older is expected to nearly triple by 2040.[10] The total share of the senior population of the Metropolitan Statistical Area (MSA) region is projected to increase from 11 percent of the total population in 2010 to 18 percent of the population in 2040, equating to an additional 451,000 residents over 65 (Figure 2.7). Many of the region's outlying counties, such as Comal and Guadalupe, are projected to experience significant growth in populations over 65, which will create demand for transit service enhancements in these areas. Transit accessibility is crucial for senior mobility, and one study estimates that 39 percent of the City of San Antonio's population over 65 have limited access to transit (Transportation for America, 2011).

The community needs sustainable transportation options to help meet Federal air quality standards.

The United States Environmental Protection Agency (EPA) sets air quality standards for six harmful air pollutants. Regions that do not meet the EPA's national standards ('nonattainment areas') are subject to regulatory intervention, including the required development of a coordinated regional emissions reduction strategy in order to meet standards as quickly as possible. In nonattainment areas, transportation projects using Federal funding may be halted if they are projected to increase emissions, and the introduction of more restrictive permitting processes may hamper economic activity.

As of 2012, the City of San Antonio was the largest city in the United States that was still in Federal compliance (AACOG, 2015). However, the past three-year ozone averages have threatened nonattainment. Ground-level ozone is caused by a photochemical reaction between nitrous oxides and volatile organic compounds emitted during the burning of fuel such as gasoline. The EPA is expected to revise its national air quality standards soon, which could lead to the classification of the Greater San Antonio Region as a nonattainment area. The community can proactively reduce the harmful air pollutants that cause ozone and threaten nonattainment by reducing use of single-occupant

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[9] See *Understanding VIA's Role in History*, *VIA's Role in the Community*, and *VIA in Comparison to Peer Agencies* in *Volume 1: The Role of Transit in a Growing Region* for additional information regarding regional transportation services.

[10] The projected increase is 192 percent.

vehicles. Transit provides the option for a more sustainable transportation mode that can shift people out of their cars and decrease emissions of harmful air pollutants. People who choose to use VIA rather than drive themselves reduce the number of cars on the road by nearly 20,000 vehicles per day (VIA, 2015c).

5.2 Customer Needs

Customers need high-quality, multimodal access to public transportation.

Safe access to transit facilities near a customer's origin and destination, whether it be by foot, bicycle, care share, or automobile, is a key factor in a potential rider's decision to use transit. The availability of high-quality pedestrian and bicycle infrastructure is a key part of any transit system, and allows transit stops to serve a much wider geographic area. Approximately 85 percent of VIA customers walk on one or both ends of their journey (VIA Origin and Destination Study, 2014). However, not all VIA bus stops, transit centers, or park & rides are accessible by sidewalks or bicycle lanes. VIA's MyLink Pedestrian Linkage Priority Plan is the agency's coordinated strategy to prioritize pedestrian linkage improvements within its service area. Enhancements to the pedestrian environment will provide safer access to bus services (VIA, 2014b). Respondents to VIA's first round of public involvement who were located in the San Antonio urbanized area were most likely to select sidewalks, lighting, and the ability to access work, shopping and entertainment ("live-work-play") as the three features most likely to make transit a more convenient travel choice.[11]

As growth continues into suburban and rural areas, particularly north of Loop 410, increased demand for multimodal transportation options outside the region's core will be more difficult to meet. Several key activity centers, such as Rolling Oaks, the South Texas Medical Center, and the area around Highway 151/Loop 1604 (*Appendix C: Transit Gap Analysis*, Figure C.3) are projected to have high demand for transit in 2040, yet suffer from a poor pedestrian environment. Many of these areas have major barriers to both pedestrians and transit vehicles, such as industrial areas and interstate highways. Some of these areas receive service from VIA's park & ride facilities, which typically serve suburban populations and provide access to low population density areas throughout the region. In addition, park & rides need to have good roadway access (while maintaining pedestrian accessibility) and provide frequent, reliable service to key regional destinations (Transportation Research Board, 2013).

Customers need high-frequency service to ease connections between origins and destinations.

Many transit trips in VIA's current network require several transfers, and crosstown trips can take several hours to complete. On average, VIA riders take 1.6 buses to reach their destinations; while the bare majority of riders (51 percent) take a single bus, one in 10 riders are required to take three or more buses for a single trip (VIA, 2015c). Transfers between low-frequency buses drastically increase overall travel time and reduce reliability due to increased possibility of missed connections

[11] See *Phase 1 Stakeholder Involvement Summary* in *Volume 2: Developing Vision 2040*.

(TRB, 2013). In the first round of public involvement, respondents from outside the San Antonio urbanized area were almost 10 percentage points more likely to select "transfers" as one of the top five most important features of VIA service.[12] Reducing both the number of transfers required and time spent waiting for buses to arrive will improve the transit experience and attract additional riders.

Customers need frequent and reliable service for transit to be a competitive option.

Frequency, or the interval between buses arriving at a stop, is a top factor influencing overall trip satisfaction in a survey administered in several cities around the US (TRB, 2013). Likewise, the results of the first round of public involvement showed that frequent and reliable service were the most important features of VIA service. Service frequency also influences how customers plan their trips. When a bus arrives every 10 to 15 minutes, customers typically will not use a schedule and simply arrive when they need to take the trip. When bus frequency exceeds 15 minutes, however, customers typically must plan their trips around the bus schedule, reducing the desirability of transit. The VIA system average frequency in the peak period is 33 minutes, with Primo and Frequent routes serving stops every 15 minutes (Table 5.2). As demand grows, VIA will need to strategically provide more frequent service throughout longer periods of the day.

Ridership also is responsive to changes in service frequencies (TRB, 2013). Generally, transit services that increase in frequency, especially in areas with existing infrequent service, result in an increase in ridership. VIA's Primo and Frequent routes have a higher average ridership, with 26 and 32 riders per hour, respectively (Table 5.2). The total travel time along these routes also can influence ridership, especially if the route is comparable to traveling in a personal vehicle. This could explain the Skip routes, which have a high ridership per hour and only have stops at major destinations. Investing in more frequent services in concentrated areas could lead to an increase in ridership and customer satisfaction.

Table 5.2 Average VIA Service Frequency and Ridership

Type of Service	Number of Routes	Peak Average (Minutes)	Base Average (Minutes)	Evening Average (Minutes)	Ridership (2014)	Total Revenue Hours (2014)	Average Ridership per Revenue Hour
Express	8	28	48	54	1,255,000	68,000	18.5
Frequent	17	15	16	38	12,408,000	388,000	32.0
Metro[13]	63	37	44	55	22,633,000	964,000	23.5
Primo	1	10	10	30	1,971,000	75,000	26.2
Skip	5	30	34	53	4,756,000	129,000	36.7
Average Per Time Period		33	40	52			

[12] *Ibid.*

[13] Including circulator services.

At the activity center level, distribution of frequent service is generally limited to places located within or directly adjacent to Loop 410 (Table 5.3). Express service extends further to a handful of suburban areas (Stone Oak, Highway 151/Loop 410, and the UTSA region). The largest areas with no or minimal VIA service are located along the I-35 corridor: Rolling Oaks, Schertz-Selma-Cibolo, and New Braunfels. However, the South Texas Medical Center lacks substantial frequent service, given its high level of activity and proximity to other activity centers.

Table 5.3 Distribution of VIA Service Types by Activity Center

Activity Center	Daily Trips[14]	Total Routes	Metro	Primo	Frequent	Express	Skip
Central Business District	92,000	53	30	1	11	8	3
Midtown	56,000	21	10	1	4	4	2
Lackland AFB	40,000	15	6		5	2	2
S. Texas Medical Center	147,000	14	9	1	1	2	1
Greater Airport Area	114,000	13	8		1	1	3
NE I-35/Loop 410	46,000	10	7			1	2
Fort Sam Houston	49,000	10	4		2	2	2
Brooks	56,000	7	4		1		2
UTSA	105,000	7	4	1		2	
Rolling Oaks	90,000	3	3				
Highway 151/Loop 1604	46,000	3	2			1	
Stone Oak	130,000	3	2			1	
Texas A&M - San Antonio	44,000	2	1		1		
Seguin	117,000	1	1				
New Braunfels	377,000						
Boerne	42,000						
Floresville	22,000						
La Vernia	18,000						
Schertz-Selma-Cibolo	156,000						

Another key factor when using transit is reliability. A reliable trip is one that arrives at the stop on-time and arrives at the destination at the scheduled time. Reliable transit operations are negatively impacted by a number of factors, including highway congestion, street design, road construction, vehicle quality, wheelchair lift usage, too-closely-spaced bus stops, and railroad crossings. For example, at-grade rail crossings impact the on-time performance of several routes in the VIA system due to detours or delays while waiting for the train to pass. As noted previously, the Greater San Antonio Region will experience significant congestion in the future that will impact transit

[14] One-way trips to and from home.

reliability, and VIA will increasingly struggle to meet its on-time performance standards.[15] Without a reliable trip, customers will have poor transit experience and, if possible, choose another mode of travel that is more reliable. Strategies are needed to address the causes of transit delay to retain and attract riders and minimize the cumulative impacts on VIA operations.

Customers need convenient access to information and payment options.

Easily understood fare collection systems, route maps, and arrival and departure information will enhance existing and new customers' transit experience by making the system easier to use. Real-time arrival and departure information helps reassure a passenger of the schedule and reduces the perception of total travel time. Real-time arrival and departure information can be provided through display at a transit stop by calling or texting an information service, or via a smartphone app. Benefits of the real-time information include, but are not limited to, an enhanced feeling of safety, reduced anxiety or stress, and shorter wait times (TRB, 2013).

VIA currently provides real-time information for many of its locations, including the Primo 100 stops. The current VIA policy is to provide real-time signage at transit centers and other locations with 100 or more daily boardings. Access to real-time information can be improved through the development of smartphone applications, which are generally easier to navigate and are becoming increasingly accessible to users. VIA's own app ("Go Via VIA") and a number of third-party offerings provide real-time arrival information for VIA vehicles. For customers without smartphones, VIA's Next Bus service operates using text messages.

None of these mobile applications, however, allow customers to purchase fares. On-board fare collection can significantly increase vehicle boarding times, slowing down service, due to the extra time needed for customers to pay before the vehicle can continue along its route. As a solution, off-board fare collection systems are becoming common in the transit industry. Many off-board fare collection technologies, such as an electronic fare box, smart cards, and smartphone apps, have proven to be effective in reducing dwell time. VIA currently offers an e-fare pass, which can be purchased and used either as a day pass or 31-day pass. However, other peer agencies, such as Portland and Dallas, are moving towards mobile ticketing and smart cards to reduce the number of fares paid in cash. In addition, many high-capacity transit modes, such as streetcars and Light Rail Transit (LRT), require customers to pay their fare before entering the vehicle.

As VIA's transit network grows and boardings increase at various locations in the service area, the implementation of real-time signage and integration of trip planning, real-time arrival information, and fare purchase functions into mobile applications will enhance the transit users' experience.

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[15] VIA's Line Service Policy and Design Standard (2015) defines satisfactory on-time performance as when the percentage of on-time transit trips arriving at all official time points does not fall below 80 percent for the systemwide average and 75 percent for individual routes. A trip is considered on time by the automated system if it arrives at the time point no more than five minutes late and no more than 30 seconds early (except where a layover is scheduled).

6.0 Conclusion

The needs identified in this report center on four key ideas: 1) recognizing the growth and changes in the Greater San Antonio Region, 2) measuring strain on the transportation network, 3) identifying community and agency needs, and 4) identifying how an integrated and efficient transportation system can serve customers as the region continues to grow.

VIA will need to determine how best to serve the needs of a large and diverse population with significant growth occurring both within and adjacent to its service area. The population of the region is expected to nearly double, and the resulting congestion will cause severe congestion on the transportation network. This congestion will have substantial effects on the economy, environment, and overall quality of life for residents of the area.

The absolute growth in population and economy coupled with significant demographic shifts will increase demand for transit. To meet this demand, it is critical for VIA to engage in a community-driven dialog to identify customer needs and build community support continued development of transportation options throughout the community. VIA's future system must provide outstanding service that links existing and developing activity centers in order to both serve and shape the region's cities and towns. Cooperation and coordination must occur with stakeholders including local governments, community groups, and transportation providers at the regional, statewide, and international levels.

The identified needs were used to prioritize policies and develop community solutions in *Volume 2: Developing Vision 2040*. Future VIA services developed as the Vision 2040 Long Range Plan is implemented will aim to meet these identified needs and improve the overall regional transportation network.

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A. Demographic Profiles

This appendix provides an analysis of the current and future demographic characteristics of the eight counties within the study area, specifically the population and employment growth within the region.[16] The distribution and density of both population and employment in 2010 and 2040 were analyzed using data from the Alamo Area Metropolitan Planning Organization (AAMPO) model, Texas Statewide model (SAM), 2010 U.S. Census, and the Census Transportation Planning Products (CTPP) database in order to identify major growth centers of population, employment, and transit demand in the study area. Specifically, the AAMPO model provided information regarding the 2010 and 2040 population and employment within the AAMPO's boundaries. The TxDOT SAM supplied supplemental population and employment information for the areas outside of AAMPO's jurisdiction. The demographic profile of the region, including age, poverty status, and zero-car household data, utilized the CTPP dataset.

A.1 Regional Population – 2010 to 2040

The population of the San Antonio Metropolitan Statistical Area (MSA) is expected to grow from 2.1 million in 2010 to about 3.8 million in 2040, as shown in Table A.1 (AAMPO Model, TxDOT SAM). About 68 percent of the regional population growth are projected to occur in Bexar County, representing an additional 1.1 million people over the next 25 years. This is nearly equivalent to the 2010 population of Dallas, Texas (U.S. Census, 2015). Comal County and Guadalupe County also are expected to experience significant population growth, contributing 10 and 12 percent of the regional growth, respectively (Figure A.1).

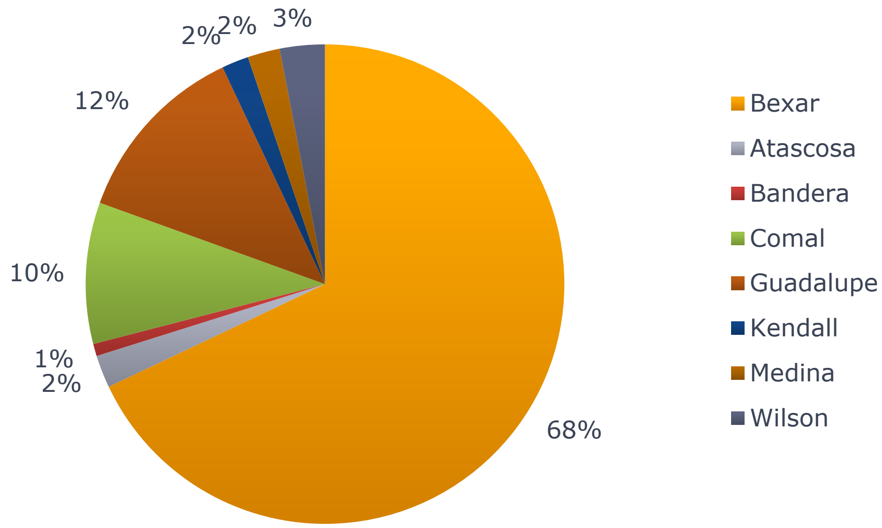
[16] Bexar County (containing the City of San Antonio) and seven outlying counties: Atascosa, Bandera, Comal, Guadalupe, Kendall, Medina, and Wilson.

Table A.1 Population Growth, 2010 to 2040

County	Population 2010	Population 2040	Population Growth	Population % Growth	Density (per Acre) 2010	Density (per Acre) 2040	Density (per Acre) % Increase
Atascosa	44,911	80,509	35,598	79%	0.06	0.1	67%
Bandera	20,485	33,941	13,456	66%	0.04	0.07	75%
Bexar	1,714,773	2,816,959	1,102,186	64%	2.13	3.51	65%
Comal	108,472	262,953	154,481	142%	0.29	0.71	145%
Guadalupe	131,533	333,606	202,073	154%	0.29	0.73	152%
Kendall	33,410	62,881	29,471	88%	0.08	0.15	88%
Medina	46,006	81,395	35,389	77%	0.05	0.1	100%
Wilson	42,918	92,241	49,323	115%	0.08	0.18	125%
MSA	**2,142,508**	**3,764,485**	**1,621,977**	**76%**	**0.45**	**0.8**	**78%**

Source: AAMPO Model, and Texas Department of Transportation (TxDOT) Statewide Analysis Model (SAM) (2014).

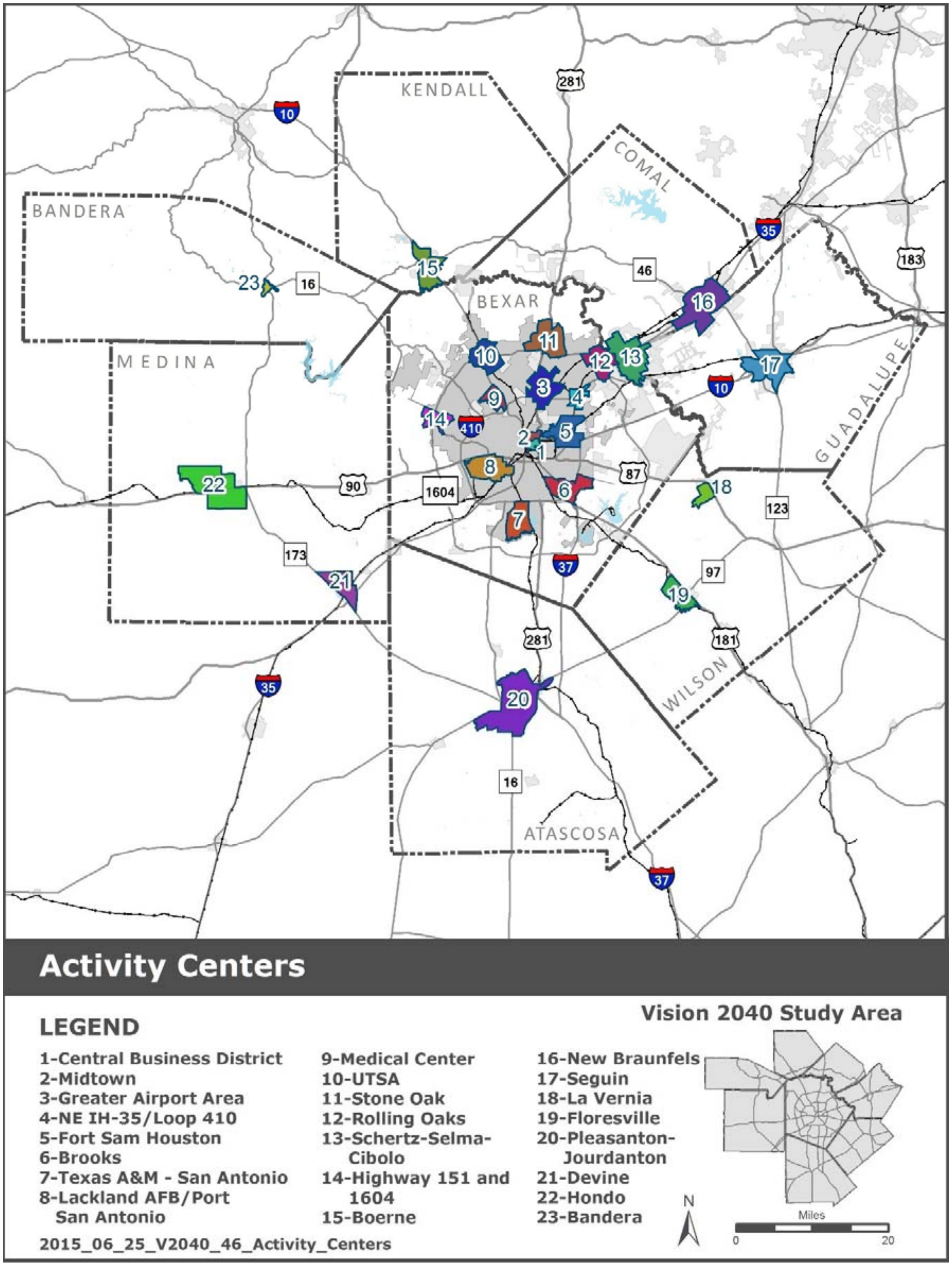
Figure A.1 Share of Regional Population Growth, 2010 to 2040



Source: AAMPO Model, and TxDOT SAM (2014).

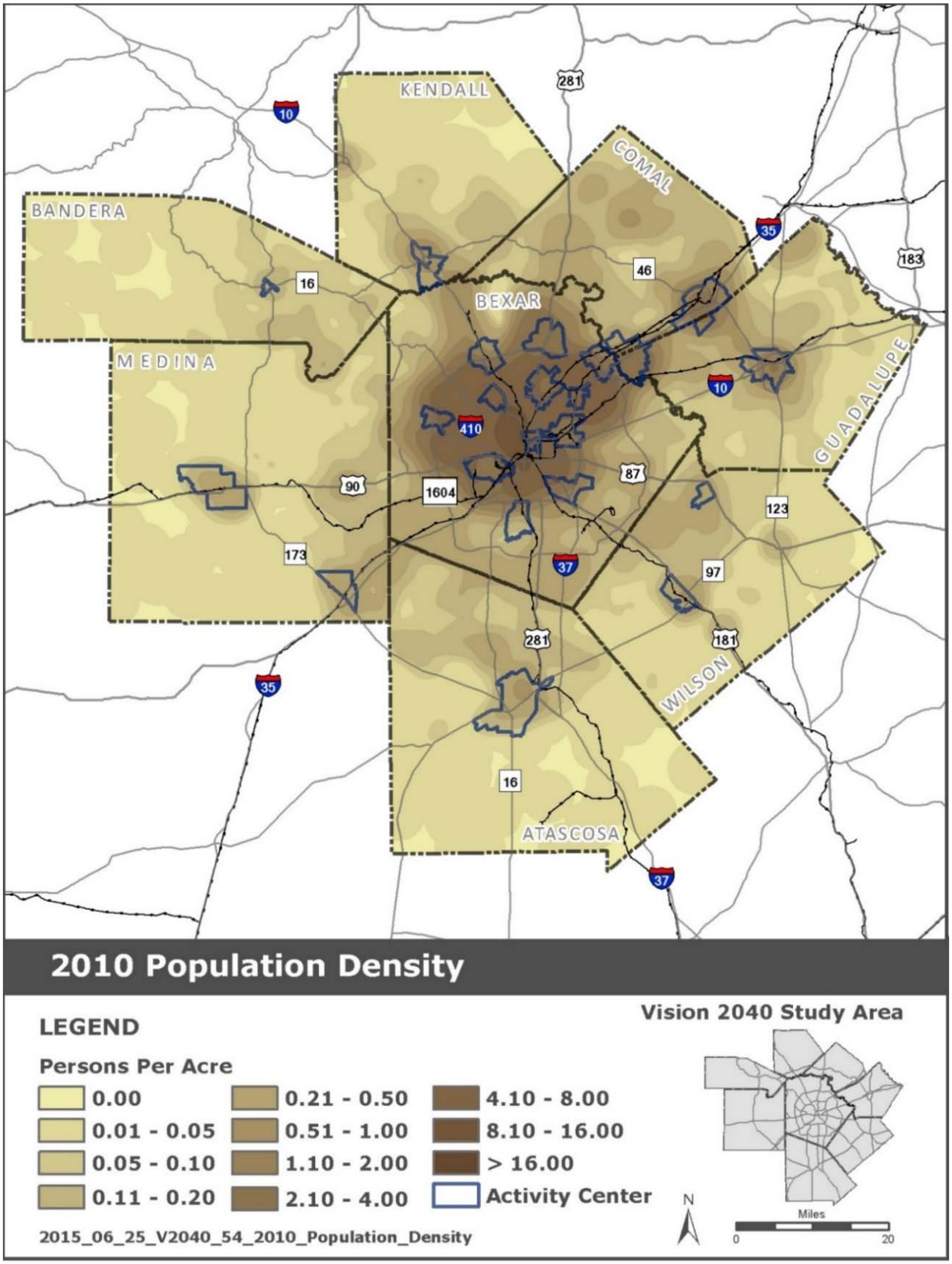
Population distribution in the study area for 2010 and 2040 are illustrated in Figure A.3 and Figure A.4 (AAMPO Model, TxDOT SAM, 2014). Substantial increase in population density is predicted in the employment activity centers identified in Figure A.2. In particular, the San Antonio Central Business District, South Texas Medical Center, Highway 151–Loop 1604, Fort Sam Houston, and Rolling Oaks activity centers are predicted to experience considerable population growth through 2040. Areas outside of Bexar County also are expected to see moderate growth in population density, including the Boerne, Floresville, Hondo, New Braunfels, Pleasanton-Jourdanton, and Seguin activity centers.

Figure A.2 Activity Centers



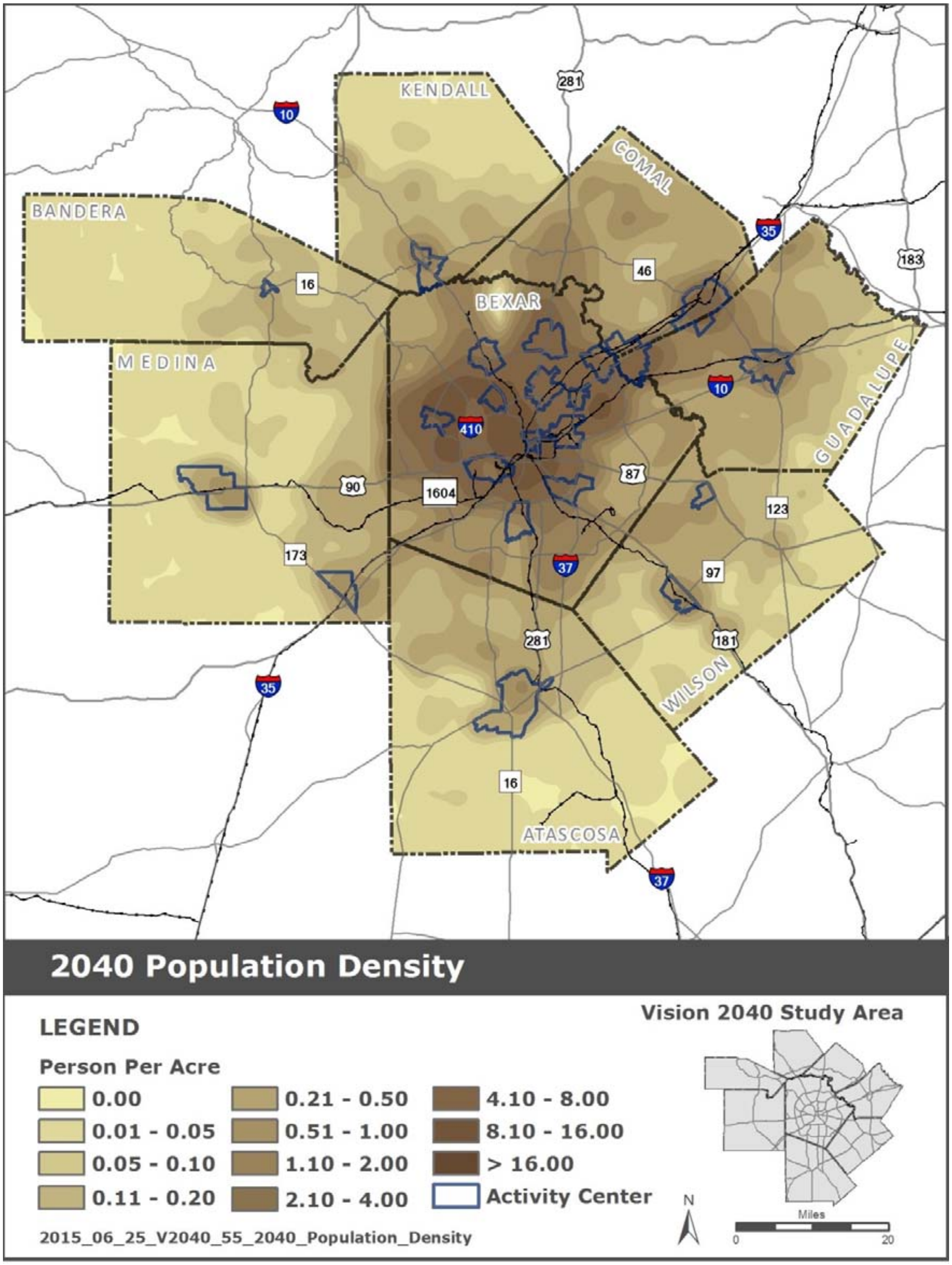
Source: City of San Antonio, VIA Metropolitan Transit (2015).

Figure A.3 2010 Population Density



Source: AAMPO Model, TxDOT SAM (2014).

Figure A.4   2040 Population Density



Source: AAMPO Model, TxDOT SAM (2014).

A.2 Employment Growth – 2010 to 2040

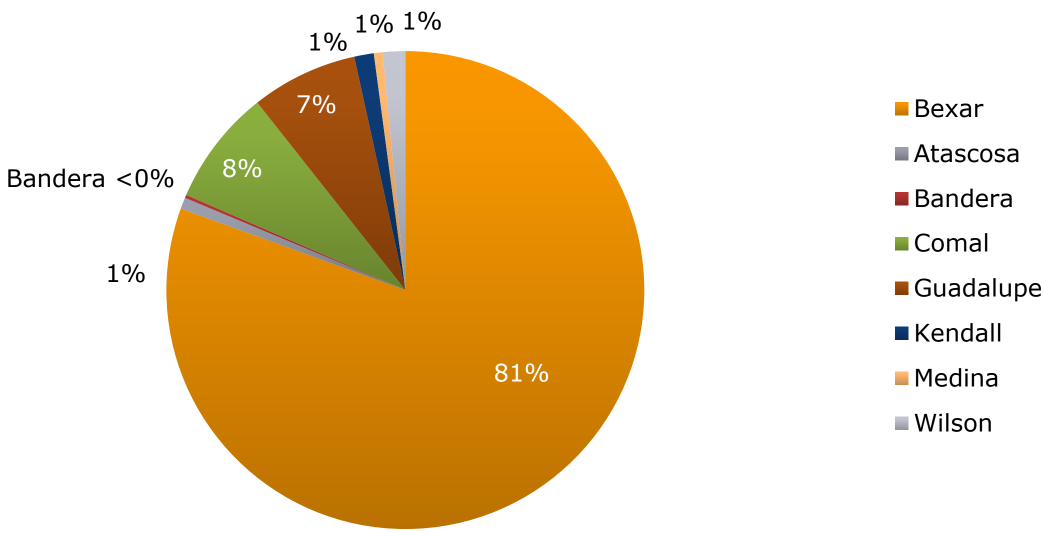
Between 2010 and 2040, regional employment is expected to increase from 0.9 million in 2010 to 1.7 million in 2040, as shown in Table A.2 (AAMPO Model, TxDOT SAM, 2014). Similar to the growth in population, the majority of the employment growth is expected in Bexar County, with an anticipated 675,000 jobs over the next 25 years. This increase accounts for 81 percent of the total expected employment growth in the region, as shown in Figure A.5. Comal and Guadalupe Counties also are predicted to experience significant employment growth, with an additional 65,000 and 60,000 employees, respectively. Regionwide, employment density is anticipated to increase by 18 percent, from 0.19 job per acre to 0.37 job per acre. Employment density in Bexar County is predicted to reach 1.81 jobs per acre in 2040.

Table A.2 Employment Growth
2010 to 2040

	Employment				Density (per Acre)		
County	2010	2040	Growth	% Growth	2010	2040	% Increase
Atascosa	10,796	17,233	6,437	60%	0.01	0.02	1%
Bandera	3,803	5,510	1,707	45%	0.01	0.01	0%
Bexar	781,899	1,457,182	675,283	86%	0.97	1.81	84%
Comal	42,733	108,492	65,759	154%	0.12	0.29	18%
Guadalupe	33,928	94,327	60,399	178%	0.07	0.21	13%
Kendall	11,890	22,981	11,091	93%	0.03	0.05	3%
Medina	10,468	15,435	4,967	47%	0.01	0.02	1%
Wilson	6,766	19,515	12,749	188%	0.01	0.04	2%
MSA	**902,283**	**1,740,675**	**838,392**	**93%**	**0.19**	**0.37**	**18%**

Source: AAMPO Model, TxDOT SAM (2014).

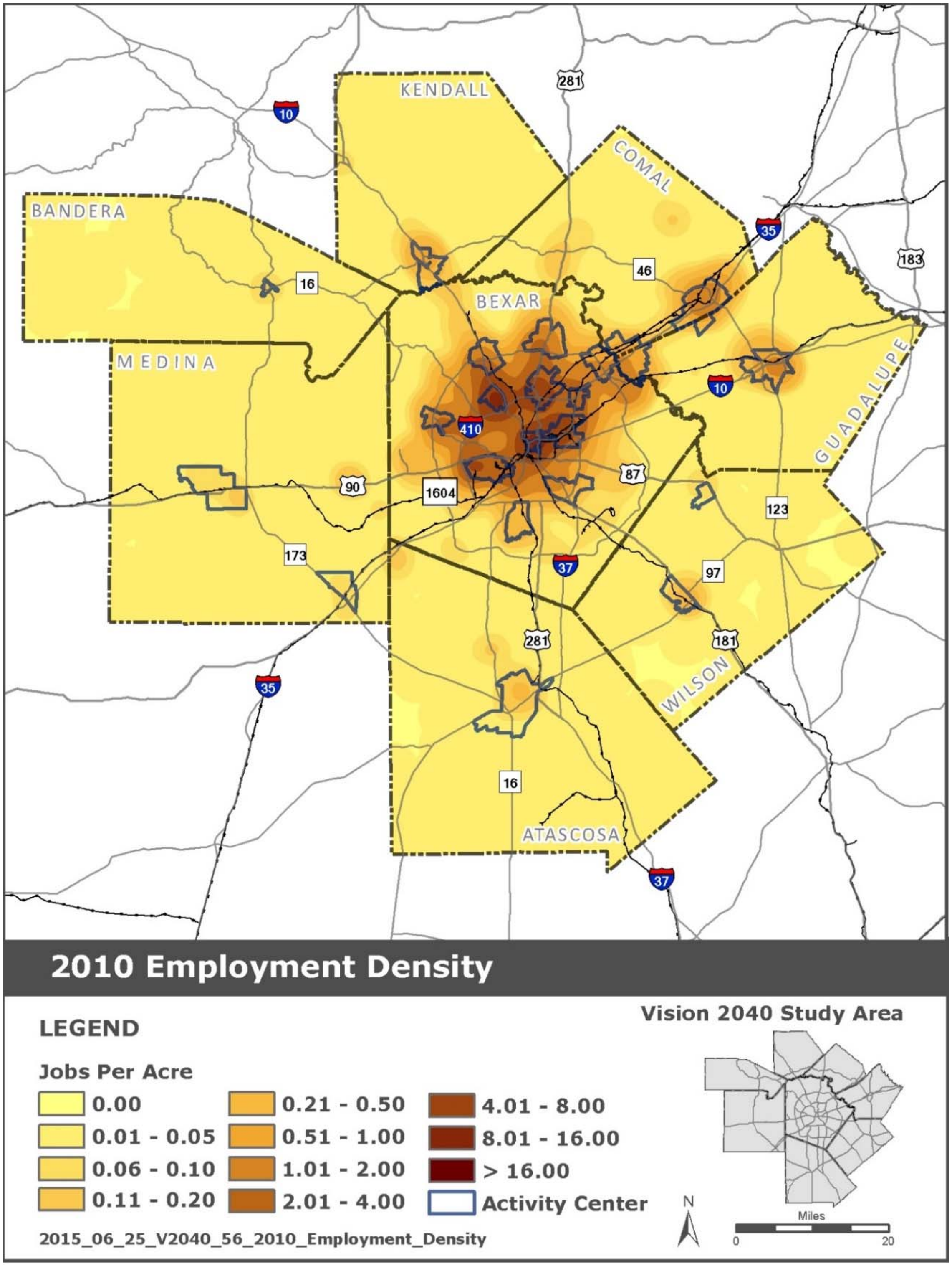
Figure A.5 Share of Regional Employment Growth, 2010 to 2040



Source: AAMPO Model, TxDOT SAM (2014).

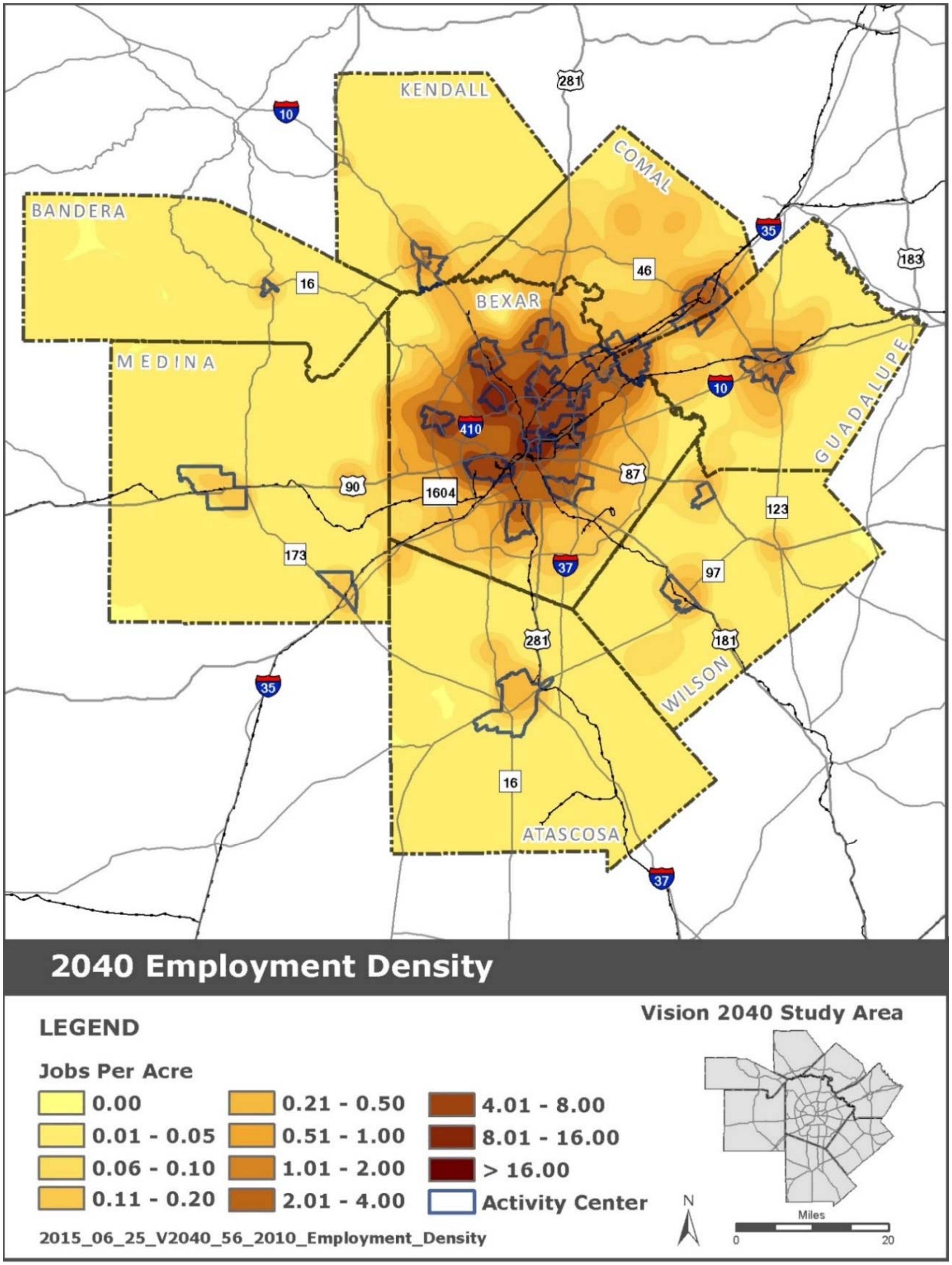
The study area's employment distribution and density in 2010 and 2040 are illustrated in Figure A.6 and Figure A.7 (AAMPO Model, TxDOT SAM, 2014). The highest employment density in 2040 appears in central Bexar County, particularly in the San Antonio Central Business District, South Texas Medical Center, and Greater Airport Areas. Considerable growth also is expected in several other activity centers, including Highway 151–Loop 1604, Fort Sam Houston, and Rolling Oaks.

Figure A.6 2010 Employment Density



Source: AAMPO Model, TxDOT SAM (2014).

Figure A.7 2040 Employment Density

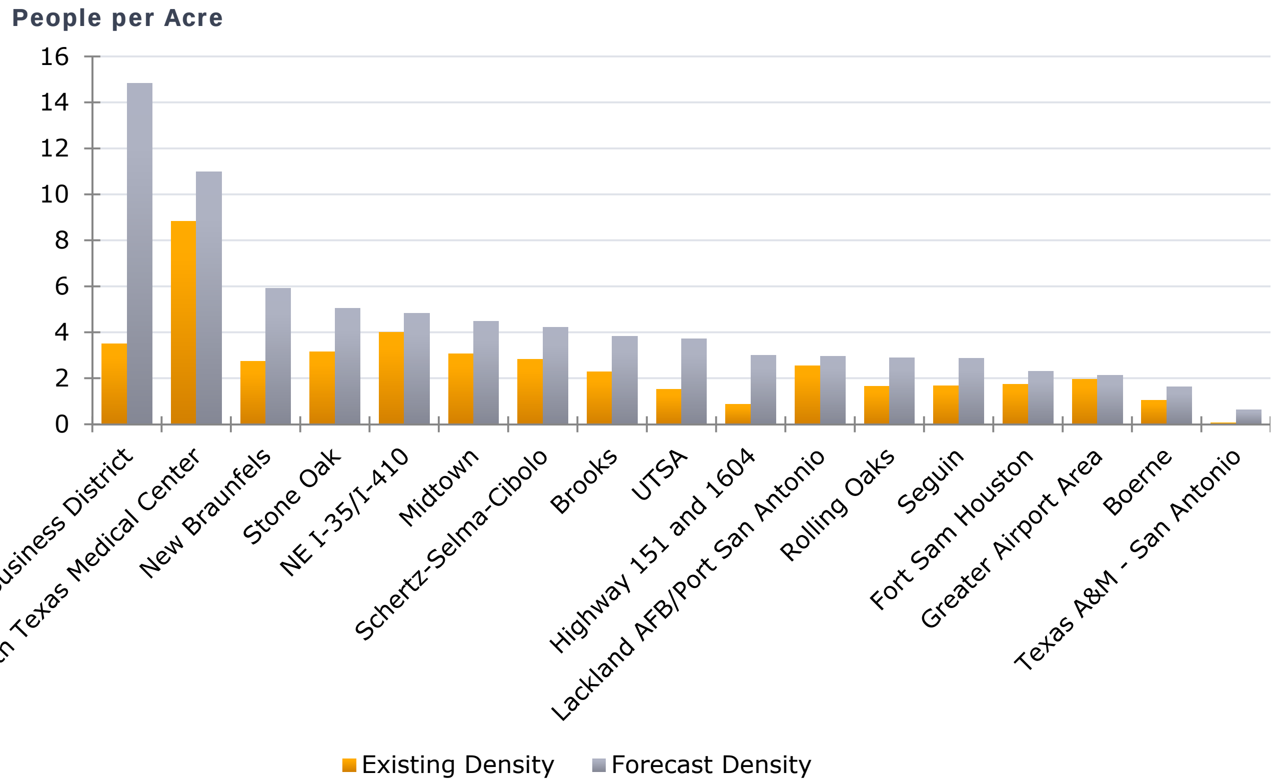


Source: AAMPO Model, TxDOT SAM (2014).

Population and Employment Growth in Activity Centers

The current and forecasted population density in 2010 within the 23 activity centers can be viewed in Figure A.8 (AAMPO Model, 2014). The San Antonio Central Business District is expected to have the highest population density growth, from 3.5 to 14.8 people per acre. New Braunfels, University of Texas San Antonio (UTSA), and Highway 151–Loop 1604 activity centers also are predicted to drastically increase in population density. All three of these activity centers are expected to double their population density by 2040.

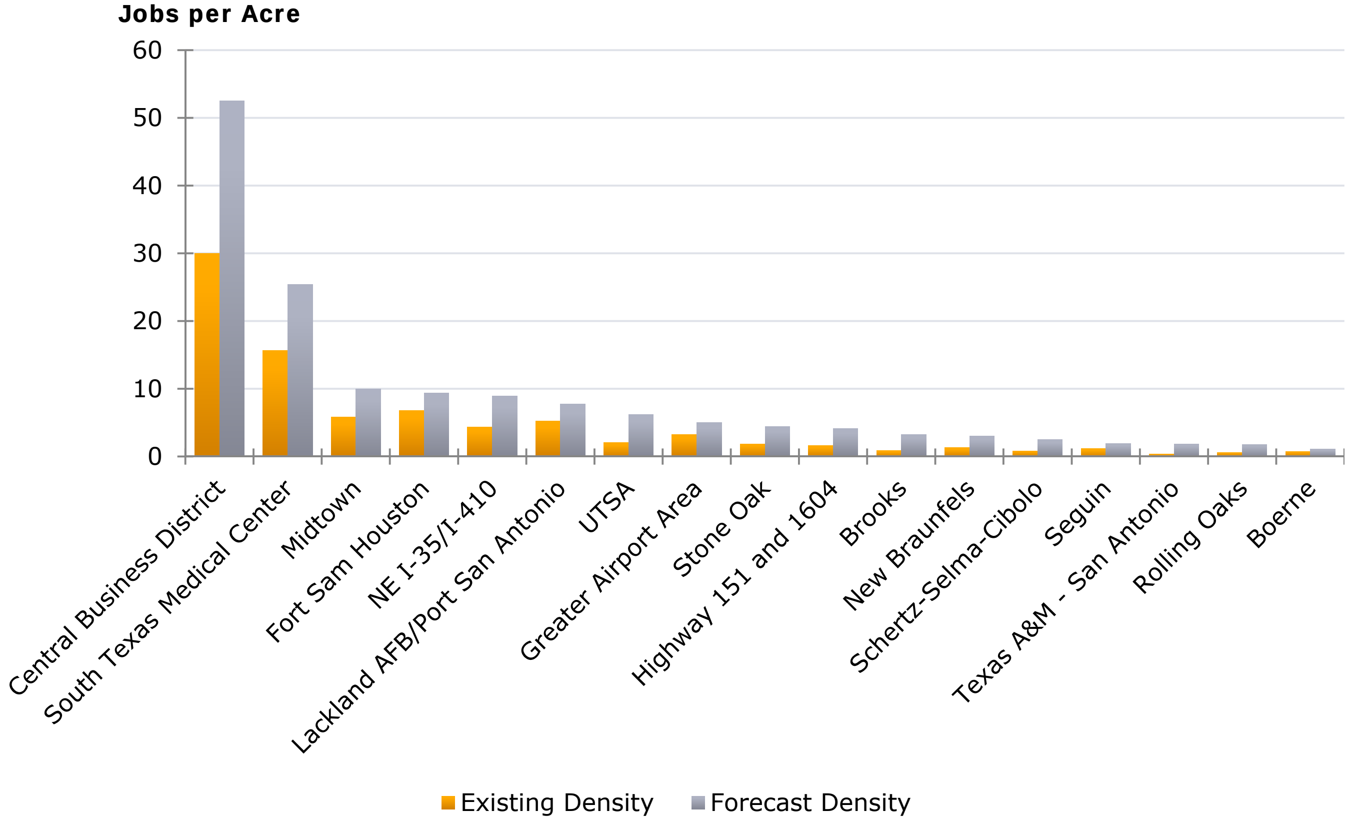
Figure A.8 Population Density Growth by Activity Center



Source: AAMPO Model (2014).

The current and forecasted employment density by activity center is shown in Figure A.9 (AAMPO Model, 2014). Employment within the San Antonio Central Business District is expected to drastically increase, from 30.0 to 52.5 jobs per acre between 2010 and 2040. South Texas Medical Center, Midtown, and UTSA also are predicted to notably increase in employment density.

Figure A.9 Employment Density Growth by Activity Center



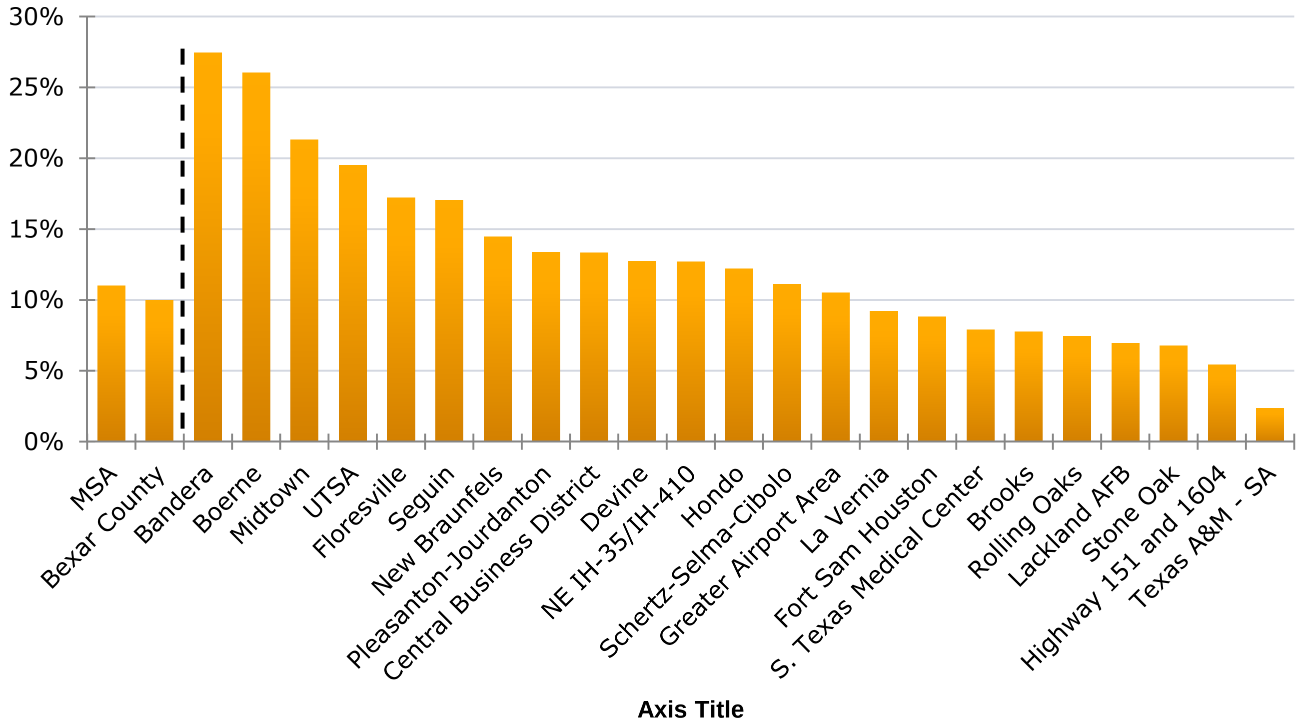
Source: AAMPO Model (2014).

Regional Demographic Profile

The demographic profile of an area can help inform the type of transit improvements that would be more beneficial to an area. For example, locations with a high population of zero-car households would benefit from access improvements, such as completed sidewalk networks, rather than additional park & ride lots. This section presents three demographic profiles of users that are more likely to use transit services for the 23 activity centers, Bexar County, and the entire MSA area, as shown in Figure A.10 through Figure A.12 (Census Transportation Planning Products [CTPP], 2013). Bexar County and the MSA area are separated from the 23 activity centers, which are sorted by centers with the highest to lowest percentage of residents with those specific characteristics.

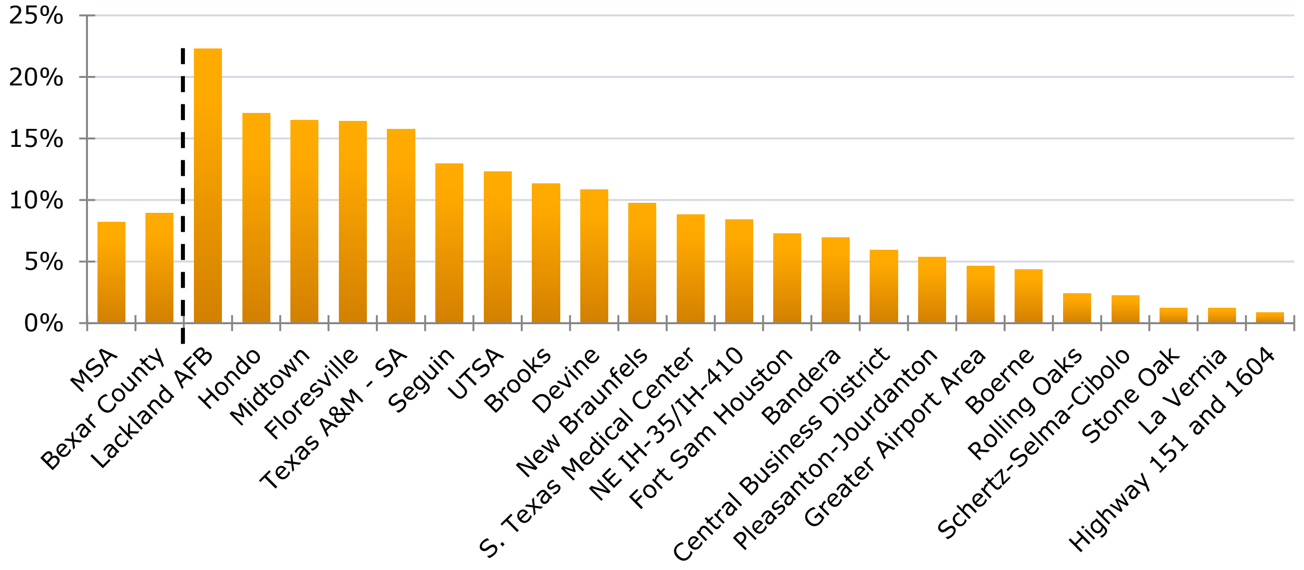
Within the 23 activity centers, Bandera and Boerne have the highest percentage of residents over 65, at 27 and 26 percent, respectively. The majority of activity centers outside of Bexar County have a higher percentage of residents over 65. However, some activity centers closer to the San Antonio city center do have a high percentage of residents over 65, specifically Midtown (21 percent) and UTSA (20 percent). Approximately 11 percent of residents in the Greater San Antonio Region are 65 and older.

Figure A.10 Percent of Population 65 and Older, 2010



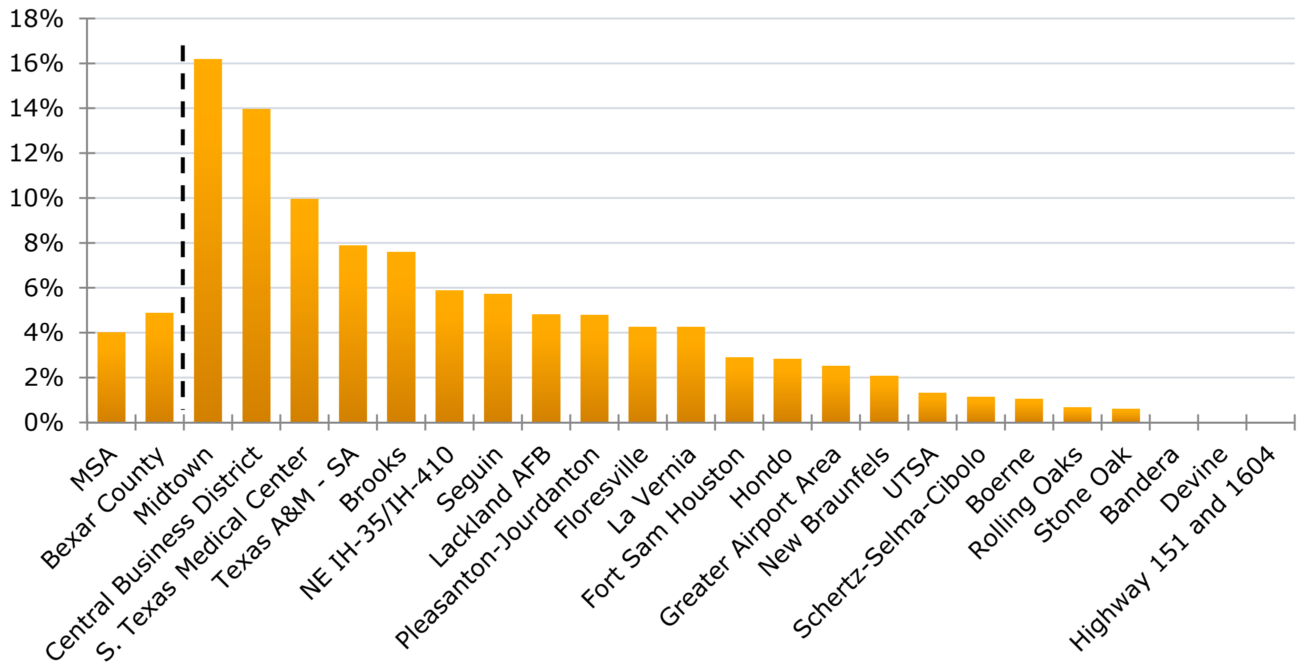
Source: Census Transportation Planning Products (CTPP) based on 2006 – 2010 American Community Survey (ACS) Data.

Figure A.11 Percent of Population below Poverty Line, 2010



Source: CTPP based on 2006 – 2010 ACS Data.

Figure A.12 Percent Zero-Car Households, 2010



Source: CTPP based on 2006 – 2010 ACS Data

The activity centers with the highest percent of residents below the poverty line are Lackland AFB (22 percent), Hondo (17 percent), and Midtown (16 percent) (CTPP, 2013). This compares to eight percent of the Greater San Antonio Region below the poverty line.

Areas with the highest concentration of zero-car households include Midtown (16 percent), San Antonio Central Business District (14 percent), and South Texas Medical Center (10 percent) (CTPP, 2013). The majority of the activity centers with the highest percentage of households with zero cars are within the City of San Antonio.

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B. Origins, Destinations, and Travel Corridors

This appendix provides a reference for the methodologies used to generate future year travel conditions on the transportation network and the detailed modeled results.

B.1 Introduction to the Model

Travel Demand Modeling

Future roadway conditions are estimated using travel demand models (TDM). Most TDMs use four key steps to estimate the amount of traffic on a roadway system:

1. **Trip Generation.** The number of trips, including both trip productions (e.g., a person leaving home) and attractions (e.g., a person arriving at work), are estimated using land use and demographic information. Trips are classified by purpose (e.g., "home-based work" trips correspond to one-way trips made directly between home and work, and vice versa).

2. **Trip Distribution.** Trip productions and attractions are matched with each other, forming origins and destinations and resulting in a list of one-way trip links linking travel analysis zones. Travel analysis zones can vary in size, but generally represent a small region where all origins and destinations use a few common access routes (e.g., a neighborhood, commercial area, or cluster of office parks).

3. **Mode Choice.** Each trip is assigned a mode (e.g., public transit or private vehicle, based on a number of variables, such as income, number of vehicles owned, or age).

4. **Network Assignment.** Trips are placed on the network. This process is complex. The model is run iteratively to balance out trips across the network, minimizing overall travel times while still capturing the effects of individual behaviors.

While TDMs provide useful information about future travel conditions that help agencies plan for the transportation needs of the community, the models do have limitations. They are limited by the demographic information entered, which may not resemble the true future of the region. They do not always accurately measure the relationship between land use and transportation, nor do they capture driver behavior well at high resolution. However, they are an excellent tool for estimating travel flows at the citywide or regional level.

Two travel demand models were used in the analysis of the San Antonio Metropolitan Statistical Area (MSA). The Alamo Area Metropolitan Planning Organization (AAMPO) model generates information on productions and attractions for the five Counties of Bexar, Comal, Guadalupe, Kendall, and Wilson. Data representing Bandera, Medina, and Atascosa Counties was obtained from the Texas Department of Transportation (TxDOT) Statewide Analysis Model (SAM). Additional information regarding the modeling approach and baseline network assumptions is provided in *Volume 2: Developing Vision 2040*.

Productions and attractions were estimated for various trip purposes: home-based work, home-based school, home-based other, and non-home based other. The production densities plotted for the three Counties of Bandera, Medina, and Atascosa represent trips produced towards the AAMPO region (Table B.1). Similarly, attraction densities plotted for those counties represent trips that were produced in the AAMPO area and directed towards the three-county area. The production and attraction densities plotted for the AAMPO area also include external local noncommercial vehicle trips. Note that productions and attractions correlate strongly with population and employment densities shown in Appendix A; however, productions and attractions vary with the specific demographic makeup of the area, are listed by model-specific analysis zones rather than census blocks, and are categorized by trip purpose.

As productions and attractions are correlated with population and employment, respectively, the growth in productions and attractions also is most strongly evident in the activity centers the San Antonio city limits. Particularly, zones within Loop 410 and those close to the San Antonio Central Business District exhibit a moderate to high change in productions and attractions per acre between 2010 and 2040, meaning that the transportation network serving these regions is most likely to be strained.

Once productions and attractions are estimated, they are paired together to form trips and assigned to the network. Each trip is composed of an origin, a destination, a mode, and a purpose. Table B.2 shows county-to-county daily trips for 2040 projected to use the transit mode. Since a limited transit network exists for outlying counties in the region, transit trips are very low for those origins.

Table B.1 County-to-County Transit Trips (AAMPO Model Only)

HBT	Bexar	Comal	Guadalupe	Kendall	Wilson
Bexar	162,363	12	26	0	0
Comal	101	64	5	0	0
Guadalupe	35	3	1	0	0
Kendall	1	0	0	0	0
Wilson	2	0	0	0	0

Source: AAMPO Model (2014).

Table B.2 shows the county-to-county daily trips by trip purpose for all modes for the year 2040 as output by AAMPO model and TxDOT SAM. Total county productions are represented by row sums; whereas, county attractions are represented by column sums; this information is shown graphically in Figure 3.1. Note that Bexar County is a major destination for trips from every county.

Table B.3 shows the top 10 activity centers by both origin and destination using the finer-scale results from the AAMPO model. Total origins and destinations include all activity centers (i.e., including those not shown in the table), but do not include internal trips. Residential activity centers in the northeast, such as Schertz-Selma-Cibolo, Stone Oak, and Rolling Oaks, dominate the productions, while the central and northwestern activity centers, such as the Greater Airport Area, San Antonio Central Business District, and South Texas Medical Center, dominate the attractions.

Total bidirectional flows between each activity center can be found in Figure B.1. This represents the total amount of trips occurring in each direction between key activity centers (e.g., areas potentially suitable for major transit improvements); flow from or to other areas in the city is not considered.

One-way flows of home-based trips (HBT) to each activity center can be found in Figure B.1 through Figure B.18.[17] These images represent the total attractions of each activity center from all other centers in the Greater San Antonio Region. Each flow line represents the approximate aggregate flow from other activity centers and the approximate direction of flow; however, flow lines do not represent the exact route that traffic would take to reach the destination. Each figure uses the same scale, allowing comparison of relative demand for transportation between activity centers.

[17] That is, trips either originating or terminating at a place of residence.

Table B.2 County-to-County Trip Exchanges (All Modes)

2040

Origin	Atascosa	Bandera	Bexar	Comal	Guadalupe	Kendall	Medina	Wilson	Totals
Home-Based Work Trips									
Atascosa	9,093	7	18,288	314	271	68	1,084	740	29,865
Bandera	9	4,658	5,230	40	10	1,555	994	1	12,496
Bexar	5,601	2,131	1,168,104	48,107	26,346	21,295	7,243	3,918	1,282,745
Comal	112	10	109,237	50,025	9,045	1,228	24	106	169,787
Guadalupe	147	4	80,870	20,025	27,616	127	31	1,205	130,025
Kendall	21	333	39,715	758	64	12,981	43	4	53,919
Medina	1,387	762	21,934	87	63	158	13,460	21	37,874
Wilson	949	1	21,926	423	1,905	15	19	8,483	33,720
Totals	17,319	7,907	1,465,304	119,778	65,321	37,428	22,898	14,477	1,750,431
Home-Based School Trips									
	Atascosa	Bandera	Bexar	Comal	Guadalupe	Kendall	Medina	Wilson	Totals
Atascosa	8,517	0	4,406	0	1	0	471	868	14,262
Bandera	1	4,181	3,019	2	0	1,014	110	0	8,328
Bexar	5,128	33	776,596	992	4,447	1,051	3,968	3,453	795,668
Comal	110	0	64,528	17,866	6,735	407	6	96	89,749
Guadalupe	132	0	38,720	2,842	21,475	6	6	4,700	67,882
Kendall	2	724	13,213	135	2	9,688	7	0	23,771
Medina	917	400	7,771	0	1	6	10,884	1	19,979
Wilson	396	0	2,444	0	13	0	0	9,565	12,418
Totals	15,202	5,339	910,696	21,837	32,673	12,173	15,453	18,683	1,032,056
Home Based Other / Non-Home-Based Trips									
	Atascosa	Bandera	Bexar	Comal	Guadalupe	Kendall	Medina	Wilson	Totals
Atascosa	90,834	11	45,253	176	181	52	2,357	3,748	142,611
Bandera	10	25,941	7,291	55	22	6,836	2,714	5	42,875
Bexar	27,359	4,774	5,755,962	190,624	121,277	82,973	30,098	39,243	6,252,310
Comal	197	62	201,692	289,864	33,854	1,985	130	496	528,279
Guadalupe	177	25	148,467	73,067	173,821	322	105	2,001	397,984
Kendall	50	1,255	77,996	1,588	294	75,221	153	39	156,595
Medina	4,809	3,448	56,684	133	112	565	72,210	71	137,943
Wilson	1,646	5	69,833	504	2,972	39	65	52,405	127,468
Totals	**125,082**	**35,521**	**6,363,177**	**556,010**	**332,534**	**167,993**	**107,742**	**98,008**	**7,786,065**

Source: TxDOT SAM Model, AAMPO Model (2014).

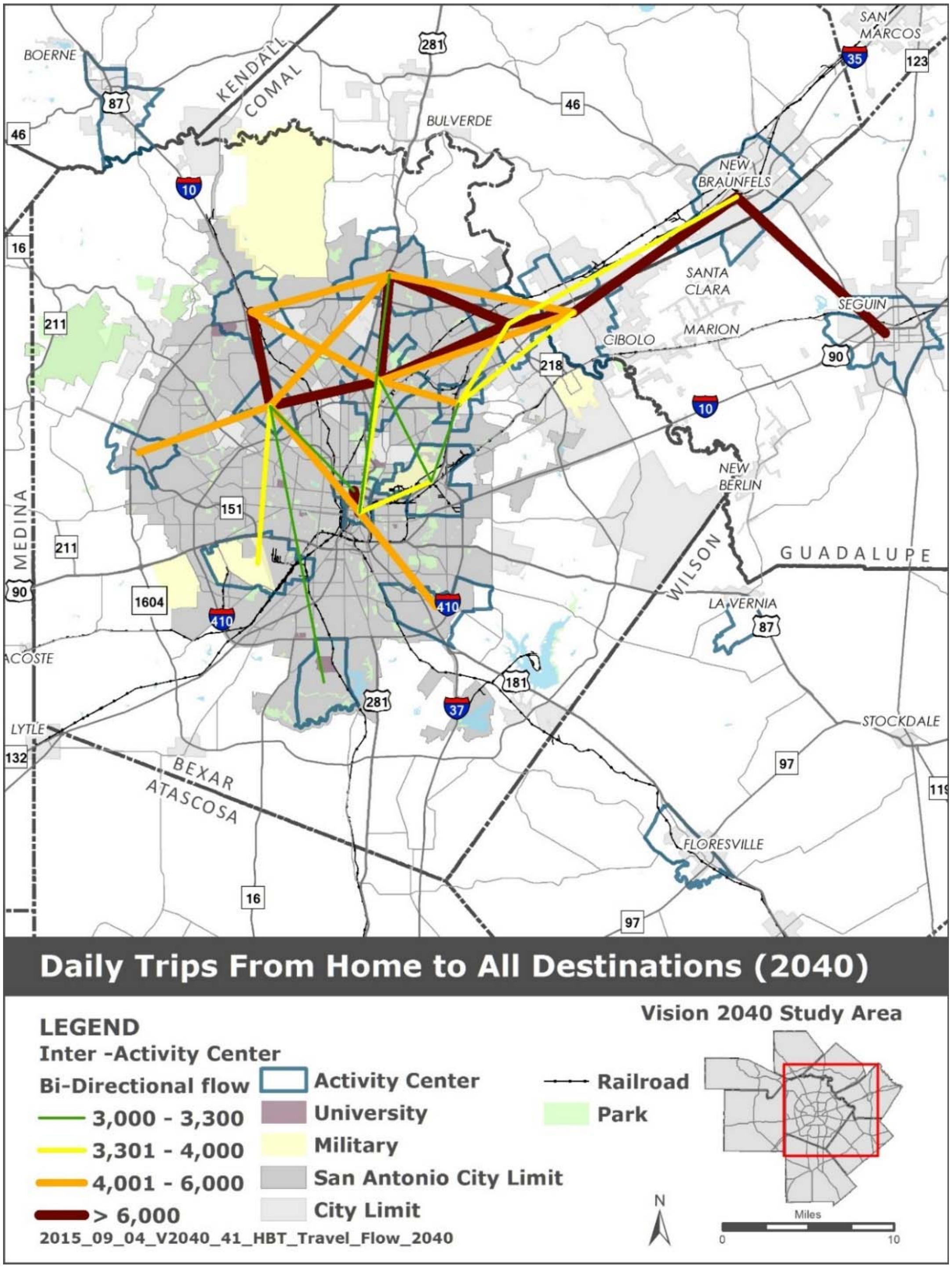
Table B.3 Top 10 Origin and Destination Activity Centers (All Modes)

Home-Based Total Flow, 2040

		Greater Airport Area	CBD (San Antonio)	S. Texas Medical Center	Midtown	Fort Sam Houston	UTSA	New Braunfels	NE 35/410	Rolling Oaks	Stone Oak	Total (All Destinations)
		Destination										
Origin	Schertz	4,835	2,276	1,346	888	2,750	669	7,374	3,547	7,803	2,793	**35,600**
	Stone Oak	9,803	2,667	3,918	1,435	1,475	3,725	425	2,009	2,682		**31,152**
	Rolling Oaks	5,119	1,807	1,305	827	2,497	999	1,688	3,153		3,631	**27,363**
	S. Texas Medical Center	3,796	3,272		2,047	1,203	3,141	215	761	306	1,009	**22,185**
	UTSA	3,242	1,998	6,450	1,431	603		202	562	426	1,992	**21,039**
	Airport Area		2,714	3,309	1,619	1,938	1,470	244	2,120	909	2,628	**19,330**
	New Braunfels	1,483	974	568	375	946	256		941	1,920	804	**16,906**
	CBD (San Antonio)	1,212		1,706	7,142	1,388	977	164	425	206	336	**16,422**
	Brooks	1,166	3,931	1,041	1,475	2,185	327	144	574	164	189	**13,816**
	Midtown	872	6,379	1,182		864	677	112	267	134	255	**12,525**
	Total (All Origins)	**37,920**	**35,339**	**29,748**	**22,313**	**20,373**	**16,789**	**16,443**	**16,381**	**16,096**	**15,507**	

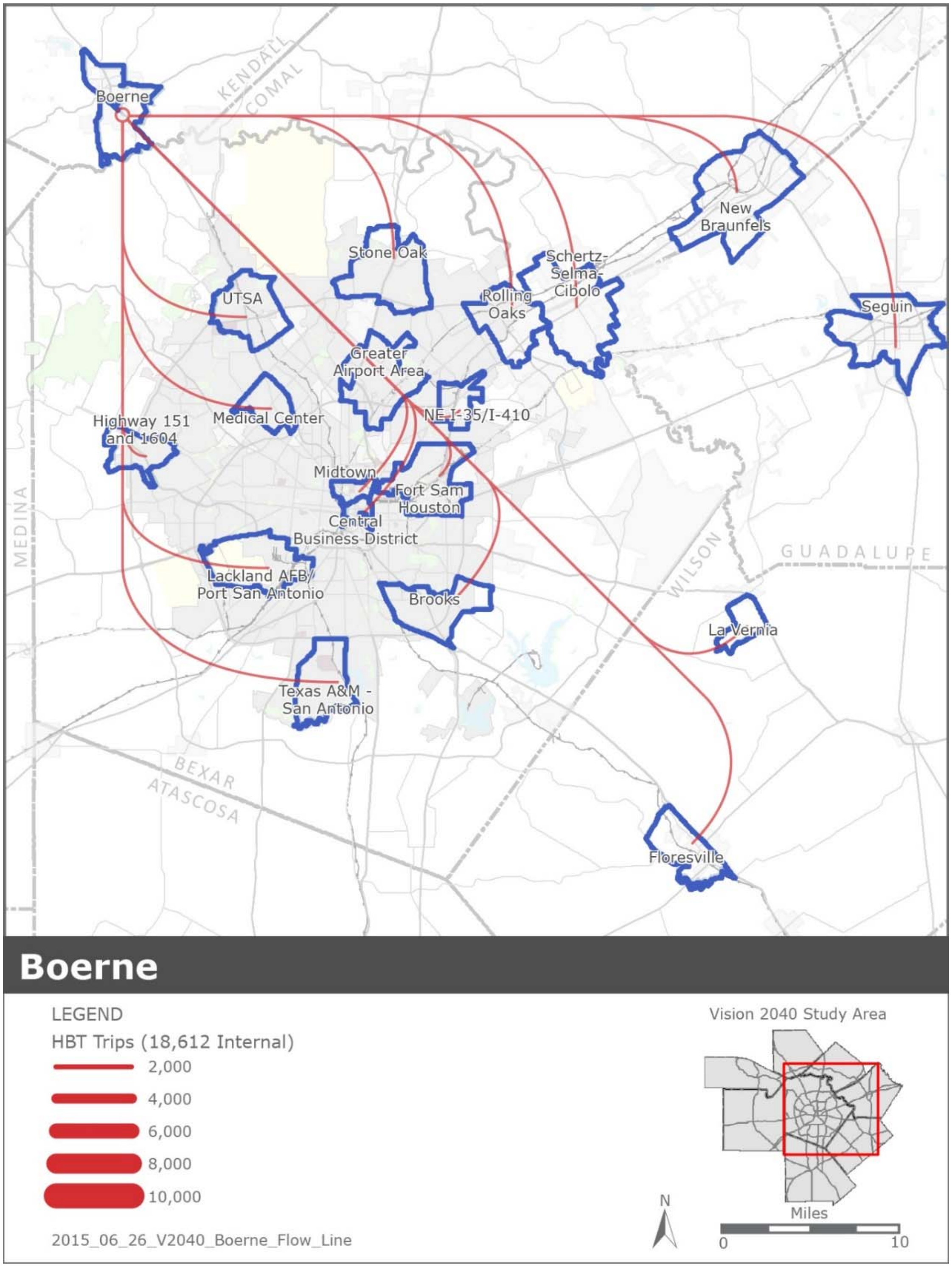
Source: AAMPO Model (2014).

Figure B.1 Home-Based Total Flow (All Modes) *Activity Centers*



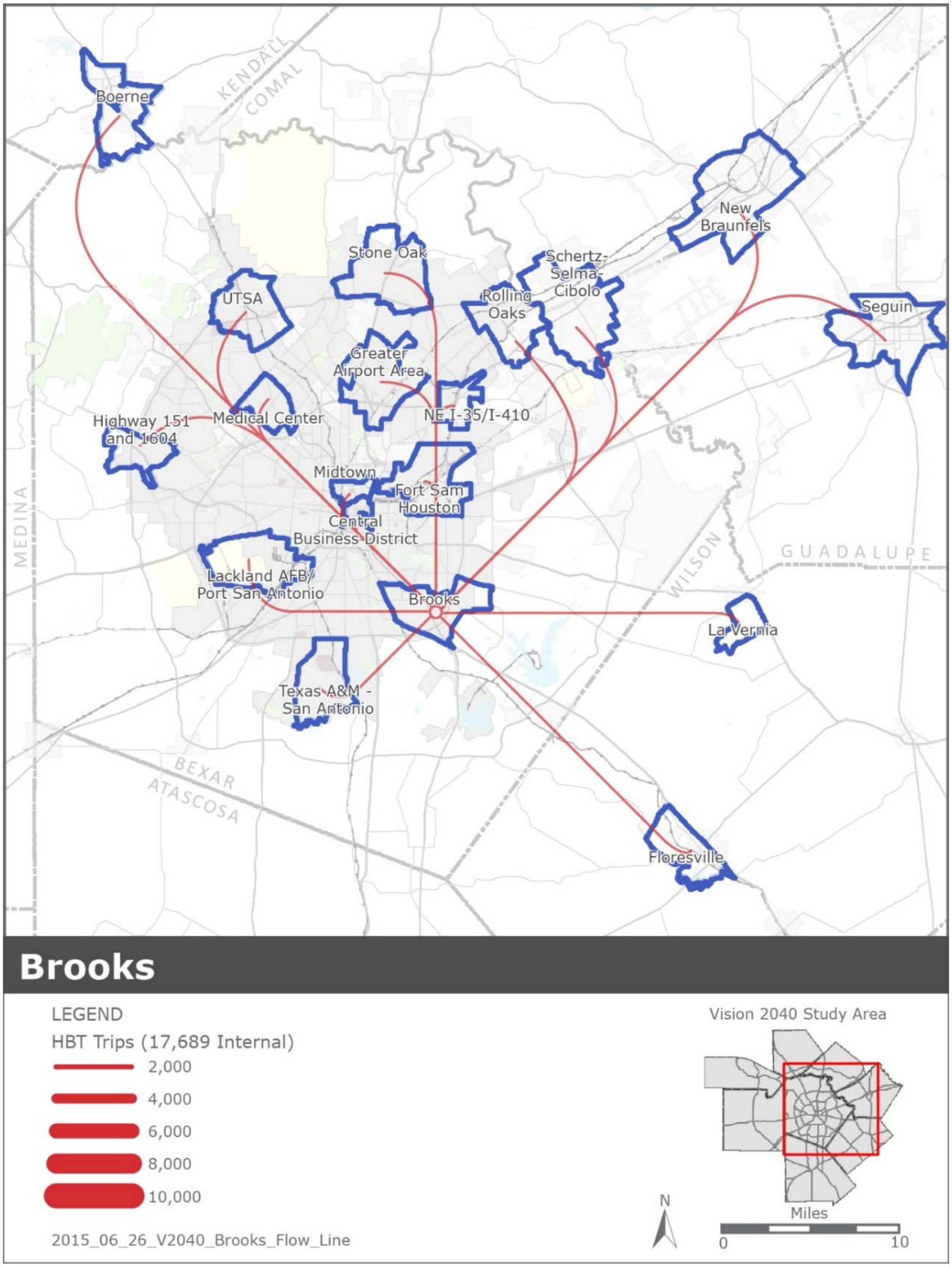
Source: AAMPO Model (2014).

Figure B.2 Trip Flows to Boerne



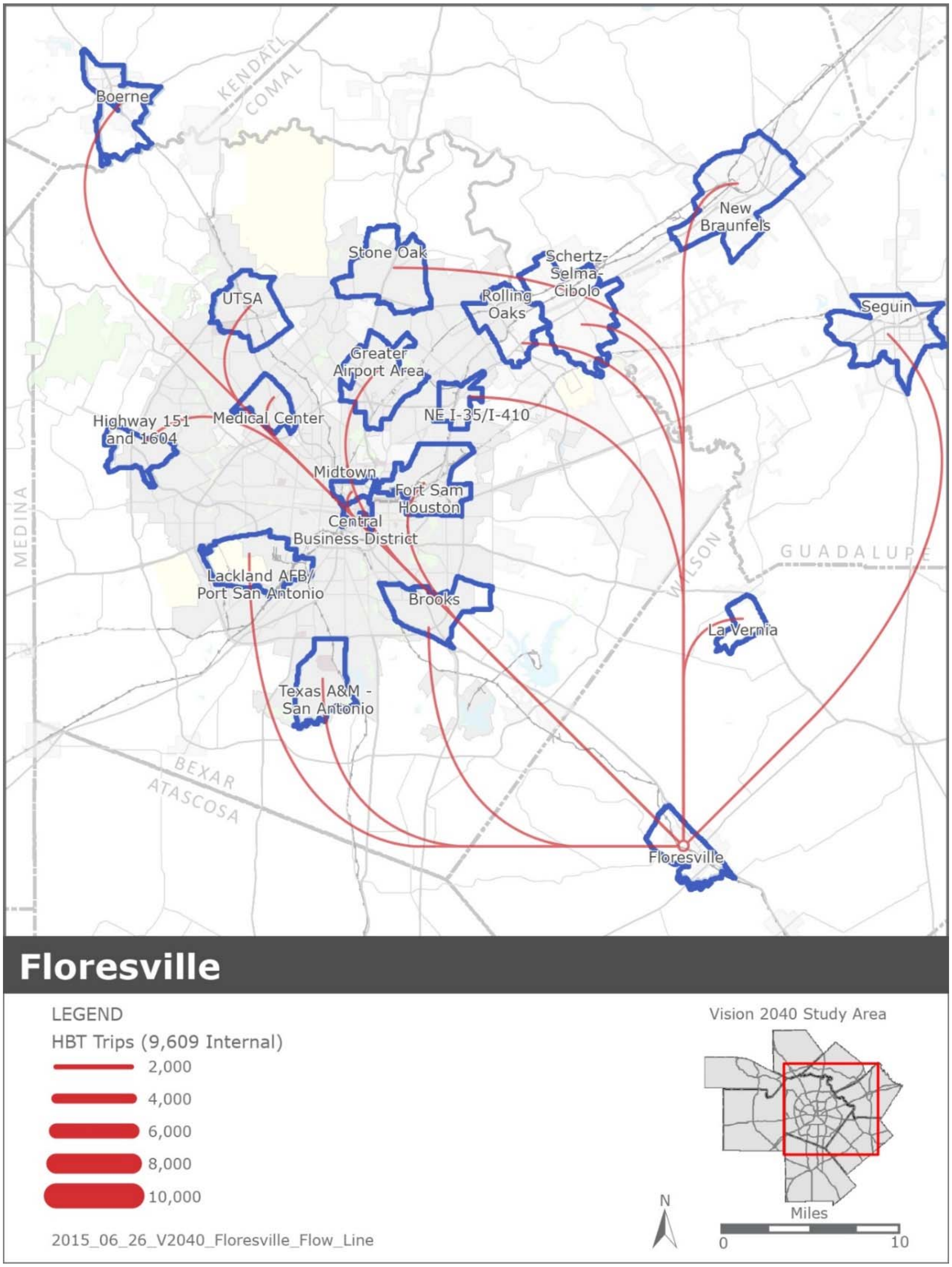
Source: AAMPO Model (2014).

Figure B.3 Trip Flows to Brooks



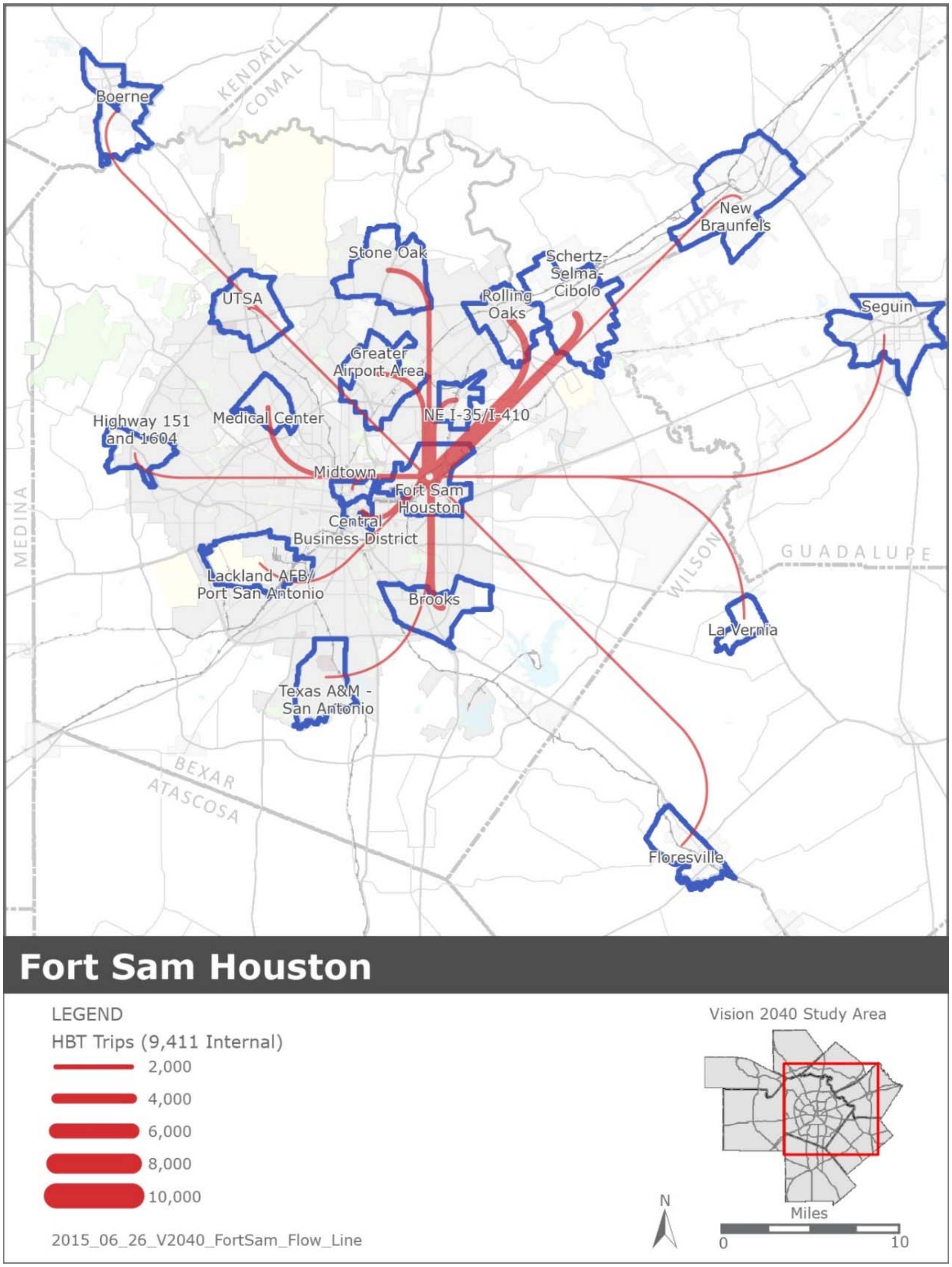
Source: AAMPO Model (2014).

Figure B.4 Trip Flows to Floresville



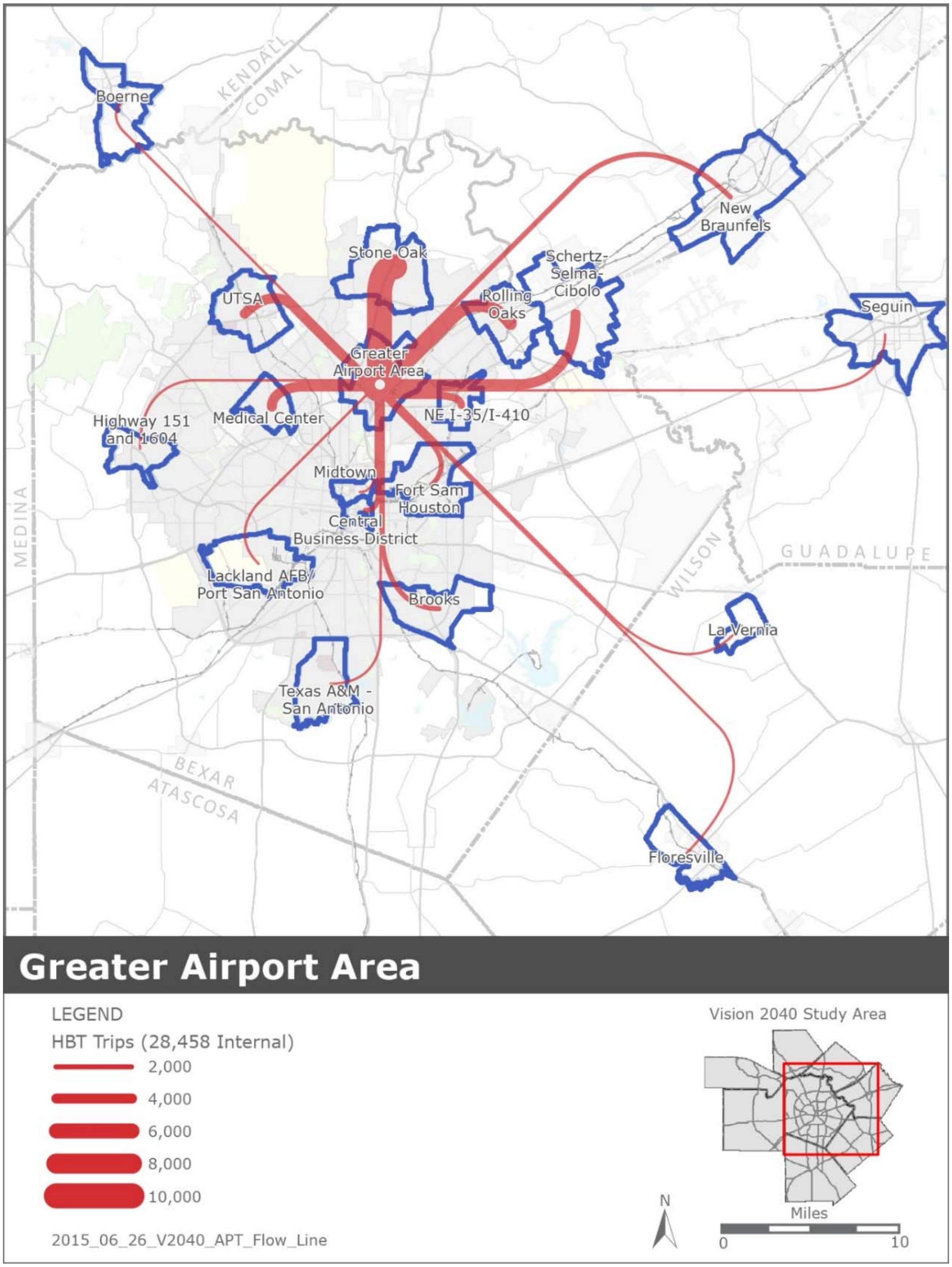
Source: AAMPO Model (2014).

Figure B.5 Trip Flows to Fort Sam Houston



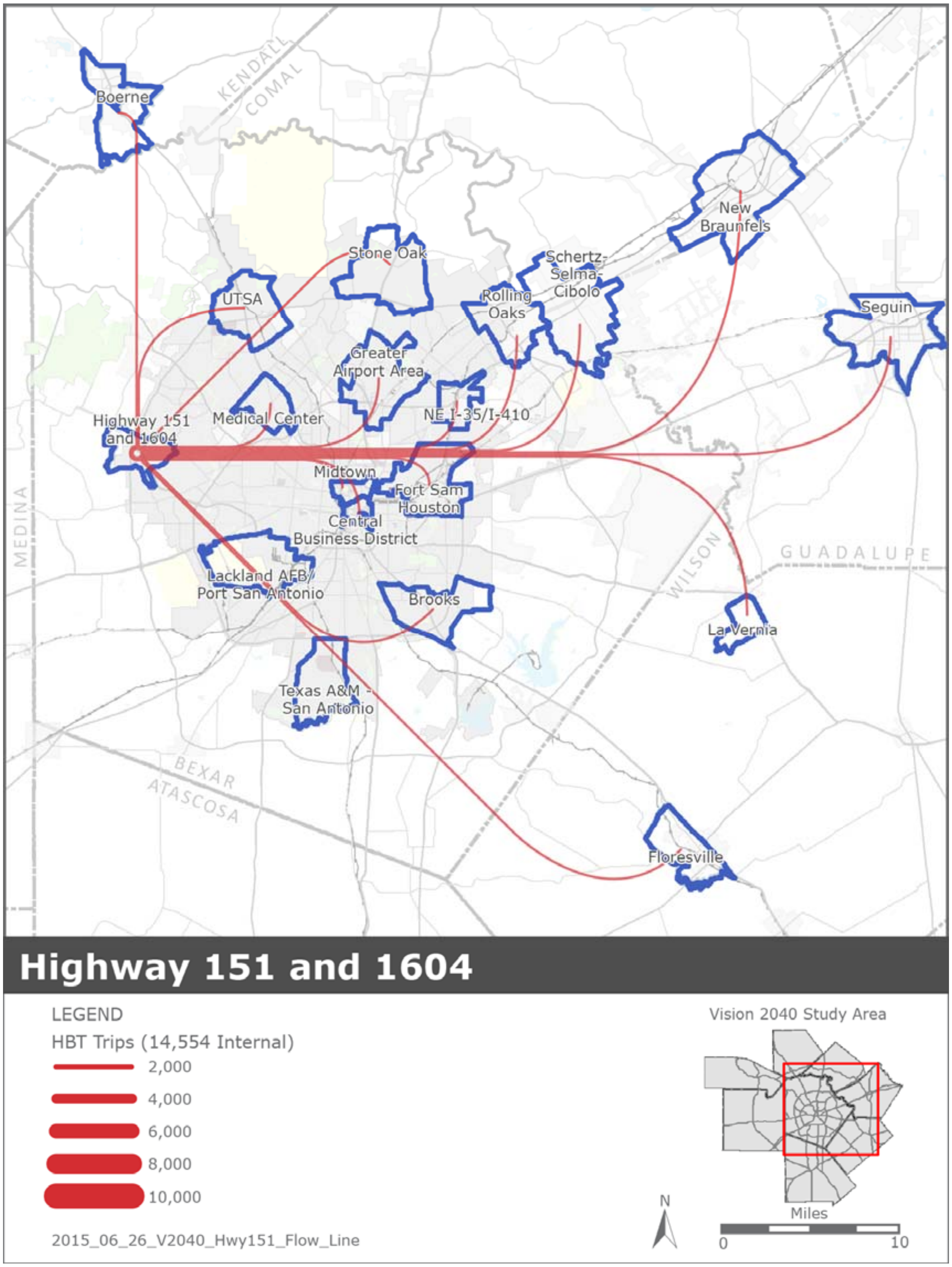
Source: AAMPO Model (2014).

Figure B.6 Trip Flows to the Greater Airport Area



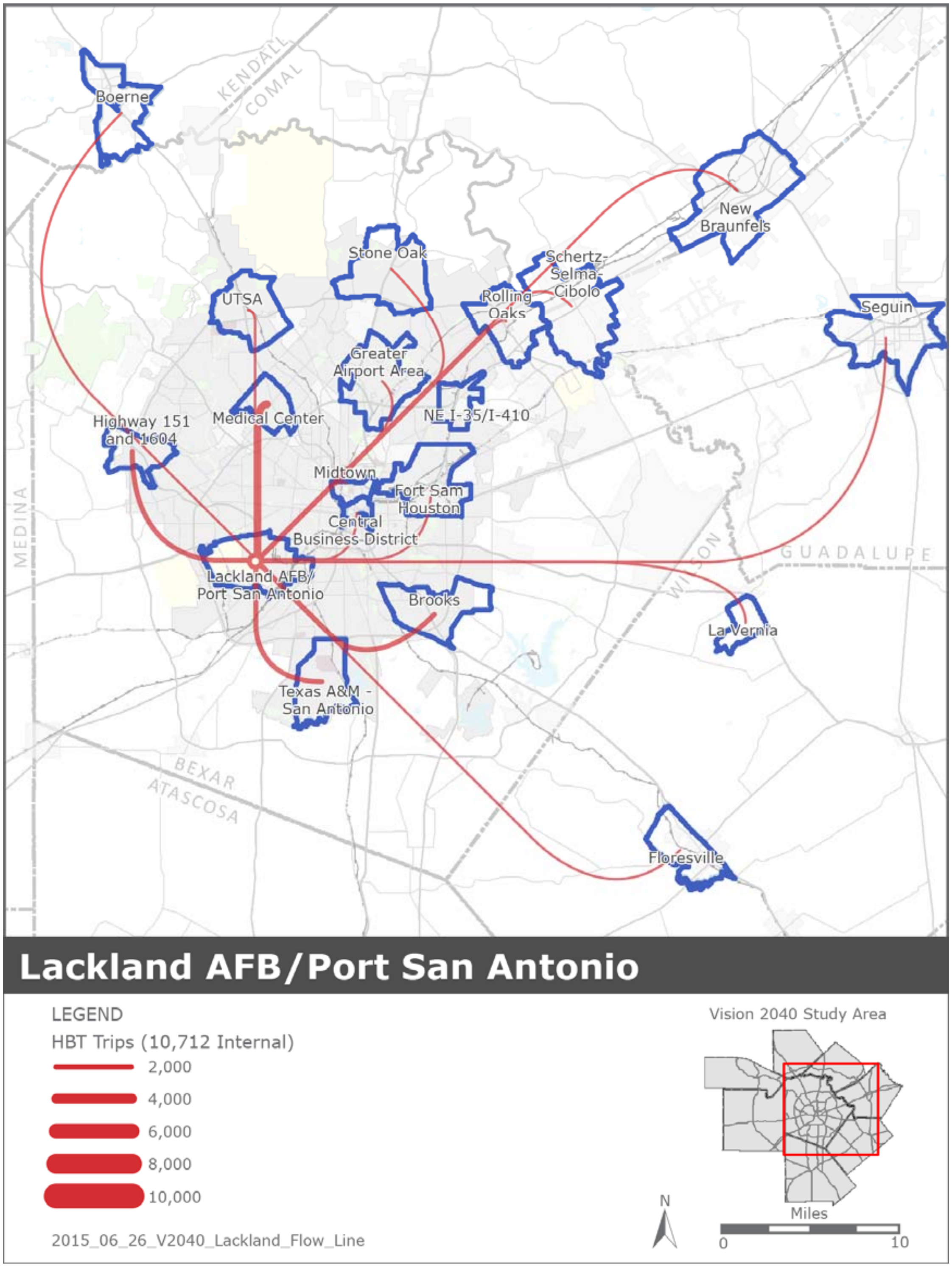
Source: AAMPO Model (2014).

Figure B.7 Trip Flows to Highway 151
Loop 1604



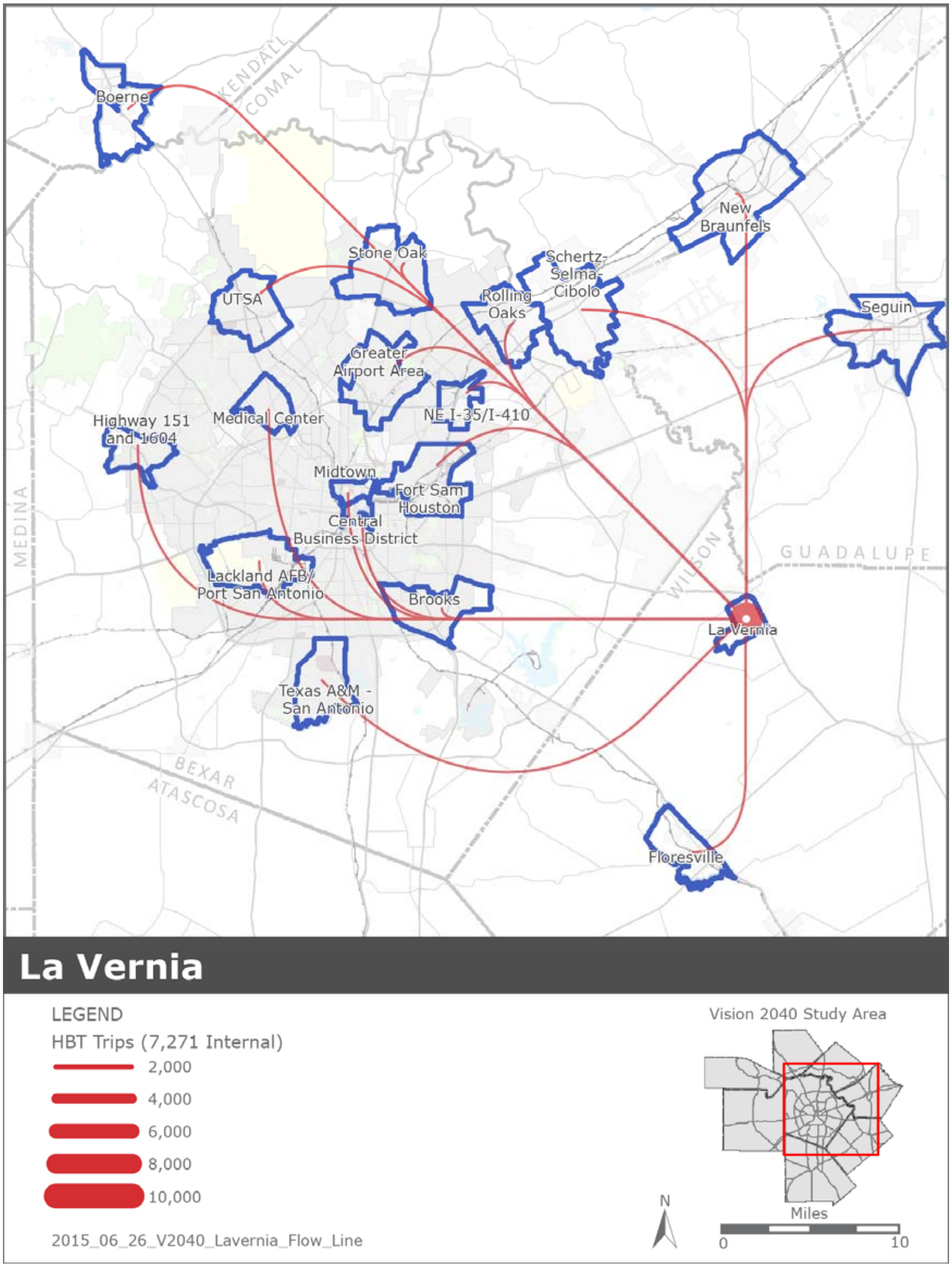
Source: AAMPO Model (2014).

Figure B.8 Trip Flows to Lackland Air Force Base (AFB)/Port San Antonio



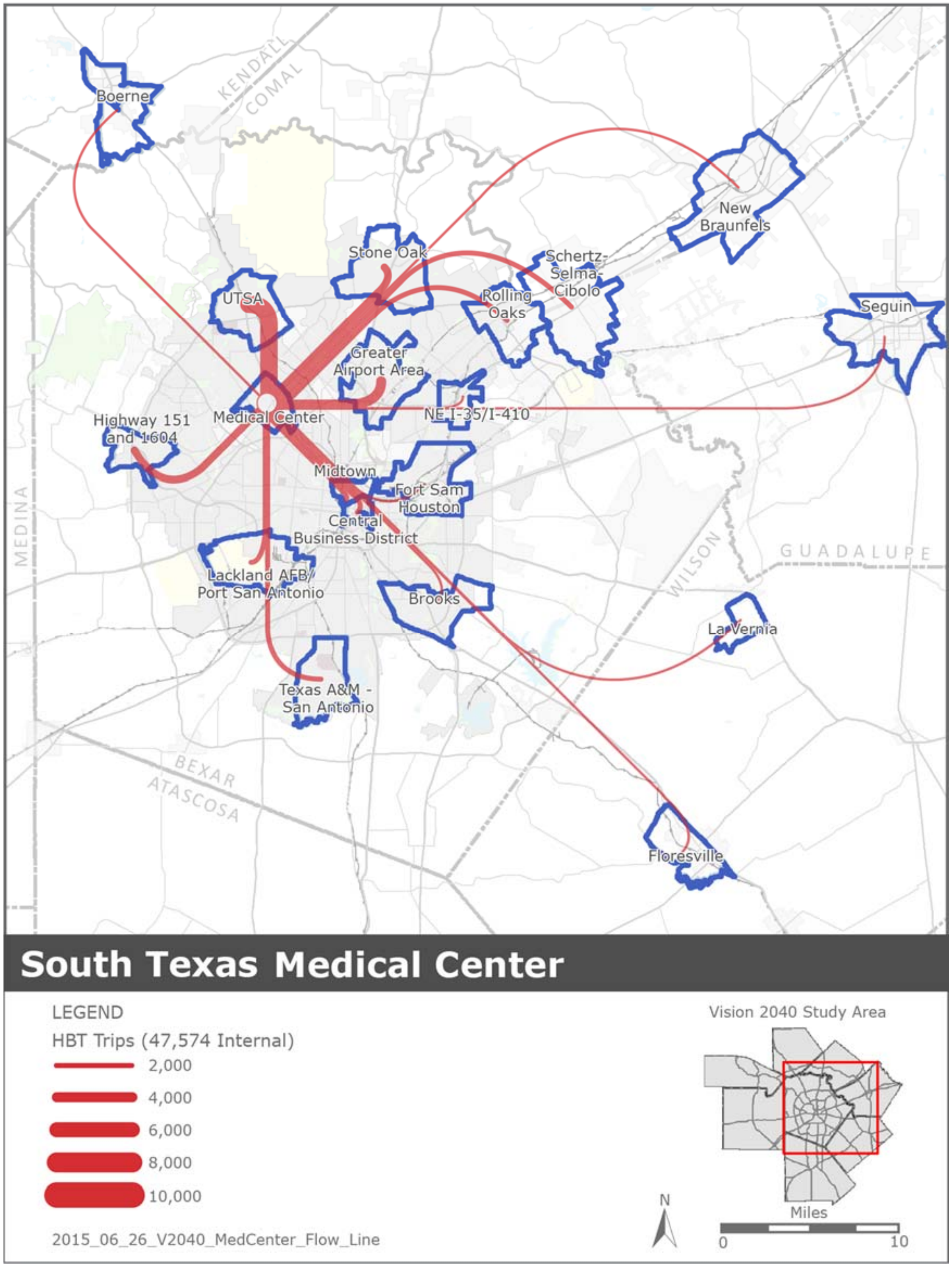
Source: AAMPO Model (2014).

Figure B.9 Trip Flows to La Vernia



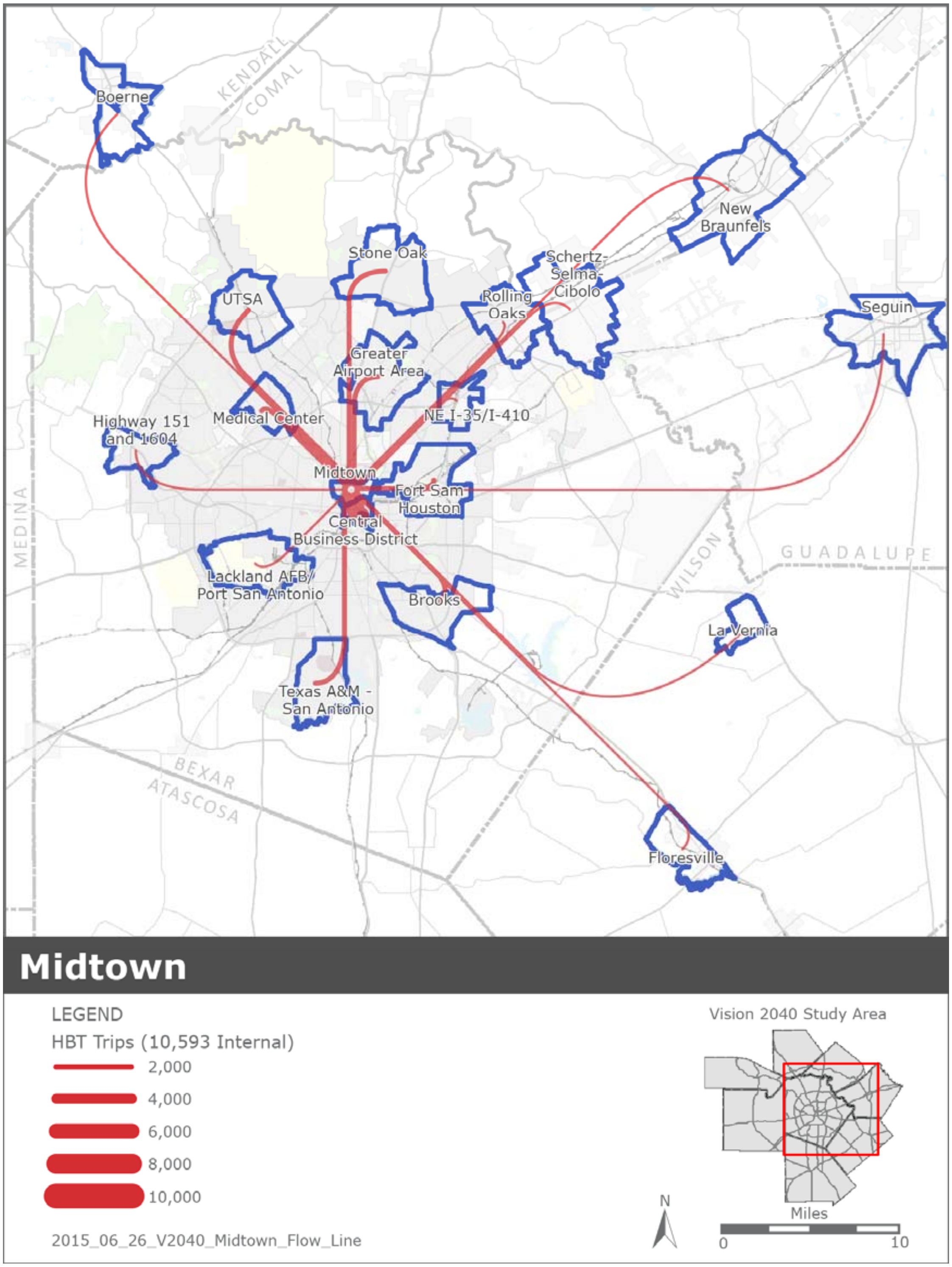
Source: AAMPO Model (2014).

Figure B.10 Trip Flows to South Texas Medical Center



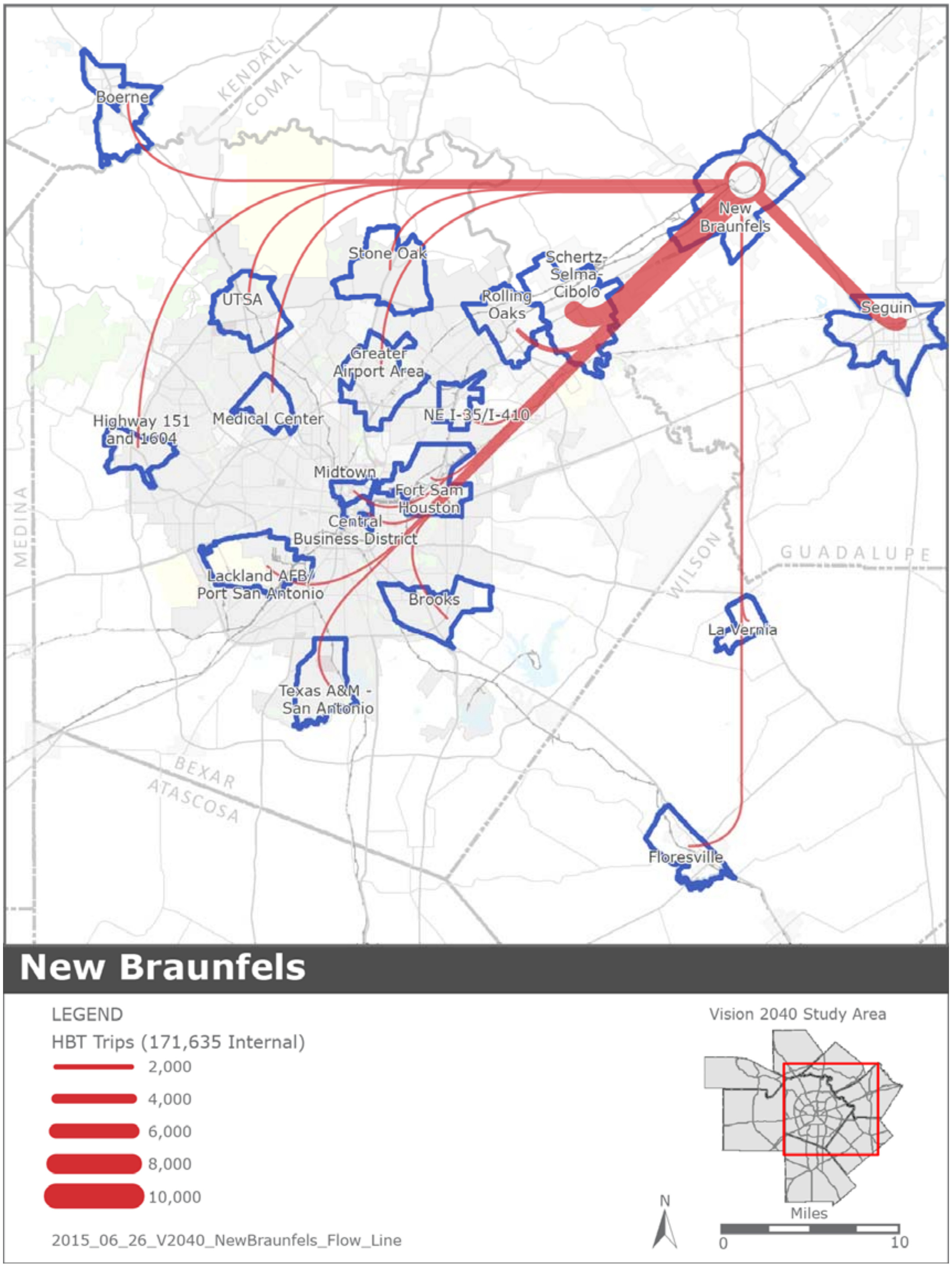
Source: AAMPO Model (2014).

Figure B.11 Trip Flows to Midtown



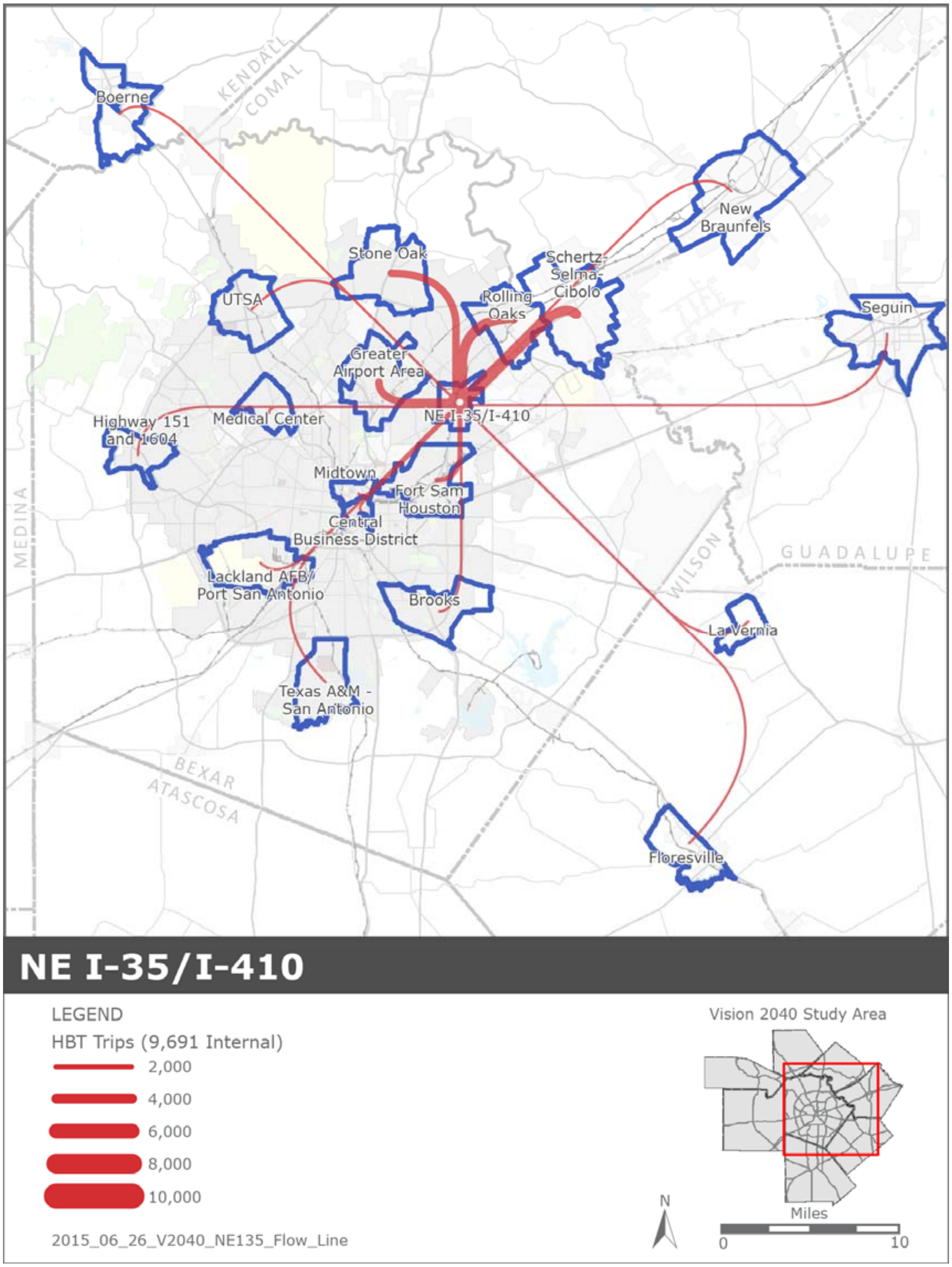
Source: AAMPO Model (2014).

Figure B.12 Trip Flows to New Braunfels



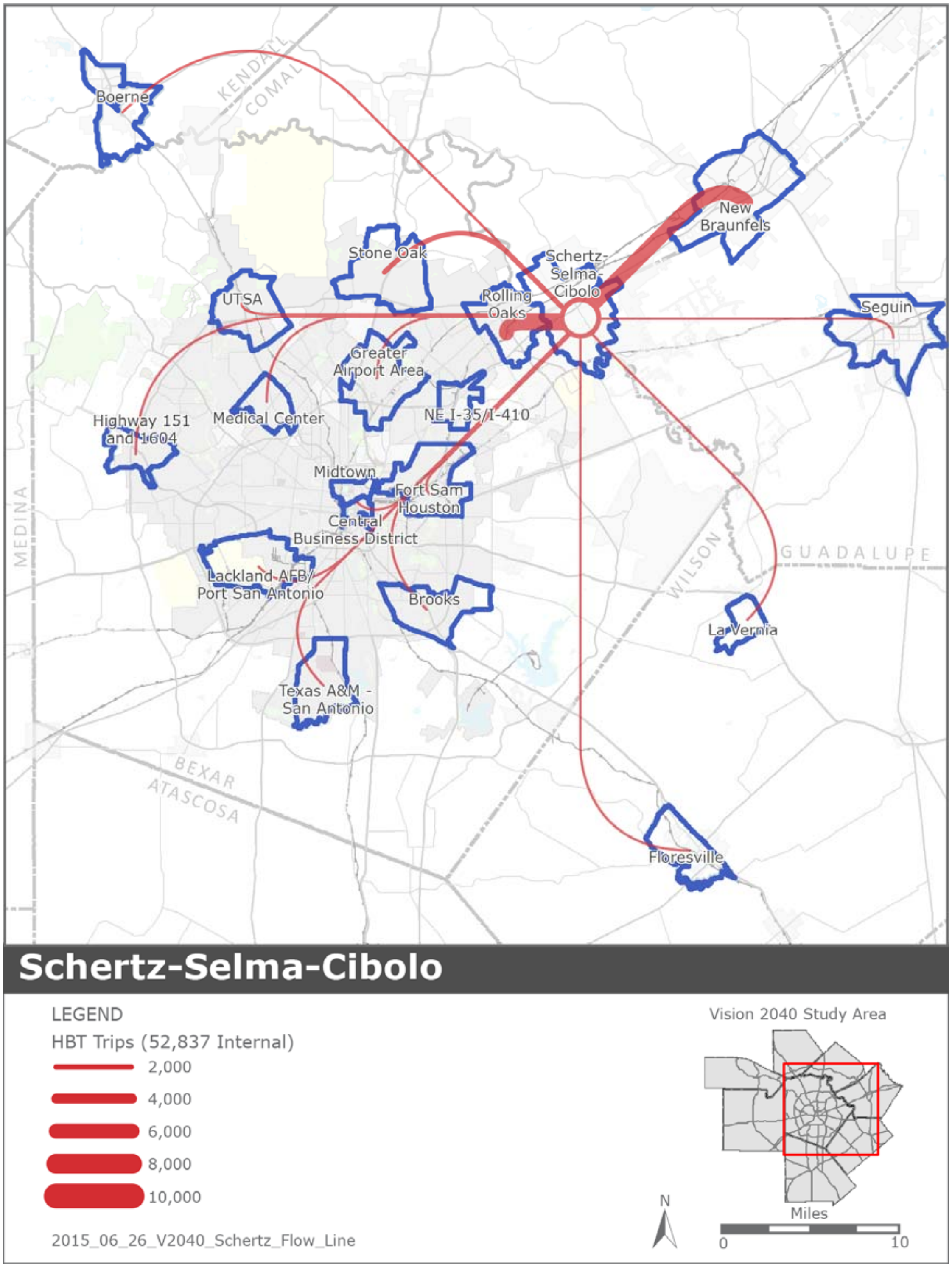
Source: AAMPO Model (2014).

Figure B.13 Trip Flows to NE I-35/Loop 410



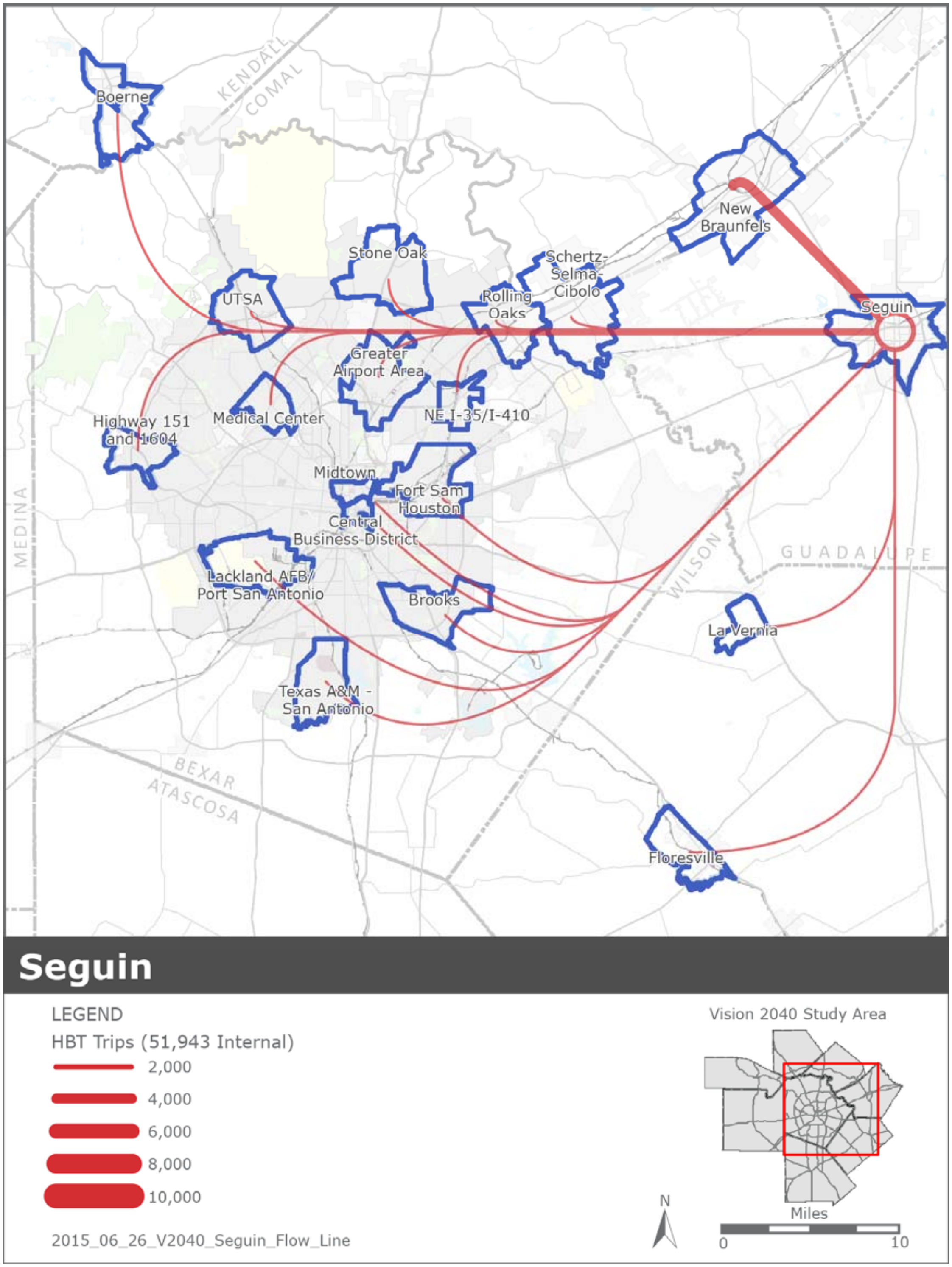
Source: AAMPO Model (2014).

Figure B.14 Trip Flows to Schertz-Selma-Cibolo



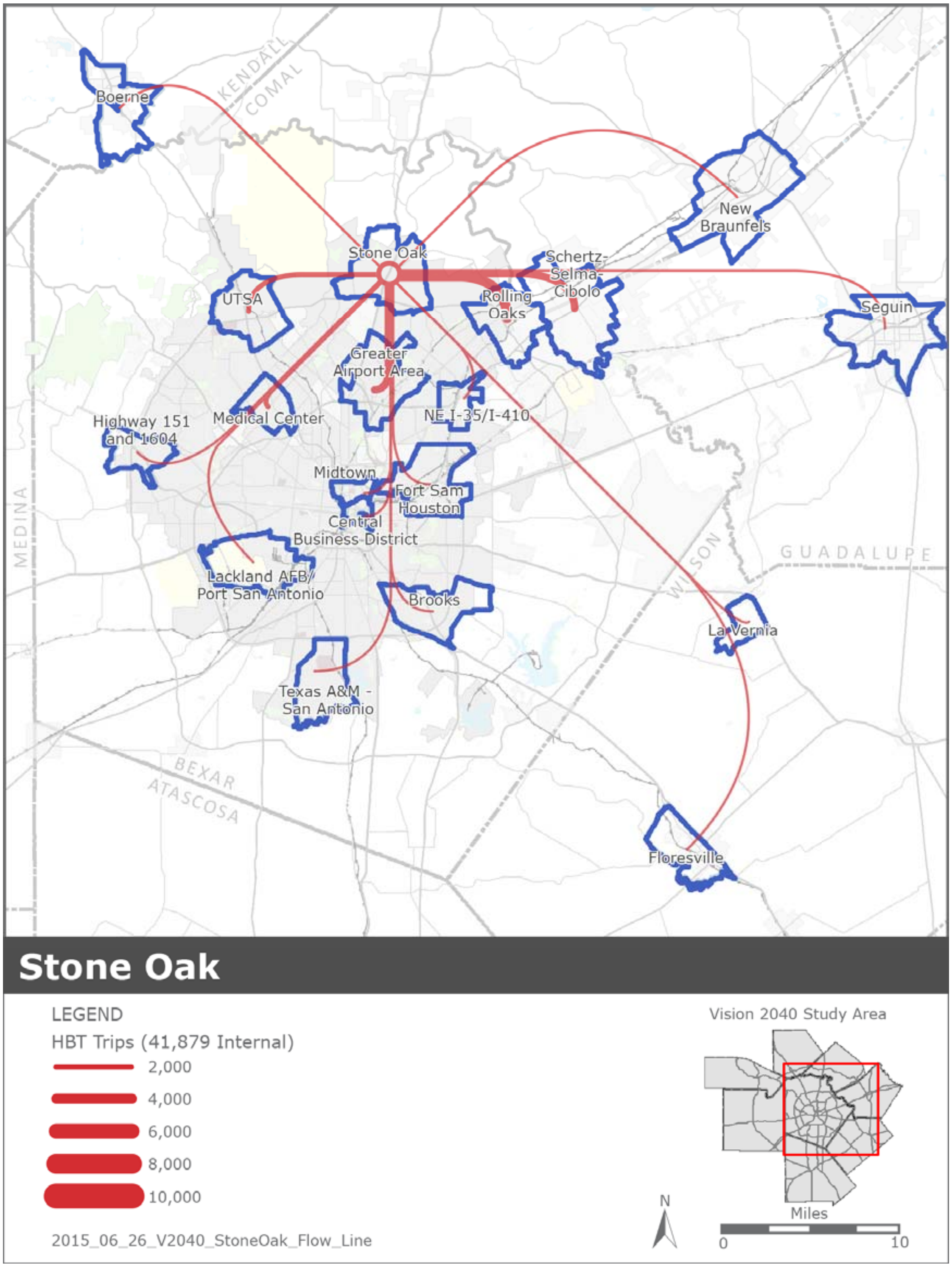
Source: AAMPO Model (2014).

Figure B.15 Trip Flows to Seguin



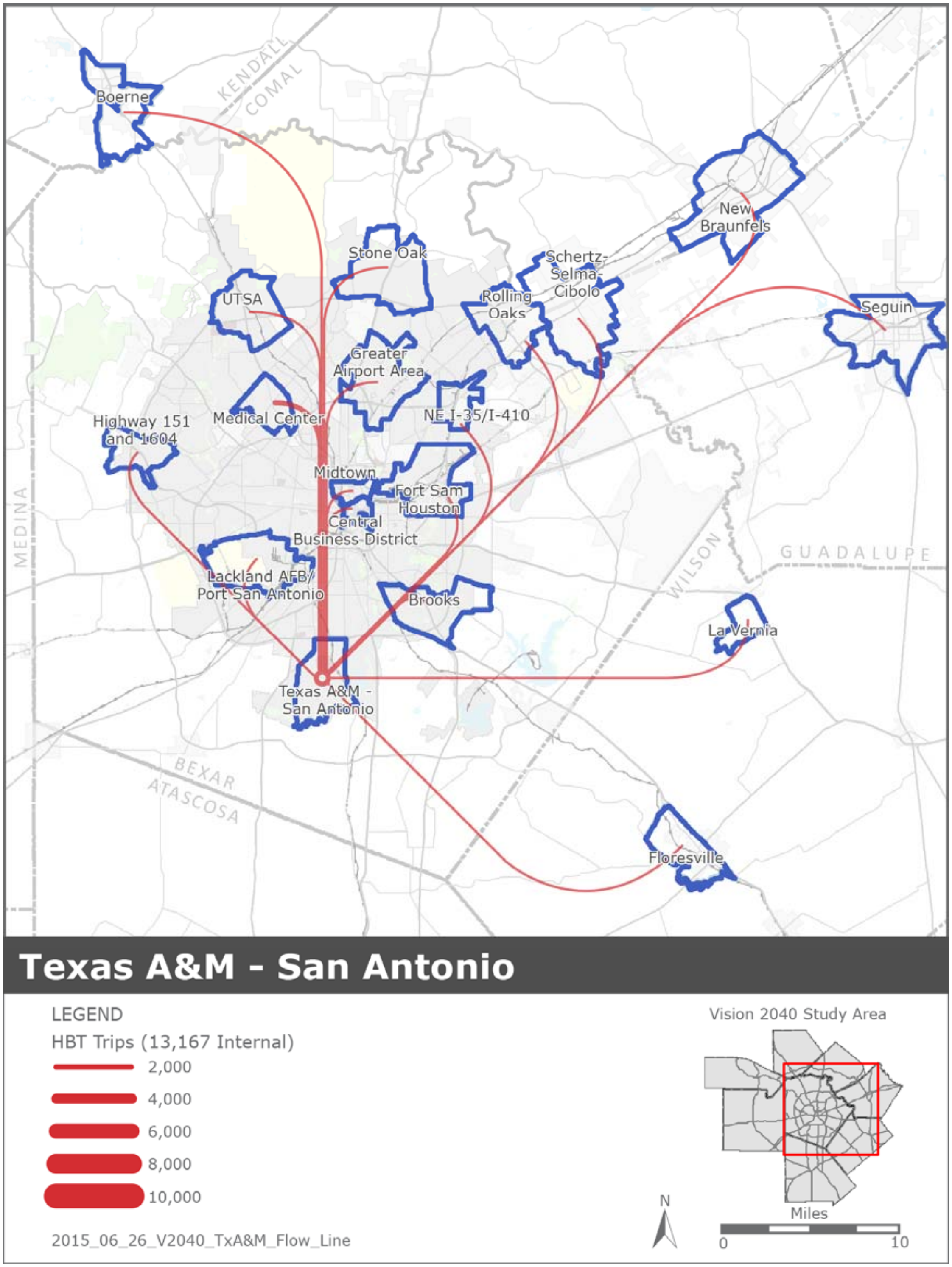
Source: AAMPO Model (2014).

Figure B.16 Trip Flows to Stone Oak



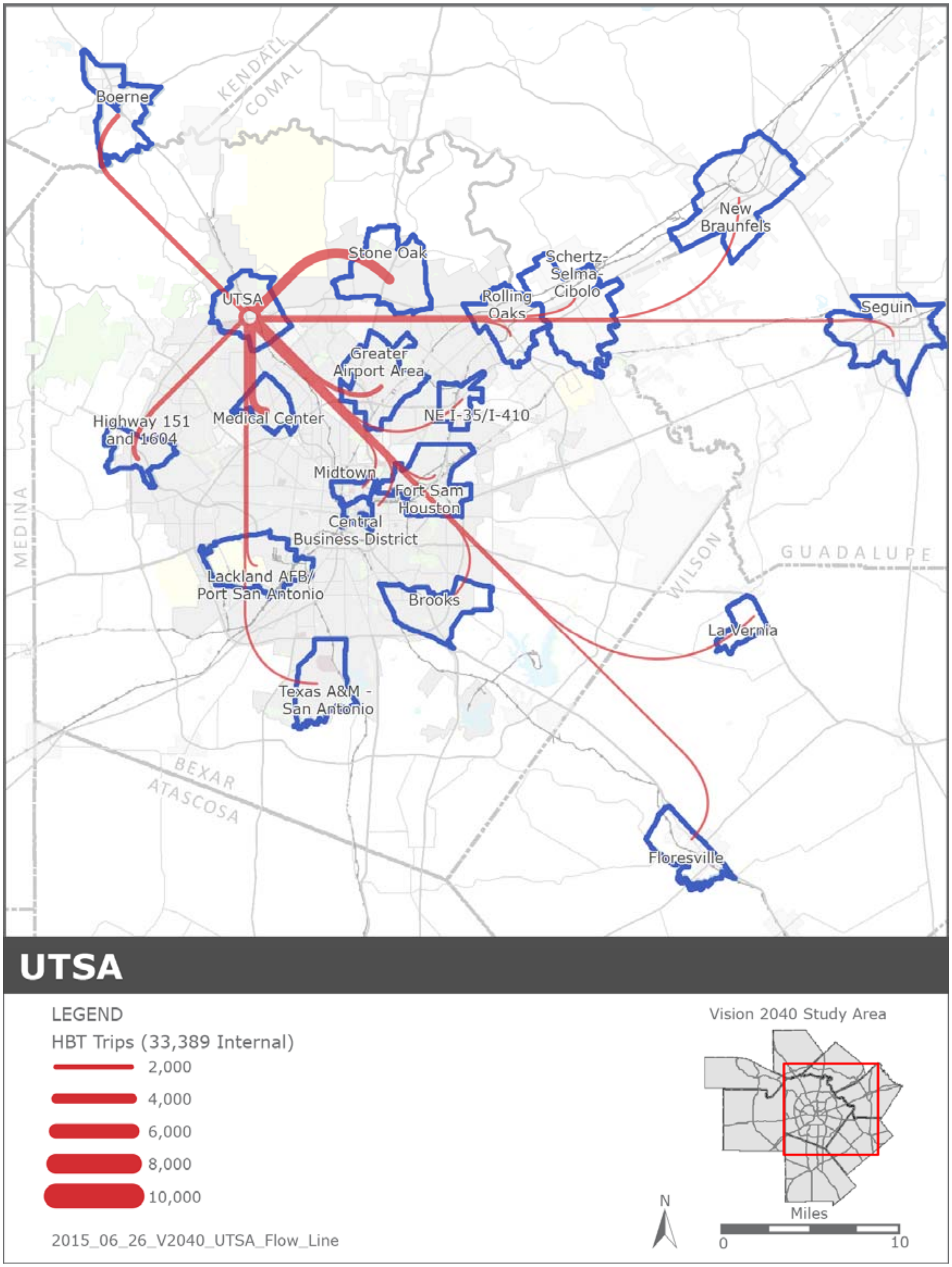
Source: AAMPO Model (2014).

Figure B.17 Trip Flows to Texas A&M San Antonio



Source: AAMPO Model (2014).

Figure B.18 Trip Flows to University of Texas at San Antonio (UTSA)



Source: AAMPO Model (2014).

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C. Transit Gap Analysis

This appendix details the methodology used in the transit propensity, or 'gap', analysis. The purpose of transit propensity analysis is to estimate how likely residents are to use transit when it is available. Much as a travel demand model compares future travel flows with the existing network in order to identify areas of needed investment in the transportation system, this analysis compares projected demand for public transit with the current available supply.

C.1 Transit Demand Index

Many factors can greatly influence transit demand and ridership. Socioeconomic characteristics of the potential riders, land use, urban form, level of transit service, and convenience of other transportation modes have all been shown in research to have significant and observable effects on how likely residents are to use transit to reach their destination.

Potential Transit Demand

In order to measure the future potential demand for public transit, key contributing factors related to public transit ridership were identified. Potential transit demand in the Greater San Antonio Region refers to demand that may not be fully expressed or realized now, but will be presented if condition permits (i.e., when transit service of sufficient quality is available). The Transit Demand Index (TDI) measures the relative magnitude of potential transit demand of each census block in the study area.[18] The TDI takes into account a census block's characteristics (e.g., demographic, socioeconomic, accessibility, land use, or others), which are associated with high potential transit ridership, and estimates the magnitudes of these associations. The TDI also controls for transit infrastructure in the area, ensuring that projected ridership is not affected by the current availability of transit service.

The first and the most fundamental question is which factors contribute to the public transit ridership for commuting trips in the study area. Prior studies have primarily suggested land-use characteristics and socioeconomic characteristics of the potential riders as the primary determinants of transit use (Ortuzar & Willumsen, 2001). Meanwhile, some studies find other contributing variables, such as the spacing between stops, centrality, interline transferability (Kuby, Barranda, & Upchurch, 2004), as well as overall quality of the transit system: safety, availability of amenities, reliability, and other

[18] Census blocks are the smallest geographic unit used by the U.S. Census Bureau to compute demographic statistics. Blocks are generally bounded by natural or manmade features and can range in population from zero to several hundred persons. Blocks are grouped into block groups, which, in turn, make up census tracts.

factors. While these variables present relevance in various case studies, the significance of such relevance varies from case to case.

An ordinary least-squares regression was employed to identify the significant variables and relative contribution of each variable in the eight counties composing the San Antonio-New Braunfels Metropolitan Statistical Area (MSA).[19] The result of the regression is presented in a general form as in the following equation:

$$Potential\ Transit\ Demand = \sum_i v_i c_i$$

Where: v^i are the identified independent variables, and c^i are their corresponding weights. Each coefficient c^i represents the number of additional riders that would be expected to take transit given a one-unit increase in variable v^i. For example, a two-percentage point increase in the number of households without a motor vehicle would cause about one additional transit rider. The effects of population, employment, land use, socioeconomic, and presence of transit stops on transit ridership were measured.

The model was able to explain about 65 percent of variability in VIA ridership as a result of these factors.[20] This means that, while 35 percent of transit ridership is explained by other factors that had either too small of an effect on their own to be measured, or by random chance alone, the majority of variation in ridership was captured by the model. Table C.1 shows those that have statistically significant impact on transit ridership in the MSA.

Table C.1 Significant Variables on Transit Ridership

Variables (v_i)	Coefficient(c_i)
Population Density	1.034
Percentage of Population Age 65 and Above	0.247
Percentage of Population below Poverty	0.423
Percentage of Zero-vehicle Households	0.594
Employment Density	0.537
Density of Trip Attraction	0.458
Median Household Income	-0.0008
Bus Stop Density	0.024

Source: Cambridge Systematics, Inc.

[19] Ordinary least-squares regression, or OLS, is a basic statistical method where an equation is estimated that minimizes the error of a linear combination of input (or independent) variables and their estimated coefficients against an output (or dependent) variable. In this case, the inputs are demographic variables and the output is transit ridership. OLS is commonly used in the natural and social sciences due to its relative simplicity and ease of interpretability. Free textbooks describing OLS (and other statistical methods) are available at http://www.statsoft.com/Textbook/Multiple-Regression (StatSoft, Inc., 2013) and http://statweb.stanford.edu/~tibs/ElemStatLearn/printings/ESLII_print10.pdf (Hastie, 2005).

[20] That is, $R^2 = 0.65$.

The model was then used to estimate future demand while controlling for infrastructure (bus stops). The last variable, bus stop density, was not included in the calculation of potential transit demand, indicating that the potential transit demand brings the composite effects of all other contributing variables of population, employment, land use, and socioeconomic characteristics, but nothing from the transit system itself.[21]

While results are available at the census block level (Figure C.1 and Figure C.2), stronger patterns emerge when results aggregated up to the activity center level. According to the results from the model, transit demand is most strongly present in the San Antonio Central Business District and South Texas Medical Center activity centers. Strong demand also exists in other areas in central and northern areas of the City of San Antonio: Midtown, Rolling Oaks, the Greater Airport area, and Highway 151–Loop 1604. New Braunfels also displays moderate demand (Figure C.3).

[21] For example: two areas with the same potential transit demand but different bus stop density will clearly have different ridership. However, if equal transit service were provided, the same transit ridership could be expected due to the same potential transit demand.

Figure C.1 Transit Demand Index (2040)
MSA

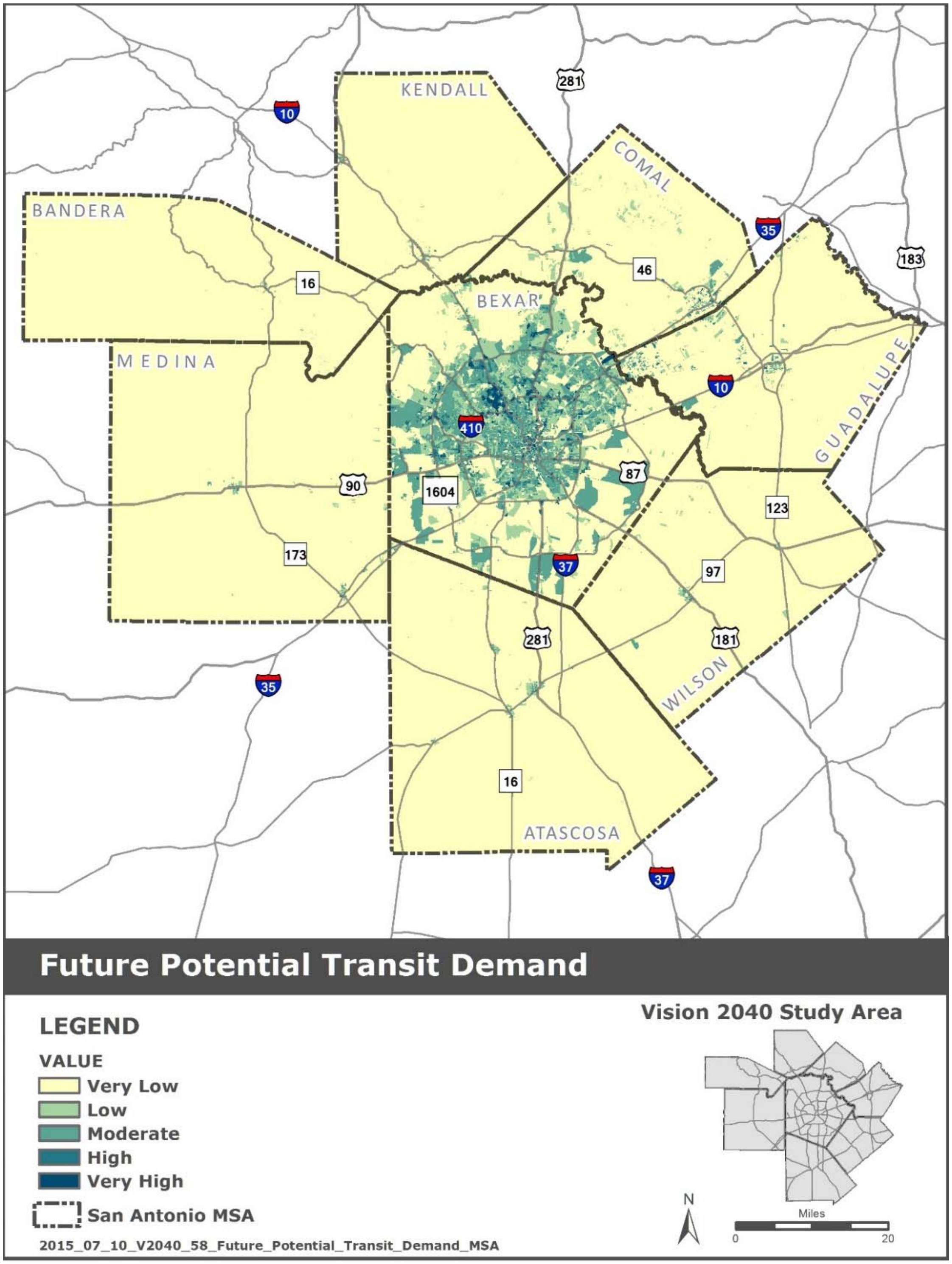


Figure C.2 Transit Demand Index (2040)
Bexar County

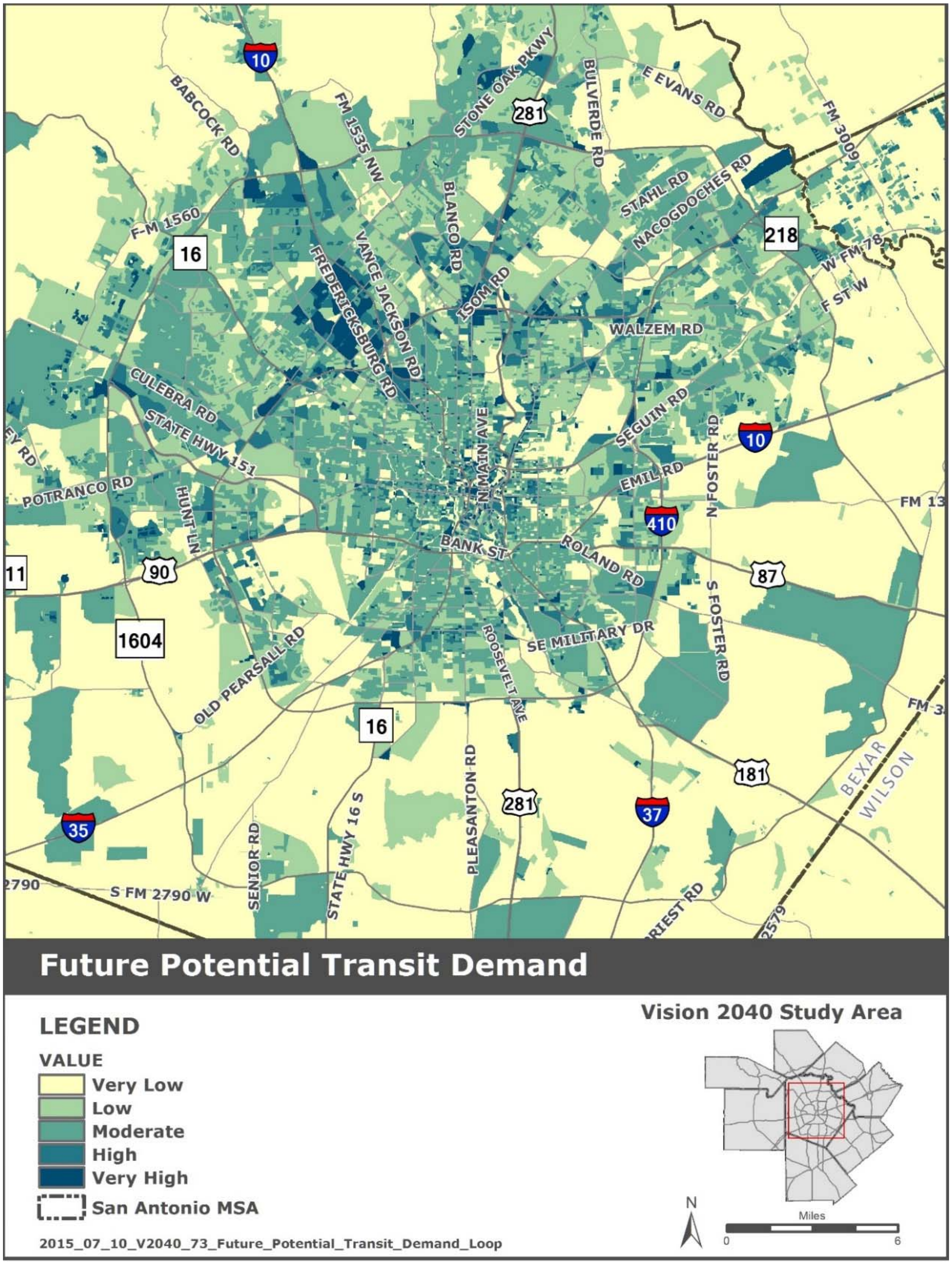
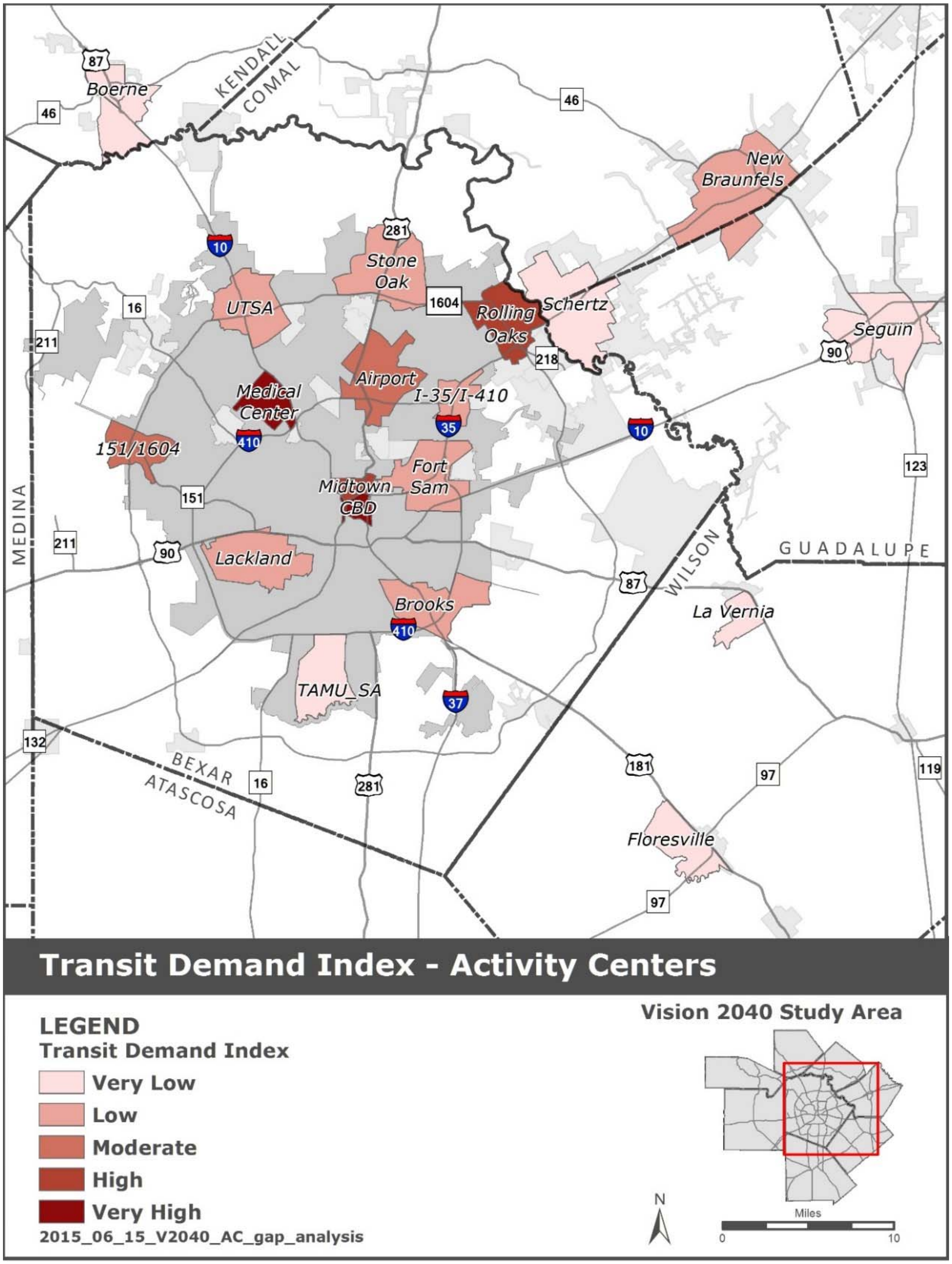


Figure C.3 Transit Demand Index
Activity Centers



C.2 Transit Supply and Gaps

Transit supply was estimated based on the current number of buses passing through a region per stop per hour. The number of scheduled buses per stop per hour (operated by either VIA or another agency) was summed and normalized across the region to calculate the relative supply of transit to each activity center to the region as a whole. The highest areas of supply inside Bexar County are located in the San Antonio Central Business District, Midtown, and South Texas Medical Center (Figure C.4 and Figure C.5).

VIA currently does not operate outside of Bexar County, keeping transit supply in the other seven counties low. The Alamo Area Council of Governments (AACOG) currently operates an hourly weekday circulator service around the City of Seguin. AACOG also operates demand-response service across a 12-county region, including Atascosa, Bandera, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, McMullen, Medina, Seguin, and Wilson Counties; however, only scheduled fixed route service was included in this analysis.

Subtracting the supply index from the demand index reveals areas where current transit supply is inadequately allocated to meet future demand as calculated by the regression model (Figure C.5). The gap index does not compare ridership projections with route capacity; rather, because the two quantities are expressed as unitless indices, each quantity represents an allocation of demand or supply rather than an absolute value. For example, a systemwide proportional increase in frequency of service would not affect the absolute supply, as the distribution of transit service would remain the same. However, increasing service to a single area would increase the relative supply, changing the indices across the region to reflect the new allocation of service. Similarly, the demand index indicates the relative distribution of the variables used to allocate the index, rather than the absolute change in population. Thus, the gap analysis identifies areas where marginal improvements to service should be prioritized.

For example, the San Antonio Central Business District and the South Texas Medical Center display similar total average demand for transit, but supply of transit to the South Texas Medical Center is much lower; thus, the South Texas Medical Center has a higher need for additional transit services.

Figure C.4 Transit Supply Index
Activity Centers

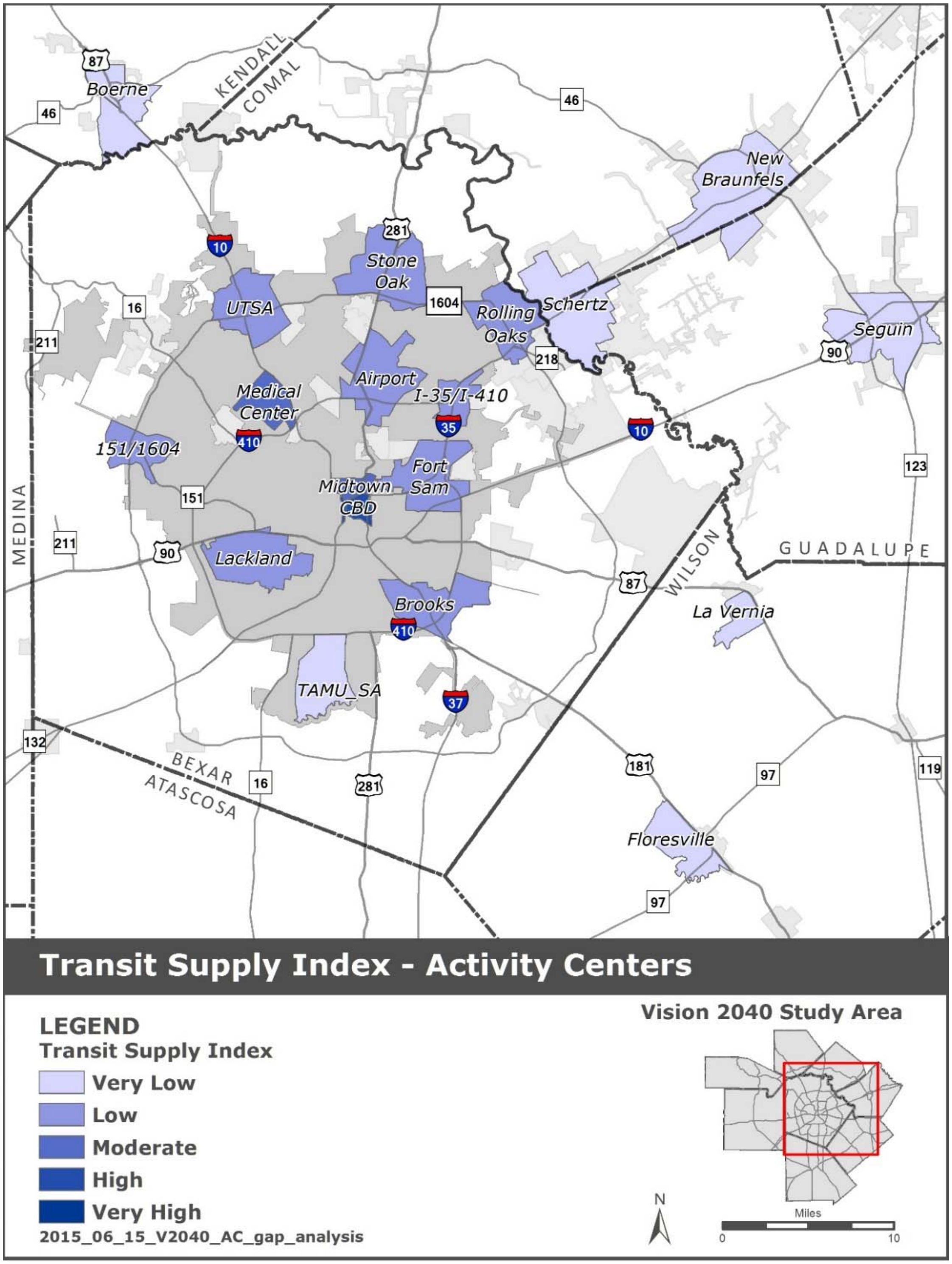
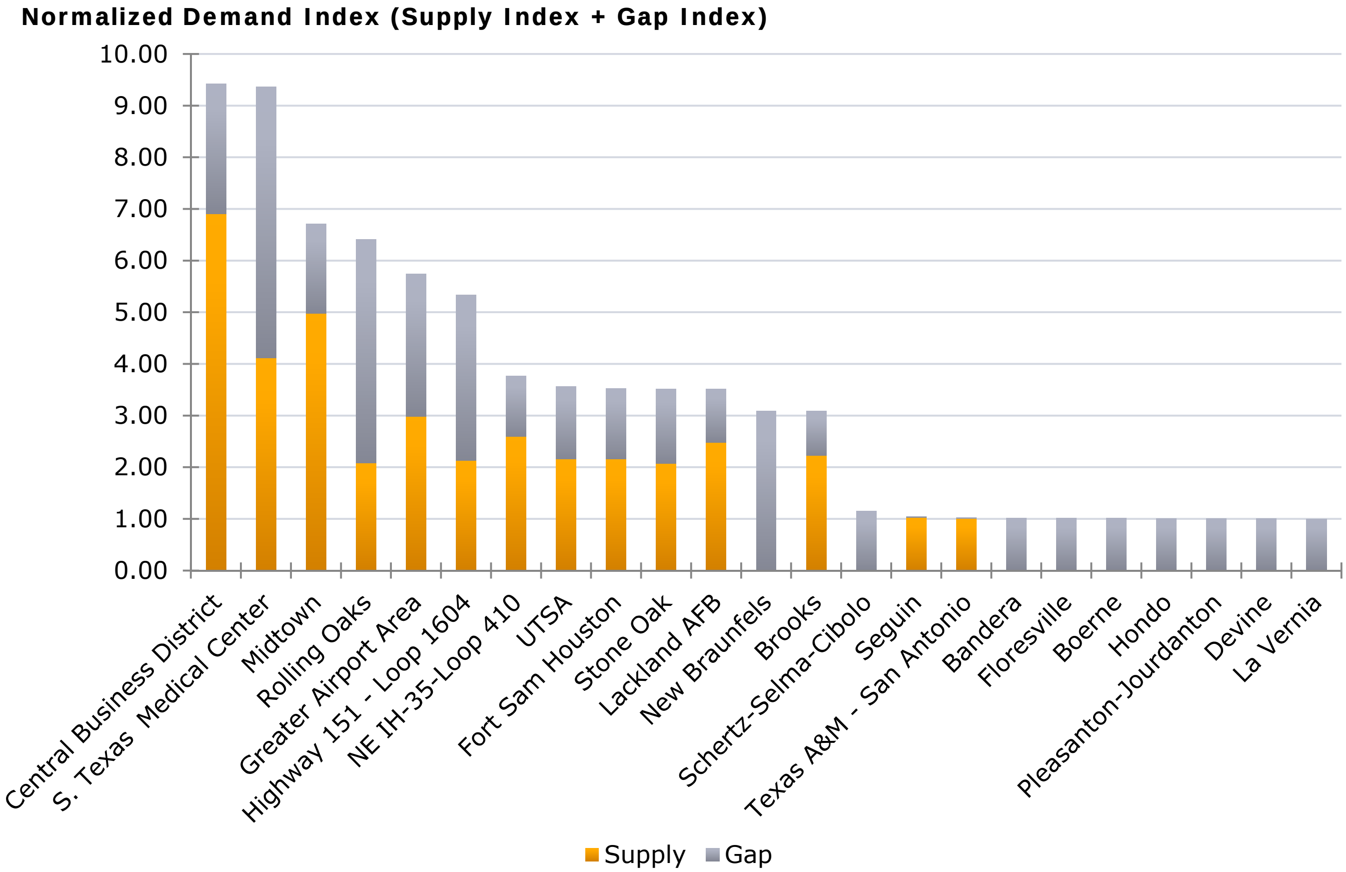


Figure C.5 Average Transit Demand and Supply by Activity Center



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