APPENDIX F: Center for Transportation Research's Dynamic Traffic Modeling Study

THE UNIVERSITY OF TEXAS AT AUSTIN
CENTER FOR TRANSPORTATION RESEARCH

Multimodal Traffic Study of the Guadalupe Corridor

Technical Report

Prepared for: CAMPO and City of Austin

Prepared by: Center for Transportation Research, The University of Texas at Austin

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This technical report presents the dynamic traffic modeling study of the Guadalupe corridor conducted by CTR in 2015, including a description of the scenarios analyzed, an overview of the methodology, and a summary of the results. The data and result analyses contained in this final report were prepared for a draft report submitted in 2015. Due to project delays unrelated to CTR's analysis, the final version is being finalized in 2017. No additional analysis work has been completed in the interim between the draft and final reports.

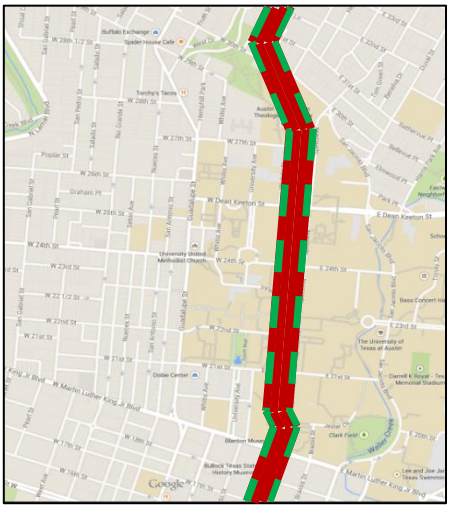
Year 2015 a.m. and p.m. peak period dynamic traffic assignment and transit models were created for the baseline scenario, along with scenarios assessing changes to transit and auto routing through the corridor and the West Campus area. All scenarios have been modeled using 2015 year traffic demand. The results, including auto and transit performance metrics, are presented and discussed herein.

Description of Scenarios

Scenario 0: Baseline

This scenario uses the current year conditions and provides a baseline for evaluating other scenarios in terms of effectiveness. Results were calibrated with field data and performance measures are calculated for evaluation purposes. Figure 1 shows the network configuration in the corridor.

(a)



(b)

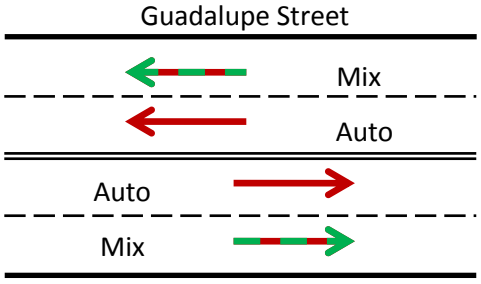
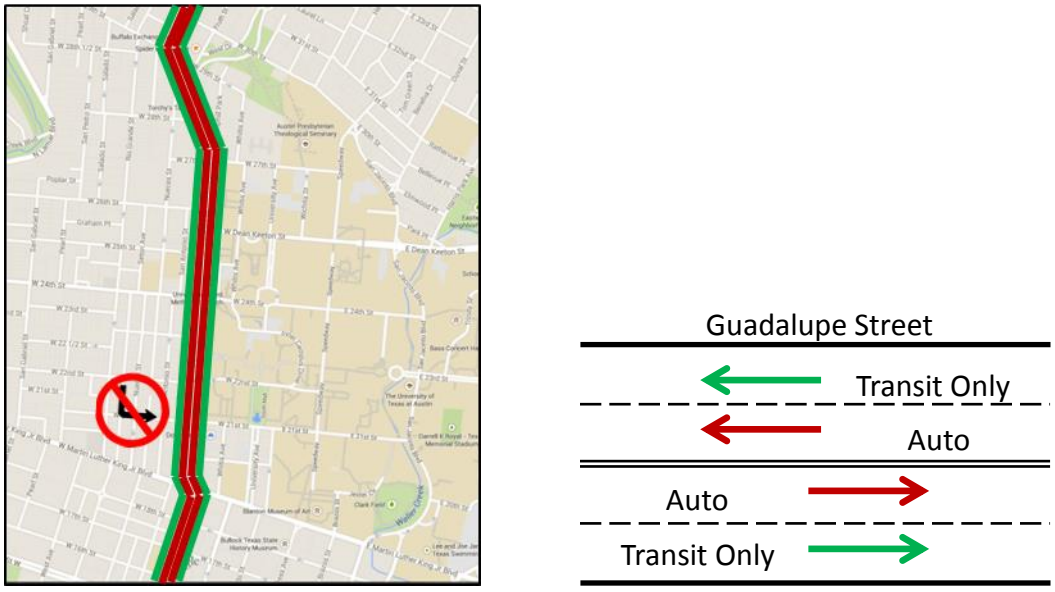


Figure 1: Baseline Configuration (Scenario 0)

Scenario 1: Transit Priority Lane on Guadalupe Street

This scenario models the transit routes in an exclusive lane along Guadalupe Street between MLK Boulevard and 29th Street. It assumes that the right lane of Guadalupe Street is dedicated to transit routes and other through traffic can use the left lane only. However, cars may turn right at intersections using the right lane. To improve traffic flow for cars, left-turns at 21st Street in the southbound direction are prohibited. Figure 2 shows this scenario configuration.



(a) *(b)*

Figure 2: Transit Priority Configuration (Scenario 1)

Note: Bus traffic shifts to Nueces St for the southbound route 642, to allow buses to bypass the prohibited left turn at 21st Street.

Scenario 2: Transit Rerouting to West Campus Streets

In Scenario 2, all buses are rerouted from Guadalupe Street to San Antonio Street for the northbound direction and Nueces Street for the southbound direction. No other changes are assumed for the network, including signals and stop signs. The northbound bus routes use San Antonio Street to 26th Street and then east to Guadalupe Street to use the existing signal at the intersection there.

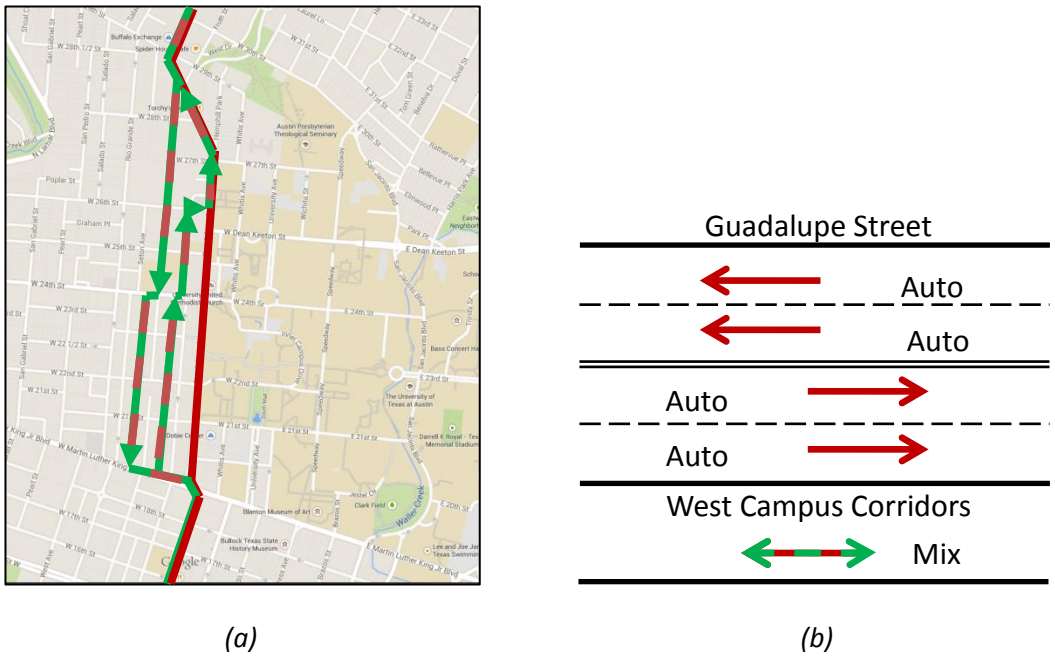
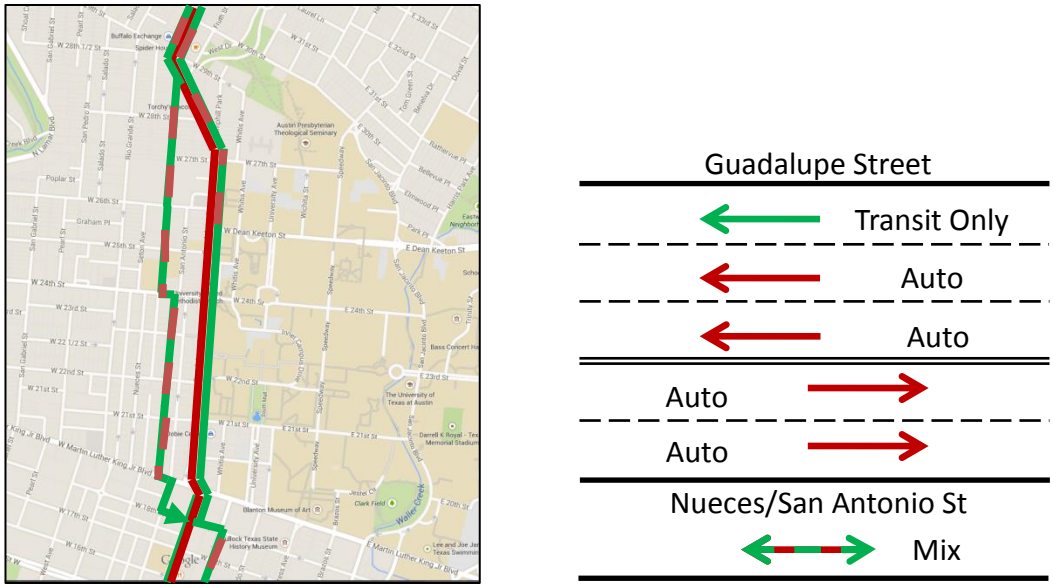


Figure 3: Rerouted Transit Configuration (Scenario 2)

Scenario 3: Southbound Transit Rerouting, Northbound Transit Priority Lane

In Scenario 3, Nueces and San Antonio are converted to bidirectional roadways. Southbound buses are rerouted from Guadalupe to Nueces and San Antonio St, whereas northbound buses use a transit priority lane from MLK Blvd to Dean Keeton St. There are additional signals at the intersections of Nueces and Guadalupe, Nueces and 26th, San Antonio and 22nd, and San Antonio and Guadalupe. There is an added contraflow transit lane on northbound Lavaca St, that takes buses west on 18th St and north on Guadalupe St. Finally, southbound buses are rerouted to San Antonio St south of MLK Blvd to link back up with Guadalupe St at 18th.



(a) *(b)*

Figure 4: Hybrid Configuration (Scenario 3)

Methodology Overview

The Center for Transportation Research (CTR) used dynamic traffic assignment (DTA) and transit assignment to model each of the scenarios described in the previous section. For the purpose of this study, the roadway network modeled area consisted of the area bordered by:

- Interstate Highway 35 on the east,
- 38th Street on the north,
- Cesar Chavez Street on the south, and
- Lamar Boulevard on the west.

The objective of the study was to predict route changes and travel time gain/loss by passenger cars, as well as improvements in bus operations and its effect on passengers' route choice. The DTA model simulated cars and buses in a mixed traffic condition to incorporate the effect of each mode on the other. A schedule-based transit assignment model was used in integration with the DTA model to determine how transit users choose their paths and stops according to each scenario.

Travel Demand Inputs for Scenarios Analyzed

At the outset of this project, it was the intent of CTR to model future year scenarios using the 2035 CAMPO travel demand model forecasts. These forecasts assume a substantial increase in traffic over current volumes. When initial model runs were attempted, the model was so congested with traffic that demands could not be accommodated, and the model entered a "gridlock" state. In this state, vehicles cannot move through the network due to downstream congestion propagation, and the DTA model does not give reliable results.

With the gridlock state resulting from 2035 travel demand forecasts, CTR reduced demand in the network to CAMPO 2025 demands. Again, the resulting DTA model runs were in a gridlock state. Therefore, in the interest getting a working DTA model to assess the differences between the scenarios, CTR used current year travel demand (CAMPO 2015) and corresponding traffic volumes for validation. The intent of CTR's work effort was to assess differences between the scenarios. Using 2015 volumes for the DTA model runs achieves that goal, and provides sound results based on accepted methodologies.

Results

The following questions are answered in this report.

- How does travel time change for auto drivers on the Guadalupe corridor between W. Martin Luther King Jr. Boulevard and 29th Street?
- How does travel time change for auto drivers traveling between the south end of downtown (South 1st Street bridge) and 38th Street?
- How is transit travel time impacted between Martin Luther King Jr. Boulevard and 29th Street?
- How is transit ridership impacted?
- How does transit travel time change for passengers traveling to and from university-area destinations along Guadalupe Street?
- How does walk access to transit change?
- What is the impact on parallel roadways?

How does travel time change for auto drivers on the Guadalupe corridor between W. Martin Luther King Jr. Boulevard and 29th Street?

Table 1 shows the range of travel times in minutes for vehicles traveling along the Drag corridor across each scenario. If transit is given priority on Guadalupe Street and the auto capacity decreases by one lane in each direction, the southbound direction of travel is adversely impacted for autos. In the northbound direction, the volume of auto traffic can be handled by one lane, and the decrease in weaving leads to some improvement. However, traffic volumes are higher in the southbound direction and require two lanes to operate smoothly in each peak period.

Table 1 – Range of Peak Hour Auto Vehicle Travel Times (minutes) on Guadalupe Street between W. Martin Luther King, Jr. Boulevard and 29th Street.

		Baseline	Transit Priority	Rerouted Transit	Hybrid
	Northbound	3 to 9	2 to 5	3 to 5	2 to 4
	Southbound	3 to 6	6 to 9	3 to 4	3 to 4
	Northbound	4 to 9	4 to 5	3 to 4	3 to 4
	Southbound	4 to 5	5 to 8	4 to 5	4 to 5

When transit is rerouted to West Campus, auto travel times improve on the corridor, as expected. In the hybrid scenario (northbound transit priority on Guadalupe Street, maintaining two auto lanes in each direction, rerouting southbound transit to West Campus), auto travel times improve as well, similar to the previous scenario.

An interesting finding is that the variability in travel time decreases as the separation between autos and transit is greater. In the Baseline Scenario, the range of travel times during the peak periods span several minutes. This decreases somewhat when transit is given priority, and even more when transit is re-routed. It is well-known that when a facility is operating at or above capacity, the reliability of the travel time decreases, which is what we observe here.

How does travel time change for auto drivers traveling between the south end of downtown (South 1st Street bridge) and 38th Street?

In the morning peak, we expect relatively small changes in travel time. When buses have priority lanes on Guadalupe Street, average auto travel time increases by one minute in the northbound direction and three minutes in the southbound direction. When transit is rerouted through West Campus, and in the hybrid scenario (which maintains two auto lanes in each direction on Guadalupe Street), travel time improves in each direction by about one minute.

How is transit travel time impacted between Martin Luther King Jr. Boulevard and 29th Street?

Table 2 shows the travel time of buses in the corridor, between Martin Luther King Boulevard and 29th Street in both a.m. and p.m. peak periods. Transit travel times are the lowest when transit is given priority on Guadalupe Street, and the highest when transit is re-routed to West Campus. The hybrid scenario transit travel times are higher than the rerouting scenario in the southbound direction due to additional signal delay that is assumed.

Table 2 – Range of Peak Hour Transit Travel Time (in minutes) between W. Martin Luther King, Jr. Boulevard and 29th Street.

		Baseline	Transit Priority	Rerouted Transit	Hybrid
	Northbound	4 to 9	3 to 7	7 to 12	3 to 8
	Southbound	4 to 8	3 to 8	4 to 7	7 to 10
	Northbound	5 to 10	3 to 9	7 to 11	4 to 9
	Southbound	3 to 10	3 to 8	5 to 11	6 to 13

How is transit ridership impacted?

Allowing transit to have priority, or travel on a street with lower congestion than Guadalupe Street, improves service and has the potential to attract more riders. The MetroRapid buses see the greatest benefit, and may attract some riders away from local bus service as the difference in service increases. This study did not look at how many travelers would switch from auto to transit or transit to auto, but instead focused on changes in service and how transit riders would select their routes differently. Two key conclusions are 1) fewer passengers use the southbound transit routes to access The University of Texas when the routes are shifted to West Campus, and 2) more passengers use the routes that have a priority lane.

How does transit travel time change for passengers traveling to and from university-area destinations along Guadalupe Street?

Figure 5 shows the average travel time by transit to or from the UT area along Guadalupe Street. The average travel time of a passenger remains approximately the same when transit is re-routed through West Campus, and sees a very small decrease (less than one minute) when transit is given priority on Guadalupe Street and in the hybrid scenario. These trends are the same in the morning and afternoon peak periods.

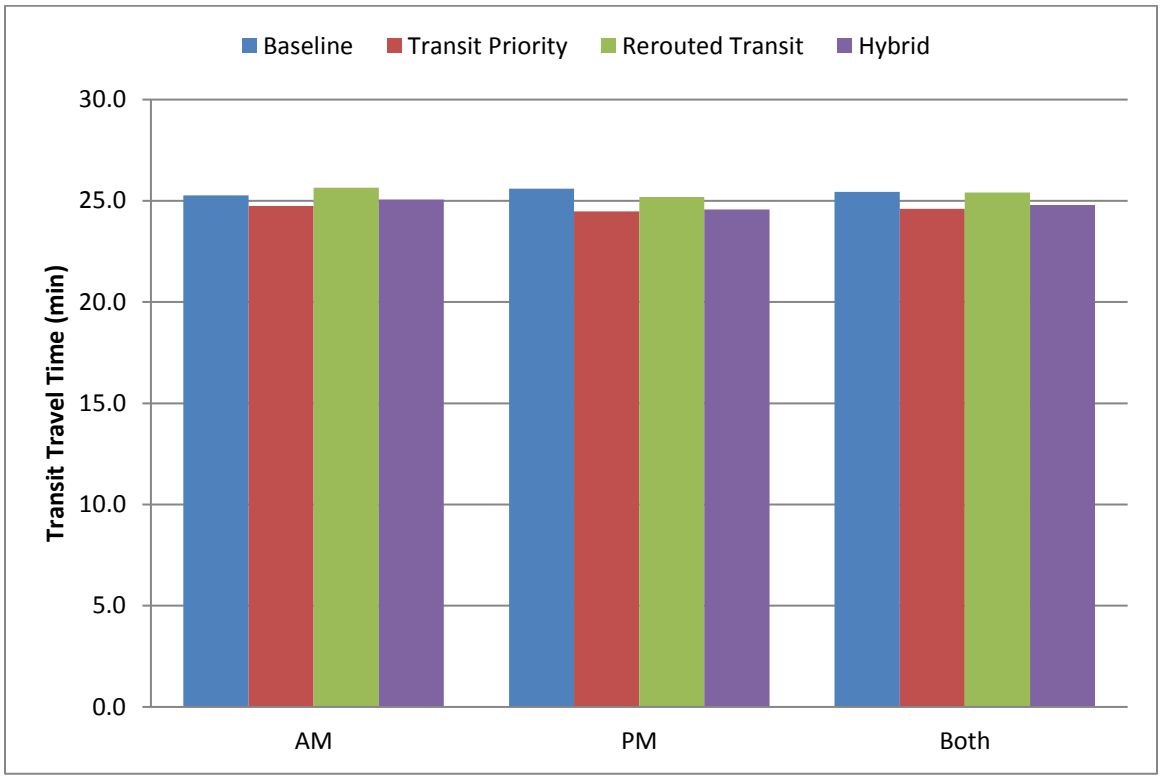


Figure 5 – Average In-Vehicle Travel Time of Transit Trips that Start or End along the Drag Corridor

How does walk access to transit change?

While this study did not look at changes to walking time to transit, due to the more aggregate nature of the model used, it did look at changes to the number of transit users crossing Guadalupe Street between W. Martin Luther King Jr. Boulevard and 29th Street. Figure 6 shows the number of transit users that cross Guadalupe Street at the Drag corridor to access their origin or destination zones. The number of crossings increased slightly in the transit priority scenario, which is the result of more passengers taking the routes on the Drag. The number of crossings decreased in the rerouting scenario due to the fact that passengers destined to West Campus do not need to cross Guadalupe Street any more. The greatest decrease is observed in the hybrid scenario, which is the result of fewer passengers using southbound

transit routes specifically to access UT campus to the east of the drag. In other words, although there is an increase in the ridership of the northbound routes, fewer people use the southbound transit to access UT zones in the hybrid scenario.

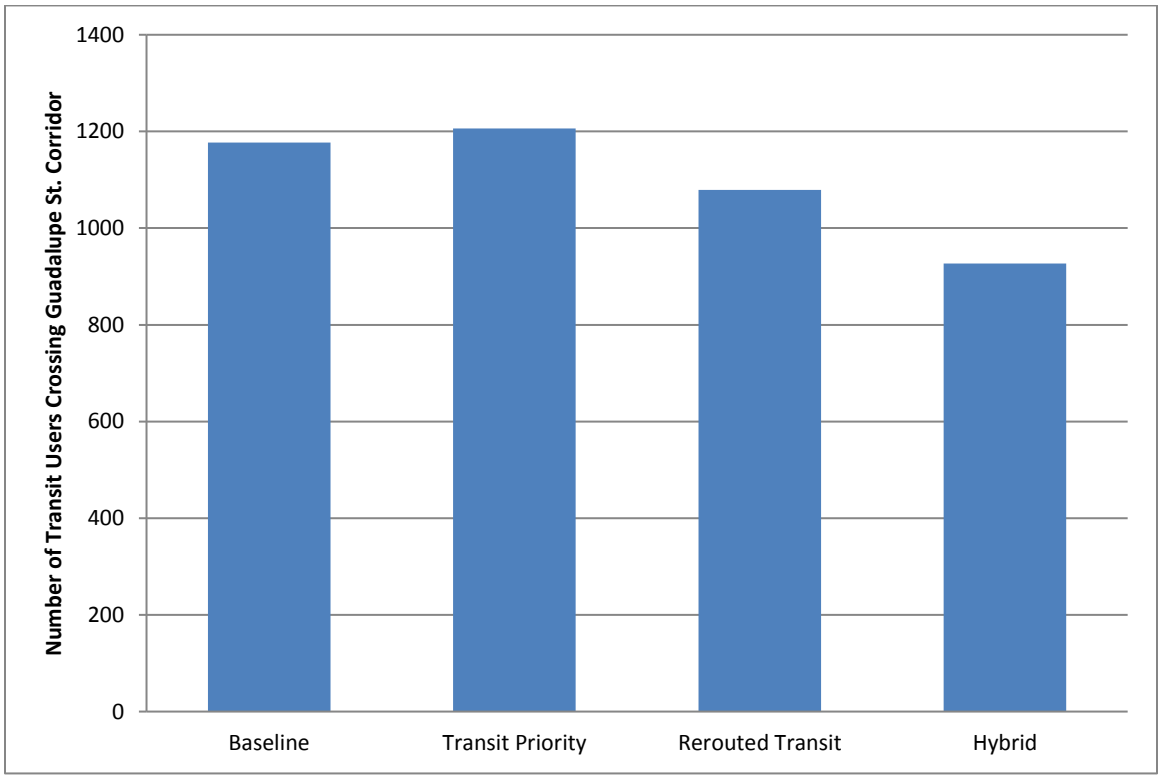


Figure 6 - Number of Transit Users Crossing Guadalupe Street between W. Martin Luther King Jr. Boulevard and 29th Street

What is the impact on parallel roadways?

If transit is given priority on Guadalupe Street, we expect an additional 100 vehicles going northbound, and an additional 200 vehicles going southbound through West Campus in the morning peak hour. The other scenarios do not show a significant change in traffic on parallel facilities in the morning. In the afternoon peak hour, if transit is given priority, we expect a shift of 100-200 northbound vehicles from Guadalupe Street to I-35. In the afternoon peak hour in the southbound direction, we expect some relief (approximately 200 vehicles) to Lamar Boulevard in scenarios where there is increased auto capacity on Guadalupe Street (hybrid scenario and rerouted transit scenario).