MoPac South: Impact on Cesar Chavez Street and the Downtown Network

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Capital Area Metropolitan Planning Organization

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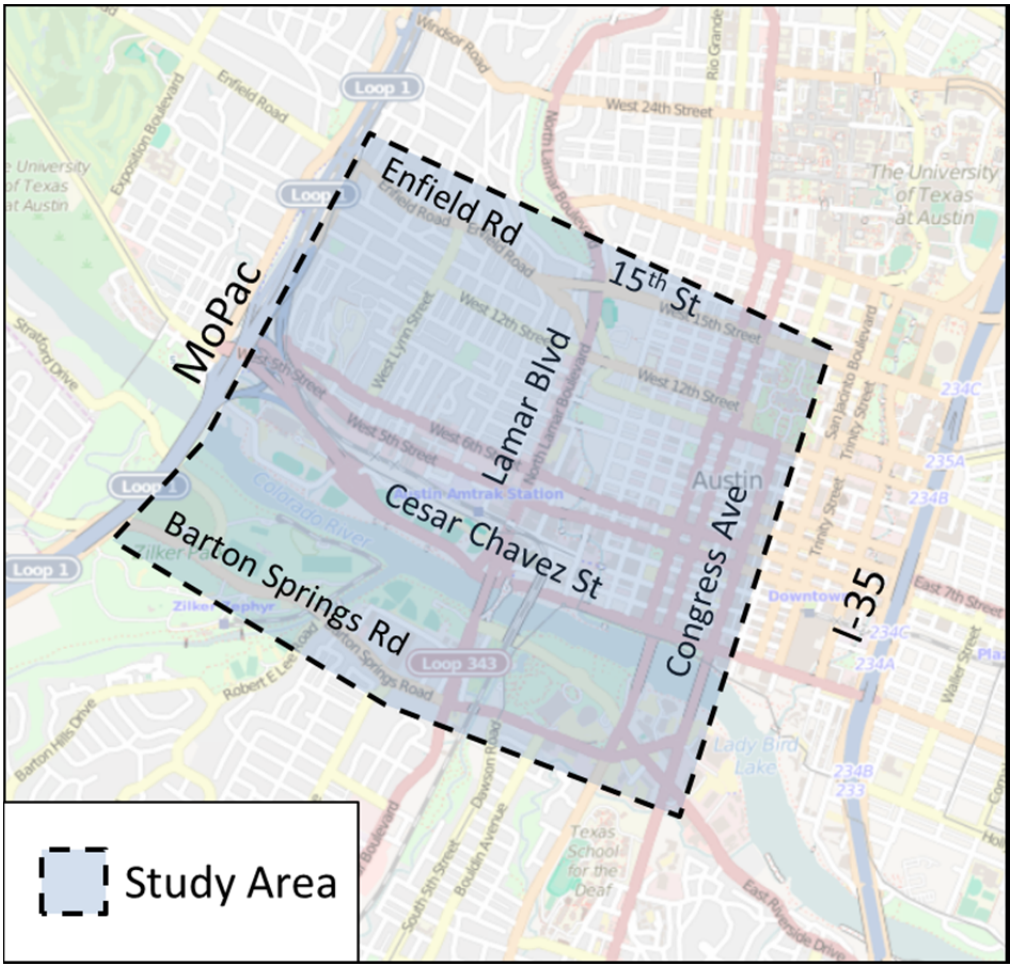
THE UNIVERSITY OF TEXAS AT AUSTIN
CENTER FOR TRANSPORTATION RESEARCH

EXECUTIVE SUMMARY

The University of Texas at Austin Center for Transportation Research (CTR) was tasked with development and application of a dynamic traffic assignment (DTA) study to analyze the impact of MoPac South Express Lanes on downtown Austin. This effort was funded by the Central Texas Regional Mobility Authority and the Capital Area Metropolitan Planning Organization (CAMPO), and supplements ongoing analysis of the MoPac corridor by the project team. The area included in this study is shown in the figure.



DTA models are useful for estimating changes to area travel patterns given changes in a roadway network. The objective of this study was to analyze traffic impacts on Cesar Chavez Street and the downtown area resulting from adding express lanes to the MoPac Expressway south of Cesar Chavez Street. Further, the study assessed the impact of proposed direct-connector ramps between the MoPac South express lanes and Cesar Chavez Street. The analysis included both morning (6:00-9:00 AM) and afternoon (3:30-6:30 PM) peak period travel demand for year 2020 traffic conditions.

Five DTA models were developed representing variations of the MoPac South express lane plan:

Scenario	Description
No-Build	No MoPac South express lanes; MoPac North express lanes included
2 EL + DC	Two express lanes in each direction with a one-lane flyover direct-connector ramp in each direction
2 EL	Two express lanes in each direction without direct-connector ramps
1 EL + DC	One express lane in each direction with a one-lane flyover direct-connector ramp in each direction
1 EL	One express lane in each direction without direct-connector ramps

Results have been compiled for all five scenarios for the AM and PM peak periods. All comparisons of results are between the Build and No-Build scenarios in year 2020. For trips beginning and ending within the designated study area, as outlined in above figure, average travel times are approximately the same for all scenarios during the AM peak. For the PM peak, average travel times are lower in all of the Build scenarios than in the No-Build Scenario within the study area. The Build scenarios facilitate better access to the corridor and reduced congestion in the vicinity of the Cesar Chavez/Lake Austin Boulevard interchange. This leads to reductions in average downtown-area travel time relative to the No-Build Scenario. Scenario "2 EL + DC" changes area travel patterns the most, and leads to some higher travel times downtown than the other build scenarios.

For the entire model area, including a section of MoPac, the Build scenarios all consistently perform better than the No-Build Scenario. Better access to the MoPac corridor coupled with improved flow along MoPac result in the lower travel times. Here, Scenario "1 EL + DC" generally performs the best. Both aggregate performance metrics and corridor-specific results were compiled.

Travel times on Cesar Chavez Street were reviewed in detail in the eastbound direction in the morning, and in the westbound direction in the afternoon between MoPac and Congress Avenue. Travel times remain relatively constant on eastbound Cesar Chavez Street in the AM peak period across scenarios. This is largely due to the fact that traffic volumes do not fluctuate substantially across scenarios. A consultant for the Mobility Authority has also determined, through detailed operational analysis, that the merge area for the direct-connector ramps with Cesar Chavez Street does not significantly disrupt flow along the roadway. Travel times on westbound Cesar Chavez Street in the PM peak period decrease in the build Scenarios relative to the No-Build Scenario. This decrease in travel time is due to less downstream congestion forming along the ramps connecting the roadway with MoPac, particularly those providing

access to southbound MoPac. Scenarios 3 and 4 attract less traffic to westbound Cesar Chavez Street and as such, result in lower travel times than Scenarios 1 and 2.

Results for 5th Street and 6th Street were also compiled between MoPac and Congress. In the morning peak period, travel times on 5th Street stay relatively constant across scenarios. Travel times on 6th Street in the PM peak period decrease in the Build scenarios relative to the No-Build Scenario. Much of this improvement occurs east of Lamar Boulevard where a change in travel pattern has a positive effect. Compared to the No-Build Scenario, the build scenarios all result in more traffic on 6th Street continuing straight through the intersection at Lamar Boulevard versus making a left turn to travel south. With improved conditions downstream at the interchange with MoPac, drivers have more incentive to use the roadway. The resulting reduction in the left-turn volume at the intersection improves conditions upstream along the roadway.

For some other roadways accessing the downtown area, including Lamar Boulevard and S. 1st Street, inbound travel times were assessed for the morning peak period and outbound travel times for the afternoon peak period. Travel times on northbound Lamar Boulevard and S. 1st Street in the morning peak period stay relatively constant across scenarios. This is largely a result of the fact that travel patterns remain consistent along these corridors across scenarios during this period.

Travel times on southbound Lamar Boulevard in the PM peak period decrease significantly in the build Scenarios versus the No-Build Scenario. This improvement is a result of a decrease in traffic using the corridor south of 6th Street as the travel pattern shifts toward more utilization of 6th Street for access to MoPac. This change is less noticeable for Scenario "1 EL", where the least impactful change is implemented along MoPac. Travel times on southbound Guadalupe Street to S. 1st Street in the PM peak period also decrease significantly in the build Scenarios versus the No-Build Scenario. In this case, the improvement is partly a result of a decrease in traffic using the corridor with additional traffic traveling toward MoPac. Generally, the build Scenarios exhibit improved travel times upstream of Cesar Chavez Street with less congestion building along westbound routes to MoPac that otherwise slow southbound traffic along the corridor.

Overall, the construction of MoPac South express lanes is not anticipated to negatively impact downtown Austin relative to the No-Build Scenario. Travel times in the morning peak period remain relatively constant across scenarios. This is a result of consistent travel patterns across scenarios in the AM peak period. Travel times in the afternoon peak period decrease in the Build scenarios versus the No-Build Scenario. This is a result of improved conditions at the interchange of MoPac at Lake Austin Boulevard/Cesar Chavez Street. Alleviation of congestion

and improved access to MoPac in the vicinity of the interchange contributes to reduced travel times and increased throughput along major corridors in the study area. While not all sections improve consistently, the build scenarios generally result in lower travel times in the area.

1. INTRODUCTION

The objective of this study was to analyze traffic impacts of adding express lanes along MoPac south of Cesar Chavez Street. Further, the project involves assessing the implementation of two direct-connector ramps between the express lanes and Cesar Chavez Street. The ramps provide direct connections between the MoPac South express lanes and Cesar Chavez Street, in both directions. The analysis, covering both morning (6:00-9:00 AM) and afternoon (3:30-6:30 PM) peak periods, was completed using dynamic traffic assignment (DTA) models. These models were used to estimate changes to area travel patterns for each scenario analyzed.

This study was funded by the Central Texas Regional Mobility Authority and the Capital Area Metropolitan Planning Organization (CAMPO). This report summarizes the results observed from the DTA models and provides several recommendations based on the findings.

2. BACKGROUND

DTA models are designed to assign vehicles to a transportation network by adjusting route selection as simulated traffic conditions change over time. They are generally more detailed and can simulate the impact of congestion more appropriately than conventional travel demand models. Though not as refined as microsimulation models, they can be used to assess areas or regions more efficiently.

The focus of the effort discussed herein was to analyze impacts of the MoPac improvements on Cesar Chavez Street and the nearby downtown area. This includes the area from Barton Springs Road to Enfield Road/15th Street, and MoPac to Congress Avenue. Figure 1 shows the study area established for this analysis.

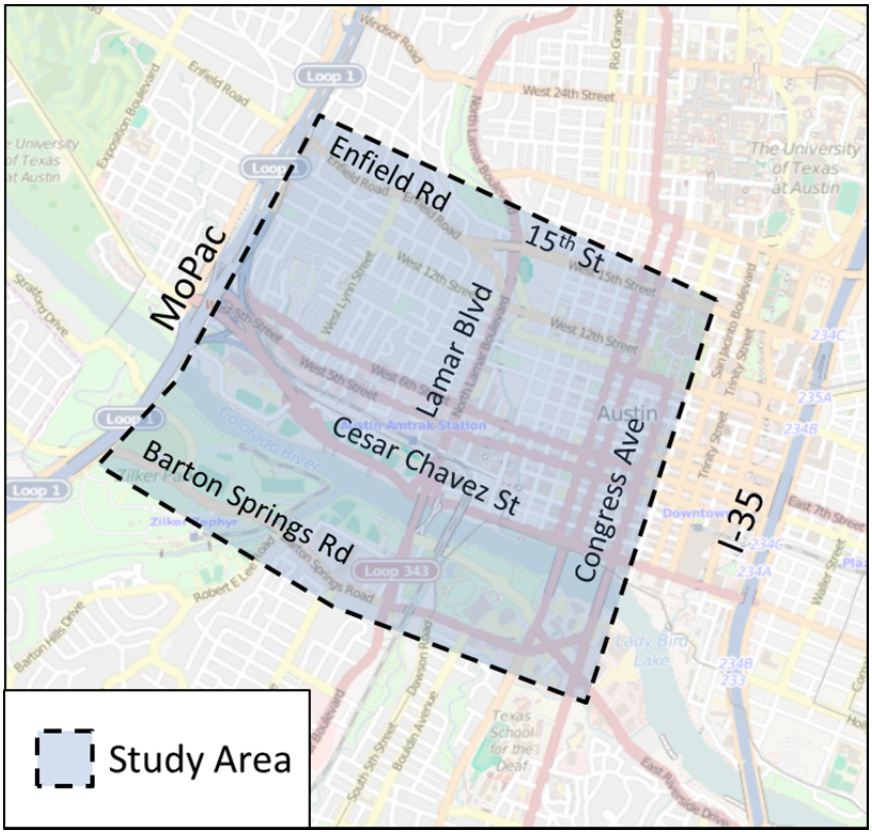


Figure 1. Project Study Area

To properly analyze the impact of the MoPac South express lanes on the study area, the limits of the DTA models extend from the area north of SH 71 (Barton Skyway) to Enfield Road/15th Street, and from MoPac to Congress Avenue. Along MoPac, the model extends just south of Loop 360 to include the ingress/egress access between the express lanes and general purpose lanes south of Cesar Chavez Street. Figure 2 shows the layout of the model used for this study. The demand for the subnetwork was extracted for each analyzed alternative from the 2020 CAMPO forecasted travel demand model with the existing plus committed network.

The CAMPO regional model used for this study covers six counties in the Austin area and establishes traffic routing throughout the region. Improvements along the MoPac corridor for each alternative were coded into the regional model to capture the full magnitude of impacts of the network changes. Therefore, route shifting that occurs beyond the DTA model boundaries, including those associated with nearby IH 35, are captured in this model and represented in the inputs used for the DTA models. Note that the IH 35 corridor modeled in the regional network does not incorporate the planned improvements as part of the Mobility 35 project since they are not expected to be complete by year 2020.

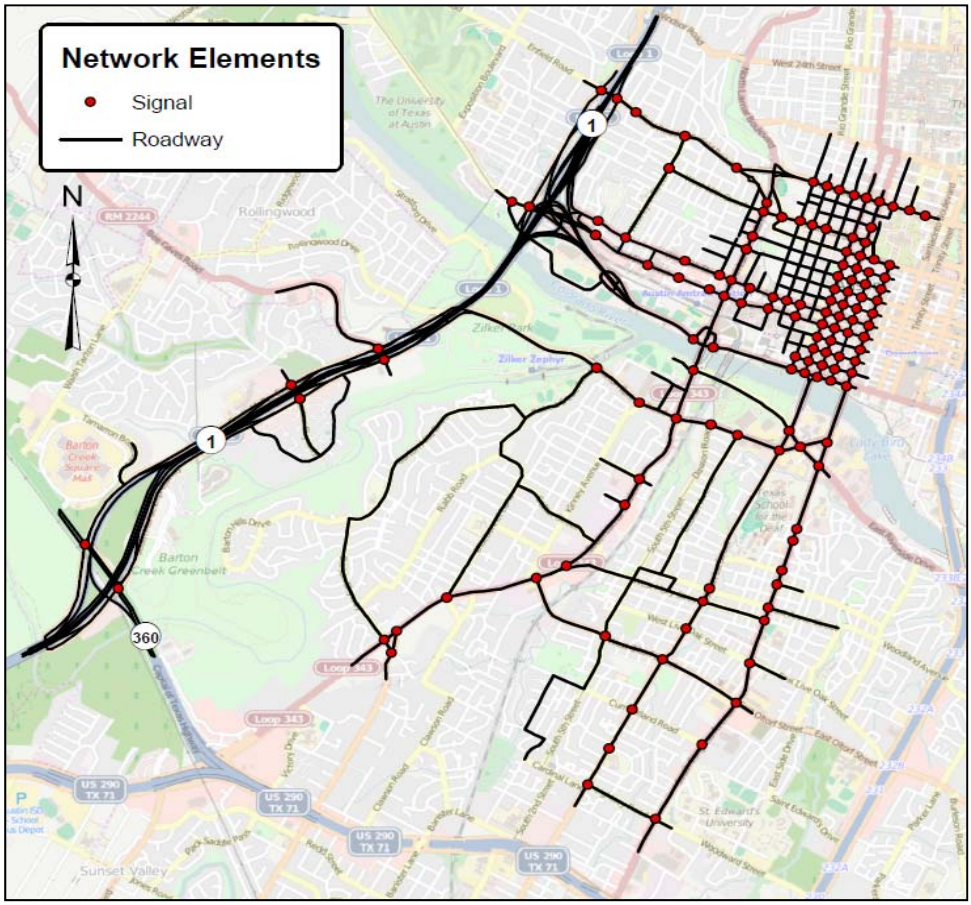


Figure 2. Layout and Extent of DTA Model

Five DTA models were developed to simulate a No-Build scenario and four build scenario models representing variations of the express lane plan. All scenarios were modeled for 2020 conditions and the demand table for each was extracted from independent runs of the CAMPO regional model with the corresponding MoPac South configuration. The scenarios with the direct-connector ramps are intended to maximize use of the facility in 2020, allowing CTR to evaluate a worst-case assessment of the impact to congestion along Cesar Chavez Street. This involved removing the toll for the direct-connector ramps in the models. The five scenarios are identified in the table below.

Table 1. DTA Model Scenarios

Scenario	Description
No-Build	No MoPac South express lanes; MoPac North express lanes included
2 EL + DC	Two express lanes in each direction with a one-lane flyover direct-connector ramp in each direction
2 EL	Two express lanes in each direction without direct-connector ramps
1 EL + DC	One express lane in each direction with a one-lane flyover direct-connector ramp in each direction
1 EL	One express lane in each direction without direct-connector ramps

3. Model Results

The model results have been assessed on an aggregate level, as well as with respect to Cesar Chavez Street specifically, roadways parallel to Cesar Chavez Street and other inbound roadways in the model, and downtown travel patterns. The findings are presented for both the AM and PM peak periods.

3.1 Aggregate Performance

For trips beginning and ending within the designated study area, as outlined in Figure 1, the average travel times are given in Table 2. For all trips within the model area, shown in Figure 2, the average travel times are provided in Table 3. Morning peak period trip travel times are shown in Figure 3 and afternoon peak period trip travel times are illustrated in Figure 4.

Table 2. Study Area Average Internal Travel Times [minutes]

	Time Period	
Scenario	AM Peak	PM Peak
No-Build	3.3	15.7
2 EL + DC	3.3	9.5
2 EL	3.4	8.8
1 EL + DC	3.3	7.4
1 EL	3.3	8.9

Table 3. Model Area Average Travel Times [minutes]

	Time Period	
Scenario	AM Peak	PM Peak
No-Build	11.5	22.8
2 EL + DC	7.8	13.4
2 EL	9.1	14.6
1 EL + DC	7.6	10.9
1 EL	8.3	14.0

In the PM peak period, travel times are lower in all of the build scenarios than in the No-Build scenario. All of the build scenarios facilitate better access to the corridor and reduced congestion in the vicinity of the Cesar Chavez/Lake Austin Boulevard interchange. This leads to reductions in average downtown-area travel time relative to the No-Build scenario. Scenario "2 EL + DC" changes area travel patterns the most, and leads to higher overall travel times downtown than the other build scenarios. The observed impact and contributing factors are discussed in more detail in the following sections.

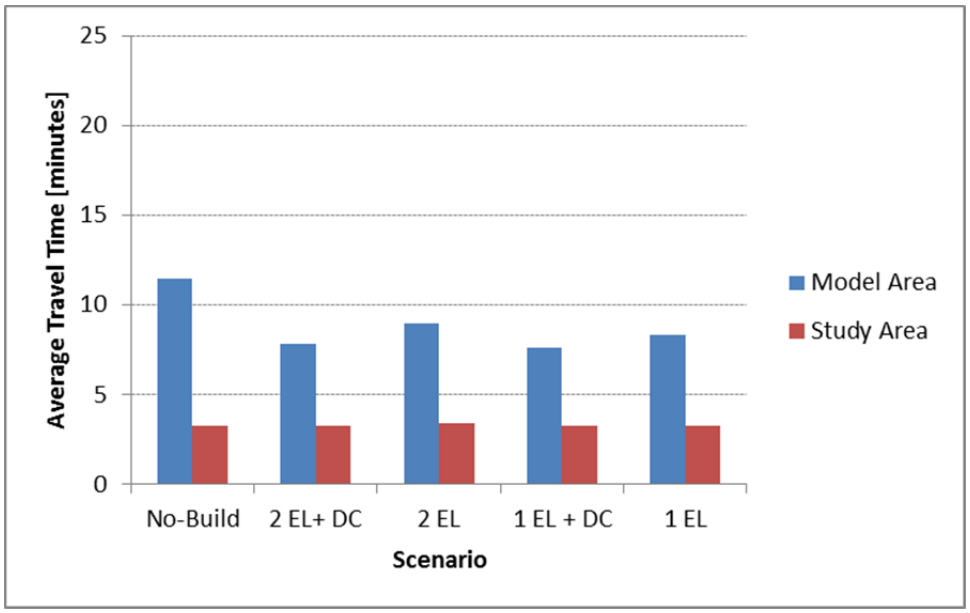


Figure 3. Average Travel Time (AM Peak Period)

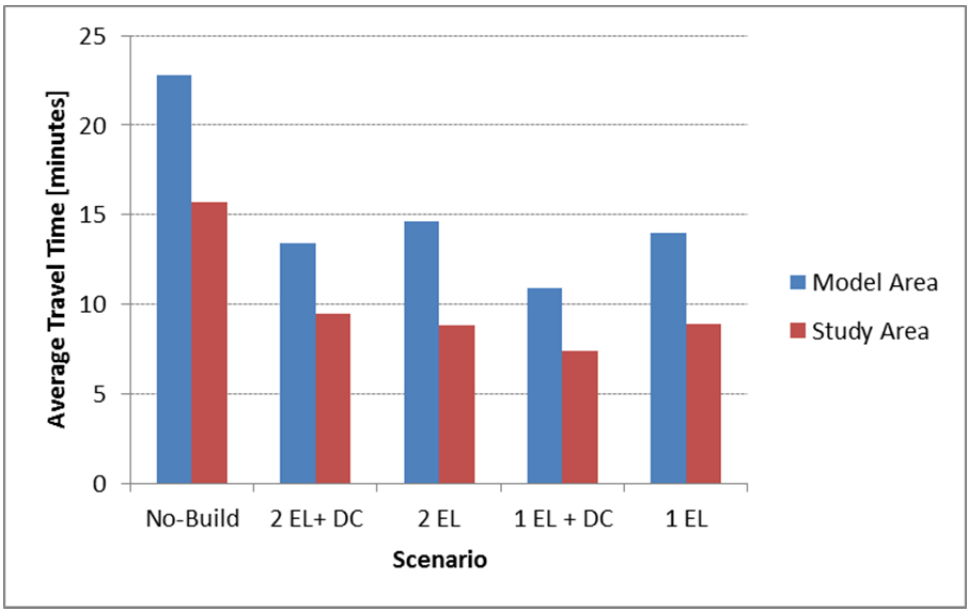


Figure 4. Average Travel Time (PM Peak Period)

For the entire model area, the build scenarios all consistently perform better than the No-Build Scenario. Better access to the MoPac corridor coupled with improved flow along MoPac result in the lower travel times. Scenario "1 EL + DC" generally performs the best where the majority of the improvements are incorporated but fewer impacts to travel patterns are experienced within the study area.

3.2 Impact to Cesar Chavez Street

For Cesar Chavez Street, the scenarios with the direct-connector ramps influence traffic in this area. This includes an additional merge area between the northbound-to-eastbound direct-connector ramp along the corridor in the immediate vicinity of the merge point for the eastbound Reserve Road entrance ramp, as shown in Figure 5.

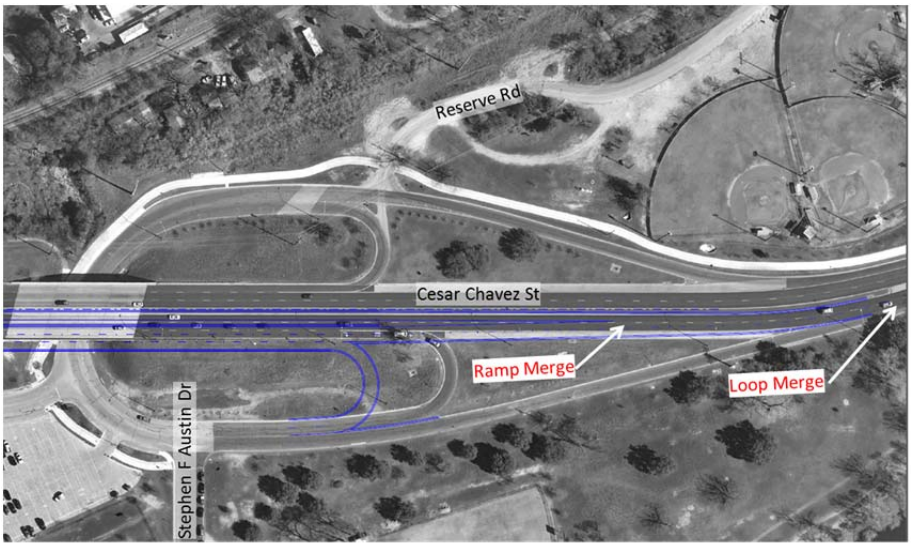


Figure 5. Merge Areas along Eastbound Cesar Chavez Street

In this section, travel times and volumes on Cesar Chavez Street are examined in the eastbound direction in the morning, and in the westbound direction in the afternoon. Figure 6 shows the limits of the corridor analyzed in the eastbound direction and Figure 7 shows the limits of the corridor analyzed in the westbound direction.

Figure 6. Travel Time Limits for Eastbound Cesar Chavez Street

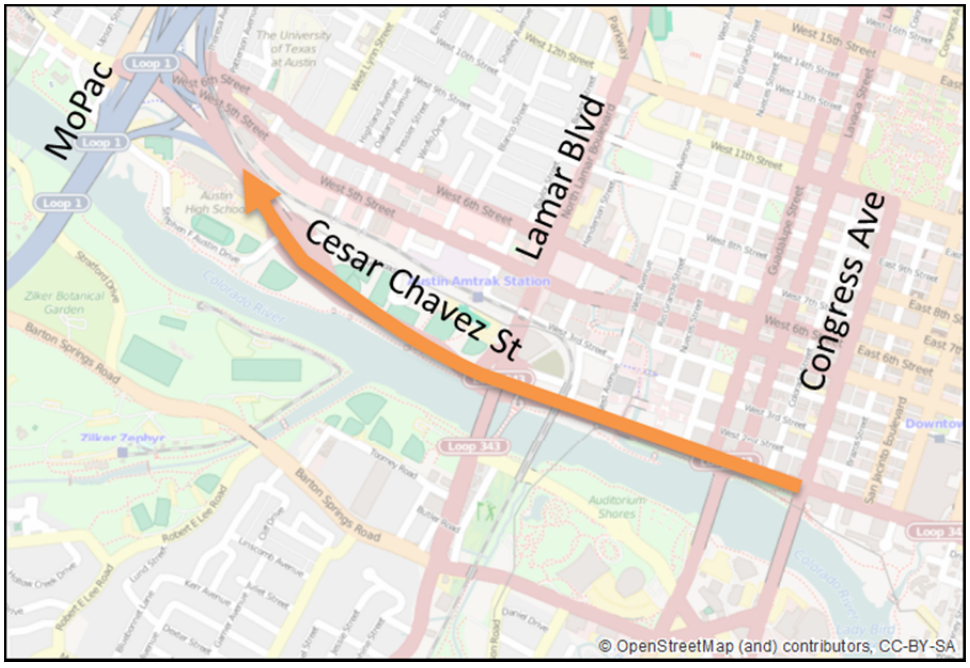


Figure 7. Travel Time Limits for Westbound Cesar Chavez Street

As shown in Figure 8, travel times remain relatively constant on eastbound Cesar Chavez Street in the AM peak period across scenarios. This is largely due to the fact that traffic volumes do not increase across scenarios. A consultant for the Mobility Authority has also determined,

through detailed operational analysis, that the merge area for the direct-connector ramps with Cesar Chavez Street does not significantly disrupt flow along the roadway.

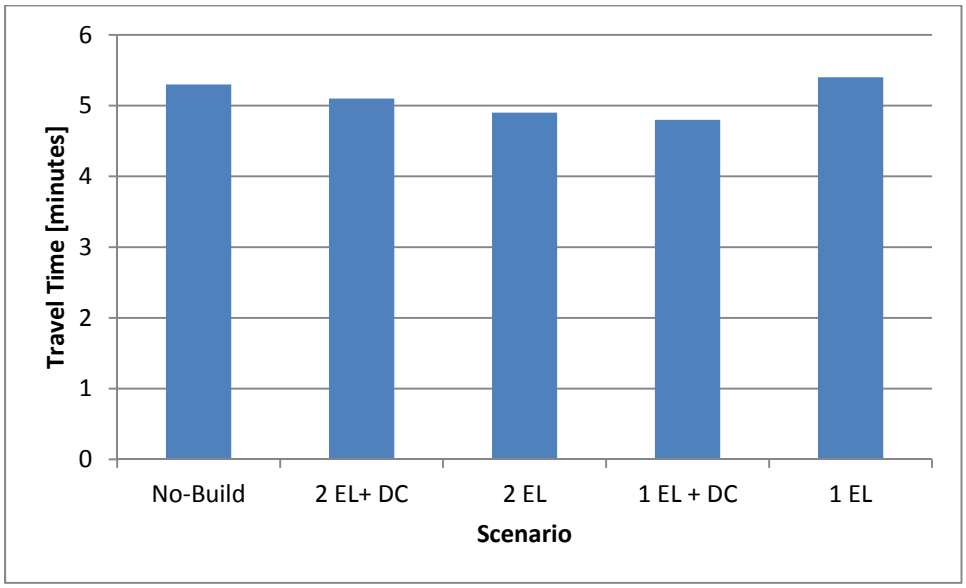


Figure 8. Eastbound Cesar Chavez Street Travel Time (AM Peak Period)

Peak direction traffic volumes along Cesar Chavez Street decrease for both peak periods west of Lamar Boulevard. This is attributable to the limited capacity downstream of the merge area with the direct-connector ramp and persistent congestion along Cesar Chavez Street across all scenarios. Some traffic diverts to 5th Street in the build scenarios further contributing to the decrease. Traffic volumes along Cesar Chavez Street and select corridors in the area were extracted from the model for the peak periods and are provided in Appendix A. Eastbound volumes along Cesar Chavez Street extracted from the model for the AM peak period are shown in Figure 9.

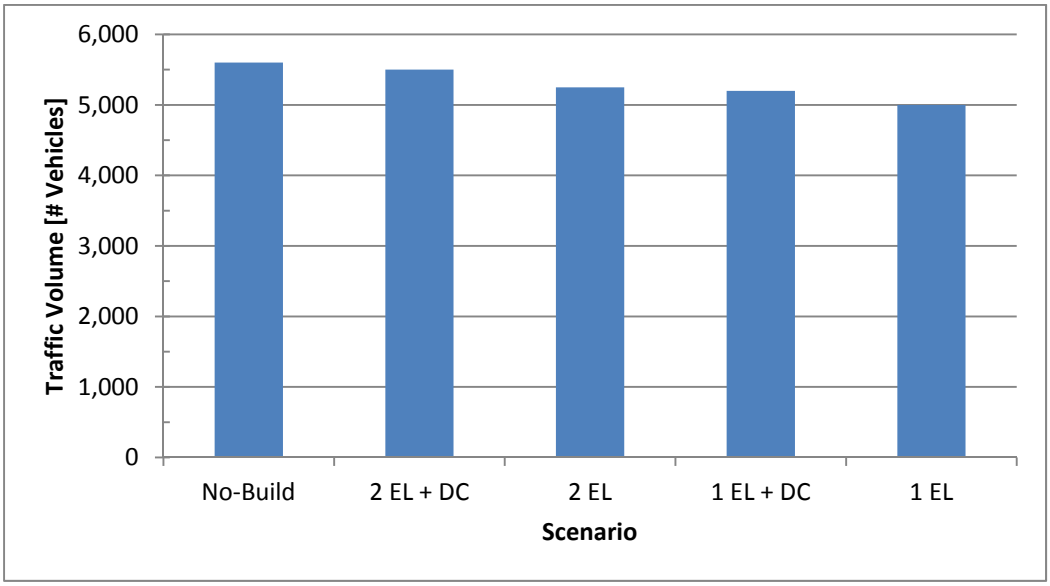


Figure 9. Eastbound Volumes along Cesar Chavez Street West of Lamar Boulevard (AM Peak Period)

In the AM peak period, the primary difference in travel pattern is in Scenario "EL 2 + DC" where traffic headed to downtown shifts to the new ramp. The number of vehicles using the inbound direct-connector ramp for the peak period (with no toll imposed on the ramp) in the model is approximately 2,300 vehicles for Scenario "EL 2 + DC" and 2,050 for Scenario "EL 1 + DC", with only approximately 700 vehicles using the existing connection.

In the PM peak period, travel times generally decrease along westbound Cesar Chavez Street due to improved conditions downstream through the MoPac interchange and along southbound MoPac. Travel times are lower in the scenarios with one express lane than the scenarios with two express lanes in each direction. Travel patterns shift more substantially in the scenarios involving the two-lane expressway. Additional traffic accessing the corridor via northbound Lamar Boulevard resulted in congestion building upstream of the intersections and subsequently higher travel times in this section, and within the full study limits evaluated, as shown in Figure 10. Figure 7 illustrates the limits along the corridor from which the travel times were extracted. Additional travel times can be found in Appendix B.

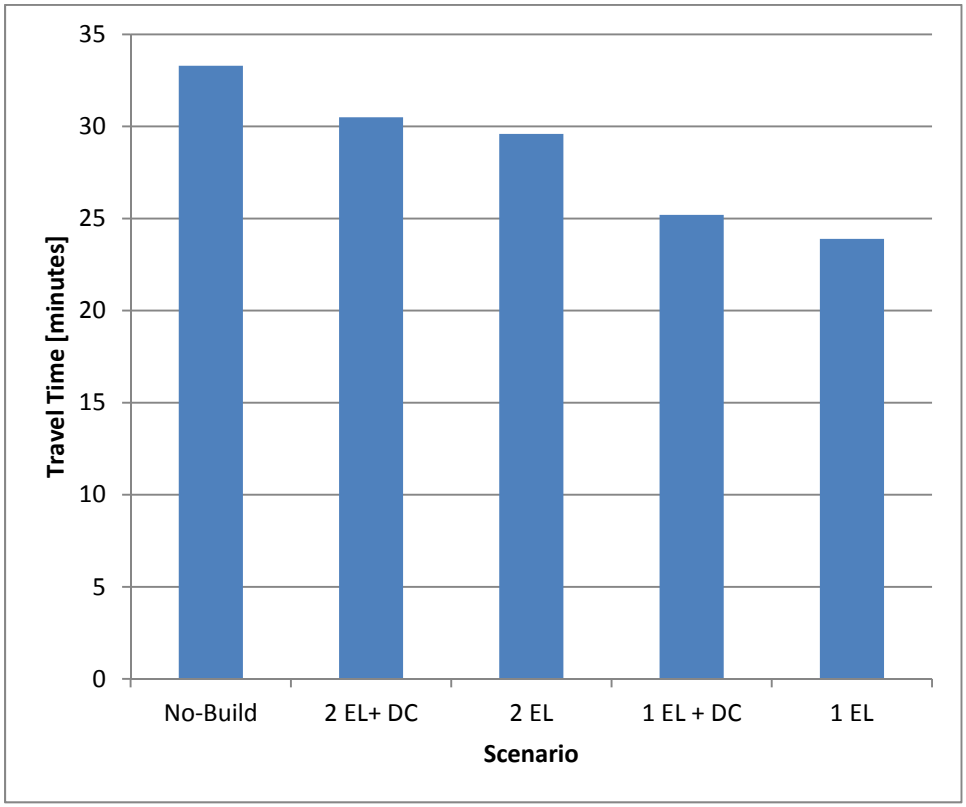


Figure 10. Westbound Cesar Chavez Street Travel Time (PM Peak Period)

This trend was also identified in the PM peak where approximately 2,850 vehicles use the outbound direct-connector ramp for Scenario "2 EL + DC" and 2,100 for Scenario "1 EL + DC" with approximately 1,000 vehicles using the existing connection. Though this shift occurs, westbound volumes along Cesar Chavez Street, west of Lamar Boulevard, remain relatively constant across scenarios. The volumes extracted from the model for the PM peak period are shown in Figure 11. Additional peak period volumes are shown in Appendix A.

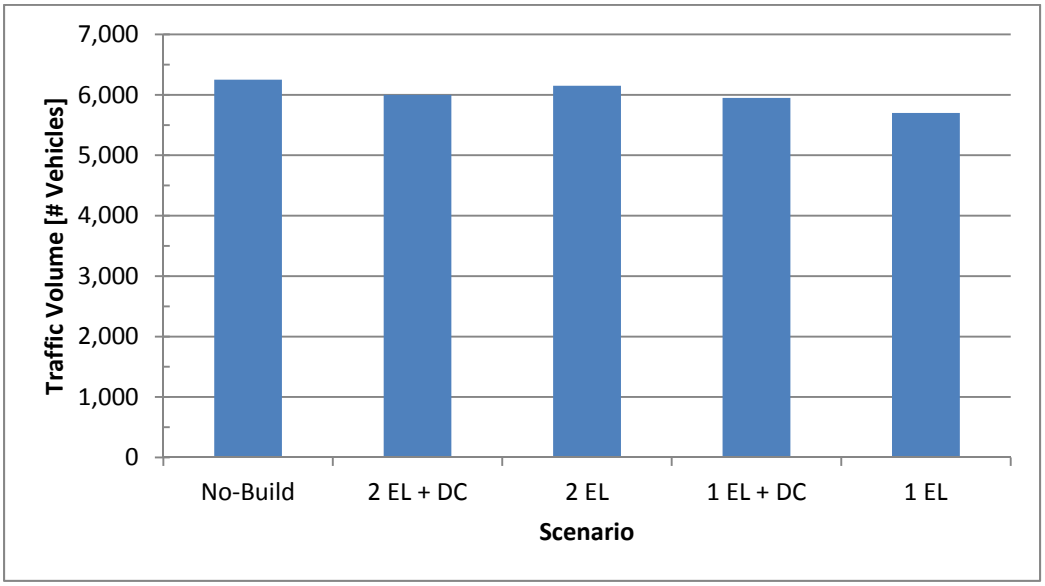


Figure 11. Westbound Volumes along Cesar Chavez Street West of Lamar Boulevard (PM Peak Period)

Additional traffic accessing Cesar Chavez Street from Lamar Boulevard is attracted to the corridor in two-lane expressway scenarios as a result of a change in congestion pattern along MoPac. Generally, travel along southbound MoPac improves in the two-lane expressway scenarios. However, two new merge conditions are created along northbound MoPac, south of Barton Skyway and near Lake Austin Boulevard. Notably, the merge area near Lake Austin Boulevard is the result of a ramp reversal with the No-Build Scenario. In the No-Build Scenario, a ramp providing access to the northbound express lane is available.

Congestion in this area in the build scenarios makes accessing northbound MoPac south of the bridge less desirable. Instead, traffic from the area just south of Lady Bird Lake tends to enter northbound MoPac via Cesar Chavez Street, accessed from northbound Lamar Boulevard, causing some additional queuing upstream. Again, while traffic volumes west of Lamar Boulevard remain fairly consistent across scenarios, the composition of this traffic changes across scenarios. This is due to improved access to northbound MoPac via the corridor with less congestion at the interchange caused by southbound traffic queuing along the ramp system. Traffic patterns for one-lane expressway scenarios do not change as much with respect to the No-Build Scenario along Cesar Chavez Street as a result of fewer downstream improvements, thus, there is not as much congestion generated along the corridor upstream of Lamar Boulevard. In all of the build scenarios, westbound traffic traveling to southbound MoPac and west on Lake Austin Boulevard shifts to 6th Street due to the improved downstream conditions through the MoPac interchange. Travel along other area corridors is discussed in more detail in the following section.

3.3 Impact to Area Roadways

In the AM peak period, traffic volumes and travel times remain consistent across all scenarios. Only small changes in traffic volumes occur along Enfield Road and 5th Street, east of MoPac, and S. 1st Street, at the South 1st Street Bridge, though a noticeable decrease along Congress Avenue occurs for inbound traffic in Scenario "2 EL + DC". This corresponds with an increase along northbound Lamar Boulevard as some traffic shifts toward MoPac in this scenario. As noted above, an increase in traffic along northbound Lamar Boulevard for all of the Build scenarios is associated with an increase in traffic along westbound Cesar Chavez Street west of the intersection area to access northbound MoPac.

3.3.1 Impact to 6th Street

In the PM peak period, more pronounced differences are found between scenarios along area roadways. Some westbound traffic (to Lake Austin Boulevard) shifts from Cesar Chavez Street and Enfield Road to 6th Street, while additional traffic destined for South Austin also uses 6th Street due to improved conditions along southbound MoPac and the interchange area along Lake Austin Boulevard in the build scenarios. Like the northbound direction, the planned configuration for the southbound direction implements a ramp reversal, changing access between the express lane and general purpose lanes for the build scenarios. Unlike the northbound direction, this reversal creates an egress point to the express lanes in the build scenarios. This change, along with the continuation of the southbound express lane, relieves congestion along the corridor in the southbound direction.

Additionally, southbound flow from westbound Cesar Chavez Street shifts to the direct-connector ramp that merges with the express lane farther to the south, further mitigating congestion in the area for scenarios with direct-connector ramps. These improvements result in attracting flow to 6th Street to access southbound MoPac. Though traffic increases along 6th Street, travel times decreased due to the improved flow along southbound MoPac with the shift in Cesar Chavez Street traffic to the southbound direct-connector ramp. Figure 12 illustrates the limits along the corridor from which the travel times were extracted. These travel times are shown in Figure 13. Additional travel times can be found in Appendix B.

Figure 12. Travel Time Limits for 6th Street

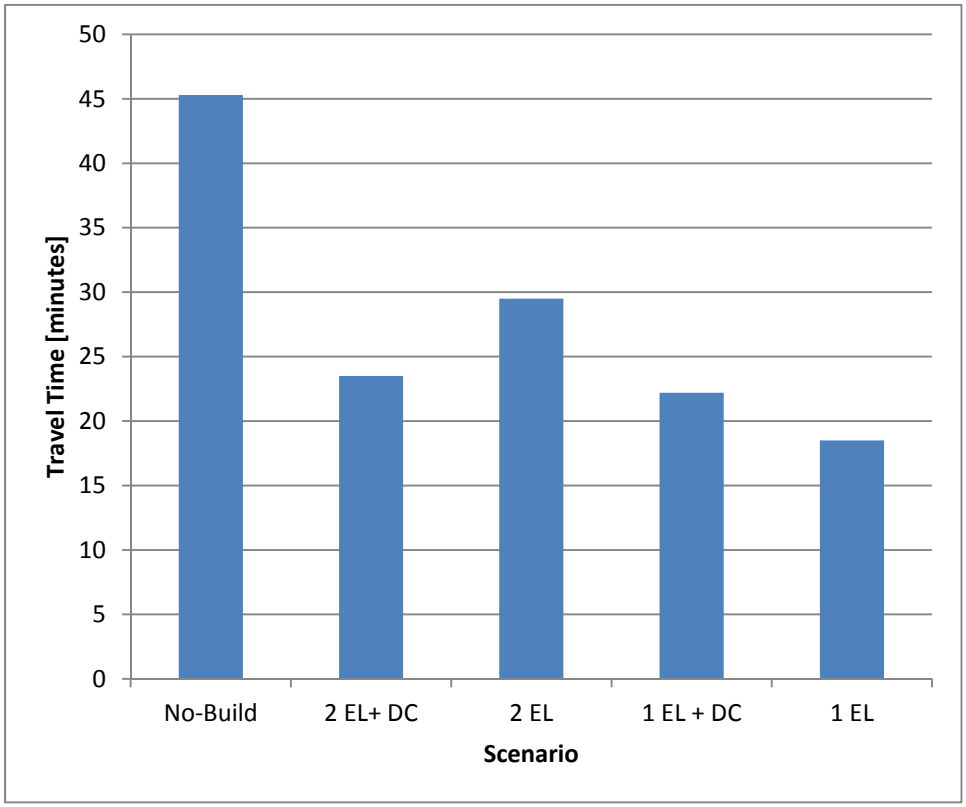


Figure 13. Westbound 6th Street Travel Time (PM Peak Period)

As shown in Figure 13, travel times on 6th Street in the PM peak period decrease in the build scenarios relative to the No-Build Scenario. Much of this improvement occurs east of Lamar Boulevard where a change in travel pattern has a positive effect. Compared to the No-Build Scenario, the build scenarios all result in more traffic on 6th Street continuing straight through the intersection at Lamar Boulevard versus making a left turn to travel south. With improved conditions downstream at the interchange with MoPac, drivers have more incentive to use the roadway. The resulting reduction in the left-turn volume at the intersection improves conditions upstream along the roadway.

3.3.2 IMPACT TO 5TH STREET

In this section, travel times on 5th Street, which is one-way in the eastbound direction, are examined for the morning peak period. Figure 14 shows the limits of the corridor analyzed.

Figure 14. Travel Time Limits for 5th Street

As shown in Figure 15, travel times on 5th Street in the AM peak period stay relatively constant across scenarios. Since there is available capacity along the corridor, and intersection control constrains flow, the changes in travel patterns do not lead to noticeable changes in travel time.

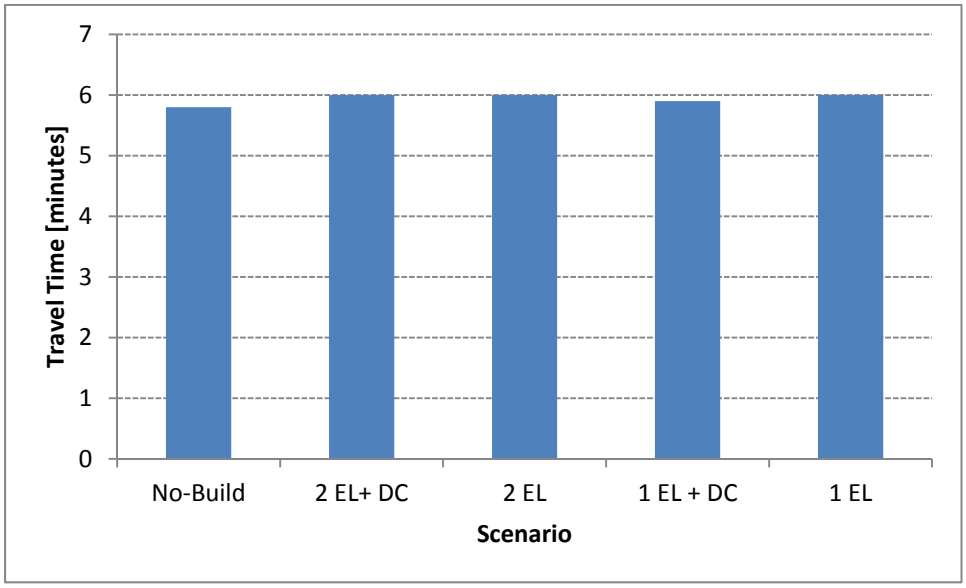


Figure 15. Eastbound 5th Street Travel Time (AM Peak Period)

3.3.3 IMPACT TO LAMAR BOULEVARD

In this section, travel times on Lamar Boulevard are examined in the northbound direction in the morning peak period and the southbound direction in the afternoon peak period. Figure 16 shows the limits of the corridor analyzed.

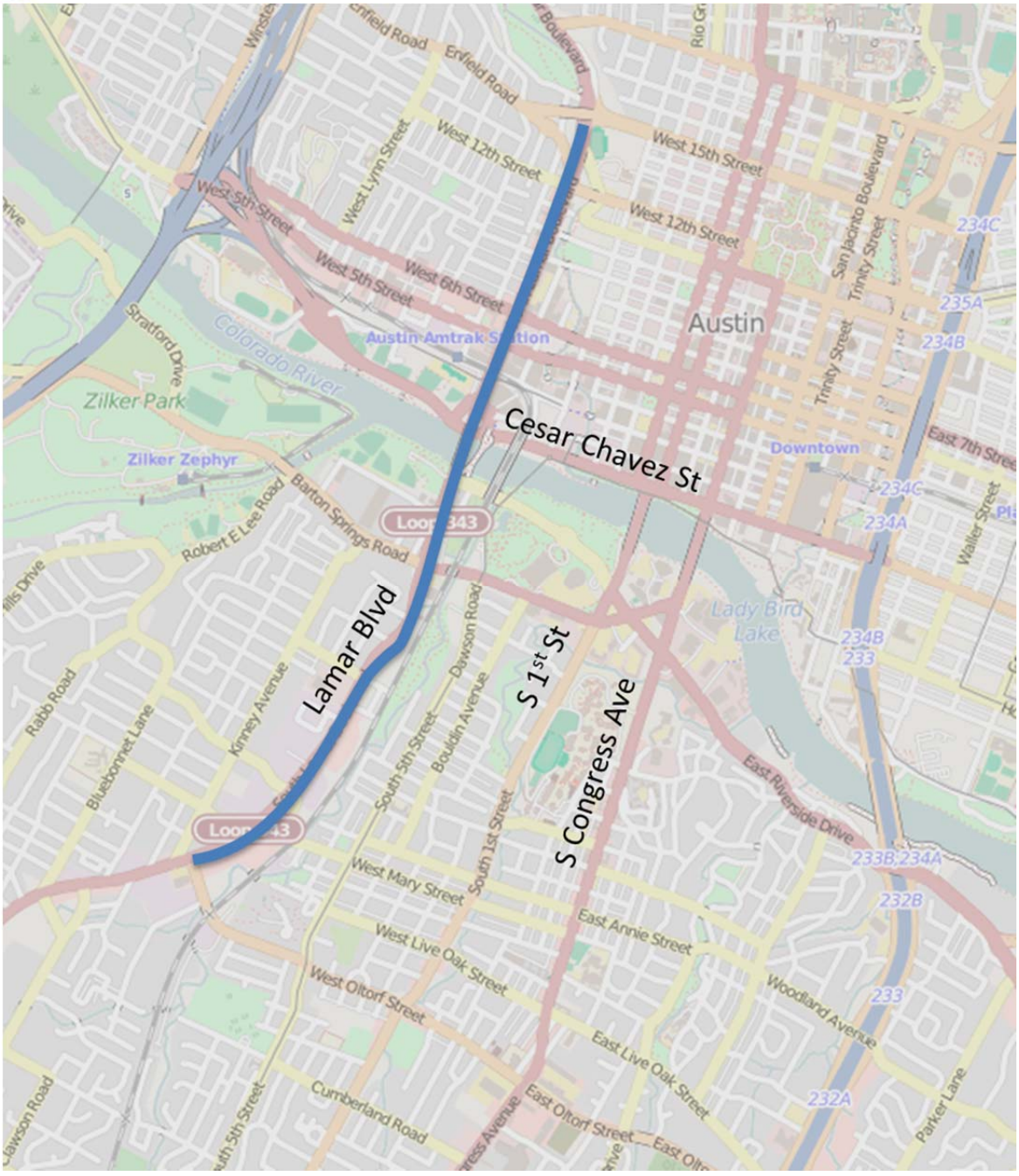


Figure 16. Travel Time Limits for Lamar Boulevard

As shown in Figure 17, travel times on northbound Lamar Boulevard in the AM peak period stay relatively constant across scenarios. This is largely a result of the fact that travel patterns remain consistent along this corridor across scenarios in the AM peak period.

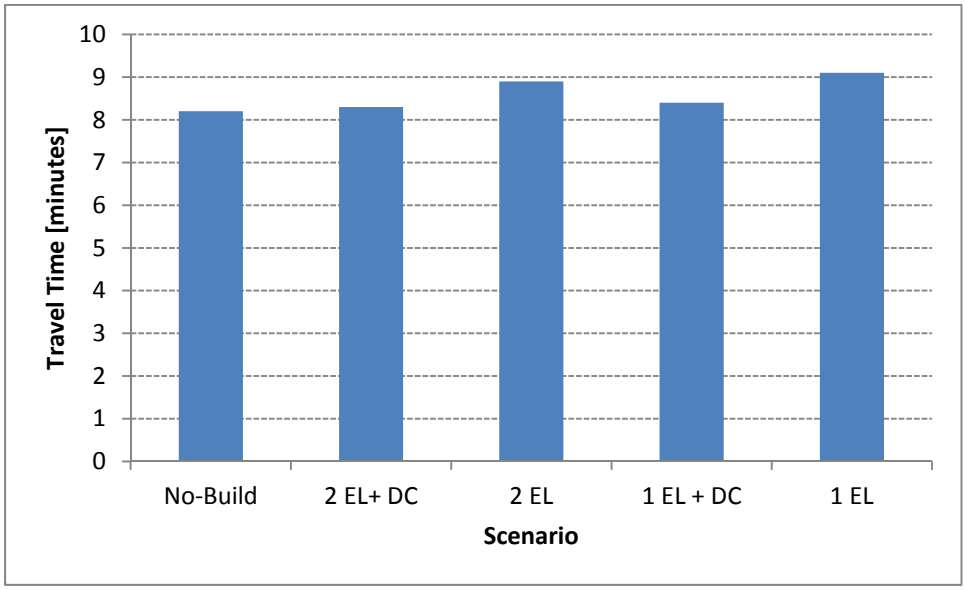


Figure 17. Northbound Lamar Boulevard Travel Time (AM Peak Period)

As shown in Figure 18, travel times on southbound Lamar Boulevard in the PM peak period decrease significantly in the build Scenarios versus the No-Build Scenario. This improvement is a result of a decrease in traffic using the corridor south of 6th Street as the travel pattern shifts toward more utilization of 6th Street for access to MoPac. This change is less noticeable for Scenario 4, where the least impactful change is implemented along MoPac.

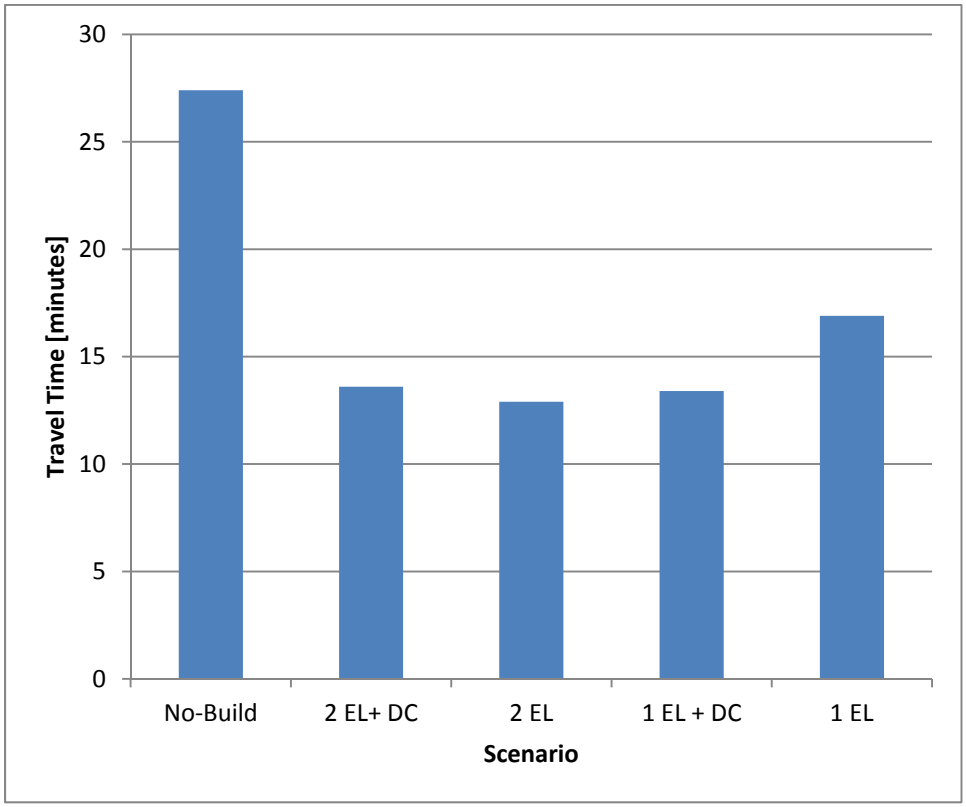


Figure 18. Southbound Lamar Boulevard Travel Time (PM Peak Period)

3.3.4 Impact to S. 1st Street and Guadalupe/Lavaca Streets

In this section, travel times on S. 1st Street to Lavaca Street in the northbound direction in the morning peak period, and Guadalupe Street to S. 1st Street in the southbound direction in the afternoon peak period are examined. Figure 19 shows the limits of the corridor analyzed.

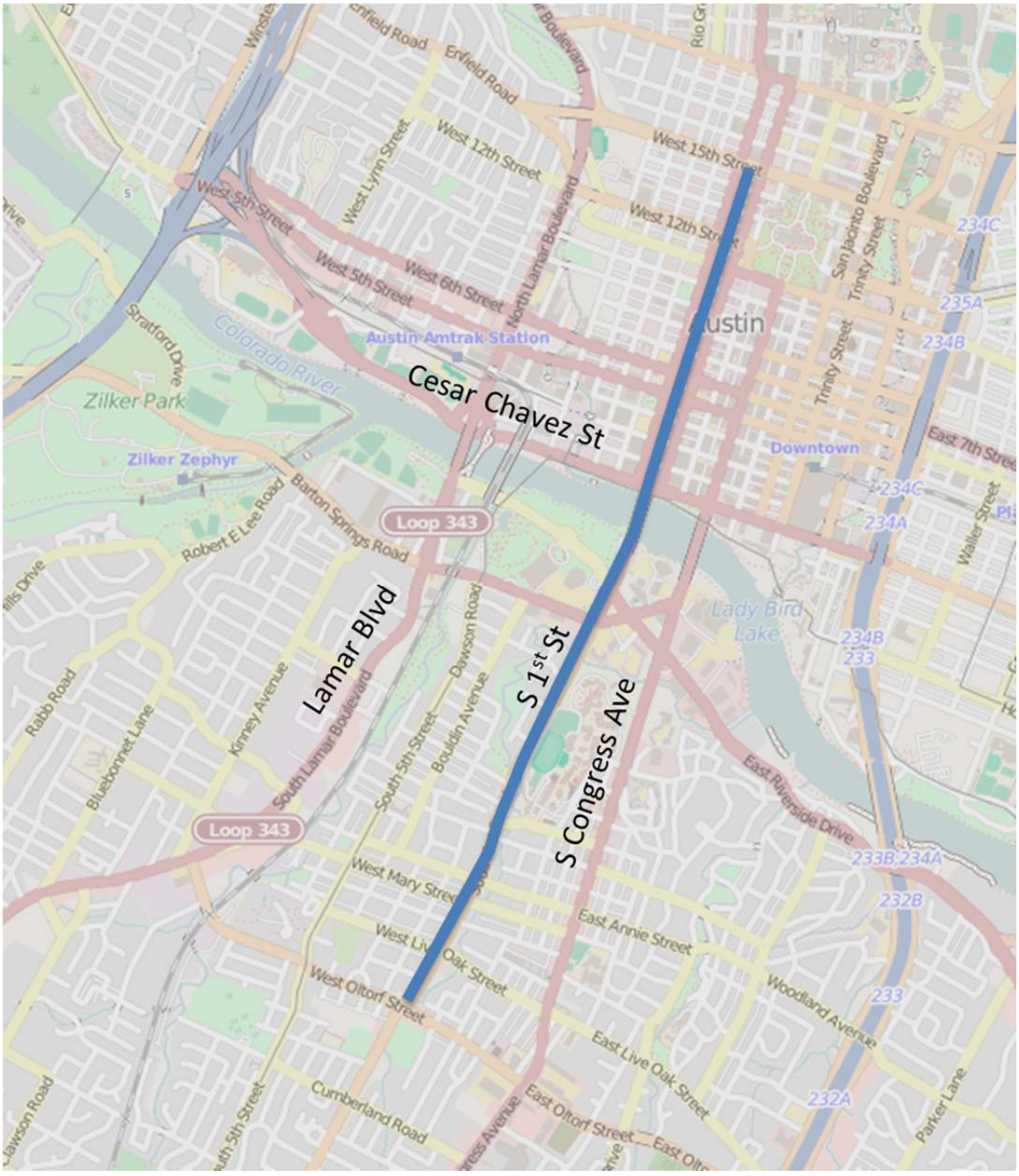


Figure 19. Travel Time Limits for S. 1st Street

As shown in Figure 20, travel times on northbound S. 1st Street to Lavaca Street in the AM peak period stay relatively constant across scenarios. Similar to northbound Lamar Boulevard, this result is largely due to travel patterns remaining consistent along this corridor across scenarios in the AM peak period.

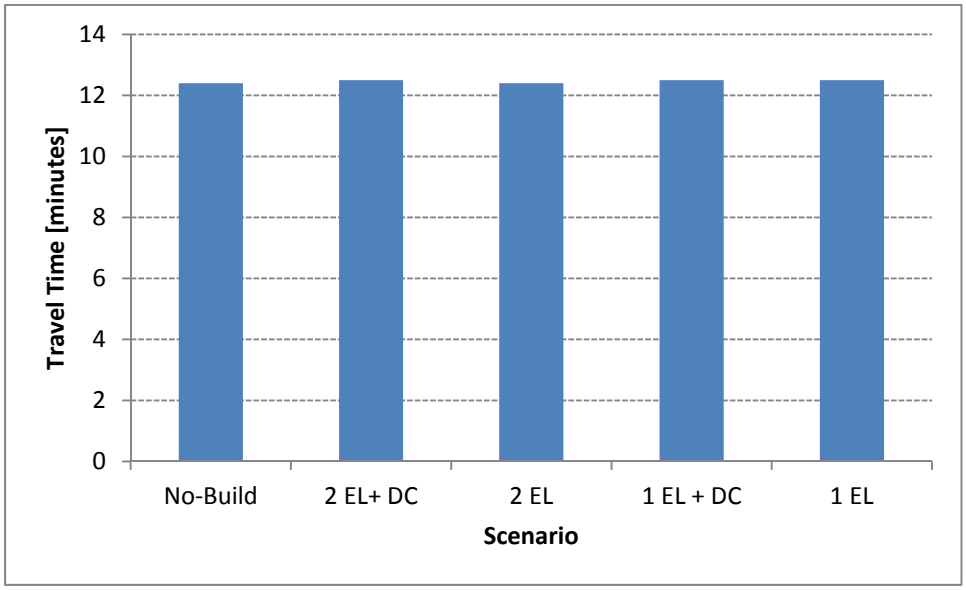


Figure 20. Northbound S. 1st Street to Lavaca Street Travel Time (AM Peak Period)

As shown in Figure 21, travel times on southbound Guadalupe Street to S. 1st Street in the PM peak period decrease significantly in the build Scenarios versus the No-Build Scenario. In this case, the improvement is partly a result of a decrease in traffic using the corridor with additional traffic traveling toward MoPac. Generally, the build scenarios exhibit improved travel times upstream of Cesar Chavez Street with less congestion building along westbound routes to MoPac that otherwise slow southbound traffic along the corridor.

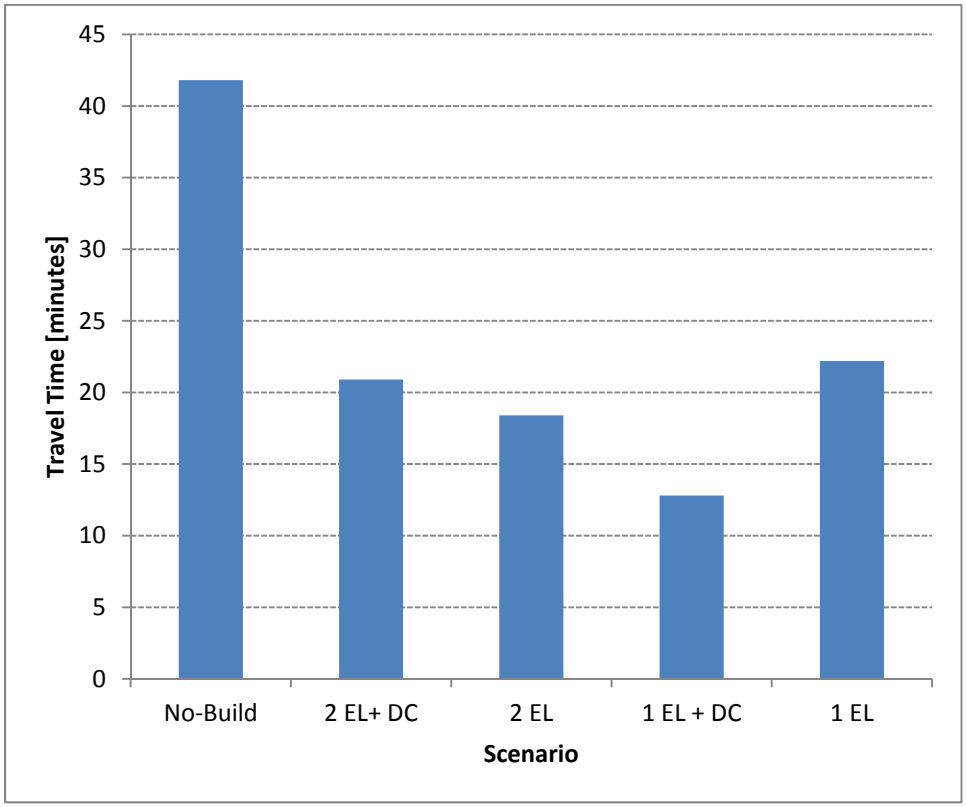


Figure 21. Southbound Guadalupe Street to S. 1st Street Travel Time (PM Peak Period)

3.4 Impact to Downtown Area Travel Patterns

In the AM peak period, the general travel patterns remained consistent across scenarios. This included both travel to the downtown area, as well as within this portion of the network. An analysis of roadway congestion and signal delay throughout the downtown network revealed small differences across the scenarios. This is depicted in the figures below using the following color scale

Figure 22. Color Scale for Figures 23-26

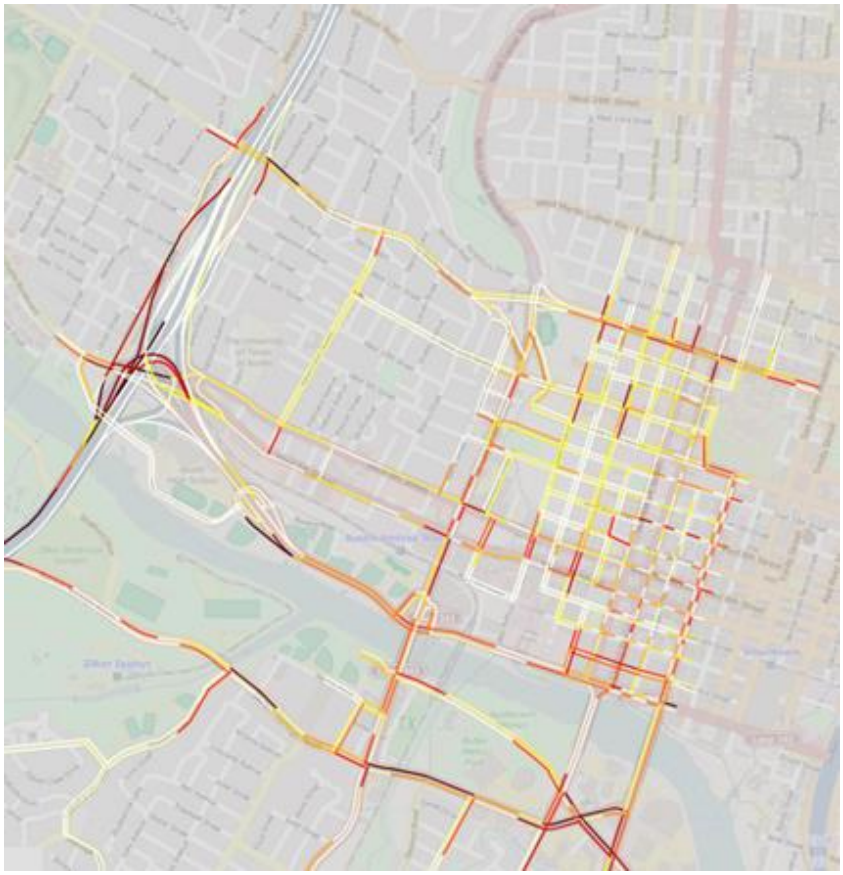


Figure 23. Congestion on Area Roadways in the No-Build Scenario (AM Peak Period)

Figure 23 illustrates some congestion forming in the downtown area during the AM peak period for the No-Build Scenario. Much of the congestion is located south of the river or along MoPac and the ramps connecting MoPac to the east/west corridors in the area. (The section of northbound MoPac shown is free-flowing because there is a bottleneck just south of Barton Springs Road that is released at this point.) For the build scenarios illustrated in Figure 24, some changes in the congestion patterns are depicted. Congestion remains visible south of the river and within the downtown grid, but is alleviated in part along MoPac and the connecting ramps. Congestion forms along the direct-connector ramp from northbound MoPac to eastbound Cesar Chavez Street. This is a result of the ramp's merge area, which is located near the merge point for the eastbound Reserve Road entrance ramp (shown in Figure 5 on page 11).

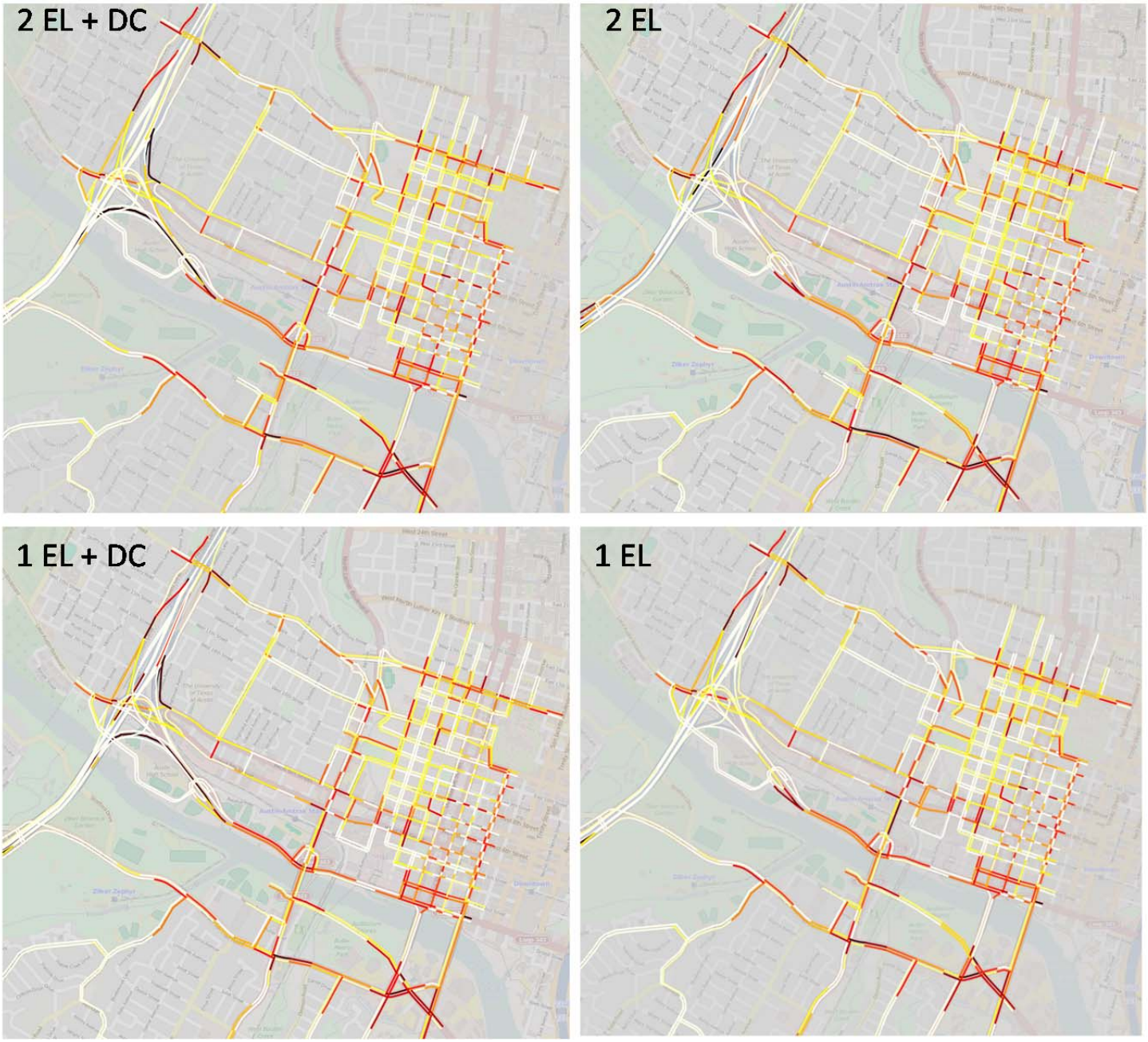


Figure 24. Congestion on Area Roadways in the Build Scenarios (AM Peak Period)

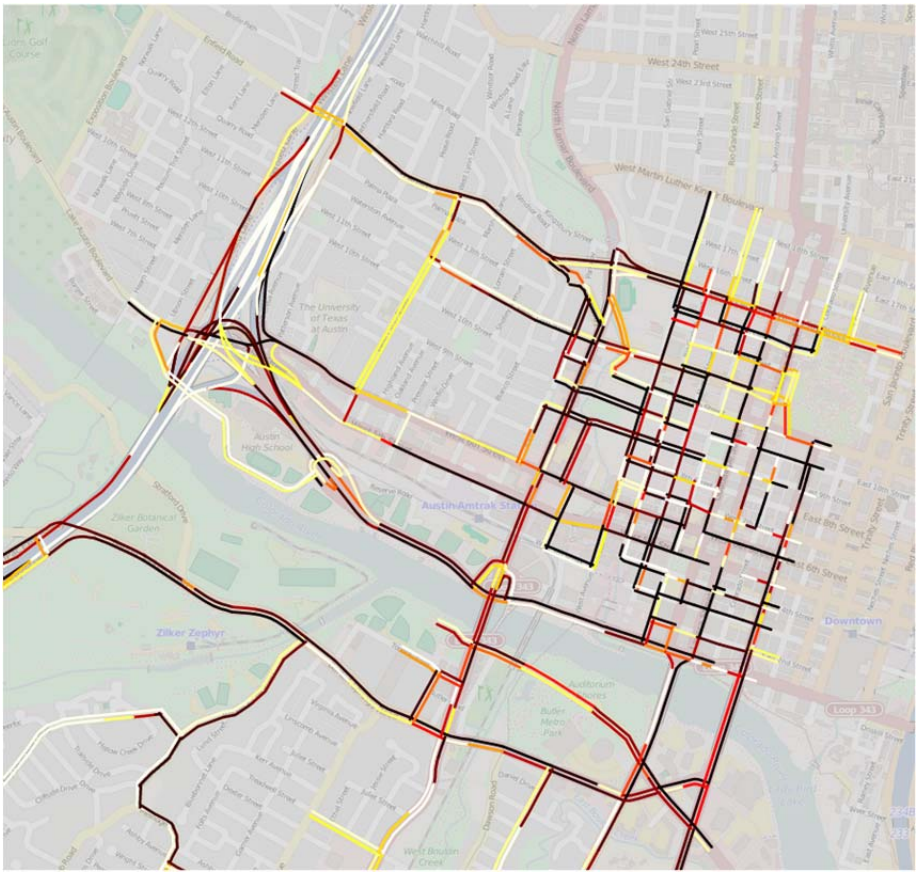


Figure 25. Congestion on Area Roadways in the No-Build Scenario (PM Peak Period)

For the PM peak period, Figure 25 illustrates heavy congestion throughout the study area in the No-Build Scenario. Congestion also persists on the ramp connections with MoPac, in particular those through the Lake Austin Boulevard/Cesar Chavez Street interchange. For the Build scenarios illustrated in Figure 26, congestion largely persists in the downtown area. Significant alleviation of congestion is shown through the aforementioned interchange, as well as along Barton Springs Road west of Lamar Boulevard. The figures clearly demonstrate better traffic flow in these areas as a result of the Build scenario improvements to MoPac.

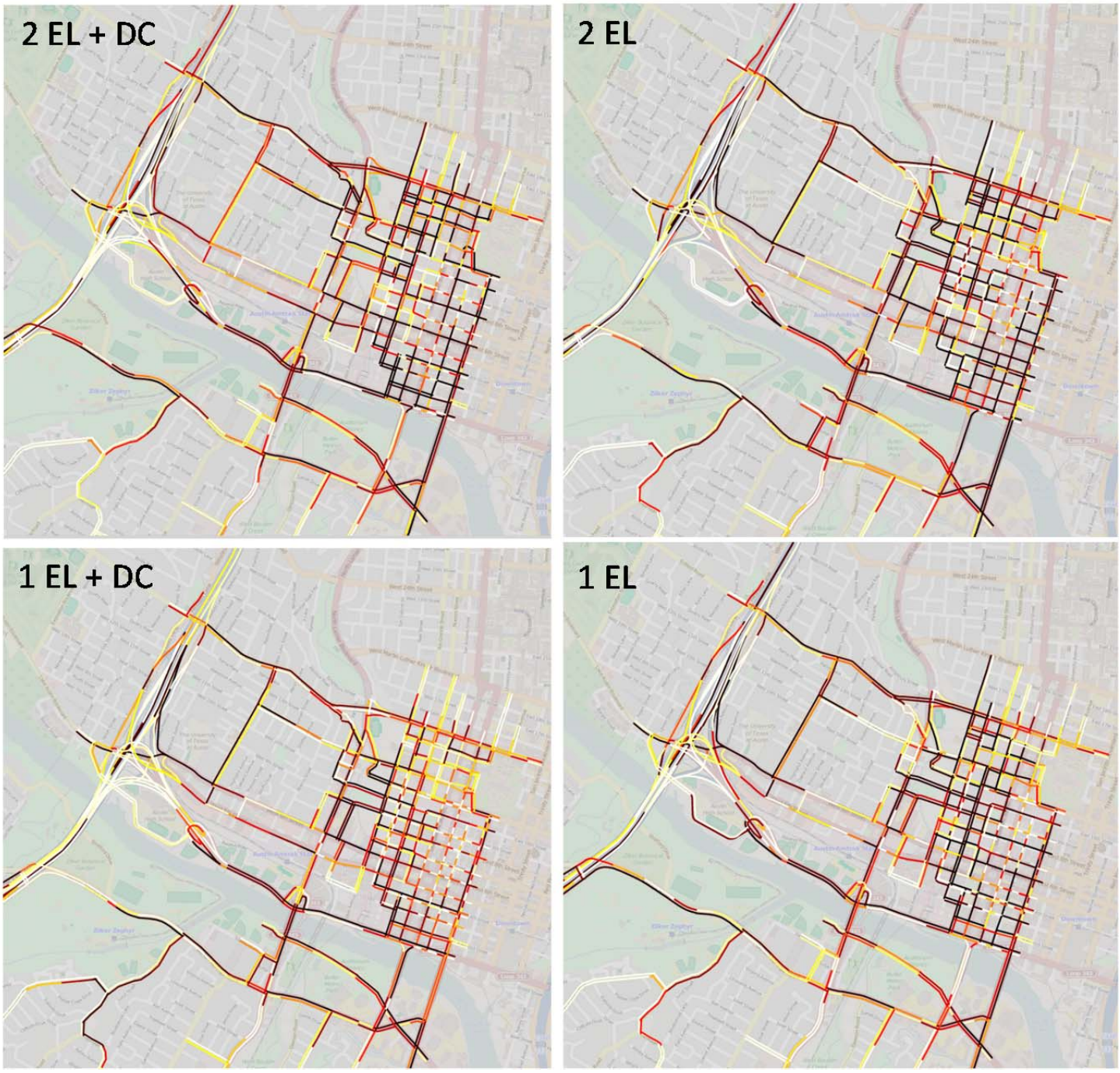


Figure 26. Congestion on Area Roadways in the Build Scenarios (PM Peak Period)

4. CONCLUSIONS

Overall, the construction of MoPac South express lanes is not anticipated to negatively impact downtown Austin. Travel times and volumes in the morning peak period remain relatively constant across scenarios. This is a result of relatively consistent travel patterns across scenarios for those conditions, though some changes affecting 5th Street and Enfield Road were found. The model results demonstrated a number of more substantial differences between scenarios for the afternoon peak period.

Travel times in the afternoon peak period decrease in the Build scenarios versus the No-Build Scenario. This is a result of improved conditions at the interchange of MoPac at Lake Austin Boulevard/Cesar Chavez Street. Alleviation of congestion and improved access to MoPac in the vicinity of the interchange contributes to reduced travel times along major corridors in the study area. While not all sections improve consistently, the Build scenarios generally result in lower travel times in the area.

With the improved operations at the interchange, an increase in volume was found along 6th Street, particularly for traffic heading west along Lak Austin Blvd or south along MoPac. With downstream conditions improving for westbound Cesar Chavez Street, along with access to MoPac, additional northbound MoPac traffic was found to use this corridor west of Lamar Boulevard (compared to the No-Build Scenario). This was especially evident with Scenarios 1 and 3, where changes in travel patterns in this area caused some congestion to form elsewhere.

For both the morning and afternoon peak periods, average travel times throughout the model area and the study area were found to improve in the Build Scenarios when compared to the No-Build Scenario. This was more evident for the afternoon peak. Additionally, inbound throughput during the morning peak period and outbound throughput during the afternoon peak period were found to increase. Again, this was largely attributable to improved conditions at the interchange of MoPac at Lake Austin Boulevard/Cesar Chavez Street, as well as better flow along south MoPac with the added capacity.

APPENDIX A
ROADWAY VOLUMES

Table A.1. AM Peak Period Traffic Volumes

	Scenario				
Roadway Location	**No-Build**	**2 EL + DC**	**2 EL**	**1 EL + DC**	**1 EL**
EB Cesar Chavez St W of Lamar Blvd	5,600	5,500	5,250	5,200	5,000
WB Cesar Chavez St W of Lamar Blvd	3,100	3,650	3,350	3,750	3,600
5th St E of MoPac	4,650	4,900	4,900	5,100	4,700
6th St E of MoPac	1,950	2,150	2,100	2,150	2,450
EB Enfield Rd E of MoPac	4,200	4,100	4,200	4,150	4,250
WB Enfield Rd E of MoPac	1,900	1,800	1,800	1,850	1,700
EB Barton Springs Rd W of Lamar Blvd	3,150	2,850	3,400	2,900	3,650
WB Barton Springs Rd W of Lamar Blvd	3,150	2,200	2,550	2,000	2,200
NB Lamar Blvd Bridge	4,950	5,650	5,300	5,600	5,800
SB Lamar Blvd Bridge	2,650	2,250	2,350	2,500	2,250
NB 1st St Bridge	2,380	2,550	2,400	2,600	2,500
SB 1st St Bridge	3,200	3,300	2,850	3,100	2,800
NB Congress Ave Bridge	7,050	6,550	6,950	6,750	7,050
SB Congress Ave Bridge	4,450	4,150	4,750	4,200	4,750
SB MoPac Express Lanes at Barton Skwy	-	1,800	1,300	1,650	1,250
NB MoPac Express Lanes at Barton Skwy	-	4,500	2,800	4,150	2,600
SB MoPac Express Lanes at Lake Austin	-	1,350	1,300	1,250	1,250
NB MoPac Express Lanes at Lake Austin	-	2,200	2,800	2,100	2,600
SB Express Direct-connector Ramp	-	450	-	400	-
NB Express Direct-connector Ramp	-	2,300	-	2,050	-

Table A.2. PM Peak Period Traffic Volumes

	Scenario				
Roadway Location	**No-Build**	**2 EL + DC**	**2 EL**	**1 EL + DC**	**1 EL**
EB Cesar Chavez W of Lamar Blvd	5,350	4,600	5,050	4,900	4,750
WB Cesar Chavez W of Lamar Blvd	6,250	6,000	6,150	5,950	5,750
5th St E of MoPac	4,650	5,050	5,100	5,600	4,700
6th St E of MoPac	2,800	4,650	4,200	4,500	4,350
EB Enfield Rd E of MoPac	3,700	3,800	3,900	3,800	3,900
WB Enfield Rd E of MoPac	5,500	5,250	5,650	5,300	5,550
EB Barton Springs Rd W of Lamar Blvd	2,000	2,050	1,900	1,800	1,850
WB Barton Springs Rd W of Lamar Blvd	5,500	4,700	4,800	4,700	4,950
NB Lamar Bridge	5,000	5,500	5,800	5,700	5,400
SB Lamar Bridge	8,150	7,000	7,100	7,150	7,100
NB 1st St Bridge	2,450	2,750	2,700	2,350	2,700
SB 1st St Bridge	4,700	4,450	4,450	5,050	4,750
NB Congress Bridge	7,500	6,950	6,950	6,900	6,950
SB Congress Bridge	9,050	9,400	9,800	9,100	9,200
SB MoPac Express Lanes at Barton Skwy	-	7,600	4,800	6,350	4,950
NB MoPac Express Lanes at Barton Skwy	-	6,300	5,200	6,000	5,950
SB MoPac Express Lanes at Lake Austin	-	4,750	4,800	4,200	4,950
NB MoPac Express Lanes at Lake Austin	-	5,100	5,200	4,700	5,950
SB Express Direct-connector Ramp	-	2,850	-	2,100	-
NB Express Direct-connector Ramp	-	1,200	-	1,300	-

APPENDIX B
CORRIDOR TRAVEL TIMES

Note: The information provided in this appendix supplements information presented earlier in the report with more disaggregate travel time results along key corridors in the study area.

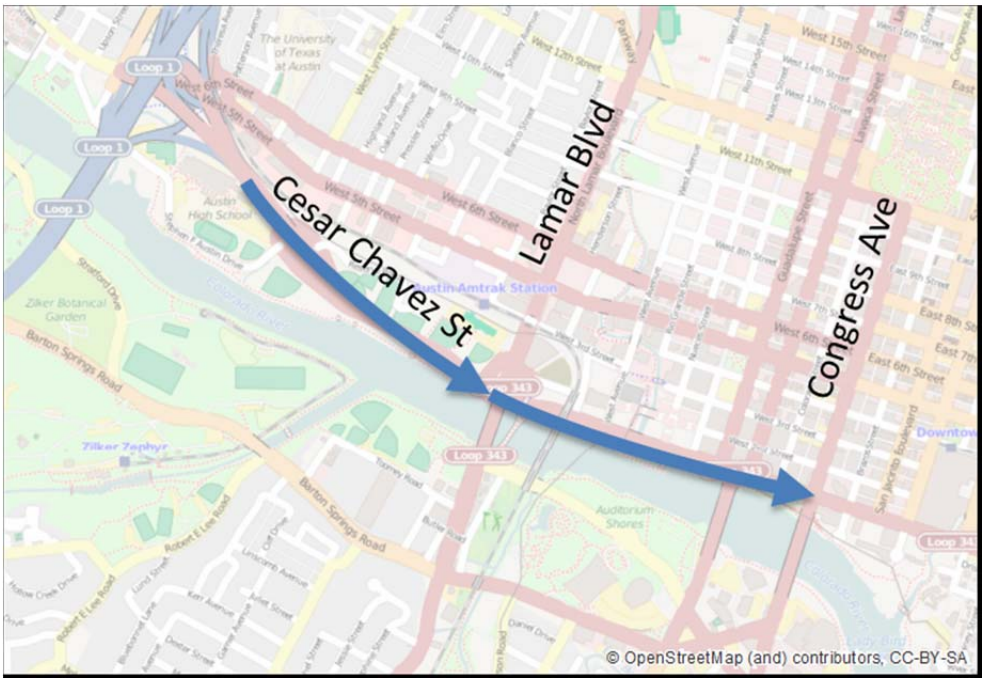


Figure B.1. Travel Time Limits for Eastbound Cesar Chavez Street

Table B.1. Eastbound Travel Time along Cesar Chavez Street (AM Peak Period)

Travel Time in Minutes			
Scenario	Mopac Merge to Lamar Blvd	Lamar Blvd to Congress Ave	Total
No-Build	2.5	2.9	5.3
2 EL + DC	2.1	2.9	5.1
2 EL	2.0	2.9	4.9
1 EL + DC	1.9	2.9	4.8
1 EL	2.6	2.9	5.4

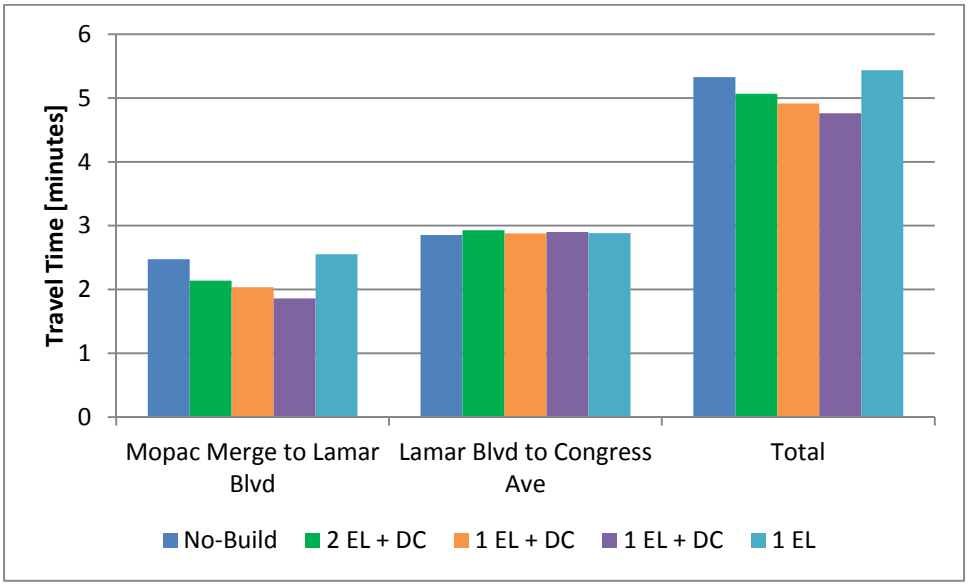


Figure B.2. Eastbound Cesar Chavez Street Travel Time (AM Peak Period)

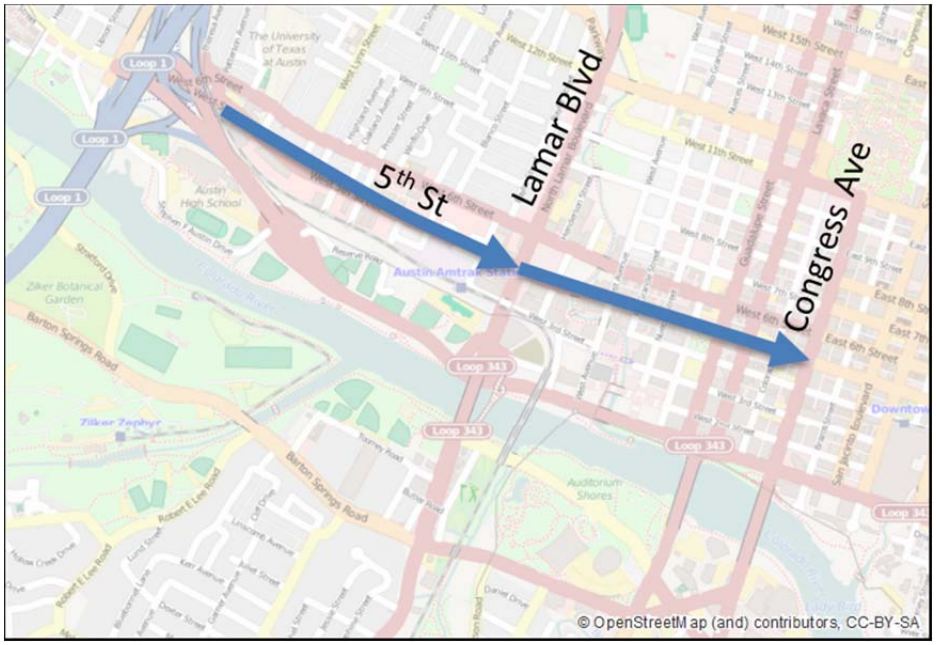


Figure B.3. Travel Time Limits for 5th Street

Table B.2. Travel Time along 5th Street (AM Peak Period)

Travel Time in Minutes			
Scenario	Mopac Merge to Lamar Blvd	Lamar Blvd to Congress Ave	Total
No-Build	2.4	3.5	5.8
2 EL + DC	2.6	3.4	6.0
2 EL	2.5	3.5	6.0
1 EL + DC	2.5	3.4	5.9
1 EL	2.6	3.4	6.0

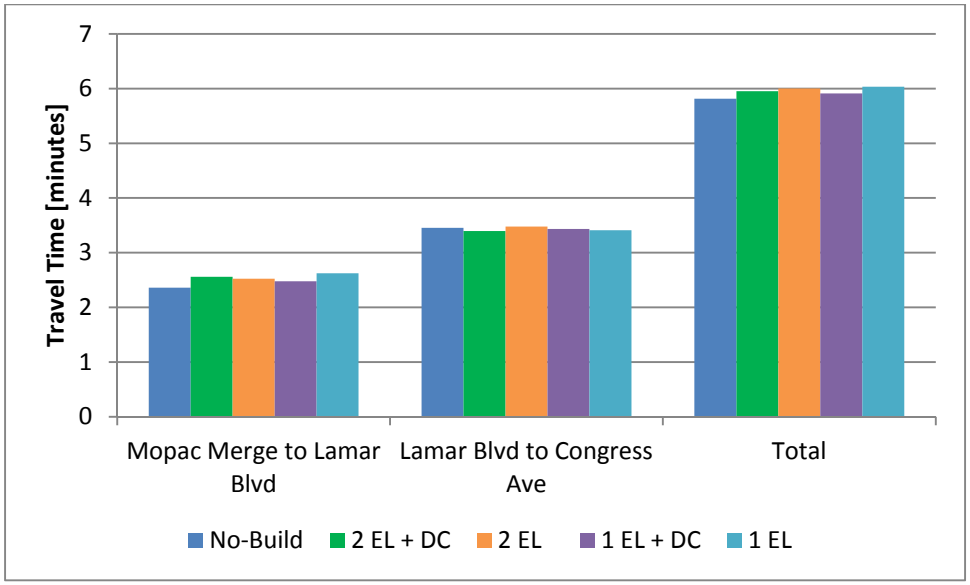


Figure B.4. 5th Street Travel Time (AM Peak Period)

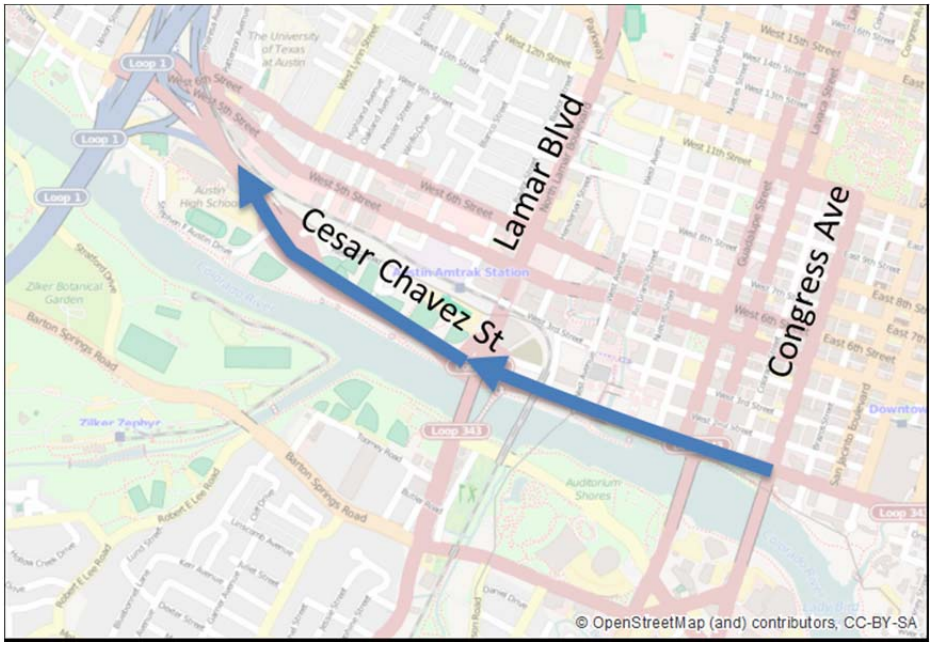


Figure B.5. Travel Time Limits for Westbound Cesar Chavez Street

Table B.3. Westbound Travel Time along Cesar Chavez Street (PM Peak Period)

Travel Time in Minutes			
Scenario	Congress Ave to Lamar Blvd	Lamar Blvd to Mopac Diverge	Total
No-Build	26.5	6.8	33.3
2 EL + DC	25.3	5.2	30.5
2 EL	24.5	5.1	29.6
1 EL + DC	20.1	5.1	25.2
1 EL	19.4	4.5	23.9

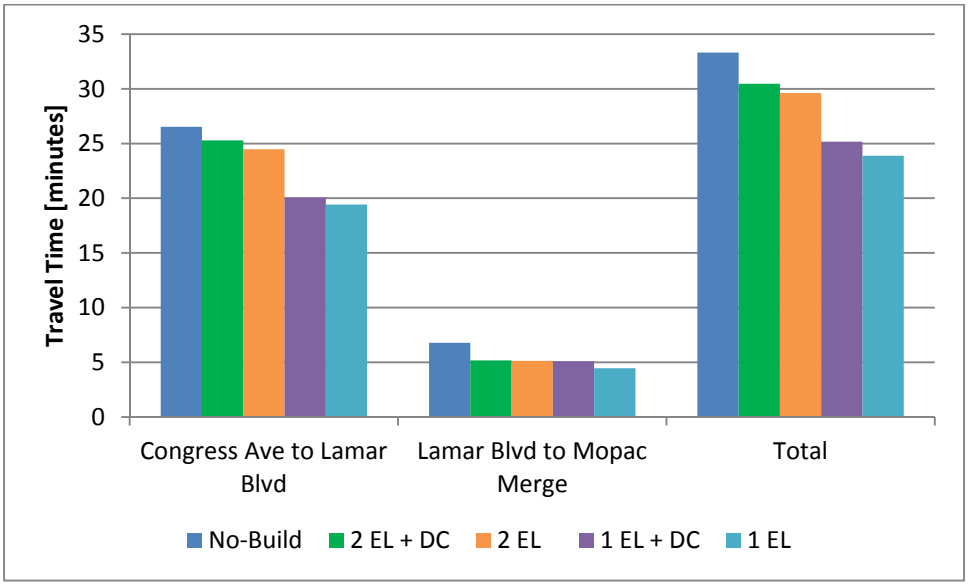


Figure B.6. Westbound Cesar Chavez Street Travel Time (PM Peak Period)

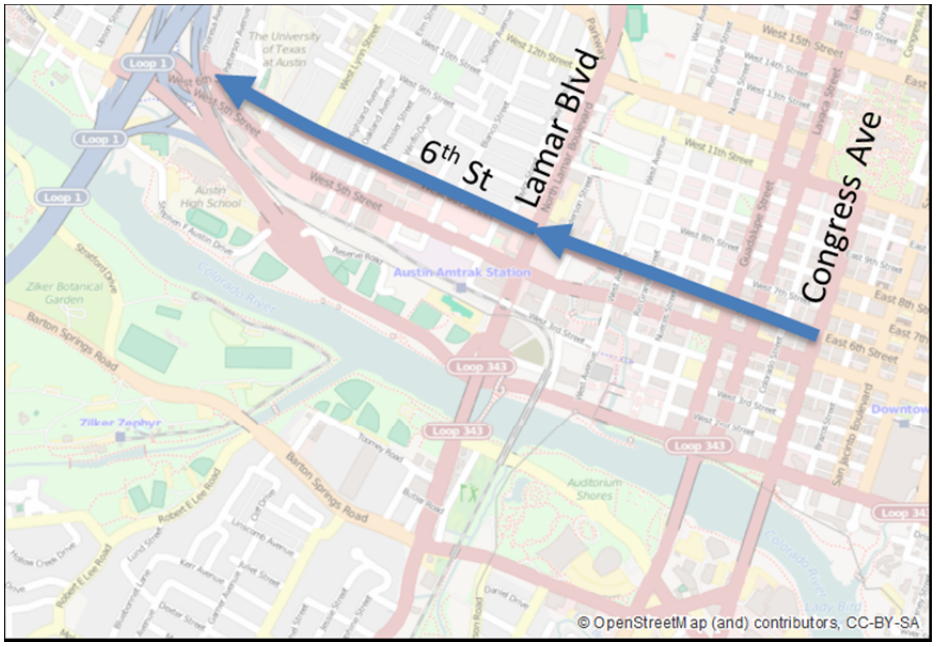


Figure B.7. Travel Time Limits for 6th Street

Table B.4. Travel Time along 6th Street (PM Peak Period)

Travel Time in Minutes			
Scenario	Congress Ave to Lamar Blvd	Lamar Blvd to Mopac Diverge	Total
No-Build	41.7	3.6	45.3
2 EL + DC	20.1	3.4	23.5
2 EL	20.4	9.1	29.5
1 EL + DC	17.8	4.4	22.2
1 EL	14.0	4.5	18.5

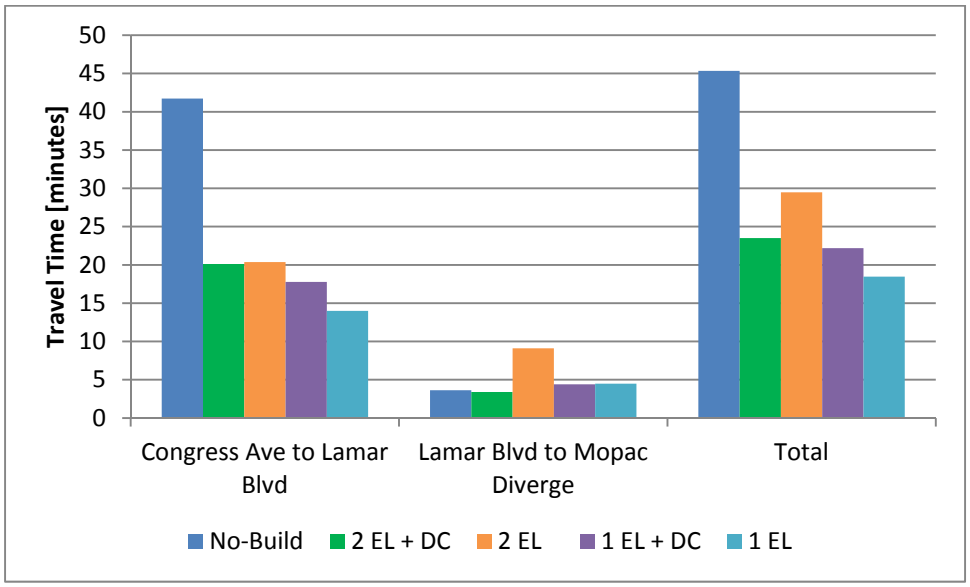


Figure B.8. 6th Street Travel Time (PM Peak Period)