



ARIZONA
TEXAS
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February 13, 2015

Mr. Meran Dadgostar P.E., R.S.
Town of Highland Park
4700 Drexel Dr.
Highland Park, Texas 75205

Re: *Traffic Circulation Study for Neighborhood Southwest of Mockingbird Lane and Airline Road, Highland Park, Texas*

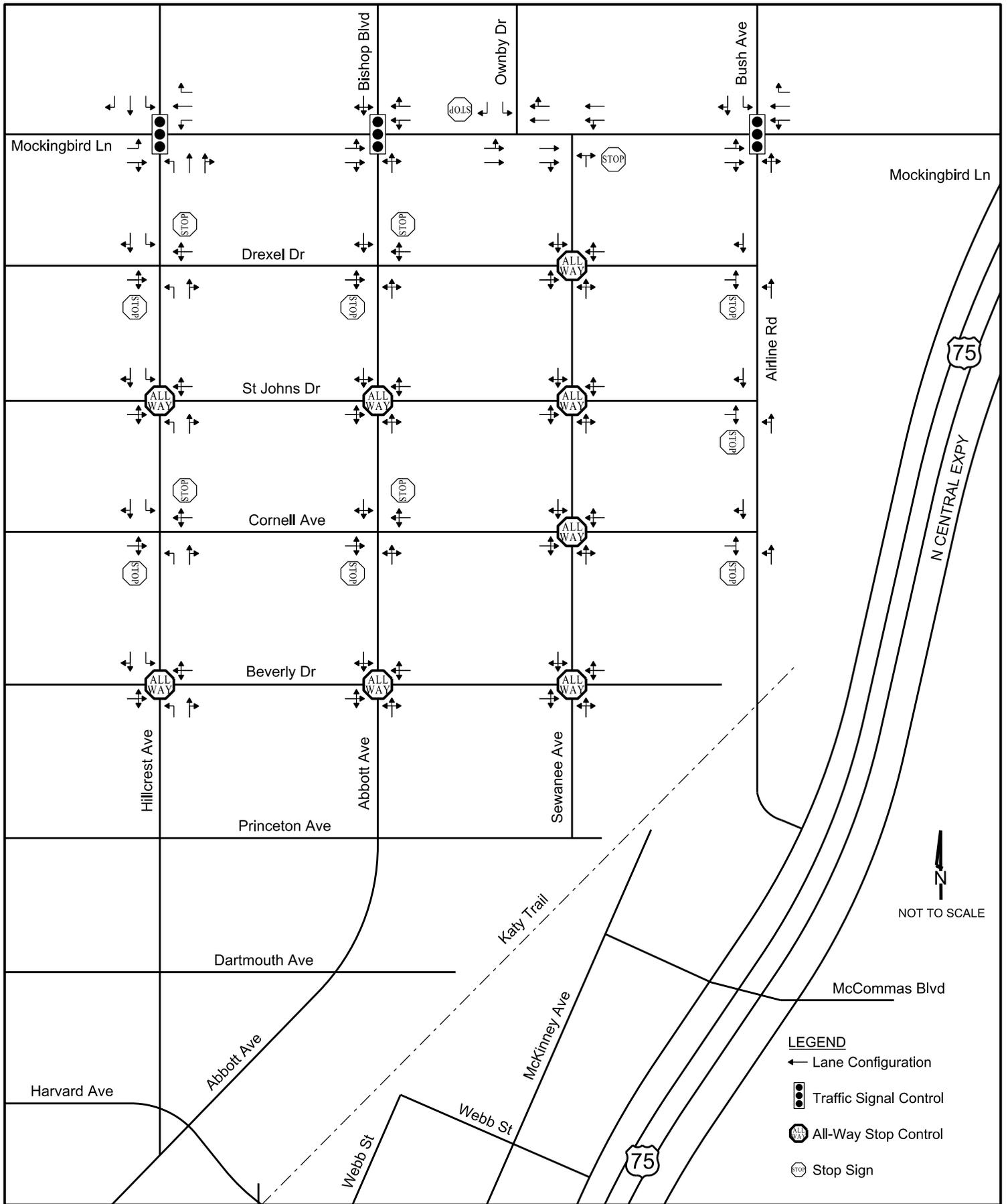
Dear Mr. Dadgostar:

Lee Engineering has completed the analysis of the traffic patterns and mitigation options in the neighborhood southwest of Mockingbird Lane and Airline Road in Highland Park, Texas. Several scenarios were analyzed to address potential neighborhood cut-through traffic and are discussed in this study.

Background Information

The primary study neighborhood includes the neighborhood bounded by Mockingbird Lane to the north, Airline Road to the east, Hillcrest Avenue to the west, and Katy Trail to the south. Southern Methodist University (SMU) is located north of the neighborhood on the other side of Mockingbird Lane. US Highway 75 (US-75) is located to the east of the neighborhood. Study intersections include the intersections of Mockingbird Lane with Hillcrest Avenue, Abbott Avenue, Sewanee Avenue, and Airline Road. Intersections within the primary study neighborhood were also included. **Figure 1** provides an aerial view of the study area.

Mockingbird Lane is a four-lane undivided roadway with a posted speed limit of 30 miles per hour (mph) in the vicinity of the study area. Mockingbird Lane is classified as a Principal Arterial in the City of Dallas and Dallas County thoroughfare plans, and is a major east-west arterial running through Highland Park. Mockingbird Lane is one of only three roads providing a complete route through the Town of Highland Park. The other roads are Beverly Drive and Bordeaux Avenue/Armstrong Avenue. Due to congestion along Mockingbird Lane, many local residents and other traffic may attempt to avoid Mockingbird Lane by using neighborhood roads to the south. Such traffic puts pressure on connecting roads, such as Airline Road, which is the nearest north-south roadway to US-75. Airline Road is a two-lane undivided roadway with a posted speed limit of 30 mph.

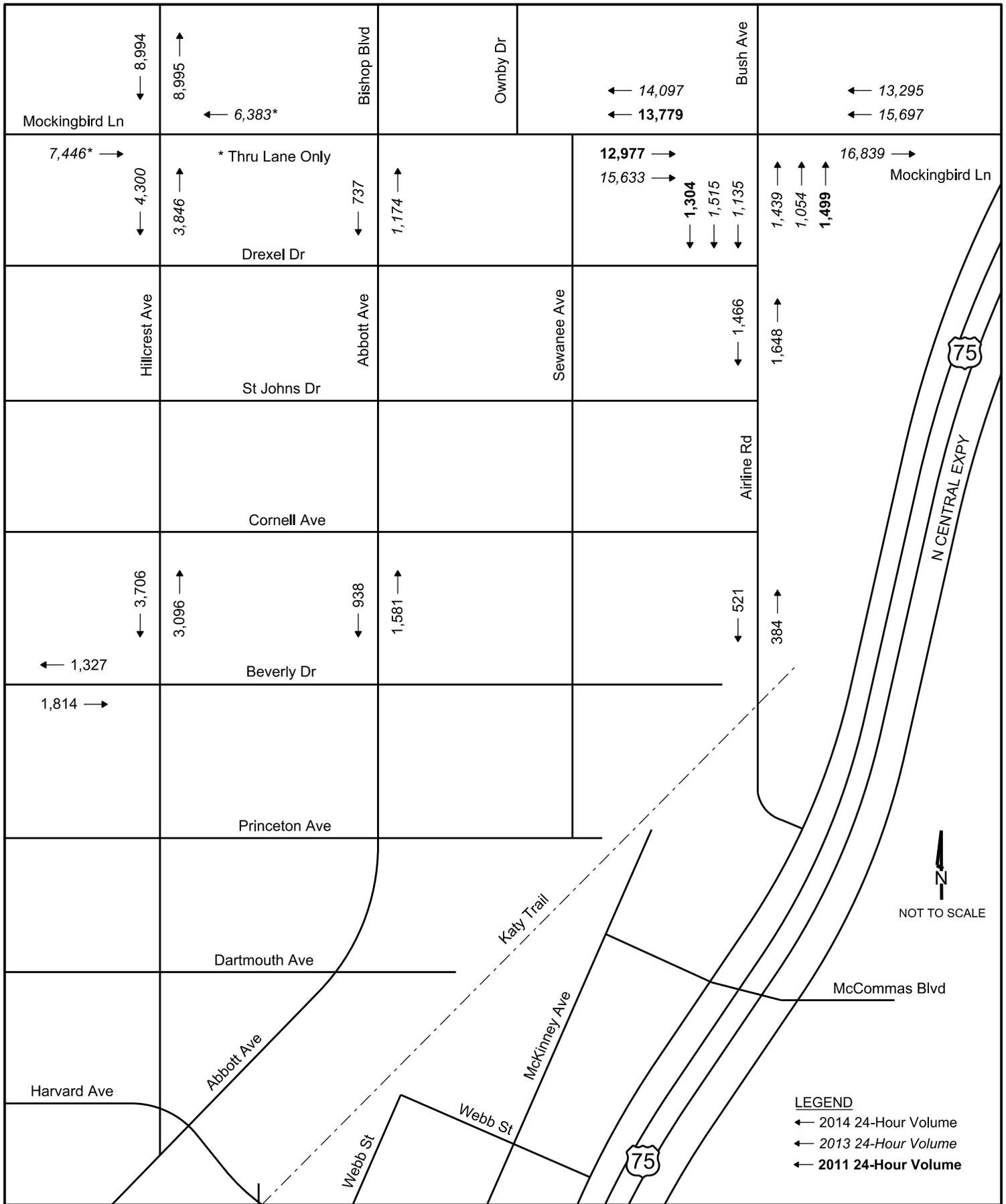



 NOT TO SCALE

- LEGEND**
-  Lane Configuration
 -  Traffic Signal Control
 -  All-Way Stop Control
 -  Stop Sign

Existing Intersection Lane Configurations and Traffic Control

Figure 2

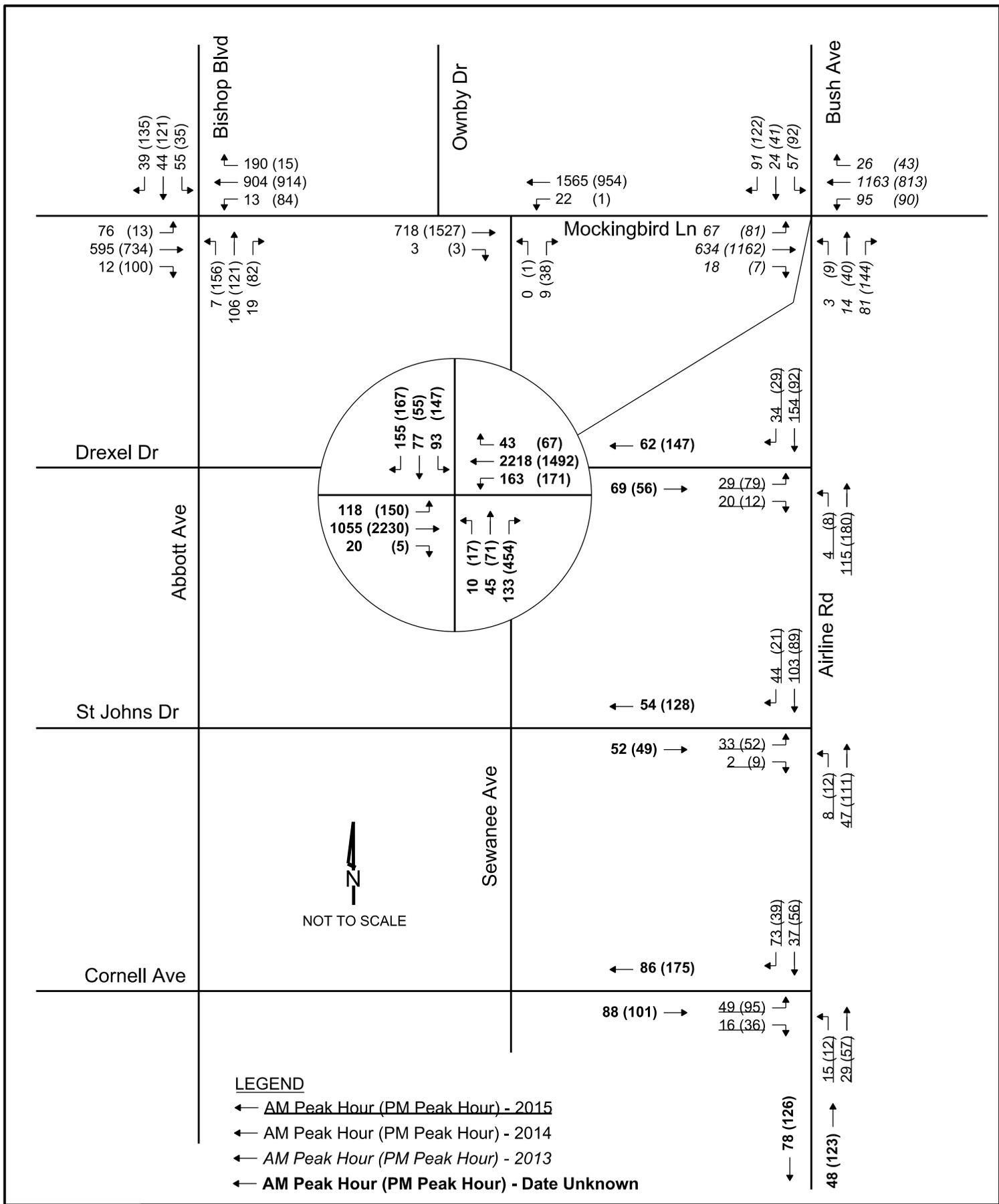


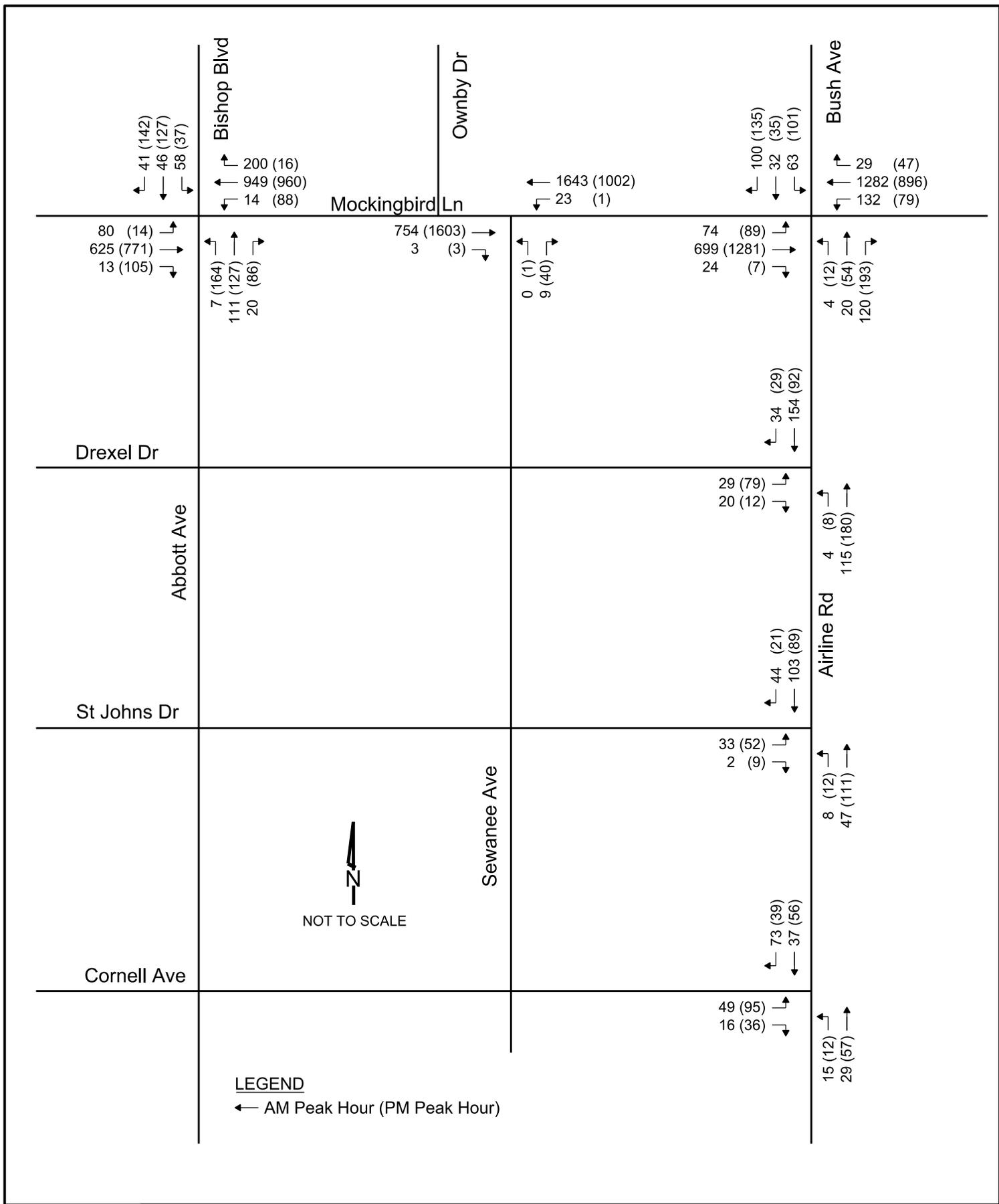
3030 LBJ FREEWAY
 SUITE 1660
 DALLAS, TEXAS 75234
 972-248-3006 FAX 972-248-3855

Weekday Average Daily Traffic Volumes

Figure 3

DALLAS - PHOENIX - ALBUQUERQUE
 OKLAHOMA CITY - SAN ANTONIO





Trip Generation

The number of trips generated by the primary and secondary study neighborhoods was estimated to obtain an idea of the local traffic volumes likely to use local roadways rather than Mockingbird Lane. The number of trips generated by a development is a function of the type and quantity of land use for the development. The number of vehicle trips generated by the neighborhoods was estimated based on the trip generation rates and equations provided in the publication entitled *Trip Generation Manual, Ninth Edition*, by the Institute of Transportation Engineers (ITE). Estimates of the number of trips generated by the site were made for the AM and PM peak hour, as well as on a daily basis. The trip generation equations, directional splits, and estimated number of trips generated by the neighborhood are provided in **Table 1**. Based on satellite imagery, approximately 330 houses are included in the primary study neighborhood and approximately 400 houses are included in the secondary study neighborhood.

Table 1: Trip Generation Calculations

Land Use	ITE Code	Average Weekday			AM Peak Hour			PM Peak Hour		
Equation/Rates¹										
Single-Family Detached Housing	210	Ln(T) = 0.92*Ln(X) + 2.72			T = 0.70*X + 9.74			Ln(T) = 0.90*Ln(X) + 0.51		
Directional Splits²										
Single-Family Detached Housing	210	50 / 50			25 / 75			63 / 37		
Trips Generated										
Neighborhood	Size	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit
Primary	330 Units	3,152	1,576	1,576	241	60	181	308	194	114
Secondary	400 Units	3,760	1,880	1,880	290	73	217	366	231	135
TOTAL		6,912	3,456	3,456	531	133	398	674	425	249

¹ T = Trip Ends; X = Dwelling Units

² XX / YY = % entering vehicles / % exiting vehicles

Based on the existing traffic volumes shown in Figure 5, the number of vehicles exiting the neighborhood to Mockingbird Lane via the study intersections (Abbott Avenue, Sewanee Avenue, and Airline Road) and to the southern portion of Airline Road are:

- 344 vehicles during the AM peak hour; and
- 769 vehicles during the PM peak hour.

The number of vehicles entering the neighborhood at the study intersections along Mockingbird Lane and from the southern portion of Airline Road are:

- 331 vehicles during the AM peak hour; and
- 514 vehicles during the PM peak hour.

Based on the trip generation results, a significant amount of traffic generated by the primary and secondary neighborhoods appears to be using local roads rather than traveling along Mockingbird Lane.

Mitigation Scenarios

Several potential options to address traffic movements in the neighborhood have been identified. Each option was evaluated as part of this project. This section presents each scenario, along with a description and analysis. For each scenario the effect of the concept will be modeled, advantages and disadvantages will be identified along with impacts on area roadways.

Review of several of the scenarios included intersection capacity analysis. The Level of Service (LOS) of an intersection is a qualitative measure of capacity and operating conditions that is directly related to vehicle delay. The LOS criteria for a signalized intersection are shown in **Table 2** and the LOS criteria for an unsignalized intersection are shown in **Table 3**. LOS is given a letter designation from A to F, with LOS A representing very short delays and LOS F representing very long delays. As a practical consideration, LOS D is typically considered the limit of acceptable operation.

Table 2: Level of Service Criteria for Signalized Intersections

Level-of-Service (LOS)	Average Control Delay (seconds/vehicle)	Description
A	≤ 10.0	Very low vehicle delays, free flow, signal progression extremely favorable, most vehicles arrive during given signal phase.
B	10.1 to 20.0	Good signal progression, more vehicles stop and experience higher delays than for LOS A.
C	20.1 to 35.0	Stable flow, fair signal progression, significant number of vehicles stop at signals.
D	35.1 to 55.0	Congestion noticeable, longer delays and unfavorable signal progression, many vehicles stop at signals.
E	55.1 to 80.0	Limit of acceptable delay, unstable flow, poor signal progression, traffic near roadway capacity, frequent cycle failures.
F	> 80.0	Unacceptable delays, extremely unstable flow and congestion, traffic exceeds roadway capacity, stop-and-go conditions.

SOURCE: *Highway Capacity Manual, HCM 2010*, Transportation Research Board, 2010

Table 3: Level of Service Criteria for Unsignalized Intersections

Level-of-Service (LOS)	Average Control Delay (seconds/vehicle)	Description
A	≤ 10.0	No delays at intersections with continuous flow of traffic. Uncongested operations: high frequency of long gaps available for all left and right turning traffic. No observable queues.
B	10.1 to 15.0	No delays at intersections with continuous flow of traffic. Uncongested operations: high frequency of long gaps available for all left and right turning traffic. No observable queues.
C	15.1 to 25.0	Moderate delays at intersections with satisfactory to good traffic flow. Light congestion; infrequent backups on critical approaches.
D	25.1 to 35.0	Increased probability of delays along every approach. Significant congestion on critical approaches, but intersection functional. No standing long lines formed.
E	35.1 to 50.0	Heavy traffic flow condition. Heavy delays probable. No available gaps for cross-street traffic or main street turning traffic. Limit of stable flow.
F	> 50.0	Unstable traffic flow. Heavy congestion. Traffic moves in forced flow condition. Average delays greater than one minute highly probable. Total breakdown.

SOURCE: *Highway Capacity Manual, HCM 2010*, Transportation Research Board, 2010

Option 1 – Close Airline Road at Mockingbird Lane

This scenario involves the complete closure of Airline Road south of Mockingbird Lane, resulting in a T-intersection of Mockingbird Lane with Bush Avenue (southbound approach). With this scenario, traffic on Airline Road accessing Mockingbird Lane and traffic on Mockingbird Lane accessing Airline Road is rerouted to other intersections. The estimated traffic volumes for Option 1 are shown in **Figure 6**. Continued signal control at Mockingbird Lane and Bush Avenue was evaluated. In addition, the effects of replacing the existing signal with stop-control on Bush Avenue was evaluated. The stop-controlled intersection was also evaluated with southbound left turn restrictions in an attempt to limit southbound delay.

Table 4 shows the intersection capacity results for intersections along Mockingbird Lane for Option 1 compared to Existing Conditions. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.

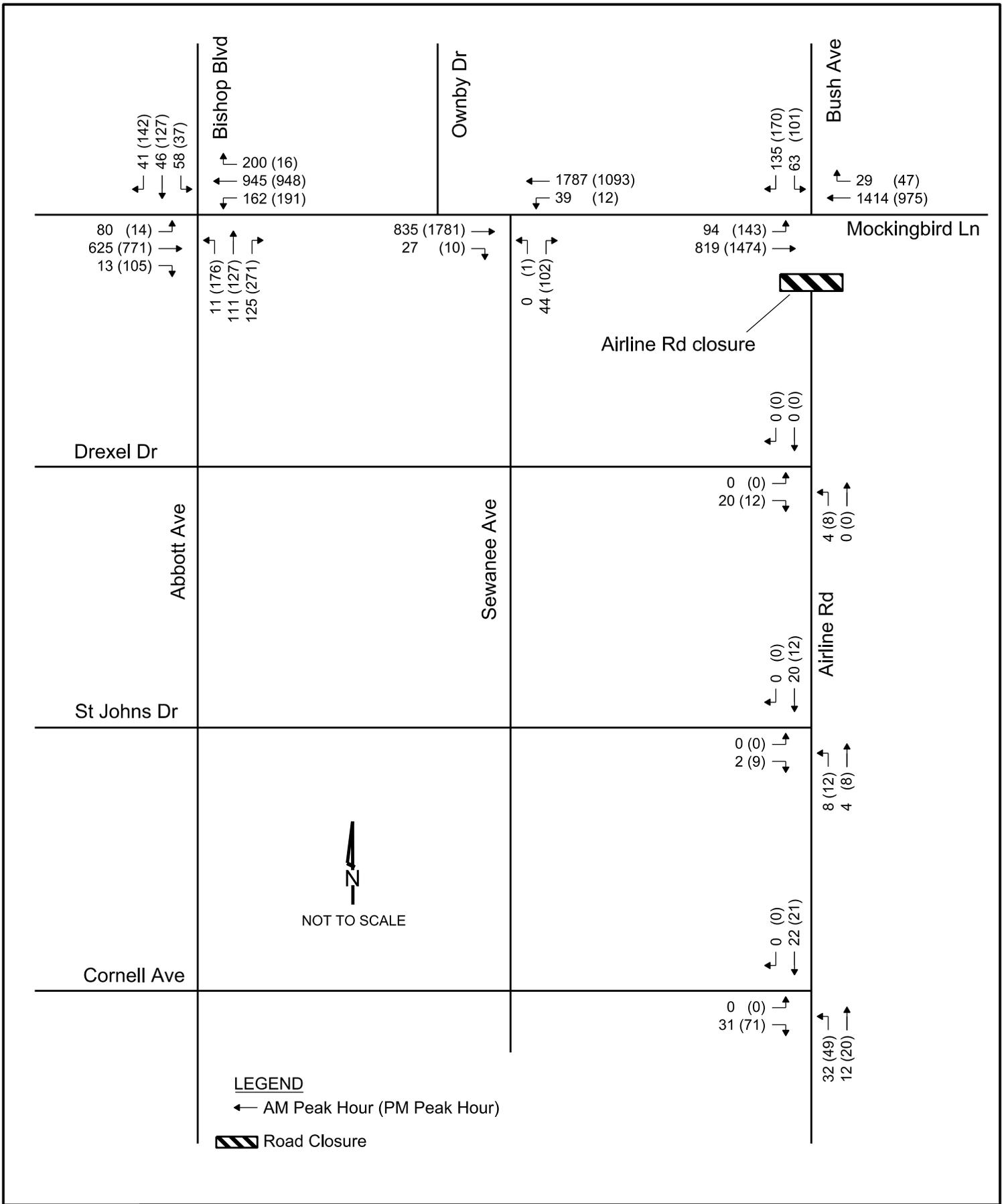


Table 4: Intersection Capacity Analysis Results – Option 1

Mockingbird Lane and Airline Road/Bush Avenue						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	54.5 (D) ¹	60.2 (E)	47.8 (D)	49.0 (D)	86.7 (F)
	PM	67.8 (E)	66.9 (E)	72.1 (E)	45.6 (D)	77.4 (E)
Option 1 (Signalized)	AM	9.4 (A)	11.9 (B)	5.7 (A)	---	25.2 (C)
	PM	16.6 (B)	18.1 (B)	2.8 (A)	---	52.0 (D)
Option 1 (Stop-Control)	AM	--- ²	4.3 (A)	0.0 (A)	---	>300 (F)
	PM	--- ²	3.5 (A)	0.0 (A)	---	>300 (F)
Option 1 (Stop-Control with no SB LT)	AM	--- ²	4.3 (A)	0.0 (A)	---	26.5 (D)
	PM	--- ²	3.5 (A)	0.0 (A)	---	16.9 (C)
Mockingbird Lane and Abbott Avenue/Bishop Boulevard						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	11.4 (B)	7.8 (A)	8.0 (A)	22.4 (C)	33.0 (C)
	PM	35.5 (D)	14.0 (B)	46.4 (D)	75.4 (E)	16.6 (B)
Option 1 (Signalized)	AM	52.5 (D)	13.8 (B)	61.7 (E)	54.2 (D)	122.0 (F)
	PM	133.9 (F)	15.5 (B)	81.1 (F)	>300 (F)	45.4 (D)
Mockingbird Lane and Sewanee Avenue						
Traffic Condition	Peak Hour	Intersection ²	EB	WB	NB	SB
Existing (Stop-Control)	AM	---	0.0 (A)	0.4 (A)	10.8 (B)	---
	PM	---	0.0 (A)	0.0 (A)	14.7 (B)	---
Option 1 (Stop-Control)	AM	---	0.0 (A)	0.7 (A)	9.5 (A)	---
	PM	---	0.0 (A)	0.6 (A)	21.5 (C)	---

¹ Delay in seconds/vehicle (Level of Service)

² Highway Capacity Manual (HCM) methodology does not provide intersection-wide delay for two-way stop-controlled (TWSC) analysis

As shown by the results in Table 4, the existing intersection of Mockingbird Lane and Abbott Avenue operates at acceptable levels of service, although the northbound approach operates at LOS E during the PM peak hour. The existing intersection of Mockingbird Lane and Airline Road operates at LOS E during the PM peak hour.

With the closure of Airline Road south of Mockingbird Lane, the intersection of Mockingbird Lane and Airline Road experiences improved levels of service on all approaches and for the intersection as a whole. This is due to the elimination of several traffic movements, including the westbound left turn and the entire northbound approach. On the other hand, as a stop-controlled T-intersection, the southbound left turn movement would experience significant delays. If southbound left turns were prohibited, the approach would be anticipated to operate at acceptable levels of service. Southbound left turns could be rerouted to the US-75 southbound frontage road via Potomac Avenue. However, some vehicles may make a right turn onto Mockingbird Lane and either U-turn at an intersection to the west, or enter the primary study neighborhood to turn around and go east on Mockingbird Lane.

Overall, it is not recommended to remove signalization at the intersection of Mockingbird Lane and Airline Road. During field visits, a significant number of pedestrians were observed crossing Mockingbird Lane at the intersection. Therefore, continued signalization is recommended for the safety of pedestrians.

In addition, with the closure of Airline Road south of Mockingbird Lane, the intersection of Mockingbird Lane and Abbott Avenue is anticipated to experience increased delays on all approaches. The intersection is anticipated to operate at LOS F during the PM peak hour. With the closure of Airline Road, a significant amount of traffic would be rerouted to utilize other entry/exit points into and out of the neighborhood. While some traffic was assumed to reroute via the intersection of Mockingbird Lane and Sewanee Avenue, most was anticipated to reroute to the intersection of Mockingbird Lane and Abbott Avenue due to the presence of a traffic signal.

Based on this analysis, it is not recommended to close Airline Road south of Mockingbird Lane. While improvement would be expected at the intersection of Mockingbird Lane and Airline Road, the intersection of Mockingbird Lane and Abbott Avenue would experience increased delays on all approaches, and unacceptable levels of service for most approaches. Closing Airline Road would limit access options for the neighborhood, including access for emergency vehicles. Finally, existing delays at the intersection of Mockingbird Lane and Airline Road may provide a metering effect on traffic entering the Town of Highland Park. Improvement to intersection operation may increase traffic volumes entering the Town. A summary of the pros and cons for Option 1 is shown in **Table 5**.

Table 5: Pros and Cons – Option 1

Pros	Cons
<ul style="list-style-type: none"> • Improved operation for new T-intersection at Mockingbird Lane and Airline Road • Reduced traffic along Airline Road • Elimination of potential to cut-through to Mockingbird Lane via Airline Road 	<ul style="list-style-type: none"> • Significantly increased delay at Mockingbird Lane and Abbott Avenue intersection due to increased traffic volumes • Increased delay at Mockingbird Lane and Sewanee Avenue intersection due to increased traffic volumes • Increased traffic along other neighborhood roadways, primarily Abbott Avenue • Overall relocation of traffic to other locations, including Abbott Avenue and Hillcrest Avenue • Limit of access options for the neighborhood, including for emergency vehicles • Increased efficiency at intersection of Mockingbird Lane and Airline Road may lead to increased traffic volumes entering and traveling through the Town of Highland Park

Option 2 – Close Airline Road North of Katy Trail

For this scenario, the effects of closing Airline Road just north of Katy Trail will be evaluated. Currently, Airline Road has access to the US Highway 75 (US-75) southbound frontage road just north of McCommas Boulevard, and to several office spaces south of Katy Trail. With the closure, Airline Road would no longer have this access, and traffic will be reassigned to other area roadways. The estimated traffic volumes for Option 2 are shown in **Figure 7**.

However, it should be noted that the amount of traffic utilizing Airline Road to access US-75 is not anticipated to be significant. From Airline Road, drivers will have to go through three signalized intersections along the US-75 frontage roads to access an on-ramp to southbound US-75. Drivers would also have to go through three signalized intersections to access an on-ramp to northbound US-75, as there is no southbound U-turn lane at the McCommas Boulevard interchange. On the other hand, there is a southbound on-ramp immediately south of the Mockingbird Lane interchange and a northbound on-ramp immediately north of Mockingbird Lane. Thus, most traffic attempting to access US-75 is expected to go to Mockingbird Lane.

Table 6 shows the intersection capacity results at the intersection of Mockingbird Lane and Airline Road for Option 2 compared to Existing Conditions. All traffic was assumed to reroute to this intersection. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.

Table 6: Intersection Capacity Analysis Results – Option 2

Mockingbird Lane and Airline Road						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	54.5 (D) ¹	60.2 (E)	47.8 (D)	49.0 (D)	86.7 (F)
	PM	67.8 (E)	66.9 (E)	72.1 (E)	45.6 (D)	77.4 (E)
Option 2 (Signalized)	AM	60.4 (E)	60.2 (E)	57.0 (E)	49.9 (D)	100.7 (F)
	PM	84.1 (F)	66.9 (E)	98.8 (F)	51.5 (D)	144.7 (F)

¹ Delay in seconds/vehicle (Level of Service)

As shown by the results in Table 6, increased delay is expected on most approaches at the intersection of Mockingbird Lane and Airline Road with the closure of Airline Road at Katy Trail due to the increased demand on the intersection. In addition, higher traffic volumes may be experienced along Airline Road with all vehicles traveling to the north rather than both the north and south. Therefore, closure of Airline Road at Katy Trail is not recommended. A summary of the pros and cons for Option 2 is shown in **Table 7**.

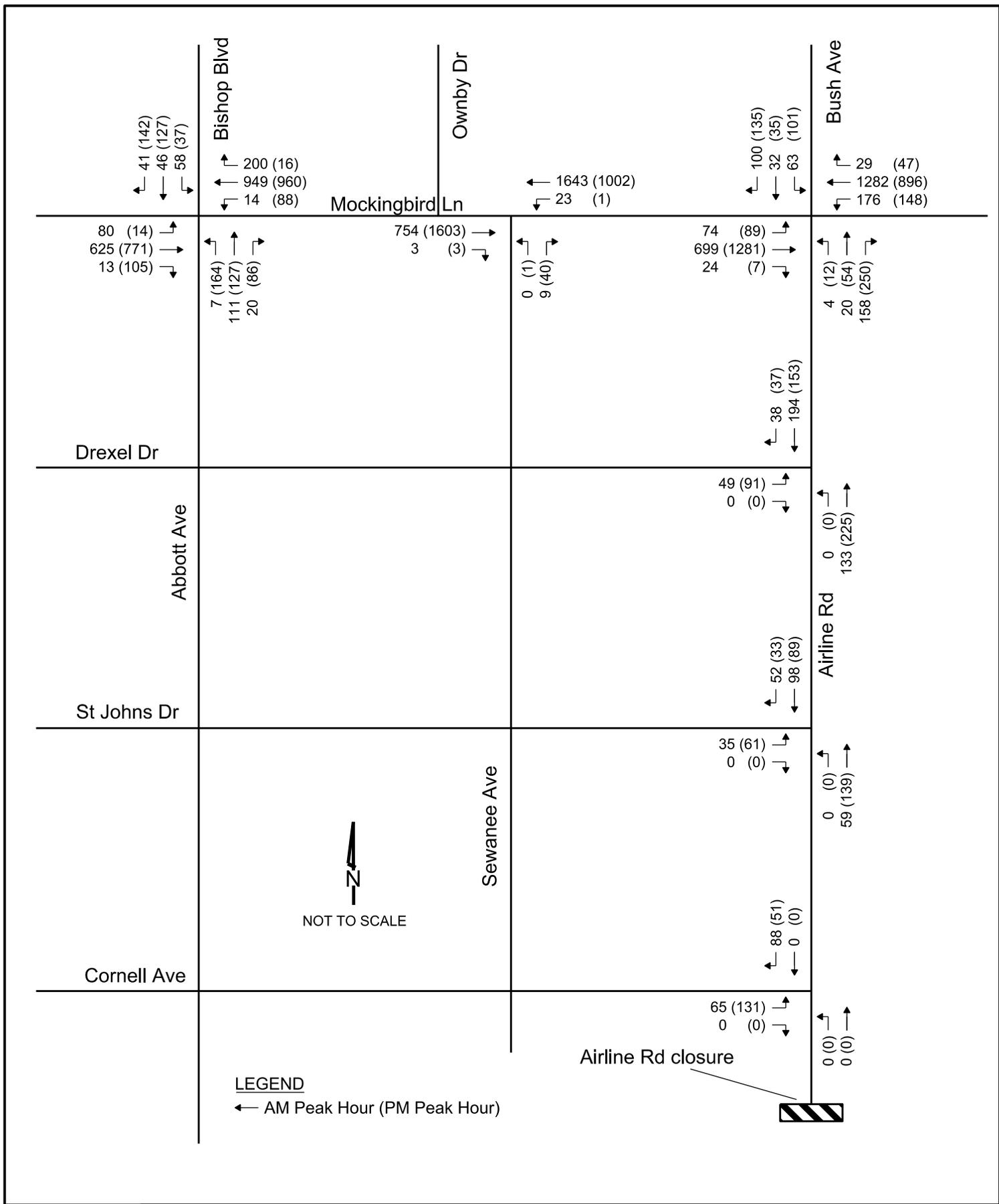


Table 7: Pros and Cons – Option 2

Pros	Cons
<ul style="list-style-type: none">• Reduced traffic along southern portion of Airline Road• Elimination of potential to cut-through neighborhood to US-75 via Airline Road• Elimination of vehicular traffic at Katy Trail crossing	<ul style="list-style-type: none">• Increased traffic volumes along northern portion of Airline Road south of Mockingbird Lane• Increased delay at Mockingbird Lane and Airline Road intersection due to increased traffic volumes• Limit of access options for the neighborhood, including for emergency vehicles• Closure of southern end of Airline Road could cause confusion to drivers for several years, and could result in lost drivers and U-turns within the neighborhood

Option 3 – Close Airline Road on Both Ends

This scenario is a combination of Option 1 and Option 2. Airline Road will be closed just south of Mockingbird Lane and just north of Katy Trail. Traffic will be reassigned from Airline Road to other area roadways to quantify the impact of the closure. The estimated traffic volumes for Option 3 are shown in **Figure 8**.

Table 8 shows the intersection capacity results for intersections along Mockingbird Lane for Option 3 compared to Existing Conditions. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.

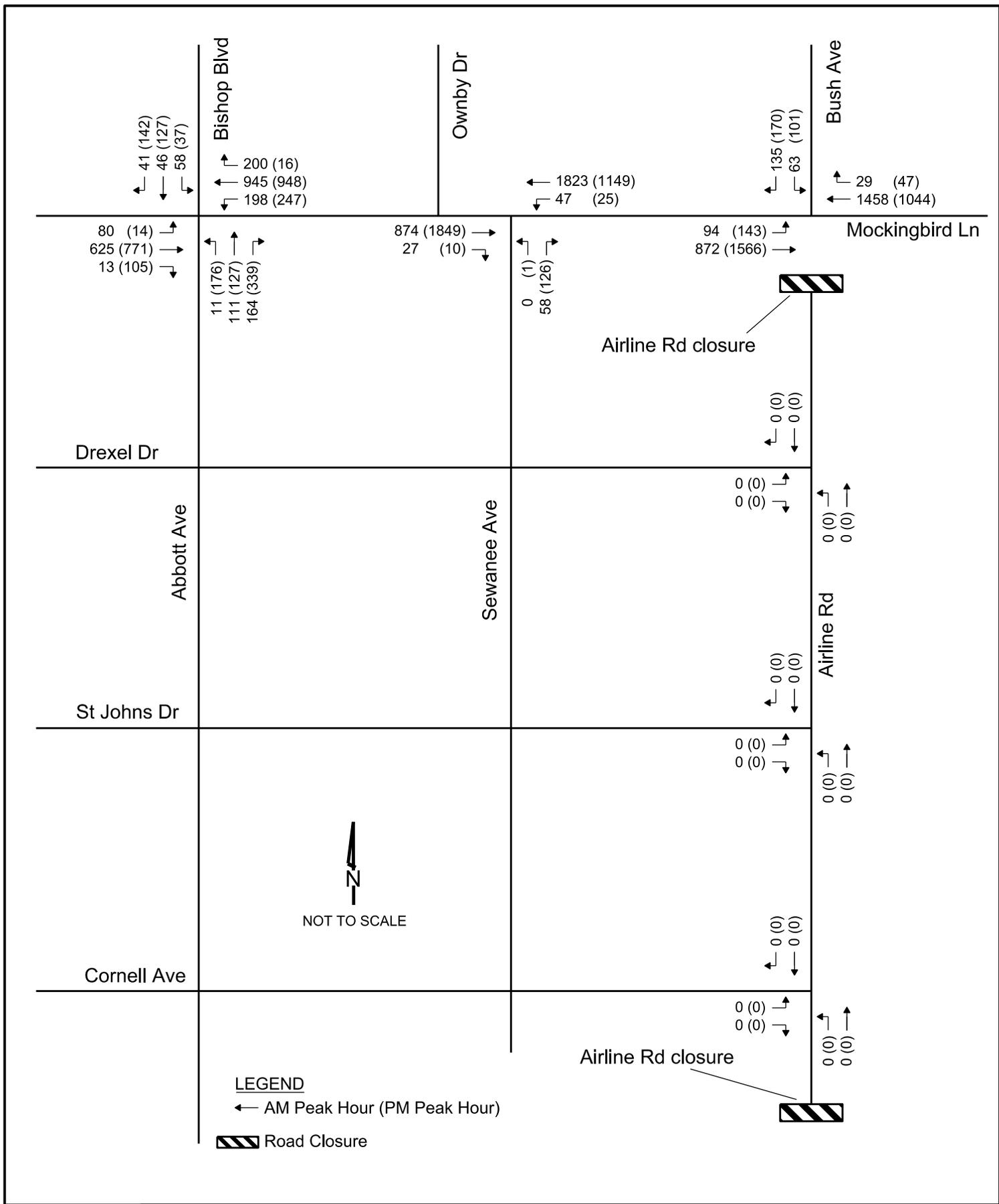
Table 8: Intersection Capacity Analysis Results – Option 3

Mockingbird Lane and Airline Road						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	54.5 (D) ¹	60.2 (E)	47.8 (D)	49.0 (D)	86.7 (F)
	PM	67.8 (E)	66.9 (E)	72.1 (E)	45.6 (D)	77.4 (E)
Option 3 (Signalized)	AM	9.7 (A)	12.2 (B)	6.0 (A)	---	25.3 (C)
	PM	23.6 (C)	31.1 (C)	2.9 (A)	---	52.7 (D)
Mockingbird Lane and Abbott Avenue						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	11.4 (B)	7.8 (A)	8.0 (A)	22.4 (C)	33.0 (C)
	PM	35.5 (D)	14.0 (B)	46.4 (D)	75.4 (E)	16.6 (B)
Option 3 (Signalized)	AM	72.4 (E)	14.0 (B)	87.0 (F)	70.2 (E)	177.5 (F)
	PM	186.1 (F)	13.6 (B)	95.2 (F)	>300 (F)	59.8 (E)
Mockingbird Lane and Sewanee Avenue						
Traffic Condition	Peak Hour	Intersection ²	EB	WB	NB	SB
Existing (Stop-Control)	AM	---	0.0 (A)	0.4 (A)	10.8 (B)	---
	PM	---	0.0 (A)	0.0 (A)	14.7 (B)	---
Option 3 (Stop-Control)	AM	---	0.0 (A)	0.9 (A)	9.6 (A)	---
	PM	---	0.0 (A)	1.4 (A)	23.1 (C)	---

¹ Delay in seconds/vehicle (Level of Service)

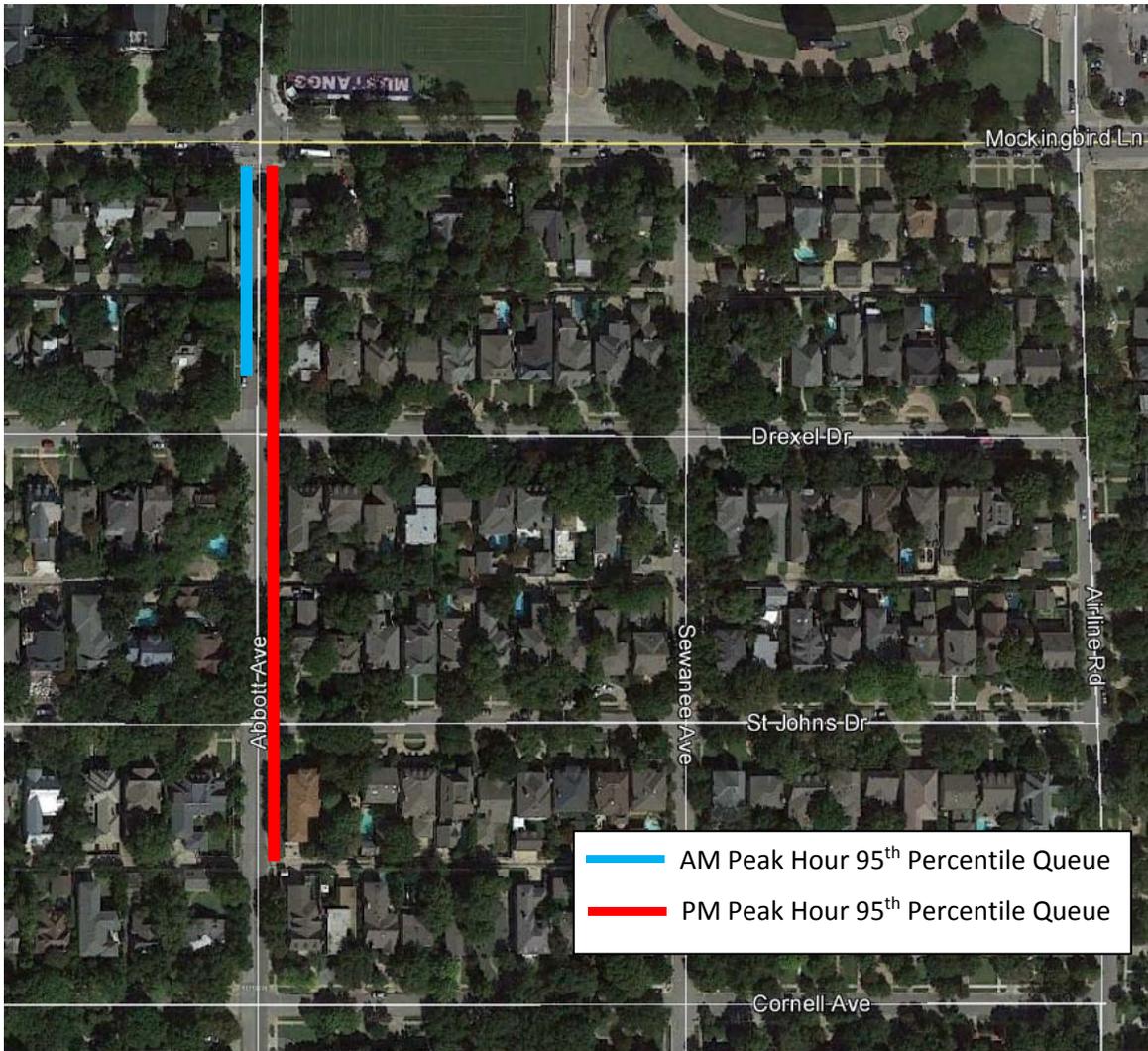
² HCM methodology does not provide intersection-wide delay for TWSC analysis

As shown in Table 8, closure of both ends of Airline Road will place increasing traffic demands at Abbott Avenue. The intersection of Mockingbird Lane and Airline Road is anticipated to operate at acceptable levels of service as a three-leg intersection. However, the intersection of Mockingbird Lane and Abbott Avenue will operate at unacceptable levels of service for the AM and PM peak hours with rerouted traffic. While higher delays will be experienced at Sewanee Avenue, the intersection will still operate at acceptable levels of service. Most traffic was rerouted to utilize the signalized intersection at Abbott Avenue.



To better illustrate the poor intersection operation anticipated at Mockingbird Lane and Abbott Avenue, the anticipated queue lengths were also investigated. Based on the Synchro results, a 95th percentile queue length of approximately 250 feet is anticipated during the AM peak hour along northbound Abbott Avenue. During the PM peak hour, a northbound queue length of at least 860 feet is anticipated. **Figure 9** shows how far cars are expected to be queued along Abbott Avenue as a result of the Airline Road closures.

Figure 9: Anticipated Queues along Abbott Avenue – Option 3



Finally, with the closure of Airline Road at both ends, the existing balance in traffic flow will be disrupted. Although residents along Airline Road may experience a positive change, increased traffic volumes in other parts of the neighborhood may be perceived negatively by other residents.

As with Option 1 and Option 2, closure of Airline Road at both ends is not recommended. A summary of the pros and cons for Option 3 is shown in **Table 9**.

Table 9: Pros and Cons – Option 3

Pros	Cons
<ul style="list-style-type: none"> • Significantly reduced traffic along Airline Road • Elimination of potential to cut-through neighborhood to US-75 or Mockingbird Lane via Airline Road • Improved operation for new T-intersection at Mockingbird Lane and Airline Road • Elimination of vehicular traffic at Katy Trail crossing 	<ul style="list-style-type: none"> • Significantly increased delay at Mockingbird Lane and Abbott Avenue intersection due to increased traffic volumes • Anticipated queues extending into the neighborhood along Abbott Avenue • Increased delay at Mockingbird Lane and Sewanee Avenue intersection due to increased traffic volumes • Increased traffic along other neighborhood roadways, primarily Abbott Avenue • Overall relocation of traffic problems to other locations, including Abbott Avenue and Hillcrest Avenue • Disruption in current balance of traffic patterns, and potential negative impact to other residents • Limit of access options for the neighborhood, including for emergency vehicles

Option 4 – Close Sewanee Avenue at Mockingbird Lane

This scenario involves the complete closure of Sewanee Avenue south of Mockingbird Lane. With this scenario, traffic on Sewanee Avenue accessing Mockingbird Lane and traffic on Mockingbird Lane accessing Sewanee Avenue is rerouted to other intersections. The estimated traffic volumes for Option 4 are shown in **Figure 10**.

Table 10 shows the intersection capacity results for intersections along Mockingbird Lane for Option 4 compared to Existing Conditions. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.

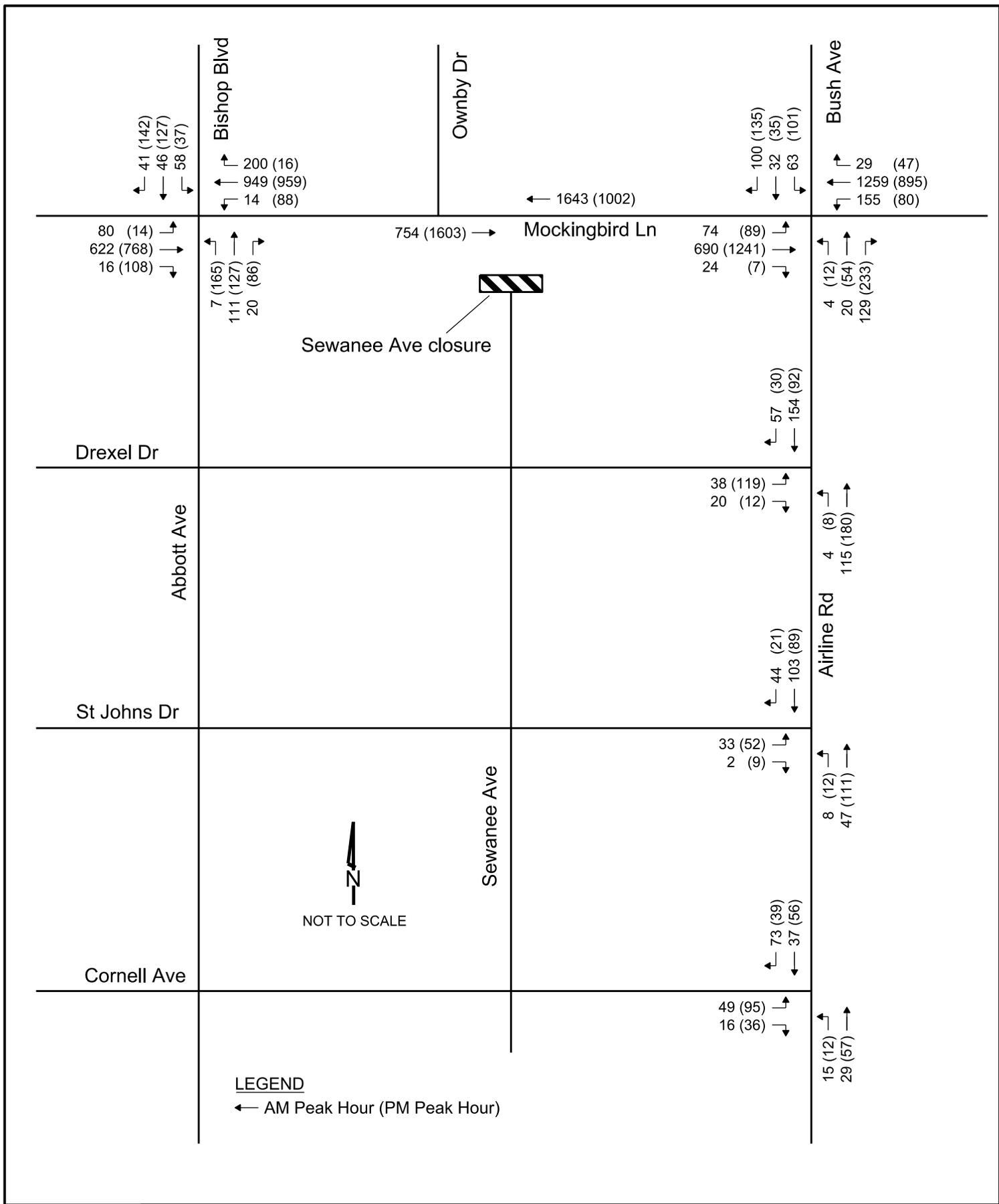


Table 10: Intersection Capacity Analysis Results – Option 4

Mockingbird Lane and Airline Road						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	54.5 (D) ¹	60.2 (E)	47.8 (D)	49.0 (D)	86.7 (F)
	PM	67.8 (E)	66.9 (E)	72.1 (E)	45.6 (D)	77.4 (E)
Option 4 (Signalized)	AM	55.2 (E)	58.2 (E)	48.6 (D)	49.2 (D)	100.7 (F)
	PM	68.4 (E)	58.7 (E)	72.1 (E)	49.3 (D)	117.7 (F)

Mockingbird Lane and Abbott Avenue						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	11.4 (B)	7.8 (A)	8.0 (A)	22.4 (C)	33.0 (C)
	PM	35.5 (D)	14.0 (B)	46.4 (D)	75.4 (E)	16.6 (B)
Option 4 (Signalized)	AM	11.4 (B)	7.8 (A)	8.0 (A)	22.4 (C)	33.0 (C)
	PM	35.8 (D)	14.0 (B)	46.4 (D)	76.9 (E)	16.6 (B)

¹ Delay in seconds/vehicle (Level of Service)

As shown in Table 10, the intersection of Mockingbird Lane and Abbott Avenue is not anticipated to be significantly affected by the closer of Sewanee Avenue at Mockingbird Lane. Most traffic currently turning at Sewanee Avenue is coming from and going to the east. Therefore, most traffic was rerouted to Airline Road. The intersection of Mockingbird Lane and Airline Road is anticipated to operate similar to existing conditions. However, the intersection level of service goes to LOS E for the AM peak hour, and the southbound approaches experiences increased delay.

Traffic volumes accessing and departing the neighborhood via Sewanee Avenue are fairly low – approximately 35 vehicles and 45 vehicles in the AM and PM peak hours, respectively. Closer of Sewanee Avenue at Mockingbird Lane is not anticipated to have a significant impact on traffic circulation in the neighborhood. Airline Road would likely experience some increase in traffic volumes, which is undesirable. Therefore, Option 4 is not recommended. A summary of the pros and cons for Option 4 is shown in **Table 11**.

Table 11: Pros and Cons – Option 4

Pros	Cons
<ul style="list-style-type: none"> Reduced traffic along Sewanee Avenue Elimination of potential to cut-through neighborhood to Mockingbird Lane via Sewanee Avenue Would likely reduce university parking along Sewanee Avenue Elimination of unprotected westbound left turn on Mockingbird Lane at Sewanee Avenue 	<ul style="list-style-type: none"> Increased delay at Mockingbird Lane and Airline Road intersection due to increased traffic volumes on northbound Airline Road and the westbound left turn Relocates traffic volumes to Airline Road Limit of access options for the neighborhood, including for emergency vehicles

Option 5 – Close Airline Road on Both Ends and Close Sewanee Avenue

This scenario is a combination of Option 3 and Option 4. Airline Road will be closed just south of Mockingbird Lane and just north of Katy Trail. Sewanee Avenue will be closed just south of Mockingbird Lane. Traffic will be reassigned from Airline Road and Sewanee Avenue to other area roadways to quantify the impact of the closure. The estimated traffic volumes for Option 5 are shown in **Figure 11**.

Table 12 shows the intersection capacity results for intersections along Mockingbird Lane for Option 5 compared to Existing Conditions. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.

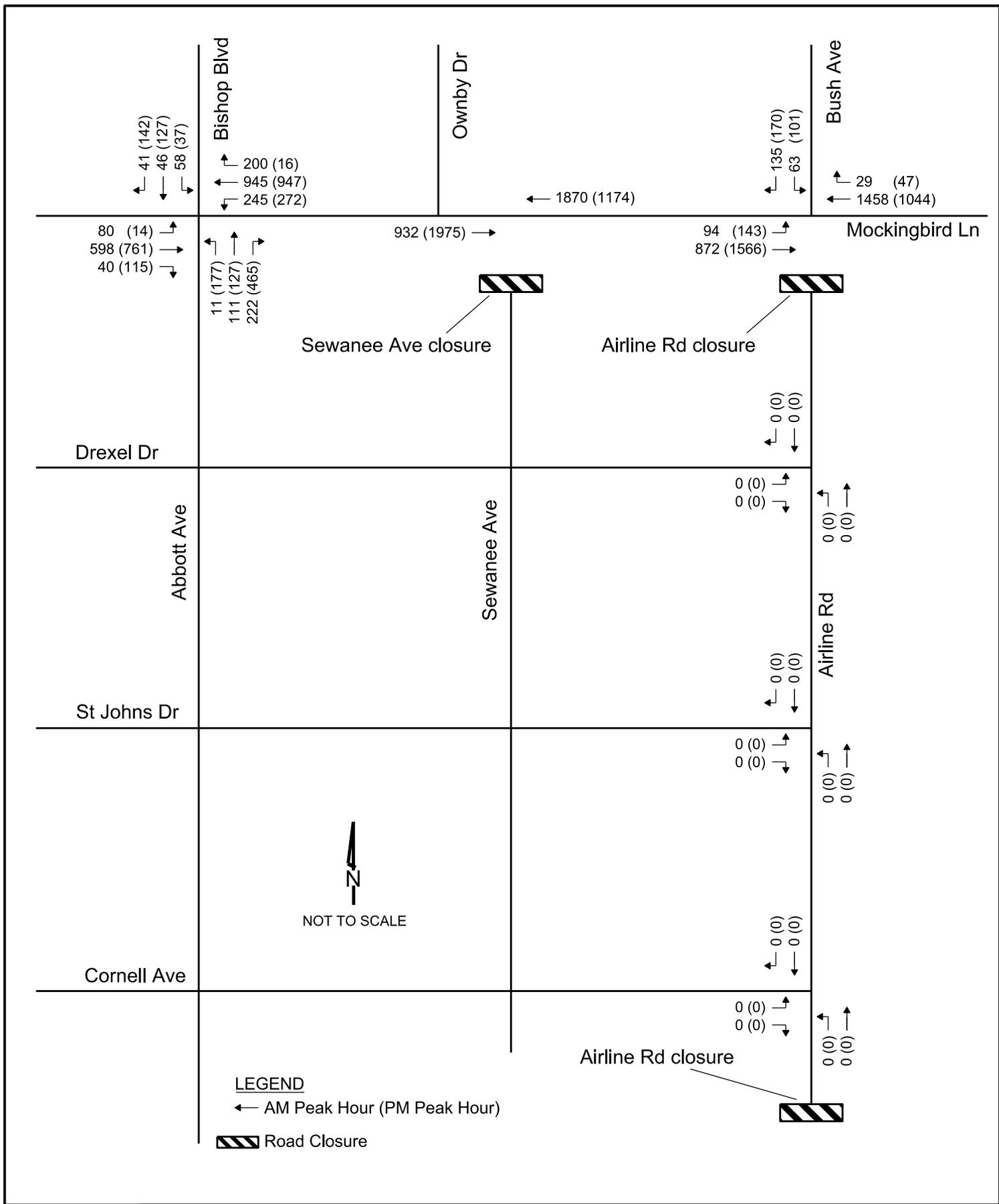
Table 12: Intersection Capacity Analysis Results – Option 5

Mockingbird Lane and Airline Road						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	54.5 (D) ¹	60.2 (E)	47.8 (D)	49.0 (D)	86.7 (F)
	PM	67.8 (E)	66.9 (E)	72.1 (E)	45.6 (D)	77.4 (E)
Option 5 (Signalized)	AM	9.1(A)	10.6 (B)	6.0 (A)	---	25.3 (C)
	PM	22.7 (C)	29.4 (C)	2.9 (A)	---	52.7 (D)
Mockingbird Lane and Abbott Avenue						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	11.4 (B)	7.8 (A)	8.0 (A)	22.4 (C)	33.0 (C)
	PM	35.5 (D)	14.0 (B)	46.4 (D)	75.4 (E)	16.6 (B)
Option 5 (Signalized)	AM	103.8 (F)	16.3 (B)	138.5 (F)	89.0 (F)	190.4 (F)
	PM	262.0 (F)	12.5 (B)	96.2(F)	>300 (F)	83.9 (F)

¹ Delay in seconds/vehicle (Level of Service)

As shown, the intersection of Mockingbird Lane and Airline Road is anticipated to operate similar to Option 3 with the closure of Airline Road south of Mockingbird Lane. Delays are significantly less than existing conditions with the elimination of the northbound leg.

However, the intersection of Mockingbird Lane and Abbott Avenue is anticipated to operate very poorly with significant delays for Option 5. With the closure of Sewanee Avenue at Mockingbird Lane and Airline Road at both ends, all traffic previously entering or exiting the neighborhood at these locations was rerouted to a single location at Abbott Avenue. Excessive delays are attributed to the significant increase in turning movement volumes. Vehicle queuing into the neighborhood along northbound Abbott Avenue is anticipated to extend even further than the queues shown in Figure 9. As with previous scenarios, the existing balance in traffic flow will be disrupted. Although residents along Airline Road may experience a positive change, increased traffic volumes in other parts of the neighborhood may be perceived negatively by other residents.



Therefore, implementation of Option 5 is not recommended. This scenario limits the access points for the neighborhood, and will significantly increase delays for both neighborhood traffic and for traffic along Mockingbird Lane. A summary of the pros and cons for Option 5 is shown in **Table 13**.

Table 13: Pros and Cons – Option 5

Pros	Cons
<ul style="list-style-type: none"> • Significantly reduced traffic along Airline Road • Elimination of potential to cut-through neighborhood to US-75 or Mockingbird Lane via Airline Road • Elimination of potential to cut-through neighborhood to Mockingbird Lane via Sewanee Avenue • Improved operation for new T-intersection at Mockingbird Lane and Airline Road • Elimination of vehicular traffic at Katy Trail crossing • Reduced traffic along Sewanee Avenue • Would likely reduce university parking along Sewanee Avenue • Elimination of unprotected westbound left turn on Mockingbird Lane at Sewanee Avenue 	<ul style="list-style-type: none"> • Significantly increased delay at Mockingbird Lane and Abbott Avenue intersection due to increased traffic volumes • Significantly increased westbound left turn volumes with potential to cause extensive queuing along westbound Mockingbird Lane • Increased traffic along other neighborhood roadways, primarily Abbott Avenue • Anticipated queues extending into the neighborhood along Abbott Avenue • Overall relocation of traffic problems to other locations, including Abbott Avenue and Hillcrest Avenue • Disruption in current balance of traffic patterns, and potential negative impact to other residents • Significant limit of access options for the neighborhood, including for emergency vehicles

Option 6 – Eliminate Parking along Sewanee Avenue and Abbott Avenue

For this scenario, parking will be prohibited along Sewanee Avenue and along Abbott Avenue, extending two blocks south of Mockingbird Lane. Currently, parking associated with local residents and with Southern Methodist University is believed to occur along these roadways. With the elimination of parking options, some traffic may be rerouted to alternative locations. Some turning movements at Abbott Avenue and Sewanee Avenue may be decreased, which could offer some improvement to intersection operation.

During field visits to the neighborhood, cars were observed parked along these roadways near Mockingbird Lane, and some are likely associated with the university. One advantage of parked vehicles is that they provide a traffic calming affect along the roadway. Thus, allowing parking may help keep speeds low along the neighborhood streets. Based on speed data collected with some of the traffic volumes, existing 85th percentile speeds within the neighborhood are less than the posted speed limits of 30 mph, and speeding does not appear to be a problem. Prohibition of parking may lead to greater speeds for vehicles entering the neighborhood.

On the other hand, elimination of parking could increase capacity for the intersections of these roadways with Mockingbird Lane. Abbott Avenue is wide enough to be restriped to allow two lanes exiting the neighborhood at Mockingbird Lane. **Table 14** shows the intersection capacity results for the intersection of Mockingbird Lane and Abbott Avenue with two approach lanes on the northbound leg, as compared to Existing Conditions. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.

Table 14: Intersection Capacity Analysis Results – Two Northbound Lanes at Abbott Avenue

Mockingbird Lane and Abbott Avenue						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	11.4 (B) ¹	7.8 (A)	8.0 (A)	22.4 (C)	33.0 (C)
	PM	35.5 (D)	14.0 (B)	46.4 (D)	75.4 (E)	16.6 (B)
With 2 Northbound Lanes (Signalized)	AM	11.5 (B)	7.7 (A)	7.9 (A)	21.3 (C)	34.9 (C)
	PM	20.0 (C)	9.6 (A)	19.4 (B)	40.0 (D)	25.5 (C)

¹ Delay in seconds/vehicle (Level of Service)

As shown, the intersection of Mockingbird Lane and Abbott Avenue is anticipated to experience improved operation during the PM peak hour with restriping for two northbound lanes, a left turn lane and a shared through/right turn lane. The northbound approach improves from LOS E to LOS D during the PM peak hour, and the delay is reduced by almost half. Therefore, prohibition of parking along Abbott Avenue for one block south of Mockingbird Lane would likely be beneficial for intersection operations. If parking is prohibited, the northbound approach of Abbott Avenue at Mockingbird Lane should be restriped to allow two northbound lanes.

Table 15 shows the intersection capacity results for the intersection of Mockingbird Lane and Abbott Avenue with two approach lanes on the northbound leg, for the Option 1 scenario, with the closure of Airline Road. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.

Table 15: Intersection Capacity Analysis Results – Two Northbound Lanes at Abbott Avenue for Option 1

Mockingbird Lane and Abbott Avenue						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Option 1 (Signalized)	AM	52.5 (D)	13.8 (B)	61.7 (E)	54.2 (D)	122.0 (F)
	PM	133.9 (F)	15.5 (B)	81.1 (F)	>300 (F)	45.4 (D)
Option 1 with 2 Northbound Lanes (Signalized)	AM	39.5 (D)	11.0 (B)	41.9 (D)	41.3 (D)	117.9 (F)
	PM	84.1 (F)	13.0 (B)	54.6 (D)	216.4 (F)	138.6 (F)

¹ Delay in seconds/vehicle (Level of Service)

As shown, the intersection of Mockingbird Lane and Abbott Avenue is anticipated to experience improved overall intersection delay, along with reduced delay on all approaches except the southbound approach during the PM peak hour. While Option 1 (closure of Airline Road south of Mockingbird Lane) is not recommended, if this option is still desirable to the Town of Highland Park, it is suggested to prohibit parking along Abbott Avenue and restripe to allow two approach lanes.

A summary of the pros and cons for Option 6 is shown in **Table 16**.

Table 16: Pros and Cons – Option 6

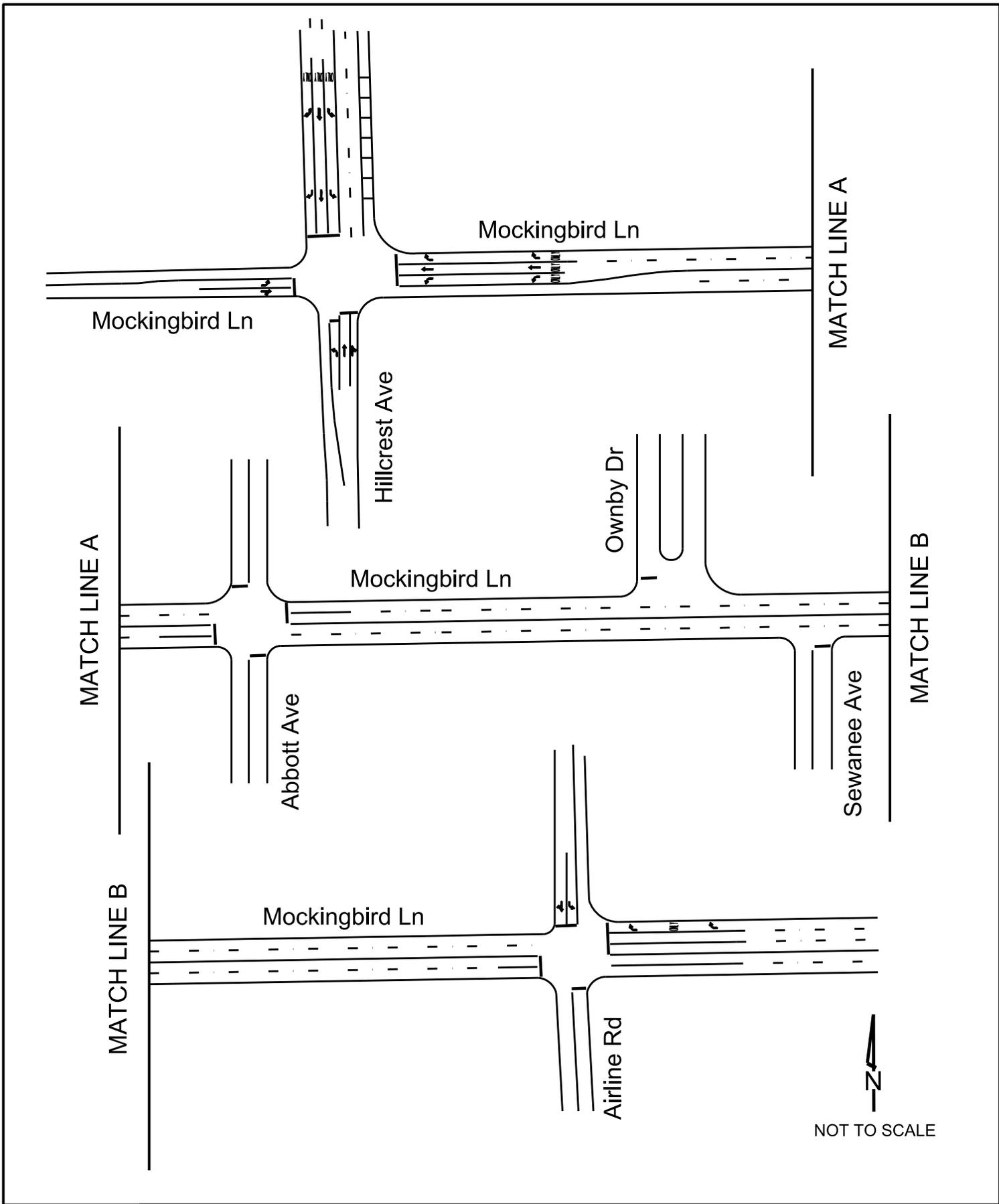
Pros	Cons
<ul style="list-style-type: none"> Likely reduction of traffic volume entering neighborhood at Abbott Avenue and Sewanee Avenue Elimination of parking maneuvers along Abbott Avenue and Sewanee Avenue south of Mockingbird Lane Increased capacity, including potential restripe Abbott Avenue to allow two northbound approach lanes at Mockingbird Lane, leading to improved intersection operation Potential reduction of pedestrian crossing movements across Mockingbird Lane 	<ul style="list-style-type: none"> Elimination of traffic calming affect provided by parked vehicles Potential for increased speeds within neighborhood where parking is eliminated Reduction in parking options for neighborhood residents

Option 7 – Evaluate Current Lane Assignment along Mockingbird Lane

This scenario includes an evaluation of the existing lane assignment along Mockingbird Lane between Airline Road and Hillcrest Avenue, including the lane assignments at the intersections of Mockingbird Lane with Airline Road, Sewanee Avenue, Abbott Avenue, and Hillcrest Avenue. Alternative lane configurations will be identified and evaluated, and recommendations made for future lane configurations. A basic schematic of the existing lane assignment is shown in **Figure 12**.

One change considered was switching timing plans for the intersections of Mockingbird Lane with Abbott Avenue and with Airline Road. Currently, the eastbound and westbound approaches of Mockingbird Lane at Airline Road run in split-phase, allowing protected left turns. The intersection of Mockingbird Lane and Abbott Avenue runs in a two-phase operation, so eastbound and westbound left turns are permitted only. This timing likely contributes to greater westbound left turn volumes into the neighborhood at Airline Road.

Table 17 shows the intersection capacity results for these intersections with a switch in signal timing compared to Existing Conditions. With split-phase operations at Abbott Avenue, it was assumed that approximately half of the existing westbound left turns at Airline Road would instead turn at Abbott Avenue. It was also assumed that both the northbound and southbound approaches of Abbott Avenue at Mockingbird Lane had been restriped to allow two approach lanes. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.



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Existing Lane Geometry

Figure 12

Table 17: Intersection Capacity Analysis Results – Signal Timing Switch

Mockingbird Lane and Airline Road						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing Split-Phase (Signalized)	AM	54.5 (D) ¹	60.2 (E)	47.8 (D)	49.0 (D)	86.7 (F)
	PM	67.8 (E)	66.9 (E)	72.1 (E)	45.6 (D)	77.4 (E)
Two-Phase (Signalized)	AM	12.7 (B)	4.5 (A)	7.6 (A)	39.8 (D)	66.5 (E)
	PM	18.7 (B)	10.3 (B)	7.4 (A)	41.2 (D)	70.5 (E)
Mockingbird Lane and Abbott Avenue						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing Two-Phase (Signalized)	AM	11.4 (B)	7.8 (A)	8.0 (A)	22.4 (C)	33.0 (C)
	PM	35.5 (D)	14.0 (B)	46.4 (D)	75.4 (E)	16.6 (B)
Split-Phase (Signalized)	AM	45.7 (D)	48.7 (D)	40.1 (D)	39.0 (D)	75.1 (E)
	PM	61.6 (E)	57.7 (E)	61.6 (E)	74.1 (E)	58.0 (E)

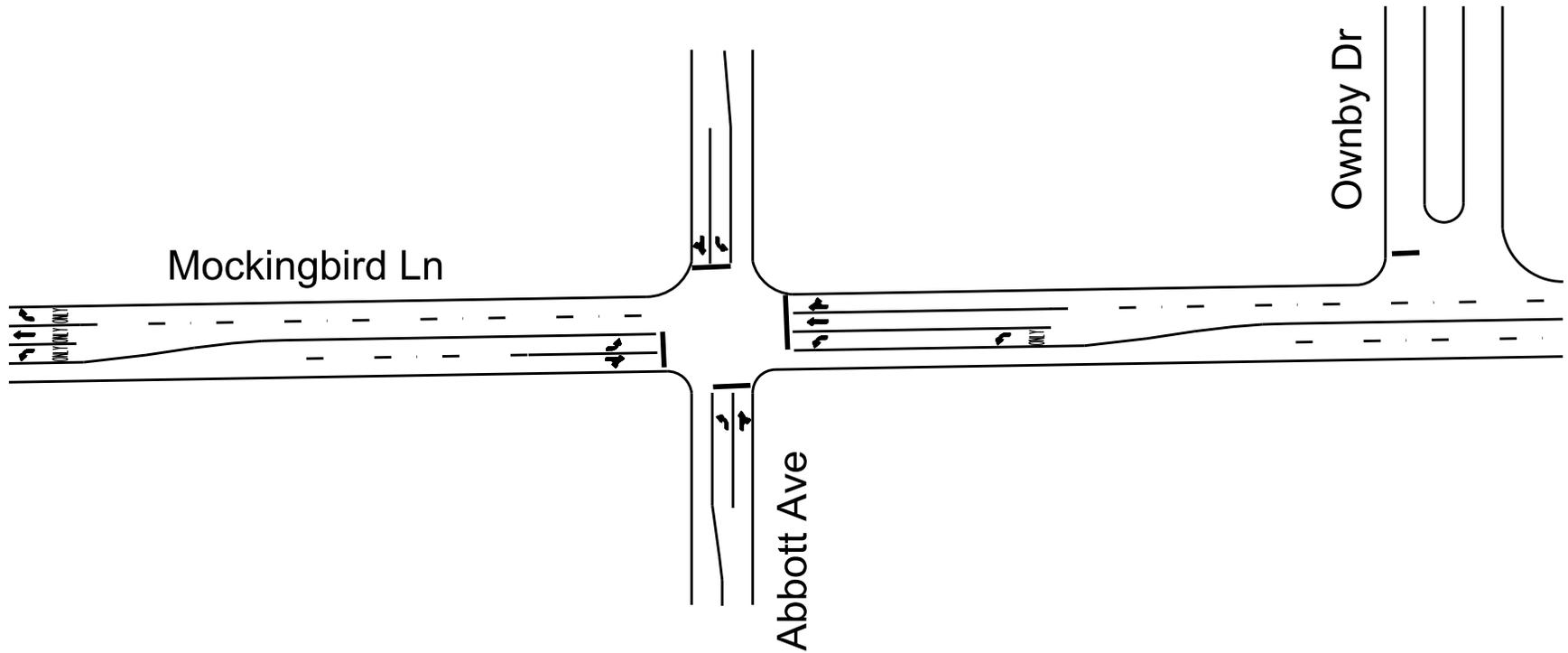
¹ Delay in seconds/vehicle (Level of Service)

As shown in Table 17, operation at the intersection of Mockingbird Lane and Airline Road is anticipated to improve with the change to two-phase operation and the relocation of half of the westbound left turn volumes. On the other hand, the intersection of Mockingbird Lane and Abbott Avenue is anticipated to experience increases in delay on all approach with a split-phase operation for the eastbound and westbound approaches.

The intersection of Mockingbird Lane and Airline Road would experience similar improvement in level of service without the relocation of westbound left turn traffic. However, split-phase operation may provide some safety benefits to the eastbound and left turn vehicles due to the high traffic volumes along Mockingbird Lane.

Another geometry change investigated was to add a westbound left turn lane at the intersection of Mockingbird Lane and Abbott Avenue by reducing the eastbound receiving lane to one lane, similar to the existing lane configuration at the intersection of Mockingbird Lane and Hillcrest Avenue. With only one downstream intersection, the eastbound approach would also have a left turn lane. With this analysis, the restriping of the northbound and southbound approaches to two approach lanes was assumed to be in place. It was assumed that half of the existing westbound left turns at Airline Road would instead turn at Abbott Avenue. **Figure 13** shows illustrates what this lane configuration would look like.

Table 18 shows the intersection capacity results for this intersection with the changes in geometry compared to Existing Conditions. Similar geometry and signal timing changes were also applied to the Option 1 conditions, with the relocation of traffic due to the closure of Airline Road. The shaded cells in the table indicate intersections, approaches, and/or movements which currently operate or are anticipated to operate beyond LOS D.



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Changes to Lane Geometry at Mockingbird and Abbott

Figure 13

Table 18: Intersection Capacity Analysis Results – Intersection Geometry Changes

Mockingbird Lane and Abbott Avenue						
Traffic Condition	Peak Hour	Intersection	EB	WB	NB	SB
Existing (Signalized)	AM	11.4 (B) ¹	7.8 (A)	8.0 (A)	22.4 (C)	33.0 (C)
	PM	35.5 (D)	14.0 (B)	46.4 (D)	75.4 (E)	16.6 (B)
With Geometry Changes	AM	15.0 (B)	8.5 (A)	5.9 (A)	38.6 (D)	70.4 (E)
	PM	27.4 (C)	16.0 (B)	15.9 (B)	71.3 (E)	41.0 (D)
Option 1 (Signalized)	AM	52.5 (D)	13.8 (B)	61.7 (E)	54.2 (D)	122.0 (F)
	PM	133.9 (F)	15.5 (B)	81.1 (F)	>300 (F)	45.4 (D)
Option 1 with Geometry Changes	AM	20.6 (C)	8.9 (A)	10.1 (B)	44.8 (D)	92.2 (F)
	PM	78.6 (E)	51.4 (D)	44.2 (D)	194.9 (F)	62.4 (E)

¹ Delay in seconds/vehicle (Level of Service)

As shown in Table 18, the proposed geometry changes would improve operation for the westbound approach, especially for Option 1. However, the eastbound approach will experience higher delay during the PM peak hour for Option 1, due to the reduction of through lanes, and the protected left turn operation assumed for the westbound left turn. The westbound left turn would experience very high volumes and substantial delays in general under Option 1 (closure of Airline Road).

Traffic Calming Measures

Traffic calming measures are intended to reduce speeds and reduce cut-through traffic within the neighborhood.

Along Airline Road, installation of all-way stop control at Drexel Drive, St Johns Drive, and at Cornell Avenue may provide some traffic calming benefit. Although all-way stop-control warrants are not met at any of the intersections, this option may be considered by the Town of Highland Park. Currently, many of the intersections within the neighborhood are all-way stop-controlled, which may contribute to increased traffic along Airline Road. Installation of all-way stops along Airline Road would likely discourage cut-through traffic, and help to spread neighborhood traffic evenly among the other north-south streets.

The intersection of Abbott Avenue and Cornell Avenue should also be considered for all-way stop control. Currently, a signed and marked school crossing exists across Abbott Avenue north of the intersection. Installation of all-way stop control would provide additional safety for school pedestrians. If an all-way stop is installed at this location, it is recommended to also install an all-way stop at the intersection of Abbott Avenue and Drexel Drive for consistency within the neighborhood.

While volume warrants are not met at these locations, the addition of these all-way stop locations will provide a consistent intersection treatment throughout the study area.

An additional option to provide traffic calming along Airline Road would be to increase on-street parking. Currently, parking is not allowed on the west side of the road. If parking were allowed on both sides of the street, speeds may be reduced.

Further discussion of additional traffic calming measures may be provided in a separate report if desired.

Conclusions and Recommendations

Roadway closures are not recommended at this time. While roadway closures may provide some benefit to limited areas of the primary study neighborhood, some other residents may perceive negative impacts instead. The investigated roadway closures would disrupt the current balance in traffic flows through the neighborhood. Closure of intersections would lead to a relocation of existing traffic to other locations. As a primary example, closure of Airline Road at Mockingbird Lane is anticipated to contribute to significant queuing within the neighborhood along northbound Abbott Avenue.

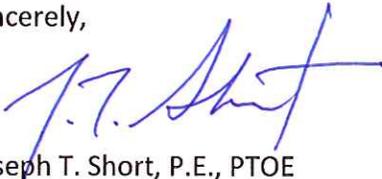
Prohibition of parking along Abbott Avenue within the first block south of Mockingbird Lane may lead to improved operation at the intersection of Abbott Avenue with Mockingbird Lane. Without on-street parking, the road could be restriped to allow two northbound lanes at the intersection.

Another geometry change that should be considered is adding westbound and eastbound left turn lanes at the intersection of Mockingbird Lane and Abbott Avenue by reducing the eastbound receiving lane to one lane, as shown in Figure 13. This measure would likely improve operation along Mockingbird Lane, and may encourage some of the existing westbound left turning volumes at Airline Road to relocate to Abbott Avenue. Providing exclusive left turn lanes would also provide some safety benefit by removing left turn traffic from the through traffic volumes and would allow for protected left turn phases. This alternative should be studied further prior to considering it for implementation, especially to analyze impacts at other intersections along Mockingbird Lane such as at Hillcrest Avenue.

Finally, installation of all-way stop control at along Airline Road at Drexel Drive, at St Johns Drive, and at Cornell Avenue should be considered as a traffic calming measure. The intersection of Abbott Avenue and Cornell Avenue should also be considered for all-way stop control to provide additional safety for school pedestrians at the existing school crosswalk. With installation of all-way stop control, pedestrian crossing signs may be removed. If an all-way stop is installed at this location, it is recommended to also install an all-way stop at the intersection of Abbott Avenue and Drexel Drive for consistency within the neighborhood.

If you have any questions regarding this study, please contact me at (972) 248-3006. We appreciate the opportunity to provide these services.

Sincerely,



Joseph T. Short, P.E., PTOE
President
Lee Engineering, LLC
TBPE Firm F-450