Appendix D

Origins, Destination and Travel Patterns

Capital – Alamo Connections Study

MEMO

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Subject: Capital-Alamo Connections Study: Origins, Destination and Travel Patterns

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The Capital-Alamo Connections Study (CACS) spans a region of 12 counties covering the entire Capital Area MPO (CAMPO) and Alamo Area MPO (AAMPO). Rapid growth in the region is evident and congestion on major north-south connections such as I-35, US 281, and SH 130 is expected to increase if no improvements are made. There is a need to better understand travel patterns in the region and identify the main origins and destinations of travelers using these corridors. This memo summarizes the Origin-Destination (OD) analysis completed for the study area using two sources of data, Bluetooth® data and StreetLight® data.

Bluetooth Data Analysis

Through a collaboration between TxDOT and Texas A&M Texas Transportation Institute (TTI), several Bluetooth readers had been installed along I-35 extending from Loop 1604 north of San Antonio to SH 195 north of Georgetown. Whenever a vehicle passes by a Bluetooth reader, its unique anonymous identification code is captured. The resulting data is generated in the form of an OD matrix showing the number of vehicles captured between every pair of Bluetooth readers along the corridor. Evidently, the same vehicle traveling between several readers will be counted several times and special data manipulation is performed to eliminate any double counting. For this study, the readers were then aggregated based on the urban area they are in. The result is an OD matrix with the percentage of trips observed between every pair of urban areas highlighting those with the highest number of trips traveling between them. **Figure 1** presents the results of the OD magnitudes obtained using Bluetooth® data.

General Observations

The resulting data shows a very low percentage of through trips (less than 1%) between North San Antonio and North Georgetown. Moreover, the highest percentages of trips were observed between closely-spaced urban areas along I-35. This may indicate that most trips along I-35 are short-distance and/or local trips within the communities and only a few are traveling along the entire length of the corridor.

Limitations of the Bluetooth® Data

Several limitations were identified related to the Bluetooth data including:

- The data does not differentiate between northbound and southbound movements along the corridor.
- The data does not differentiate between different types of vehicles (trucks versus personal vehicles).
- The reader placement stopped north of San Antonio at the time of this study and therefore did not cover the entire study area. No OD analysis could be performed *within* the San Antonio urban area either.
- Readers were placed on one side of the Interstate with most readers closer to the northbound direction and only a few on the southbound side. This indicates potential bias for one direction of travel.
- Due to the dependence of the reader on the Bluetooth signal in the vehicle, situations where the signal in the vehicle is blocked (for example if a truck happens to be driving parallel to the vehicle while it passes a reader) prevented the reader from counting that vehicle, thus apparently skewing the results.
- A small number of the Bluetooth readers seemed to be non-functional and generated zero readings.
- Data was limited to the readers placed along I-35 therefore no OD matrices could be generated for other major north-south corridors in the region such as US 281 and SH 130.
- The readings rely on the presence of a phone device in the vehicle that has a Bluetooth signal. Travelers with no Bluetooth signal or phone device were therefore not captured.
- Data can only be obtained during periods the Bluetooth Antennas are in operation.

StreetLight Data Analysis

To verify the observations made using the Bluetooth data, and to resolve several limitations identified with the Bluetooth data collection, another data source was obtained through a private data vendor, StreetLight®, to generate similar OD matrices for the major urban areas and corridors in the region.

StreetLight data is based on two sources of data, 1) Location-Based Services (LBS) which rely on phone apps that use and have location-based services enabled, and 2) GPS devices embedded in vehicles. StreetLight data does not rely on any actual readers installed along the corridor. This is reported to eliminate issues related to signals being lost on certain portions of the highway. Moreover, the dataset separates commercial vehicles (trucks) from personal vehicles providing a clearer picture of the different types of travel patterns. Data was obtained for the month of September 2017. Both LBS and GPS data sources were used simultaneously to generate OD matrices for the different vehicle types. The analysis also examined weekday- versus weekend-trips and different times of day (AM Peak, PM Peak, Off-peak). This memo focuses on personal vehicle travel analysis. Commercial vehicle results are presented in the Freight Analysis section of the main report.

Two types of analyses were performed. The first one considered the different urban areas in the study region based on their city limits to be the origins and destinations and examined travel between them regardless of the route taken. The second analysis examined travel along the three major north-south corridors in the region, I-35 (from south of San Antonio to North of Georgetown), US 281 (from south of San Antonio to SH 29 towards Georgetown), and SH 130 (the entire facility length from I-10 on the south to I-35 north of Georgetown). Corridor analyses were performed by placing analysis “gates” along the highways and at major entrance and exit ramps along I-35.

General Observations

Urban Area OD Analysis

The first analyses examined travel patterns between and within the major urban areas in the region including San Antonio, New Braunfels, San Marcos, Kyle, Buda, Austin, Round Rock, and Georgetown. **Figures 2 and 3** show the results of the analysis for an average weekday and weekend respectively. Peak hours were also examined as shown in **Figures 4 and 5**.

General Observations

- A significant number of weekday trips that start within the Austin and San Antonio metro areas remain within those areas.
- Trips between Austin and San Antonio constitute only 1% of all trips in the region.
- There is a number of weekday trips from smaller urban areas to the nearest larger urban area. Examples include New Braunfels to San Antonio and Round Rock to Austin. These trips constitute a smaller percentage during weekend days.
- The number of trips headed outside the Austin and San Antonio metro areas are similar on weekdays and weekends.
- The highest percentage of trips originating in Georgetown remain within Georgetown with a percentage going to Round Rock and Austin.
- Round Rock has a significant percentage of trips commuting to north and south Austin, yet local trips still constitute the largest percentage of travel originating there.
- Buda and Kyle's main commuter flow is to South Austin followed by neighboring areas such as San Marcos and north San Antonio.

Corridor OD Analysis

Similarly, a corridor OD analysis was performed on the three main north-south corridors in the region. The aim of this analysis was to identify the main entrance and exit points of vehicles on each of the highways. Special consideration was given to eliminate any double counting of vehicles. In the case of I-35, analysis "gates" were placed at each entrance and exit ramp and an OD matrix was generated for the different locations. **Figure 6** presents a heat map of the OD weekday results for the I-35 corridor. The results suggest that most trips along these highways are local trips, and that the congestion observed is possibly due to the lack of arterial connections. Local improvements and alternative routes could help in alleviating at least some of these regional demands.

General Observations

- The analysis of trips along I-35 ramps depicts a high number of local and short movements, especially in Austin and San Antonio, with a very low percentage of trips traveling between the two large urban areas. This verifies the results observed using Bluetooth data where less than 1% of trips traveled between north San Antonio and Georgetown.
- A significant number of trips only use I-35 to travel between one or two consecutive interchanges.
- Travel on US 281 outside of San Antonio appears to serve longer-distance travel.
- Analysis of destinations for trips originating at each SH 130 interchange indicates heavy usage of the north end of the corridor.

Conclusion

An OD analysis was performed to better understand travel patterns and major origins and destinations in the study area. Two data sources were used, Bluetooth® and StreetLight®, which rely

on different devices such as a Bluetooth signal, phone app location services, and vehicle-embedded GPS devices. The results show that most trips traveling in the north-south direction in the region are local trips originating and ending within the same urban area. Only 1-2% of trips are long-distance regional trips traveling between San Antonio and Georgetown. There are also several weekday trips going from the smaller urban areas to the nearest larger urban area, probably consisting of home-based work trips. The results show that, today, the congestion is locally produced rather than long-distance. The lack of appropriate alternative routes and arterials concentrates the local north-south movements on a few major facilities in the region such as I-35. With the anticipated growth in the region, these patterns may change, and more long-distance trips traveling through the length of the study area could be expected. However, the focus today should be identifying solutions to solve local travel demands/congestion.

Figure 1: Urban Area OD Analysis using Bluetooth Data

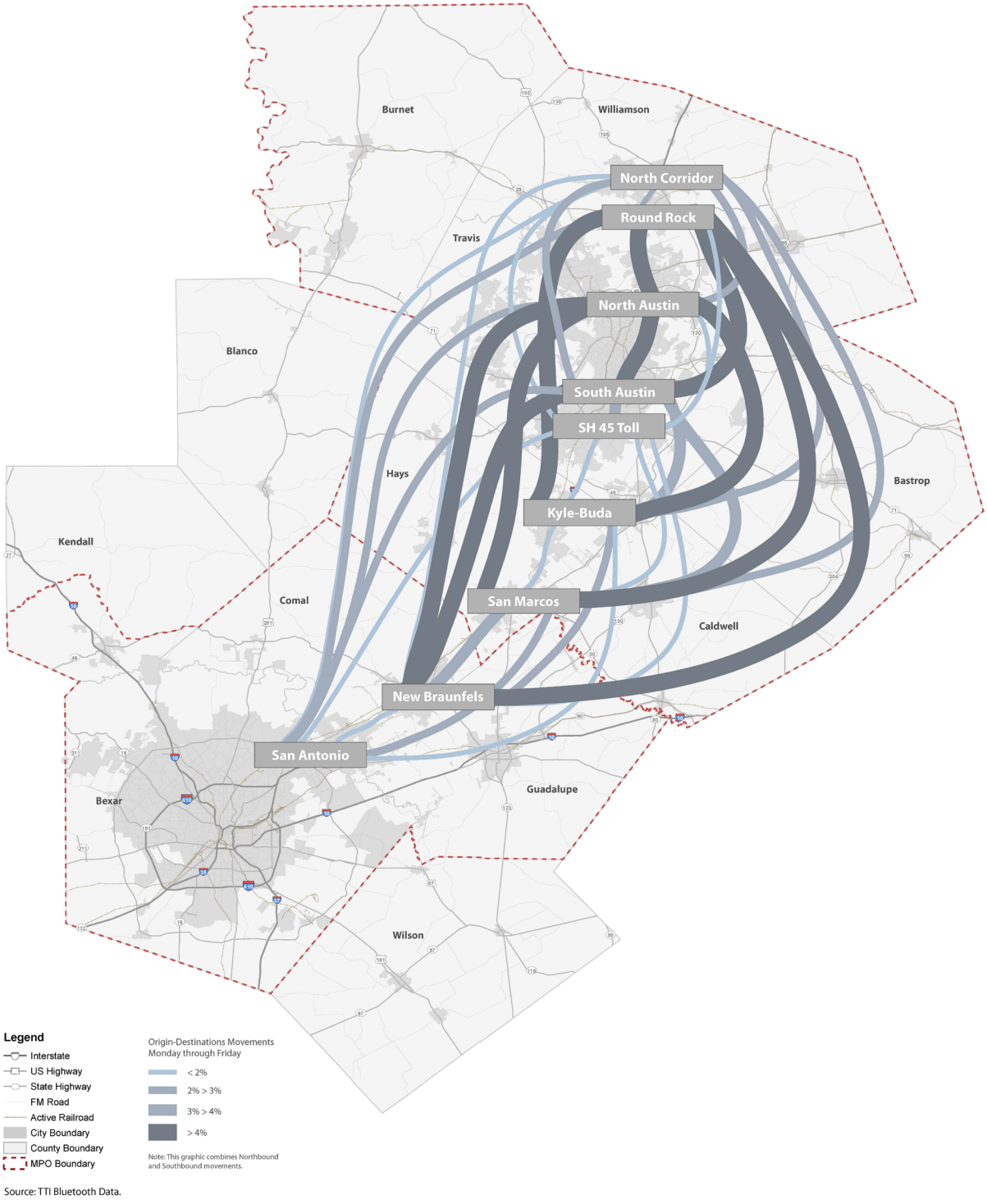

Figure 2: Urban Area OD Analysis Weekday using StreetLight Data

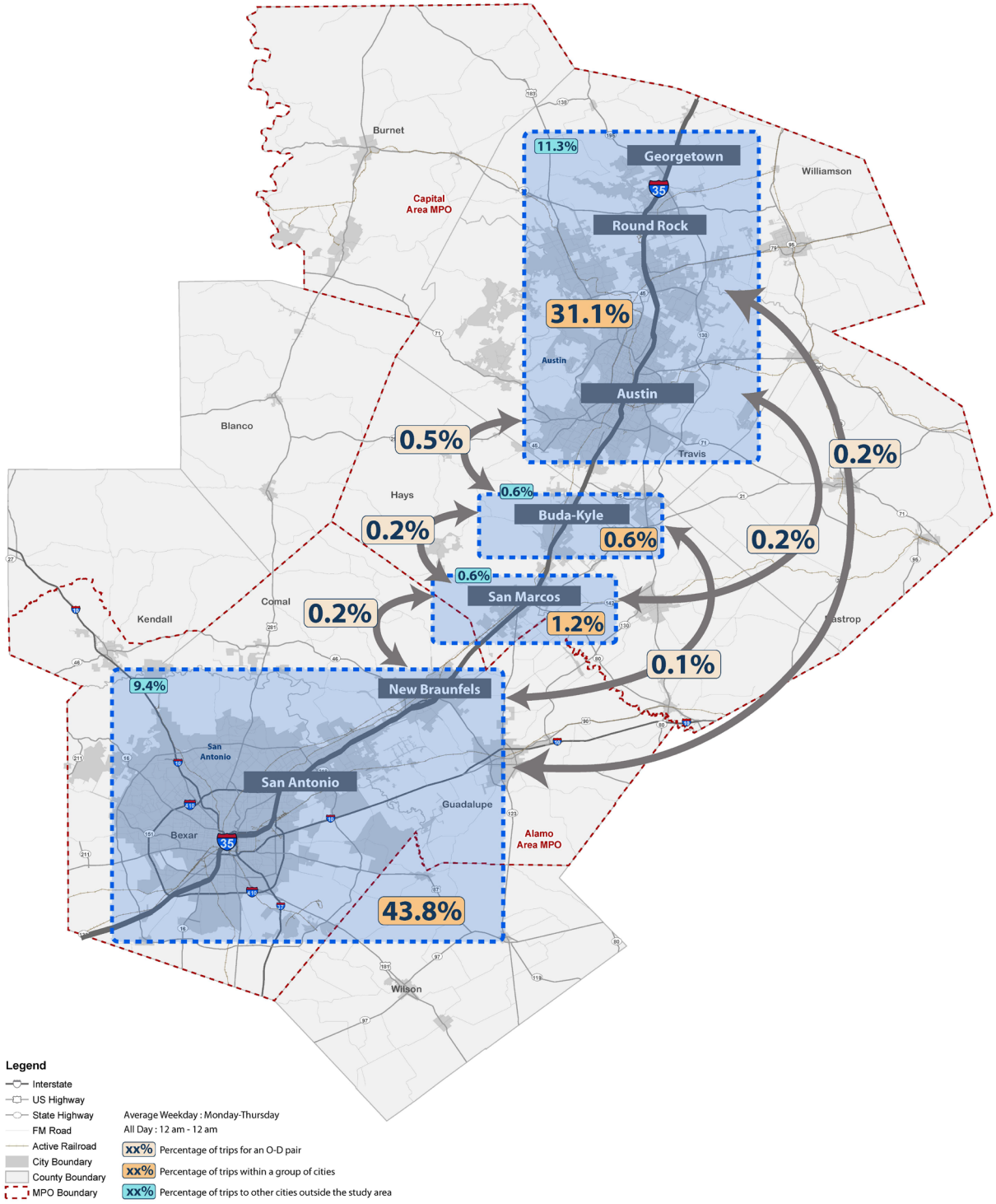

Figure 3: Urban Area OD Analysis Weekday using StreetLight Data

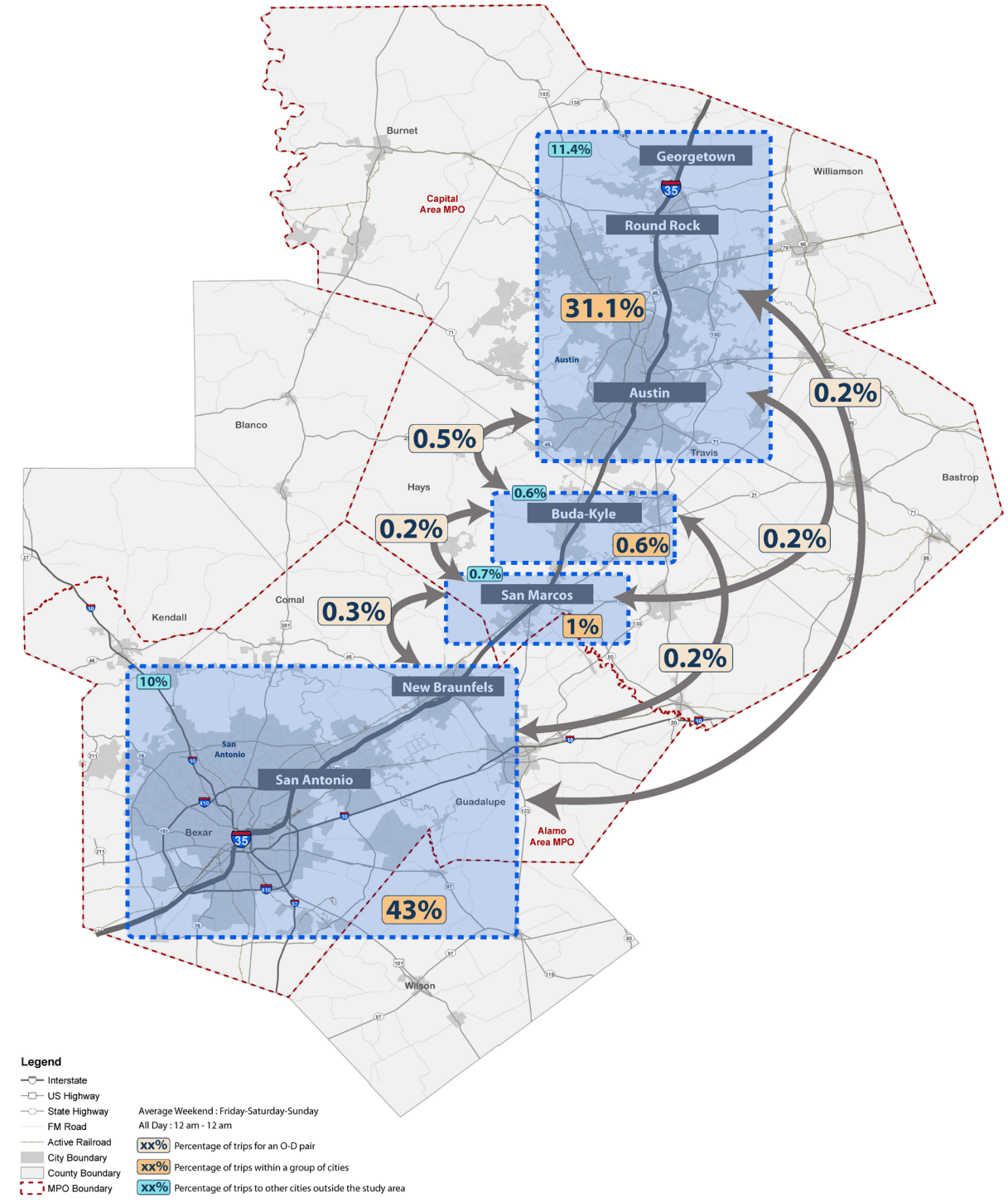

Figure 4: Urban Area OD Analysis AM Peak using StreetLight Data

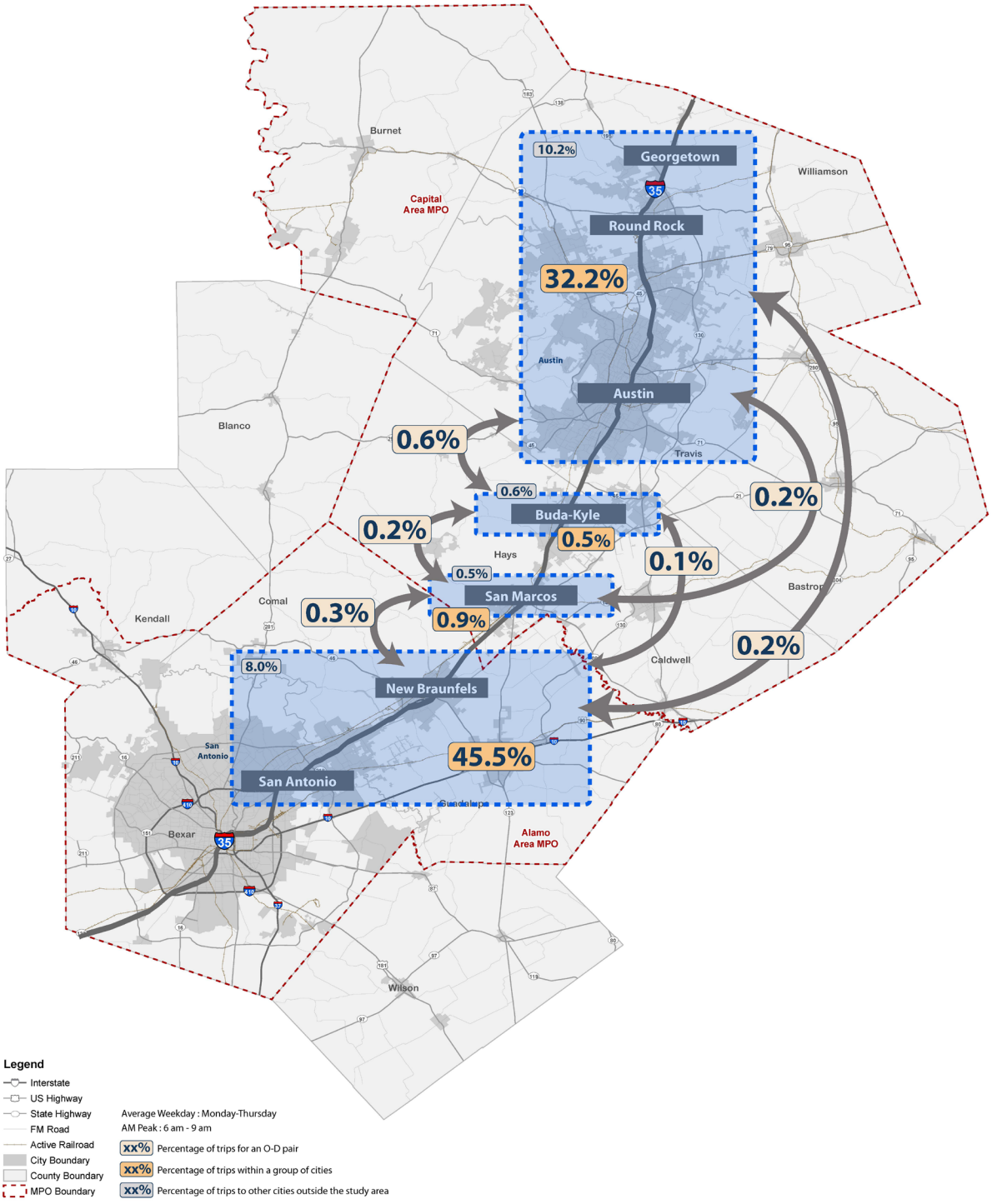

Figure 5: Urban Area OD Analysis PM Peak using StreetLight Data

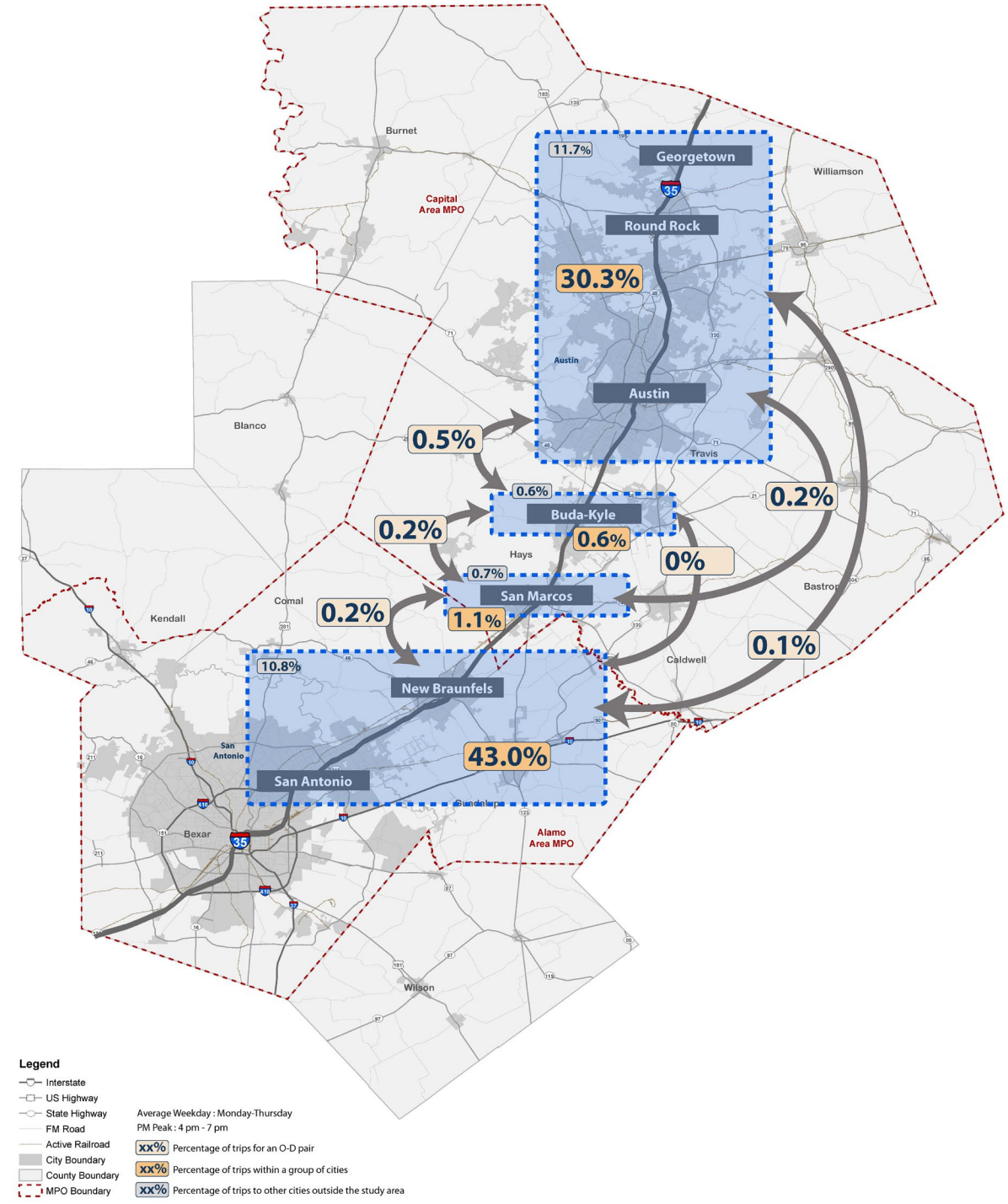

Figure 6: I-35 Ramp OD Analysis Heat Map using StreetLight Data