

# Lamar Avenue Corridor Study

# final report

*prepared for*

**Tennessee Department of Transportation**

*prepared by*

**Cambridge Systematics, Inc.**

*In association with*

**University of Memphis**

**Kimley-Horn & Associates**



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Cambridge Systematics, Inc.  
730 Peachtree Street, NE, Suite 1050  
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*date*

June 2011

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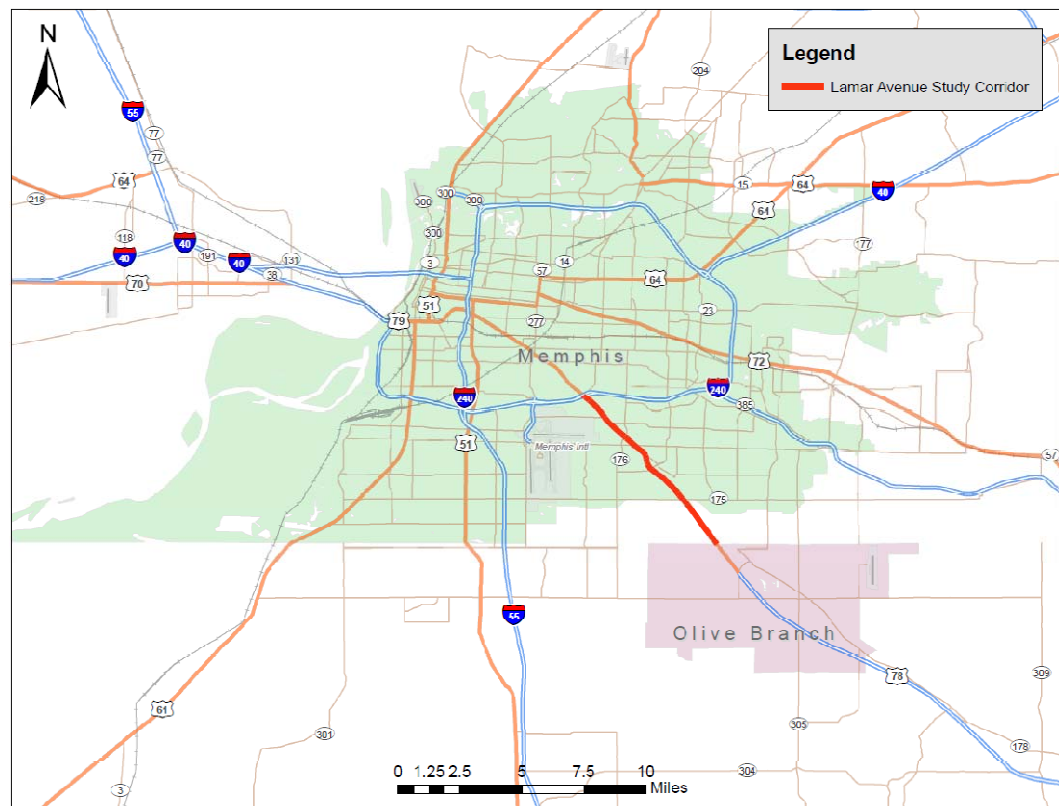
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# Executive Summary

This purpose of this study is to identify transportation improvements needed for the Lamar Avenue Corridor. Lamar Avenue (U.S. 78) is a major roadway in Memphis, Tennessee that begins just southeast from downtown Memphis and runs southeast ending at the Tennessee border with Mississippi. At the Mississippi border, Lamar Avenue becomes Corridor X and the corridor continues its alignment south through Mississippi to Birmingham, Alabama. The portion of the corridor under study for this project starts at I-240 and ends at the Mississippi state line (Figure ES.1).

Figure ES.1 Regional Overview of Lamar Avenue Corridor



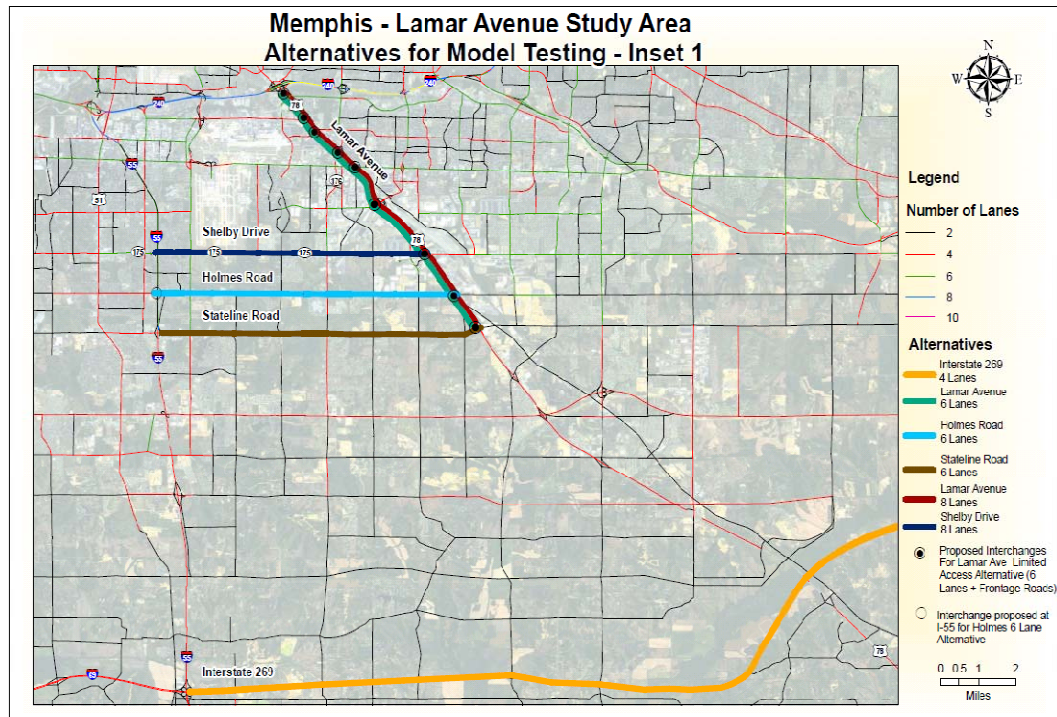
## ALTERNATIVES ANALYZED

The alternatives analyzed in this study were done in two phases. In the first phase, a total of seven capacity improving options were identified for improving travel conditions on Lamar Avenue. In the second phase, eleven options were considered that included a mix of operational improvements and the

development of new interchanges at key locations. These options were developed from project meetings involving several stakeholders including: the Tennessee DOT, the Memphis MPO, the Memphis Chamber of Commerce Aerotropolis committee, and the consultant team. The seven capacity alternatives are described below with build alternatives shown in Figure ES.2. The eleven interchange options are described later in this executive summary starting in Table ES.4.

1. **No-Build** - E+C network, including base year subarea validation adjustments.
2. **Holmes Road with Six Lanes** - Between I-55 on the west end and Lamar Avenue on the east end. A new interchange also was coded where Holmes Road intersects with I-55. This ensures that Holmes provides a suitable bypass route off Lamar from the South to I-55/I-240 in the north.
3. **Stateline Road with Six Lanes** - Between I-55 and Lamar Avenue. A new interchange was coded between Lamar Avenue and an extended Stateline alignment. Stateline in the E+C scenario does not intersect with Lamar at the interchange location necessitating the eastward extension. This option also provides a suitable bypass route around Lamar Avenue.
4. **Shelby Drive with Eight Lanes** - Between I-55 and Lamar Avenue and represents an addition of one lane in each direction. This option provides another bypass route test. Given the location of Shelby Drive, however, a significant amount of through traffic would still traverse the southern portions of Lamar Avenue.
5. **Lamar Avenue with Six Lanes** - From Stateline Road to I-240. The corridor already is six lanes on the north end of the corridor which then drops off to four lanes south of Getwell Road.
6. **Lamar Avenue with Eight Lanes** - From Stateline Road to I-240.
7. **Lamar Limited Access Expressway** - The final option tested and the most difficult to code was converting the Lamar Avenue corridor to a limited access highway. Included in this option are a series of frontage roads and slip ramps on the northern end of the alignment to attempt to provide driveway access to the local businesses currently being served by Lamar Avenue.

Figure ES.2 Map of Alternatives Analyzed for Lamar Avenue Corridor



## TRAFFIC IMPACTS OF CAPACITY ENHANCEMENT ALTERNATIVES

Traffic impacts of the operational alternative were estimated using microsimulation modeling. The first operational alternative considered was the synchronization of traffic signals on Lamar Avenue. The second alternative considered was to make minor operational improvements in the corridor at the only two intersections where right-of-way was available – Lamar Avenue at Holmes Road and Lamar Avenue at Shelby Drive. Unfortunately, the microsimulation indicated that traffic volumes in 2030 were too large for operational improvements to have a significant impact on the traffic conditions in the study area.

Traffic impacts for the other alternatives were estimated using the Memphis MPO travel demand model. Table ES.1 provides a summary of the model output statistics from each of these alternatives along with the estimated cost of each alternative. Overall, the results indicate that the travel benefits of the alternatives can be ranked from best to worst as followed:

- Upgrading Lamar Avenue to Interstate (Alternative 7);
- Adding lanes to Lamar Avenue (Alternatives 5, 6);

- Diversion Alternatives (Alternatives 2, 3, and 4); and
- No-Build (Alternative 1).

Upgrading Lamar Avenue to an Interstate has the largest impact on reducing average delay on the corridor. This alternative reduces travel time on Lamar Avenue by 8.86 minutes relative to the No-Build alternative. This is a reduction of over 50 percent. Making Lamar Avenue six or eight lanes also has a substantial impact on average delay and travel time. These alternatives reduce travel time on Lamar Avenue by 4.44 minutes and 5.53 minutes, respectively. The diversion alternatives do not reduce travel time on Lamar Avenue significantly. Similarly, upgrading Lamar Avenue to an Interstate has the largest impact on total delay for the entire study area.

**Table ES.1 Summary Traffic Impacts of Capacity Enhancement Alternatives**

Performance Measure	No-Build E+C	Six-Lane Holmes with New I-55 Interchange	Six Lanes Stateline with Lamar Interchange	Eight Lanes Shelby	Six-Lane Lamar	Eight-Lane Lamar	Upgrading Lamar to Interstate
Alternative	1	2	3	4	5	6	7
Cost (Millions of Dollars)	–	\$58.6	\$169.1	\$65.5	\$89.1	\$254.7	\$637.9
Lamar Travel Time (Minutes)	16.81	16.23	15.56	16.54	12.37	11.28	7.95
Lamar Total Delay (Vehicle Hours)	492,658	445,458	397,215	471,133	313,424	248,869	113,412
Lamar Truck Delay (Truck Hours)	117,668	96,094	88,816	101,031	61,324	45,021	24,191
Lamar Vehicle-Miles Traveled	397,981	383,585	388,094	390,385	600,202	679,407	711,840
Study Area Total Delay (Vehicle Hours)	2,748,000	2,504,115	2,507,440	2,557,469	2,528,163	2,427,403	2,097,663
Study Area Vehicle-Miles Traveled	5,582,900	5,507,907	5,513,894	5,490,579	5,708,131	5,693,764	5,657,424
V/C Ratio (South of Perkins Int)	1.84	1.76	1.79	1.75	1.18	1.01	1.45
Truck Volume (South of Shelby Drive)	12,947	11,684	11,876	12,911	15,101	15,387	15,406

## BENEFIT/COST RATIOS FOR CAPACITY IMPROVING ALTERNATIVES

TDOT has developed a method to monetize travel benefits and create direct benefit/cost ratios for corridor improvement alternatives. This methodology was first developed as part of the I-40/I-81 Corridor Feasibility Study, and it

currently is being applied to the I-75 Corridor Feasibility Study. The benefit/cost ratio methodology for the statewide corridors was established based on estimating the following four categories of performance metrics:

1. Recurrent delay;
2. Nonrecurrent delay;
3. Safety; and
4. Air quality.

For the Lamar Avenue Corridor Study, nonrecurrent delay is not included in this benefit/cost analysis, because none of the alternatives are designed specifically to address this issue. Similarly, safety is not incorporated in the benefit/cost analysis. The Lamar Avenue corridor is short relative to statewide corridors, so that fatalities do not occur with any discernible pattern that can be reasonably addressed through the capacity enhancement alternatives that are considered as part of this study.

To develop, benefit/cost ratios for each alternative, the monetary value of each of the performance metrics that was calculated based on national standards that have been developed as part of the Federal Highway Administration Highway Economic Requirement System (HERS). The monetary values for each of the performance metrics are shown in Table ES.2.

**Table ES.2 Monetary Value of Performance Metrics**

Performance Metric	Monetary Value
Recurrent Delay for Automobiles	\$19.82/hour of delay
Recurrent Delay for Trucks	\$36.05/hour of delay
Automobile Air Pollution Costs	\$0.011 per VMT
Truck Air Pollution Costs	\$0.039 per VMT

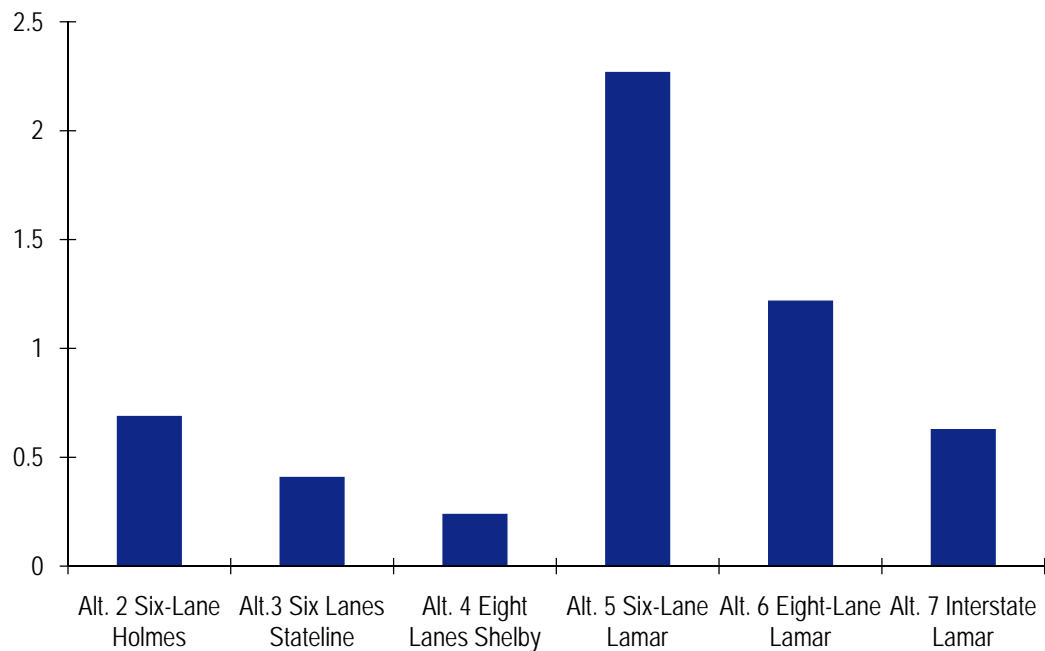
Source: FHWA, Highway Economic Requirements System: Technical Report, U.S. Department of Transportation, 2002.

The benefit/cost ratios were estimated by spreading project costs evenly over 30 years and comparing the annualized project costs to monetized traffic benefits in 2030. The estimates are shown for each alternative in Table ES.3 and Figure ES.3. The highest B/C ratio is for making Lamar Avenue a six-lane facility with a ratio of 2.27. The next highest ratio is making Lamar Avenue an eight-lane facility with a B/C ratio of 1.22. These are the only two alternatives with benefits that are higher than costs in 2030. Upgrading Lamar Avenue to an Interstate has the highest amount of benefits as shown in Table 6.9. However, due to the high cost of this alternative, the B/C ratio for this alternative is the third highest of all of the ones considered for this study at 0.63.

**Table ES.3 Cost Per Change in Lamar Avenue VMT**

Metric (Millions of Dollars)	Change in Miles Traveled Relative to No-Build					
	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
2030 Project Benefits	\$2.2	\$4.6	\$0.8	\$10.2	\$13.7	\$20.7
2030 Project Costs	\$3.2	\$11.3	\$3.4	\$4.5	\$11.3	\$32.7
2030 B/C Ratio	0.69	0.41	0.24	2.27	1.22	0.63

**Figure ES.3 Benefit/Cost Ratios by Capacity Improving Alternatives**



## PERFORMANCE OF INTERCHANGE IMPROVEMENTS

Figure ES.4 and Table ES.4 show the LOS and calculated travel speeds along the study corridor. Except for the interstate alternative, the data in the table is the average of the A.M., P.M., northbound, and southbound MOEs gathered from the Synchro Arterial Analysis Reports. For the interstate alternative, the data shown are for the full day time period in 2030, so the data for this alternative are not directly comparable to the other alternatives. The averages for each option were utilized in order to provide comparable MOEs across each alternative. As shown in Figure ES.4, the arterial travel speed of the non-interstate options ranges from 21.4 to 34.9 miles per hour. This is significantly lower than the 50 miles per hour average posted speed limit of the corridor.



The results of the analysis show that adding interchanges to Lamar Avenue increase travel speeds and generally increase LOS. 6-Laning Lamar Avenue with all three interchanges has the highest average travel speeds at 34.9 mph. This alternative has an average travel speed of more than 10 mph. This alternative has a 10 percent higher travel speed than only building interchanges without adding more capacity on Lamar Avenue. It has a 20 percent higher travel speed than 8-laning Lamar Avenue with no interchanges, and it has nearly a 30 percent higher travel speed than 6-laning Lamar Avenue with no interchanges.

Figure ES.4 also shows the average speeds for constructing each interchange by itself using the assumption that Lamar Avenue is increased to six lanes. The results show that the interchange at Shelby Drive is the best performing single interchange generating 28.2 mph average travel speeds on the corridor. Developing an interchange at Winchester Road comes in a close second with an average travel speed of 27.1 mph, and Holmes Road is a more distant third with 25.7 mph.

An analysis of the best two intersections shows that developing interchanges at Winchester Road and Shelby Drive provide the most travel speed benefits. Its average travel speed of 32.9 mph is slightly higher than the speed achieved by leaving Lamar Avenue with four lanes and developing interchanges at all three intersections. It is also just 8 percent lower than developing interchanges at all three intersections and 6-laning Lamar Avenue. Developing interchanges at Winchester Road and Shelby Drive provides nearly 25 percent higher travel speeds than simply making Lamar Avenue eight lanes without interchanges.

Note that the four-lane operational improvements alternative without interchanges has slightly lower performance relative to the no build. This is due to the increased use of “protected-only” left turn phases along the corridor where double left turn lanes are utilized. The individual intersections associated with the four-lane operational improvements alternative without interchanges may operate better than the no build. However, the net effect on the Lamar Avenue corridor is calculated to be slightly worse.

### **Delay and Travel Time Results for Each Alternative**

Figure ES.5 and Table ES.5 summarize the delay and travel time along the study corridor. As with Figure ES.4, the data in the table is the average of the A.M., P.M., northbound, and southbound MOEs gathered from the Synchro Arterial Analysis Reports, except for the interstate alternative. The travel time on the corridor ranges from 7.9 minutes under free flow conditions to 18.2 minutes with the four lane operational improvements alternative without interchanges. The delay for the non-interstate, non-free flow alternatives range from 3.3 minutes for the top performing alternative to 10.3 minutes for the four-lane operational improvements without interchanges alternative.

Similar to the results for the speed analysis, the alternative of 6-laning Lamar Avenue with all three interchanges provides the best performance of the non-

interstate alternatives. This alternative has just 3.3 minutes of average delay in the simulation results. The next closest alternative is 6-laning Lamar Avenue with interchanges at Winchester Road and Shelby Drive followed closely by leaving Lamar Avenue at four lanes with interchanges at all three intersections. These alternatives have 4.0 minutes and 4.4 minutes of average delay respectively.

Each of the top three alternatives perform significantly better than simply 6-laning or 8-laning Lamar Avenue without any interchanges. Therefore, these results reinforce the notion that developing interchanges has significant travel benefits for the corridor.

**Table ES.4 Lamar Avenue LOS and Speed**

Alternative	Cost (\$ Millions)	Number of Mainline Lanes	Arterial Speed (mph)	Percent Improve- ment	LOS Range
Alt. 1 – No Build	-	4	22.1	n/a	C-F
Alt. 1A – Operational improvements without interchanges	9.4	4	21.4	-3%	D-F
Alt. 5 – 6-lane, no ints	89.1	6	24.5	11%	C-E
Alt. 6 – 8-lane, no ints	254.6	8	27.9	26%	C-D
Alt. 5H – 6-lane, int. at Holmes	109.2	6	25.7	16%	C-E
Alt. 5W – 6-lane, int at Winchester	142.4	6	27.1	23%	C-D
Alt. 5S – 6-lane, int. at Shelby	195.6	6	28.2	28%	C-D
Alt. 5HW – 6-lane, int. at Holmes and Winchester	162.4	6	28.4	29%	C-D
Alt. 5HS – 6-lane, int. at Holmes and Shelby	215.7	6	29.7	35%	C-D
Alt. 5WS – 6-lane, int. at Winchester and Shelby	248.9	6	32.9	49%	B-C
Alt. 5HWS – 6-lane, int. at Holmes, Winchester and Shelby	275.1	6	34.9	58%	B-C
Alt. 5HWS-4L – 4-lane, int. at Holmes, Winchester, and Shelby	213.2	4	31.8	44%	B-C
Alt. 7 - Upgrading Lamar Avenue to an Interstate	637.9	4	56.6	156%	B

Note: Current Lamar Avenue free-flow speed (bidirectional) is 50 mph.

Figure ES.4 Lamar Avenue Bidirectional Speeds (mph)

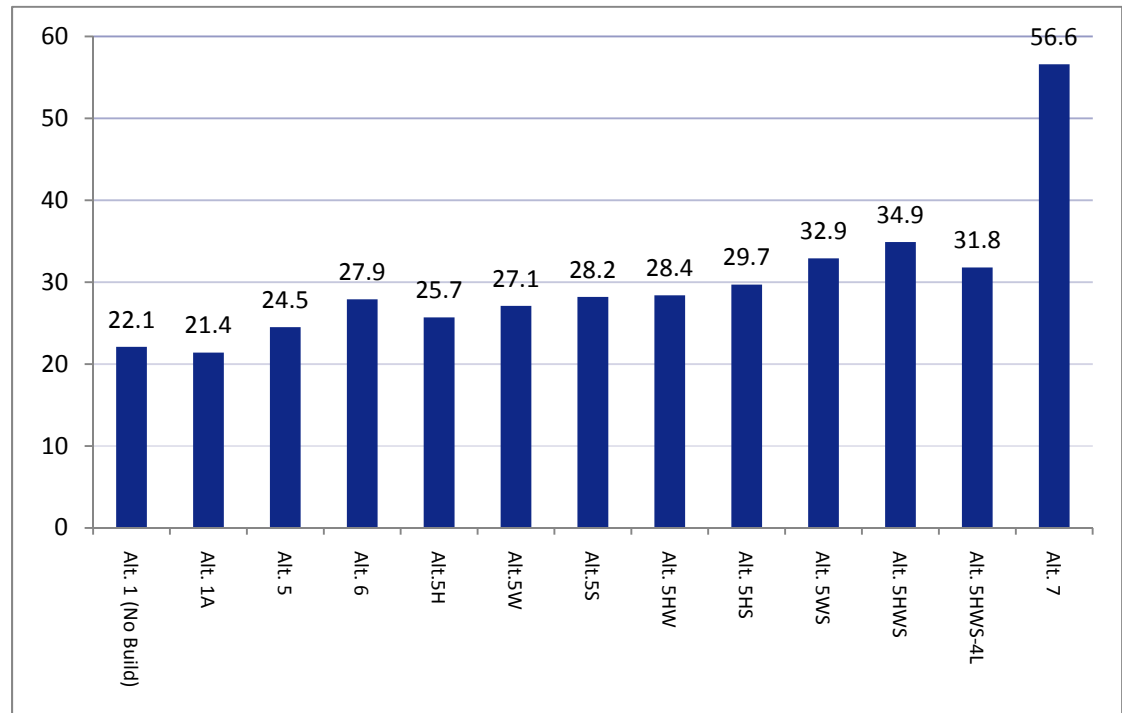
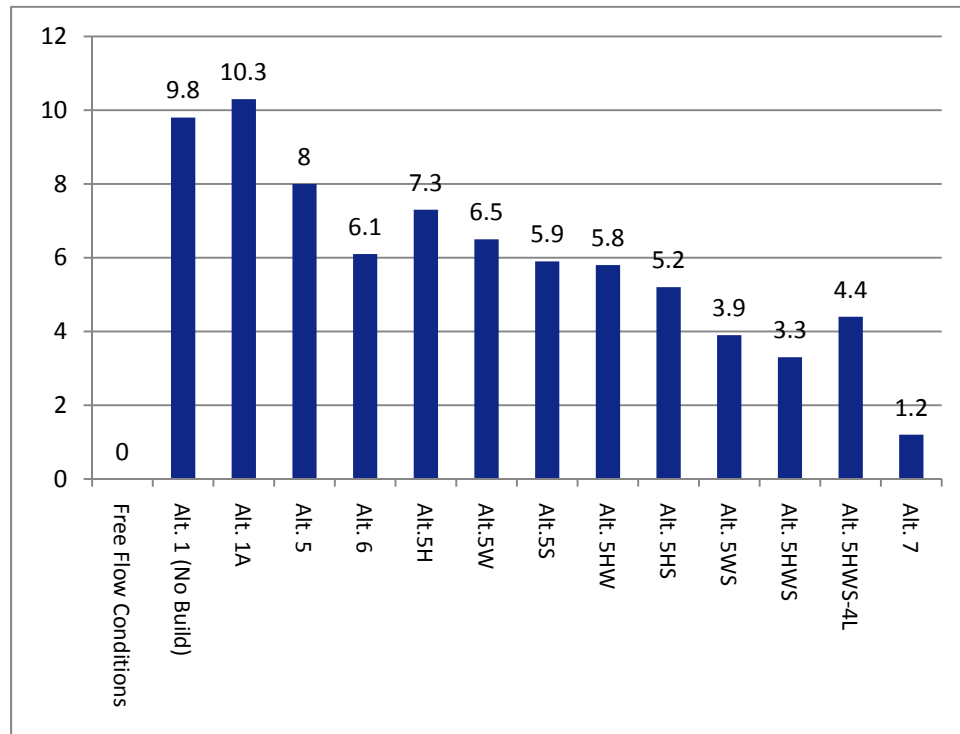


Table ES.5 Lamar Avenue Delay and Travel Time

Arterial	Number of Mainline Lanes	Arterial Speed (mph)	Travel Time (minutes)	Delay (minutes)
Free Flow Conditions	6	49.6	7.9	0.0
Alt. 1 – No Build	4	22.1	17.7	9.8
Alt. 1A – Operational improvements without interchanges	4	21.4	18.2	10.3
Alt. 5 – 6-lane, no ints	6	24.5	15.9	8.0
Alt. 6 – 8-lane, no ints	8	27.9	14.0	6.1
Alt. 5H – 6-lane, int. at Holmes	6	25.7	15.2	7.3
Alt. 5W – 6-lane, int at Winchester	6	27.1	14.4	6.5
Alt. 5S – 6-lane, int. at Shelby	6	28.2	13.8	5.9
Alt. 5HW – 6-lane, int. at Holmes and Winchester	6	28.4	13.7	5.8
Alt. 5HS – 6-lane, int. at Holmes and Shelby	6	29.7	13.1	5.2
Alt. 5WS – 6-lane, int. at Winchester and Shelby	6	32.9	11.8	3.9
Alt. 5HWS – 6-lane, int. at Holmes, Winchester and Shelby	6	34.9	11.2	3.3
Alt. 5HWS-4L – 4-lane, int. at Holmes, Winchester, and Shelby	4	31.8	12.3	4.4
Alt. 7 - Upgrading Lamar Avenue to an Interstate	4	56.6	8.0	1.2

Figure ES.5 Lamar Avenue Delay (Minutes)



## KEY FINDINGS

Lamar Avenue is a severely congested roadway impacting the operation of several freight facilities in the study area. Impacted facilities include the newly expanded BNSF yard, the Memphis International Airport, and several warehouses and distribution centers in the study area. This study has analyzed several alternatives for improving traffic conditions in Lamar Avenue over a long-term horizon. There are several key conclusions from this analysis as follows:

- **Signalization and road geometry improvements are insufficient to provide notable benefits to the Lamar Avenue corridor.** Options such as signal timing and geometric improvements fail to deliver significant benefits, because congestion on the corridor overwhelms the benefits of these improvements.
- **Upgrading Lamar Avenue to an Interstate provides the most traffic relief benefits for Lamar Avenue.** It reduces delay the most both for Lamar Avenue and for the study area as a whole. It also provides the lowest travel time for traveling the entire length of Lamar Avenue. It also provides a

seamless connection to I-22, which has been constructed along the Lamar Avenue alignment in Mississippi.

- **Making Lamar Avenue eight or six lanes for its entire alignment between the Mississippi state line and I-240 provides the second and third highest traffic impacts** to the corridor and the study area. These alternatives provide relatively high amounts of congestion relief to Lamar Avenue and the study area, including significantly reduced travel time on the corridor. These alternatives also preserve connectivity between Lamar Avenue and the multitude of freight-related facilities in the study area.
- **The diversion alternatives do not provide a significant amount of traffic impacts to the corridor.** This is likely due to the diversion benefits of I-269, as mentioned earlier. These alternatives do not significantly improve traffic along Lamar Avenue.
- **Adding lanes to Lamar Avenue provide the highest benefit/cost ratios for all of the Lamar Avenue improvements.** This is because their costs are significantly lower than upgrading Lamar Avenue to an Interstate. Making Lamar Avenue eight lanes provides roughly two-thirds of the benefit of upgrading Lamar to an Interstate with only one-third of the cost. Making Lamar Avenue six lanes provides half the benefit with only one-sixth of the costs.
- **Upgrading key intersections along Lamar Avenue to interchanges would be a cost-effective, near-term enhancement to the corridor.** Simulation analysis demonstrated that interchanges at Shelby Drive, Winchester Road, and Holmes Road provided efficient traffic improvements to assist in accommodating the near-term traffic demand in the corridor.



## 2.0 Introduction

### 2.1 BACKGROUND OF STUDY

This purpose of this study is to identify transportation improvements needed for the Lamar Avenue Corridor. Lamar Avenue (U.S. 78) is a major roadway in Memphis, Tennessee that begins just southeast from the core of downtown Memphis and runs southeast ending at the Tennessee border with Mississippi. At the Mississippi border, Lamar Avenue becomes Corridor X and the corridor continues its alignment south through Mississippi to Birmingham, Alabama. The portion of the corridor under study for this project starts at I-240 and ends at the Mississippi state line (Figure 2.1).

This report summarizes the alternatives analysis conducted for this corridor. A separate report, Lamar Avenue Corridor – Existing Data and Conditions, describes the current operations in the corridor based on available count data, travel time runs, land use data, intersection analysis, and travel demand model outputs.

### 2.2 OVERVIEW OF CORRIDOR

There are several important facilities that are located in the corridor's study area, including the Memphis International Airport, the Burlington Northern Santa Fe (BNSF) railyard, and several economically important warehouses and distribution centers (Figure 2.2). Lamar Avenue becomes I-22 as it crosses into Mississippi, and ultimately this roadway connects Memphis to Birmingham, Alabama; Atlanta, Georgia; and other major metropolitan cities in the Southeast.

The BNSF railyard recently expanded its container handling capacity from 318,000 20-foot equivalent units (TEU) to 500,000 TEUs. The increased truck traffic is a cause for concern and one of the primary drivers for studying this corridor. Lamar Avenue also is used for commuting by residents in the neighborhoods to the east of the corridor and residents in Olive Branch, Mississippi, one of the fastest growing cities in the past decade. Thus, in addition to its importance for freight, this corridor is critical for passenger traffic. The total corridor under study between the Mississippi state line and I-240 is approximately 7.5 miles. This corridor consists of 30 intersections, 13 of which are signalized as shown in Figure 2.2.

The land use around Lamar Avenue in the study area is predominantly industrial, underscoring the importance of this corridor for freight. There also is a scatter of commercial/office uses and residential uses along the corridor and a cluster of agricultural use near the Mississippi state line.

Figure 2.1 Regional Overview of Lamar Avenue Corridor

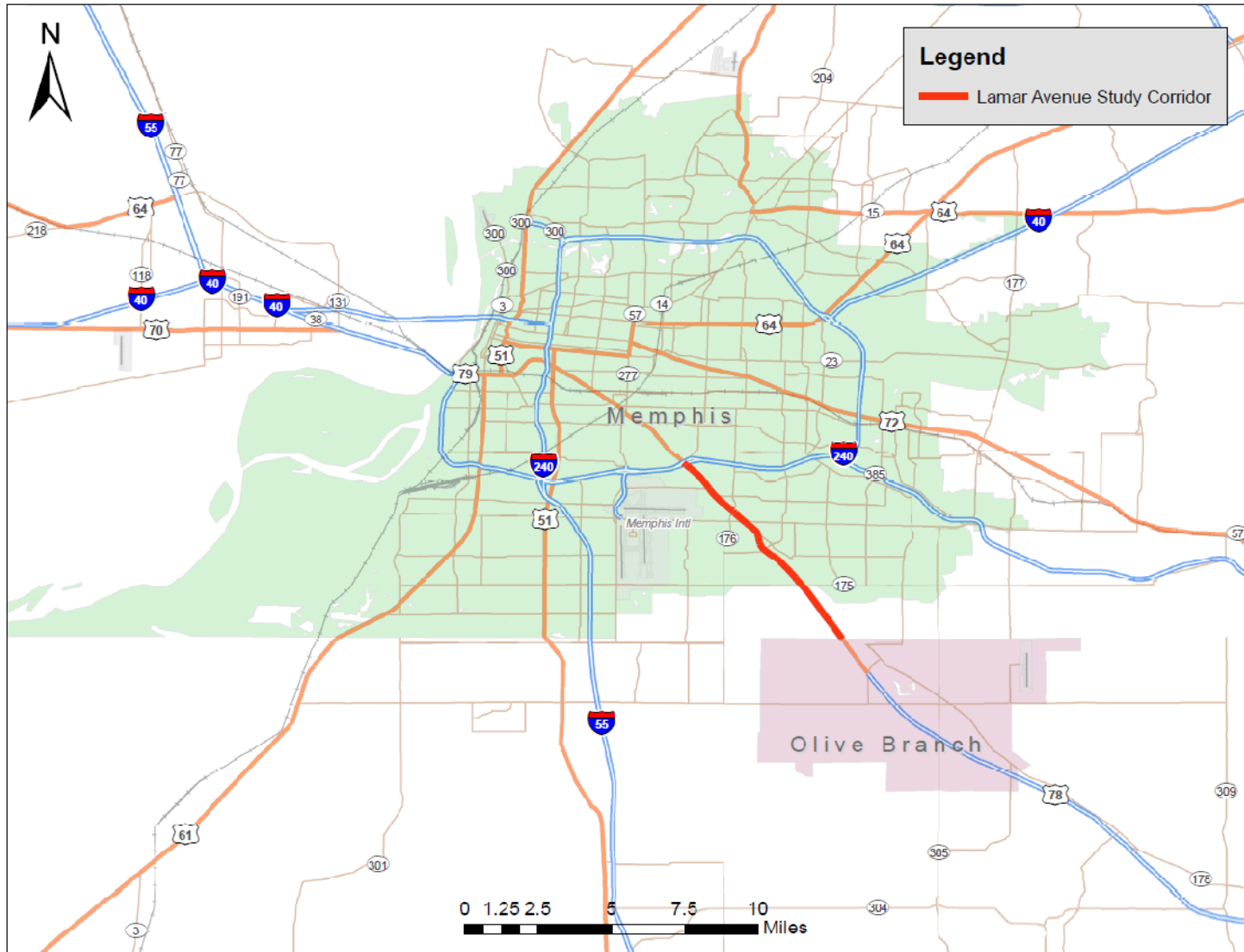
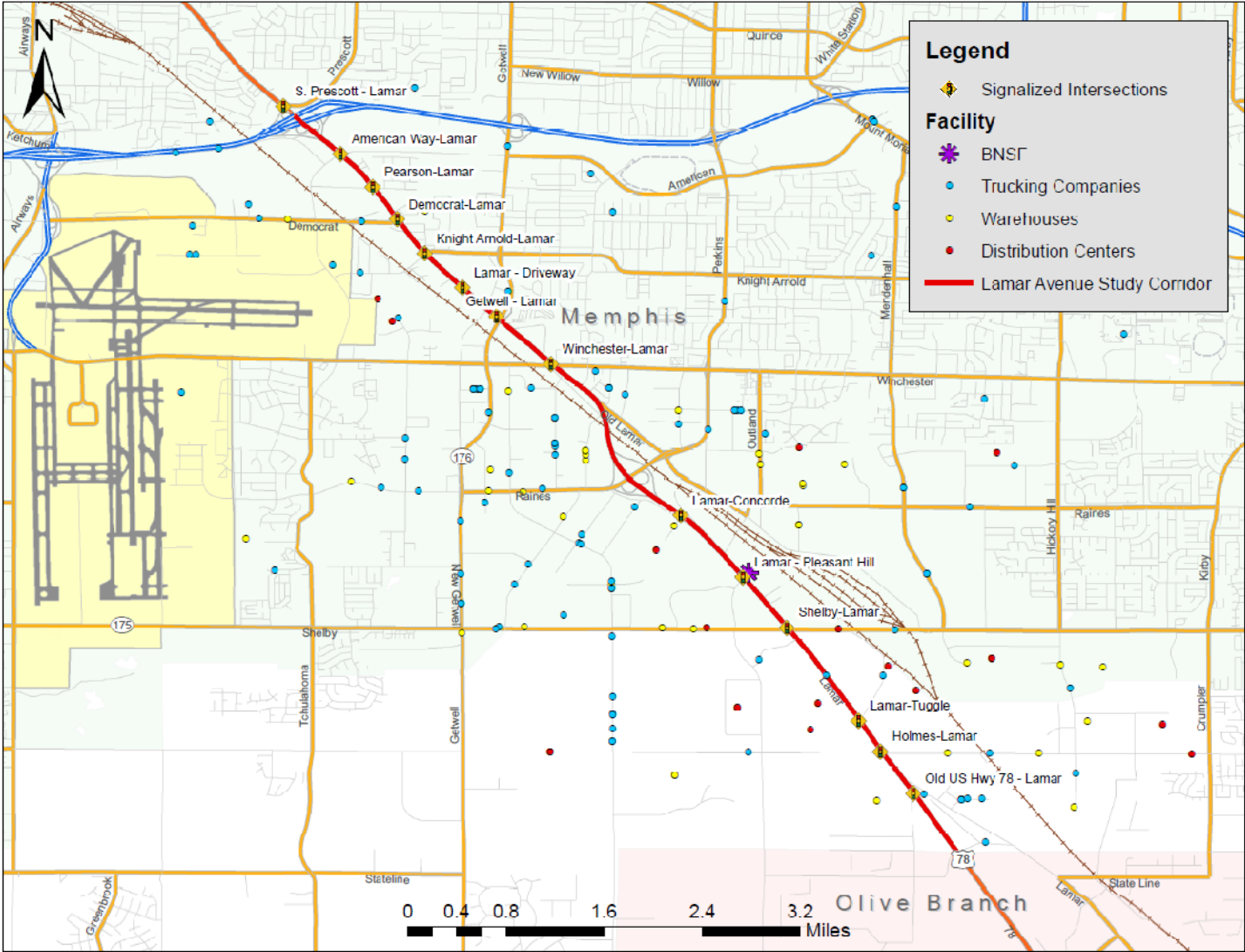




Figure 2.2 Key Facilities on Lamar Avenue





## 3.0 Deficiencies Identified on Lamar Avenue

### 3.1 CURRENT INTERSECTION LEVEL OF SERVICE

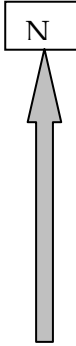
The University of Memphis utilized turning count data collected by the City of Memphis to conduct a level of service analysis (LOS) of nine intersections on Lamar Avenue in June 2009. The level of service analysis was conducted for four separate periods: a.m. peak; lunch peak; mid-afternoon; and p.m. peak hour. A summary of the level of service is shown in Table 3.1. The key findings from this level of service analysis are as follows:

- Overall, the corridor operates at LOS D during all time periods and as an average throughout the day with the exception of the mid-afternoon time period which operates at LOS C.
- Winchester Road and Shelby Drive operate at LOS F throughout the entire day.
- Holmes Drive operates at LOS E or F throughout the entire day. Given the lower volumes using this intersection, it indicates that intersection improvements are warranted at this location.
- The southern end of the corridor operates at a much lower LOS than the northern end of the corridor. The northern end of the corridor operates between LOS B and D throughout most of the day. This can be contrasted with the southern end of the corridor, which operates at LOS E or F at many intersections throughout the entire day.
- There is wide variability in the LOS throughout the corridor indicating that an intersection-by-intersection approach must be used to identify potential solutions for the corridor. This includes looking at overall LOS at intersections and examining turning movement patterns to identify capacity and road geometry solutions that work with the existing traffic flow.

The LOS analysis indicates that the Shelby Drive intersection with Lamar Avenue is congested for all periods of the day. This makes Shelby Drive the worst performing intersection on the corridor and it is consistent with the high volumes of turning traffic in all directions at Shelby Drive.

**Table 3.1 Average Level of Service in Lamar Avenue at Various Times**

Intersection	Peak Hour				Average
	a.m. (7:30-8:30)	Lunch (11:30-12:30)	Midday (2:30-3:30)	p.m. (4:30-5:30)	
Lamar at American Way	C	C	D	F	D
Lamar at Pearson	B	D	B	B	C
Lamar at Democrat	C	E	B	B	C
Lamar at Knight Arnold	B	C	B	C	C
Lamar at Winchester	F	F	F	F	F
Lamar at Concorde	E	B	A	B	C
Lamar at Shelby	F	F	F	F	F
Lamar at Tuggle	E	F	A	B	D
Lamar at Holmes	F	E	E	F	F
Average	D	D	C	D	D



Source: University of Memphis Analysis, June 2009.

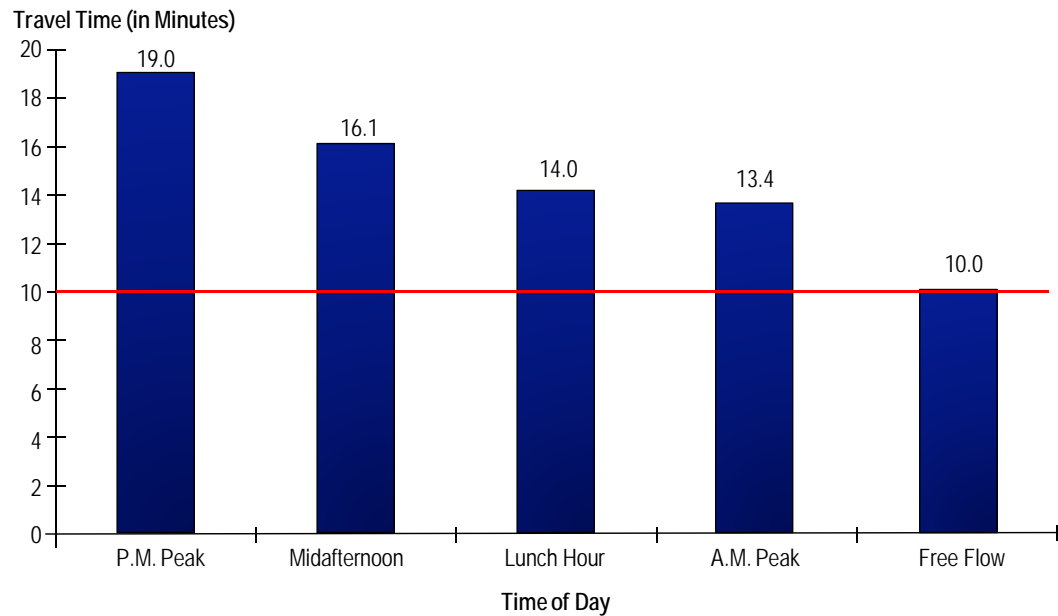
### 3.2 CURRENT TRAVEL TIME FOR ENTIRE CORRIDOR

Figures 3.1 and 3.2 show the average travel times runs in the southbound and northbound direction for the entire corridor. These travel times were estimated based on dozens of travel time runs of Lamar Avenue Corridor using the median speed technique. The median speed technique estimates travel time by operating the data collection car such that the car is passed by as many vehicles as the car passes. As shown in Figure 3.1, in the southbound direction, the minimum travel time is in the a.m. peak period with an average total travel time of 13.4 minutes through the corridor. The travel time in the corridor gets progressively worse as the day progresses, so that during the p.m. peak period, the average total travel time is 19.0 minutes. This compares to an estimated free-flow travel time of 10.0 minutes. Therefore, the average increase in travel time between the free-flow conditions and the p.m. peak period is approximately 90 percent. The average travel speeds along the corridor decrease from 34 mph during the a.m. peak period to 24 mph during the p.m. peak period. This compares to an average free-flow speed of 40 mph under free-flow conditions.

Figure 3.2 shows that the average total travel time in the northbound direction is the highest in the a.m. peak period with a travel time of 17.7 minutes. This is 18.8 percent higher than the p.m. peak-period total travel time of 14.9 minutes, and it is 77 percent higher than the estimated free-flow travel time in the northbound direction of 10 minutes. This is a lower percentage increase than the differential in the southbound direction. The travel speed in the northbound direction is 26 mph in the a.m. peak period and roughly 30 mph for the other three periods, which also illustrates the lesser differences in the southbound direction relative to the northbound direction.

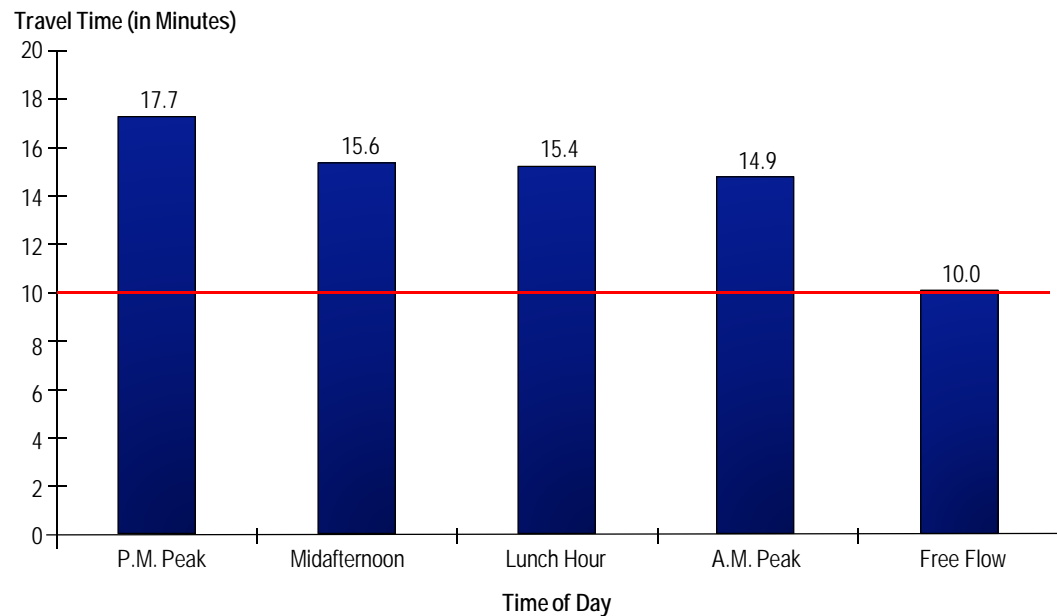
The nature of the congestion in the corridor also confirms that there is a significant amount of commute-related traffic. The northbound direction has the longest travel times in the a.m. peak period when commuters from neighborhoods east of the corridor and as far south as Olive Branch, Mississippi use Lamar Avenue to get to employment centers in downtown and midtown Memphis. Conversely, in the southbound direction, the longest travel times are during the p.m. peak period as commuters return home using Lamar Avenue.

**Figure 3.1 Average Travel Time Across Corridor**  
*Southbound*



Source: University of Memphis Travel Time Study, July 2009.

**Figure 3.2 Average Travel Time Across Corridor  
Northbound**



Source: University of Memphis Travel Time Study, July 2009.

### 3.3 DESCRIPTION OF TRAVEL DEMAND MODEL ADJUSTMENTS

Model validation testing and truck assignment comparisons were performed to evaluate the suitability of the model for the analysis at hand. Testing indicated that the Memphis model as delivered required a number of validation adjustments to be made before it could be used as a base-case scenario benchmark.

Model validation adjustments were made in three principal areas:

1. The traffic analysis zone (905) that houses the intermodal rail yard was split. The split left the warehouses in the original zone now numbered 10034 and the intermodal-specific activity in the newly split zone 10033.
2. The centroid connectors in the area were realigned and in some case, additional centroid connectors were included to help with validation over/under assignments along some key links, including Lamar Avenue and Shelby Drive.
3. Following attempts to adjust the speeds via congestion factors based on area type and facility type, the posted speeds were adjusted on Lamar Avenue, Shelby Drive, Interstate 55 between Shelby Drive and I-240 as well as some of

the ramps. Speeds in the Memphis model are not populated from Speed/Capacity tables which necessitated this action.

After conducting eight iterative base year model runs and adjustments involving the areas mentioned above, the model was deemed to be producing truck volumes and validation statistics within the study subarea that were suitably good to be used as a baseline scenario. This included verifying consistency of key truck movements with the findings of a recent truck following study conducted by the University of Memphis.

With the baseline assumptions complete, a forecast year (2030) run was performed on an existing-plus-committed (E+C) network with the same assumptions and modifications as used in the base year. The split zone was assumed to have 2,000 truck trips per day in 2030 heading into and out of the intermodal yard based on growth trends in intermodal business activity. To accommodate this special situation, the truck productions and attractions were hard-coded into the zone file following trip generation. The values used were 1,000 trips for productions and attractions, respectively. This was necessary as the Memphis model previously only had accommodations for four special generator zones which are the Airport, the FedEx Superhub 2) and a Graceland zone. No special generator facilitation is made in the model for other zones.

Each alternative was run with the transit modeling aspects turned off. This was done to facilitate consistency in comparisons between options. The coded Lamar Interstate alternative necessitated breaking many transit links and recoding transit in the area. This implied a level of effort that was beyond the resources in time and budget available for this study and was thus not undertaken. To ensure an even set of comparisons, transit was thus “turned off” for all the other alternative model runs, including the 2030 E+C baseline.

### **3.4 PERFORMANCE BASED ON TRAVEL DEMAND MODEL**

The area under study is deemed to operate poorly given the large volume of truck movements along the corridor causing traffic delays, especially in the vicinity of the Lamar Avenue intersection with Shelby Drive. Anticipated intermodal yard expansion and general freight traffic growth is likely to exacerbate the problem, which can be attributed partially to poor roadway geometry for the truck volumes present.

As part of this study, travel demand modeling was performed using the 2030 Memphis Metropolitan Planning Organization (MPO) regional travel demand model to analyze several potential Lamar Avenue capacity improvement options with specific attention paid to truck impacts. The model outputs indicate that there will continue to be high levels of congestion on Lamar Avenue based on future traffic volume projections along with Existing and Committed projects in the study area. The current conditions volume-to-capacity indicates that most of

Lamar Avenue is already operating above 1.0 which is considered congested. The 2030 travel demand model output shows that the volume-to-capacity ratio along Lamar Avenue deteriorates further in the future years such that the V/C ratio is as high as 2.0 at some locations. This would indicate that Lamar Avenue will become a severely congested corridor in 2030.

Overall, the analysis of this section demonstrates that there are significant deficiencies along Lamar Avenue. This is demonstrated based on travel time runs, intersection analysis, and travel demand model runs. More detailed information on these analyses is provided in the earlier report, *Lamar Avenue Corridor – Existing data and Conditions*.



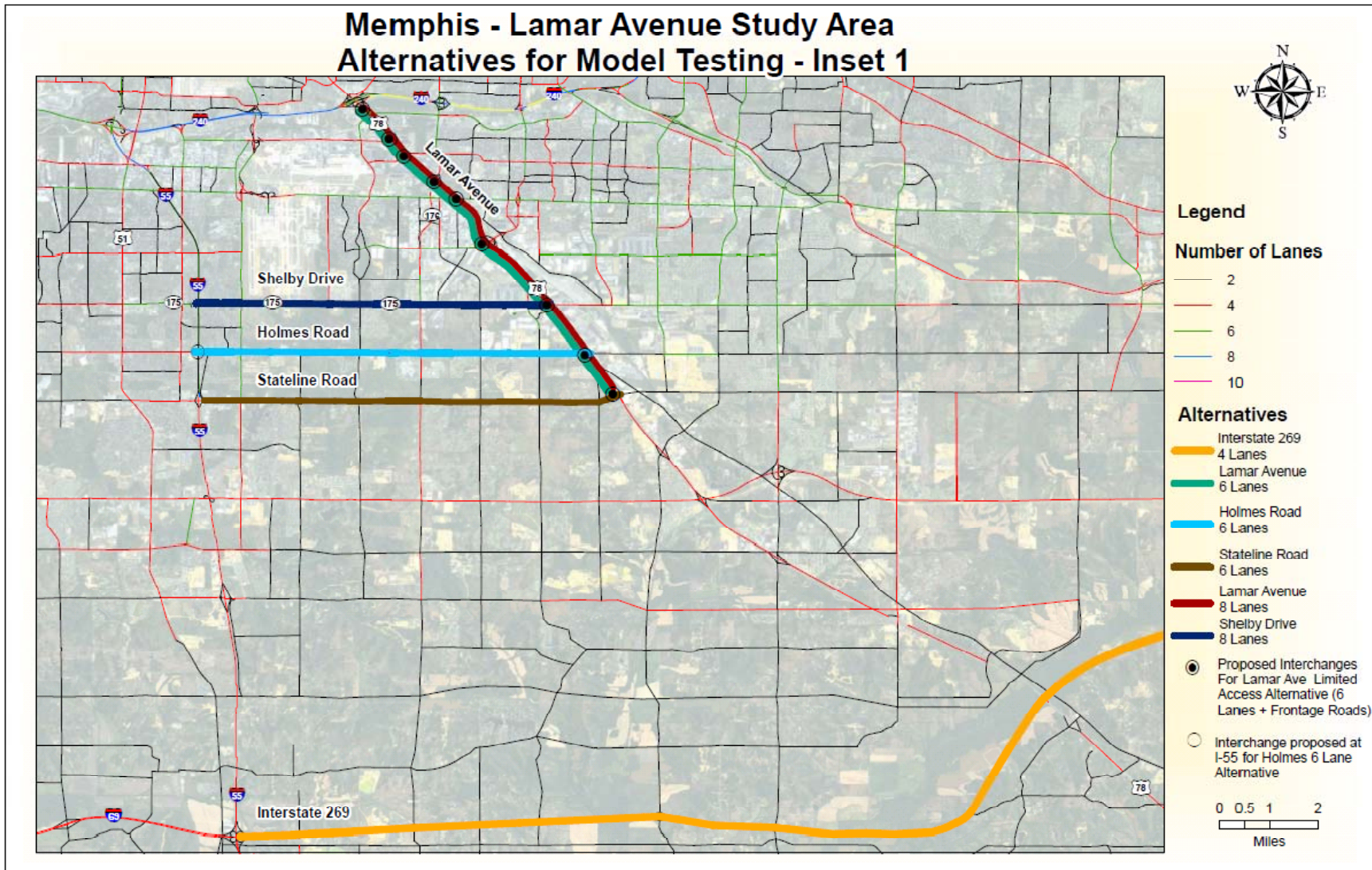
## 4.0 Description of Alternatives – Capacity Options

A total of seven options were conceived, coded in the model and tested against a base case (no-build) scenario. These options were developed through project meetings involving the consultant team, the Tennessee DOT, the Memphis MPO, and the Memphis Chamber of Commerce. These alternatives can be grouped into three categories: 1) do nothing, 2) divert traffic around Lamar Avenue, and 3) upgrade Lamar Avenue.

All seven alternatives were coded, all starting from the 2030 E+C baseline network. These include in order of run sequence:

1. **No-Build** – E+C network, including base year subarea validation adjustments.
2. **Holmes Road with Six Lanes** – Between I-55 on the west end and Lamar Avenue on the east end. A new interchange also was coded where Holmes Road intersects with I-55. This ensures that Holmes provides a suitable bypass route off Lamar from the South to I-55/I-240 in the north.
3. **Stateline Road with Six Lanes** – Between I-55 and Lamar Avenue. A new interchange was coded between Lamar Avenue and an extended Stateline alignment. Stateline in the E+C scenario does not intersect with Lamar at the interchange location necessitating the eastward extension. This option also provides a suitable bypass route around Lamar Avenue.
4. **Shelby Drive with Eight Lanes** – Between I-55 and Lamar Avenue and represents an addition of one lane in each direction. This option provides another bypass route test. Given the location of Shelby Drive, however, a significant amount of through traffic would still traverse the southern portions of Lamar Avenue.
5. **Lamar Avenue with Six Lanes** – From Stateline Road to I-240. The corridor already is six lanes on the north end of the corridor which then drops off to four lanes south of Getwell Road.
6. **Lamar Avenue with Eight Lanes** – From Stateline Road to I-240.
7. **Interstate Type Facility** – The final option tested and the most difficult to code was converting the Lamar Avenue corridor to a limited access highway. Included in this option are a series of frontage roads and slip ramps on the northern end of the alignment to attempt to provide driveway access to the local businesses currently being served by Lamar Avenue.

Figure 4.1 Alternatives for Model Testing



## 4.1 TYPICAL CROSS SECTIONS AND COST ESTIMATES

Typical sections for each build alternative were developed and were used to estimate the construction quantities per unit length of the improvement. The cross sections were developed using the existing and proposed laneage, edge of travel way treatments, median treatments, pedestrian way, and right-of-way widths. Standard unit prices from the 2009 Tennessee Department of Transportation (TDOT) Average Unit Prices from awarded contracts were applied to the quantities to estimate the opinion of probable construction cost. The total costs developed using this methodology were compared to per mile costs maintained by the project planning office for similar type projects. Preliminary engineering costs will be estimated based on a percentage of the construction cost.

The costs for right-of-way are made up of land and improvement acquisition, incidentals, damages, and relocation payments. Right-of-way land acquisition costs were initially estimated using an average of sampled appraised values in terms of cost per acre for properties along the corridor from the Shelby County and DeSoto County Assessors of Property. Incidentals were estimated using a per property cost for each parcel disturbed as part of the evaluated alternative. Damages were estimated based on unit prices for loss of access and parking. Improvement costs were based on assessed values from the Shelby County and DeSoto County Assessors of Property.

In January 2010 as part of a separate effort, TDOT Region 4 developed cost estimates for widening State Route 4 / U.S. Route 78 (Lamar Avenue) in three segments to an eight lane facility. The three segments were as follows:

- Mississippi/Tennessee State Line to approximately 2,700' south of Shelby Drive,
- 2,700' south of Shelby Drive to Raines Road/Perkins Road, and
- Raines Road/Perkins Road to Getwell Road.

Based on TDOT Region 4 right-of-way experience with right-of-way acquisition, unit prices for land and improvement acquisition, incidentals, damages, and relocation payments were adjusted. In addition to these adjustments and consistent with Region 4 right-of-way practice, the overall multiplier to account for contingencies was increased from 43% of the right-of-way costs to 60%.

Utilities relocation costs were based on an average cost per mile of reimbursable and nonreimbursable utilities for an assumed average service line size for the following:

- Water;
- Gas;
- Electric;

- Stormwater sewer;
- Sanitary sewer; and
- Overhead electric.

The average cost per mile for reimbursable and nonreimbursable utilities were used for the Lamar Avenue improvements, as well as the diversion alternatives. Cost to relocate major utilities, such as transmission towers or underground cross-country pipelines were estimated based on the type of improvement and the potential impact.

Table 4.1 shows the estimated costs for each alternative.

**Table 4.1 Cost Estimates by Alternative**

Alternative	Length (Miles)	Description	Total Cost
1	0	No-Build	–
2	4.6	Widen Holmes Road to Six Lanes between Lamar Avenue and I-55, with an Interchange at I-55	\$58,606,000
3	6.9	Widen Stateline Road to a Six-Lane Facility with Concrete Median	\$169,070,000
4	5.5	Widen Shelby Drive to Eight Lanes between Lamar Avenue and I-55	\$65,500,000
5	5.2	Widen U.S. 78/Lamar Avenue to a Six-Lane Facility	\$89,104,000
6	6.9	Widen U.S. 78/Lamar Avenue to an Eight-Lane Facility	\$254,645,000
7	6.9	Improve U.S. 78/Lamar Avenue to an Interstate Type Facility	\$637,914,000

## 5.0 Model Output Statistics

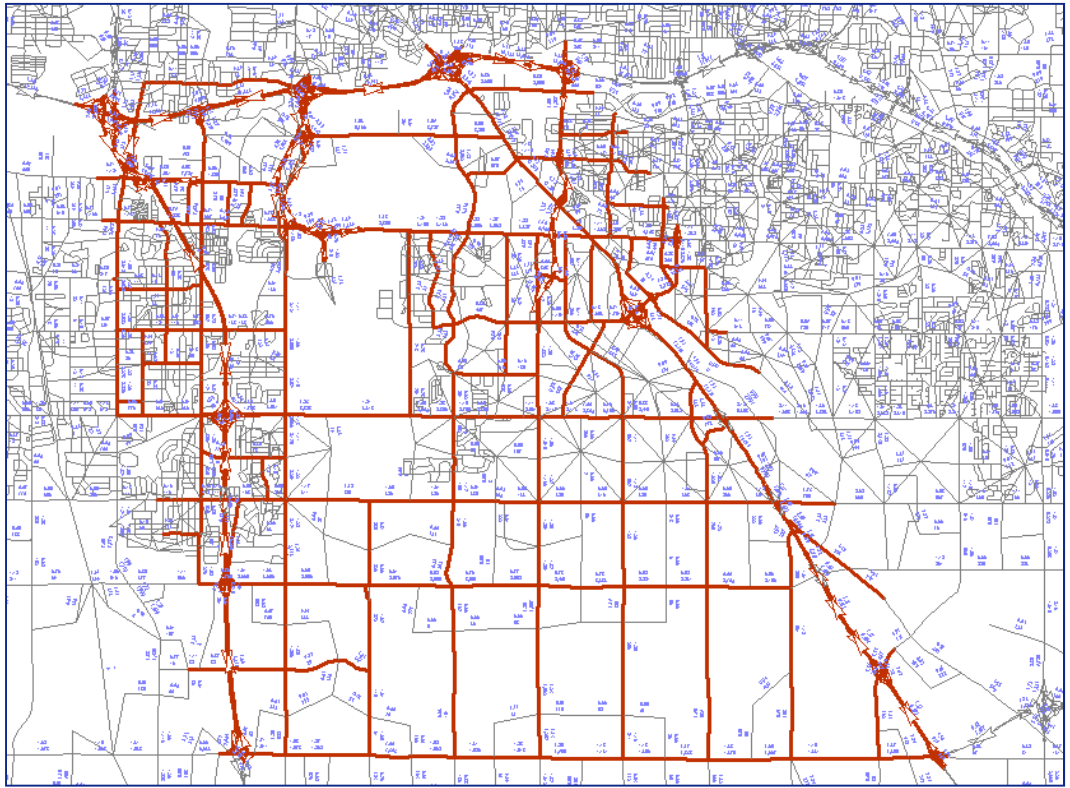
The Memphis MPO travel demand model was used to generate statistics to measure the performance of Lamar Avenue for each of the build alternatives. The Lamar Avenue corridor statistics summarize travel demand from I-240 all the way to the state line. There are some statistics summarized for individual links along the corridor. Additionally, there are a number of statistics were summarized for the study area. As depicted in Figure 5.1 below, the study area is represented as a polygon with the following boundaries:

- The northern boundary is I-240;
- The western boundary is I-55;
- The southern boundary is Goodman Road; and
- The Eastern boundary is Lamar Avenue at the south end and then includes all of Getwell Road from Lamar Avenue to I-240 as well as the southern portions of Perkins Road.

A series of performance metrics were derived to evaluate each option in terms of impact to Lamar Avenue and to the overall study area. They included:

- Lamar Avenue Total Delay (vehicle hours);
- Lamar Avenue Truck Delay (truck hours);
- Lamar Avenue Travel Time (minutes);
- Study Area Total Delay (vehicle hours);
- Study Area Truck Delay (truck hours);
- Volume over capacity ratio at five locations along Lamar Avenue;
- Truck volumes at the same five locations along Lamar Avenue; and
- Truck split between Lamar Avenue and Shelby Drive.

Figure 5.1 Study Area



# 6.0 Alternatives Analysis – Capacity Options

## 6.1 DETAILED MODEL OUTPUT STATISTICS

The travel demand model was utilized to determine the traffic impacts in 2030 as described in Section 4.0. Table 6.1 provides detailed statistics regarding the model output for each of the alternatives. Overall, the results indicate that the travel benefits of the alternatives can be ranked from best to worst as followed:

- Upgrading Lamar Avenue to Interstate (Alternative 7);
- Adding lanes to Lamar Avenue (Alternatives 5,6);
- Diversion Alternatives (Alternatives 2, 3, 4); and
- No Build (Alternative 1).

It should be noted that for all of the alternatives analyzed in this report, it was assumed that I-269 is completely built. I-269 is a new outer loop for the Memphis metropolitan region. It crosses the Lamar Avenue corridor approximately 10 miles south of the Tennessee/Mississippi state line and connects the corridor (which then becomes I-22) with I-40 to the northeast and I-55 to the west. This corridor will provide a key alternative route for truck and auto traffic that currently passes through the Lamar Avenue corridor study area. The consultant team conducted a preliminary analysis of the impact of I-269 on Lamar Avenue, and it was found that the corridor reduces total delay on Lamar Avenue by roughly ten percent, and it reduces truck delay on Lamar Avenue by nearly 15 percent. The data collection described in Chapter 2 indicated that roughly 50 percent of the truck traffic on Lamar Avenue is from truck trips that do not stop in the study area. I-269 will provide a valuable alternative for these truck trips and reserve more Lamar Avenue capacity for trucks that have either an origin or destination inside the study area.

The sections below describe the performance of the capacity options for the Lamar Avenue study area across a broad spectrum of performance measures.

Table 6.1 Detailed Statistics for 2030 Model Run Outputs

Performance Measure	No-Build E+C	Six-Lane Holmes with New I-55 Interchange	Six Lanes Stateline with Lamar Interchange	Eight Lanes Shelby	Six-Lane Lamar	Eight-Lane Lamar	Upgrading Lamar to Interstate
Alternative	1	2	3	4	5	6	7
Total Project Costs (2010 Dollars)	–	\$58,606,000	\$ 169,070,000	\$ 65,500,000	\$ 89,104,000	\$254,645,000	\$ 637,914,000
Average Delay on Lamar Avenue (Minutes)	8.05	7.53	6.88	7.85	3.81	2.72	1.18
Lamar Total Delay (Vehicle Hours)	492,658	445,458	397,215	471,133	313,424	248,869	113,412
Lamar Truck Delay (Truck Hours)	117,668	96,094	88,816	101,031	61,324	45,021	24,191
Lamar Vehicle-Miles Traveled	397,981	383,585	388,094	390,385	600,202	679,407	711,840
Lamar Truck Miles Traveled	96,755	88,095	87,871	89,692	108,126	112,213	126,408
Lamar Travel Time (Minutes)	16.81	16.23	15.56	16.54	12.37	11.28	7.95
Study Area Total Delay (Vehicle Hours)	2,748,000	2,504,115	2,507,440	2,557,469	2,528,163	2,427,403	2,097,663
Study Area Truck Delay (Truck Hours)	200,951	166,946	161,270	172,467	138,955	118,228	257,001
Study Area Vehicle-Miles Traveled	5,582,900	5,507,907	5,513,894	5,490,579	5,708,131	5,693,764	5,657,424
Study Area Truck Miles Traveled	666,687	641,057	642,717	640,087	664,803	665,120	667,059
Volume over Capacity Ratio (North of American Way)	1.79	1.75	1.76	1.75	1.55	1.27	1.33
Volume over Capacity Ratio (South of Getwell Road)	1.84	1.81	1.82	1.80	1.53	1.36	1.27
Volume over Capacity Ratio (South of Perkins Interchange)	1.84	1.76	1.79	1.75	1.18	1.01	1.45
Volume over Capacity Ratio (South of Shelby Drive)	1.68	1.51	1.60	1.71	1.25	1.02	1.34
Volume over Capacity Ratio (Between Holmes and Old Lamar)	2.17	2.21	2.01	2.18	1.31	1.01	1.33
Truck Volume (North of American Way)	12,854	11,662	11,725	11,713	13,225	13,652	19,548
Truck Volume (South of Getwell Road)	14,500	13,329	13,377	13,374	15,788	16,566	18,617
Truck Volume (South of Perkins Interchange)	17,132	13,368	13,450	13,435	19,048	19,482	21,052
Truck Volume (South of Shelby Drive)	12,947	11,684	11,876	12,911	15,101	15,387	15,406
Truck Volume (South of Holmes Road)	12,945	11,050	11,479	12,886	14,694	14,802	14,932
Truck Volume Split N:W of Lamar:Shelby Interchange	78:22	84:16	83:17	75:25	81:19	84:16	81:19



### **6.1.1 Upgrading Lamar Avenue to Interstate (Alternative 7)**

Generally, Alternative 7 (upgrading Lamar Avenue to an Interstate) provides the most congestion relief for Lamar Avenue in 2030. With this alternative, the average delay on Lamar Avenue is just over one minute compared to over eight minutes in the no-build scenario. This resulted in Alternative 7 having the smallest amount of delay for all vehicles and for trucks as well. Upgrading Lamar Avenue to an Interstate results in half as much delay as the next closest alternative.

The travel time on Lamar Avenue for this alternative is only 7.89 minutes in 2030. This is over three minutes less than the next closest alternative, and it is less than half of the travel time of the No-Build alternative. This demonstrates that upgrading Lamar Avenue to Interstate is the best alternative in terms of its ability to speed traffic along the corridor.

Alternative 7 also reduces total study area 2030 delay more than all of the other alternatives. There were 2.1 million hours of annual study area delay for Alternative 7 compared to 2.4 million annual hours for the next closest alternative. However, the study area VMT under Alternative 8 was actually the second highest of all of the alternatives. This is likely because the improvements attract new vehicles to utilize the study area that do not under the other alternatives. Similarly, upgrading Lamar Avenue to an Interstate results in the highest truck VMT of all of the alternatives.

Upgrading Lamar Avenue to an interstate results in a volume-to-capacity (V/C) ratio that ranges from 1.27 to 1.45 at various points along the corridor in 2030. A V/C ratio above 1.0 indicates that the corridor is operating above its design capacity. Therefore, upgrading Lamar Avenue to an Interstate does not fully eliminate congestion on the corridor. This is likely due to the additional traffic that is attracted to the corridor due to the attractiveness of the corridor after it is upgraded to an Interstate. Consistent with this theme, this alternative has the highest volume of trucks at the intersections at American Way, Getwell Road, and Perkins Road.

### **6.2.2 Adding Lanes to Lamar Avenue (Alternatives 5 and 6)**

Alternative 5 turns Lamar Avenue into a six-lane corridor for its entire alignment between Stateline Road and I-240. Alternative 6 turns Lamar Avenue into an eight-lane corridor for the same alignment. Both of these alternatives reduce delay significantly for Lamar Avenue in 2030. The average delay of the eight-lane alternative in 2030 along Lamar Avenue is only 2.72 minutes relative to 8.05 minutes for the No-Build alternative. The average delay of the six-lane alternative in 2030 is only 3.81 minutes, a reduction of over 50 percent of the delay on the corridor relative to the No-Build alternative.

The total Lamar Avenue 2030 travel time for these two alternatives is 12.37 minutes and 11.28 minutes for the six-lane and eight-lane alternatives,

respectively. This is a considerable improvement compared to the 16.81 minutes for the No Build, but not as good as the 7.95 minute travel time estimated for upgrading Lamar Avenue to an Interstate.

The total delay on Lamar Avenue in 2030 for these two alternatives is 313,424 vehicle hours and 248,869 vehicle hours for the six-lane and eight-lane alternatives, respectively. The six-lane alternative is roughly 180,000 hours less than the No-Build alternative, and the eight-lane alternative reduces Lamar Avenue delay by roughly 50 percent relative to the No-Build alternative. Interestingly, the total VMT for the eight-lane alternative is approximately 680,000. This is roughly equivalent to the approximately 710,000 VMT for upgrading Lamar Avenue to an Interstate. Both the six-lane and the eight-lane alternative enable Lamar Avenue to carry more than 50 percent more VMT relative to the No-Build alternative.

These two alternatives only performed modestly relative to reducing total study area delay in 2030. The study area delay for these two alternatives is 2.53 and 2.43 million vehicle hours in 2030. This is less than 10 percent less than the total study area delay relative to the No-Build alternative. This is also about 20 percent more than the total study area delay relative to upgrading Lamar Avenue to an Interstate.

These two alternatives perform the best in terms of having the lowest V/C ratios in 2030. The eight-lane alternative has V/C ratios of approximately 1.0 in 2030 for the southern end of the corridor, and V/C ratios around 1.3 for the northern end. These are generally the lowest V/C ratios for all of the alternatives. The six-lane alternative has V/C ratios of 1.2 to 1.5, also having better performance at the southern end of the corridor. These are much lower than the V/C ratios of the No-Build alternative of between 1.7 to 2.3 in 2030.

### **6.2.3 Diversion Alternatives (Alternatives 2, 3, and 4)**

There were three diversion alternatives that were tested in the study area. Alternative 2 tested making Holmes Road six lanes. Alternative 3 tested making Stateline Road six lanes. Alternative 4 tested making Shelby Drive eight lanes. These improvements were all made between I-55 and Lamar Avenue with interchanges added at I-55 for alternatives that do not currently have it. The truck-following studies conducted as part of the Lamar Avenue Corridor - Existing Conditions and Data Report indicated that there were a large percentage of trucks that travel the entire length of Lamar Avenue without having stopping at any locations inside the study area. Similarly, the vast majority of the commuter traffic on Lamar Avenue is traveling between the suburban cities in Northern Mississippi and downtown Memphis. Therefore, the goal of the diversion alternatives was to route some of the through traffic away from Lamar Avenue to preserve the performance of the corridor.

Unfortunately, these diversion alternatives do not improve the performance of Lamar Avenue significantly. The average 2030 delay on Lamar Avenue trips was

7.53, 6.88, and 7.85 minutes for Alternatives 2,3 and 4, respectively. This is only slightly less than the 8.05 minutes of the No-Build alternative, and much less than the alternatives that focused on improving Lamar Avenue (Alternatives 5-7). Similarly, the Lamar Avenue total delay, truck delay, VMT, average travel times, and V/C ratios show little improvement for the diversion alternatives relative to the No-Build alternatives.

## 6.2 CHANGE IN CORRIDOR AVERAGE DELAY AND TRAVEL TIME PERFORMANCE

Table 6.2 shows the reduction in average 2030 delay and travel time performance for each of the alternatives. Upgrading Lamar Avenue to an Interstate has the largest impact on reducing average delay on the corridor. This alternative reduces travel time on Lamar Avenue by 8.86 minutes relative to the No-Build alternative. This is a reduction of over 50 percent. Making Lamar Avenue six or eight lanes also has a substantial impact on average delay and travel time. These alternatives reduce travel time on Lamar Avenue by 4.44 minutes and 5.53 minutes, respectively. The diversion alternatives do not reduce travel time on Lamar Avenue significantly. The most effective of these alternatives only reduces travel time by 1.16 minutes relative to the No Build.

**Table 6.2 Reduction in Average Delay and Travel Time on Lamar Avenue**

Corridor Metric	Change in Average Delay and Travel Time Relative to No Build (Minutes)						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Average Delay on Lamar Avenue	8.05	-0.51	-1.16	-0.19	-4.24	-5.33	-6.87
Lamar Avenue Travel Time	16.81	-0.49	-1.16	-0.18	-4.44	-5.53	-8.86

## 6.3 CHANGE IN CORRIDOR DELAY PERFORMANCE

Table 6.3 shows the reduction in total 2030 delay and travel time performance for each of the alternatives. Upgrading Lamar Avenue to an Interstate has the largest impact on reducing total delay on the corridor and in the study area as a whole. This alternative reduces the 492,658 annual hours of delay on Lamar Avenue by 379,246 annual hours. This is a reduction of over 75 percent. This is also 130,000 and 200,000 more annual hours than the alternatives to add lanes to Lamar Avenue to eight lanes and six lanes, respectively. The diversion

alternatives (Alternatives 2-4) had a minimal impact on total corridor delay relative to the other alternatives. Making Shelby Lane an eight-lane facility had the least impact on Lamar Avenue. It only reduced the total corridor delay by 14,619 annual hours. This is likely because Shelby Road is too far north along Lamar Avenue to have as large an impact as the other diversion alternatives.

Similarly, upgrading Lamar Avenue to an Interstate has the largest impact on total delay for the entire study area. This alternative reduced the No-Build delay of 2.7 million annual hours by roughly 650,000 annual hours. This is over twice the impact of the next most significant alternative, which is making Lamar Avenue an eight-lane facility. Notably, making Lamar Avenue six lanes have roughly the same amount of impact on total study area delay as increasing capacity on Holmes Road (Alternative 2) and increasing capacity on Stateline Road (Alternative 3). The benefits of these three alternatives on total study area delay range from 145,500 to 219,837 annual hours. Increasing capacity on Shelby Drive (Alternative 4) has a much smaller impact on total delay in the study area.

**Table 6.3 Reduction in 2030 Total Delay**

Delay Metric	Alt. 1 No-Build	Change in Total Delay Relative to No Build (Hours)					
		Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Lamar Total Delay	492,658	-40,295	-88,537	-14,619	-179,234	-243,788	-379,246
Lamar Truck Delay	117,668	-9,148	-16,425	-4,211	-56,344	-72,647	-93,477
Study Area Total Delay	2,748,000	-148,825	-145,500	-95,471	-219,837	-320,598	-650,338
Study Area Truck Delay	200,951	-13,897	-19,573	-8,375	-61,995	-82,723	56,051

## 6.4 CHANGE IN VEHICLE-MILES TRAVELED

The diversion alternatives (Alternatives 2-4) were successful at reducing VMT on Lamar Avenue relative to the No-Build alternative. The alternatives that made improvements directly to Lamar Avenue (Alternatives 5-7) increased the VMT on Lamar Avenue relative to the No-Build alternative (Table 6.4). However, the reduction in travel time along Lamar Avenue by the diversion alternatives is minimal. The most significant diversion occurred from the Holmes Drive improvements (Alternative 2), but even these reductions are less than 4 percent (14,662 miles) of the 397,981 miles traveled on Lamar Avenue in the No-Build alternative. Conversely, the increase in vehicle-miles traveled on Lamar Avenue from Alternatives 5, 6, and 7 is extensive ranging from 202,221 miles to 313,859 miles.

This indicates that there is significant pent-up demand to utilize the Lamar Avenue facility and much less willingness to divert around the facility. In large part, this is due to the fact that all of the alternatives analyzed for this study assume that I-269 is completed by 2030. I-269 is an outer perimeter facility for the Memphis metropolitan region that would connect I-22 to I-55 approximately 15 miles south of the Tennessee-Mississippi border. Many of the truck and auto trips that currently travel on Lamar Avenue through the study area without stopping inside the study area would be diverted to I-269 to travel between Mississippi to downtown Memphis. Therefore, the diversion alternatives considered in this study showed minimal impact on Lamar Avenue VMT along with other performance metrics of the corridor such as travel time and delay.

All of the alternatives increase total study area VMT. This is likely because these improvements are attracting trips from outside the study area to utilize the facilities inside the study area. The eight-lane Lamar Avenue alternative had the highest increase in study area VMT with slightly lower increases seen in Alternatives 5 and 7.

**Table 6.4 Reduction in Miles Traveled**

VMT Metric	Change in Miles Traveled Relative to No Build						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Lamar Avenue VMT	397,981	-14,662	-10,154	-7,862	202,221	281,426	313,859
Lamar Avenue Truck VMT	96,755	-2,745	-2,969	-1,148	11,371	15,457	29,653
Study Area VMT	5,582,900	68,890	74,877	51,562	125,231	110,864	74,524
Study Area Truck VMT	666,687	2,134	3,794	1,164	-1,884	-1,568	372

## 6.5 CHANGE IN NUMBER OF TRUCKS ON LAMAR AVENUE

Table 6.5 shows that the diversion alternatives were only minimally successful in diverting trucks away from Lamar Avenue. The largest decrease in the number of trucks was seen south of Perkins Road. This location has 325 fewer trucks than the 13,693 trucks estimated to be at this location in the No-Build alternative. As mentioned in the previous section, this is likely because many of the trucks with the potential to divert used I-269 rather than one of the diversion alternatives considered in this analysis. I-269 was assumed to be completed for all of the alternatives considered in this analysis.

Alternatives 6-7 increased the capacity directly on Lamar Avenue, and each of these alternatives experienced a significant increase in truck volumes relative to the No Build. North of American Way, upgrading Lamar Avenue to an Interstate attracted an additional 6,964 trucks to the 12,584 trucks estimated to use that facility in the No-Build alternative, an increase of over 50 percent. Increasing Lamar Avenue to six and eight lanes experienced the largest increase in truck traffic at the southern end of the corridor with over 2,000 trucks being added to the No-Build alternative south of Shelby Drive. This increase in truck traffic likely coincides with a similar increase in auto traffic for these alternatives.

**Table 6.5 Change in Number of Lamar Avenue Trucks**

Location	Change in Number of Trucks on Lamar Avenue Relative to No Build						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
North of American Way	12,584	149	212	200	641	1,068	6,964
South of Getwell Road	14,500	594	642	639	1,288	2,066	4,117
South of Perkins Interchange	17,132	-325	-243	-258	1,916	2,350	3,920
South of Shelby Drive	12,947	427	619	1,654	2,154	2,440	2,459
South of Holmes Road	12,945	-281	148	1,555	1,749	1,857	1,987

## 6.6 CHANGE IN V/C RATIO

Table 6.6 shows that all of the alternatives decreased the V/C ratio for Lamar Avenue. The decrease was minimal for the diversion alternatives (Alternatives 2-4). This is due to the minimal amount of traffic that was diverted away from Lamar Avenue for these alternatives. The most significant decrease in V/C ratio was from making Lamar Avenue an eight-lane facility. This reduced the V/C ratio from a minimum of 1.68 in the No Build by up to 1.16 between Old Holmes Road and Old Lamar Road.

Table 6.6 Change in V/C Ratio Relative to No-Build

Location	Change in V/C Ratio						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
North of American Way	1.79	-0.13	-0.12	-0.13	-0.24	-0.52	-0.46
South of Getwell Road	1.84	-0.06	-0.05	-0.07	-0.31	-0.48	-0.57
South of Perkins Interchange	1.84	-0.04	-0.01	-0.05	-0.66	-0.83	-0.39
South of Shelby Drive	1.68	-0.23	-0.14	-0.03	-0.43	-0.66	-0.34
Between Holmes and Old Lamar	2.17	-0.05	-0.25	-0.08	-0.86	-1.16	-0.84





## 7.0 Alternatives Analysis - New Interchanges

The purpose of this chapter is to determine the traffic benefits of developing interchanges at select locations along Lamar Avenue. In particular, interchanges were considered at the intersections of Lamar Avenue with Holmes Road, Winchester Road, and Shelby Drive. Various combinations of these improvements are compared to no build, transportation systems management, and capacity improving alternatives. This analysis was conducted using a microsimulation tool as opposed to the travel demand model which was used in Chapter 5. Microsimulation is more accurate in estimating the impact of interchanges. The microsimulation methodology is described in greater detail in Section 6.2.

### 7.1 DESCRIPTION OF INTERCHANGE IMPROVEMENT ALTERNATIVES

There are twelve alternatives analyzed in this chapter. Three of the first four alternatives are similar to alternatives analyzed in Chapter 6. Therefore, the identification for these alternatives will remain numerically the same as that used in Chapter 6. The remaining alternatives are noted using alphabetic identifiers. Descriptions of each alternative are provided in the following list.

- **Alt. 1 - No-Build** - E+C network, including base year subarea validation adjustments.
- **Alt. 1A - Operational improvements without interchanges** - Signal optimization and minor geometric improvements including the extension of turn lane lengths and the construction of additional turn lanes at intersections. These improvements were simulated at two intersections along Lamar Avenue - Holmes Road and Shelby Drive.
- **Alt. 5 - 6-Lane Lamar Avenue with no additional interchanges** - From Stateline Road to I-240. The corridor already is six lanes on the north end of the corridor which then drops off to four lanes south of New Getwell Road. Operational improvements are also included.
- **Alt. 6 - 8-Lane Lamar Avenue with no additional interchanges** - From Stateline Road to I-240. Operational improvements are also included.
- **Alt. 5H - 6-Lane Lamar with interchange at Holmes Road** - This option constructs a tight diamond interchange at Holmes Road and improves Lamar Avenue to six travel lanes from Stateline Road to I-240.

- **Alt. 5W - 6-Lane Lamar with interchange at Winchester Road** - This option constructs a SPUI interchange at Winchester Road and improves Lamar Avenue to six travel lanes from Stateline Road to I-240.
- **Alt. 5S - 6-Lane Lamar with interchange at Shelby Drive** - This option constructs a SPUI interchange at Shelby Drive and improves Lamar Avenue to six travel lanes from Stateline Road to I-240.
- **Alt. 5HW - 6-Lane Lamar with interchanges at Holmes Road and Winchester Road** - This option constructs interchanges at Holmes Road and Winchester Road and improves Lamar Avenue to six travel lanes from Stateline Road to I-240.
- **Alt. 5HS - 6-Lane Lamar with interchanges at Holmes Road and Shelby Drive** - This option constructs interchanges at Holmes Road and Shelby Drive and improves Lamar Avenue to six travel lanes from Stateline Road to I-240.
- **Alt. 5WS - 6-Lane Lamar with interchanges at Winchester Road and Shelby Drive** - This option constructs interchanges at Winchester Road and Shelby Drive and improves Lamar Avenue to six travel lanes from Stateline Road to I-240.
- **Alt. 5HWS - 6-Lane Lamar with interchanges at Holmes Road, Winchester Road, and Shelby Drive** - This option constructs interchanges at Holmes Road, Winchester Road, and Shelby Drive and improves Lamar Avenue to six travel lanes from Stateline Road to I-240.
- **Alt. 5HWS-4L - 4-Lane Lamar with interchanges at Holmes Road, Winchester Road, and Shelby Road** - This option constructs interchanges at Holmes Road, Winchester Road, and Shelby Road while maintaining the existing four travel lanes along Lamar Avenue from Stateline Road to I-240.

The estimated costs for each of the alternatives are shown in Table 6.1. These costs were developed through a combination of analysis from the consultant team, the Tennessee DOT, and previous project analysis. The costs are considered preliminary, and will need to be refined as the concept for Lamar Avenue moves forward.

All of the options bulleted above include operational improvements. All of the options also include modifications at the existing interchanges at New Getwell Road and Perkins/Raines Road. The interchange modification at New Getwell Road constructs a Single Point Urban Interchange (SPUI). The interchange modification at Perkins/Raines Road alters the loop placements of the existing Partial Cloverleaf Interchange. Both of these modifications are included in existing design plans. Both of the modifications primarily improve operations along the side roads and not along Lamar Avenue.

The interchange options do not include access control measures outside of the specific interchange locations being studied. Except where new interchanges are

specifically noted, the existing intersections will remain along Lamar Avenue. Additionally, the effect of new interchanges on side road and driveway access was not investigated as part of this analysis.

There are nine signalized intersections along the route are not under study for conversion to interchanges. These intersections are as follows: Old Highway 78/Davidson Road, Tuggle Road, Pleasant Hill Road/Railyard Terminal, ConcordeRoad/Old Lamar Avenue, New Getwell Road (New Getwell Road is a Freeway type facility at this interchange and Lamar Avenue is signal controlled), Knight Arnold Road, Democrat Road, Pearson Road, and Tchulahoma Road/American Way.

**Table 7.1 Cost of Alternatives – New Interchange Options**

Alternative	Total Costs (\$ millions)
Alt. 1 – No Build	-
Alt. 1A – Operational improvements without interchanges	9.4
Alt. 5 – 6-lane, no ints	89.1
Alt. 6 – 8-lane, no ints	254.6
Alt. 5H – 6-lane, int. at Holmes	109.2
Alt. 5W – 6-lane, int at Winchester	142.4
Alt. 5S – 6-lane, int. at Shelby	195.6
Alt. 5HW – 6-lane, int. at Holmes and Winchester	162.4
Alt. 5HS – 6-lane, int. at Holmes and Shelby	215.7
Alt. 5WS – 6-lane, int. at Winchester and Shelby	248.9
Alt. 5HWS – 6-lane, int. at Holmes, Winchester and Shelby	275.1
Alt. 5HWS-4L – 4-lane, int. at Holmes, Winchester, and Shelby	213.2



## 7.2 DESCRIPTION OF SIMULATION METHODOLOGY







The simulation analysis was conducted utilizing the Synchro Software program's Arterial Analysis capabilities. This Arterial Analysis is based on the reports used in the Arterials section of the Transportation research Board Highway Capacity Manual in Chapter 15. Twelve signalized intersections are included in the analysis. The speed limit along the study corridor ranges from 40 to 70 miles per hour. Driveways and unsignalized intersections were not included in the Synchro Models.

The simulation was conducted for the year 2010 for the A.M. and P.M. peak travel periods. The Synchro software program generates measures of effectiveness (MOEs) as outputs separately for both the northbound and southbound directions of travel. The four MOEs generated for this analysis are: 1) level of service, 2) average speed, 3) delay, and 4) travel time. These measures are defined as follows:

- **Level of Service (LOS)** is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. LOS range from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each LOS represents a range of operating conditions and the driver's perception of those conditions. Figure 7.1 provides a description and pictorial representations of each LOS category.
- **Average travel speed** is calculated in the LOS analysis. Speed, or its reciprocal travel time, is an important measure of congestion and the quality of the traffic service provided to the motorist.
- **Delay** is calculated in this analysis as the difference in travel time between posted speed limit operations and the Synchro calculated travel time along Lamar Avenue.
- **Travel time** along a route is calculated by dividing the distance of each segment by the average travel speed on each segment, then summing the travel times along each segment on the arterial.

These MOEs are calculated specifically for Lamar Avenue and do not reflect traffic changes to other roads in the study area.

Figure 7.1 LOS Table

LOS	Traffic Flow Conditions	Representative Photo
A	Free flow operations. Vehicles are almost completely unimpeded in their ability to maneuver with the traffic stream. The general level of physical and psychological comfort provided to the driver is high.	
B	Reasonable free flow operations. The ability to maneuver within the traffic stream is only slightly restricted and the general level of physical and psychological comfort provided to the driver is still high.	
C	Flow with speeds at or near free flow speeds. Freedom to maneuver within the traffic stream is noticeably restricted and lane changes require more vigilance on the part of the driver. The driver notices an increase in tension.	
D	Speeds decline with increasing traffic. Freedom to maneuver within the traffic stream is more noticeably limited. The driver experiences reduced physical and psychological comfort levels.	
E	At lower boundary, the facility is at capacity. Operations are volatile because there are virtually no gaps in the traffic stream. There is little room to maneuver. The driver experiences poor levels of physical and psychological comfort.	
F	Breakdowns in traffic flow. The number of vehicles entering the highway section exceed the capacity or ability of the highway to accommodate that number of vehicles. There is little room to maneuver. The driver experiences poor levels of physical and psychological comfort.	

## 7.3 DESCRIPTION OF SIMULATION RESULTS

### LOS and Speed Results for Each Alternative

Figure 7.2 and Table 7.2 show the LOS and calculated travel speeds along the study corridor. Except for the interstate alternative, the data in the table is the average of the A.M., P.M., northbound, and southbound MOEs gathered from the Synchro Arterial Analysis Reports. For the interstate alternative, the data shown are for the full day time period in 2030, so the data for this alternative are not directly comparable to the other alternatives. The averages for each option were utilized in order to provide comparable MOEs across each alternative. As shown in Figure 7.2, the arterial travel speed of the non-interstate options ranges from 21.4 to 34.9 miles per hour. This is significantly lower than the 50 miles per hour average posted speed limit of the corridor.

The results of the analysis show that adding interchanges to Lamar Avenue increase travel speeds and generally increase LOS. 6-Laning Lamar Avenue with all three interchanges has the highest average travel speeds at 34.9 mph. This alternative has an average travel speed of more than 10 mph. This alternative has a 10 percent higher travel speed than only building interchanges without adding more capacity on Lamar Avenue. It has a 20 percent higher travel speed than 8-laning Lamar Avenue with no interchanges, and it has nearly a 30 percent higher travel speed than 6-laning Lamar Avenue with no interchanges.

Figure 7.2 also shows the average speeds for constructing each interchange by itself using the assumption that Lamar Avenue is increased to six lanes. The results show that the interchange at Shelby Drive is the best performing single interchange generating 28.2 mph average travel speeds on the corridor. Developing an interchange at Winchester Road comes in a close second with an average travel speed of 27.1 mph, and Holmes Road is a more distant third with 25.7 mph.

An analysis of the best two intersections shows that developing interchanges at Winchester Road and Shelby Drive provide the most travel speed benefits. Its average travel speed of 32.9 mph is slightly higher than the speed achieved by leaving Lamar Avenue with four lanes and developing interchanges at all three intersections. It is also just 8 percent lower than developing interchanges at all three intersections and 6-laning Lamar Avenue. Developing interchanges at Winchester Road and Shelby Drive provides nearly 25 percent higher travel speeds than simply making Lamar Avenue eight lanes without interchanges.

Note that the four-lane operational improvements alternative without interchanges has slightly lower performance relative to the no build. This is due to the increased use of “protected-only” left turn phases along the corridor where double left turn lanes are utilized. The individual intersections associated with the four-lane operational improvements alternative without interchanges may operate better than the no build. However, the net effect on the Lamar Avenue corridor is calculated to be slightly worse.

## Delay and Travel Time Results for Each Alternative

Figure 7.3 and Table 7.3 summarize the delay and travel time along the study corridor. As with Figure 7.2, the data in the table is the average of the A.M., P.M., northbound, and southbound MOEs gathered from the Synchro Arterial Analysis Reports, except for the interstate alternative. The travel time on the corridor ranges from 7.9 minutes under free flow conditions to 18.2 minutes with the four lane operational improvements alternative without interchanges. The delay for the non-interstate, non-free flow alternatives range from 3.3 minutes for the top performing alternative to 10.3 minutes for the four-lane operational improvements without interchanges alternative.

Similar to the results for the speed analysis, the alternative of 6-laning Lamar Avenue with all three interchanges provides the best performance of the non-interstate alternatives. This alternative has just 3.3 minutes of average delay in the simulation results. The next closest alternative is 6-laning Lamar Avenue with interchanges at Winchester Road and Shelby Drive followed closely by leaving Lamar Avenue at four lanes with interchanges at all three intersections. These alternatives have 4.0 minutes and 4.4 minutes of average delay respectively.

Each of the top three alternatives perform significantly better than simply 6-laning or 8-laning Lamar Avenue without any interchanges. Therefore, these results reinforce the notion that developing interchanges has significant travel benefits for the corridor.

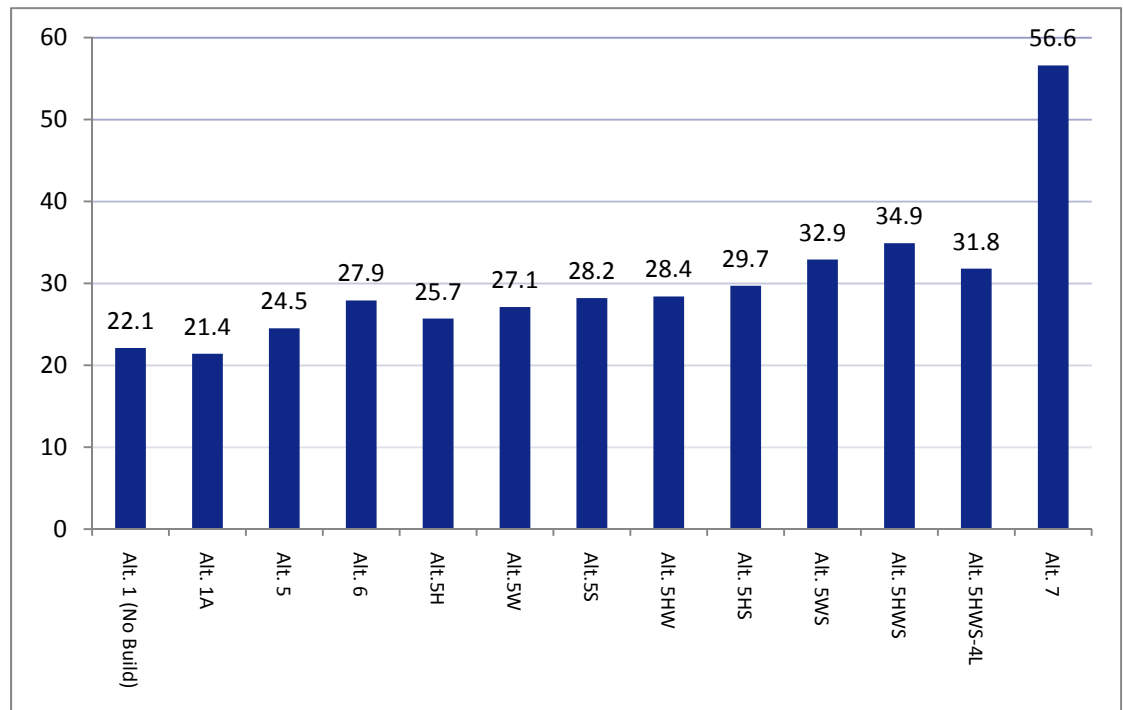


**Table 7.2 Lamar Avenue LOS and Speed**

Alternative	Number of Mainline Lanes	Arterial Speed (mph)	Percent Improvement	LOS Range
Alt. 1 – No Build	4	22.1	n/a	C-F
Alt. 1A – Operational improvements without interchanges	4	21.4	-3%	D-F
Alt. 5 – 6-lane, no ints	6	24.5	11%	C-E
Alt. 6 – 8-lane, no ints	8	27.9	26%	C-D
Alt. 5H – 6-lane, int. at Holmes	6	25.7	16%	C-E
Alt. 5W – 6-lane, int at Winchester	6	27.1	23%	C-D
Alt. 5S – 6-lane, int. at Shelby	6	28.2	28%	C-D
Alt. 5HW – 6-lane, int. at Holmes and Winchester	6	28.4	29%	C-D
Alt. 5HS – 6-lane, int. at Holmes and Shelby	6	29.7	35%	C-D
Alt. 5WS – 6-lane, int. at Winchester and Shelby	6	32.9	49%	B-C
Alt. 5HWS – 6-lane, int. at Holmes, Winchester and Shelby	6	34.9	58%	B-C
Alt. 5HWS-4L – 4-lane, int. at Holmes, Winchester, and Shelby	4	31.8	44%	B-C
Alt. 7 - Upgrading Lamar Avenue to an Interstate	4	56.6	156%	B

Note: Current Lamar Avenue free-flow speed (bidirectional) is 50 mph.

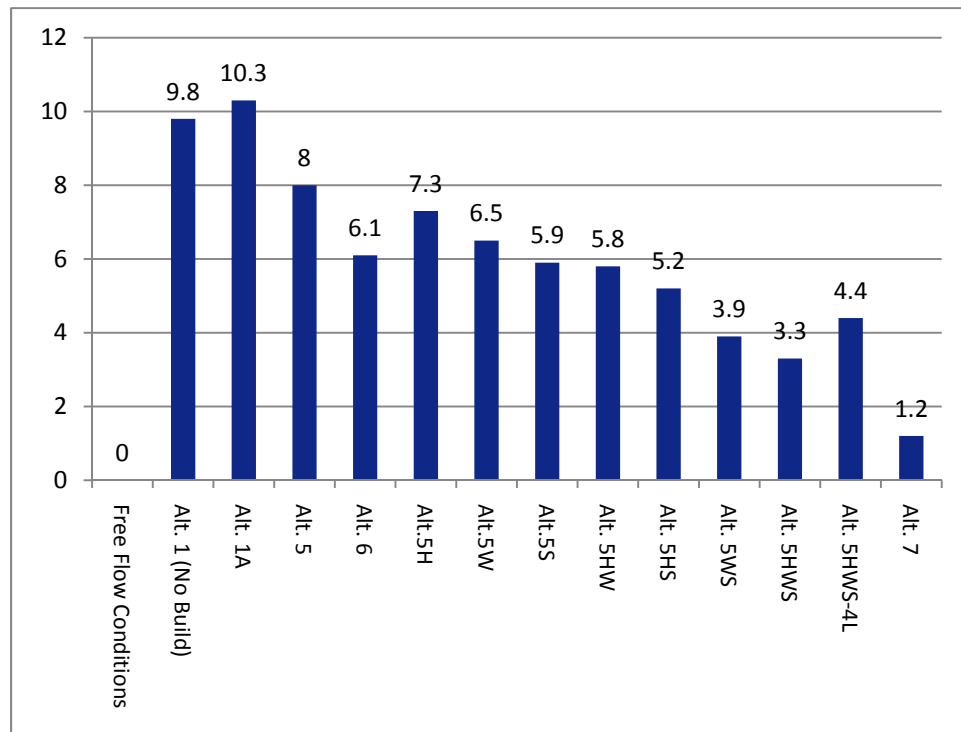
**Figure 7.2 Lamar Avenue Bidirectional Speeds (mph)**



**Table 7.3 Lamar Avenue Delay and Travel Time**

Arterial	Number of Mainline Lanes	Arterial Speed (mph)	Travel Time (minutes)	Delay (minutes)
Free Flow Conditions	6	49.6	7.9	0.0
Alt. 1 – No Build	4	22.1	17.7	9.8
Alt. 1A – Operational improvements without interchanges	4	21.4	18.2	10.3
Alt. 5 – 6-lane, no ints	6	24.5	15.9	8.0
Alt. 6 – 8-lane, no ints	8	27.9	14.0	6.1
Alt. 5H – 6-lane, int. at Holmes	6	25.7	15.2	7.3
Alt. 5W – 6-lane, int at Winchester	6	27.1	14.4	6.5
Alt. 5S – 6-lane, int. at Shelby	6	28.2	13.8	5.9
Alt. 5HW – 6-lane, int. at Holmes and Winchester	6	28.4	13.7	5.8
Alt. 5HS – 6-lane, int. at Holmes and Shelby	6	29.7	13.1	5.2
Alt. 5WS – 6-lane, int. at Winchester and Shelby	6	32.9	11.8	3.9
Alt. 5HWS – 6-lane, int. at Holmes, Winchester and Shelby	6	34.9	11.2	3.3
Alt. 5HWS-4L – 4-lane, int. at Holmes, Winchester, and Shelby	4	31.8	12.3	4.4
Alt. 7 - Upgrading Lamar Avenue to an Interstate	4	56.6	8.0	1.2

**Figure 7.3 Lamar Avenue Delay (minutes)**



## 8.0 Benefit/Cost Analysis and Conclusions

This section describes a range of benefit/cost analyses across all of the alternatives. The first set of benefit/cost analyses compares the cost of each of the capacity enhancement alternatives relative to improvements in specific metrics. These analyses include:

- Cost per change in average corridor delay and travel times (Section 8.1);
- Cost per change in total delay (Section 8.2); and
- Cost per change in VMT (Section 8.3).

This is followed by a benefit/cost analysis (Section 8.4) that is performed for the entire corridor based on monetizing the benefits and costs of each alternative for the year 2030. This analysis is also conducted only for the capacity enhancement alternatives.

Section 8.5 describes a benefit/cost analysis for the interchange improvement alternatives.

Section 8.6 provides summary conclusions regarding all of the improvement alternatives for Lamar Avenue.

### 8.1 COST PER TRAVEL TIME BENEFIT

The first cost/benefit analysis compares the cost of each alternative to the benefits as they accrue to the average minute of delay for a trip of the entire Lamar Avenue corridor from the Mississippi State Line to I-240.

Table 8.1 shows that the cost per minute of delay savings varies widely for each of the alternatives. Making Lamar Avenue six lanes (Alternative 5) is the most cost-effective in terms of the money spent relative to the reduction in travel time delay for an average trip across the corridor. For this alternative, the cost is roughly \$21 million per average minute of delay saved in traveling the entire corridor. Making Lamar Avenue eight lanes (Alternative 6) comes in a close second best in terms of cost-effectiveness of addressing average corridor delay. For this alternative, the cost is roughly \$48 million per average minute of delay saved in traveling the entire corridor.

While upgrading Lamar Avenue to an Interstate (Alternative 7) has the highest amount of savings in average corridor delay, it is a distant third in terms of its cost-effectiveness of this savings. For this alternative, the cost is roughly \$93 million per average minute of delay saved in traveling the entire corridor.

This ineffectiveness is directly related to the high cost of this alternative. It is more than twice as high as the next most expensive alternative. However, it does not provide twice the benefits of the other alternatives. None of the diversion alternatives (Alternatives 2-4) is cost-effective in terms of average delay reduction for Lamar Avenue. This is primarily due to the minimal improvement in delay reduction on Lamar Avenue for these alternatives.

Table 8.1 shows the cost per savings in average travel time of the entire Lamar Avenue corridor from the Mississippi state line to I-240. This metric is slightly more useful than using average delay, because it incorporates the savings that will accrue to Lamar Avenue due to the increased travel speeds of upgrading Lamar Avenue to an Interstate. However, the results are similar to Table 8.2 in that Alternatives 5 and 6 are the most cost-effective in terms of providing reduced average travel times for the Lamar Avenue corridor. Upgrading Lamar Avenue to an Interstate provided the lowest average travel time for the corridor, but was a distant third in terms of cost-effectiveness in providing these travel time savings. None of the diversion alternatives (Alternatives 2-4) is cost-effective in terms of average travel time reduction for Lamar Avenue.

**Table 8.1 Cost Per Savings in Average Minute of Lamar Avenue of Delay**

Corridor Metric	Change in Average Delay and Travel Time (Minutes)						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight- Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Average Delay on Lamar Avenue (minutes)	8.05	-0.51	-1.16	-0.19	-4.32	-5.40	-6.98
Cost per Savings in Average Minute of Delay (Millions of Dollars)	N/A	115	146	345	21	48	93

**Table 8.2 Cost Per Reduction in Average Minute of Lamar Avenue Delay**

Corridor Metric	Change in Average Delay and Travel Time (Minutes)						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight- Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Lamar Avenue Travel Time (minutes)	16.81	-0.49	-1.16	-0.18	-4.44	-5.53	-8.86
Cost per Reduction in Average Minute of Delay (Millions of Delay)	N/A	120	146	364	20	46	72

## 8.2 COST PER TOTAL DELAY BENEFITS

Table 8.3 shows the cost per hour of reduction in total delay on Lamar Avenue for the year 2030. This is calculated by dividing the total project costs by the reduction in the annual hours of delay on Lamar Alternative for each alternative in 2030. Similar to the previous section, adding lanes to Lamar Avenue (Alternatives 5 and 6) are the most cost-effective in reducing total delay along the corridor. Upgrading Lamar Avenue to an Interstate (Alternative 7) reduces total Lamar Avenue delay by the highest amount, but this alternative is relatively ineffective compared to adding lanes to Lamar Avenue. This ineffectiveness is directly related to the high cost of this alternative. It is nearly three times higher than the next most expensive alternative. Similarly, the diversion alternatives (Alternatives 2-4) are also not cost-effective in terms of reducing total delay on Lamar Avenue. The ineffectiveness of the diversion alternatives is a function of the lower traffic impact benefits associated with this alternative rather than high project costs.

Table 8.4 shows the cost per hour of reduction in total delay in the entire study area as defined in Section 4.0 for the year 2030. This is calculated by dividing the total project costs by the reduction in the annual hours of delay for the entire study area for each alternative in 2030. Interestingly, making Holmes Road into a six-lane facility is the most cost-effective utilizing this metric with Alternatives 5 and 6 close behind. Upgrading Lamar Avenue to an Interstate (Alternative 7) reduces total study area delay by the highest amount, but this alternative is the second worst in terms of cost-effectiveness in delay reduction.

**Table 8.3 Cost Per Hour of Reduction in Total 2030 Delay on Lamar Avenue**

Delay Metric	Change in Total Delay in Annual Hours Relative to No Build						
	Alt. 1 No- Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Lamar Total Delay	485,752	-40,295	-88,537	-14,619	-180,267	-242,616	-377,062
Cost Per Hour of Reduction in Delay (Dollars)	N/A	1,454	1,910	4,480	497	1,045	1,682

**Table 8.4 Cost Per Hour of Reduction in Total 2030 Delay in Study Area**

Delay Metric	Change in Delay in Hours						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Study Area Total Delay	2,652,940	-148,825	-145,500	-95,471	-188,811	-259,179	-595,272
Cost Per Hour of Reduction in Delay	N/A	394	1,162	686	405	794	981

### 8.3 COST PER CHANGE IN VEHICLE-MILES TRAVELED

Table 8.5 shows the cost per change in Lamar Avenue VMT. This table has different implications for the diversion alternatives (Alternatives 2-4) than it does for the alternatives that directly improve Lamar Avenue (Alternatives 5-7). For the diversion alternatives, the relevant consideration is the cost per mile of VMT reduction on Lamar Avenue. This is a measure of the cost-effectiveness of the diversion of each of these alternatives where the less negative the number, the better. From this standpoint, it can be seen that none of these alternatives are cost effective. They range from -\$3,997 to -\$16,654 per mile of VMT reduced on Lamar Avenue.

For Alternatives 5-7, the relevant consideration is the cost per additional VMT served on the facility. This is a measure of cost-effectiveness of carrying additional vehicles on Lamar Avenue where the lower the number, the better. From this standpoint, Alternatives 5 and 6 are the most cost-effective, and Alternative 7 is the least cost-effective. Adding lanes to Lamar Avenue is a much more cost-effective means of handling new traffic than upgrading Lamar Avenue to an Interstate.

Table 8.6 shows the cost per change in study area VMT for each alternative. This measures the cost-efficiency of each alternative in terms of new VMT attracted to the study area, and the cost to serve this new VMT. Alternatives 6 and 7 are again the leading alternatives in terms of cost-efficiency of study area VMT.

**Table 8.5 Cost Per Change in Lamar Avenue VMT**

VMT Metric	Change in Miles Traveled Relative to No Build						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Lamar Avenue VMT	397,981	-14,662	-10,154	-7,862	202,221	281,426	313,859
Cost Per Change in Lamar Avenue VMT	N/A	-3,997	-16,654	-8,331	441	905	2,032

**Table 8.6 Cost Per Change in Study Area VMT**

VMT Metric	Change in Miles Traveled Relative to No Build						
	Alt. 1 No-Build	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs (Millions of Dollars)	-	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Study Area VMT	5,582,900	68,890	74,877	51,562	125,231	110,864	74,524
Cost Per Change in Study Area VMT	N/A	851	2,258	1,270	712	2,297	8,560

## 8.4 MONETIZED BENEFIT/COST ANALYSIS

The Tennessee Department of Transportation has developed a method to monetize travel benefits and create direct benefit/cost ratios for corridor improvement alternatives. This methodology was first developed as part of the I-40/I-81 Corridor Feasibility Study, and it is currently being applied to the I-75 Corridor Feasibility Study. In this section, benefit/cost ratios are developed for each of the Lamar Avenue corridor alternatives. This will allow for a more direct comparison between alternatives. It will also allow for a generalized comparison between improvements considered for Lamar Avenue, and improvements being considered for the larger statewide corridor feasibility studies.

The benefit/cost ratio methodology for the statewide corridors was established based on estimating the following four categories of performance metrics:

- Recurrent delay;
- Nonrecurrent delay;

- Safety; and
- Air Quality.

Recurrent delay is the delay that results from daily congestion in the Lamar Avenue study area. It is the result of daily demand for travel that exceeds the capacity of the roadway. Nonrecurrent delay is delay caused by unpredictable incidents such as accidents, debris in the roadway, and inclement weather. Safety is measured in terms of number of crashes and number of fatalities. Air quality is measured based on FHWA HERS analysis for the air pollution cost per mile traveled for autos and trucks.

For the Lamar Avenue Corridor Study, the recurrent delay can be estimated using the Memphis MPO travel demand model as described in Section 5.0. Air quality was also estimated using truck and auto VMT data from the travel demand model. However, nonrecurrent delay is not included in this benefit/cost analysis, because none of the alternatives is designed specifically to address this issue. Similarly, safety is not incorporated in the benefit/cost analysis. The most significant component of a safety analysis is reduction in fatalities. However, this corridor is short relative to statewide corridors, so that fatalities do not appear to occur with any discernible pattern that can be reasonably addressed through the capacity enhancement alternatives that are considered as part of this study.

To develop benefit/cost ratios for each metric, it was necessary to determine the monetary value of each of the performance metrics that were calculated. This monetization was developed based on national standards that have been developed as part of the Federal Highway Administration Highway Economic Requirement System (HERS). The monetary values for each of the performance metrics are shown in Table 8.7.

**Table 8.7 Monetary Value of Performance Metrics**

Performance Metric	Monetary Value
Recurrent Delay for Autos	\$19.82/hour of delay
Recurrent Delay for Trucks	\$36.05/hour of delay
Auto Air Pollution Costs	\$0.011 per VMT
Truck Air Pollution Costs	\$0.039 per VMT

Source: FHWA, Highway Economic Requirements System: Technical Report, U.S. Department of Transportation, 2002. \*2030 values assume 3 percent annual increase in monetary values.

It is important to emphasize that the benefit/cost ratios that are calculated as part of this task refer only to the benefits and costs as they accrue to Lamar Avenue. Each of the alternatives also has broader systemwide impacts on travel within the study area and the Memphis region that are not included in this analysis. This process was used to maintain the focus of the analysis on how each proposed improvement would impact Lamar Avenue. Additionally, it should be noted that benefit/cost ratios should not be the sole determinant of a



project's value as there are several other factors that should be considered in the project prioritization and programming process, which cannot be quantified using this technique.

#### 8.4.1 Monetizing Benefits for Each Alternative to 2030

The benefits described in Table 8.7 were extended to 2030 by using an average annual inflation rate of 3 percent. The resulting value of each of the relevant performance metrics are shown below in Table 8.8.

Table 8.9 shows the 2030 change in Lamar Avenue corridor total delay and VMT for both trucks and autos. The values in Table 8.8 were applied to the metrics in Table 8.9 to develop the benefits for implementing each of the alternatives. Upgrading Lamar Avenue to an Interstate provides the greatest benefits in monetary terms. This alternative equates to roughly \$20.7 million in savings in 2030. This compares to approximately \$13.7 million in savings for making Lamar Avenue an eight-lane facility, and \$10.2 million in savings for making Lamar Avenue a six-lane facility. None of the diversion alternatives provides more than \$5 million in annual savings relative to the No-Build alternative.

**Table 8.8 Projecting Monetary Value of Performance Metrics to 2030**

Performance Metric	2002 Monetary Value	2030 Monetary Value*
Recurrent Delay for Automobiles	\$19.82/hour of delay	\$45.35/hour of delay
Recurrent Delay for Trucks	\$36.05/hour of delay	\$82.48/hour of delay
Auto Air Pollution Costs	\$0.011 per VMT	\$0.025 per VMT
Truck Air Pollution Costs	\$0.039 per VMT	\$0.089 per VMT

Source: FHWA, Highway Economic Requirements System: Technical Report, U.S. Department of Transportation, 2002. \*2030 values assume 3 percent annual increase in monetary values.

**Table 8.9 Calculation of Benefits by Alternative**

VMT Metric	Change in Miles Traveled Relative to No Build					
	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Change in Truck Delay Hours Relative to No Build	-9,148	-16,425	-4,211	-56,344	-72,647	-93,477
Truck Delay Benefits/Hour	\$82.48	\$82.48	\$82.48	\$82.48	\$82.48	\$82.48
Total Truck Delay Benefits	\$754,511	\$1,354,769	\$347,312	\$4,647,232	\$5,991,895	\$7,709,959
Change in Auto Delay Hours Relative to No Build	-31,147	-72,112	-10,409	-122,890	-171,142	-285,769
Auto Delay Benefits/Hour	\$45.35	\$45.35	\$45.35	\$45.35	\$45.35	\$45.35
Total Auto Delay Benefits	\$1,412,407	\$3,270,040	\$471,993	\$5,573,075	\$7,761,273	\$12,959,644

VMT Metric	Change in Miles Traveled Relative to No Build					
	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Change in Truck Miles Traveled Relative to No Build	-2,745	-2,969	-1,148	11,371	15,457	29,653
Truck AQ Benefits Per Mile	\$0.089	\$0.089	\$0.089	\$0.089	\$0.089	\$0.089
Total Truck AQ Benefits	\$245	\$265	\$102	-\$1,012	-\$1,376	-\$2,639
Change in Auto Miles Traveled	-11,917	-7,184	-6,714	127,115	112,431	74,152
Auto AQ Benefits Per Mile	\$0.0252	\$0.0252	\$0.0252	\$0.0252	\$0.0252	\$0.0252
Total Auto AQ Benefits	\$300	\$181	\$169	-\$3,178	-\$2,811	-\$1,854
Total Benefits Relative to No Build	\$2,167,463	\$4,625,255	\$819,576	\$10,216,117	\$13,748,982	\$20,665,110

#### 8.4.2 Developing 2030 Costs for Each Alternative

To develop 2030 annualized costs by alternative, the total project costs were divided by 30 years based on the estimated life cycle for the alternatives considered in this study. Annualized operations and maintenance (O&M) costs were estimated to be three percent of the construction costs in year one of completed construction with three percent average annualized inflation assumed through 2030. The impact of this methodology is that each of the annual costs of the alternatives is roughly proportional to the total project costs for the alternatives. However, alternatives that have relatively high percentages of right-of-way costs included in the total project costs will have somewhat lower O&M costs relative to the other alternatives. Therefore, upgrading Lamar to an Interstate (Alternative 7) has the highest annualized costs at \$32.7 million. Making Lamar Avenue an 8-lane facility and making Stateline Road a six-lane facility are tied for second highest annualized costs at \$11.3 million. This is followed by making Lamar Avenue six lanes with annualized 2030 costs of \$4.5 million. The cost breakdown is provided in Table 8.10.

**Table 8.10 2030 Annualized Costs by Alternative**

Cost Metric (Millions of Dollars)	Change in Miles Traveled Relative to No Build					
	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
Total Project Costs	\$58.6	\$169.1	\$65.5	\$89.1	\$254.6	\$637.9
Total Project Costs Annualized Over 30 Years	\$2.0	\$5.6	\$2.2	\$3.0	\$8.5	\$21.3
O&M Annualized to Year 2030	\$1.2	\$5.7	\$1.2	\$1.5	\$2.8	\$11.4
Total Annualized Costs in 2030	\$3.2	\$11.3	\$3.4	\$4.5	\$11.3	\$32.7

### 8.4.3 Benefit/Cost Ratios by Alternative

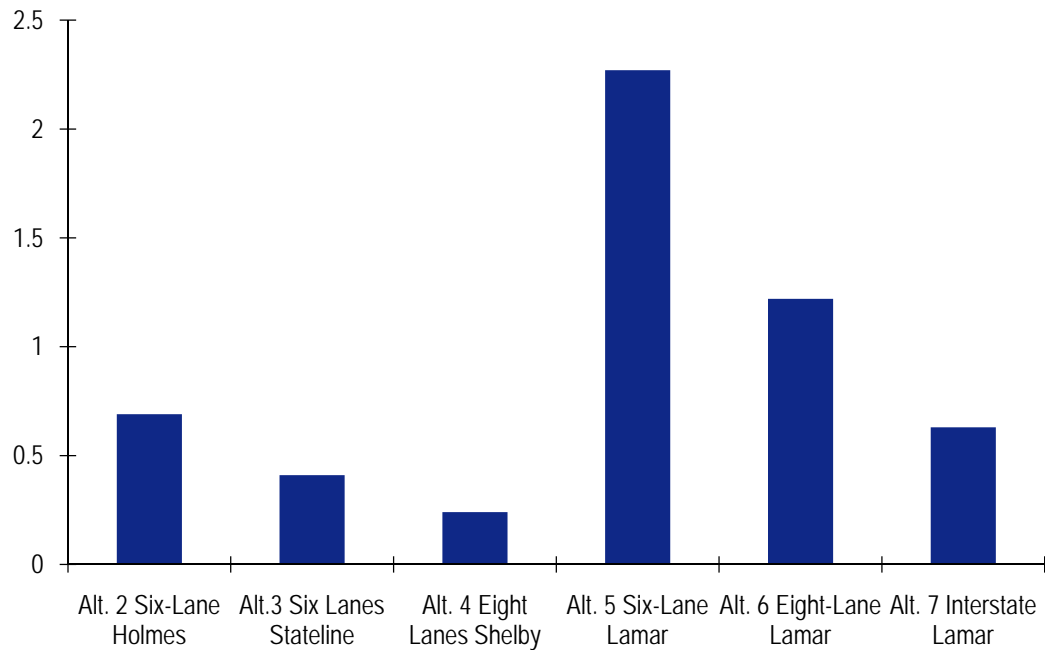
The 2030 benefits provided in Table 8.9 were combined with the 2030 annualized costs provided in Table 8.10 to develop 2030 benefit/cost (B/C) ratios for each alternative. These ratios are provided in Table 8.11 and Figure 8.1. The highest B/C ratio is for making Lamar Avenue a six-lane facility with a ratio of 2.27. The next highest ratio is making Lamar Avenue an eight-lane facility with a B/C ratio of 1.22. These are the only two alternatives with benefits that are higher than costs in 2030. Upgrading Lamar Avenue to an Interstate has the highest amount of benefits as shown in Table 8.9. However, due to the high cost of this alternative, the B/C ratio for this alternative is the third highest of all of the ones considered for this study at 0.63.

The highest B/C ratio for a diversion alternative was making Holmes Road six lanes with a 0.69 B/C ratio. The other diversion alternatives had ratios of 0.41 and 0.24 for adding lane to Stateline Road and Shelby Drive, respectively.

**Table 8.11 Benefit-Cost Ratios by Alternative**

Cost Metric (Millions of Dollars)	Change in Miles Traveled Relative to No Build					
	Alt. 2 Six-Lane Holmes	Alt. 3 Six Lanes Stateline	Alt. 4 Eight Lanes Shelby	Alt. 5 Six-Lane Lamar	Alt. 6 Eight-Lane Lamar	Alt. 7 Interstate Lamar
2030 Project Benefits	\$2.2	\$4.6	\$0.8	\$10.2	\$13.7	\$20.7
2030 Project Costs	\$3.2	\$11.3	\$3.4	\$4.5	\$11.3	\$32.7
2030 B/C Ratio	0.69	0.41	0.24	2.27	1.22	0.63

Figure 8.1 Benefit/Cost Ratios by Alternative



## 8.5 BENEFIT/COST ANALYSIS FOR INTERCHANGE IMPROVEMENT ALTERNATIVES

This section describes a benefit/cost analysis for the interchange improvement alternatives. The analysis of the interchange alternatives was conducted using a simulation model rather than the travel demand model used for the capacity enhancement alternatives. The simulation model was selected because it is better suited to describing the impacts of alternatives that do not increase the mainline capacity of Lamar Avenue. These alternatives include interchange improvements, signalization improvements, and geometric improvements. However, the methodology conducted for the simulation analysis has vastly different characteristics than the travel demand model and therefore the results described in this section are not directly comparable to Sections 8.1 to 8.4.

One of the key metrics generated for the interchange alternatives was the travel time of Lamar Avenue. By comparing the travel times for each alternative to the differential in costs between the alternatives, it is possible to observe some benefit-cost relationships for the interchange alternatives. Table 8.12 shows the costs of each alternative along with the benefits in terms of improved travel time for the Lamar Avenue corridor. These two metrics are used to generate a cost per minute of travel time benefit for the corridor.

As shown in Table 7.12, the alternative with the lowest (best) cost-to-travel time relationship is Alternative 5HWS-4L (4-lane Lamar with all three interchanges) with a ratio of \$39 million per minute of average travel time savings on Lamar Avenue. However, there are five alternatives with ratios that are relatively close to this best alternative. These alternatives are: Alt. 5H, Alt. 5W, Alt. 5HW, Alt. 5WS, and Alt. 5HWS. The highest of these alternatives has a cost-to-travel time relationship of \$44 million per minute of average travel time savings on Lamar Avenue. The interchange with the worst ratio as a single improvement is the interchange at Shelby Drive with a cost per minute benefit ratio of \$50 million compared to \$43 million and \$44 million at the other two interchanges. The 8-lane alternative with no interchanges (Alternative 6) performed much worse than the 6-lane alternative without interchanges and the alternatives with interchanges. The four-lane alternative with operational improvements had a negative performance in terms of its ability to reduce travel time on Lamar Avenue due to the fact that it maximized performance at two intersections without increasing capacity rather than maximizing performance along Lamar Avenue.

These results indicate that the development of interchanges on Lamar Avenue are cost-effective solutions with increasing efficiency as more interchanges are built. The results also indicate that developing an interchange at Shelby Drive is only cost-effective if an interchange at Winchester Road is also pursued. Additionally, while the 4-lane alternative has the best cost-per-benefit ratio, the more extensive results of the travel demand model described in sections 8.1 through 8.4 indicate that six lanes are needed to meet the long-term needs of both cars and trucks in the study area throughout all periods of the day.

**Table 8.12 Monetary Value of Performance Metrics**

Performance Metric	Cost (\$ millions)	Reduction in Average Travel Time for Lamar Avenue (minutes)	Cost Per Minute of Benefit Ratio
Alt. 1 – No Build	-	n/a	n/a
Alt. 1A – Operational Improvements without Interchanges	9.4	-0.5	-19
Alt. 5 – 6-lane, no ints	89.1	1.8	50
Alt. 6 – 8-lane, no ints	254.6	3.7	69
Alt. 5H – 6-lane, int. at Holmes	109.2	2.5	44
Alt. 5W – 6-lane, int at Winchester	142.4	3.3	43
Alt. 5S – 6-lane, int. at Shelby	195.6	3.9	50
Alt. 5HW – 6-lane, int. at Holmes and Winchester	162.4	4.0	41
Alt. 5HS – 6-lane, int. at Holmes and Shelby	215.7	4.6	47
Alt. 5WS – 6-lane, int. at Winchester and Shelby	248.9	5.9	42
Alt. 5HWS – 6-lane, int. at Holmes, Winchester and Shelby	275.1	6.5	42
Alt. 5HWS-4L – 4-lane, int. at Holmes, Winchester, and Shelby	213.2	5.4	39

## 8.6 CONCLUSIONS

Lamar Avenue is a severely congested facility impacting the operation of several freight facilities in the study area. Impacted facilities include the newly expanded BNSF yard, the Memphis International Airport, and several warehouses and distribution centers in the study area.

This study has analyzed several alternatives for improving traffic conditions in Lamar Avenue over a long-term horizon. There are several key conclusions from this analysis as follows:

- **Operational solutions are insufficient to provide notable benefits to the Lamar Avenue corridor.** Options such as signal timing and geometric improvements fail to deliver significant benefits, because congestion on the corridor overwhelms the benefits of these improvements.
- **Upgrading Lamar Avenue to an Interstate provides the most traffic relief benefits for Lamar Avenue.** It reduces delay the most both for Lamar Avenue and for the study area as a whole. It also provides the lowest travel time for traveling the entire length of Lamar Avenue. It also provides a seamless connection to I-22, which has been constructed along the Lamar Avenue alignment in Mississippi.
- Making Lamar Avenue eight or six lanes for its entire alignment between the Mississippi state line and I-240 provides the second and third highest traffic impacts to the corridor and the study area. These alternatives provide relatively high amounts of congestion relief to Lamar Avenue and the study area, including significantly reduced travel time on the corridor. These alternatives also preserve connectivity between Lamar Avenue and the multitude of freight-related facilities in the study area.
- **The diversion alternatives do not provide a significant amount of traffic impacts to the corridor.** This is likely due to the diversion benefits of I-269, as mentioned earlier. These alternatives do not significantly improve traffic along Lamar Avenue.
- **Adding lanes to Lamar Avenue provide the highest benefit/cost ratios for all of the Lamar Avenue improvements.** This is because their costs are significantly lower than upgrading Lamar Avenue to an Interstate. Making Lamar Avenue eight lanes provides roughly two-thirds of the benefit of upgrading Lamar to an Interstate with only one-third of the cost. Making Lamar Avenue six lanes provides half the benefit with only one-sixth of the costs.
- **Upgrading key intersections along Lamar Avenue to interchanges would be a cost-effective, near-term enhancement to the corridor.** Simulation analysis demonstrated that interchanges at Shelby Drive, Winchester Road, and Holmes Road provided efficient traffic improvements to assist in accommodating the near-term traffic demand in the corridor.

Other important conclusions which were not directly analyzed in this study, but are relevant for future consideration are as follows:

- **Lamar Avenue should be added to Tennessee’s ITS system, Smartway.** Lamar Avenue is the most significant roadway feeding into the core of Memphis that does not have real-time traffic data available to the trucking community or general public. While significant diversion alternatives are not yet available for Lamar Avenue, the real-time travel data will provide valuable operational information to the corridor as improvements are implemented. This recommendation is also consistent with the recommendations provided in the Memphis Freight Infrastructure Study conducted by the Memphis Chamber of Commerce, which identified ITS improvements as part of the solution for Lamar Avenue.
- **The development of I-269 is critical to diverting through traffic away from Lamar Avenue.** I-269 will provide through traffic connecting Mississippi to downtown Memphis an option to divert away from Lamar Avenue and towards I-55. This diversion will be relevant for both auto and truck traffic. Providing real-time travel information on the conditions of Lamar Avenue, I-269, and I-55 should also be the focus of the ITS improvements developed on Lamar Avenue. This will provide motorists and truck drivers with the information needed to maximize the use of the study area’s infrastructure. Without I-269 being built, then the alternatives described in this study will need to be reanalyzed. It is possible that without I-269 being built that the B/C ratios estimated in this study would change significantly.





# **A. Typical Cross Sections**

Figure A.1 Lamar Avenue Corridor Existing Sections

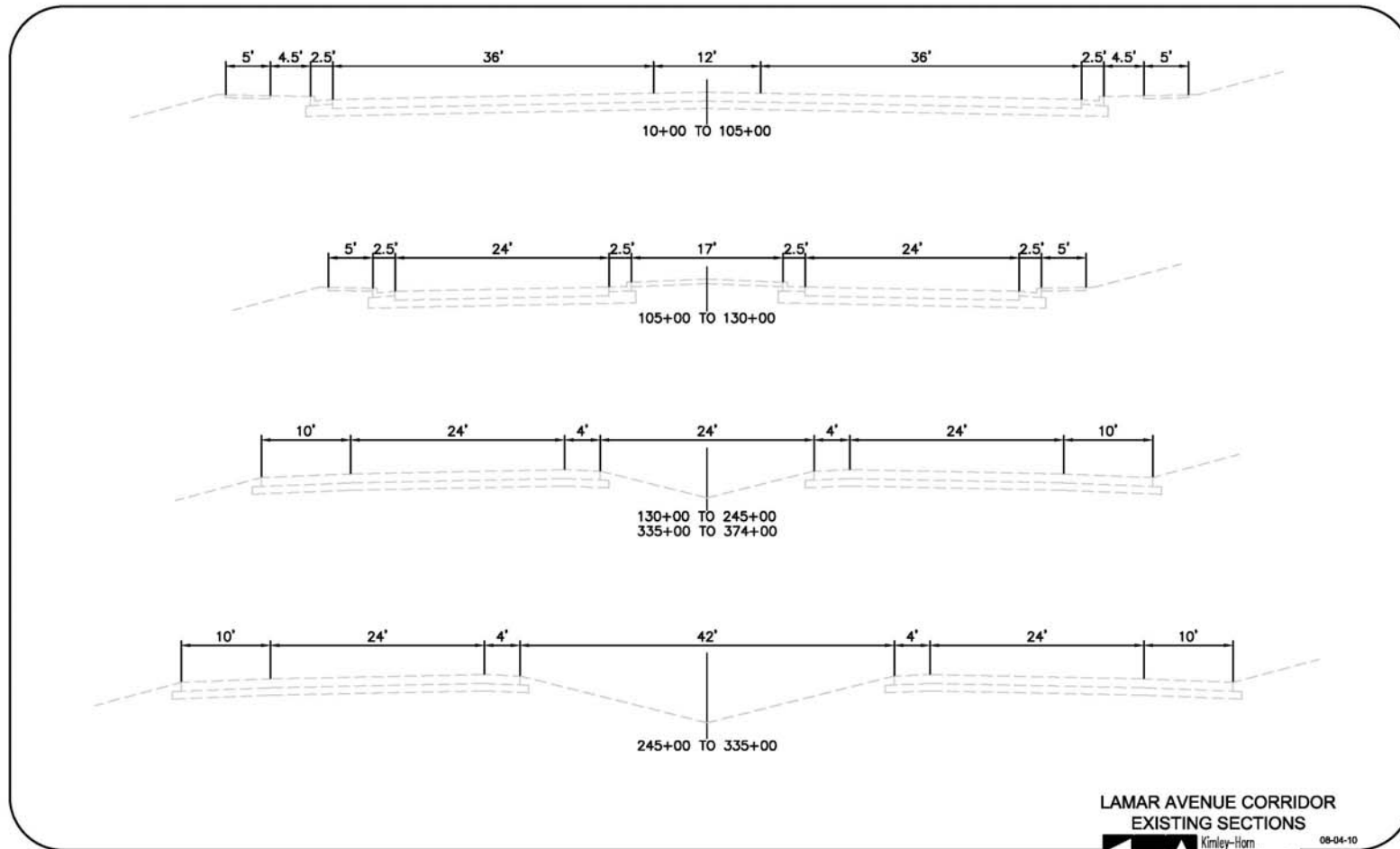


Figure A.2 Stateline Road Existing Sections

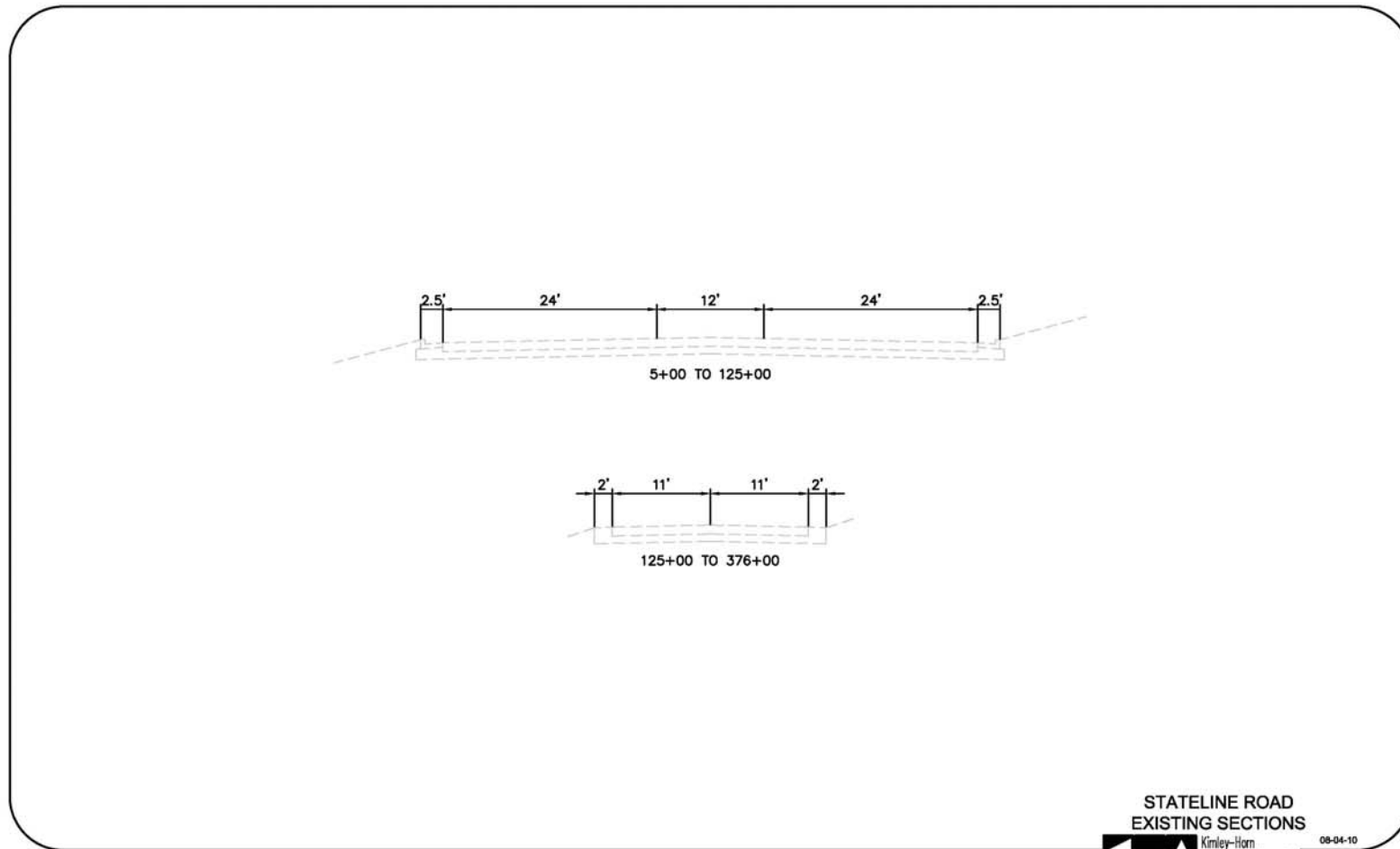


Figure A.3 Lamar Avenue Corridor Proposed Sections

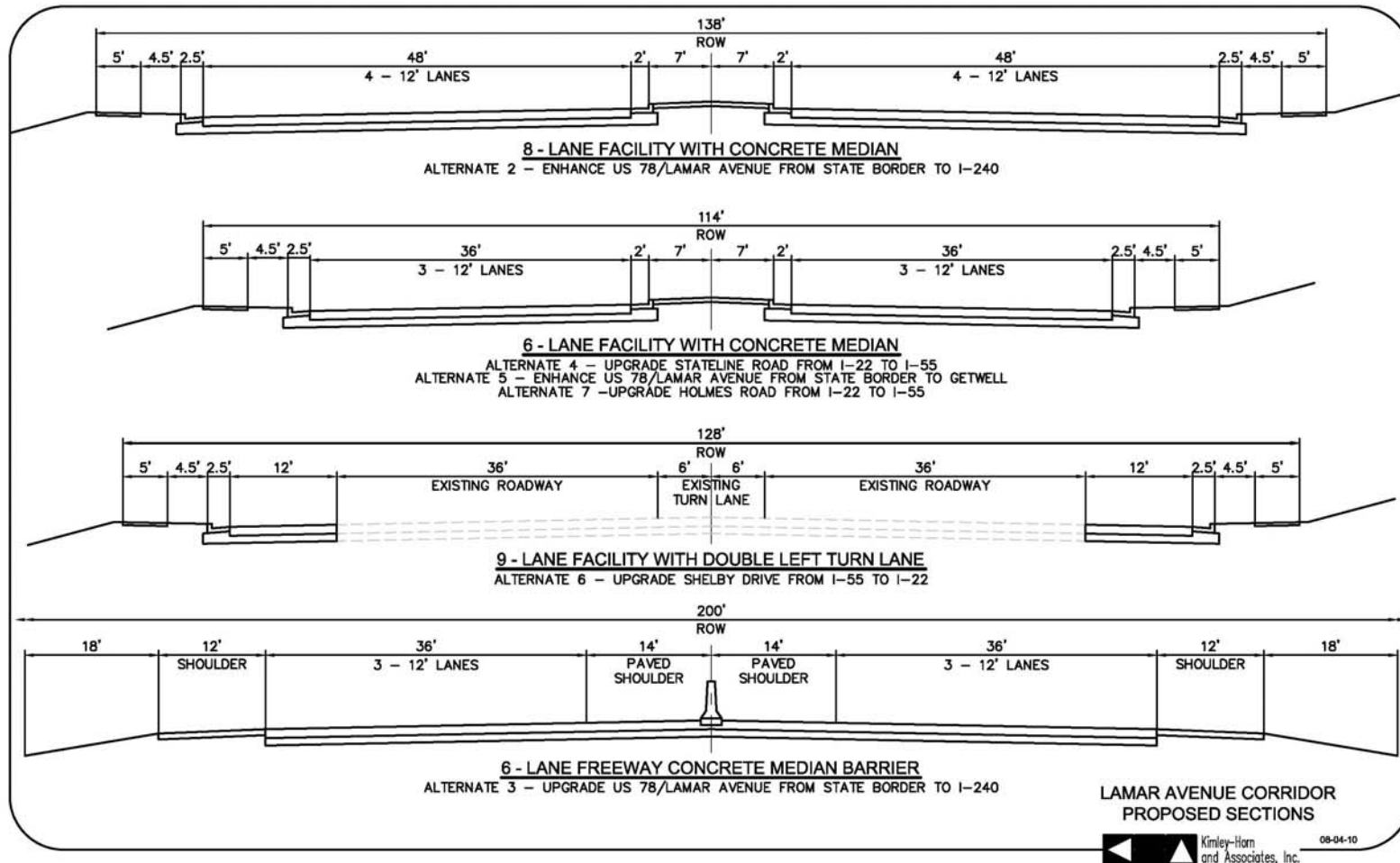


Figure A.4 Lamar Avenue Corridor – 8 Lane Facility with Concrete Median

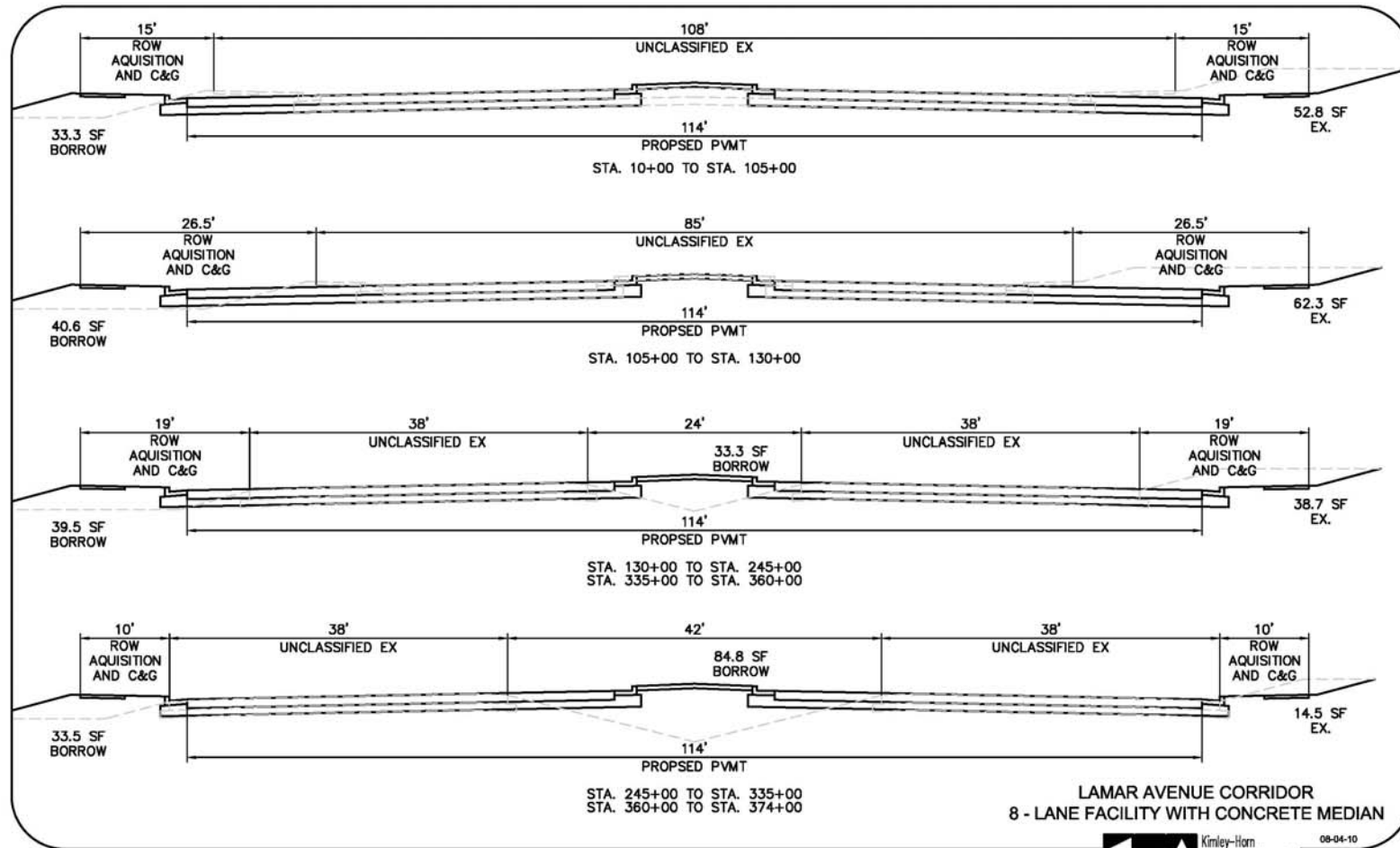


Figure A.5 Lamar Avenue Corridor – 6 Lane Freeway with Concrete Median Barrier

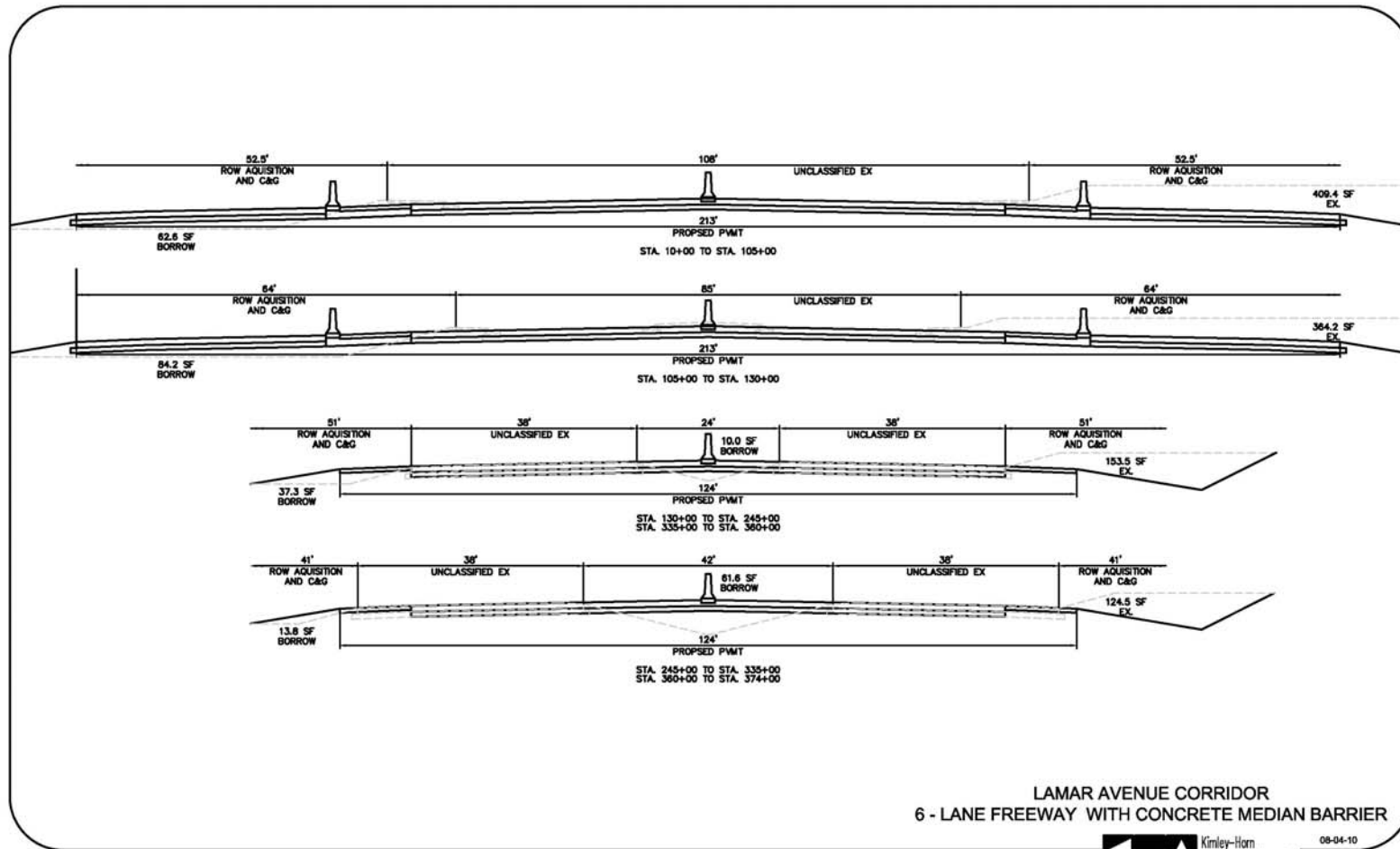


Figure A.6 Lamar Avenue Corridor – 6 Lane with Concrete Median from State Border to Getwell

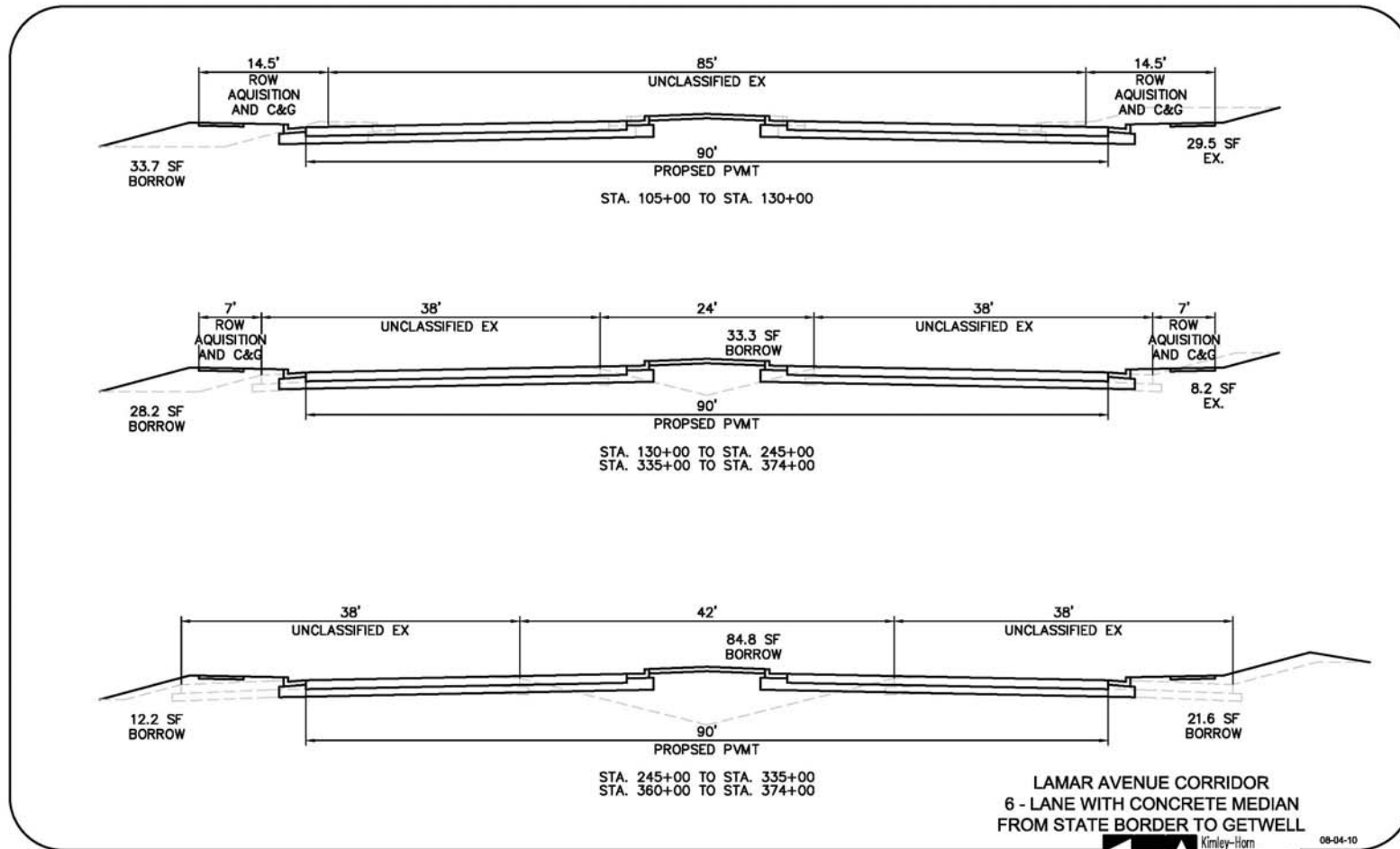


Figure A.7 Stateline Road – 6 Lane with Concrete median from I-55 to I-22

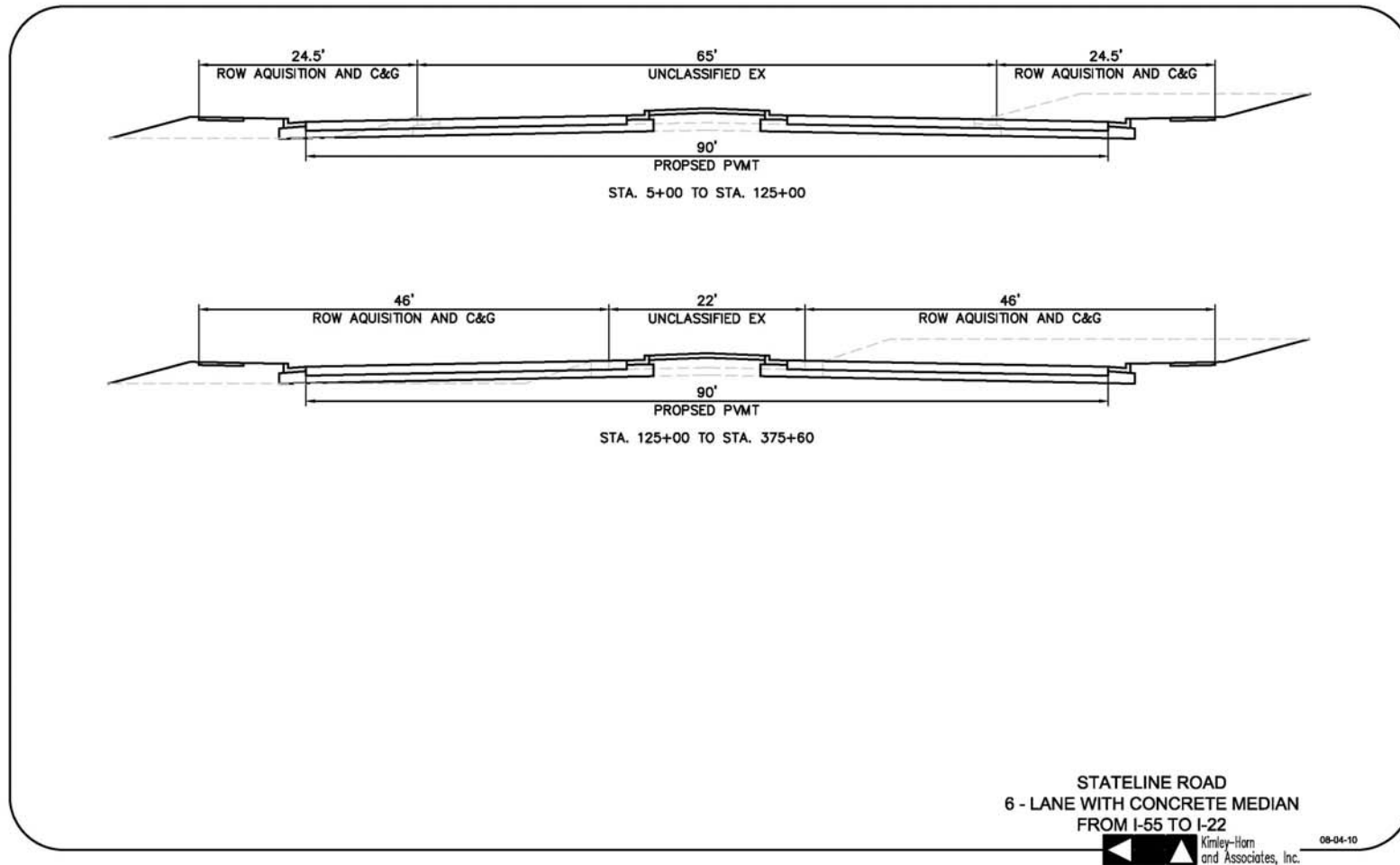




Figure A.8 S.R. 4 Typical Sections

