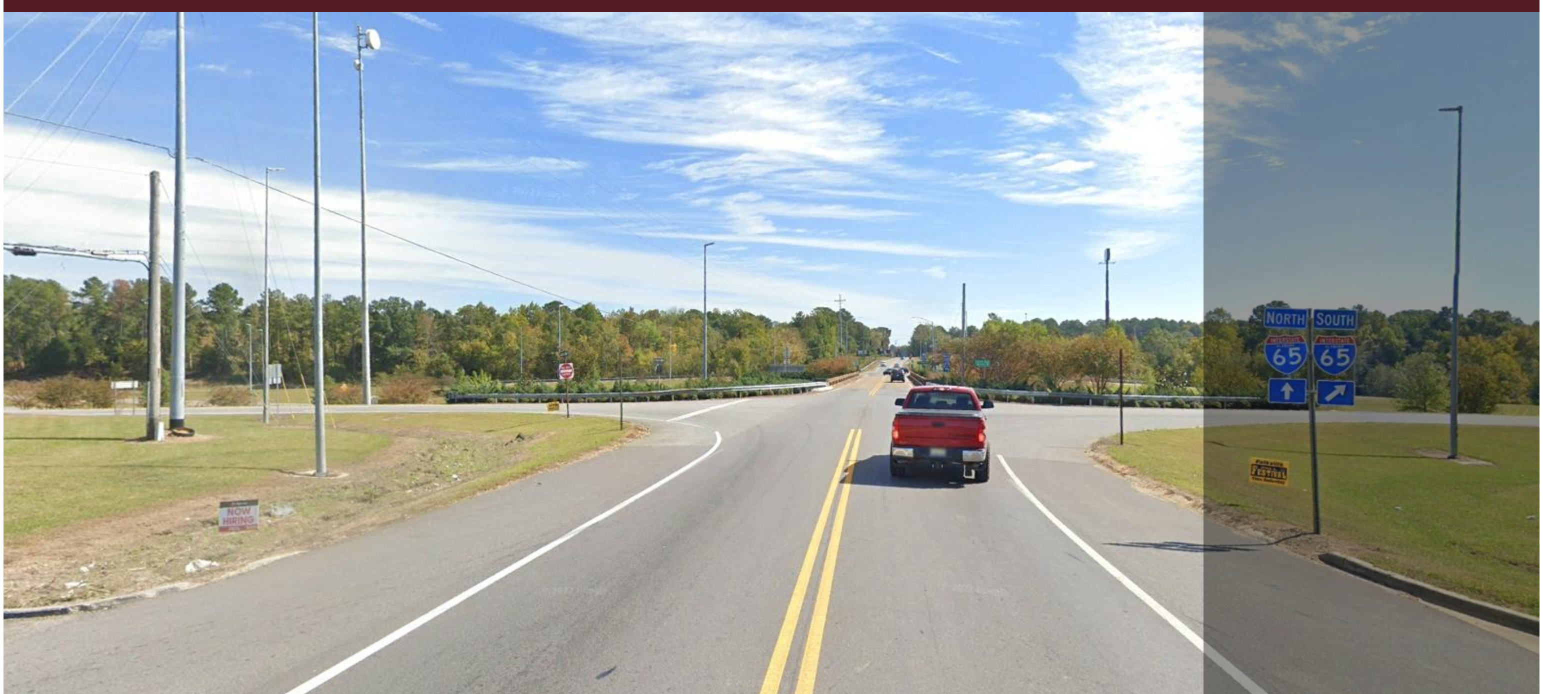
Bethel Road and I-65 Interchange Traffic Study

Final Report



Prepared For:

Decatur Area Metropolitan Planning Organization

September 2023

GarverUSA.com

Bethel Road and I-65 Interchange Traffic Study

Final Report

Decatur Area Metropolitan Planning Organization

Decatur, Alabama

Prepared by:

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Garver Project No.: 22T35110

Engineer's Certification

I hereby certify that this Report for the Bethel Road and I-65 Interchange Traffic Study was prepared by Garver under my direct supervision for the Decatur Area Metropolitan Planning Organization.

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1.0 Introduction

At the request of the Decatur Metropolitan Planning Organization (MPO), Garver performed a planning study to identify issues that exist or are anticipated to develop at intersections along SR 36, Bethel Road, and at the I-65 interchanges with SR 67 and SR 36. The study will focus on evaluating the feasibility of a new interchange at I-65 and Bethel Road along with a new connector from Bethel Road to Highway 31 to relieve existing and future congestion along SR 36 through downtown Hartselle.

As part of the study, this document presents the transportation needs that were identified based on an evaluation of the following:

- **Existing Conditions** – Garver evaluated the existing conditions based on the following:
    - **Data Compilation** – Garver reviewed 24-hour turning movement counts for 8 intersections, all of which were collected on January 19, 2023.
    - **Field Observations** – Garver performed a site visit to observe the operational issues with the existing conditions.
- **Safety Analysis** – Garver reviewed and evaluated the crash data provided by Decatur Area MPO. The evaluation included the following:
    - Identification of high crash locations
    - Calculation of corridor crash rates
- **Volume Development** – Garver balanced raw volumes to develop 2023 Existing volumes for the AM and PM peak hours. Growth rates were determined from the Decatur Area travel demand model (TDM) provided by Decatur Area MPO. The growth rates were applied to 2023 Existing volumes to develop 2045 No Build volumes. Traffic was diverted with the proposed interchange and connector in place to develop 2045 Build volumes.
- **Operational Analysis** – *Synchro 11* and *SimTraffic* software were used to analyze the level of service (LOS) and queue lengths for 2023 Existing, 2045 No Build, and 2045 Build conditions.

2.0 Existing Conditions

The corridors evaluated in the study area are SR 36 from I-65 to Highway 31, Bethel Road from SR 36 to I-65, and the interchanges at I-65/SR 36 and I-65/SR 67 as displayed in **Figure 1**. The SR 36 corridor is a two-lane roadway that runs through downtown Hartselle and has an average daily traffic (ADT) volume ranging from 10,000 vpd to 15,000 vpd. This route has a posted speed limit of 45 mph near the I-65 interchange and reduces to 25 mph through downtown. The I-65/SR 36 interchange primarily services traffic travelling to/from the City of Hartselle and is located approximately 6 miles south of the I-65/SR 67 interchange. Bethel Road is a primarily north-south road that provides a direct route between the City of Priceville and the City of Hartselle. The majority of the Bethel Road corridor is a two-lane road with a posted speed limit of 45 mph and an ADT volume of approximately 3,000 vpd. The SR 67 and I-65 interchange services traffic traveling to/from I-65 and the SR 67 corridor, which connects the City of Priceville and the City of Decatur. At this interchange, SR 67 is a four-lane, divided highway with a posted speed limit of 50 mph and carries approximately 25,000 vehicles per day (vpd).

The following eight (8) study intersections were evaluated as part of this study:

- Signalized:
  - I-65 SB Ramps at SR 67
  - I-65 NB Ramps at SR 67
  - I-65 NB Ramps at SR 36
  - SR 36 at Bethel Road
  - SR 36 at Highway 31
- Unsignalized:
  - I-65 SB Ramps at SR 36
  - Bethel Road at Indian Hills Road
  - Highway 31 at Sparkman Street

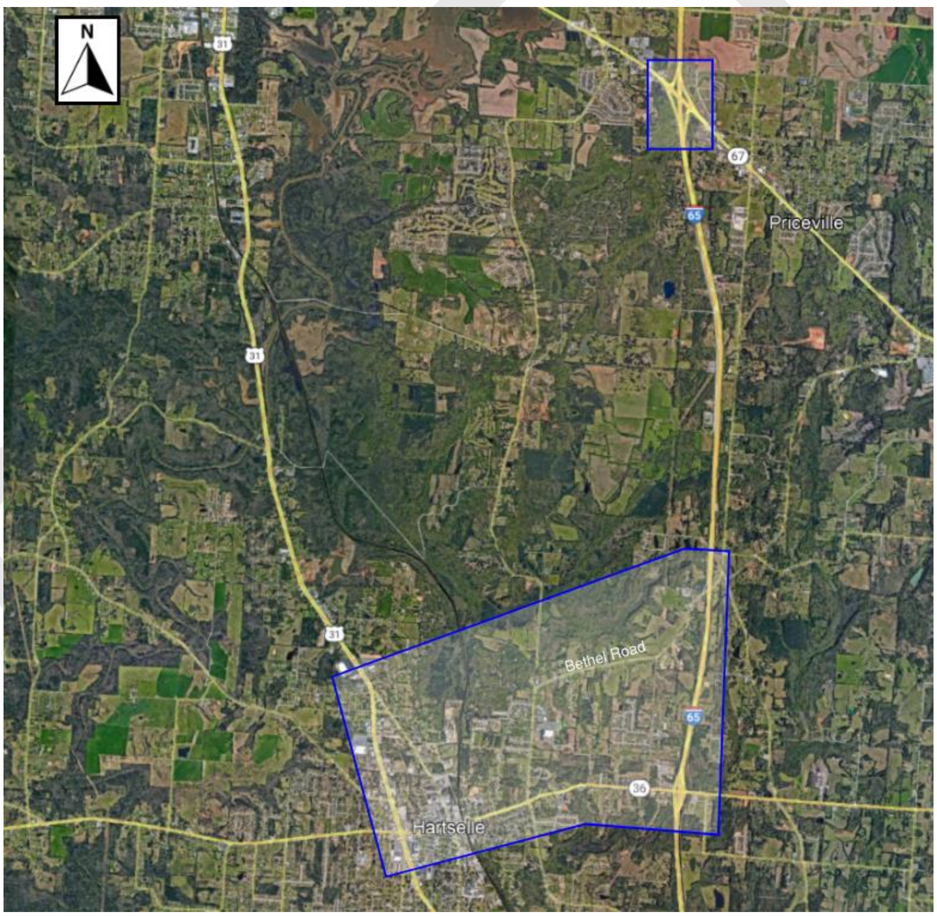


Figure 1: Study Area

2.1 Field Observations

Garver conducted field observations at the study intersections during the AM and PM peak hours on Tuesday, April 18th, 2023, in order to verify driver behavior and identify operational issues or safety concerns that should be considered when developing build alternatives. These field observations are essential for ensuring that traffic models are properly calibrated. During the site visit, operational or safety issues were observed at nearly all of the study intersections as discussed below:

a) I-65 SB Ramps at SR 67
During the PM peak hour, a queue of approximately 15 vehicles was noted on the southbound off-ramp (**Figure 2**).

Figure 2: Southbound Approach at I-65 SB Ramps/SR 67 Intersection

b) I-65 NB Ramps at SR 67
A queue was noted on the eastbound left turn lane in the AM peak hour. At times, the queue was observed to encroach upon the eastbound through lane (**Figure 3**).

Figure 3: Eastbound Left Turn Lane at I-65 NB Ramps/SR 67 Intersection

c) I-65 SB Ramps at SR 36

During both peak hours, a queue was noted on the westbound approach due to westbound vehicles waiting for a gap to turn left onto the SB on-ramp (**Figure 4**). During the PM peak, a queue extending nearly to the I-65 through lanes (approximately 20 vehicles) was observed along the southbound off-ramp (**Figure 5**).

Figure 4: Westbound Approach at I-65 SB Ramps/SR 36 Intersection

Figure 5: Southbound Approach at I-65 SB Ramps/SR 36 Intersection

d) I-65 NB Ramps at SR 36

In the AM peak hour, a significant queue extending more than 0.25 miles was observed on the eastbound approach (**Figure 6**). During the PM peak hour, this queue extended slightly past the southbound ramps.

Figure 6: Eastbound Approach at I-65 NB Ramps/SR 36 Intersection

e) SR-36 at Bethel Road

During the PM peak hour, a queue of approximately 16 vehicles was noted on the westbound approach (**Figure 7**).

Figure 7: Westbound Approach at Bethel Rd/SR-36 Intersection

f) SR-36 at Highway 31

Significant queuing was observed on the eastbound approach during the AM peak hour, and the queue did not clear in one cycle (**Figure 8**). During the PM peak hour, significant queuing was observed on the southbound approach. Both through lanes on this approach did not clear within one cycle.

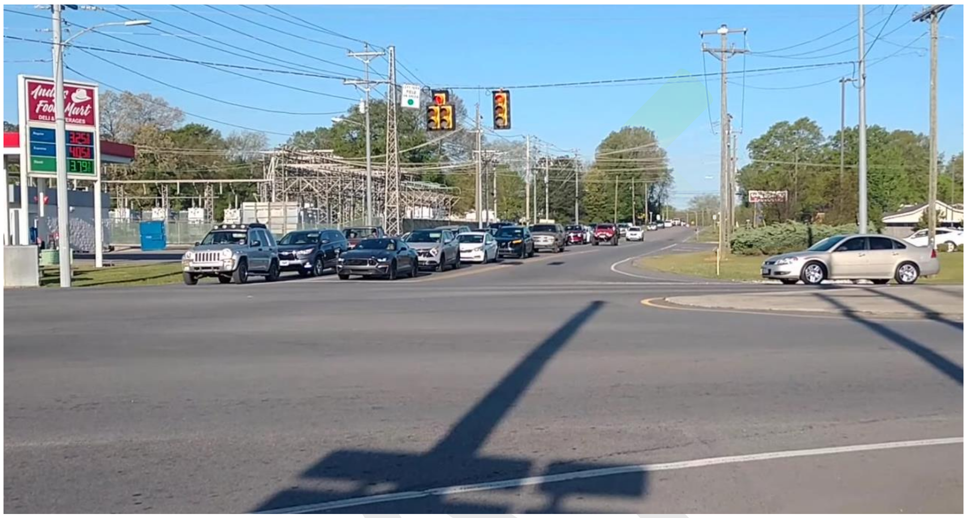


Figure 8: Eastbound Approach at Highway 31/SR-36 Intersection

g) Bethel Road at Indian Hills Road

During both peak hours, low traffic volume and minimal queuing was observed at this intersection.

h) Highway 31 at Sparkman Street

During the AM peak hour, a queue of 8 cars was observed on the Sparkman Street westbound approach due to vehicles waiting for a gap on Highway 31 (**Figure 9**).

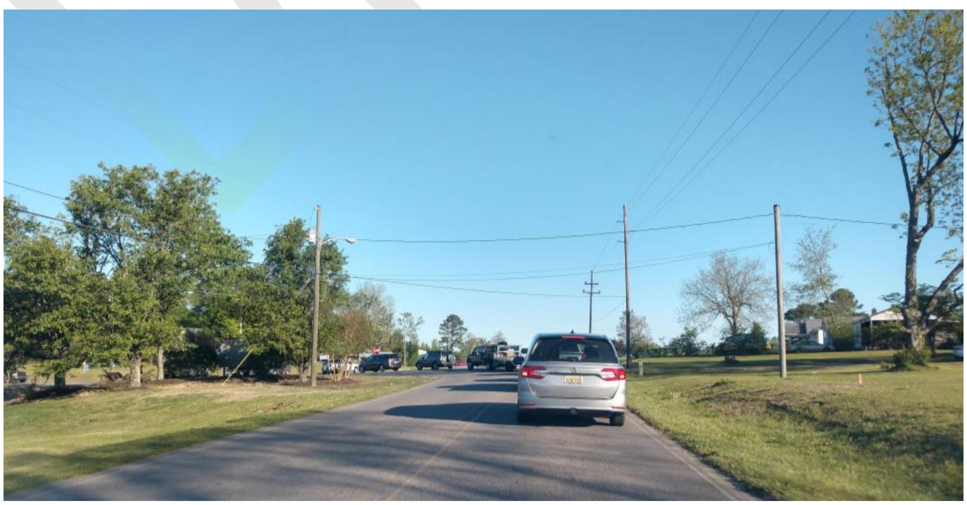


Figure 9: Westbound Approach at Highway 31/Sparkman St Intersection

3.0 Safety Analysis

Safety analysis was performed for the study area. Decatur MPO provided crash data from 2017 to 2021 (the latest five complete years of available data) which was evaluated to identify crash patterns and high crash locations. Crash data was also used to determine segment crash rates for the SR 36 and Bethel Road corridors. The following sections describe the safety findings.

3.1 Crash Patterns and Locations

Tables 1 and 2 summarize the number of crashes by severity and the number of crashes by type of collision within the study area. As shown in **Table 1**, the total number of crashes for the five-year period was 562 crashes, and property damage only (PDO) was the prevalent severity level. Within the five (5) years, nine (9) fatal and suspected serious injury (KA) crashes were reported. The two fatal crashes were located west of the I-65 at SR 67 ramps and near the Highway 31/Sparkman Street intersection.

The most common crash type was rear-end followed by angle as displayed in **Table 2**. Rear-end crashes are generally caused by driving in heavy traffic conditions, distracted driving, and speeding. Angle crashes are generally caused by left-turn conflicts at intersections or cross-street traffic not yielding to the main line traffic.

Table 1: Overall Crashes by Severity (2017 – 2021)

Year	Fatal (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Other	Total
2017	0	2	0	13	107	2	124
2018	1	3	5	9	116	0	134
2019	0	2	2	6	107	2	119
2020	1	0	3	8	67	3	82
2021	0	0	6	13	83	1	103
Total	2	7	16	49	480	8	562
%	0.36%	1.25%	2.85%	8.72%	85.41%	1.42%	100.00%

Table 2: Overall Crashes by Type of Collision (2017 – 2021)

Year	Sideswipe	Angle	Rear End	Single Vehicle	Head On	Other	Total
2017	7	31	74	12	0	0	124
2018	10	37	62	19	2	4	134
2019	9	32	69	6	1	2	119
2020	4	24	42	9	2	1	82
2021	5	35	56	6	0	1	103
Total	35	159	303	52	5	8	562
%	6.23%	28.29%	53.91%	9.25%	0.89%	1.42%	100.00%

"Angle" includes "angle (front to side) opposite direction", "angle (front to side) same direction", "angle oncoming (frontal)", "side impact (90 degree)", and "side impact (angled)" type crashes.
"Other" includes "other" and "causal vehicle backing rear to side" type crashes.

Crashes were categorized as intersection or segment crashes based on the field marked “At Intersection” in the crash data. As shown in **Table 3**, approximately 62% of total crashes occurred at the intersections while 38% occurred along a segment and were not considered intersection related. In addition, 7 of the 9 KA crashes were located along a segment. Based on the crash data, the majority of intersection crashes were rear end crashes (58%) followed by angle crashes (28%) as displayed in **Table 4**. For segment crashes, rear end crashes were also the most prevalent at 47%.

Table 3: Intersection and Segment Crash Distribution

Type	All Crashes		KA Crashes	
	No.	%	No.	%
Intersection	351	62.46%	2	22.22%
Segment	211	37.54%	7	77.78%
Total	562	100.00%	9	100.00%

Table 4: Intersection and Segment Crash Distribution by Type of Collision

Crash Type	All Crashes				KA Crashes			
	Intersection		Segment		Intersection		Segment	
	No.	%	No.	%	No.	%	No.	%
Sidesw ipe	18	5.13%	17	8.06%	0	0.00%	0	0.00%
Angle	97	27.64%	62	29.38%	2	100.00%	2	28.57%
Rear End	204	58.12%	99	46.92%	0	0.00%	1	14.29%
Single Vehicle	23	6.55%	29	13.74%	0	0.00%	3	42.86%
Head On	4	1.14%	1	0.47%	0	0.00%	0	0.00%
Other	5	1.42%	3	1.42%	0	0.00%	1	14.29%
Total	351	100.00%	211	100.00%	2	100.00%	7	100.00%

“Angle” includes “angle (front to side) opposite direction”, “angle (front to side) same direction”, “angle oncoming (frontal)”, “side impact (90 degree)”, and “side impact (angled)” type crashes.
“Other” includes “other” and “causal vehicle backing rear to side” type crashes.

A crash heat map was developed to identify high crash locations. As shown in **Figure 10**, the majority of the crashes within the study area occurred along SR 36. High crash locations are shown at multiple locations throughout the SR 36 corridor especially at the SR 36 and Highway 31 intersection.

Figure 10: Crash Heat Map

Because the majority of the crashes within the study area are occurring along the SR 36 corridor, crash data just along SR 36 was also evaluated by itself as shown in **Tables 5 and 6**. Approximately 353 crashes occurred along SR 36 from I-65 to Highway 31 within the study period. Crash data shows 60% of the crashes were rear-end crashes and 85% of total crashes were PDO severity level crashes.

Table 5: SR 36 - Crashes by Severity

2017 - 2021	Sideswipe	Angle	Rear End	Single Vehicle	Head On	Other	Total
SR 36	16	76	218	33	4	6	353
	4.53%	21.53%	61.76%	9.35%	1.13%	1.70%	100.00%

Table 6: SR 36 - Crashes by Type of Collision

2017 - 2021	Fatal (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Other	Total
SR 36	0	2	10	32	305	4	353
	0.00%	0.57%	2.83%	9.07%	86.40%	1.13%	100.00%

"Angle" includes "angle (front to side) opposite direction", "angle (front to side) same direction", "angle oncoming (frontal)", "side impact (90 degree)", and "side impact (angled)" type crashes.
"Other" includes "other" and "causal vehicle backing rear to side" type crashes.

3.2 Crash Rate

Average crash rates were calculated for the five years of crash data in order to evaluate the safety performance of SR 36 and Bethel Road within the study area as compared with the statewide average crash rate. The SR 36 corridor was divided to two segments (Highway 31 to Bethel Road and Bethel Road to I-65) and the Bethel Road corridor was divided to two segments (SR 36 to Indian Hills Road and Indian Hills Road to I-65) based on roadway characteristics and volumes. The statewide crash rate for Alabama was determined based on crash data from the 2020 Crash Facts published by Alabama Department of Transportation (ALDOT). Crash rates are expressed as crashes per million vehicle-miles traveled (MVM). As shown in **Table 7**, the corridor crash rates for SR 36 were roughly three times higher than the Alabama statewide crash rate. It should be noted that the Alabama crash rate is for all roadway classifications.

Table 7: Corridor Crash Rates

Segment	Length (miles)	ADT (vpd)	Total Crashes	Crash Rate (per MVM)	AL Crash Rate (per MVM)	Crash Rate/AL Crash Rate
SR 36 - Highway 31 to Bethel Road	1.10	13,150	183	6.93	2.02	3.43
SR 36 - Bethel Road to I-65	1.35	13,650	170	5.05	2.02	2.50
Bethel Road - SR 36 to Indian Hills Rd	1.50	4,000	21	1.92	2.02	0.95
Bethel Road - Indian Hills Rd to I-65	2.80	2,700	9	0.65	2.02	0.32

4.0 Volume Development

Volumes were developed throughout the study area for 2023 Existing average daily traffic (ADT), AM peak hour, and PM peak hour. These volumes were then projected to 2045 to develop the 2045 No Build volumes. This process is detailed in the following subsections.

4.1 Traffic Count Data

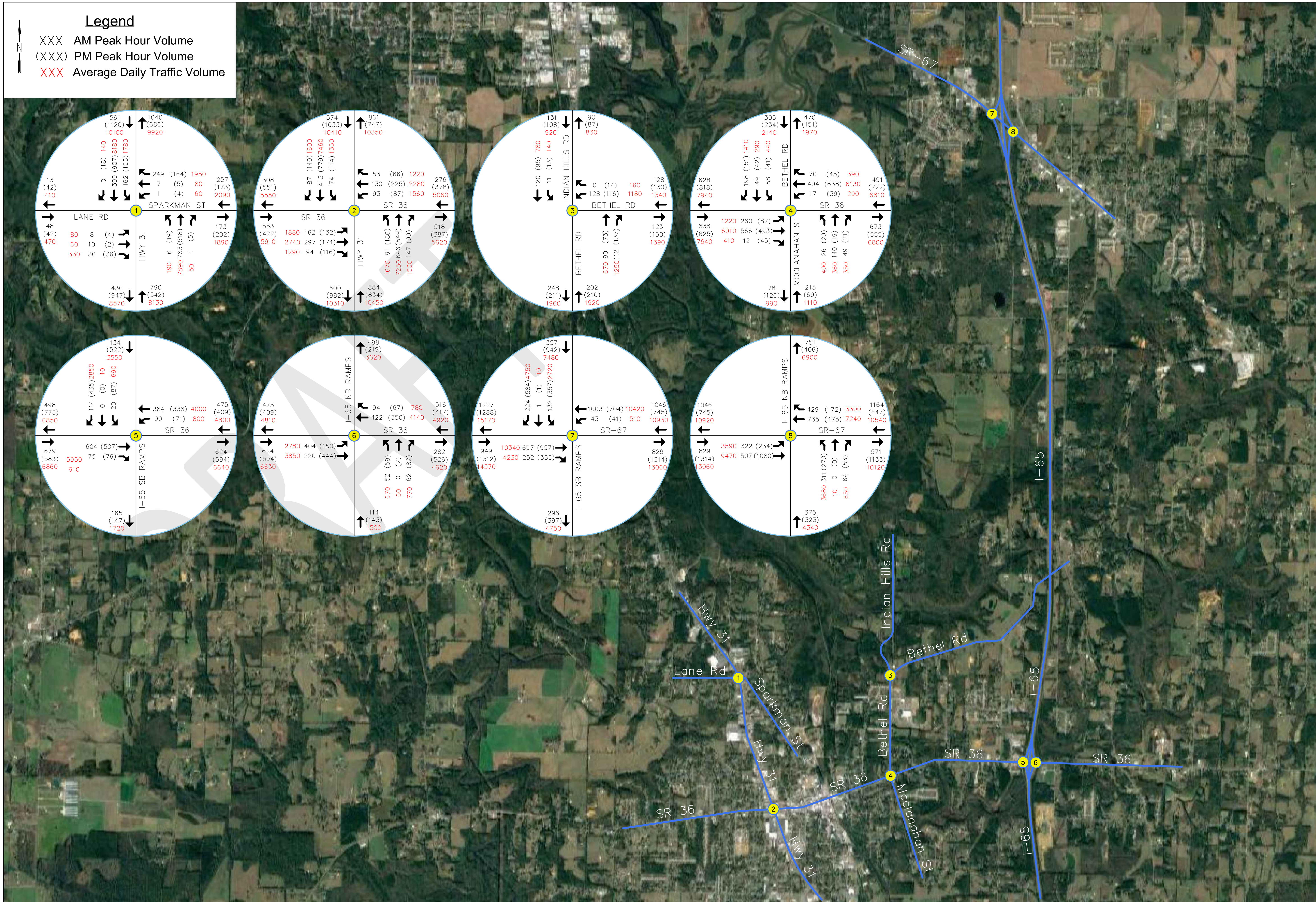
The Traffic Group conducted 24-hour turning movement counts for eight (8) study intersections within the study area. These counts were taken on January 19, 2023. The traffic counts were processed to determine AM and PM peak hour turning movement volumes, ADT volumes, peak hour factors, and percentages of heavy vehicles for the study intersections. Based on the turning movement counts, the AM peak was determined to occur from 7:00 to 8:00 AM and the PM peak from 4:30 to 5:30 PM. Since the I-65 and SR 67 interchange is located six (6) miles north of the rest of the study area, separate peak hours were developed for the two signalized intersections at that interchange. The AM peak was determined to be 7:15 to 8:15 AM and the PM peak from 4:45 to 5:45 PM. The traffic count data are included in **Appendix A – Traffic Data**.

4.2 Development of 2023 Existing Volumes

The 2023 Existing Volumes shown in **Figure 11** were developed from the traffic count data. Volume balancing between study intersections was performed when necessary.

Figure 11

2023 Existing Volumes



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4.3 Traffic Forecast

The Decatur Area MPO provided 2015 and 2045 traffic volumes from the Decatur Area TDM. Volumes at multiple locations within the study area were used to calculate the average annual growth rates for various roadways as shown in **Tables 8 to 10**. Based on the average annual growth rates, the recommended growth rates of 1.2% for SR 67, 1.6% for Highway 36 and Bethel Road, and 1.0% for Highway 31 were used to project future traffic volumes.

Table 8: SR 67 Growth Rates

Year	SR 67 west of I-65	SR 67 east of I-65	Weighted Average	Recommended
2015	26679	16550		
2045	38634	23092		
AGR (%)	1.24%	1.12%	1.19%	1.20%

Table 9: SR 36 and Bethel Road Growth Rates

Year	SR 36 west of I-65	SR 36 west of Bethel Rd	SR 36 between Railroad St NW and Hammit St NE	SR 36 between Railroad St NW and Sparkman St NW	SR 36 between Sparkman St NW and Sycamoare St NW	SR 36 between Corsble St NW and Cedar St NW	SR 36 between Kimbrough St NW and Hwy 31	SR 36 between Hwy 31 and Rooks St	Bethel Rd north of Hwy 36*	Bethel Rd north Bethel St NE*	Bethel Rd north of Indian Hills Rd NE	Bethel Rd south of Stephenson Rd (near I-65)	Weighted Average	Recommended
2015	13408	14391	12883	11177	7076	6528	5846	14604	2306	2797	2106	2466		
2045	19665	24561	18115	16873	10584	9658	9988	21245	6277	6257	3908	4397		
AGR (%)	1.28%	1.80%	1.14%	1.38%	1.35%	1.31%	1.80%	1.26%	3.39%	2.72%	2.08%	1.95%	1.58%	1.60%

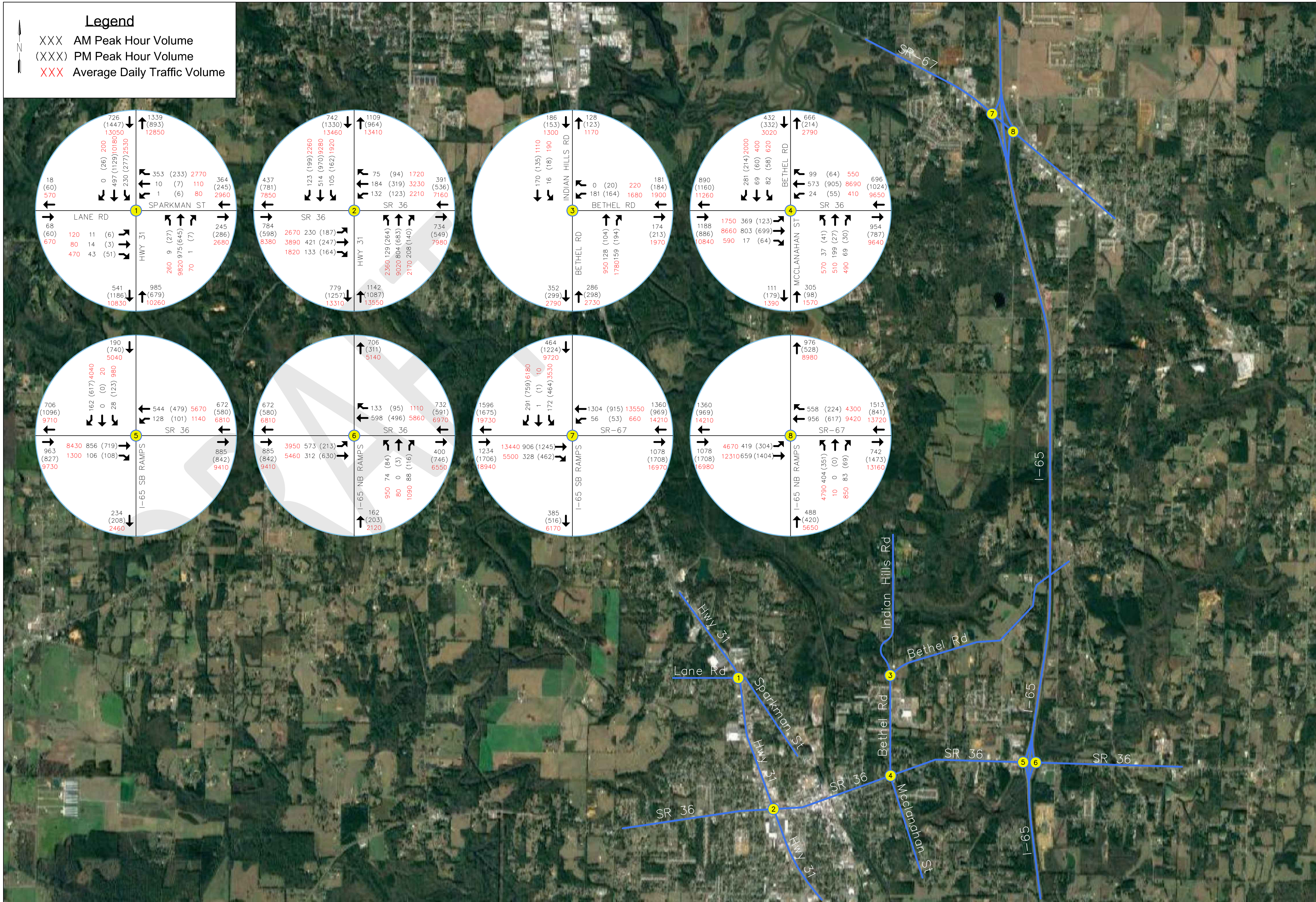
Table 10: Highway 31 Growth Rates

Year	Hwy 31 north of Hwy 36	Hwy 31 south of Hwy 36	Hwy 31 north of Sparkman St	Hwy 31 south of Sparkman St	Weighted Average	Recommended
2015	23017	15381	22806	18090		
2045	32237	20961	30254	23505		
AGR (%)	1.13%	1.04%	0.95%	0.88%	1.00%	1.00%

4.4 Development of 2045 No Build Volumes

Using the regression formula, the recommended growth rates described in the previous subsection were applied to the 2023 Existing volumes to develop the 2045 No Build volumes shown in **Figures 12.** By the 2045 design year, the ADT on SR 36 is projected to increase up to 22,000 vpd which is above the capacity of a two-lane roadway.

Figure 12



2045 Future No Build Volumes

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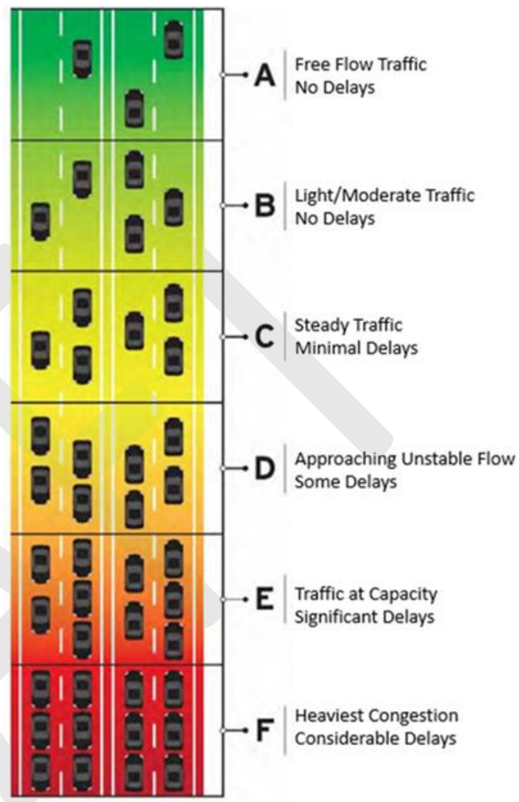
5.0 Operational Analysis – Existing and No Build Conditions

The study area was evaluated under 2023 Existing and 2045 No Build conditions in order to identify any current or anticipated operational needs during typical peak hours.

To quantify the operational needs for the study area, the *Highway Capacity Manual 6th Edition (HCM)* methodology was utilized. The *HCM* qualitatively describes operating conditions within a traffic stream or at an intersection using a concept known as Level of Service (LOS). LOS is typically designated into six categories. These range from LOS A indicating free-flow, low density, or nearly negligible delay conditions to LOS F where demand exceeds capacity and large queues are experienced. A graphical representation of LOS is presented in **Figure 13**. For this study, LOS D is the threshold for acceptable level of service for any movement at a major intersection.

Figure 13: Level of Service (LOS) Categories



For intersections, the *HCM* methodology uses control delay, measured in average seconds of delay per vehicle, as the basis for determining LOS. Control delay at an intersection is the average stopped time per vehicle traveling through the intersection plus the movements at slower speeds due to the vehicles moving up in the queue or slowing upstream of the approach. **Table 11** provides the LOS delay thresholds as stated in the latest *HCM*.

Table 11: Thresholds for Control Delay at Intersections

Level of Service	Description	Signalized Intersection Control Delay (sec/veh)	Stop Controlled Intersection
A	Most vehicles do not stop	0 to 10	0 to 10
B	Some vehicles stop	> 10 to 20	> 10 to 15
C	Significant number of stops	> 20 to 35	> 15 to 25
D	Many stop, individual cycle failure	> 35 to 55	> 25 to 35
E	Frequent individual cycle failure, at capacity	> 55 to 80	> 35 to 50
F	Arrival rate exceeds capacity	> 80 or v/c > 1	> 50 or v/c >1

Synchro 11 software along with its companion *SimTraffic* software were used to determine the expected delays and LOS at each intersection within the study area based on *HCM* methodology and *SimTraffic* microsimulation methodology. Microsimulation allows the user to analyze intersection operations both individually and in context of the entire study network. Additionally, microsimulation gives the user a powerful visualization tool to trace any sources of vehicle delay and queuing as well as the opportunity to perform multiple simulation runs with varying traffic loading within the peak hour to account for the expected variability within a system. This variation also accounts for the various types of drivers (aggressiveness, gap acceptance tolerance) and vehicles (performance on grades, general acceleration/ deceleration). Finally, microsimulation provides the best means to demonstrate the impacts of queues on nearby intersections.

The results from the operational analyses of 2023 Existing conditions and 2045 No Build conditions for the study intersections are discussed in the following subsections.

5.1 Operational Analysis – 2023 Existing Conditions

Existing conditions were analyzed using 2023 Existing volumes. All signalized intersections were modeled with an estimate of the current signal timings as observed during the field visit. The *Synchro* models were calibrated as necessary in order to simulate what was observed in the field as accurately as possible.

5.1.1 Intersection Analysis

The results based on *HCM* methodology and *SimTraffic* methodology are summarized in **Tables 12 and 13**. The complete results are provided in **Appendix B - Operational Analysis Results**.

The results from both the *HCM* and *SimTraffic* methodologies showed all movements operating at acceptable LOS D or better during all peak hours with the exception of movements at the following intersections:

- Highway 31 at Lane Road/Sparkman Street
  - LOS F on the eastbound approach during the AM peak hour (*HCM* methodology)
  - LOS E on the eastbound approach during the AM peak hour (*SimTraffic* methodology)
  - LOS E on the westbound approach during the AM and PM peak hours (*SimTraffic* methodology)
- Highway 31 at SR 36
  - LOS E on the southbound approach during the PM peak hour (*SimTraffic* methodology)
- I-65 SB Ramps at SR 36
  - LOS F on the southbound approach during the PM peak hour (*HCM* methodology)
  - LOS F on the southbound approach during the AM and PM peak hours (*SimTraffic* methodology)
- I-65 SB Ramps at SR 67
  - LOS E on the southbound approach during the PM peak hour (*HCM* methodology)
  - LOS F on the southbound approach during the PM peak hour (*SimTraffic* methodology)

Table 12: 2023 Existing Conditions – *HCM Results*

Intersection	Control	Time Period	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Hwy 31 @ Lane Rd/Sparkman St	Two-Way Stop	AM	LOS	F			D			A	A	A	B	A		A
			Delay	63.9			33.6			8.4	0.1	0.0	11.9	0.0		8.3
		PM	LOS	C			C			B	A	A	A	A		A
			Delay	21.0			18.7			10.2	0.2	0.0	9.4	0.0		3.3
Hwy 31 @ SR 36	Signal	AM	LOS	C	D		C	C		D	C	C	D	C	C	C
			Delay	22.1	38.8		26.3	29.5		51.4	24.8	21.5	54.1	22.7	20.8	28.7
		PM	LOS	C	C		C	D		D	B	B	D	C	B	C
			Delay	26.1	32.4		25.9	36.5		42.7	17.7	14.7	48.9	23.7	17.4	27.3
Bethel Rd @ Indian Hills Rd	One-Way Stop	AM	LOS	B		B				A	A			A		A
			Delay	10.3		10.3				7.7	0.0			0.0		4.4
		PM	LOS	A		A				A	A			A		A
			Delay	9.9		9.9				7.6	0.0			0.0		3.6
McClanahan St/Bethel Rd @ SR 36	Signal	AM	LOS	A	B		A	B		C			B		C	B
			Delay	9.7	11.7		7.8	14.8		22.4			19.6		25.4	15.3
		PM	LOS	A	A		A	B		C			C		B	A
			Delay	5.1	6.9		4.0	10.4		20.5			20.3		19.2	9.6
I-65 SB Ramps @ SR 36	One-Way Stop	AM	LOS		A		A	A					C		C	A
			Delay		0.0		9.5	0.0					16.5		16.5	2.4
		PM	LOS		A		A	A					F		F	D
			Delay		0.0		9.0	0.0					93.5		93.5	32.7
I-65 NB Ramps @ SR 36	Signal	AM	LOS	n/a[1]												
			Delay													
		PM	LOS													
			Delay													
I-65 SB Ramps @ SR-67	Signal	AM	LOS		A	n/a[2]	A	A					C		n/a[2]	A
			Delay		7.8		5.1	4.9					30.1			7.8
		PM	LOS		B		A	A					E			C
			Delay		12.5		8.7	6.4					69.3			20.2
I-65 NB Ramps @ SR-67	Signal	AM	LOS	C	B			C	n/a[2]	D		n/a[2]				C
			Delay	32.2	12.6			33.5		36.0						28.1
		PM	LOS	C	B			C		C						C
			Delay	20.2	19.4			28.3		20.2						21.7

n/a[1] - *HCM* 6th edition methodology does not support the perm + prot left turn type from a shared lane
n/a[2] - *HCM* methodology does not calculate delay for a channelized right turn at a signalized intersection

Table 13: 2023 Existing Conditions – *SimTraffic* Results

Intersection	Control	Time Period	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Hwy 31 @ Lane Rd/Sparkman St	Two-Way Stop	AM	LOS	E	D	A	C	E	C	A	A	A	A	A	A	A
			Delay	42.6	28.1	3.0	19.0	36.5	22.0	4.2	3.5	1.8	9.6	1.5	0.0	6.8
		PM	LOS	C	D	A	E	C	A	B	A	A	A	A	A	A
			Delay	22.2	28.5	2.2	40.9	22.1	7.4	10.3	2.8	2.5	6.3	2.1	0.9	3.4
Hwy 31 @ Hwy 36	Signal	AM	LOS	C	C	C	C	B	C	D	C	B	D	C	A	C
			Delay	22.8	32.2	24.3	31.6	18.4	21.1	45.8	24.3	10.4	53.4	25.5	7.7	25.2
		PM	LOS	C	C	C	C	B	C	D	C	A	E	D	B	C
			Delay	25.7	30.6	23.8	23.7	17.8	24.8	43.3	22.6	7.3	63.7	39.1	17.2	29.3
Bethel Rd @ Indian Hills Rd	One-Way Stop	AM	LOS	A		A				A	A			A	A	A
			Delay	6.1		3.4				4.8	3.5			0.5	0.0	3.0
		PM	LOS	A		A				A	A			A	A	A
			Delay	6.2		2.7				3.5	2.4			0.5	1.5	2.2
McClanahan St/Bethel Rd @ Hwy 36	Signal	AM	LOS	C	B	B	B	C	B	C	C	B	C	A	A	B
			Delay	28.1	15.4	12.4	15.0	21.2	15.7	27.7	28.9	17.0	28.8	0.5	1.5	19.8
		PM	LOS	B	B	A	B	B	B	C	B	A	B	A	A	B
			Delay	18.8	13.4	9.9	14.0	14.6	10.3	20.4	16.1	7.4	17.9	0.5	1.5	14.1
I-65 SB Ramps @ Hwy 36	One-Way Stop	AM	LOS		D	D	B	A					F		F	D
			Delay		33.4	32.6	10.4	7.4					124.9		79.1	29.7
		PM	LOS		A	A	A	A					F		F	D
			Delay		6.0	4.0	6.9	6.0					88.3		78.2	31.9
I-65 NB Ramps @ Hwy 36	Signal	AM	LOS	D	D			B	B	C		A				C
			Delay	51.9	52.4			19.1	12.4	21.1		8.6				34.4
		PM	LOS	A	B			B	A	B		A				B
			Delay	10.0	10.6			10.3	5.4	18.4		9.1				10.4
I-65 SB Ramps @ SR-67	Signal	AM	LOS		A	A	B	B					C		A	A
			Delay		5.6	1.3	18.2	13.0					24.5		7.1	9.7
		PM	LOS		A	A	C	B					F		B	C
			Delay		8.8	2.0	22.1	16.8					132.6		13.4	25.7
I-65 NB Ramps @ SR-67	Signal	AM	LOS	D	B			D	A	D		A				C
			Delay	42.7	15.2			36.7	4.2	49.3		6.2				27.9
		PM	LOS	C	C			C	A	C		A				C
			Delay	25.6	22.5			28.2	1.3	27.2		7.0				22.6

5.1.2 Queue Lengths

Queue lengths were reviewed and compared to the available storage lengths in order to identify areas where improvements may be needed. The 95th percentile queue lengths obtained from the *Synchro* models according to *HCM* methodology are shown in **Table 14**. The queue lengths shown in the table are expressed in terms of feet by assuming an average vehicle length of 25 feet since the *HCM* methodology yields queues in terms of vehicles. **Table 15** shows the 95th percentile queue lengths in feet based on the *SimTraffic* methodology. Lengthy queue lengths are highlighted in table.

The results of the *HCM* methodology showed adequate existing storage lengths for all intersections. The *SimTraffic* methodology showed a significant amount of queuing on the eastbound approaches at the intersections of I-65 SB Ramps at SR 36 and I-65 NB Ramps at SR 36 during the AM peak hour. Simulation showed the eastbound queue at the intersection of I-65 NB Ramps at SR 36 to extend past the bridge through the I-65 SB Ramps intersection which is consistent with that was observed during the site visit. In the PM peak hour, extensive queueing is also shown on the southbound approaches at the I-65 SB Ramps at SR 36 and the I-65 SR Ramps at SR 67 intersections. The *SimTraffic* software analyzes each intersection in context of the entire study network and thus captures the impact of queue spillback from one intersection through the adjacent intersection. The *HCM* methodology does not have the capability to account for such impacts.

Table 14: Intersection Queues (ft) - 2023 Existing Conditions – *HCM Results*

Intersection	Control	Time Period	EB Movement			WB Movement			NB Movement			SB Movement		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Hwy 31 @ Lane Rd/Sparkman St	Existing Storage (ft)		-		70	-			-			150	-	
	Two-Way Stop	AM	58			145			0	0		28	0	
		PM	15			50			3	0		18	0	
Hwy 31 @ Hwy 36	Existing Storage (ft)		145	-		130	-		225	-	230	315	-	195
	Signal	AM	138	410		83	188		120	268	128	103	173	75
		PM	100	230		68	253		188	163	20	125	263	28
Bethel Rd @ Indian Hills Rd	Existing Storage (ft)		-		-				-				-	
	One-Way Stop	AM	18		18				5	0			0	
		PM	13		13				5	0			0	
McClanahan St/Bethel Rd @ Hwy 36	Existing Storage (ft)		300	-		115	-		-			-		285
	Signal	AM	55	210		5	200		130			60		130
		PM	8	95		3	145		23			38		5
I-65 SB Ramps @ Hwy 36	Existing Storage (ft)			-		-						-		-
	One-Way Stop	AM		0		8	0					33		33
		PM		0		8	0					433		433
I-65 NB Ramps @ Hwy 36	Existing Storage (ft)		-				-		-		-			
	Signal	AM	n/a[1]											
		PM												
I-65 SB Ramps @ SR-67	Existing Storage (ft)			-	345	150	-					625		625
	Signal	AM		78	0	5	50					95		0
		PM		135	0	8	48					340		0
I-65 NB Ramps @ SR-67	Existing Storage (ft)		330	-			-	-	1100		1100			
	Signal	AM	263	150			363	0	338		0			
		PM	140	313			188	0	190		0			

n/a[1] - *HCM* methodology does not support a perm + prot left-turn type from a shared lane.

Table 15: Intersection Queues (ft) - 2022 Existing Conditions – *SimTraffic* Results

Intersection	Control	Time Period	EB Movement			WB Movement			NB Movement			SB Movement		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Hwy 31 @ Lane Rd/Sparkman St	Existing Storage (ft)		-		70	-			-			150	-	
	Two-Way Stop	AM	45			239			18	11		95	25	
		PM	21			87			34	4		65	3	
Hwy 31 @ Hwy 36	Existing Storage (ft)		145	-		130	-		225	-	230	315	-	195
	Signal	AM	194	319		110	176		119	225	106	96	154	60
		PM	136	223		137	252		167	182	58	157	242	105
Bethel Rd @ Indian Hills Rd	Existing Storage (ft)		-		-				-				-	
	One-Way Stop	AM	53		53				54				0	
		PM	40		40				46				3	
McClanahan St/Bethel Rd @ Hwy 36	Existing Storage (ft)		300	-		115	-		-			-		285
	Signal	AM	179	198		42	265		189			95		86
		PM	64	174		50	226		68			63		71
I-65 SB Ramps @ Hwy 36	Existing Storage (ft)			-		-						-		-
	One-Way Stop	AM		733		159						357		357
		PM		3		101						776		776
I-65 NB Ramps @ Hwy 36	Existing Storage (ft)		-				-		-		-			
	Signal	AM	528				261		95		95			
		PM	209				140		91		91			
I-65 SB Ramps @ SR-67	Existing Storage (ft)			-	345	150	-					625		625
	Signal	AM		122	0	41	118					137		12
		PM		150	9	43	114					769		207
I-65 NB Ramps @ SR-67	Existing Storage (ft)		330	-			-	-	1100		1100			
	Signal	AM	296	284			325	29	382		5			
		PM	168	239			202	0	225		35			

5.2 Operational Analysis – 2045 No Build Conditions

For the 2045 No Build conditions, peak hour factors and peak periods were assumed to remain unchanged from the 2023 Existing conditions. The signal timings at existing signalized intersections were optimized. The 2045 No Build traffic volumes were used, and the analyses were performed using the same methodology and assumptions as were used for the 2023 Existing conditions. The results are described in the following subsections.

5.2.1 Intersection Analysis

The results from the 2045 No Build intersection analysis are shown in **Tables 16 and 17**. The complete results are provided in **Appendix B- Operational Analysis Results**. Both methodologies showed the operation of most of the study intersections to deteriorate by design year 2045 with multiple movements failing during at least one peak hour.

Based on the *HCM* and *SimTraffic* methodologies, the following movements are anticipated to operate poorly by design year 2045 with the existing lane configuration and traffic control:

- Highway 31 at Lane Road/Sparkman Street
    - LOS E/F on the eastbound and westbound approaches during both peak hours with the existing stop control (both methodologies)
- Highway 31 at SR 36
    - LOS E/F on the eastbound and westbound approaches and left turn movements on the northbound and southbound approached during both peak (both methodologies)
- SR 36 at Bethel Road/McClanahan Street
    - LOS E/F on all approaches and an overall LOS F in the AM peak hour (both methodologies)
- I-65 SB Ramps at SR 36
    - LOS F on the eastbound approach during both peak hours (*SimTraffic* methodology)
    - LOS F on the southbound approach during both peak hours (both methodologies)
- I-65 NB Ramps at SR 36
    - LOS E/F on the eastbound approach during both peak hours (*SimTraffic* methodology)
- I-65 SB Ramps at SR 67
    - LOS E on the southbound approach during the AM peak hour (*HCM* methodology)
- I-65 NB Ramps at SR 67
    - LOS E/F on the westbound approach and left turn movement on the northbound approach in the AM peak hour (*HCM* methodology)
    - LOS E/F for the left turn movements on the eastbound and northbound approaches in the AM peak hour (*SimTraffic* methodology)

Table 16: 2045 No Build Conditions – *HCM Results*

Intersection	Control	Time Period	MOE	EB Movement Left	EB Movement Thru	EB Movement Right	WB Movement Left	WB Movement Thru	WB Movement Right	NB Movement Left	NB Movement Thru	NB Movement Right	SB Movement Left	SB Movement Thru	SB Movement Right	Overall
Hwy 31 @ Lane Rd/Sparkman St	Two-Way Stop	AM	LOS	F			F			A	A	A	C	A		F
			Delay	8364.6			459.1			8.8	0.1	0.0	16.7	0.0		346.5
		PM	LOS	F			F			B	A	A	B	A		C
			Delay	259.9			147.0			11.7	0.4	0.0	10.9	0.0		22.9
Hwy 31 @ Hwy 36	Signal	AM	LOS	C		E	E		C	E	D	D	F	D	C	D
			Delay	23.4		69.9	58.9		33.6	76.9	48.8	37.5	84.2	38.5	34.7	49.2
		PM	LOS	D		D	D		E	F	C	C	E	D	C	D
			Delay	52.5		54.9	37.7		78.9	80.3	28.8	22.9	65.8	44.7	28.9	50.1
Bethel Rd @ Indian Hills Rd	One-Way Stop	AM	LOS	B		B				A	A			A		A
			Delay	12.0		12.0				8.0	0.0			0.0		5.0
		PM	LOS	B		B				A	A			A		A
			Delay	11.0		11.0				7.8	0.0			0.0		3.9
McClanahan St/Bethel Rd @ Hwy 36	Signal	AM	LOS	F	C		C	F		F			E		E	F
			Delay	80.2	29.8		22.2	91.5		628.9			68.1		57.0	127.5
		PM	LOS	B	B		A	B		C			C		C	B
			Delay	15.0	11.2		6.9	19.7		34.9			33.6		30.7	17.5
I-65 SB Ramps @ Hwy 36	One-Way Stop	AM	LOS		A		B	A					F		F	A
			Delay		0.0		11.6	0.0					60.0		60.0	7.1
		PM	LOS		A		B	A					F		F	F
			Delay		0.0		10.5	0.0					701.3		701.3	242.4
I-65 NB Ramps @ Hwy 36	Signal	AM	LOS	n/a[1]												
			Delay													
		PM	LOS													
			Delay													
I-65 SB Ramps @ SR-67	Signal	AM	LOS		B	n/a[2]	B	A					E		n/a[2]	B
			Delay		15.3		14.0	0.1					57.5			10.1
		PM	LOS		C		D	A					D			C
			Delay		29.0		35.5	0.6					53.3			23.6
I-65 NB Ramps @ SR-67	Signal	AM	LOS	C	A			E	n/a[2]	F		n/a[2]				D
			Delay	33.8	0.3			60.2		90.9						44.6
		PM	LOS	C	A			C		C						B
			Delay	24.9	1.4			29.4		33.2						14.7

n/a[1] - *HCM* 6th edition methodology does not support the perm + prot left turn type from a shared lane
n/a[2] - *HCM* methodology does not calculate delay for a channelized right turn at a signalized intersection

Table 17: 2045 No Build Conditions – *SimTraffic* Results

Intersection	Control	Time Period	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Hwy 31 @ Lane Rd/Sparkman St	Two-Way Stop	AM	LOS	F	F	B	A	F	F	A	A	A	B	A	A	C
			Delay	76.9	50.8	13.0	0.0	151.7	113.8	5.1	3.9	4.6	13.7	1.8	0.0	23.1
		PM	LOS	F	F	A	F	F	E	B	A	A	B	A	A	A
			Delay	110.4	90.4	2.6	105.2	83.8	44.1	14.1	2.9	2.3	10.1	3.0	1.1	8.3
Hwy 31 @ Hwy 36	Signal	AM	LOS	F	F	F	D	C	C	F	D	C	F	C	B	E
			Delay	108.5	111.0	114.4	44.1	32.0	26.2	86.2	38.7	21.5	113.8	34.6	10.6	58.4
		PM	LOS	E	E	E	E	D	D	F	E	C	E	D	C	E
			Delay	73.7	74.5	65.5	57.7	54.1	50.6	379.0	55.2	33.1	64.5	42.7	22.8	76.2
Bethel Rd @ Indian Hills Rd	One-Way Stop	AM	LOS	A		A				A	A			A	A	A
			Delay	9.4		4.3				5.0	3.1			0.5	9.4	3.1
		PM	LOS	A		A				A	A			A	A	A
			Delay	8.3		3.6				4.9	3.1			0.6	0.4	2.9
McClanahan St/Bethel Rd @ Hwy 36	Signal	AM	LOS	F	F	F	E	F	E	F	F	F	F	F	E	F
			Delay	219.8	220.3	187.7	58.6	80.4	73.3	250.5	244.1	242.5	201.5	156.3	73.9	167.2
		PM	LOS	C	B	B	B	B	B	D	D	C	C	C	B	B
			Delay	24.4	16.0	11.8	18.9	16.8	11.5	39.9	37.3	25.3	33.5	28.8	18.9	18.6
I-65 SB Ramps @ Hwy 36	One-Way Stop	AM	LOS		F	F	A	A					F		F	F
			Delay		864.6	871.2	5.1	6.0					855.1		756.7	537.8
		PM	LOS		F	F	B	A					F		F	F
			Delay		106.5	102.1	11.5	8.3					1878.9		1833.4	671.2
I-65 NB Ramps @ Hwy 36	Signal	AM	LOS	F	F			B	B	D		C				E
			Delay	137.1	132.1			16.0	11.2	48.4		25.1				55.6
		PM	LOS	E	E			B	A	D		C				D
			Delay	62.0	59.0			11.9	7.9	48.4		32.5				37.5
I-65 SB Ramps @ SR-67	Signal	AM	LOS		C	A	C	B					D		A	B
			Delay		26.8	1.9	23.2	11.2					45.1		6.8	16.5
		PM	LOS		C	A	D	B					D		B	B
			Delay		20.1	2.7	36.7	13.3					40.7		12.1	17.6
I-65 NB Ramps @ SR-67	Signal	AM	LOS	F	B			D	A	E		A				E
			Delay	205.7	19.3			51.5	9.2	55.8		6.5				57.3
		PM	LOS	D	C			C	A	C		A				C
			Delay	49.8	22.3			25.5	1.5	29.8		7.2				24.8

5.2.2 Queue Lengths

The queue lengths for 2045 No Build conditions are tabulated in **Tables 18 and 19**. Locations where queue lengths exceed the existing storage lengths for turn lanes are highlighted in yellow. Based on both methodologies, the following existing storage lengths would be insufficient to accommodate 2045 design year volumes:

- eastbound, westbound, and northbound approaches at the intersection of Highway 31 at SR 36;
- eastbound and southbound approaches at the intersection of Bethel Road/McClanahan Street at SR 36; and
- eastbound left turn at the intersection of I-65 NB Ramps at SR 67.

The *SimTraffic* methodology also shows worsening queues on the eastbound approaches at the intersections of I-65 SB Ramps at SR 36 and I-65 NB Ramps at SR 36 during both peak hours. Both methodologies show extensive queueing on the southbound approach at the intersection of I-65 SB Ramps at SR 36.

Table 18: Intersection Queues (ft) - 2045 No Build Conditions – *HCM Results*

Intersection	Control	Time Period	EB Movement			WB Movement			NB Movement			SB Movement		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Hwy 31 @ Lane Rd/Sparkman St	Existing Storage (ft)		-		70	-			-			150	-	
	Two-Way Stop	AM	305			785			0	0		65	0	
		PM	130			303			5	0		35	0	
Hwy 31 @ Hwy 36	Existing Storage (ft)		145	-		130	-		225	-	230	315	-	195
	Signal	AM	220	845		200	303		240	515	270	215	310	165
		PM	238	498		143	593		403	310	43	243	525	100
Bethel Rd @ Indian Hills Rd	Existing Storage (ft)		-		-				-				-	
	One-Way Stop	AM	33		33				10	0			0	
		PM	20		20				8	0			0	
McClanahan St/Bethel Rd @ Hwy 36	Existing Storage (ft)		300	-		115	-		-			-		285
	Signal	AM	580	765		20	1053		1280			273		395
		PM	55	295		10	463		73			103		18
I-65 SB Ramps @ Hwy 36	Existing Storage (ft)			-		-						-		-
	One-Way Stop	AM		0		18	0					153		153
		PM		0		13	0					1593		1593
I-65 NB Ramps @ Hwy 36	Existing Storage (ft)		-				-		-		-			
	Signal	AM	n/a[1]											
		PM												
I-65 SB Ramps @ SR-67	Existing Storage (ft)			-	345	150	-					625		625
	Signal	AM		298	0	30	3					258		0
		PM		450	0	48	8					485		0
I-65 NB Ramps @ SR-67	Existing Storage (ft)		330	-			-	-	1100		1100			
	Signal	AM	313	5			620	0	665		0			
		PM	173	18			248	0	308		0			

n/a[1] - *HCM* methodology does not support a perm + prot left-turn type from a shared lane.

Table 19: Intersection Queues (ft) - 2045 No Build Conditions – *SimTraffic* Results

Intersection	Control	Time Period	EB Movement			WB Movement			NB Movement			SB Movement		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Hwy 31 @ Lane Rd/Sparkman St	Existing Storage (ft)		-		70	-			-			150	-	
	Two-Way Stop	AM	112			556			27	15		122	46	
		PM	35			356			69	28		109	37	3
Hwy 31 @ Hwy 36	Existing Storage (ft)		145	-		130	-		225	-	230	315	-	195
	Signal	AM	310	1079		167	229		254	361	200	204	218	100
		PM	293	698		202	436		350	1366	142	229	380	270
Bethel Rd @ Indian Hills Rd	Existing Storage (ft)		-		-				-				-	
	One-Way Stop	AM	66		66				60				0	
		PM	50		50				63				0	
McClanahan St/Bethel Rd @ Hwy 36	Existing Storage (ft)		300	-		115	-		-			-		285
	Signal	AM	488	4201		109	1022		535			1204		314
		PM	94	284		88	311		116			111		131
I-65 SB Ramps @ Hwy 36	Existing Storage (ft)			-		-						-		-
	One-Way Stop	AM		5053		102						1135		1135
		PM		1868		208						980		980
I-65 NB Ramps @ Hwy 36	Existing Storage (ft)		-				-		-		-			
	Signal	AM	465				328		177		177			
		PM	527				248		213		213			
I-65 SB Ramps @ SR-67	Existing Storage (ft)			-	345	150	-					625		625
	Signal	AM		268	11	52	49					209		9
		PM		277	13	66	56					424		53
I-65 NB Ramps @ SR-67	Existing Storage (ft)		330	-			-	-	1100		1100			
	Signal	AM	361	1235			389	79	501		4			
		PM	298	351			230	9	293		9			

6.0 Evaluation of Build Conditions

Traffic analyses showed that poor operating conditions already exist in the study area with unacceptable levels of service and queues forming at the I-65 and SR 36 interchange. Without improvements to the intersections, operating conditions will further deteriorate by 2045 design year.

For the Build conditions, a new interchange at I-65 and Bethel Road is proposed along with a new two-lane connector from Bethel Road at Indian Hills Road to Highway 31 at Sparkman Street to improve traffic flow and divert some of the traffic load off of SR 36. The conceptual layout (Alternate 1) is illustrated on **Figure 14**. The new interchange will be located approximately 1.7 miles north of the I-65 at SR 36 interchange and 4.3 miles south of the I-65 at SR 67 interchange. Other improvements include a roundabout at the Bethel Road and Indian Hills Road intersection. Volume development and operational analysis for the 2045 Build conditions for Alternate 1 are discussed in the following subsections. It should be noted that a similar alternative (Alternative 2) was developed and shown in **Figure 15** for illustrative purpose only. With the terrain of the area, this alternate appears to be more feasible and less costly.

6.1 Build Volume Development

The Decatur Area MPO provided traffic data from the 2050 TDM for the 2045 Existing Plus Committed (E+C) conditions and the 2045 Build conditions. Based on the traffic data, the 2045 Build conditions show an average reduction in volumes of approximately 50% along SR 36 with the proposed interchange of I-65 at Bethel Road and the new connector. Nominal reduction is shown at the I-65 at SR 67 interchange.

To develop the 2045 Build volumes, a portion of the traffic along SR 36 was rerouted to the new connector and the I-65 at Bethel Road interchange. The following movements were assumed to use the new connector and interchange:

- eastbound traffic on SR 36 to I-65 NB (50%)
- westbound traffic on SR 36 from I-65 SB (50%)
- eastbound traffic on SR 36 to I-65 SB from Highway 31 SB (25%)
- westbound traffic on SR 36 from I-65 NB to Highway 31 NB (25%)
- eastbound traffic on SR 36 to east of I-65 from Highway 31 SB (25%)
- westbound traffic on SR 36 from east of I-65 to Highway 31 NB (25%)

The volumes for 2045 Build conditions are shown in **Figure 16**. With the proposed improvements, the ADT volume along SR 36 ranges from 10,500 vpd to 15,500 vpd in 2045 design year (compared to 22,000 vpd under 2045 No Build conditions). The ADT volume for the new connector is estimated to be 10,000 vpd.

Figure 14: Conceptual Layout of I-65 and Bethel Road Interchange - Alternative 1

GARVER
5125A Research Drive
Huntsville, AL 35805
(256) 534-5512

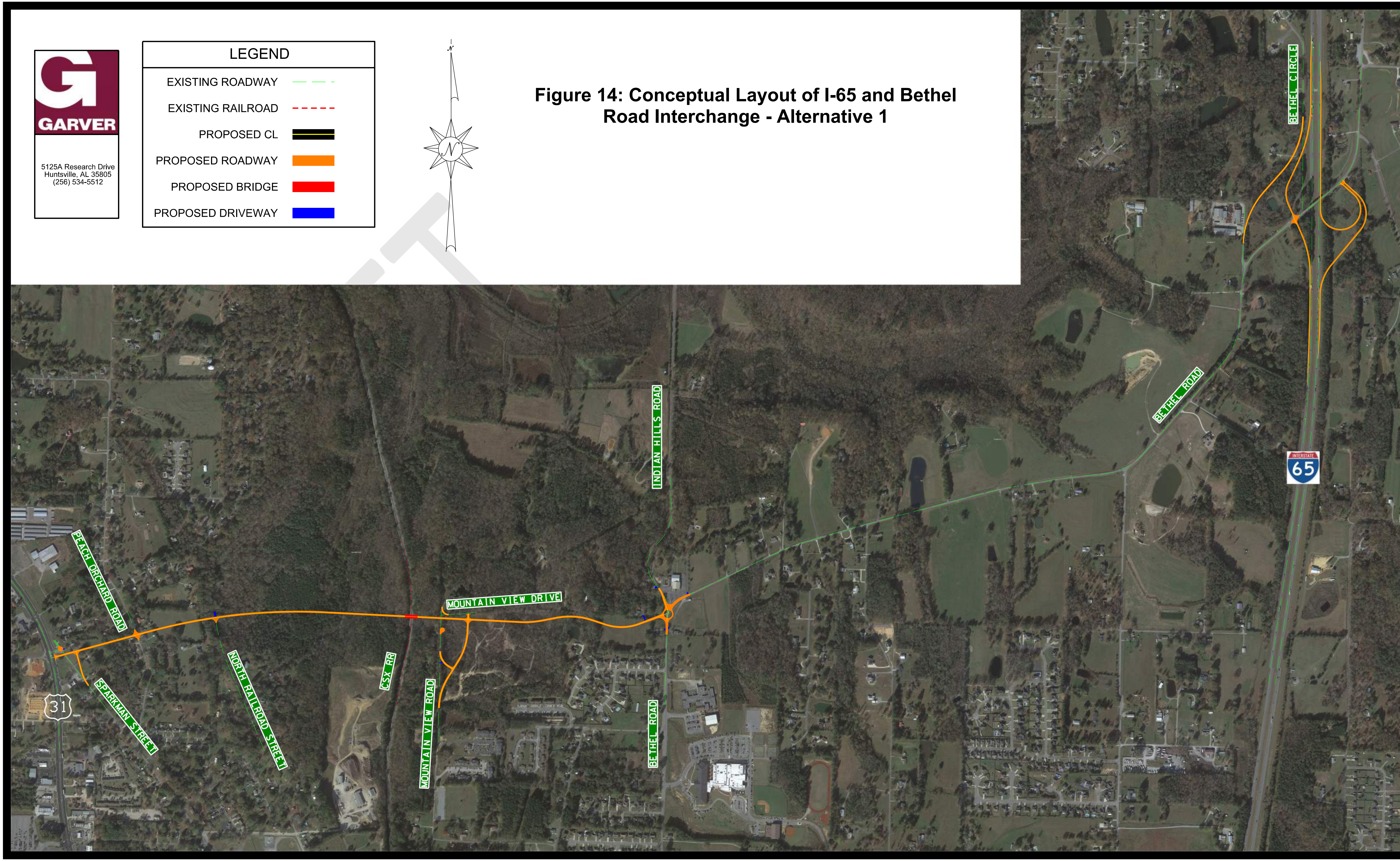


Figure 15: Conceptual Layout of I-65 and Bethel Road Interchange - Alternative 2

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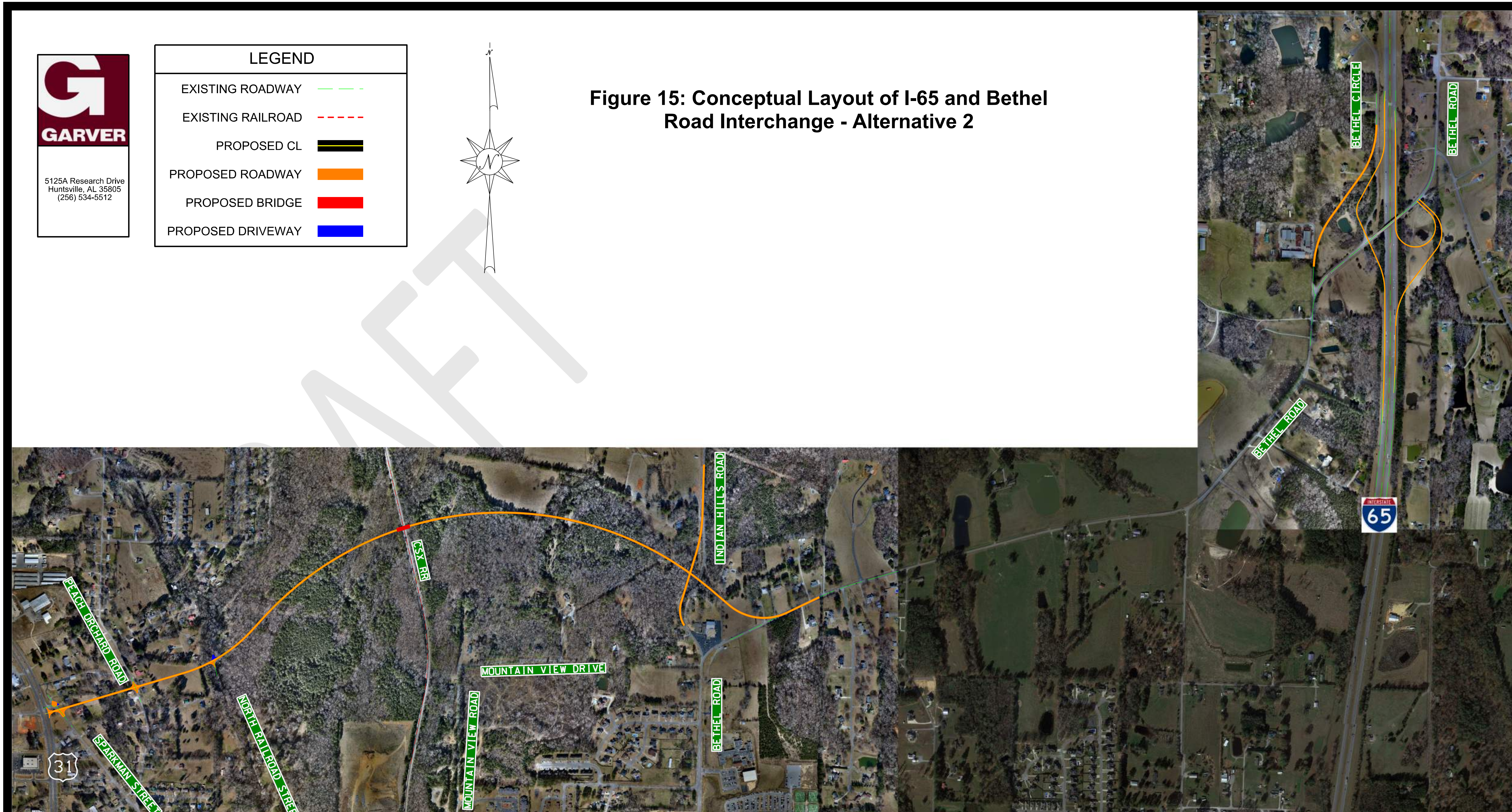
Huntsville, AL 35805
(256) 534-5512

LEGEND

EXISTING ROADWAY	
EXISTING RAILROAD	
PROPOSED CL	
PROPOSED ROADWAY	
PROPOSED BRIDGE	
PROPOSED DRIVEWAY	



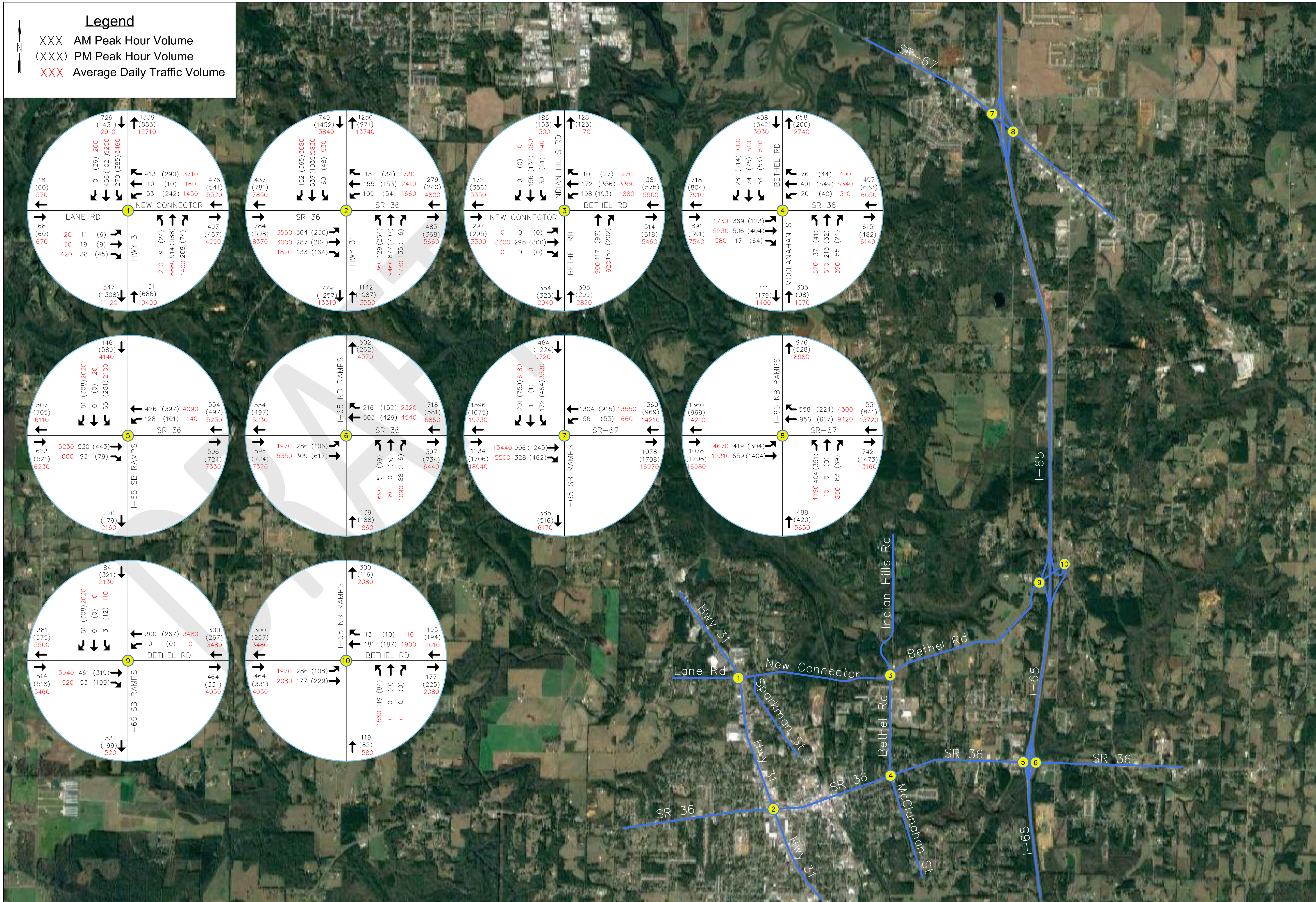


Figure 16

2045 Build Volumes

Sept 2023

GARVER

6.2 Operational Analysis – 2045 Build Conditions

6.2.1 Operational Analysis – First Iteration

For the first iteration of the 2045 Build conditions, the 2045 Build volumes were used, and the analysis was performed using the same approach utilized for the Existing and No Build conditions. The intersections at the proposed interchange were analyzed as stop controlled and the intersection at Highway 31/new connector was analyzed as signalized. Traffic signal timings were optimized for the analysis. Results of the Build operational analysis first iteration (Alternative 1A) are shown in **Tables 20 and 21**. Complete results are provided in **Appendix B – Operational Analysis Results**.

The results show the intersections along the new connector and at the proposed I-65/Bethel Road interchange to operate adequately with LOS D or better for all movements through 2045 design year. With the reduction in volumes along SR 36, the overall delay for intersections along SR 36 are shown to improve in the Build conditions. However, some movements will operate at LOS E/F at Highway 31/SR 36, Bethel Road/McClanahan Street/SR 36, I-65 SB Ramps/SR 36, I-65 NB Ramps/SR 36, and I-65 NB Ramps/SR 67 without further improvements. At the I-65/SR 36 interchange, the eastbound approaches experience LOS F with the existing lane configuration at the I-65 NB ramps. In addition, the southbound approach at I-65 SB ramps will operate at LOS F during both peak hours with the stop control. The results also show the SR 36/Bethel Road intersection to operate at LOS E/F for the minor approaches with the existing lane configuration during the AM peak hour.

Table 20: 2045 Build Conditions (Alternative 1A) – *HCM* Results

Intersection	Control	Time Period	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Hwy 31 @ Lane Rd/New Connector	Signal	AM	LOS	C	C		C	C		A	B	B	B	A	A	A
			Delay	21.3	21.5		22.9	21.1		5.4	10.3	10.4	11.3	4.0	0.0	9.5
		PM	LOS	C	C		B	B		B	C	C	B	B	B	B
			Delay	23.8	25.4		19.6	17.4		13.4	20.2	20.2	12.0	13.0	12.9	15.6
Hwy 31 @ SR 36	Signal	AM	LOS	D	D		C	C		D	C	B	D	C	C	C
			Delay	35.6	42.8		25.0	27.7		48.7	32.6	17.1	48.7	26.9	20.1	33.7
		PM	LOS	D	E		C	C		E	B	B	D	C	B	D
			Delay	40.0	60.5		29.2	33.6		62.8	15.3	12.1	54.0	34.4	19.2	35.3
Sparkman St at New Connector	One-Way Stop	AM	LOS		A	A	A	A		D		A				B
			Delay		0.0	0.0	0.0	0.0		32.5		0.0				10.1
		PM	LOS		A	A	A	A		C		A				A
			Delay		0.0	0.0	0.0	0.0		21.8		0.0				4.0
Bethel Rd/New Connector @ Indian Hills Rd	Roundabout	AM	LOS	A			A			A			A			A
			Delay	9.7			7.0			8.9			7.1			8.2
		PM	LOS	A			A			A			A			A
			Delay	7.5			8.3			7.2			7.2			7.8
McClanahan St/Bethel Rd @ SR 36	Signal	AM	LOS	C	B		B	C		D			C		C	C
			Delay	26.1	17.6		12.8	26.9		51.7			29.8		25.6	28.1
		PM	LOS	A	A		A	B		B			B		B	B
			Delay	6.6	8.7		5.5	13.1		19.9			20.0		18.5	12.0
I-65 SB Ramps @ SR 36	One-Way Stop	AM	LOS		A		A	A					E		E	A
			Delay		0.0		9.6	0.0					41.9		41.9	5.5
		PM	LOS		A		A	A					F		F	F
			Delay		0.0		9.0	0.0					544.4		544.4	200.1
I-65 NB Ramps @ SR 36	Signal	AM	LOS	n/a[1]												
			Delay													
		PM	LOS	n/a[1]												
			Delay													
I-65 SB Ramps @ Bethel Rd	One-Way Stop	AM	LOS		A		A	A					B		B	A
			Delay		0.0		0.0	0.0					10.9		10.9	1.0
		PM	LOS		A		A	A					B		B	A
			Delay		0.0		0.0	0.0					14.3		14.3	4.2
I-65 NB Ramps @ Bethel Rd	One-Way Stop	AM	LOS		A	A	A	A		B		B				A
			Delay		0.0	0.0	8.5	0.0		12.8		12.8				2.1
		PM	LOS		A	A	A	A		B		B				A
			Delay		0.0	0.0	8.0	0.0		12.7		12.7				1.9
I-65 SB Ramps @ SR-67	Signal	AM	LOS		B	n/a[2]	B	A					E		n/a[2]	B
			Delay		15.3		14.0	0.1					57.5			10.1
		PM	LOS		C		D	A					D			C
			Delay		29.0		35.5	0.6					53.3			23.6
I-65 NB Ramps @ SR-67	Signal	AM	LOS	C	A			E	n/a[2]	F		n/a[2]				D
			Delay	33.8	0.3			60.2		90.9						44.6
		PM	LOS	C	A			C		C						B
			Delay	24.9	1.4			29.4		33.2						14.7

n/a[1] - *HCM* 6th edition methodology does not support the perm + prot left turn type from a shared lane
n/a[2] - *HCM* methodology does not calculate delay for a channelized right turn at a signalized intersection

Table 21: 2045 Build Conditions (Alternative 1A) – *SimTraffic* Results

Intersection	Control	Time Period	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Hwy 31 @ Lane Rd/New Connector	Signal	AM	LOS	C	C	A	C	C	A	B	B	B	C	A	A	B
			Delay	25.7	31.7	2.4	32.4	22.8	5.6	12.3	16.6	13.4	20.4	4.4	0.0	13.1
		PM	LOS	C	C	A	D	C	A	B	B	B	B	A	A	B
			Delay	25.6	34.7	2.3	45.3	21.5	3.6	15.6	12.5	10.4	13.9	8.0	3.5	12.6
Hwy 31 @ SR 36	Signal	AM	LOS	D	D	D	C	C	C	D	C	B	D	C	A	C
			Delay	41.5	44.1	36.1	29.4	33.6	22.3	51.2	25.7	11.3	47.4	24.1	8.9	30.1
		PM	LOS	D	E	D	C	D	C	F	D	C	D	C	C	E
			Delay	54.5	62.5	50.3	32.8	40.3	26.3	302.6	37.8	22.8	52.8	34.8	21.0	58.7
Sparkman St at New Connector	One-Way Stop	AM	LOS		A	A	A	A		D		A				A
			Delay		0.7	0.6	0.0	8.3		26.5		4.2				10.0
		PM	LOS		A	A	A	B		D		A				B
			Delay		0.7	0.9	0.0	15.0		29.4		1.3				10.9
Bethel Rd/New Connector @ Indian Hills Rd	Roundabout	AM	LOS	B	A	A	C	C	C	A	A	A	A	A	A	B
			Delay	14.7	1.7	0.0	15.8	15.8	16.3	0.0	6.7	6.4	5.7	6.3	0.0	11.6
		PM	LOS	B	A	A	C	A	C	A	A	A	A	A	C	B
			Delay	13.9	0.0	0.0	17.9	6.1	17.5	0.0	7.0	6.4	6.0	6.6	17.9	13.1
McClanahan St/Bethel Rd @ SR 36	Signal	AM	LOS	C	B	B	C	D	D	F	F	F	F	E	B	D
			Delay	29.9	14.5	12.4	25.6	46.2	39.3	121.3	117.9	108.5	81.2	70.5	16.2	43.0
		PM	LOS	B	B	A	B	B	A	C	B	A	B	B	B	B
			Delay	15.5	12.4	8.3	12.3	15.6	9.2	21.8	18.1	9.5	18.1	19.5	10.9	14.0
I-65 SB Ramps @ SR 36	One-Way Stop	AM	LOS		F	F	A	A					F		F	F
			Delay		235.3	250.3	7.6	7.6					462.9		412.9	162.6
		PM	LOS		A	A	A	A					F		F	F
			Delay		7.7	5.3	7.7	6.9					771.1		785.0	289.7
I-65 NB Ramps @ SR 36	Signal	AM	LOS	F	F			C	B	E		C				D
			Delay	97.2	94.2			21.7	17.2	62.1		29.9				48.9
		PM	LOS	B	B			B	A	C		B				B
			Delay	18.9	15.4			11.7	7.3	28.7		16.3				14.5
I-65 SB Ramps @ Bethel Rd	One-Way Stop	AM	LOS		A	A	A	A					A		A	A
			Delay		9.6	9.2	0.0	1.7					8.6		7.1	6.7
		PM	LOS		B	B	A	A					B		A	A
			Delay		13.1	11.7	0.0	1.6					11.3		7.2	8.3
I-65 NB Ramps @ Bethel Rd	One-Way Stop	AM	LOS		A	A	A	A		A		A				A
			Delay		2.2	2.4	6.6	1.6		10.0		0.0				3.4
		PM	LOS		A	A	A	A		A		A				A
			Delay		2.3	2.5	5.0	1.5		7.0		2.5				2.8
I-65 SB Ramps @ SR-67	Signal	AM	LOS		C	A	C	B					D		A	B
			Delay		24.0	1.8	22.6	11.2					48.0		6.7	15.8
		PM	LOS		C	A	D	B					D		B	B
			Delay		20.5	2.6	36.3	13.9					39.7		12.4	17.8
I-65 NB Ramps @ SR-67	Signal	AM	LOS	F	B			D	A	F		A				E
			Delay	227.5	19.0			50.0	6.9	84.7		7.8				63.1
		PM	LOS	D	C			C	A	C		A				C
			Delay	51.4	23.4			26.1	1.4	28.3		7.4				25.4

6.2.2 Operational Analysis – Second Iteration

After noting problem locations from the first iteration, further analysis was performed based on an iterative process to determine additional improvements needed with the proposed interchange and new connector. A second iteration of the 2045 Build conditions was modeled with the following additional improvements:

- Provide a right turn lane for the eastbound approch at the intersection of Highway 31 at SR 36.
- Provide left and right turn lanes for the northbound and southbound approches at the intersection of Bethel Road/McClanahan Street at SR 36.
- At the I-65/SR 67 interchange, provide dual left turn lanes for the southbound approach at the intersection of I-65 SB Ramps at SR 67 and dual left turn lanes for the eastbound and northbound approaches at the intersection of I-65 NB Ramps at SR 67. It should be noted that a previous study recommended a Diverging Diamond Interchange (DDI) be analyzed for this interchange.

- For the I-65/SR 36 interchange, analysis was initially performed with both intersections signalized. However, to provide adequate LOS, an eastbound left turn lane at the I-65 NB Ramps and a westbound left turn lane at the I-65 SB Ramps would be needed which would require the bridge widening. Therefore, the interchange was also analyzed with roundabouts at the ramp terminals as illustrated in **Figure 17**. The results show good operating conditions with LOS C or better for all movements using the roundabouts configuration at this interchange. Because the roundabouts configuration does not require widening the bridge, this configuration was selected for the Build analysis second iteration (Alternative 1B).

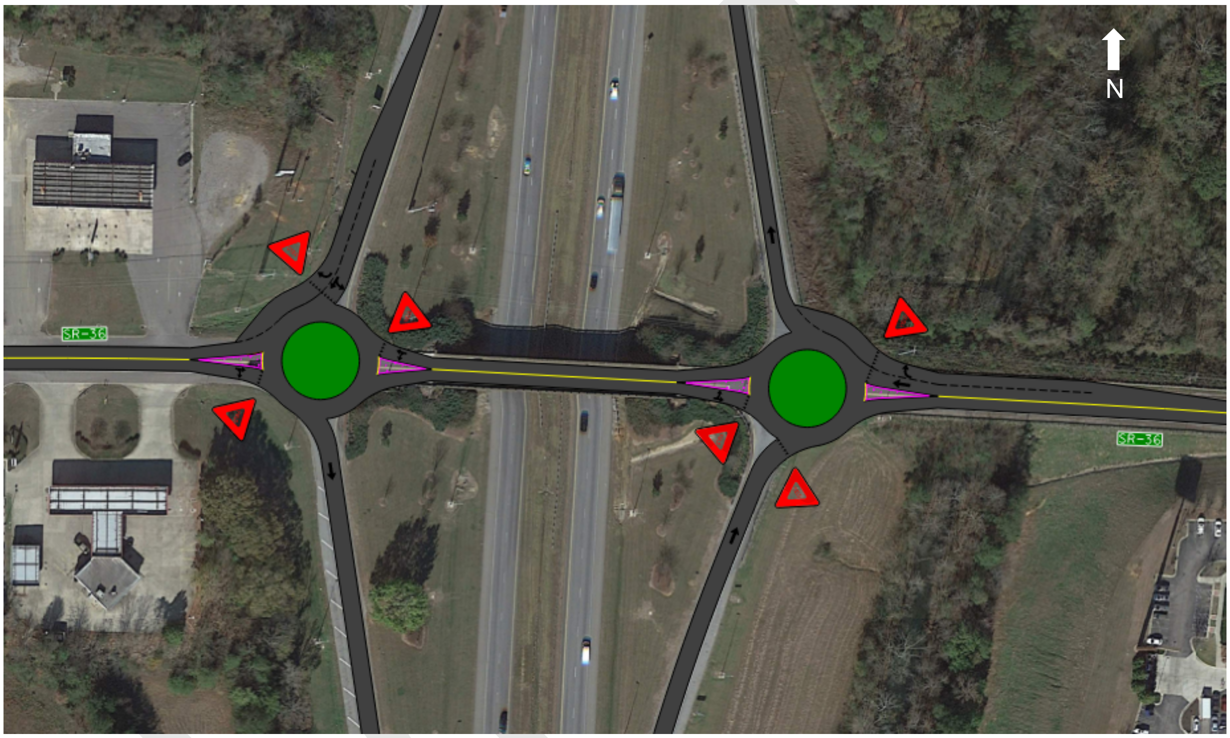


Figure 17: Proposed Improvements at I-65/SR 36 Interchange

Results of the Build operational analysis second iteration (Alternative 1B) are shown in **Tables 22 and 23**. Complete results are provided in **Appendix B – Operational Analysis Results**. The results of this analysis demonstrate that all intersections operate at LOS D or better according to both methodologies except for the southbound through movement at the intersection of Highway 31 at SR 36 in the PM peak hour. The queue lengths for Build conditions (Alternative 1B) are tabulated in **Tables 24 and 25**. No significant queue lengths were noted from the results. Recommended minimum storage lengths were developed based on the 95th percentile queue lengths and are highlighted in light yellow in the tables.

Table 22: 2045 Build Conditions (Alternative 1B) – *HCM* Results

Intersection	Control	Time Period	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Hwy 31 @ Lane Rd/New Connector	Signal	AM	LOS	C	C		C	C		A	B	B	B	A	A	A
			Delay	21.3	21.5		22.9	21.1		5.4	10.3	10.4	11.3	4.0	0.0	9.5
		PM	LOS	C	C		B	B		B	C	C	B	B	B	B
			Delay	24.7	26.4		19.2	17.6		13.8	20.2	20.2	12.3	13.3	13.2	15.7
Hwy 31 @ SR 36	Signal	AM	LOS	C	C	A	C	D		B	C	B	B	C	B	C
			Delay	29.4	27.6	0.0	27.0	38.4		17.0	29.5	16.5	19.4	23.7	18.4	27.5
		PM	LOS	C	C	A	C	D		C	B	B	B	C	B	C
			Delay	27.1	28.6	0.0	28.5	38.1		24.3	14.7	11.5	12.9	24.6	16.0	22.7
Sparkman St at New Connector	Roundabout	AM	LOS		A		A			A		A				A
			Delay		4.7		6.3			8.6		8.6				6.2
		PM	LOS		A		A			A		A				A
			Delay		4.3		6.7			5.6		5.6				5.4
Bethel Rd/New Connector @ Indian Hills Rd	Roundabout	AM	LOS	A			A			A			A			A
			Delay	9.7			7.0			8.9			7.1			8.2
		PM	LOS	A			A			A			A			A
			Delay	7.5			8.3			7.2			7.2			7.8
McClanahan St/Bethel Rd @ SR 36	Signal	AM	LOS	C	B		B	C		C	D	C	C	C	C	C
			Delay	26.7	17.7		12.9	27.3		29.9	50.5	31.9	31.3	33.1	31.5	27.4
		PM	LOS	A	B		A	B		C	C	C	C	C	C	B
			Delay	8.9	11.3		7.4	16.2		23.4	26.0	25.2	23.1	27.5	25.3	15.2
I-65 SB Ramps @ SR 36	Roundabout	AM	LOS		B		A						A		A	A
			Delay		11.5		7.0						5.7		5.7	9.0
		PM	LOS		B		A						A		A	A
			Delay		13.9		6.3						9.4		8.5	9.7
I-65 NB Ramps @ SR 36	Roundabout	AM	LOS	A				B		A		A				A
			Delay	7.7				10.8		8.1		8.1				9.3
		PM	LOS	A				A		B		B				A
			Delay	9.0				7.6		10.5		10.5				8.3
I-65 SB Ramps @ Bethel Rd	One-Way Stop	AM	LOS		A		A	A					B		B	A
			Delay		0.0		8.5	0.0					10.9		10.9	1.0
		PM	LOS		A		A	A					B		B	A
			Delay		0.0		8.6	0.0					14.3		14.3	4.2
I-65 NB Ramps @ Bethel Rd	One-Way Stop	AM	LOS		A	A	A	A		B		B				A
			Delay		0.0	0.0	8.5	0.0		12.8		12.8				2.2
		PM	LOS		A	A	A	A		B		B				A
			Delay		0.0	0.0	8.0	0.0		12.7		12.7				1.9
I-65 SB Ramps @ SR-67	Signal	AM	LOS		B	n/a[1]	A	A					D		n/a[1]	A
			Delay		15.3		10.0	0.3					53.0			9.8
		PM	LOS		B		C	A					D			B
			Delay		17.1		21.5	0.5					35.2			14.6
I-65 NB Ramps @ SR-67	Signal	AM	LOS	C	A			D	n/a[1]			n/a[1]				C
			Delay	29.7	0.4			51.8								30.6
		PM	LOS	C	A			C								B
			Delay	26.6	1.9			20.5								10.1

n/a[1] - *HCM* 6th edition methodology does not support the perm + prot left turn type from a shared lane

Table 23: 2045 Build Conditions (Alternative 1B) – *SimTraffic* Results

Intersection	Control	Time Period	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Hwy 31 @ Lane Rd/New Connector	Signal	AM	LOS	C	C	A	C	B	A	A	B	B	C	A	A	B
			Delay	27.1	25.7	2.1	33.8	19.0	4.6	10.0	15.9	12.9	20.6	4.4	0.0	12.5
		PM	LOS	C	D	A	D	C	A	B	B	B	B	A	A	B
			Delay	30.3	38.2	2.0	39.0	23.3	3.9	18.6	14.9	14.0	16.0	9.3	3.8	13.9
Hwy 31 @ SR 36	Signal	AM	LOS	C	C	A	C	D	C	C	C	A	C	C	A	C
			Delay	28.0	26.1	2.7	24.0	40.0	29.1	24.8	24.0	9.1	27.6	26.0	9.3	23.6
		PM	LOS	D	C	A	C	D	C	D	B	A	D	E	C	D
			Delay	44.9	29.6	2.6	28.5	42.7	27.0	38.8	16.5	5.7	35.7	58.2	34.7	36.4
Sparkman St at New Connector	Roundabout	AM	LOS		A	A	B	B		B		B				A
			Delay		3.8	2.8	13.4	13.9		15.0		12.7				8.9
		PM	LOS		A	A	B	C		B		B				A
			Delay		4.0	2.9	13.1	18.3		10.3		11.4				9.9
Bethel Rd/New Connector @ Indian Hills Rd	Roundabout	AM	LOS	B	A	A	C	C	C	A	A	A	A	A	C	B
			Delay	13.0	4.8	0.0	16.4	16.2	17.0	0.0	7.1	6.2	5.0	6.2	16.4	11.3
		PM	LOS	B	A	A	C	A	C	A	A	A	A	A	A	B
			Delay	13.1	2.6	0.0	19.3	7.4	18.0	0.0	6.6	6.6	4.6	6.5	0.0	13.1
McClanahan St/Bethel Rd @ SR 36	Signal	AM	LOS	C	B	B	C	D	D	D	D	B	C	C	B	C
			Delay	34.9	20.0	15.4	29.2	47.2	41.0	36.9	38.8	10.8	32.7	32.4	17.5	31.2
		PM	LOS	B	B	A	B	C	B	C	C	A	C	C	B	B
			Delay	19.7	14.3	9.1	18.6	23.5	17.5	22.4	23.7	6.8	23.6	24.9	14.9	18.8
I-65 SB Ramps @ SR 36	Roundabout	AM	LOS		C	B	A	A					A		A	B
			Delay		17.5	15.0	3.8	5.5					4.8		2.5	10.7
		PM	LOS		C	B	A	A					A		A	A
			Delay		17.3	14.2	3.5	5.1					9.6		3.3	9.2
I-65 NB Ramps @ SR 36	Roundabout	AM	LOS	A	A			C	A	A		A				A
			Delay	4.5	5.8			17.3	5.9	5.1		5.3				9.5
		PM	LOS	A	A			A	A	A		A				A
			Delay	4.5	6.3			9.0	4.3	6.4		6.2				6.7
I-65 SB Ramps @ Bethel Rd	One-Way Stop	AM	LOS		A	A	A	A					A		A	A
			Delay		9.8	9.5	7.1	1.7					9.8		7.3	6.8
		PM	LOS		B	B	B	A					B		A	A
			Delay		13.2	11.1	12.1	1.8					10.6		7.8	8.5
I-65 NB Ramps @ Bethel Rd	One-Way Stop	AM	LOS		A	A	A	A		A		A				A
			Delay		2.0	2.4	5.4	1.4		8.0		6.5				3.1
		PM	LOS		A	A	A	A		A		A				A
			Delay		2.2	2.4	4.3	1.7		6.9		3.8				2.8
I-65 SB Ramps @ SR-67	Signal	AM	LOS		A	A	C	B					D		A	B
			Delay		5.3	1.7	21.2	11.6					45.0		7.5	10.3
		PM	LOS		B	A	C	B					C		B	B
			Delay		10.6	2.9	30.6	13.0					30.0		13.9	13.5
I-65 NB Ramps @ SR-67	Signal	AM	LOS	D	B			D	A	D		A				C
			Delay	46.5	13.2			40.5	6.7	35.3		7.5				27.8
		PM	LOS	D	C			B	A	C		A				C
			Delay	46.7	20.4			16.1	3.2	20.1		8.2				20.6

Table 24: Intersection Queues (ft) - 2045 Build Conditions (Alternative 1B) – *HCM Results*

Intersection	Control	Time Period	EB Movement			WB Movement			NB Movement			SB Movement		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Hwy 31 @ Lane Rd/Sparkman St	Proposed Storage (ft)		50	-	70	200	-	55	50	-	-	175	-	-
	Signal	AM	8	10		30	5		3	145		68	20	
		PM	3	5		118	5		8	150		98	170	178
Hwy 31 @ Hwy 36	Proposed Storage (ft)		325	-		130	-		225	-	230	315	-	375
	Signal	AM	303	250		98	170		75	350	8	38	208	18
		PM	180	165		43	145		135	180	23	20	328	68
Sparkman St at New Connector	Proposed Storage (ft)			-	-	50	-		-		125			
	Roundabout	AM		25	0	0	25		50		50			
		PM		25	0	0	50		25		25			
Bethel Rd/New Connector @ Indian Hills Rd	Proposed Storage (ft)		-			-			-			-		
	Roundabout	AM	50			50			25			50		
		PM	50			75			25			25		
McClanahan St/Bethel Rd @ Hwy 36	Proposed Storage (ft)		300	-		115	-		-			-		285
	Signal	AM	230	348		10	385		35	268	10	53	78	15
		PM	28	168		8	240		23	20	5	30	48	15
I-65 SB Ramps @ Hwy 36	Proposed Storage (ft)			-		-						915		915
	Roundabout	AM		100		50						0		0
		PM		125		50						50		50
I-65 NB Ramps @ Hwy 36	Proposed Storage (ft)		-				-		800		800			
	Roundabout	AM	75	100			100	0	25		25			
		PM	100	100			50	0	25		25			
I-65 SB Ramps @ Bethel Rd	Proposed Storage (ft)			-		50	-					-		-
	One-Way Stop	AM		0		0	0					10		10
		PM		0		0	0					65		65
I-65 NB Ramps @ Bethel Rd	Proposed Storage (ft)			-	50	50	-		-		-			
	One-Way Stop	AM		0	0	0	0		20		20			
		PM		0	0	0	0		15		15			
I-65 SB Ramps @ SR-67	Proposed Storage (ft)			-	-	125	-					230		-
	Signal	AM		298	0	28	5					130		0
		PM		270	0	30	8					190		0
I-65 NB Ramps @ SR-67	Proposed Storage (ft)		275	-			-	-	225		-			
	Signal	AM	185	5			580	0	0		0			
		PM	90	23			170	0	0		0			

Table 25: Intersection Queues (ft) - 2045 Build Conditions (Alternative 1B) – *SimTraffic* Results

Intersection	Control	Time Period	EB Movement Left	EB Movement Thru	EB Movement Right	WB Movement Left	WB Movement Thru	WB Movement Right	NB Movement Left	NB Movement Thru	NB Movement Right	SB Movement Left	SB Movement Thru	SB Movement Right
Hwy 31 @ Lane Rd/Sparkman St	Proposed Storage (ft)		50	-	70	200	-	55	50	-	-	175	-	-
	Signal	AM	26	30		64	148		15	221	207	165	64	60
		PM	17	24		198	211		35	172	180	157	131	135
Hwy 31 @ Hwy 36	Proposed Storage (ft)		325	-		130	-		225	-	230	315	-	375
	Signal	AM	231	293	93	118	194		110	254	94	61	174	90
		PM	215	245	72	93	179		202	185	64	179	632	360
Sparkman St at New Connector	Proposed Storage (ft)			-	-	50	-		-		125			
	Roundabout	AM		19	0	0	84		111		111			
		PM		8	0	0	135		72		72			
Bethel Rd/New Connector @ Indian Hills Rd	Proposed Storage (ft)		-			-			-			-		
	Roundabout	AM	118			99			105			62		
		PM	114			150			92			61		
McClanahan St/Bethel Rd @ Hwy 36	Proposed Storage (ft)		300	-		115	-		-			-		285
	Signal	AM	306	309		93	550		81	218	85	56	80	138
		PM	96	190		122	361		61	52	38	49	60	97
I-65 SB Ramps @ Hwy 36	Proposed Storage (ft)			-		-						915		915
	Roundabout	AM		192		21						44		2
		PM		150		25						108		25
I-65 NB Ramps @ Hwy 36	Proposed Storage (ft)		-				-		800		800			
	Roundabout	AM	88	88			212	63	80		80			
		PM	36	36			77	0	74		74			
I-65 SB Ramps @ Bethel Rd	Proposed Storage (ft)			-		50	-					-		-
	One-Way Stop	AM		0		12	0					61		61
		PM		0		15	0					114		114
I-65 NB Ramps @ Bethel Rd	Proposed Storage (ft)			-	50	50	-		-		-			
	One-Way Stop	AM		0	0	23	0		69		69			
		PM		3	3	11	0		63		63			
I-65 SB Ramps @ SR-67	Proposed Storage (ft)			-	-	125	-					230		-
	Signal	AM		122	52	60	65					133		10
		PM		217	99	65	28					194		42
I-65 NB Ramps @ SR-67	Proposed Storage (ft)		275	-			-	-	225		-			
	Signal	AM	255	122			432	78	195		199			
		PM	191	213			144	20	125		121			

7.0 Summary and Recommendations

Safety and operational analyses were performed for the SR 36 and Bethel Road corridors and key intersections within the study area including the interchanges of I-65 at SR 36 and I-65 at SR 67. Results of the safety analysis reveal rear end crashes to be the most common crash type along SR 36 and throughout the study area. The corridor crash rate for SR 36 was roughly three times higher than the Alabama statewide average. The crash heat map shows high crash incidences at multiple locations throughout the SR 36 corridor especially at the SR 36 and Highway 31 intersection.

Analysis of the existing conditions showed poor operating conditions already exist in the study area with unacceptable levels of service and queues forming at several intersections. The I-65 interchange at SR 36 experiences significant queuing at both intersections with the existing lane configuration and current traffic control. The eastbound queue at the I-65 NB Ramps extends past the bridge and through the I-65 SB Ramps intersection. The southbound approach at the I-65 SB Ramps intersection also experiences lengthy queues. Improvements are already needed at the I-65/SR 36 interchange.

With the expected growth, traffic volumes on SR 36 are projected to increase beyond the capacity of the existing two-lane roadway by design year 2045. To provide additional capacity and relieve existing and future congestion along the SR 36 corridor, a new two-lane connector and interchange at I-65/Bethel Road are proposed. The study area was analyzed with the proposed connector and interchange (Alternative 1). The results show the intersections along the new connector and at the proposed I-65/Bethel Road interchange to operate adequately through 2045 design year. With the reduction in volumes along SR 36, the overall delay for intersections along SR 36 are shown to improve in the Build conditions. However, additional improvements at multiple intersections along SR 36 will still be needed to provide acceptable operations and enhance safety throughout the corridor.

Based on the analyses performed, the additional recommended improvements to consider along SR 36 and SR 67 are as follows:

- Install roundabouts at the I-65/SR 36 interchange. With poor traffic operations in the existing conditions, the improvements should be considered for the immediate future.
- Provide a right turn lane for the eastbound approch at the intersection of Highway 31 at SR 36.
- Provide left and right turn lanes for the northbound and southbound approches at the intersection of Bethel Road/McClanahan Street at SR 36.
- For the I-65/SR 67 interchange, provide dual left turn lanes for the southbound approach at the I-65 SB Ramps at SR 67, and provide dual left turn lanes for the eastbound and northbound approaches at the I-65 NB Ramps at SR 67.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