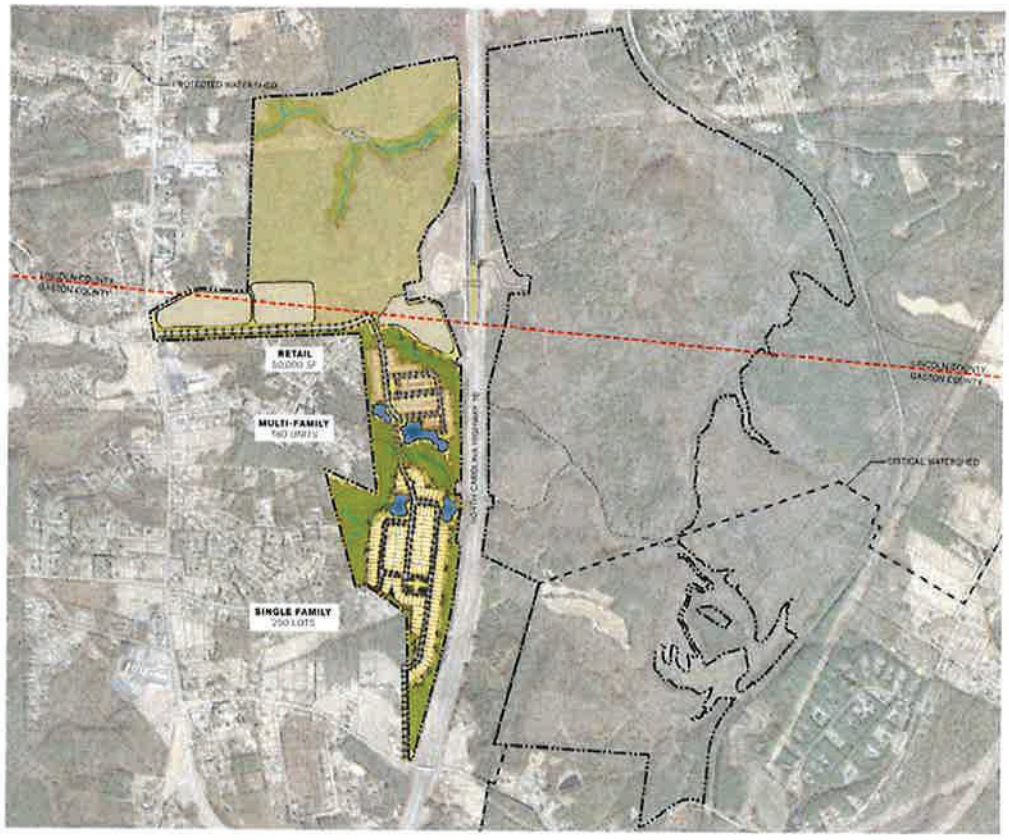
DESIGN RESOURCE GROUP

TRAFFIC IMPACT ANALYSIS (FINAL)

RIVERBEND PRESERVE PHASE 2

North of Killian Road and West of NC 16

Gaston County, North Carolina



for

The Shaw Tate Group

June 2020

811-002 (C-2165)

NORTH CAROLINA PROFESSIONAL SEAL 16315 ENGINEER RANDY E GODDARD

Randy E Goddard

JUNE 10, 2020

2459 Wilkinson Boulevard, Suite 200
Charlotte, NC 28208

O 704.343.0608
W www.drgrp.com

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EXECUTIVE SUMMARY

The Shaw Tate Group proposes to develop a site with the following land uses:

- 250 Single-Family Homes
- 180 Multi-Family (Low-Rise) Units
- 50,000 SF of Retail

The proposed site is located north of Killian Road and west of NC 16 in Gaston County, NC (see Figure 1). The development is expected to be completed in 2024.

This report provides analysis of the traffic operations within the area of influence, according to the standards set by the North Carolina Department of Transportation's (NCDOT) "Policy on Street and Driveway Access to North Carolina Highways, Chapter 4 Part C", and Gaston County's UDO Section 5.11. It provides intersection improvements needed for mitigating traffic impacts. This study evaluates the following scenarios:

- 2019 Existing Conditions
- 2024 No Build Conditions
- 2024 Build-out Conditions

The area of influence of the site as defined by North Carolina Department of Transportation (NCDOT) staff includes the following three existing intersections and one proposed intersection: (See Appendix for the approved scoping information)

1. Lucia Riverbend Highway & NC 16 Business (signalized)
2. Lucia Riverbend Highway & Killian Road (signalized)
3. Lucia Riverbend Highway & Old Beatty Road-Access "A" (unsignalized)
4. Killian Road & Access "B"

According to the preliminary site plan (Concept Exhibit), access to the development is expected to occur via one unsignalized access on Lucia Riverbend Highway and one unsignalized access on Killian Road:

- Proposed Access "A" (Full-Movement): unsignalized access allowing for full movement access located on NC 16 across from Old Beatty Road.
- Proposed Access "B" (Full-Movement): unsignalized access allowing for full movement located on Killian Road approximately 150 feet west of the NC 16 overpass.

The trip generation results indicate that the development is expected to generate 446 total AM peak hour trips and 561 total PM peak hour trips.

With the results of our analyses (the specifics are described in the Traffic Analysis section of this report) we suggest the following improvements/modifications at the study intersections/ proposed accesses:

2024 Build Suggested Recommendations:

1. NC 16 Business & Lucia Riverbend Highway

- No suggested improvements.

2. Lucia Riverbend Highway & Killian Road

- Extend northbound right turn lane storage from 175 feet to 275 feet on Lucia Riverbend Highway
- Extend southbound left turn lane storage from 125 feet to 200 feet on Lucia Riverbend Highway

3. Lucia Riverbend Highway & Old Beatty Road-Access "A"

We propose the following intersection configuration:

- Align east/west approaches to a four-legged intersection (right-of-way to be acquired to ensure alignment)
- Construct a southbound left turn lane with 100 feet of storage on Lucia Riverbend Highway
- Construct northbound left turn lane with 100 feet of storage on Lucia Riverbend Highway to allow for intersection alignment
- Construct northbound right turn lane with 100 feet of storage on Lucia Riverbend Highway
- One ingress and two egress lanes (a westbound thru-right turn lane and left turn lane with 200' storage) on Proposed Access "A"
- Minimum internal protected stem of 200'

4. Killian Road & Access "C"

We propose the following intersection configuration:

- Construct an eastbound left turn lane with 100 feet of storage on Killian Road
- One ingress and two egress lanes (a terminating southbound right turn lane and left turn lane with 100' storage) on Proposed Access "B"
- Minimum internal protected stem of 100'

In summary, it was determined that Riverbend Preserve Phase 2 site development will not significantly affect the operations of vehicular traffic on the adjacent roadways with both these suggested improvements as well as, the suggested intersection improvements/enhancements from the approved Riverbend Preserve Phase 1 Traffic Impact Analysis.

PROPOSED DEVELOPMENT

The Shaw Tate Group proposes to develop a site with the following land uses:

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- Proposed Access "B" (Full-Movement): unsignalized access allowing for full movement located on Killian Road approximately 150 feet west of the NC 16 overpass.

1. Lucia Riverbend Highway & NC 16
2. Lucia Riverbend Highway & Killian Road
3. Lucia Riverbend Highway & Old Beatty Road-Access "A"
4. Killian Road & Access "B"

DESIGN RESOURCE GROUP
LANDSCAPE ARCHITECTURE
CIVIL ENGINEERING
TRANSPORTATION PLANNING
O 2459 Wilkinson Blvd, Ste 200 Charlotte, NC 28208
P 704.343.0608
W www.drgrp.com

RIVERBEND PRESERVE PHASE 2 TIA

GASTON/ LINCOLN COUNTY, NC

THE SHAW TATE GROUP
1030 S.CALDWELL STREET
CHARLOTTE, NC 28203

AREA OF INFLUENCE

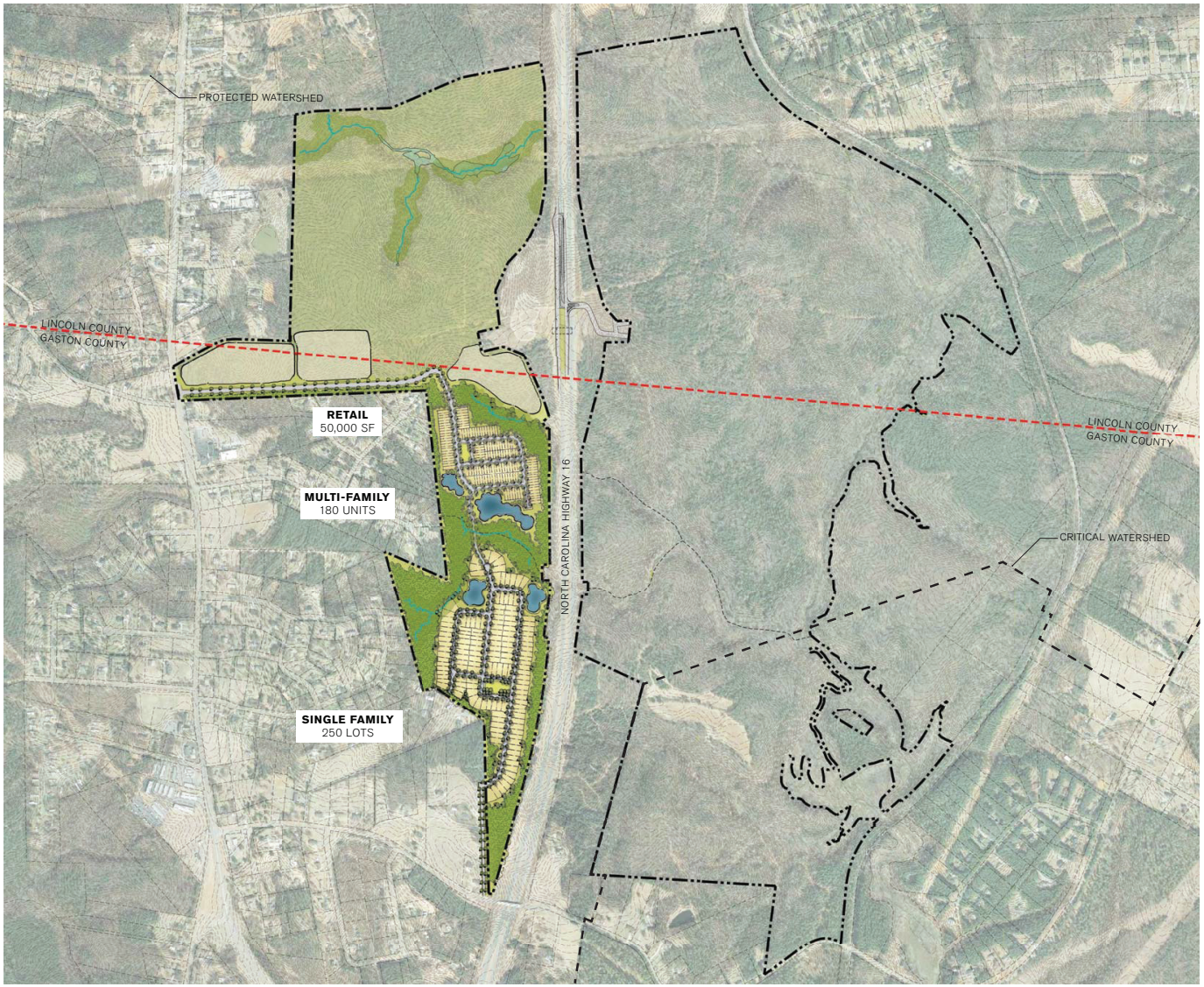
0 500' 1,000' N
SCALE: 1" = 1,000'

PROJECT #: 811-001
DRAWN BY: SA
CHECKED BY: MW

MARCH 2020

REVISIONS:
1.

Figure 1



RIVERBEND PRESERVE GASTON/LINCOLN COUNTY, NC ▪ CONCEPT EXHIBIT 400 scale

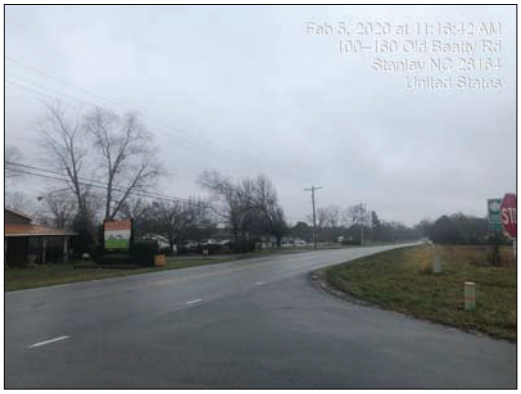
PN 1018503 | 10.24.2019

LandDesign

AREA CONDITIONS

The area of influence of the site as defined by North Carolina Department of Transportation (NCDOT) staff includes the following three existing intersections and one proposed intersection: (See Appendix for the approved scoping information)

1. Lucia Riverbend Highway & NC 16 Business (signalized)
2. Lucia Riverbend Highway & Killian Road (signalized)
3. Lucia Riverbend Highway & Old Beatty Road-Access “A” (unsignalized)
4. Killian Road & Access “B”



Old Beatty Road facing south towards proposed site

Old Beatty Road facing north towards proposed site

Morning (7:00-9:00 AM) and afternoon (4:00-6:00 PM) peak period turning movement counts (TMCs) were conducted at intersections 1 and 2 on Tuesday May 14, 2019. The remaining intersection (#3) was counted on Thursday December 12, 2019. See Appendix for raw count data sheets.

According to the latest NCDOT Roadway Functional Classification data, Lucia Riverbend Highway (NC 16 Business) is a Minor Arterial with a posted speed limit of 50 or 55 mph (in the vicinity of the study area). The roadway is a two-lane undivided facility, with no bike lanes, curb/gutter, planting strip, or sidewalk present on either side of the roadway.

Killian Road is a secondary route with a posted speed limit of 55 mph. The roadway is a one-lane undivided facility, with no bike lanes, curb/gutter, planting strip, or sidewalk present on either side of the roadway in the vicinity of the site.

In addition to the intersection TMCs, geospatial information provided by NCDOT's ArcGIS portal (*Go! NC*), such as Annual average daily traffic (AADT) and crash data were collected.

AADT for two-way volumes on roadways within the area of influence are depicted in Table 1 based on latest 2016 data.

Table 1: Average Annual Daily Traffic Volumes (vehicles per day)

Roadway	AADT
Lucia Riverbend Highway west of NC 16 Business	7,900
Killian Road east of Lucia Riverbend Highway	1,100
Lucia Riverbend Highway south of Old Beatty Road	11,000

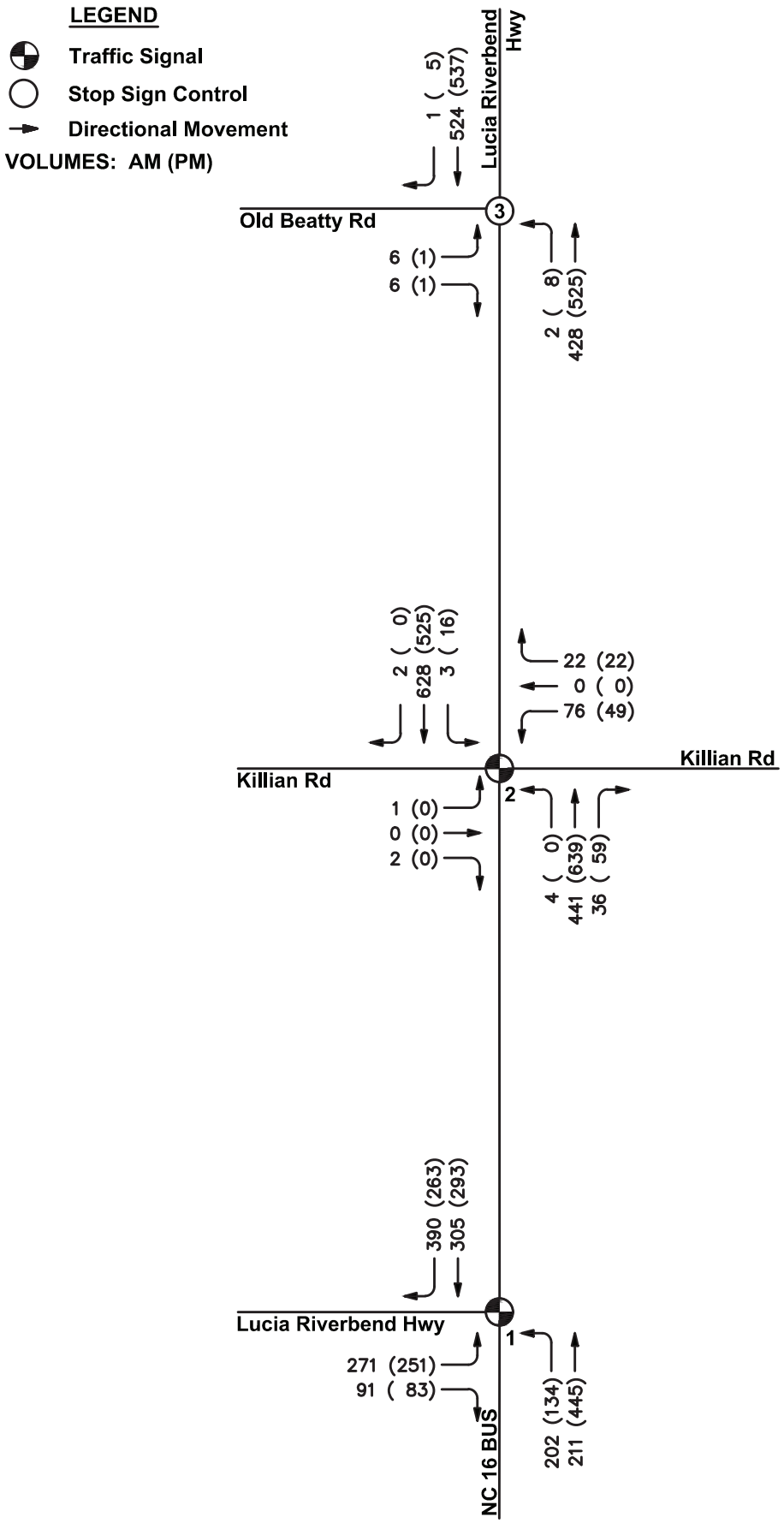
Crash frequency per intersection is reported in Table 2 with data ranging from January 1, 2014 to December 31, 2018.

Table 2: Crash Data from 2014-2018

Intersection	Severity Type			Total Crashes
	K Injury	B & C Injury Crashes	PDO Crashes	
Lucia Riverbend Hwy. & Stanley Lucia Rd.	**0**	**1**	**5**	**6**

Notes:
K: Fatality **B:** B injury type (evident), **C:** injury type (possible), **PDO:** Property Damage Only

Figure 2 portrays the existing TMCs for the AM and PM peak hours. Figures 3A and 3B includes the directional distribution for the townhomes + retail site and the single-family site, respectively. These directional distribution percentages were approved by NCDOT staff on December 6, 2019 per existing traffic patterns.



Raw Turning Movement Counts were collected on Tuesday May 14, 2019 for intersections 1 and 2.
Raw Turning Movement Counts were collected on Thurday December 12, 2019 for intersection 3.
Volumes were not balanced between intersections due to local businesses and subdivisions.

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LANDSCAPE ARCHITECTURE
CIVIL ENGINEERING
TRANSPORTATION PLANNING
O 2459 Wilkinson Blvd, Ste 200 Charlotte, NC 28208
P 704.343.0608
W www.drgrp.com

RIVERBEND PRESERVE PHASE 2 TIA

GASTON/ LINCOLN COUNTY, NC

THE SHAW TATE GROUP
1030 S.CALDWELL STREET
CHARLOTTE, NC 28203

EXISTING PEAK HOUR TRAFFIC VOLUMES

0 NTS N
SCALE: NTS

PROJECT #: 811-001
DRAWN BY: SA
CHECKED BY: MW

MARCH 2020

REVISIONS:
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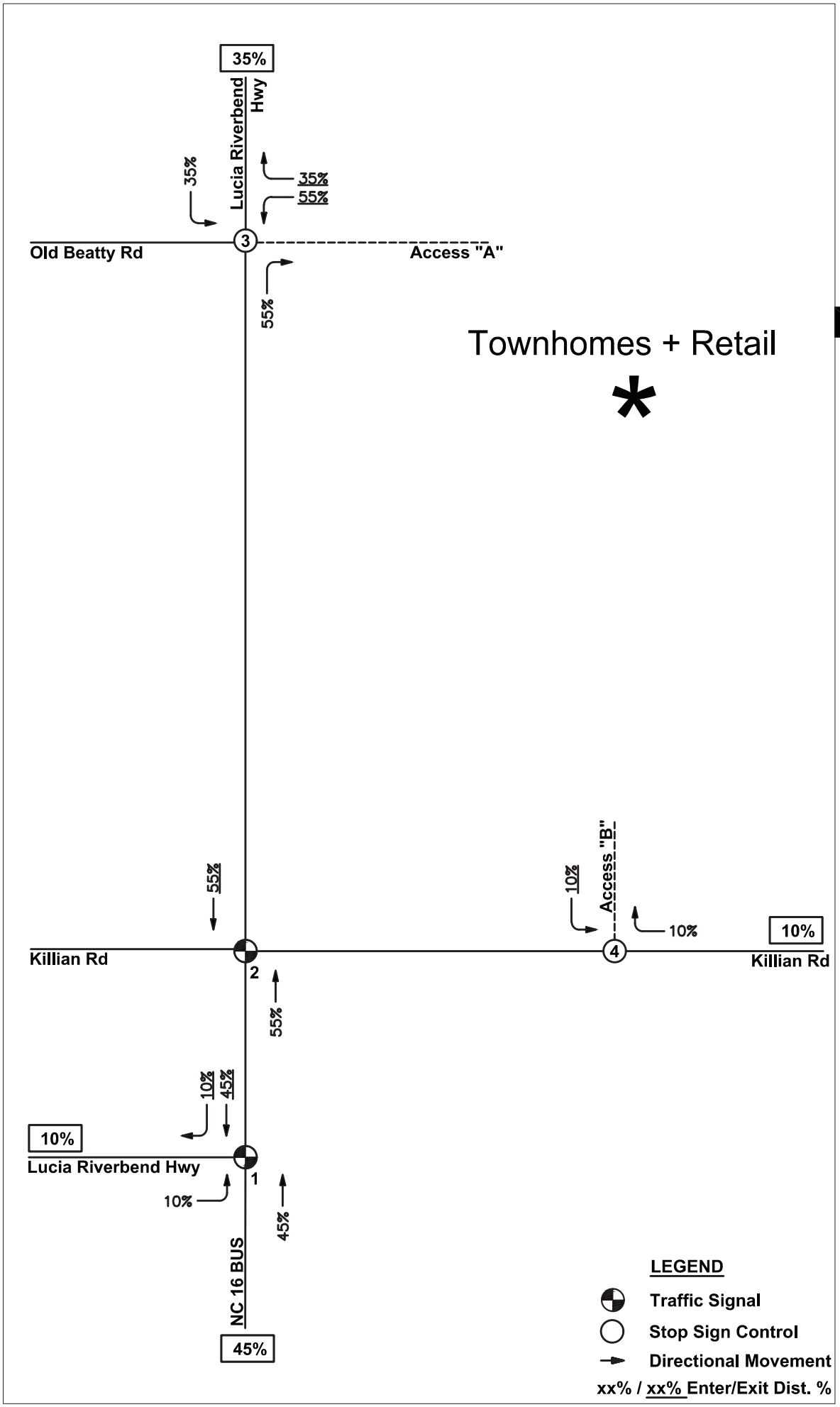
Figure 2



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CIVIL ENGINEERING
TRANSPORTATION PLANNING
O 2459 Wilkinson Blvd, Ste 200 Charlotte, NC 28208
P 704.343.0608
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RIVERBEND PRESERVE PHASE 2 TIA

GASTON/ LINCOLN COUNTY, NC

THE SHAW TATE GROUP
1030 S.CALDWELL STREET
CHARLOTTE, NC 28203

TOWNHOMES + RETAIL TRIP SITE DIRECTIONAL DISTRIBUTION

0 NTS N

SCALE: NTS

PROJECT #: 811-001
DRAWN BY: SA
CHECKED BY: MW

MARCH 2020

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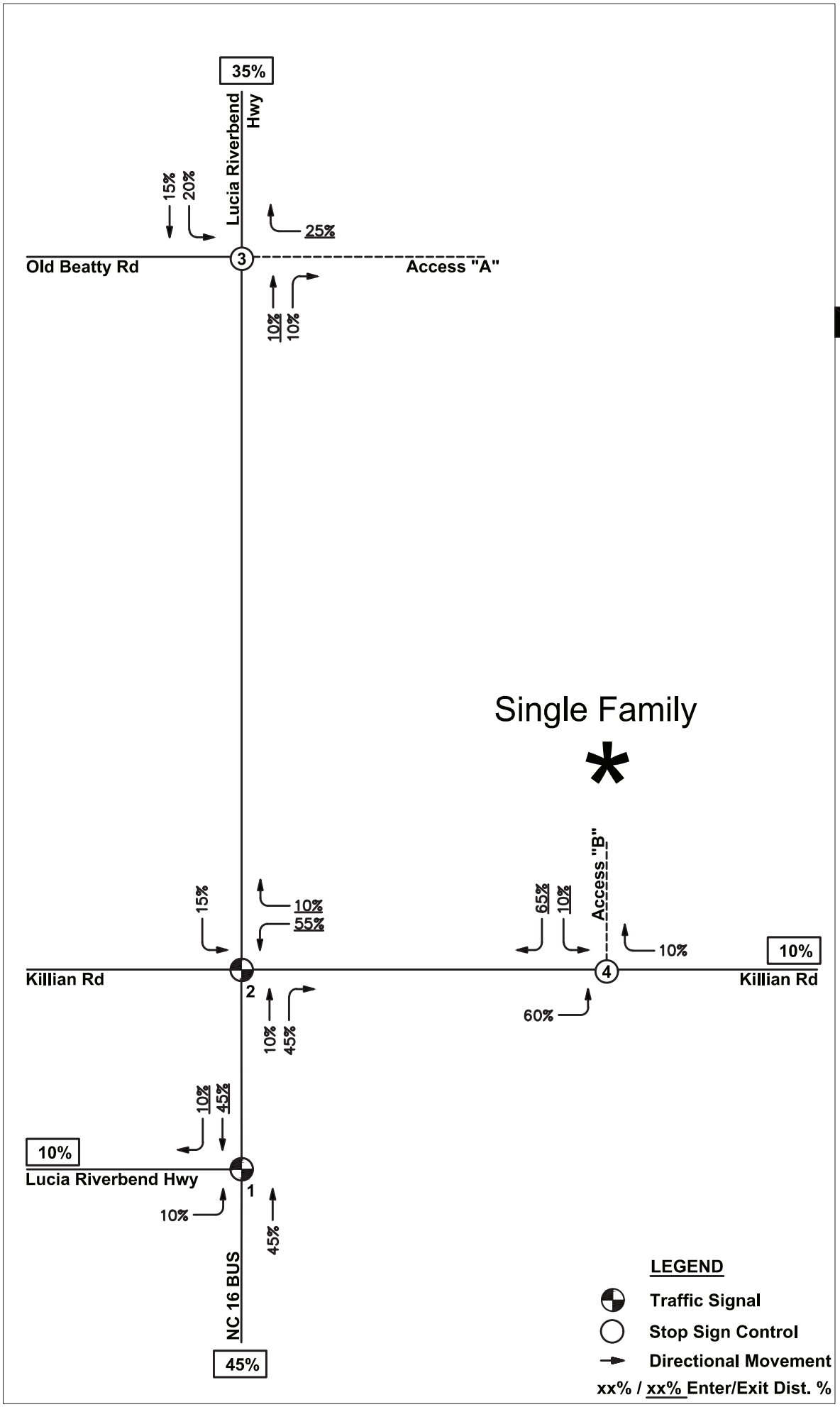
Figure 3A



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TRANSPORTATION PLANNING
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P 704.343.0608
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RIVERBEND PRESERVE PHASE 2 TIA

GASTON/ LINCOLN COUNTY, NC

THE SHAW TATE GROUP
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CHARLOTTE, NC 28203

SINGLE FAMILY SITE DIRECTIONAL DISTRIBUTION

0 NTS N
SCALE: NTS

PROJECT #: 811-001
DRAWN BY: SA
CHECKED BY: MW

MARCH 2020

REVISIONS:
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Figure 3B

PROJECTED TRAFFIC

The daily and peak-hour trip generation data for the site is presented in Table 3. Values derived for the anticipated trips generated by the site are obtained from the Institute of Transportation Engineers, Trip Generation Manual, 10th Edition, 2017.

Table 3: Trip Generation

Land Use [ITE Code]			Daily	AM Peak Hour			PM Peak Hour		
				Enter	Exit	Total	Enter	Exit	Total
Single-Family Housing [210]	250	DUs	2,416	46	137	183	155	91	246
Single Family Total			**2,416**	**46**	**137**	**183**	**155**	**91**	**246**
Multi-Family (Low-Rise) [220]	180	DUs	1,320	20	65	85	63	37	100
Retail [820]	50,000	DUs	3,753	110	68	178	157	170	327
Townhomes + Retail Subtotal			5,073	130	133	263	220	207	427
*Pass-By Reductions**			*-112*	*0*	*0*	*0*	*-56*	*-56*	*-112*
Townhomes + Retail w/ Reductions			**4,961**	**130**	**133**	**263**	**164**	**151**	**315**
Total Trips			**7,377**	**176**	**270**	**446**	**319**	**242**	**561**

The trip generation results indicate that the development is expected to generate 446 total AM peak hour trips and 561 total PM peak hour trips.

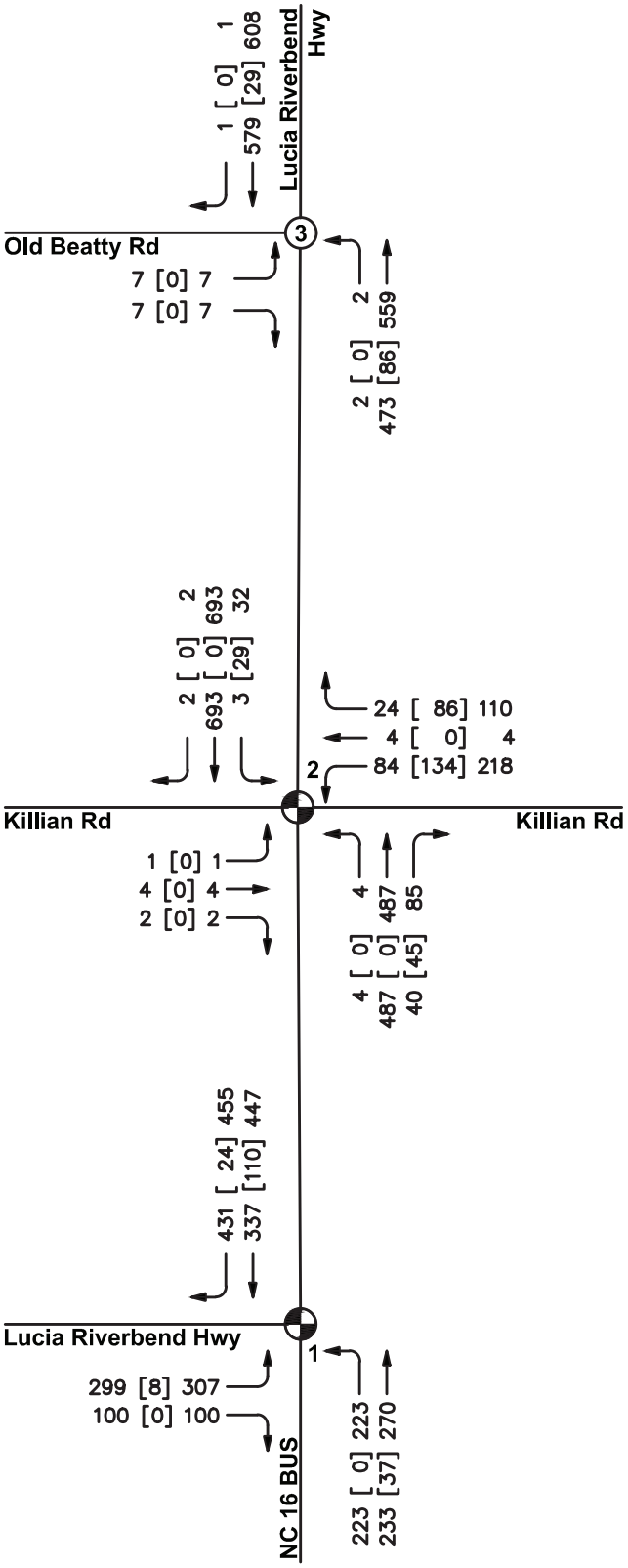
The projected background traffic volumes used in the analyses were developed from the existing peak hour TMCs. Per NCDOT, a 2% per year growth rate was used for the 2024 background volumes. The No Build volumes for the AM and PM peaks are presented in Figures 4 and 5 respectively. The 2024 AM and PM peak hour Build traffic volumes are presented in Figures 6 and 7. The background traffic is indicated to the far left of the movement arrows, followed by the offsite traffic in square brackets, the Townhomes/Retail site traffic in curly brackets and Single Family site traffic parentheses. The four volumes are added to obtain the projected total traffic for that movement:

Background + [Offsite] + {Townhomes/Retail Trips} + (Single Family Trips) = Total

LEGEND

- Traffic Signal
- Stop Sign Control
- Directional Movement

VOLUMES: Background [Offsite] Total



Existing count data were grown by a 2% compounded annual growth rate for No Build conditions.

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LANDSCAPE ARCHITECTURE
CIVIL ENGINEERING
TRANSPORTATION PLANNING
O 2459 Wilkinson Blvd, Ste 200 Charlotte, NC 28208
P 704.343.0608
W www.drgrp.com

RIVERBEND PRESERVE PHASE 2 TIA

GASTON/ LINCOLN COUNTY, NC

THE SHAW TATE GROUP
1030 S.CALDWELL STREET
CHARLOTTE, NC 28203

2024 NO BUILD CONDITIONS AM PEAK HOUR VOLUMES

0 NTS N

SCALE: NTS

PROJECT #: 811-001
DRAWN BY: SA
CHECKED BY: MW

MARCH 2020

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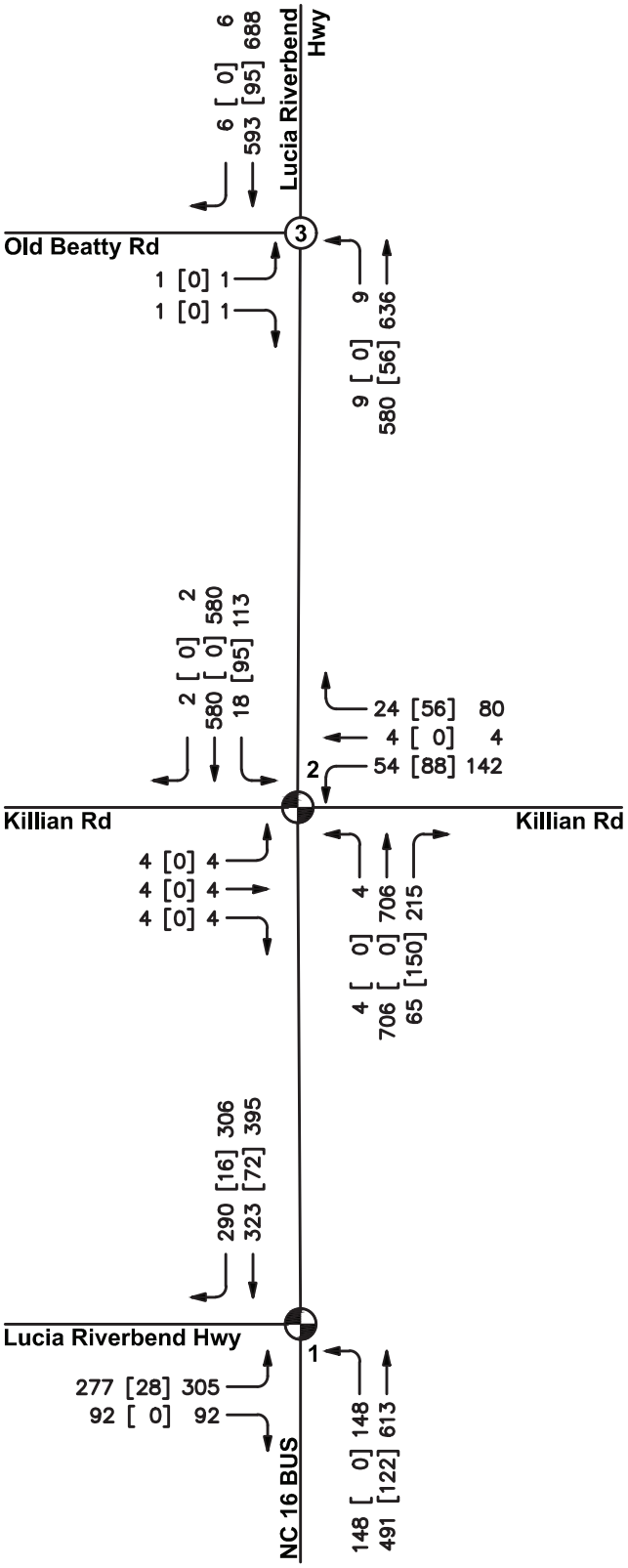
Figure 4

LEGEND

- Traffic Signal
- Stop Sign Control
- Directional Movement

VOLUMES: Background [Offsite] Total



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2024 NO BUILD CONDITIONS PM PEAK HOUR VOLUMES

0 NTS N

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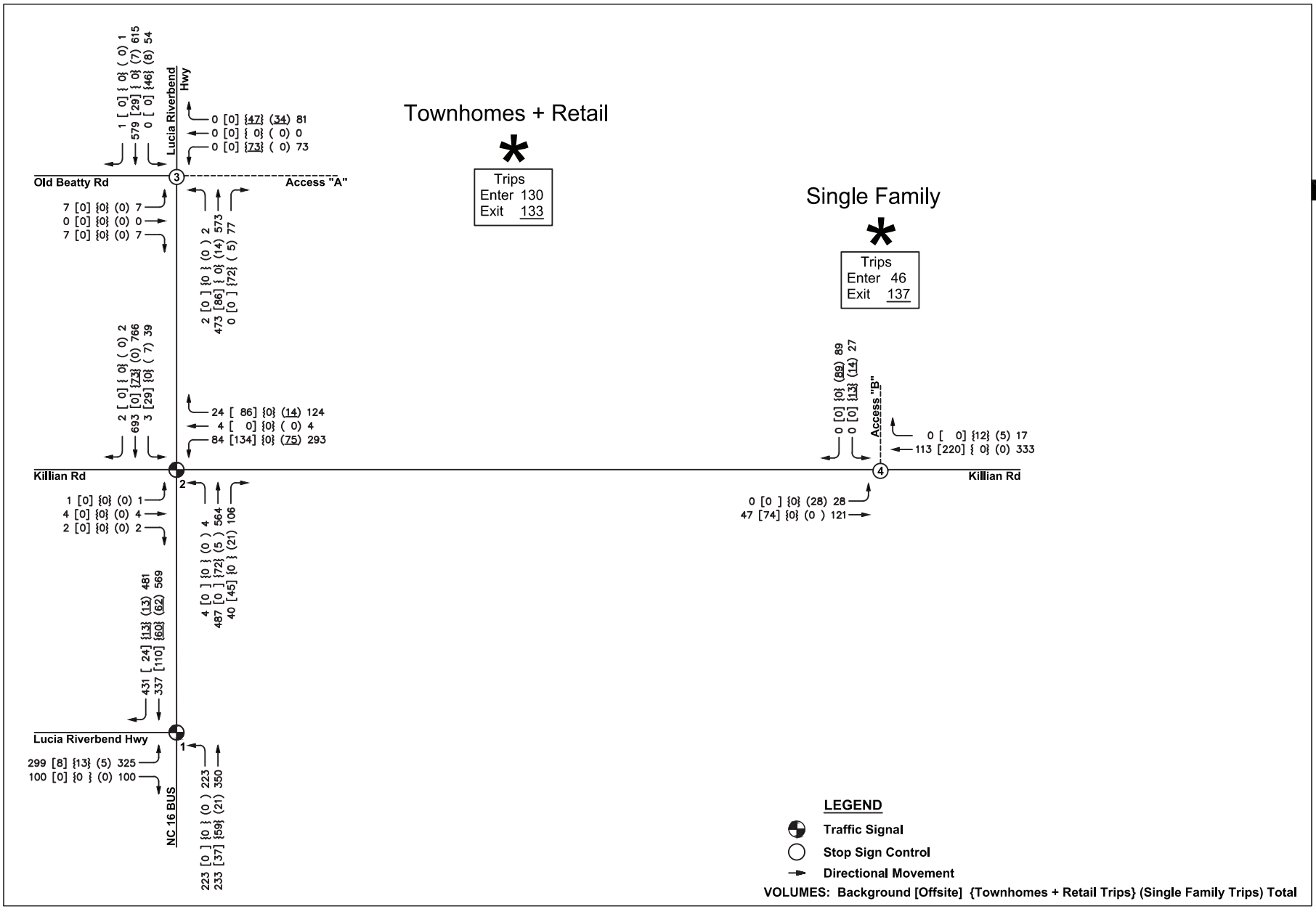
Figure 5



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1030 S.CALDWELL STREET
CHARLOTTE, NC 28203

2024 BUILD CONDITIONS AM PEAK HOUR VOLUMES

SCALE: NTS

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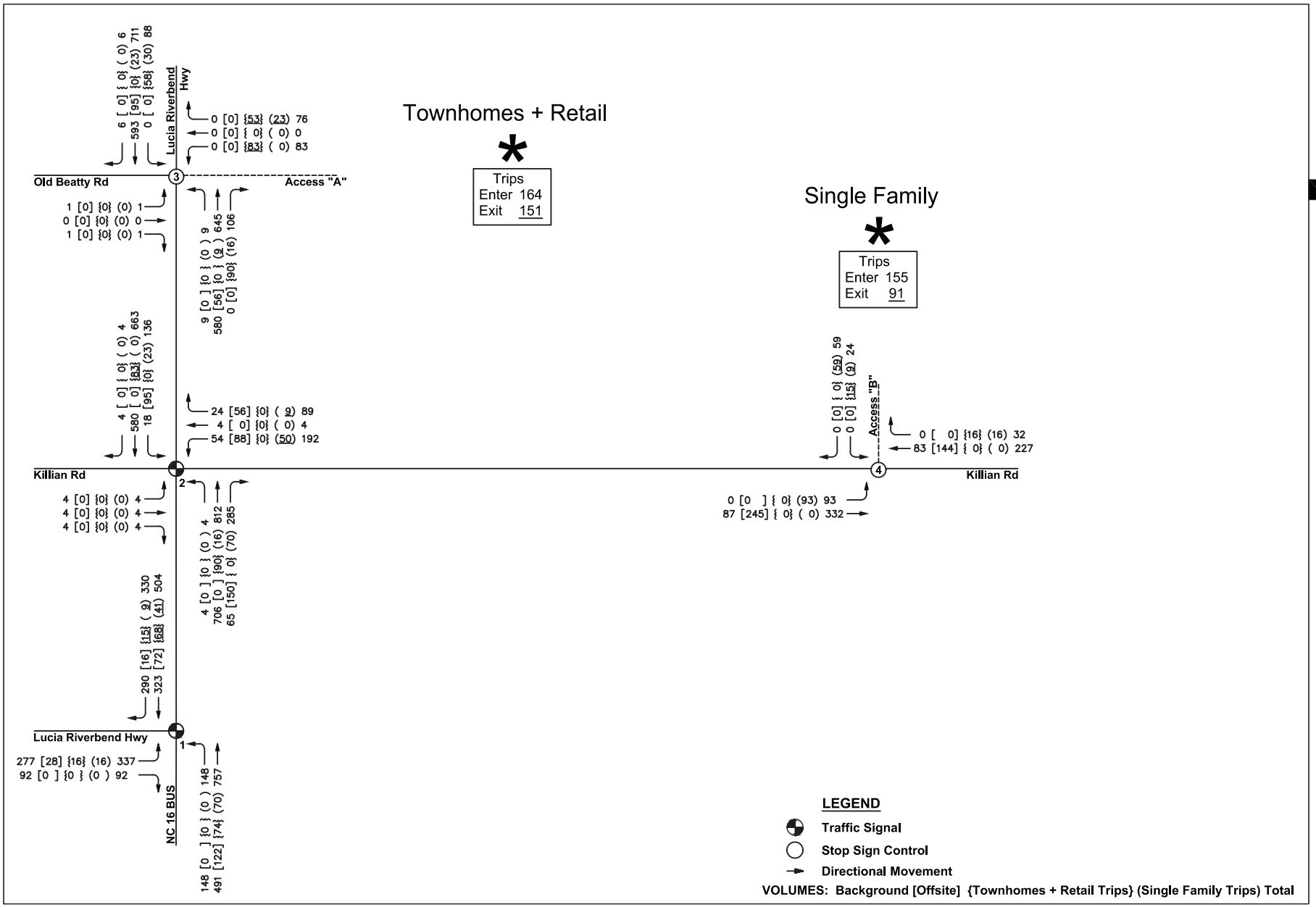
Figure 6



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RIVERBEND PRESERVE PHASE 2 TIA

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2024 BUILD CONDITIONS PM PEAK HOUR VOLUMES

SCALE: NTS

PROJECT #: 811-002
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Figure 7

TRAFFIC ANALYSIS

The study intersections identified within the area of influence were analyzed to detect the traffic impact that the development has under the build-out year (2024). The traffic analysis evaluates following measures of effectiveness' (MOEs) and their respective criteria at the intersections assuming the future year conditions of 2024.

Level of service (LOS) of an intersection or approach is a qualitative MOE of traffic operations. It is a measure of average control delay in time within a peak period. The Transportation Research Board's Highway Capacity Manual[1] (HCM) defines the LOS thresholds established for signalized and unsignalized intersections per the following exhibits:

Intersection LOS	Exhibit 19-8 Signalized Intersection Control Delay per Vehicle (sec/vehicle)	Exhibit 20-2 Unsignalized Intersection Control Delay per Vehicle (sec/vehicle)
A	≤10.0	≤ 10.0
B	> 10.0 and ≤ 20.0	> 10.0 and ≤ 15.0
C	> 20.0 and ≤ 35.0	> 15.0 and ≤ 25.0
D	> 35.0 and ≤ 55.0	> 25.0 and ≤ 35.0
E	> 55.0 and ≤ 80.0	> 35.0 and ≤ 50.0
F	>80.0	> 50.0

For the analysis of unsignalized intersections, intersection LOS is defined in terms of the average control delay for each minor-street movement (or shared movement) as well as major-street left-turns. It should be noted that stop sign controlled streets/driveways intersecting major streets typically experience long delays during peak hours, while most of the traffic moving through the intersection on the major street experiences little or no delay.

This report provides analysis of the traffic operations within the area of influence, according to the standards set by the North Carolina Department of Transportation's (NCDOT) "Policy on Street and Driveway Access to North Carolina Highways, Chapter 4 Part C", and Gaston County's UDO Section 5.11. It provides intersection improvements needed for mitigating traffic impacts. This study evaluates the following scenarios:

- 2019 Existing Conditions
- 2024 No Build Conditions
- 2024 Build-out Conditions

NCDOT ANALYSIS REQUIREMENTS - In order to determine the mitigation responsibility of the developer, this study compares 2024 Build results to the 2024 No Build results.

Per Chapter 5, Section J of the *August 2003 NCDOT Policy on Street and Driveway Access to North Carolina Highways,* the applicant shall be required to identify mitigation improvements to the roadway network if at least one of the following conditions exists when comparing base network conditions to project conditions:

[1] National Research Council. Transportation Research Board. Highway Capacity Manual 6th Ed., Washington, DC. 2016.

- *The total average delay at an intersection or an individual approach increases by 25% or greater, while maintaining the same level of service,*
- *The Level of Service (LOS) degrades by at least one level at an intersection or an individual approach,*
- *Or the Level of Service is "F" for an intersection or an individual approach.*

This section of the NCDOT access policy also states that, *mitigation improvements shall be identified when the analysis indicates that the 95th percentile queue exceeds the storage capacity of the existing lane.*

SYNCHRO 10.3 was the software tool used in determining the delay, capacity and corresponding LOS at the study intersections. SimTraffic 10.3, a traffic simulation software application for unsignalized and signalized intersections, was used to calculate the maximum queue lengths at the study intersections. The Synchro and SimTraffic results of each scenario is displayed per intersection and are presented in Tables 4 – 17.

Base assumptions for the analysis scenarios include:

- A 2% per year background growth rate between the existing 2019 and future 2024 conditions
- All study intersections and movements assume a 0.90 peak hour factor (PHF)
- Observed heavy vehicle percentages (from TMCs) were used in all analysis for all intersections, a minimum of 2% was applied to proposed intersections.
- A minimum of 4 vehicles was assumed for all allowed movements.
- Existing signal plans were used in the Existing, No Build and Build conditions, coded based on the NCDOT Congestion Management Capacity Analysis Guidelines (2015) See Appendix for existing signal plans:
  - Right turn on red (RTOR) was disabled
  - Permitted-Protected phasing was adjusted to protected only in future conditions
  - Minimum green time was adjusted per speed limit
  - Yellow and red times were adjusted to 5 seconds and 2 seconds, respectively with -2 seconds of lost time adjustment
  - Signals were coordinated in all future scenarios
  - Cycle lengths were adjusted to future minimums per phase
- Signal timings as given by the signal plan were utilized and the intersections were optimized through all future scenarios
- All future scenarios assume the improvements per approved Riverbend Preserve Phase 1 TIA at the intersection of Lucia Riverbend Highway & NC 16 Business and the intersection of Killian Road & NC 16 Business.
  - ❖ <u>Lucia Riverbend Highway & NC 16 Business</u>
    - Implement southbound right turn overlap phasing on NC 16 Business
    - Extend eastbound right turn lane to 150' on Lucia Riverbend Highway
  - ❖ <u>Killian Road & NC 16 Business</u>
    - Construct a separate westbound right turn lane with 175' storage on Killian Road
    - Remark the existing combined left-thru-right lane to a combined left-thru lane
    - Extend southbound left turn lane storage to 125' on NC 16 Business

1. NC 16 Business & Lucia Riverbend Highway

Table 4: NC 16 Bus. & Lucia Riverbend Hwy Analysis Results

Approach	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec/veh)	Capacity (v/c)	LOS	Delay (sec/veh)	Capacity (v/c)
Existing Conditions						
Intersection	D	41.5	0.88	D	35.9	0.79
Eastbound - Lucia Riverbend Highway	D	48.5	-	D	40.1	-
Northbound - NC 16	D	38.7	-	C	31.5	-
Southbound - Lucia Riverbend Highway	D	39.6	-	D	38.1	-
2024 No Build Conditions with Riverbend Preserve Phase 1 TIA Improvements						
Intersection	C	27.7	0.80	C	22.5	0.74
Eastbound - Lucia Riverbend Highway	D	43.1	-	D	36.9	-
Northbound - NC 16	C	27.3	-	C	19.5	-
Southbound - Lucia Riverbend Highway	C	21.1	-	B	17.7	-
2024 Build Conditions with Riverbend Preserve Phase 1 TIA Improvements						
Intersection	C	31.2	0.89	C	24.0	0.82
Eastbound - Lucia Riverbend Highway	D	53.4	-	D	42.8	-
Northbound - NC 16	C	28.6	-	C	20.3	-
Southbound - Lucia Riverbend Highway	C	23.5	-	B	18.4	-

2019 Existing Conditions

Currently the intersection operates with a LOS “D” in both peak hours.

2024 No Build Conditions

With the inclusion of the growth in the background and future adjustments to the signal, the intersection operates with a LOS “C” in both peak hours.

2024 Build Conditions

When comparing the impact of the 2024 Build to the 2024 No Build conditions the intersection LOS remains a “C” in both peak periods. The overall intersection delay increases between the No Build and Build scenarios by 13% in the AM peak hour and 7% in the PM peak hour.

It should be noted that improvements from Riverbend Preserve Phase 1 TIA will alleviate the traffic at this intersection with minimal queuing while the majority of the traffic moving through the intersection on the major street experiences little or no delay per Table 5.

This intersection does not require further mitigation under NCDOT guidelines. Therefore, no developer required improvements at this intersection should be deemed necessary.

Table 5: NC 16 Bus. & Lucia Riverbend Hwy Queue Lengths

Lucia Riverbend Highway/ @ NC 16 /Lucia Riverbend Highway	Storage (ft)	AM PEAK		PM PEAK	
		95th % Queue	Max Queue	95th % Queue	Max Queue
2024 No Build Conditions with Riverbend Preserve Phase 1 TIA Improvements					
Eastbound Left-Turn (Lucia Riverbend Highway)	TERM.	#309'	302'	260'	403'
Eastbound Right-Turn (Lucia Riverbend Highway)	150’	98'	227'	84'	216'
Northbound Left-Turn (NC 16)	TERM.	#244'	257'	#192'	202'
Northbound Thru (NC 16)	-	110'	174'	344'	291'
Southbound Thru (Lucia Riverbend Highway)	TERM.	#416'	420'	307'	304'
Southbound Right-Turn (Lucia Riverbend Highway)	300’	281'	396'	m117'	181'
2024 Build Conditions with Phase 2 Improvements					
Eastbound Left-Turn (Lucia Riverbend Highway)	TERM.	#359'	391'	#328'	324'
Eastbound Right-Turn (Lucia Riverbend Highway)	150’	101'	248'	87'	250'
Northbound Left-Turn (NC 16)	TERM.	#266'	325'	149'	218'
Northbound Thru (NC 16)	-	138'	194'	463'	368'
Southbound Thru (Lucia Riverbend Highway)	TERM.	#530'	614'	#446'	493'
Southbound Right-Turn (Lucia Riverbend Highway)	300’	176'	400'	104'	344'

2. Lucia Riverbend Highway & Killian Road

Table 6: Lucia Riverbend Hwy & Killian Rd Analysis Results

Approach	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec/veh)	Capacity (v/c)	LOS	Delay (sec/veh)	Capacity (v/c)
Existing Conditions						
Intersection	A	8.6	0.55	A	6.1	0.48
Eastbound - Killian Road	B	19.3	-	C	21.0	-
Westbound - Killian Road	C	26.5	-	C	24.7	-
Northbound - Lucia Riverbend Highway	A	5.9	-	A	5.2	-
Southbound - Lucia Riverbend Highway	A	7.7	-	A	4.5	-
2024 No Build Conditions with Riverbend Preserve Phase 1 TIA Improvements						
Intersection	C	20.5	0.78	C	20.2	0.78
Eastbound - Killian Road	C	24.8	-	C	32.2	-
Westbound - Killian Road	D	43.6	-	D	53.0	-
Northbound - Lucia Riverbend Highway	B	14.1	-	B	17.4	-
Southbound - Lucia Riverbend Highway	B	14.9	-	B	13.2	-
2024 Build Conditions with Riverbend Preserve Phase 1 TIA Improvements						
Intersection	C	25.9	0.89	C	28.9	0.92
Eastbound - Killian Road	C	23.3	-	C	31.3	-
Westbound - Killian Road	D	49.1	-	E	65.7	-
Northbound - Lucia Riverbend Highway	B	17.5	-	C	26.6	-
Southbound - Lucia Riverbend Highway	C	20.9	-	B	19.1	-
2024 Build Conditions with Test Improvements (Westbound LTL)						
Intersection	C	31.5	0.83	C	27.8	0.90
Eastbound - Killian Road	D	53.5	-	C	32.1	-
Westbound - Killian Road	E	56.8	-	E	64.5	-
Northbound - Lucia Riverbend Highway	C	25.3	-	C	24.1	-
Southbound - Lucia Riverbend Highway	C	23.3	-	B	19.9	-

2019 Existing Conditions

Currently the intersection operates with a LOS “A” in both peak hours.

2024 No Build Conditions

With the inclusion of the growth in the background and future adjustments to the signal, the intersection operates with a LOS “C” in both peak hours.

2024 Build Conditions

When comparing the impact of the 2024 Build to the 2024 No Build conditions the intersection LOS remains a “C” in both peak hours. The overall intersection delay increases between the No Build and Build scenario is 26% in the AM peak hour and 43% in the PM peak hour. In addition, the some of the approaches exceed the allowable parameters in both peak hours.

2024 Build with Test Improvements Conditions

Based on NCDOT guidelines, the analysis results indicate the need to identify mitigation at the study intersection as means to improve LOS and delay.

The following improvements are suggested:

- Extend northbound right turn lane storage from 175 feet to 275 feet on Lucia Riverbend Highway
- Extend southbound left turn lane storage from 125 feet to 200 feet on Lucia Riverbend Highway

The following improvement was tested within the analysis:

- Westbound left turn lane on Killian Road

Assuming these improvements are in place, the intersection LOS remains a "C" in both peak hours. The overall intersection delay increases between the No Build and Build scenario is 54% in the AM peak hour and 38% in the PM peak hour.

This tested improvement showed minimal to no improvement to this intersection and therefore, is not suggested as a developer responsibility.

It should be noted that improvements from Riverbend Preserve Phase 1 TIA will alleviate the traffic at this intersection with minimal queuing while the majority of the traffic moving through the intersection on the major street experiences little or no delay per Table 7.

Table 7: Lucia Riverbend Hwy & Killian Rd Queue Lengths

Killian Road @ Lucia Riverbend Highway	Storage (ft)	AM PEAK		PM PEAK	
		95th % Queue	Max Queue	95th % Queue	Max Queue
2024 No Build Conditions with Riverbend Preserve Phase 1 TIA Improvements					
Eastbound Left-Thru-Right (Killian Road)	-	18'	51'	21'	46'
Westbound Left-Thru (Killian Road)	TERM.	#226'	247'	#185'	165'
Westbound Right-Turn (Killian Road)	175'	104'	180'	90'	123'
Northbound Left-Thru (Lucia Riverbend Highway)	-	413'	206'	375'	415'
Northbound Right-Turn (Lucia Riverbend Highway)	175'	m46'	95'	95'	275'
Southbound Left-Turn (Lucia Riverbend Highway)	125	48'	137'	125'	185'
Southbound Thru-Right Turn (Lucia Riverbend Highway)	TERM.	400'	299'	194'	237'
2024 Build Conditions with Phase 2 Improvements					
Eastbound Left-Thru-Right (Killian Road)	-	18'	40'	21'	40'
Westbound Left-Thru (Killian Road)	TERM.	#328'	275'	#261'	209'
Westbound Right-Turn (Killian Road)	175'	113'	241'	99'	127'
Northbound Left-Thru (Lucia Riverbend Highway)	-	#510'	619'	#695'	616'
Northbound Right-Turn (Lucia Riverbend Highway)	175'	74'	275'	150'	275'
Southbound Left-Turn (Lucia Riverbend Highway)	125	56'	88'	#196'	170'
Southbound Thru-Right Turn (Lucia Riverbend Highway)	TERM.	534'	421'	254'	211'

3. Lucia Riverbend Highway & Old Beatty Road-Access "A"

Table 12: Lucia Riverbend Hwy & Old Beatty Rd-Access "A" Analysis Results

Approach	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec/veh)	Capacity (v/c)	LOS	Delay (sec/veh)	Capacity (v/c)
Existing Conditions						
Eastbound - Old Beatty Road	C	16.4	-	C	17.9	-
Northbound - Lucia Riverbend Highway	A	0.0	-	A	0.1	-
Southbound - Lucia Riverbend Highway	A	0.0	-	A	0.0	-
2024 No Build Conditions with Riverbend Preserve Phase 1 TIA Improvements						
Eastbound - Old Beatty Road	C	20.2	-	C	23.9	-
Northbound - Lucia Riverbend Highway	A	0.1	-	A	0.1	-
Southbound - Lucia Riverbend Highway	A	0.0	-	A	0.0	-
2024 Build Conditions with Riverbend Preserve Phase 1 TIA Improvements						
Eastbound - Old Beatty Road	C	21.4	-	D	28.6	-
Westbound - Access "A"	C	16.0	-	E	42.5	-
Northbound - Lucia Riverbend Highway	A	0.0	-	A	0.1	-
Southbound - Lucia Riverbend Highway	A	0.8	-	A	1.1	-
2024 Build Conditions with Phase 2 Improvements						
Eastbound - Old Beatty Road	C	21.3	-	D	27.5	-
Westbound - Access "A"	C	23.2	-	E	36.9	-
Northbound - Lucia Riverbend Highway	A	0.1	-	A	0.1	-
Southbound - Lucia Riverbend Highway	A	0.8	-	A	1.1	-

2019 Existing Conditions

Currently the worst approach of the intersection (Eastbound-Old Beatty Road) operates with a LOS "C" both peak hours.

2024 No Build Conditions

With the inclusion of the growth in the background, the worst approach of the intersection (Eastbound-Old Beatty Road) remains at a LOS "C" in both peak hours.

2024 Build Conditions

When comparing the impact of the 2024 Build to the 2024 No Build conditions, the worst approach of the intersection (Eastbound-Old Beatty Road) operates at a "C" in the AM peak hour and becomes a "D" in the PM peak hour. The eastbound delay increases between the No Build and Build scenario is 6% in the AM peak hour and 20% in the PM peak hour.

It should be noted that stop sign controlled streets/driveways intersecting major streets typically experience long delays during peak hours, while the majority of the traffic moving through the intersection on the major street experiences little or no delay.

2024 Build with Improvements Conditions

We propose the following intersection configuration:

- Align east/west approaches to a four-legged intersection (right-of-way to be acquired to ensure alignment)
- Construct a southbound left turn lane with 100 feet of storage on Lucia Riverbend Highway
- Construct northbound left turn lane with 100 feet of storage on Lucia Riverbend Highway to allow for intersection alignment
- Construct northbound right turn lane with 100 feet of storage on Lucia Riverbend Highway
- One ingress and two egress lanes (a westbound thru-right turn lane and left turn lane with 200' storage) on Proposed Access "A"
- Minimum internal protected stem of 200'

Assuming these improvements are in place, the worst approach of the intersection (Eastbound-Old Beatty Road) operates at a "C" in the AM peak hour and becomes a "D" in the PM peak hour (both of which are considered acceptable based on NCDOT guidelines). Sight distance should be verified by site-civil engineer during permitting process.

Table 13: Lucia Riverbend Hwy & Old Beatty Road-Access "A" Queue Lengths

Old Beatty Road/ @ Lucia Riverbend Highway	Storage (ft)	AM PEAK		PM PEAK	
		95th % Queue	Max Queue	95th % Queue	Max Queue
2024 No Build Conditions with Riverbend Preserve Phase 1 TIA Improvements					
Eastbound Left-Right Turn (Old Beatty Road)	-	5'	32'	3'	22'
Northbound Left-Thru (Lucia Riverbend Highway)	-	0'	50'	0'	84'
2024 Build Conditions with Phase 2 Improvements					
Eastbound Left-Thru-Right (Old Beatty Road)	-	8'	29'	5'	50'
Westbound Left-Turn (Access "A")	150'	43'	93'	78'	193'
Westbound Thru-Right (Access "A")	-	20'	85'	23'	80'
Northbound Left-Turn (Lucia Riverbend Highway)	100'	0'	24'	0'	27'
Northbound Thru-Right (Lucia Riverbend Highway)	-	0'	10'	0'	37'
Southbound Left-Turn (Lucia Riverbend Highway)	100'	5'	44'	10'	68'

4. Killian Road & Access "C"

Table 16: Killian Rd & Access "C" Analysis Results

Approach	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec/veh)	Capacity (v/c)	LOS	Delay (sec/veh)	Capacity (v/c)
2024 Build Conditions with Phase 2 Improvements						
Eastbound - Killian Road	A	1.5	-	A	1.8	-
Westbound - Killian Road	A	0.0	-	A	0.0	-
Southbound - Access "B"	B	11.7	-	B	12.4	-

2024 Build with Improvements Conditions

We propose the following intersection configuration:

- Construct an eastbound left turn lane with 100 feet of storage on Killian Road
- One ingress and two egress lanes (a terminating southbound right turn lane and left turn lane with 100' storage) on Proposed Access "B"
- Minimum internal protected stem of 100'

Assuming these improvements are in place, the worst approach of the intersection (Southbound-Access "B") operates at a "B" in the AM peak hour and becomes a "B" in the PM peak hour. (both of which are considered acceptable based on NCDOT guidelines). Sight distance should be verified by site-civil engineer during permitting process.

Table 17: Killian Rd & Access "C" Queue Lengths

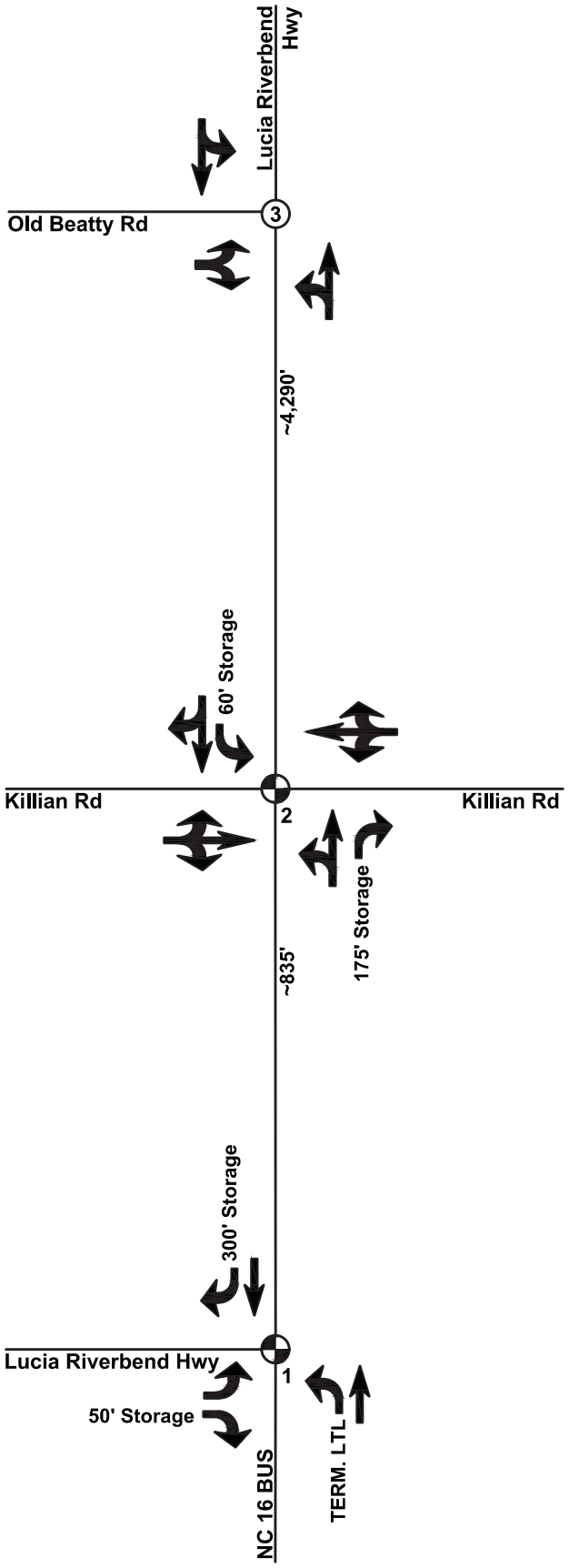
Killian Road @ /Access "B"	Storage (ft)	AM PEAK		PM PEAK	
		95th % Queue	Max Queue	95th % Queue	Max Queue
2024 Build Conditions with Phase 2 Improvements					
Eastbound Left-Turn (Killian Road)	100	3'	33'	8'	69'
Southbound Left Turn (Access "B")	-	5'	35'	8'	35'
Southbound Right Turn (Access "B")	-	13'	80'	8'	63'

Analysis software result reports per scenario are provided in the Appendix.

The existing/suggested laneage is shown on Figures 8 and 9.

LEGEND

- Traffic Signal
- Stop Sign Control
- Existing Laneage



DESIGN RESOURCE GROUP

LANDSCAPE ARCHITECTURE
CIVIL ENGINEERING
TRANSPORTATION PLANNING

2459 Wilkinson Blvd, Ste 200 Charlotte, NC 28208
704.343.0608
www.drgrp.com

RIVERBEND PRESERVE PHASE 2 TIA

GASTON/ LINCOLN COUNTY, NC

THE SHAW TATE GROUP
1030 S.CALDWELL STREET
CHARLOTTE, NC 28203

EXISTING LANEAGE

0 NTS N

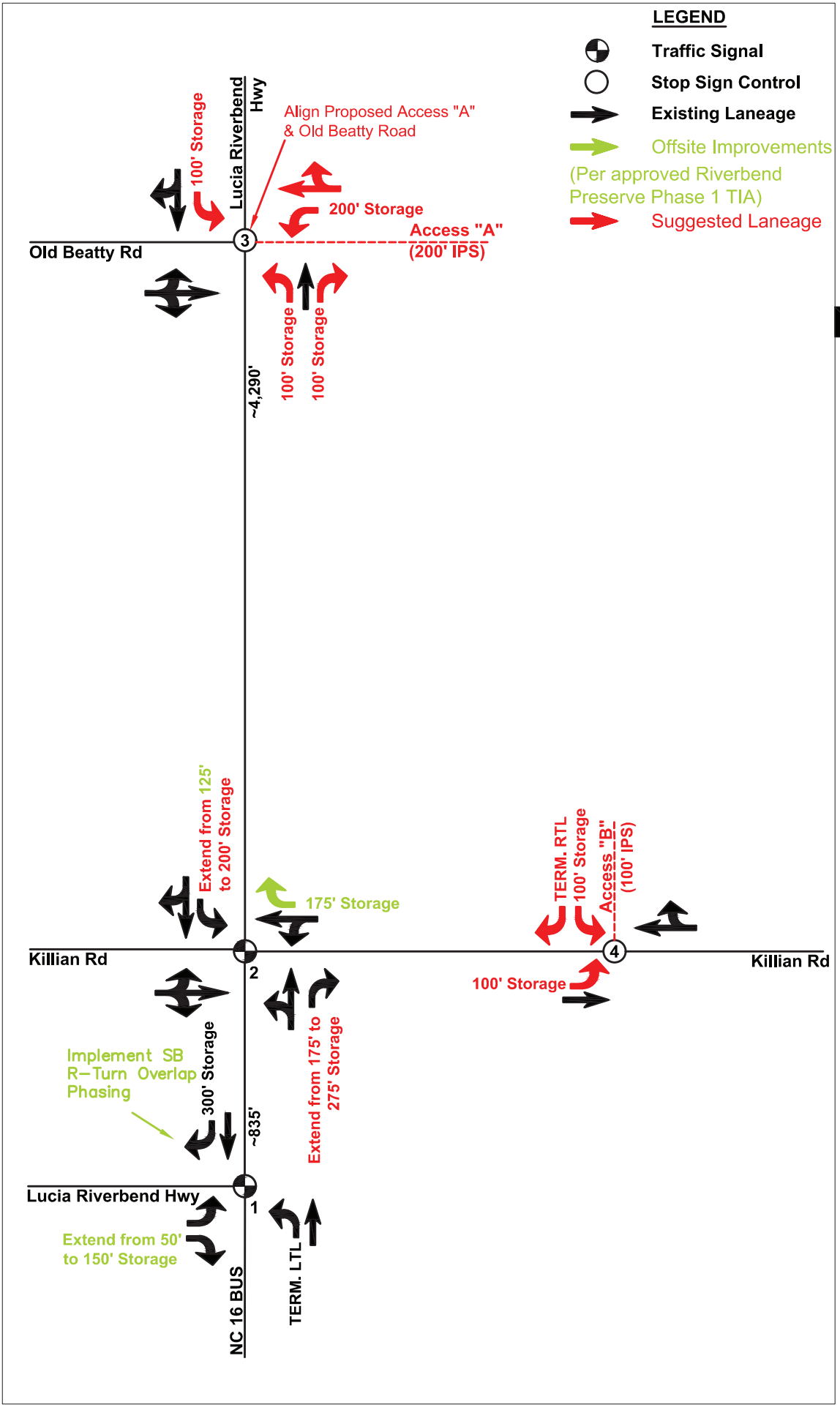
SCALE: NTS

PROJECT #: 811-001
DRAWN BY: SA
CHECKED BY: MW

MARCH 2020

REVISIONS:
1.

Figure 8



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SUGGESTED LANEAGE

0 NTS N

SCALE: NTS

PROJECT #: 811-001
DRAWN BY: SA
CHECKED BY: MW

MARCH 2020

REVISIONS:
1. Revised per Con.Mgmnt. comments 5/18/2020

Figure 9

CONCLUSION

In conclusion, it was determined that Riverbend Preserve Phase 2 site development will not significantly affect the operations of vehicular traffic on the adjacent roadways with both these suggested improvements as well as, the suggested intersection improvements/enhancements from the approved Riverbend Preserve Phase 1 Traffic Impact Analysis.

APPENDIX