

Lyndon Oaks
Traffic Impact Analysis
Knightsdale, North Carolina

TRAFFIC IMPACT ANALYSIS

FOR

LYNDON OAKS

LOCATED

IN

KNIGHTDALE, NC

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11-29-2023

NOVEMBER 2023

RKA Project No. 22584

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TRAFFIC IMPACT ANALYSIS
LYNDON OAKS
KNIGHTDALE, NORTH CAROLINA

EXECUTIVE SUMMARY

1. Development Overview

A Traffic Impact Analysis (TIA) was conducted for the proposed Lyndon Oaks subdivision development in accordance with the Knightdale (Town) Unified Development Ordinance (UDO) and North Carolina Department of Transportation (NCDOT) capacity analysis guidelines. The proposed development is to be located on the west side of Bethlehem Road between Interstate 87 and Old Faison Road in Knightdale, North Carolina. The proposed development, anticipated to be completed in 2031, is proposed to consist of 308 single-family homes, 192 townhomes, and 15,000 square feet of commercial space. Site access is proposed via one (1) full-movement driveway on Old Faison Road at the existing location of Tart Farm Road and one roundabout at the existing intersection of Bethlehem Road and Crosscut Place.

The study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- 2023 Existing Traffic Conditions
- 2031+1 No-Build Traffic Conditions
- 2031+10 No-Build Traffic Conditions
- 2031+1 Build Traffic Conditions
- 2031+10 Build Traffic Conditions

2. Existing Traffic Conditions

The study area for the TIA was determined through coordination with the Town and NCDOT and consists of the following existing intersections:

- Old Faison Road and Bethlehem Road
- Old Faison Road and Tart Farm Road
- Old Faison Road and Pleasant Colony Drive
- Old Faison Road and Quiet Way

- Bethlehem Road and Crosscut Place
- US 64 EB Ramps and Hodge Road
- US 64 WB Ramps and Old Faison Road
- Smithfield Road and Old Ferrell Road
- Bethlehem Road and Poole Road

Existing peak hour traffic volumes were determined based on traffic counts conducted at the study intersection listed below, in April of 2023 by Quality Counts during a typical weekday AM (7:00 AM – 9:00 AM) and PM (4:00 PM – 6:00 PM) peak periods:

- Old Faison Road and Bethlehem Road
- Old Faison Road and Tart Farm Road
- Old Faison Road and Pleasant Colony Drive
- Old Faison Road and Quiet Way
- Bethlehem Road and Crosscut Place
- US 64 EB Ramps and Hodge Road
- US 64 WB Ramps and Old Faison Road
- Smithfield Road and Old Ferrell Road
- Bethlehem Road and Poole Road

Traffic volumes were balanced between study intersections, where appropriate.

3. Site Trip Generation

The proposed development is assumed to consist of 308 single-family homes, 192 townhomes, and 15,000 square feet of commercial space. Average weekday daily, AM peak hour, and PM peak hour trips for the proposed development were estimated using methodology contained within the ITE Trip Generation Manual, 11th Edition. Table E-1 provides a summary of the trip generation potential for the site.

Table E-1: Site Trip Generation

Land Use (ITE Code)	Intensity	Daily Traffic (vpd)	Weekday AM Peak Hour Trips (vph)		Weekday PM Peak Hour Trips (vph)	
			Enter	Exit	Enter	Exit
Single-Family Detached (210)	308 DU	2,840	52	155	180	106
Townhomes (215)	192 DU	1,414	24	70	66	45
Strip Retail Plaza (822)	10 KSF	652	17	12	39	39
High-Turnover Restaurant (932)	5 KSF	536	26	22	28	17
Total Trips		5,442	119	259	313	207
<i>Internal Capture (7% AM & 6% PM)*</i>			-9	-17	-20	-13
Total External Trips			110	242	293	194
<i>Pass-By Trips</i>			-0	-0	-19	-19
Total Primary (New) Trips			110	242	274	175

4. Future Traffic Conditions

Through coordination with NCDOT and the Town, it was determined that an annual growth rate of 3% would be used to generate 2032 projected weekday AM and PM peak hour traffic volumes. For the 2041 future analysis, a 1% growth rate was applied each year after the build +1 year analysis. The following adjacent developments were identified to be considered under future conditions:

- Riverview Commons
- Widewaters Expansion

5. Capacity Analysis Summary

The analysis considered weekday AM and PM peak hour traffic for 2023 existing, 2032 no-build, 2032 build, 2041 no-build, and 2041 build conditions. Refer to Section 7 of the TIA for the capacity analysis summary performed at each study intersection.

6. Recommendations

Based on the findings of this study, specific geometric and traffic control improvements have been identified at study intersections. The improvements are summarized below and are illustrated in Figure E-1.

Recommended Improvements by STIP W-5705AK Westbound I-87 Ramps and Hodge Road

- Construct westbound right turn lane with 100 feet of storage and appropriate decel and taper.
- Construct westbound left turn lane with 100 feet of storage and appropriate decel and taper.
- Modify signal timings and signal phasing

Recommended Improvements by Developer Old Faison Road and Bethlehem Road

- Coordinate with Town on desired improvements. Provide fee in lieu contribution as necessary

Old Faison Road and Tart Farm Road/Site Access A

- Construct an eastbound right turn lane with 75 feet of storage and appropriate decel and taper.
- Construct exclusive northbound left turn lane with full storage.
- Provide stop control for northbound approach.

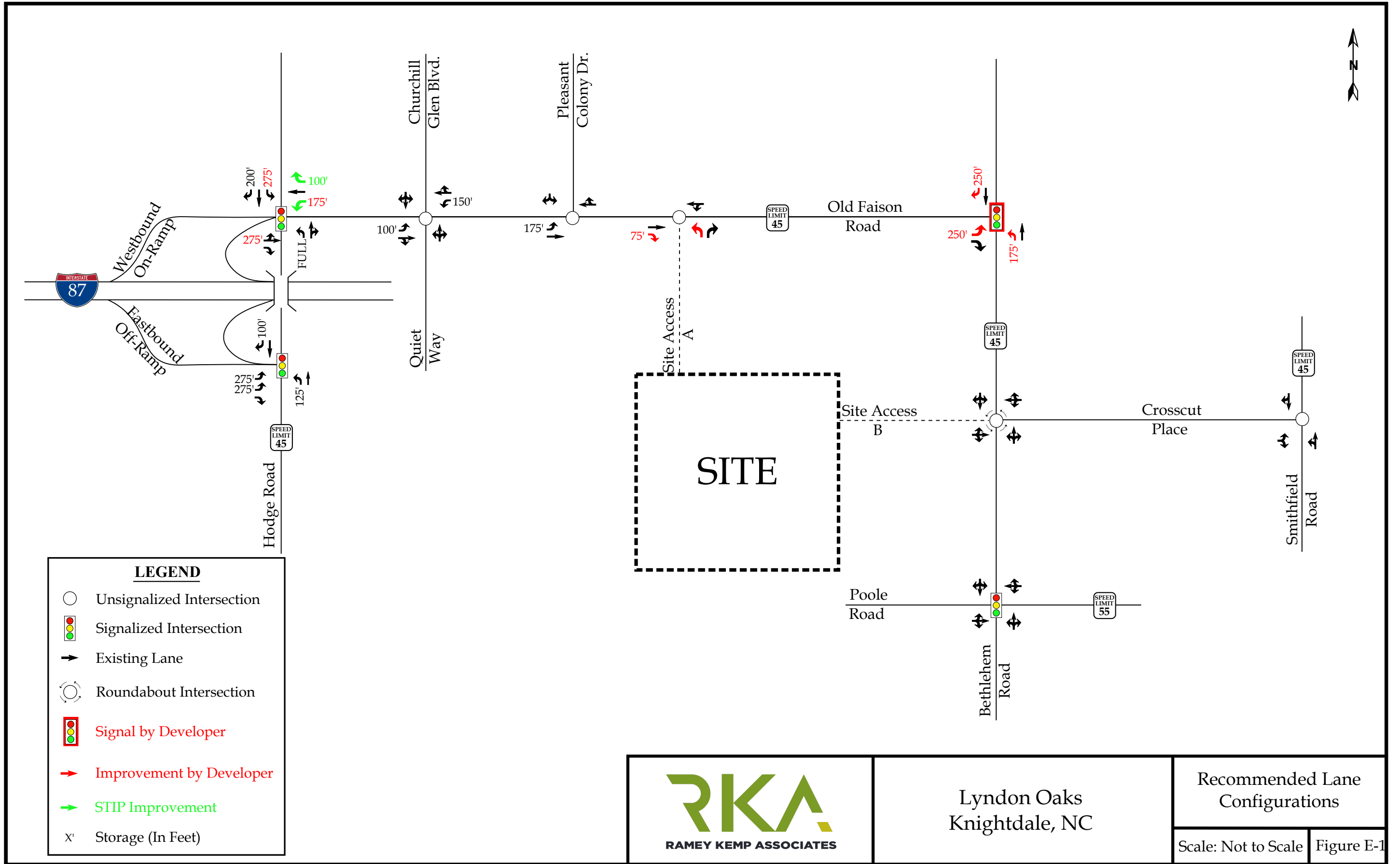
Bethlehem Road and Crosscut Place/Site Access B

- Construct a single-lane roundabout.
- Construct eastbound approach with one ingress and one egress lane.
- Provide yield control for eastbound approach.

Westbound I-87 Ramps and Hodge Road

- Extend westbound left turn lane to contain 175 feet of storage and appropriate decel and taper.
- Extend southbound left turn lane to contain 275 feet of storage and appropriate decel and taper.

- Extend eastbound left-through lane to contain 275 feet of storage and appropriate decel and taper.



Lyndon Oaks
Knightdale, NC

Recommended Lane
Configurations

Scale: Not to Scale Figure E-1

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TRAFFIC IMPACT ANALYSIS
LYNDON OAKS
KNIGHTDALE, NORTH CAROLINA

1. INTRODUCTION

The contents of this report present the findings of the Traffic Impact Analysis (TIA) conducted for the proposed Lyndon Oaks subdivision development to be located on the west side of Bethlehem Road between Interstate 87 and Old Faison Road in Knightdale, North Carolina. The purpose of this study is to determine the potential impacts to the surrounding transportation system created by traffic generated by the proposed development, as well as recommend improvements to mitigate the impacts.

The proposed development, anticipated to be completed in 2031, is proposed to consist of 308 single-family homes, 192 townhomes, and 15,000 square feet of commercial space. At the time that this TIA was completed, the commercial uses were unknown; however, for a conservative approach to the analysis, 10,000 square feet of strip retail and 5,000 square feet of high-turnover restaurant were assumed.

Per the Town of Knightdale (Town) Unified Development Ordinance (UDO), future analysis should include the build year + 1, as well as a future (build year + 10 years) scenario. The study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- 2023 Existing Traffic Conditions
- 2031+1 No-Build Traffic Conditions
- 2031+10 No-Build Traffic Conditions
- 2031+1 Build Traffic Conditions
- 2031+10 Build Traffic Conditions

1.1. Site Location and Study Area

The development is proposed to be located on the west side of Bethlehem Road between Interstate 87 and Old Faison Road in Knightdale, North Carolina. Refer to Figure 1 for the site location map.

The study area for the TIA was determined through coordination with the North Carolina Department of Transportation (NCDOT) and the Town and consists of the following existing intersections:

- Old Faison Road and Bethlehem Road
- Old Faison Road and Tart Farm Road
- Old Faison Road and Pleasant Colony Drive
- Old Faison Road and Quiet Way
- Bethlehem Road and Crosscut Place
- US 64 EB Ramps and Hodge Road
- US 64 WB Ramps and Old Faison Road
- Smithfield Road and Old Ferrell Road
- Bethlehem Road and Poole Road

Refer to Appendix A for the approved scoping documentation.

1.2. Proposed Land Use and Site Access

The proposed development is assumed to consist of the following uses:

- 308 single-family detached homes
- 192 townhomes
- 10,000 square feet (s.f.) of strip retail
- 5,000 s.f. of high-turnover restaurant

Site access is proposed via one (1) full-movement driveway on Old Faison Road at the existing location of Tart Farm Road and one roundabout at the existing intersection of Bethlehem Road and Crosscut Place. This roundabout is in concordance with the Town's code. Refer to Figure 2 for a copy of the preliminary site plan.

1.3. Adjacent Land Uses

The proposed development is located in an area consisting primarily of residential development.

1.4. Existing Roadways

Existing lane configurations (number of traffic lanes on each intersection approach), lane widths, storage capacities, and other intersection and roadway information within the study area are shown in Figure 3. Table 1 provides a summary of this information, as well.

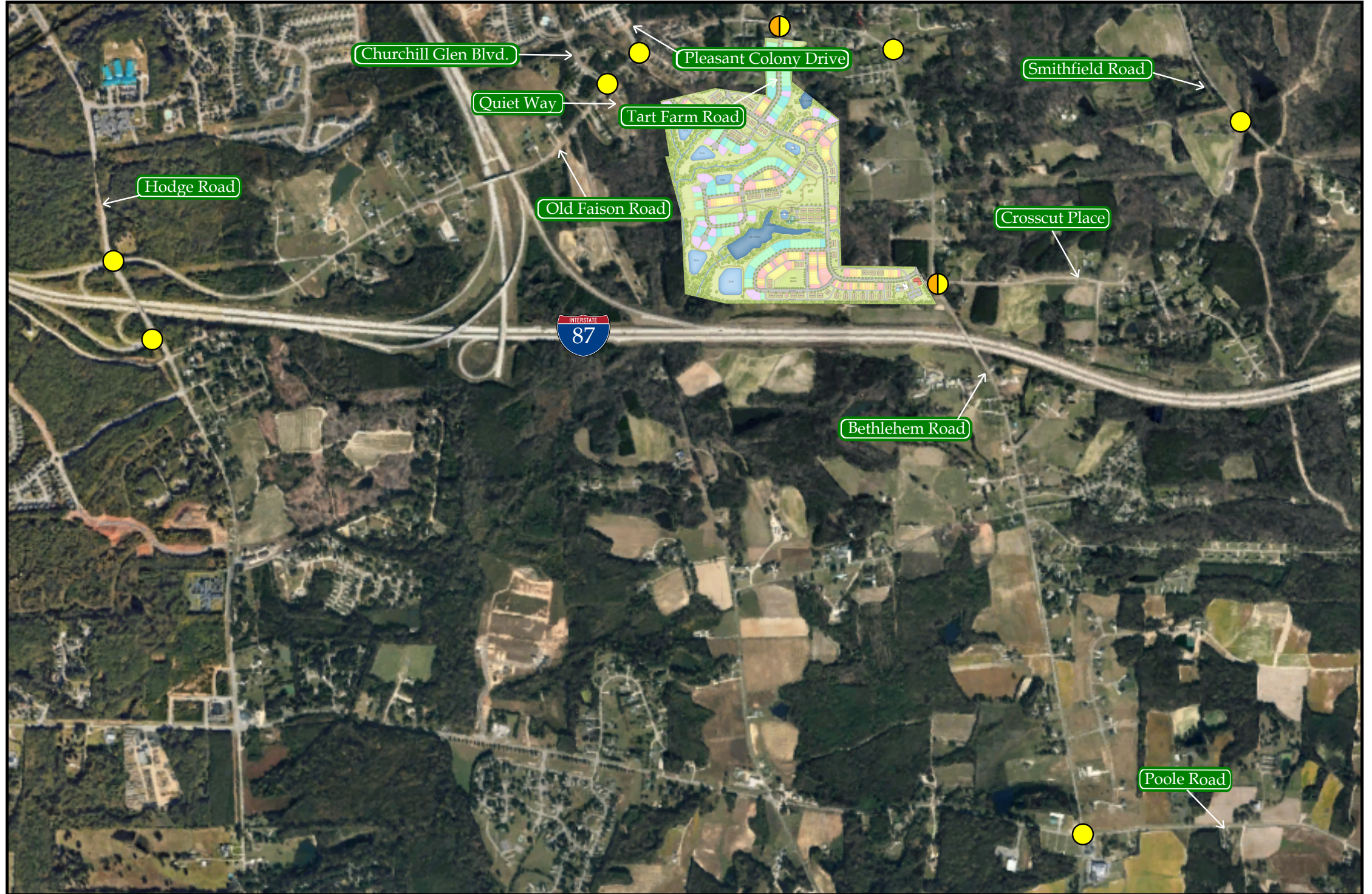
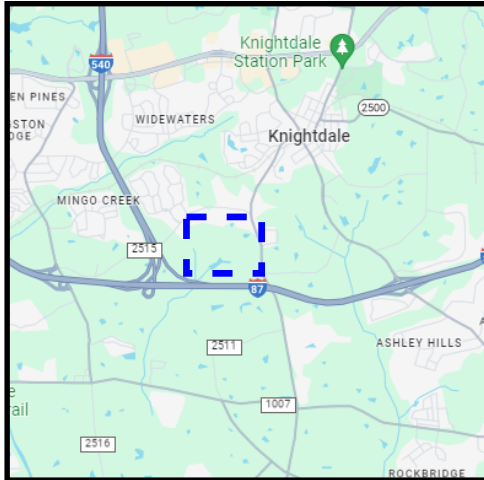
Table 1: Existing Roadway Inventory

Road Name	Route Number	Typical Cross Section	Speed Limit	2019 AADT (vpd)
I-495	I-495	8-lane divided	65 mph	88,500
Old Faison Road	SR 2515	2-lane undivided	45 mph	4,100**
Bethlehem Road	SR 5270	2-lane undivided	45 mph	6,400
Crosscut Place/Old Ferrell Road	SR 2512	2-lane undivided	45 mph	760**
Tart Farm Road	N/A	2-lane undivided	Not Posted	40***
Pleasant Colony Drive	N/A	2-lane undivided	25 mph	1,010***
Quiet Way	N/A	2-lane undivided	Not Posted	90***
Hodge Road	SR 2516	2-lane undivided	Not Posted	9,900
Poole Road	SR 1007	2-lane undivided	55 mph	4,600
Smithfield Road	SR 2233	2-lane undivided	45 mph	8,200




*ADT from 2021

**ADT from 2015

***ADT based on the traffic counts from 2023 and assuming the weekday PM peak hour volume is 10% of the average daily traffic.



LEGEND

-  Study Intersection
-  Proposed Site Access
-  Study Area

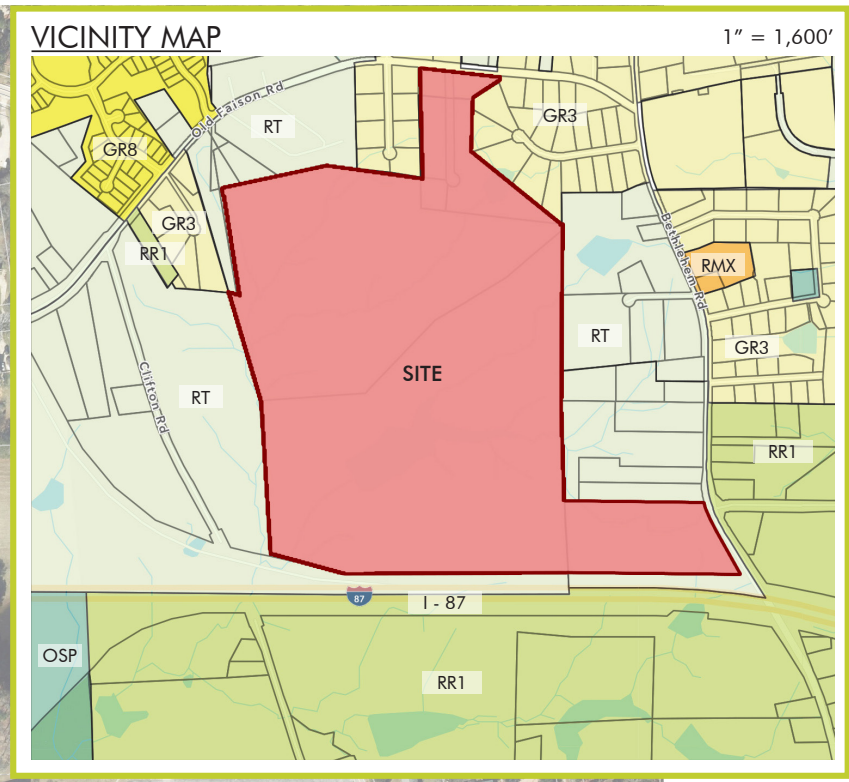
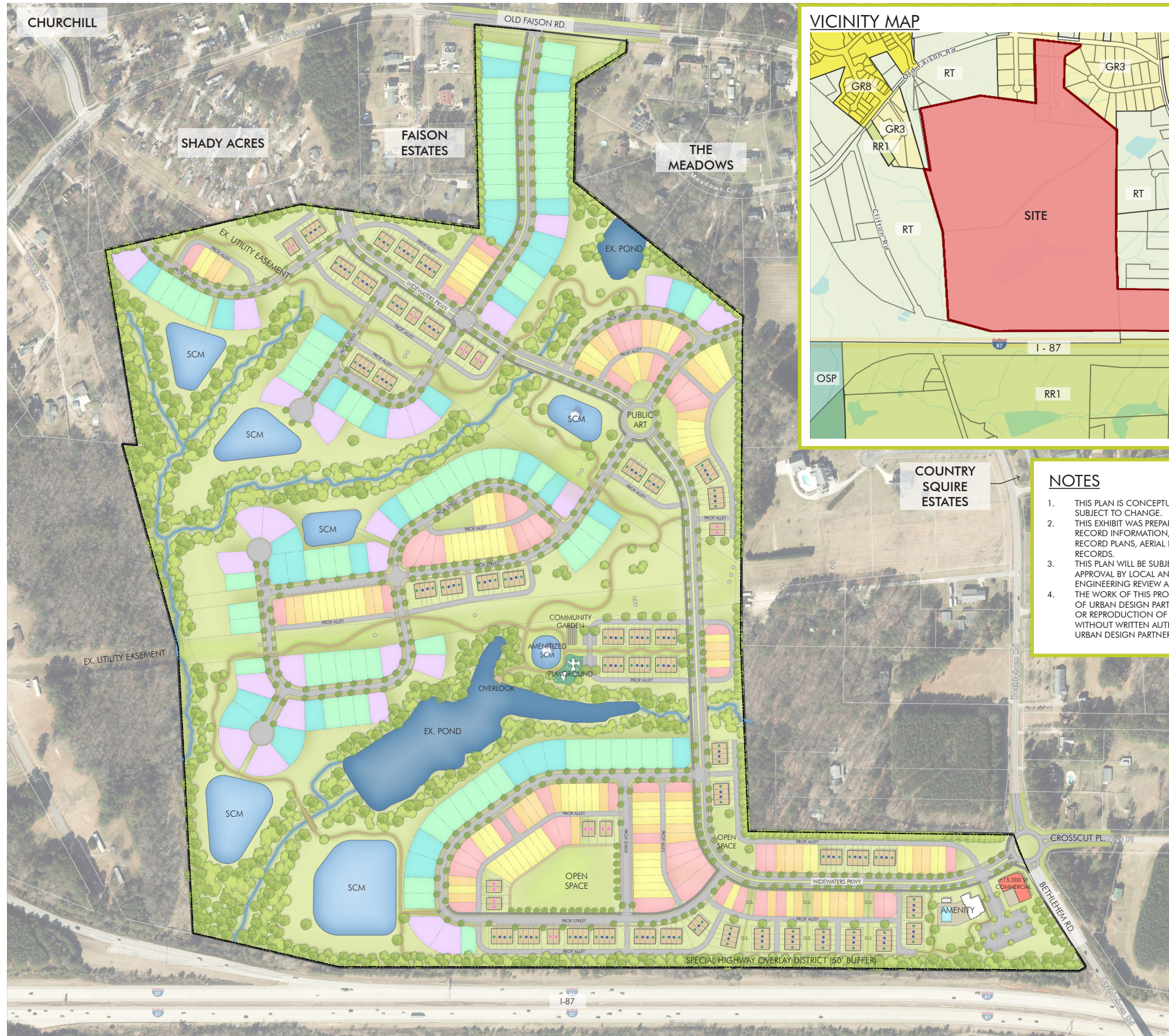



RKA
RAMEY KEMP ASSOCIATES

Lyndon Oaks
Knightdale, NC

Site Location Map

Scale: Not to Scale	Figure 1
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NOTES

1. THIS PLAN IS CONCEPTUAL IN NATURE AND IS SUBJECT TO CHANGE.
2. THIS EXHIBIT WAS PREPARED USING AVAILABLE RECORD INFORMATION, ALTA SURVEY, GIS MAPS, RECORD PLANS, AERIAL IMAGERY, AND LAND RECORDS.
3. THIS PLAN WILL BE SUBJECT TO REVIEW AND APPROVAL BY LOCAL AND STATE PLANNING AND ENGINEERING REVIEW AGENCIES.
4. THE WORK OF THIS PRODUCT IS THE PROPERTY OF URBAN DESIGN PARTNERS, PLLC. NO USE OR REPRODUCTION OF THIS PLAN IS PERMITTED WITHOUT WRITTEN AUTHORIZATION FROM URBAN DESIGN PARTNERS, PLLC.

SITE DATA

ACRES:	± 171.88 AC TOTAL
PIN:	1753-15-2116, 1743-95-3683, 1743-97-1085, 1743-98-6356, 1743-98-9384, 1753-07-1583, 1743-97-6575
EXISTING ZONING:	RT
PROPOSED ZONING:	PUD
BASE DISTRICT:	GR8

DEVELOPMENT SUMMARY

COMMERCIAL:	± 15,000 SF
RESIDENTIAL:	
FRONT-LOADED (SINGLE FAM. DETACHED)	
60' LOTS	75 DU (15.0%)
70' LOTS	33 DU (6.6%)
80' LOTS	26 DU (5.2%)
REAR-LOADED (SINGLE FAM. DETACHED)	
30' LOTS	77 DU (15.4%)
35' LOTS	47 DU (9.4%)
40' LOTS	50 DU (10.0%)
TOWNHOMES (REAR-LOADED)	
20' UNITS	84 DU (16.8%)
22' UNITS	88 DU (17.6%)
24' UNITS	20 DU (4.0%)
TOTAL:	500 DU
REQ. PARKING (MINIMUM):	
• SINGLE FAMILY	616 SPACES
• TOWNHOMES	384 SPACES
• COMMERCIAL	53 SPACES
» EV	2 SPACES
» BICYCLE	2 SPACES
REQ. OPEN SPACE:	± 20.9 AC
500 DU x 3.5 BEDS =	1,750 BEDS
1,750 BEDS x 520sf =	910,000sf (20.9 AC)



LYNDON OAKS | SKETCH PLAN

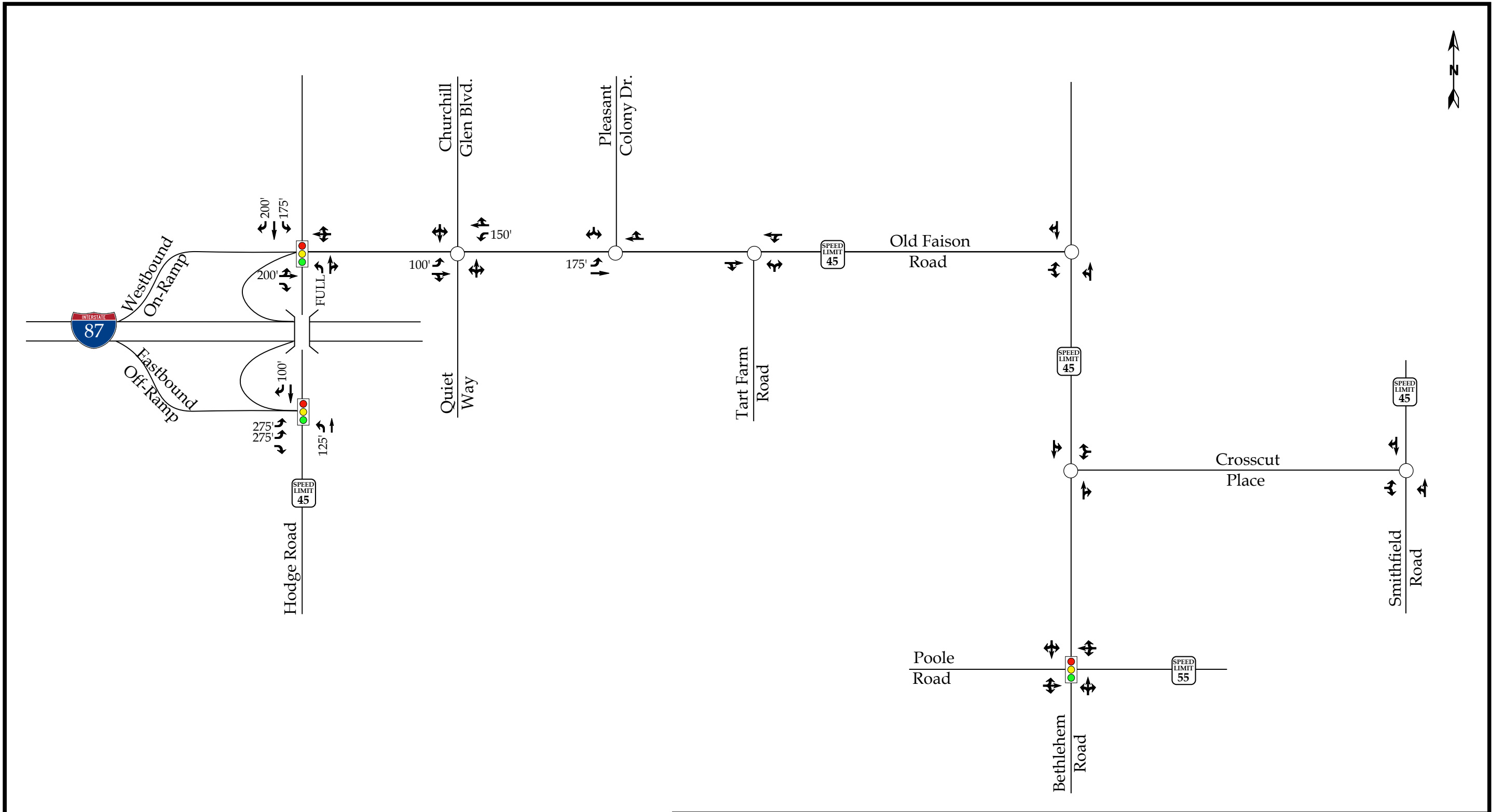
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22-RDU-083

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Lyndon Oaks
Knightdale, NC

2023 Existing
Lane Configurations

Scale: Not to Scale Figure 3

2. 2023 EXISTING PEAK HOUR CONDITIONS

2.1. 2023 Existing Peak Hour Traffic Volumes

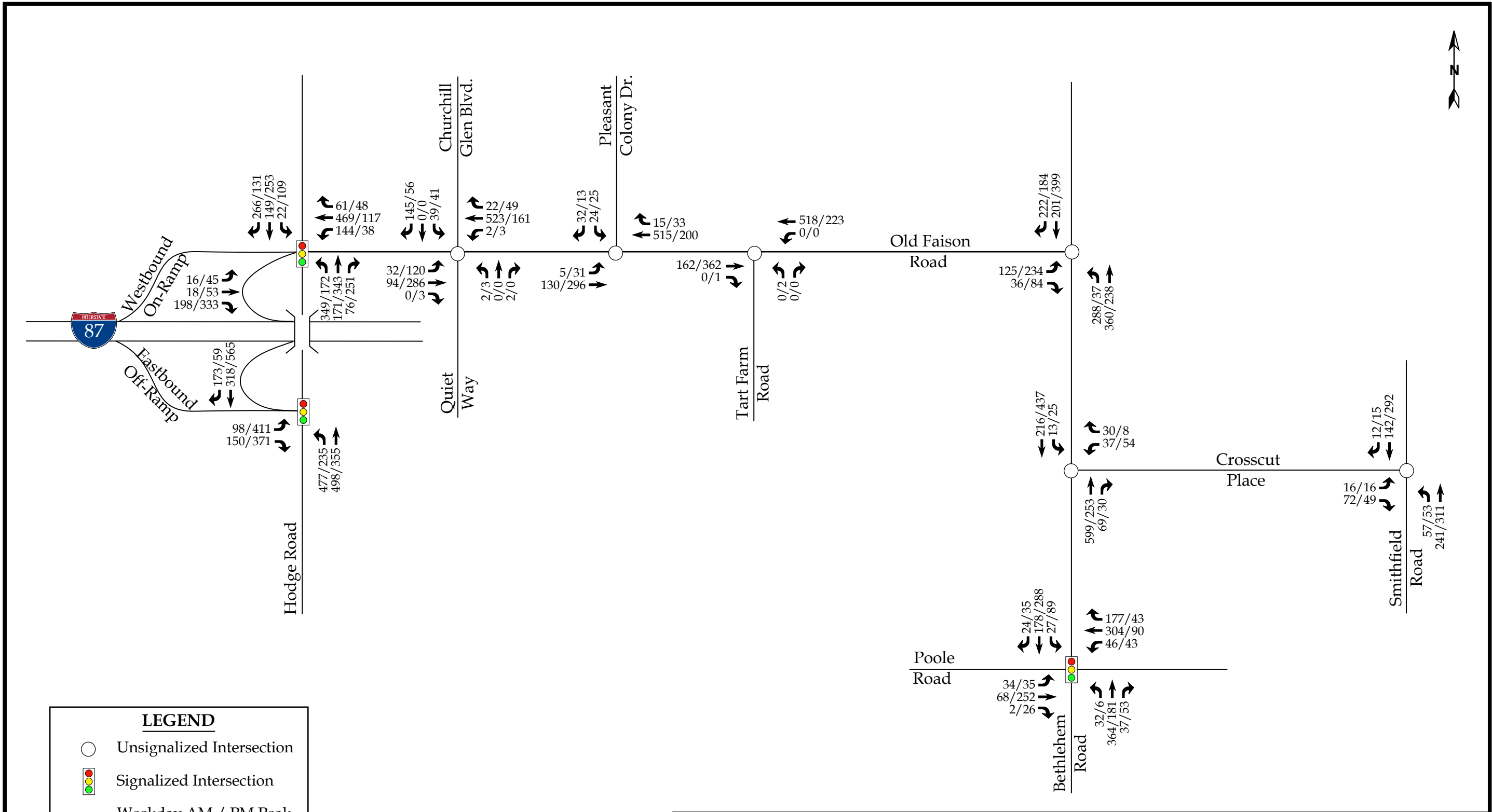
Existing peak hour traffic volumes were determined based on traffic counts conducted at the study intersections listed below, in April of 2023 by Quality Counts during a typical weekday AM (7:00 AM – 9:00 AM) and PM (4:00 PM – 6:00 PM) peak periods while schools were in session:

- Old Faison Road and Bethlehem Road
- Old Faison Road and Tart Farm Road
- Old Faison Road and Pleasant Colony Drive
- Old Faison Road and Quiet Way
- Bethlehem Road and Crosscut Place
- US 64 EB Ramps and Hodge Road
- US 64 WB Ramps and Old Faison Road
- Smithfield Road and Old Ferrell Road
- Bethlehem Road and Poole Road

Weekday AM and PM traffic volumes were balanced between study intersections, where appropriate. Refer to Figure 4 for 2023 existing weekday AM and PM peak hour traffic volumes. A copy of the count data is located in Appendix B of this report.

2.2. Analysis of 2023 Existing Peak Hour Traffic Conditions

The 2023 existing weekday AM and PM peak hour traffic volumes were analyzed to determine the current levels of service at the study intersections under existing roadway conditions. Signal information was obtained from NCDOT and is included in Appendix C. The results of the analysis are presented in Section 7 of this report.



Note: Based on NCDOT Congestion Management guidelines, a volume of 4 vehicles per hour (vph) was analyzed for any movement with less than 4 vph.

	Lyndon Oaks Knightdale, NC	2023 Existing Peak Hour Traffic	
		Scale: Not to Scale	Figure 4

3. NO-BUILD PEAK HOUR CONDITIONS

In order to account for growth of traffic and subsequent traffic conditions at a future year, no-build traffic projections are needed. No-build traffic is the component of traffic due to the growth of the community and surrounding area that is anticipated to occur regardless of whether or not the proposed development is constructed. No-build traffic is comprised of existing traffic growth within the study area and additional traffic created as a result of adjacent approved developments.

3.1. Ambient Traffic Growth

Through coordination with NCDOT and the Town, it was determined that an annual growth rate of 3% would be used to generate 2032 projected weekday AM and PM peak hour traffic volumes. For the 2041 future analysis, a 1% growth rate was applied each year after the build +1 year analysis. Refer to Figure 5a for 2032 projected peak hour traffic and Figure 5b for 2041 projected peak hour traffic.

3.2. Adjacent Development Traffic

Through coordination with NCDOT and the Town, Riverview Commons should be considered as an approved adjacent development in this study. A residential development located near the Widewaters expansion that is not yet approved by NCDOT was also to be considered in the analysis. Site trips for this development were generated based off of methodology contained in the ITE *Trip Generation Manual*, 11th Edition then distributed based on the regional distributions for the proposed site., Table 2, on the following page, provides a summary of the adjacent developments.

Table 2: Adjacent Development Information

Development Name	Location	Build-Out Year	Land Use / Intensity	TIA Performed
Riverview Commons	North of Poole Road, west of Hodge Road	2023	364 dwelling units of apartments and 30 townhomes	Davenport
Widewaters Expansion	North of Old Faison Road, West of Woodfield Lane	Before 2032	257 single-family attached, 98 single-family attached	N/A

It should be noted that including trips from the above adjacent developments on top of an annually compounded growth rate is anticipated to provide conservative results in this area, as local development growth is the most impactful for more rural areas. Additionally, there is expected to be interaction between some of the adjacent developments and the proposed development based on the different land uses; however, no reduction in adjacent development trips was proposed to provide a conservative estimation of future traffic volumes. It should be noted that the adjacent developments were approved, during scoping, by NCDOT and the Town. Adjacent development trips are shown in Figure 6. Additional adjacent development information can be found in Appendix D.

3.3. Future Roadway Improvements

Based on coordination with NCDOT and the Town, State Transportation Improvement Program (STIP) project W-5705AK was to be included in all future analyses. STIP W-5705AK is expected to widen the westbound approach of Old Faison Road (at Hodge Road) to provide exclusive left and right turn lanes. Updated signal plans for the intersection of Hodge Road and Old Faison Road can be found in Appendix C showing the improvements proposed by W-5705AK.

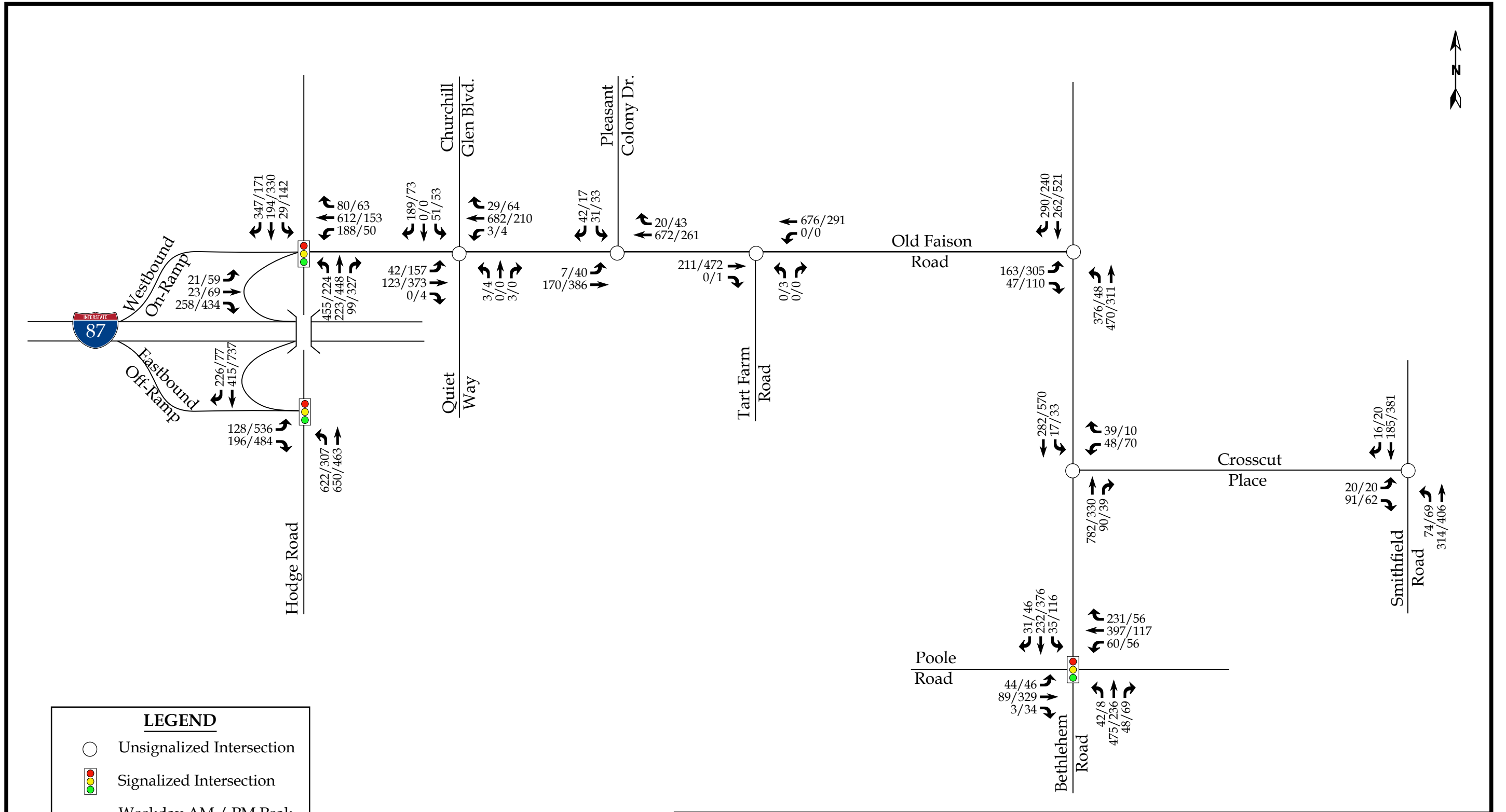
3.4. No-Build Peak Hour Traffic Volumes

The no-build traffic volumes were determined by projecting the 2023 existing peak hour traffic to the respective build year as discussed in section 3.1 and adding the adjacent

development trips. Refer to Figure 7a for an illustration of the 2032 no-build peak hour traffic volumes 7b for an illustration of the 2041 no-build peak hour traffic.

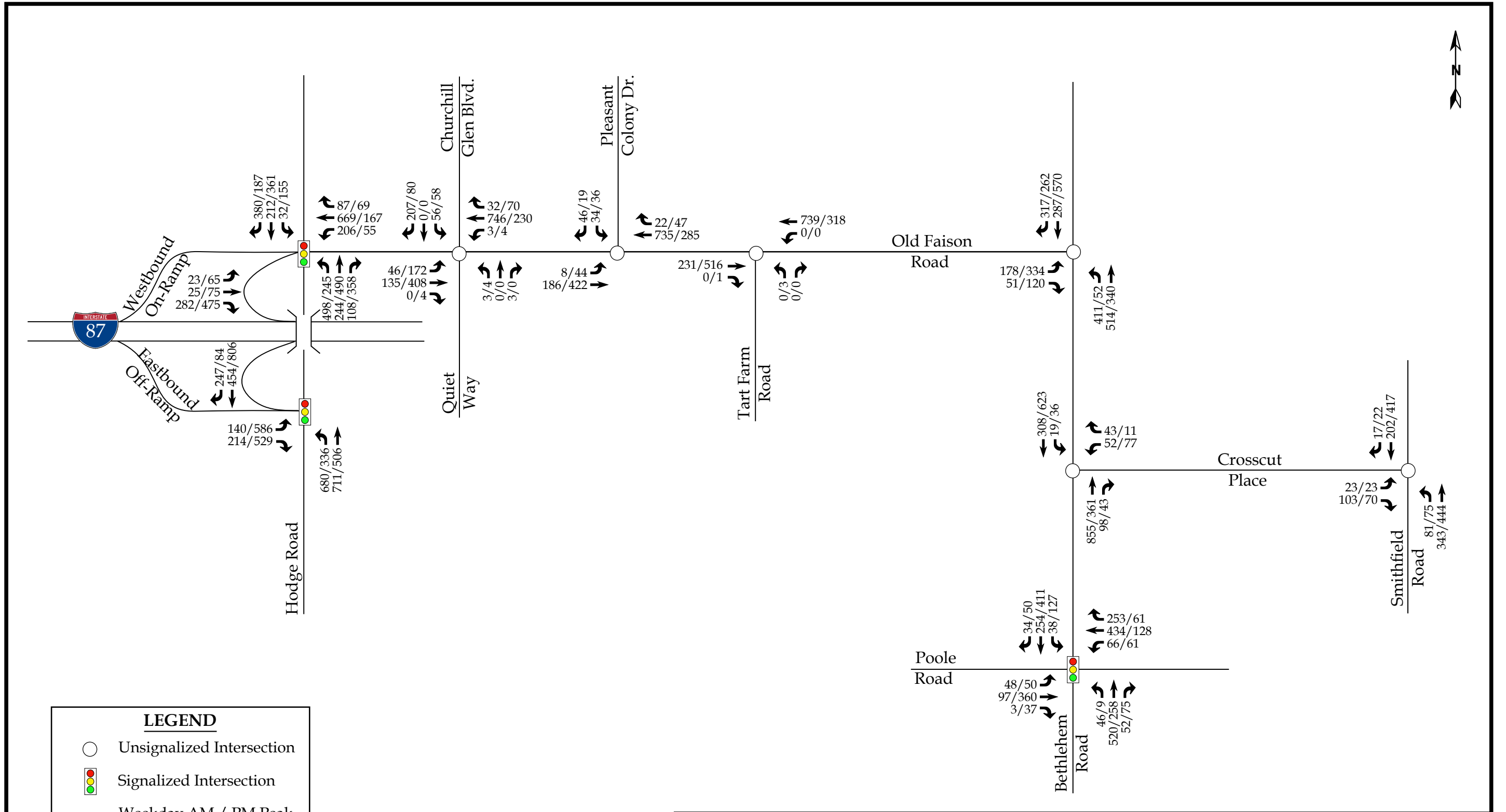
3.5. Analysis of- No-Build Peak Hour Traffic Conditions

The 2032 and 2041 no-build AM and PM peak hour traffic volumes at the study intersections were analyzed with future geometric roadway conditions and traffic control, including improvements required to be provided by the aforementioned adjacent developments, as well as STIP W-5705AK. The analysis results are presented in Section 7 of this report.



Note: Based on NCDOT Congestion Management guidelines, a volume of 4 vehicles per hour (vph) was analyzed for any movement with less than 4 vph.

	Lyndon Oaks Knightdale, NC	2032 Projected Peak Hour Traffic	
		Scale: Not to Scale	Figure 5a

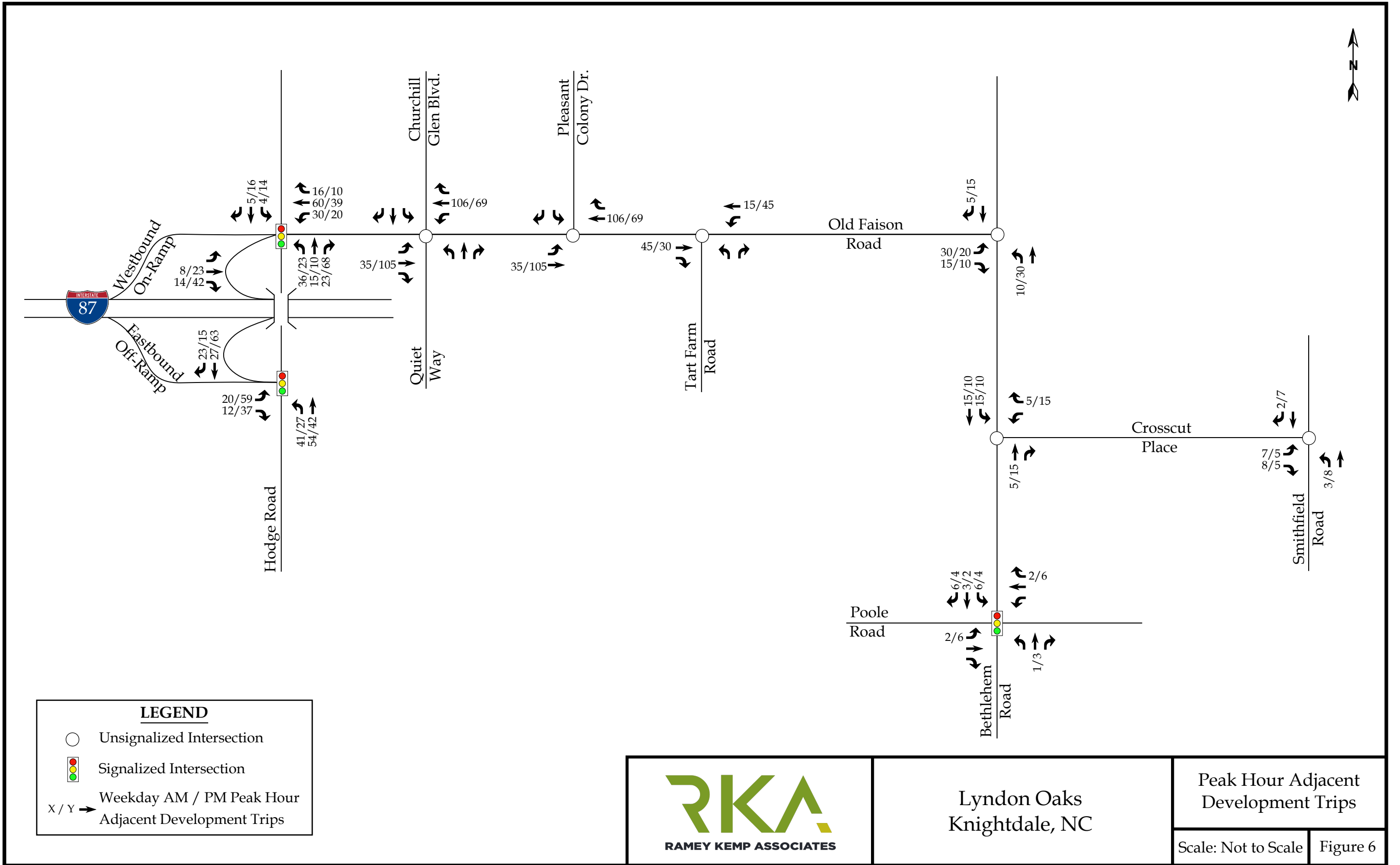


LEGEND

- Unsignalized Intersection
- 🚦 Signalized Intersection
- X / Y → Weekday AM / PM Peak Hour Traffic

Note: Based on NCDOT Congestion Management guidelines, a volume of 4 vehicles per hour (vph) was analyzed for any movement with less than 4 vph.

	<p>Lyndon Oaks Knightdale, NC</p>	<p>2041 Projected Peak Hour Traffic</p>
		<p>Scale: Not to Scale Figure 5b</p>

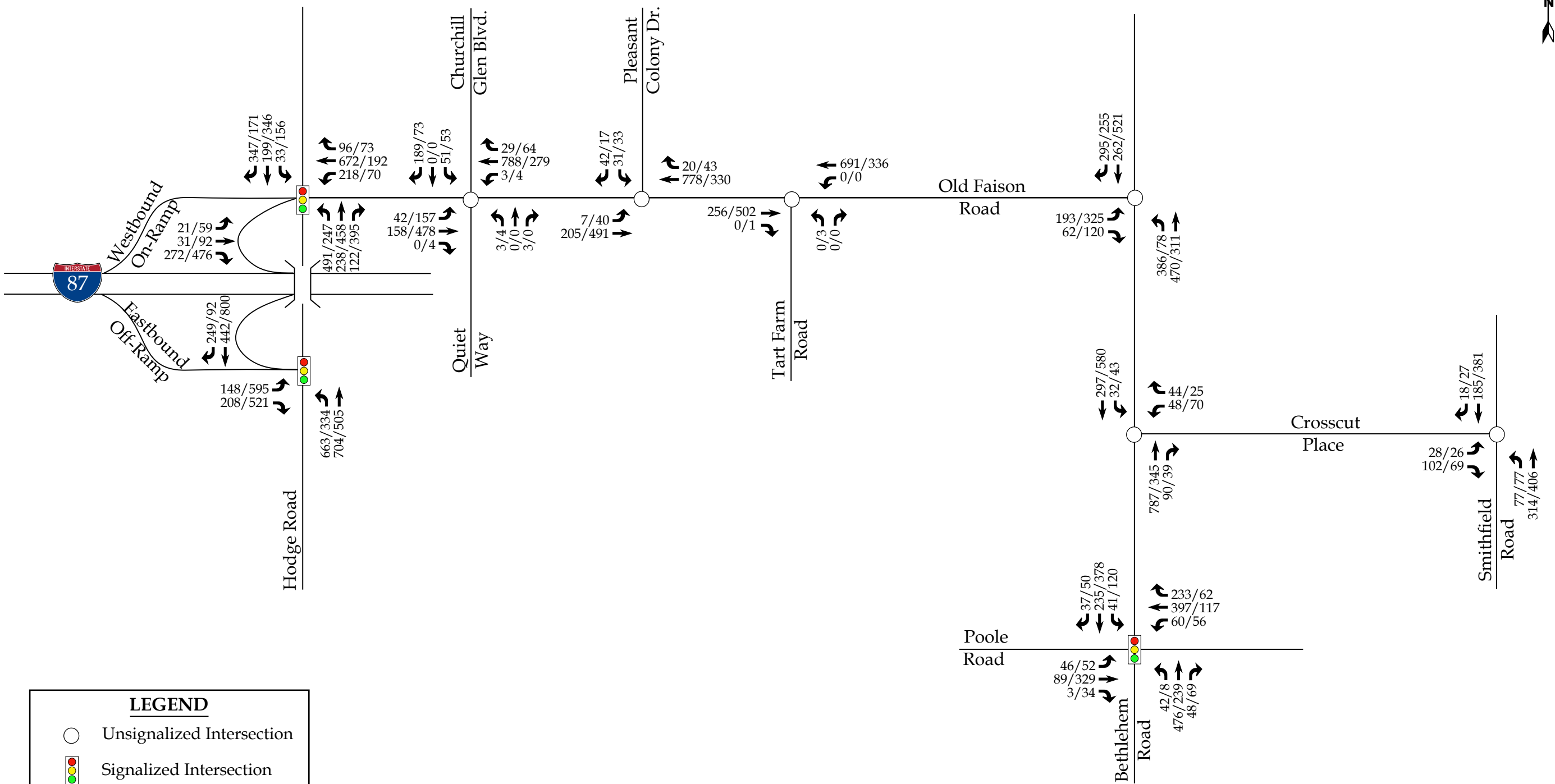
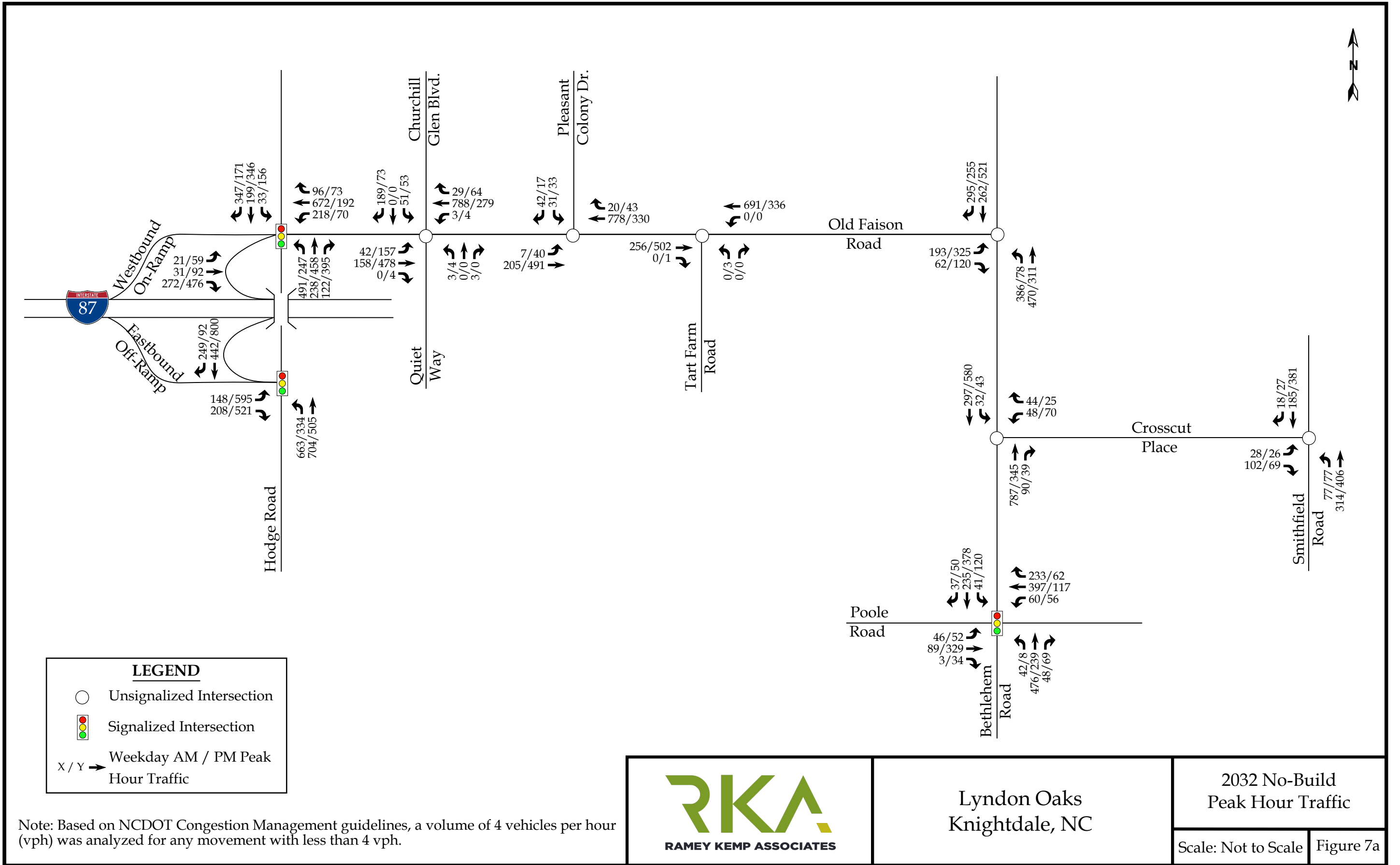


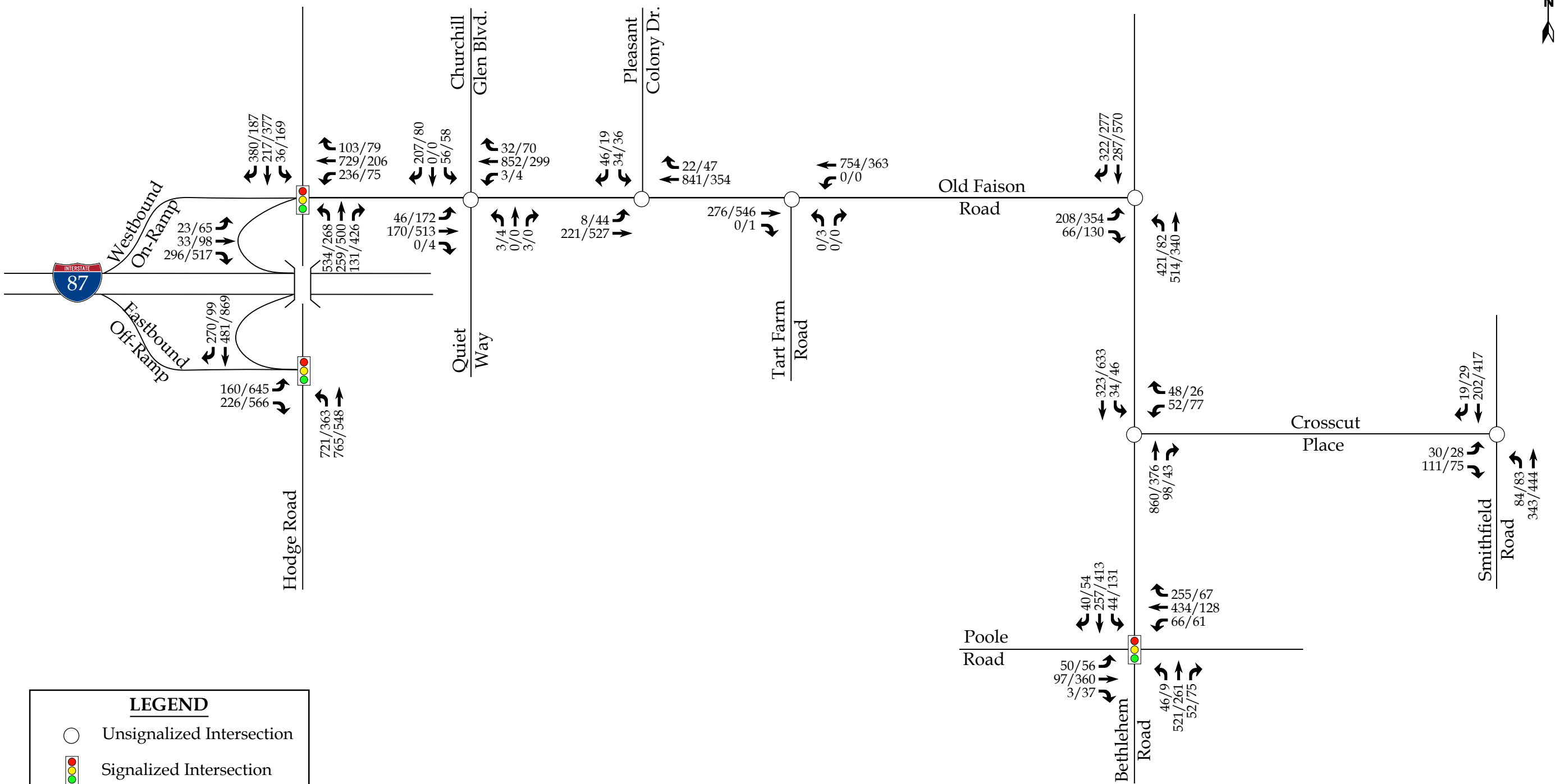
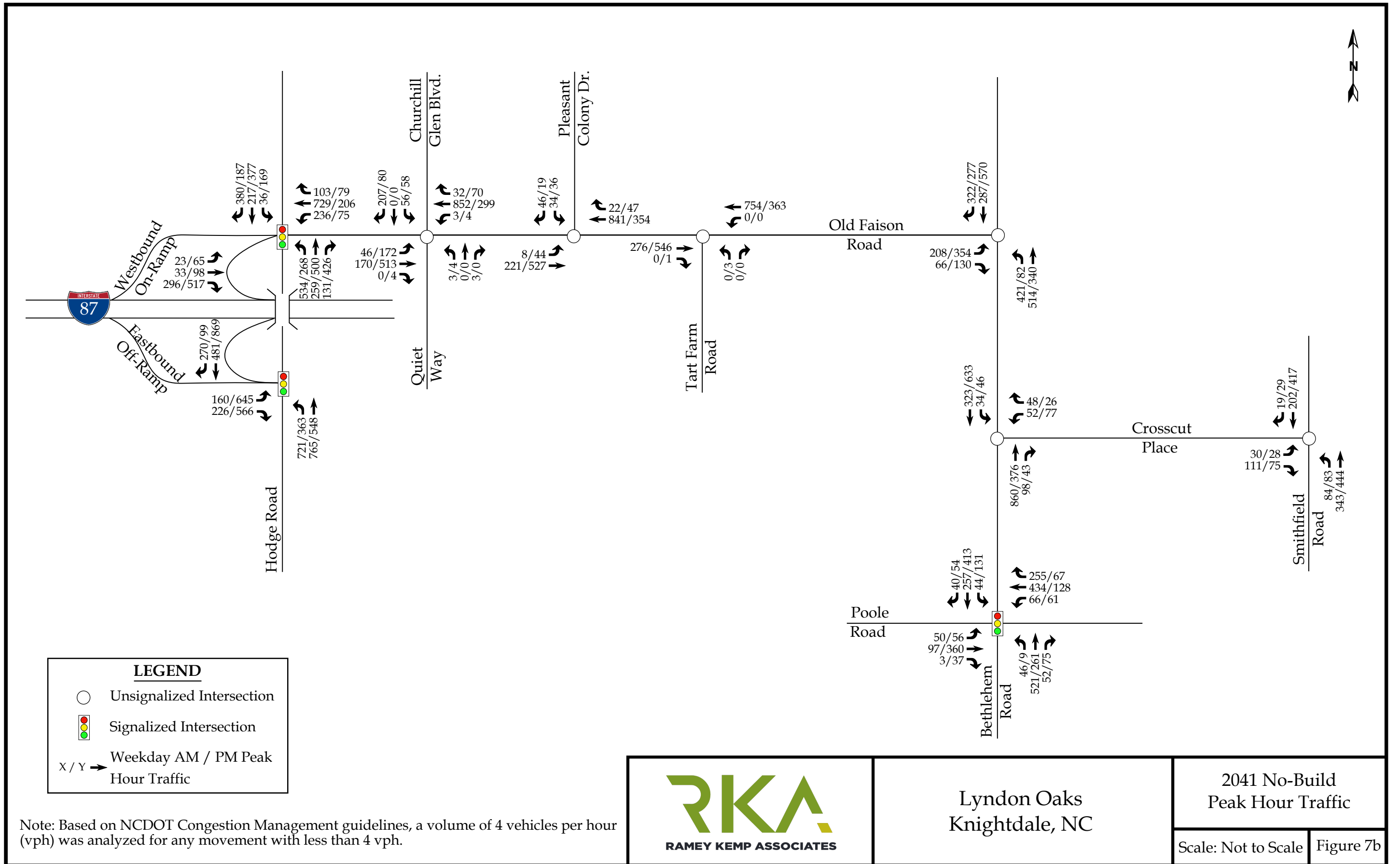
Lyndon Oaks
Knightdale, NC

Peak Hour Adjacent
Development Trips

Scale: Not to Scale

Figure 6





4. SITE TRIP GENERATION AND DISTRIBUTION

4.1. Trip Generation

Average weekday daily, AM peak hour, and PM peak hour trips for the proposed development were estimated using methodology contained within the ITE *Trip Generation Manual*, 11th Edition. Table 3 provides a summary of the trip generation potential for the site.

Table 3: Trip Generation Summary

Land Use (ITE Code)	Intensity	Daily Traffic (vpd)	Weekday AM Peak Hour Trips (vph)		Weekday PM Peak Hour Trips (vph)	
			Enter	Exit	Enter	Exit
Single-Family Detached (210)	308 DU	2,840	52	155	180	106
Townhomes (215)	192 DU	1,414	24	70	66	45
Strip Retail Plaza (822)	10 KSF	652	17	12	39	39
High-Turnover Restaurant (932)	5 KSF	536	26	22	28	17
Total Trips		5,442	119	259	313	207
<i>Internal Capture (7% AM & 6% PM)*</i>			-9	-17	-20	-13
Total External Trips			110	242	293	194
<i>Pass-By Trips</i>			-0	-0	-19	-19
Total Primary (New) Trips			110	242	274	175

*Utilizing methodology contained in the NCHRP Report 684.

It is estimated that the proposed development will generate approximately 5,442 total site trips during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 378 trips (119 entering and 259 exiting) will occur during the weekday AM peak hour and 520 (313 entering and 207 exiting) will occur during the weekday PM peak hour. However, not all trips generated are expected to be 'new' trips. A portion of the trips are expected to be captured internally (i.e. internal capture), while some trips are expected to be pulled from traffic that is already utilizing the adjacent roadway network (i.e. pass-by).

Internal capture of trips between the residential, retail, and restaurant uses was considered in this study. Internal capture is the consideration for trips that will be made within the site between different land uses, so the vehicle technically never leaves the internal site but can still be considered as a trip to that specific land use. Based on the National Collaborative Highway Research Program (NCHRP) Report 684 methodology under full build conditions, a weekday AM peak hour internal capture rate of 7% and a weekday PM peak hour internal capture rate of 6% was applied to the total trips. The internal capture reductions are expected to account for approximately 26 trips (9 entering and 17 exiting) during the weekday AM peak hour and 33 trips (20 entering and 13 exiting) during the weekday PM peak hour. Refer to Appendix A for scoping documentation containing the NCHRP 684 sheets for each peak hour.

Pass-by trips were also taken into consideration in this study. Pass-by trips are made by the traffic already using the adjacent roadway, entering the site as an intermediate stop on their way to another destination. Pass-by percentages are applied to site trips after adjustments for internal capture. Pass-by trips are expected to account for approximately 38 trips (19 entering and 19 exiting) during the weekday PM peak hour. It should be noted that the pass-by trips were balanced, as it is likely that these trips would enter and exit in the same hour.

The total primary (new) site trips are the calculated site trips after the reduction for internal capture and pass-by trips. Primary site trips are expected to account for approximately 352 trips (110 entering and 242 exiting) during the weekday AM peak hour and 449 trips (274 entering and 175 exiting) during the weekday PM peak hour under full build conditions.

4.2. Site Trip Distribution and Assignment

Trip distribution percentages used in assigning site traffic for this development were estimated based on a combination of existing traffic patterns, population centers adjacent to the study area, adjacent development traffic studies, and engineering judgment.

It is estimated that the residential site trips will be regionally distributed as follows:

- 40% to/from the west via I-87
- 15% to/from the east via I-87
- 10% to/from the north via Hodge Road
- 10% to/from the north via Bethlehem Road
- 5% to/from the north via Smithfield Road
- 5% to/from the south via Smithfield Road
- 5% to/from the south via Hodge Road
- 4% to/from the west via Poole Road
- 4% to/from the east via Poole Road
- 2% to/from the south via Bethlehem Road

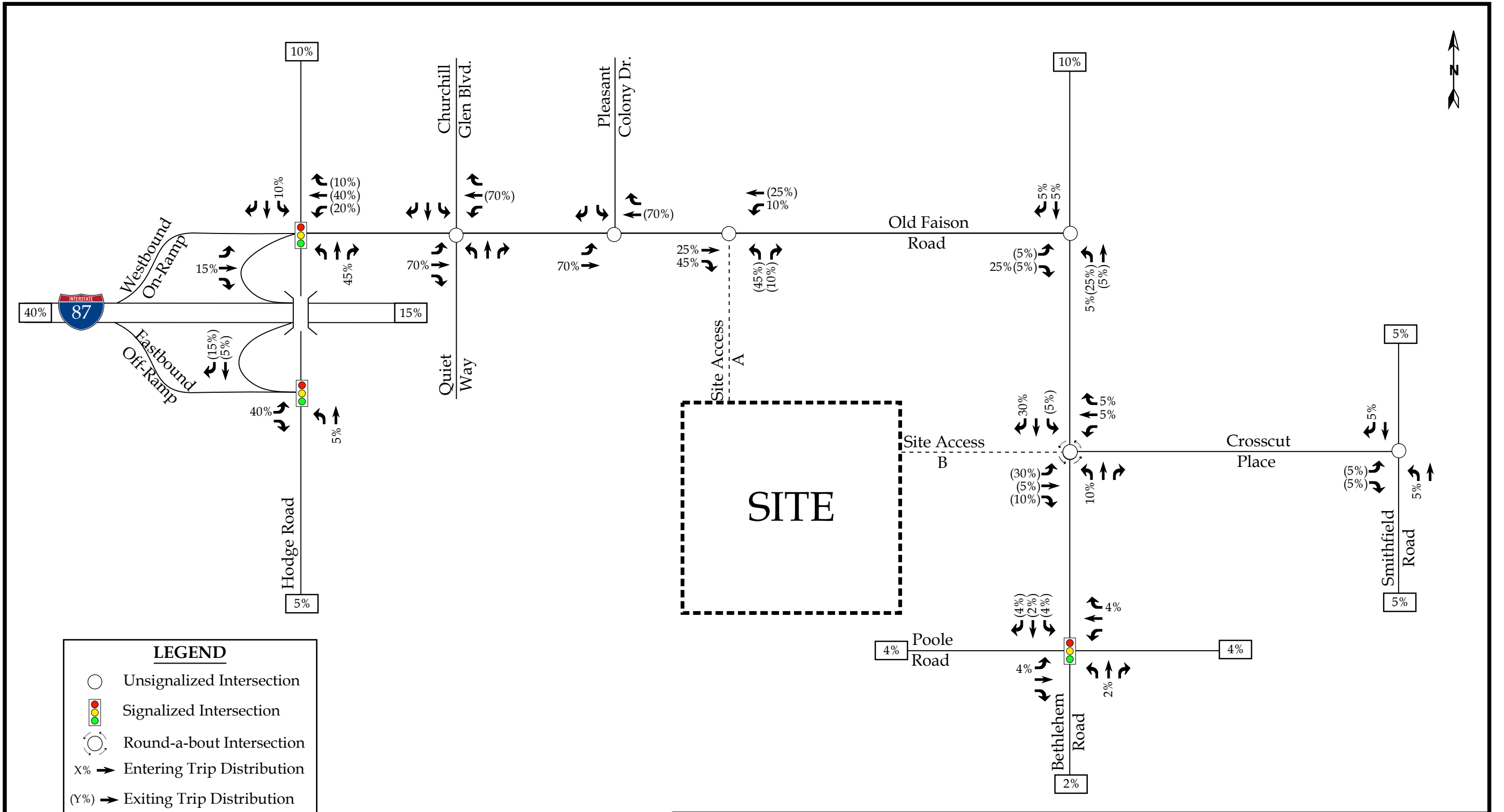
It is estimated that the commercial site trips will be regionally distributed as follows:

- 25% to/from the north via Bethlehem Road
- 20% to/from the west via I-87
- 15% to/from the east via I-87
- 10% to/from the north via Hodge Road
- 10% to/from the north via Smithfield Road
- 10% to/from the south via Smithfield Road
- 5% to/from the south via Hodge Road
- 2% to/from the west via Poole Road
- 2% to/from the east via Poole Road
- 1% to/from the south via Bethlehem Road

The residential site trip distribution is shown in Figure 8a, and the commercial site trip distribution is shown in Figure 8b. Refer to Figure 9a for the residential site trip assignment and Figure 9b for commercial site trip assignment.

The pass-by site trips were distributed based on existing traffic patterns with consideration given to the proposed driveway access and site layout. Refer to Figure 10 for the pass-by site trip distribution. Pass-by site trips are shown in Figure 11.

The total site trips were determined by adding the primary site trips and the pass-by site trips. Refer to Figure 12 for the total peak hour site trips at the study intersections.



LEGEND

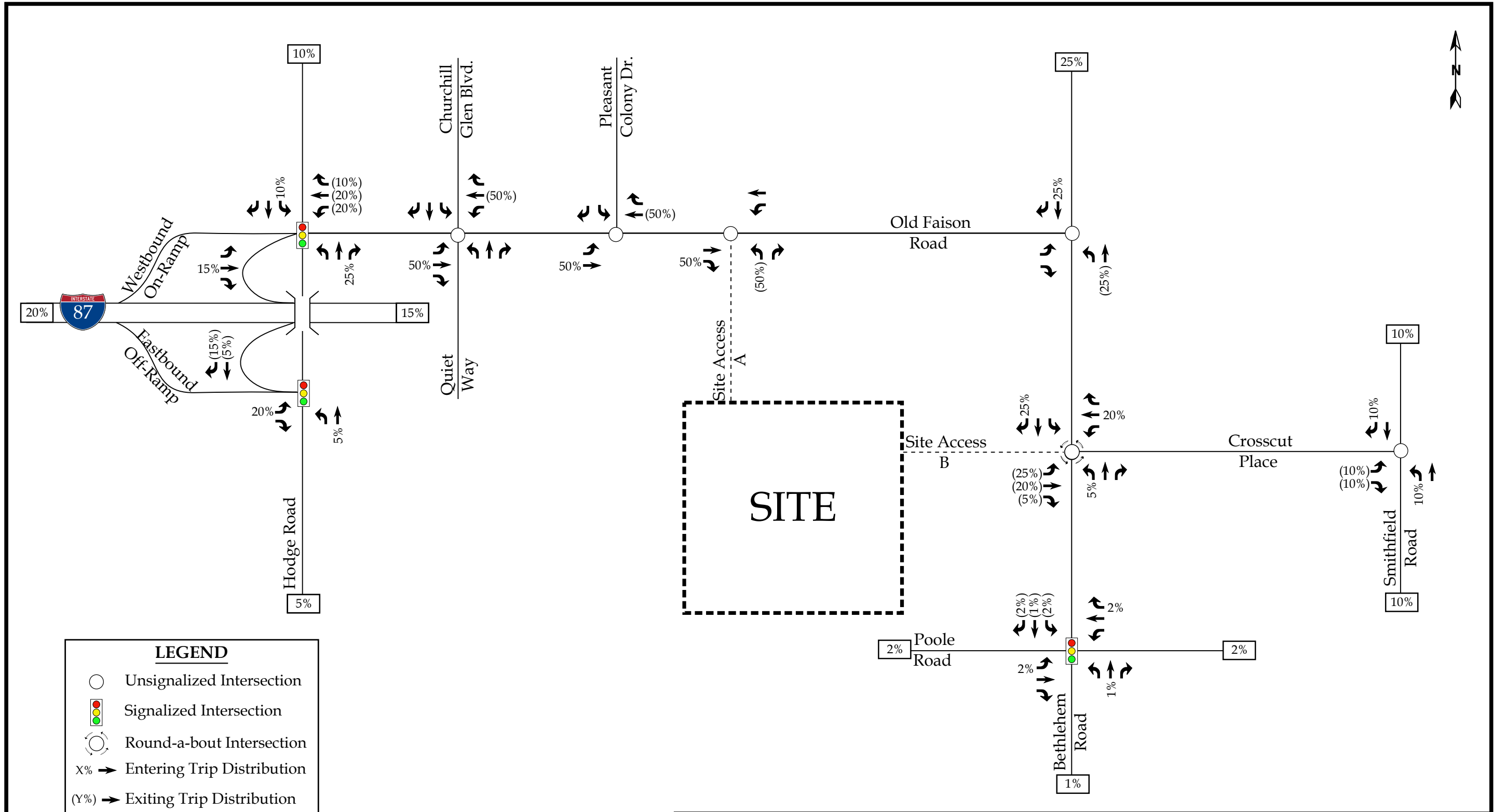
- Unsignalized Intersection
- ◫ Signalized Intersection
- ⊙ Round-a-bout Intersection
- X% → Entering Trip Distribution
- (Y%) → Exiting Trip Distribution
- ▭ XX% Regional Trip Distribution



Lyndon Oaks
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Site Trip Distribution
- Residential

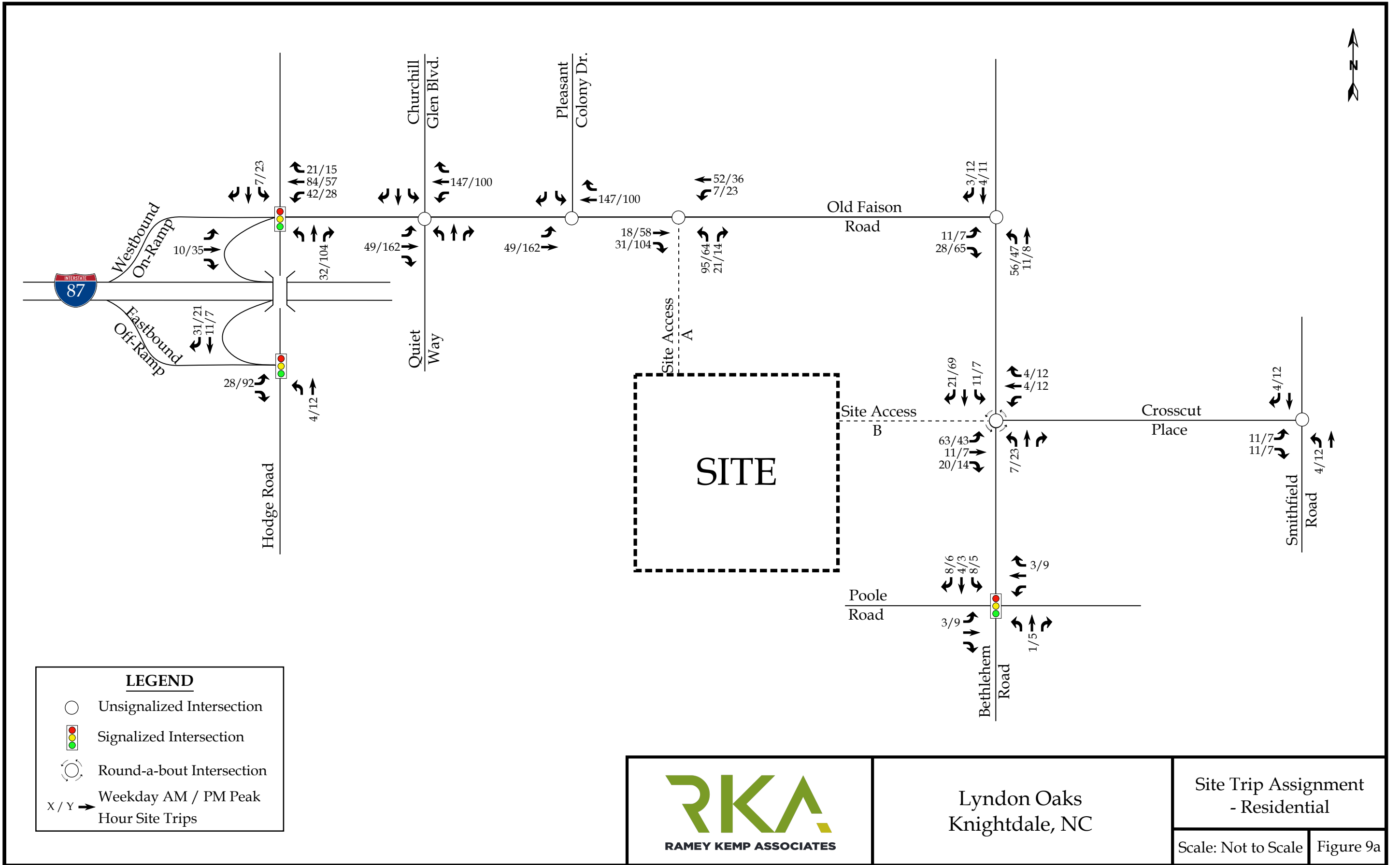
Scale: Not to Scale Figure 8a

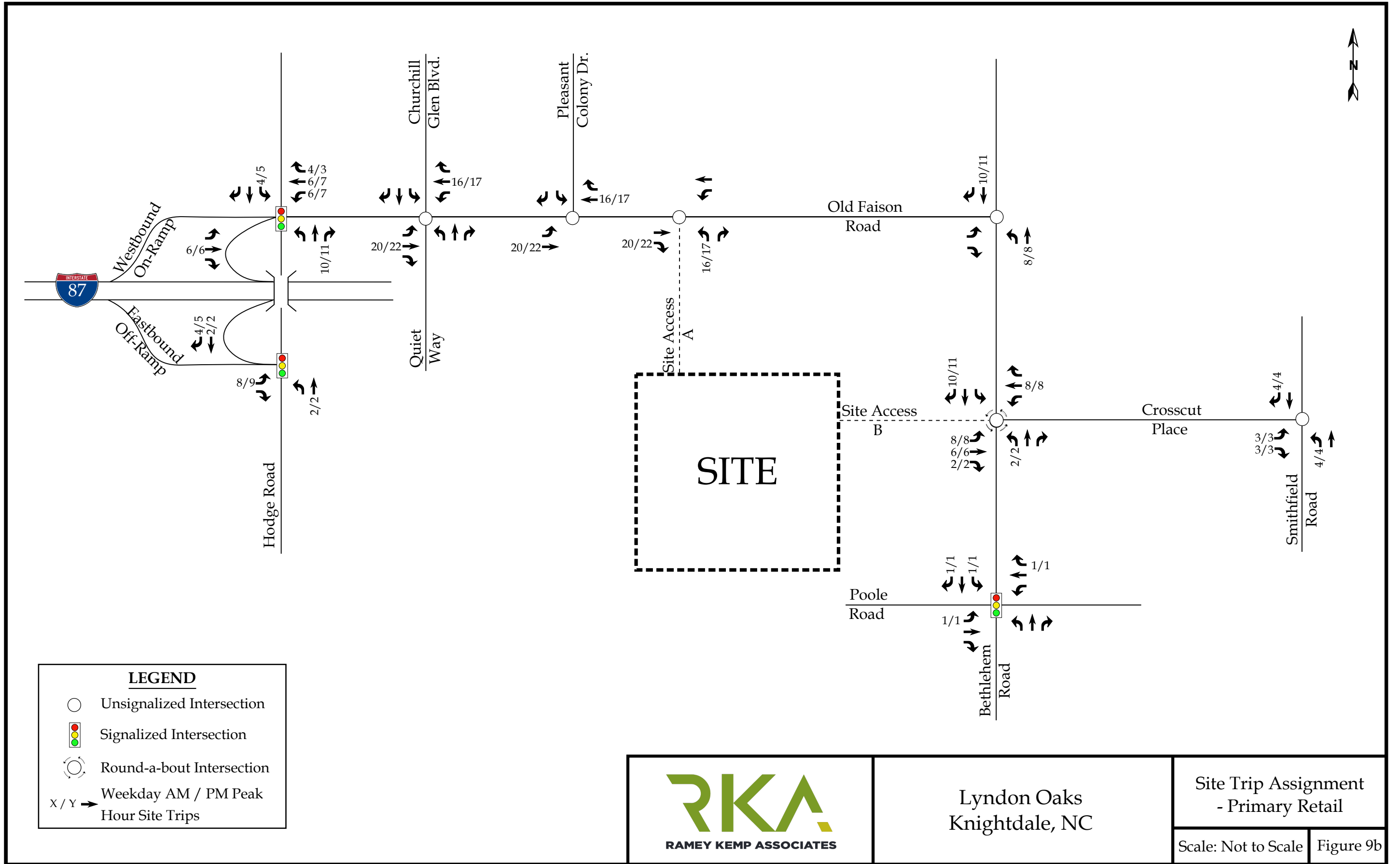


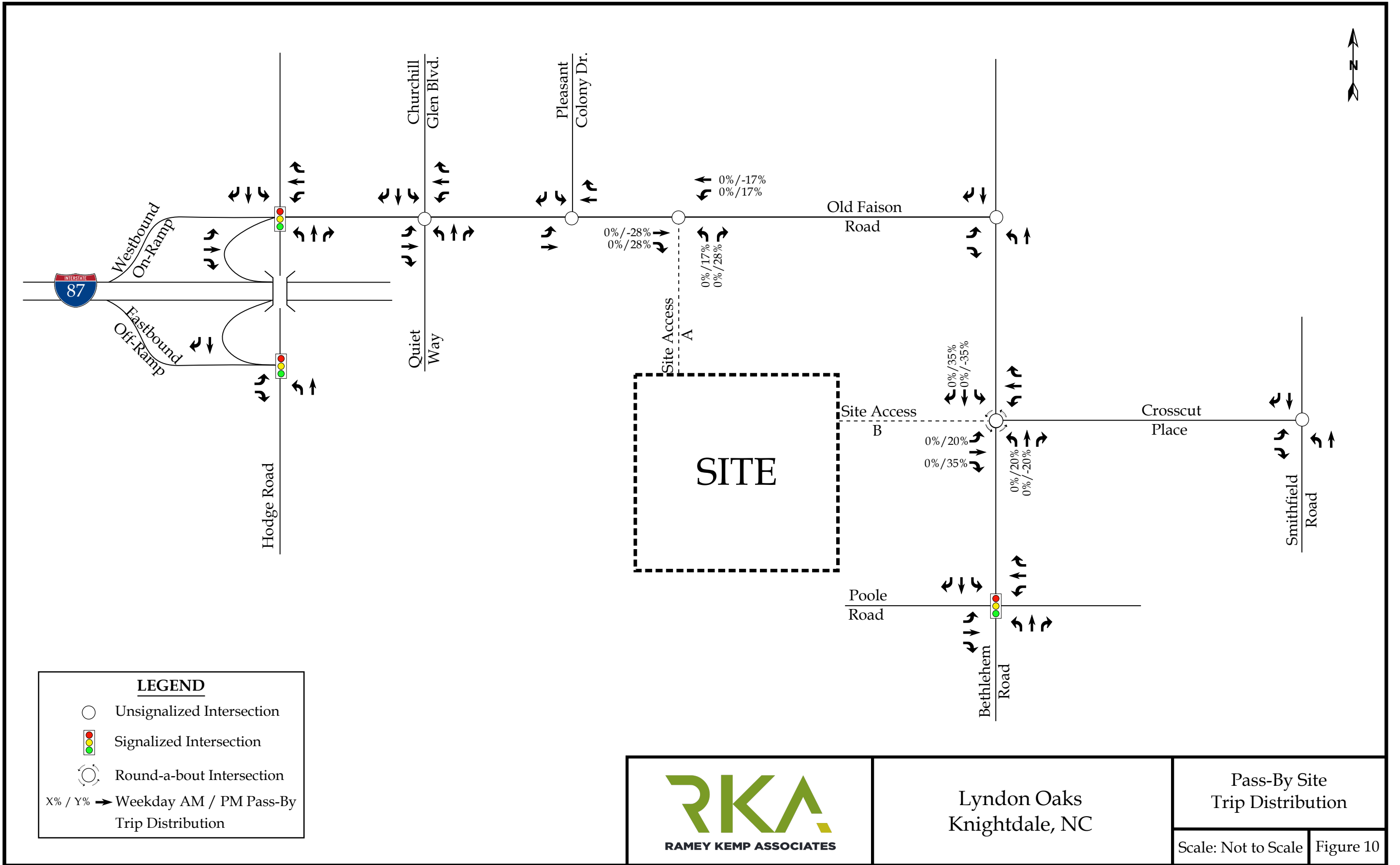
Lyndon Oaks
Knightdale, NC

Site Trip Distribution
- Retail/Restaurant

Scale: Not to Scale Figure 8b

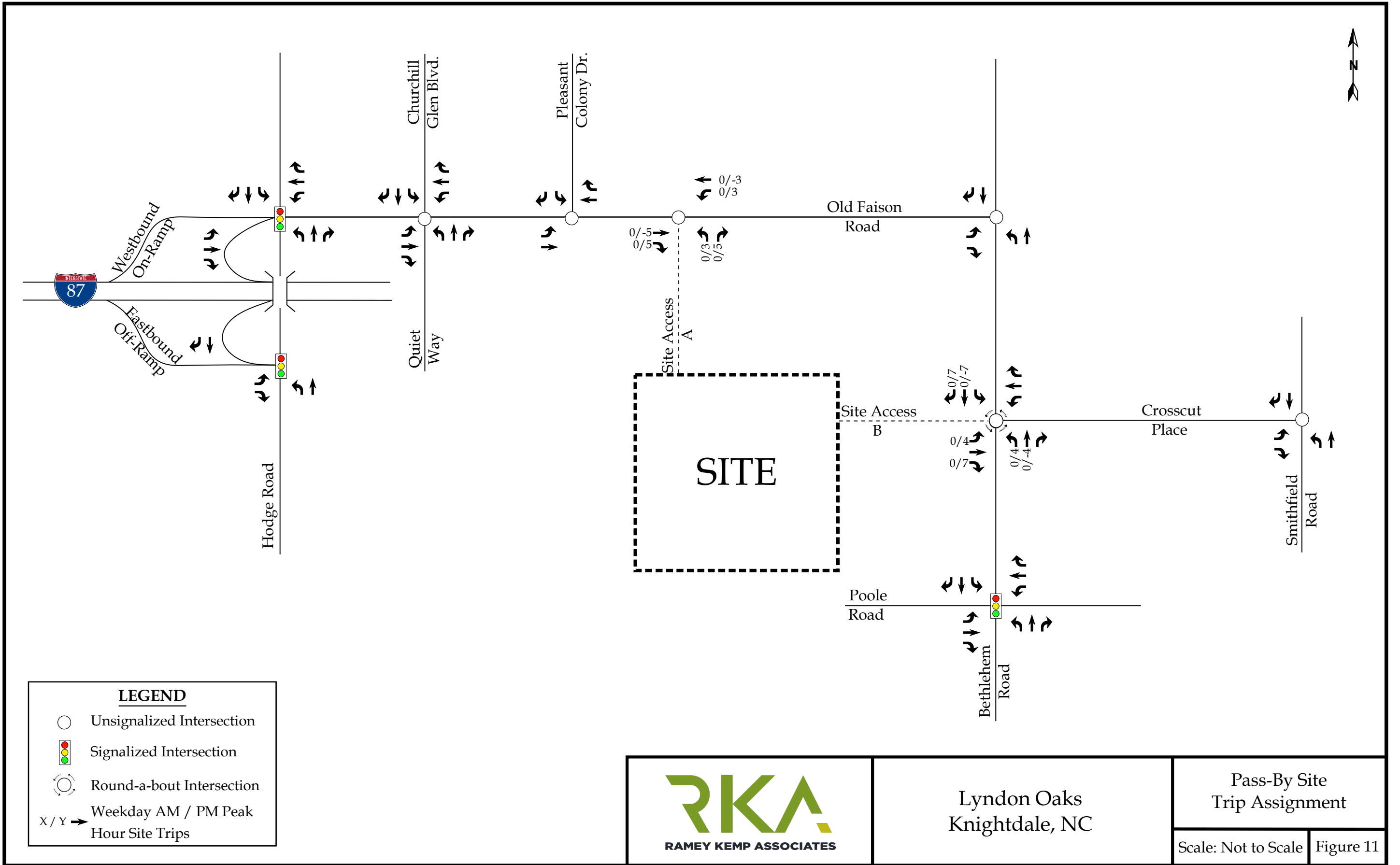


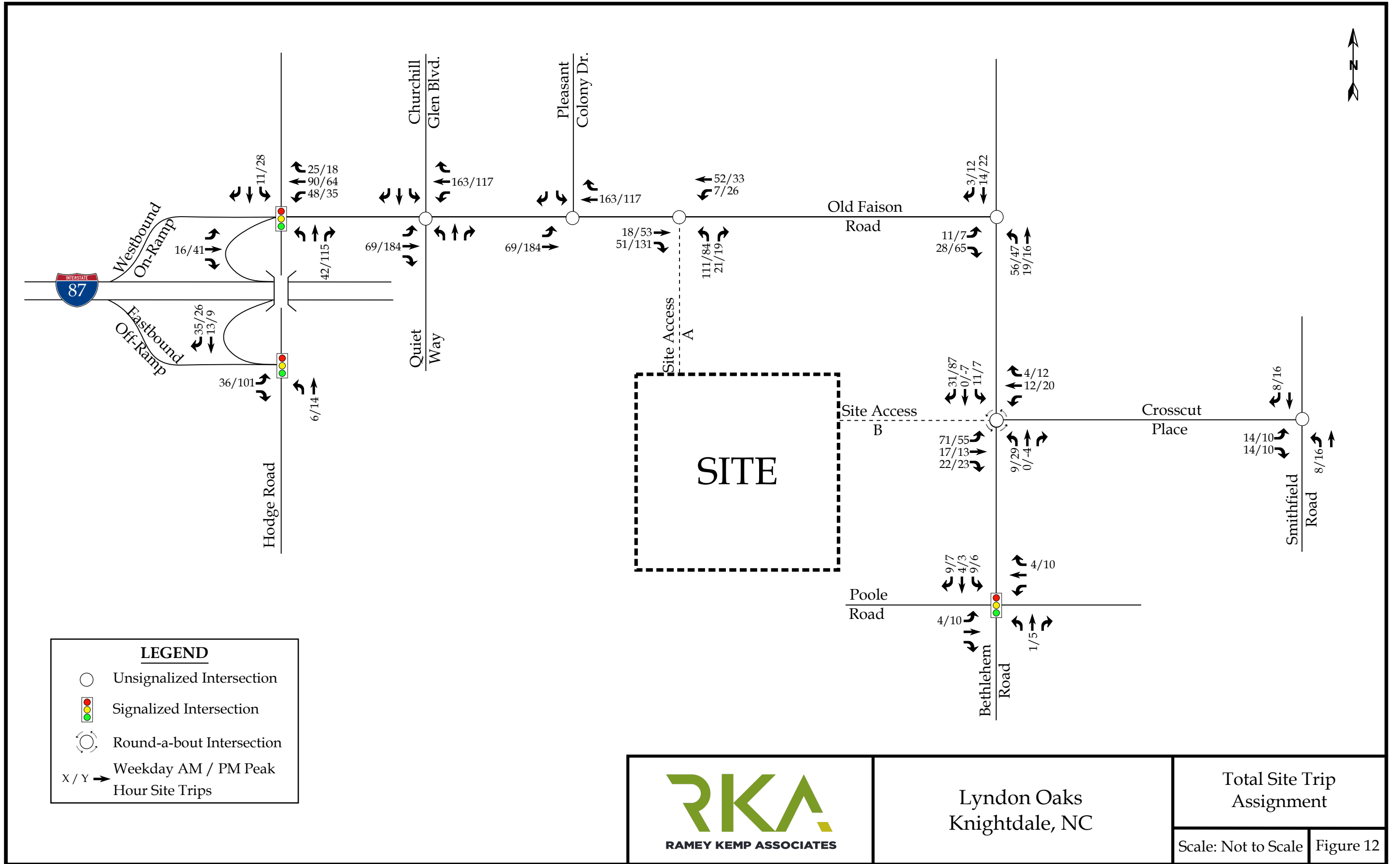




Lyndon Oaks
Knightdale, NC

Scale: Not to Scale Figure 10





Lyndon Oaks
Knightdale, NC

Total Site Trip
Assignment

Scale: Not to Scale

Figure 12

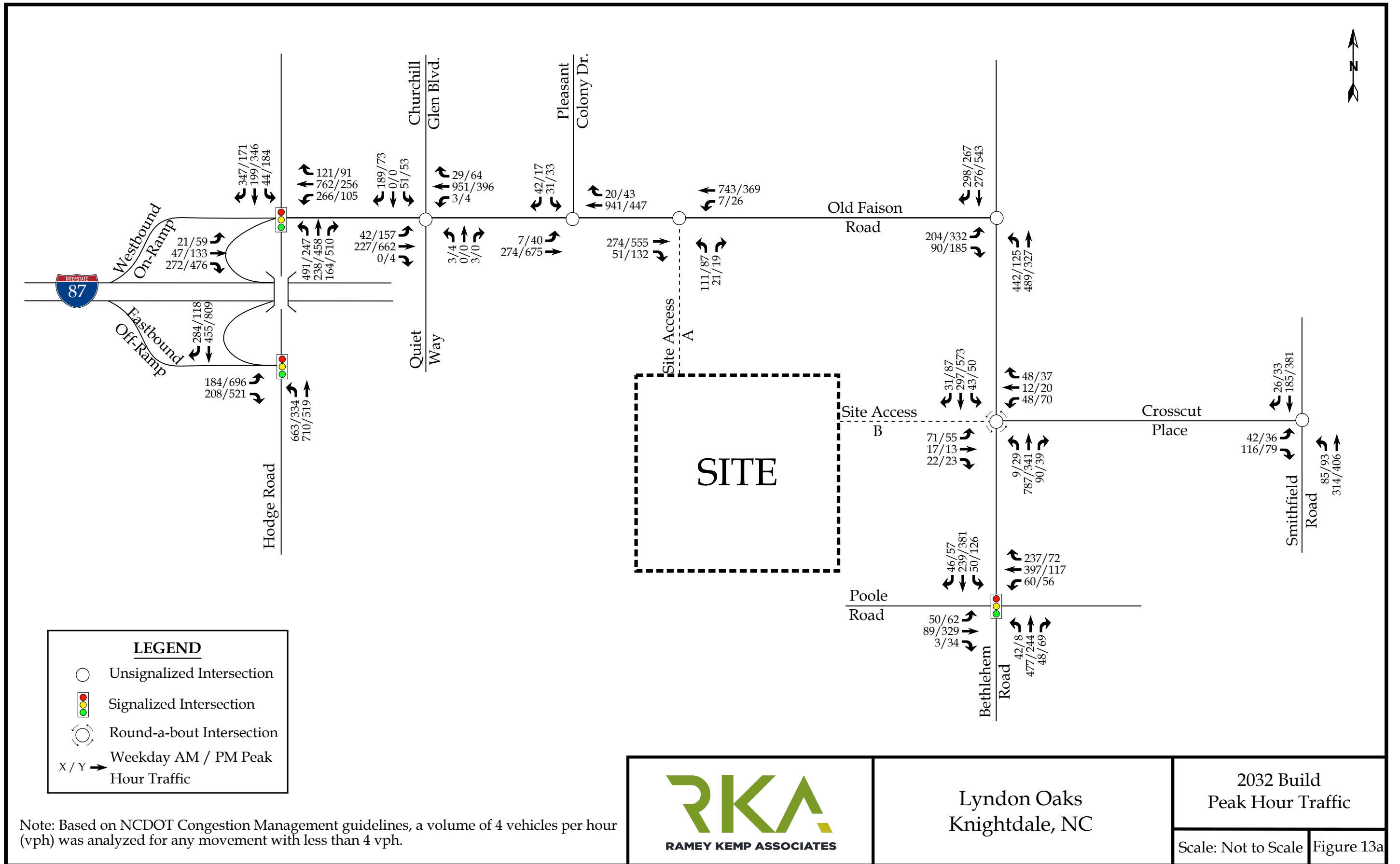
5. BUILD TRAFFIC CONDITIONS

5.1. Build Peak Hour Traffic Volumes

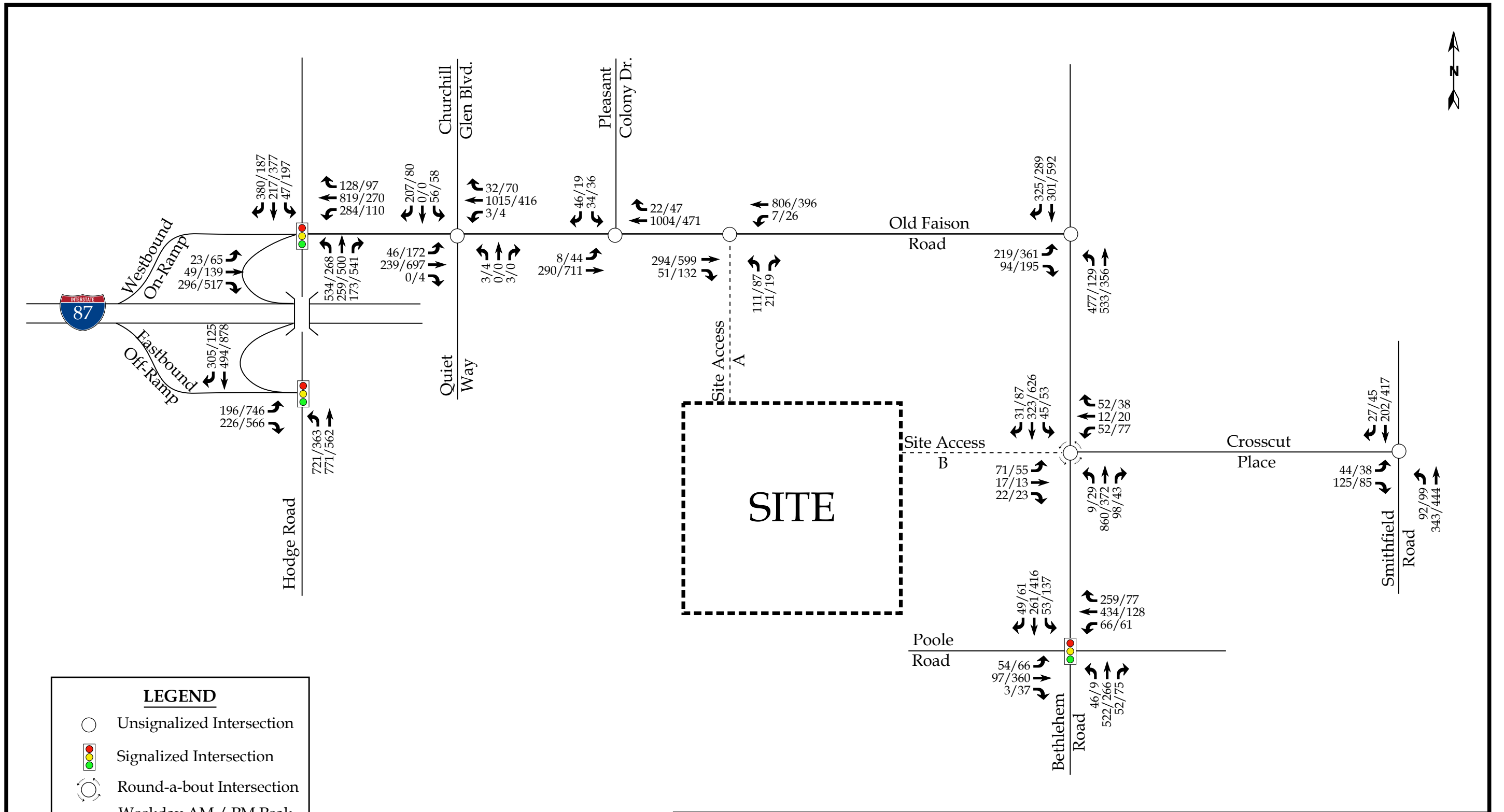
To estimate traffic conditions with the site fully built-out, the total site trips were added to the 2032 no-build traffic volumes and the 2041 no-build traffic volumes, respectively. Refer to Figure 13a for an illustration of the 2032 build peak hour traffic volumes with the proposed site fully developed and Figure 13b for an illustration of the 2041 build peak hour traffic volumes.

5.2. Analysis of Build Peak Hour Traffic Conditions

Study intersections were analyzed with the 2032/2041 build traffic volumes using the same methodology previously discussed for the no-build traffic conditions. Intersections were analyzed with improvements necessary to accommodate future traffic volumes. The results of the capacity analysis for each intersection are presented in Section 7 of this report.



Note: Based on NCDOT Congestion Management guidelines, a volume of 4 vehicles per hour (vph) was analyzed for any movement with less than 4 vph.



LEGEND

- Unsignalized Intersection
- 🚦 Signalized Intersection
- ⦿ Round-a-bout Intersection
- X / Y → Weekday AM / PM Peak Hour Traffic

Note: Based on NCDOT Congestion Management guidelines, a volume of 4 vehicles per hour (vph) was analyzed for any movement with less than 4 vph.

	<p>Lyndon Oaks Knightdale, NC</p>	<p>2041 Build Peak Hour Traffic</p>
		<p>Scale: Not to Scale Figure 13b</p>

6. TRAFFIC ANALYSIS PROCEDURE

Study intersections were analyzed using the methodology outlined in the *Highway Capacity Manual* (HCM), 6th Edition published by the Transportation Research Board. Capacity and level of service are the design criteria for this traffic study. A computer software package, Synchro (Version 10.3), was used to complete the analyses for the study area intersections. Please note that the unsignalized capacity analysis does not provide an overall level of service for an intersection; only delay for an approach with a conflicting movement. The software package SIDRA INTERSECTION 9 was utilized for all roundabout analysis. For roundabout intersections, Sidra provides LOS calculations for all approaches and an overall resulting LOS. Synchro capacity analysis results for unsignalized intersections do not provide an overall LOS, but rather a LOS for movements approaches that have a conflicting movement.

The HCM defines capacity as “the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.” Level of service (LOS) is a term used to represent different driving conditions, and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers.” Level of service varies from Level “A” representing free flow, to Level “F” where breakdown conditions are evident. Refer to Table 4 for HCM levels of service and related average control delay per vehicle for both signalized and unsignalized intersections. Control delay as defined by the HCM includes “initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay”. An average control delay of 50 seconds at a signalized intersection results in LOS “D” operation at the intersection.

Table 4: Highway Capacity Manual – Levels-of-Service and Delay

UNSIGNALIZED/ROUNDBOUT INTERSECTION		SIGNALIZED INTERSECTION	
LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)	LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)
A	0-10	A	0-10
B	10-15	B	10-20
C	15-25	C	20-35
D	25-35	D	35-55
E	35-50	E	55-80
F	>50	F	>80

6.1. Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the NCDOT Congestion Management Guidelines.

7. CAPACITY ANALYSIS

7.1. Old Faison Road and Bethlehem Road

The existing unsignalized intersection was analyzed under all traffic conditions with the lane configurations and traffic control shown in Table 5. Refer to Table 5 for a summary of the analysis results. Refer to Appendix E for the Synchro capacity analysis reports.

Table 5: Analysis Summary of Old Faison Road and Bethlehem Road

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	F ² A ¹ --	N/A	F ² A ¹ --	N/A
2032 No-Build	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	F ² B ¹ --	N/A	F ² B ¹ --	N/A
2032 Build	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	F ² B ¹ --	N/A	F ² B ¹ --	N/A
2032 Build – Scenario A	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	A ³ E ³ C ³	D (29)	B ³ B ³ C ³	B (14)
2032 Build – Scenario B	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	D C D	C (29)	D B C	C (29)
2041 No-Build	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	F ² B ¹ --	N/A	F ² B ¹ --	N/A
2041 Build	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	F ² B ¹ --	N/A	F ² B ¹ --	N/A
2041 Build – Scenario A	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	A ³ F ³ D ³	E (46)	E ³ B ³ C ³	C (24)
2041 Build – Scenario B	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	D C D	C (33)	D C C	C (30)

Improvements to lane configurations are shown in bold.

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.
3. Level of service for approaching a roundabout.

Capacity analysis of all traffic conditions (with the existing lane geometry and traffic control) indicates the major street left-turn movement on Bethlehem Road is expected to operate at LOS B or better during both weekday AM and PM peak hours. The minor-street approach of Old Faison Road is expected to operate at LOS F under all analysis scenarios during the AM and PM peak hours. Significant queuing is expected at the intersection on all approaches. Refer to Appendix O for SimTraffic queuing reports.

Based on information provided by the Town, the Town of Knightdale's Comprehensive Transportation Plan (CTP) calls for a roundabout at this intersection. Under Scenario A improvements, the intersection is modeled as a single-lane roundabout. Under 2032 build conditions, the roundabout is expected to operate at an overall LOS D during the AM peak hour and LOS B during the PM peak hour. All approaches are expected to operate at LOS D or better, except for the northbound approach during the AM peak hour. It should be noted that the v/c ratio of the roundabout is expected to have a vehicle to capacity ratio of 0.968 during the AM peak hour under 2032 build conditions. Under 2041 build conditions, the roundabout is expected to operate at an overall LOS E during the AM peak hour and LOS C during the PM peak hour. Increased approach delays are expected with the additional increase in traffic.

The intersection was also analyzed as a signalized intersection (under Scenario B) to compare the efficiency of the installation of signal to that of a roundabout. A peak hour signal warrant was analyzed to determine if a signal is warranted. The peak hour signal warrant is met under existing, no-build, and build conditions. Refer to Appendix O for additional signal warrant data. Under this scenario, lane configuration improvements are also necessary to accommodate queuing due to the stopping of movements on Bethlehem Road that are currently free-flow. An exclusive northbound left, southbound right, and eastbound left are considered in the analysis. Under Scenario B, the signalized intersection is expected to operate at an overall LOS C under 2032 build and 2041 build conditions.

Since the intersection operates at a lower delay and manageable queues with a signal, signalizing the intersection is recommended over the roundabout alternative. A fee-in-lieu

contribution towards improvements at this intersection is recommended by the developer as NCDOT turn lane warrants are met for both right and left turn lanes without the proposed development traffic and the intersection meets the peak hour signal warrants under existing conditions.

7.2. Old Faison Road and Tart Farm Road/Site Access A

The existing unsignalized intersection was analyzed under all traffic conditions with the lane configurations and traffic control shown in Table 6. Refer to Table 6 for a summary of the analysis results. Refer to Appendix F for the Synchro capacity analysis reports.

Table 6: Analysis Summary of Old Faison Road and Tart Farm Road/Site Access A

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	EB WB NB	1 TH-RT 1 LT-TH 1 LT-RT	-- A ¹ B ²	N/A	-- A ¹ B ²	N/A
2032 No-Build	EB WB NB	1 TH-RT 1 LT-TH 1 LT-RT	-- A ¹ B ²	N/A	-- A ¹ B ²	N/A
2032 Build	EB WB NB	1 TH, 1 RT 1 LT-TH 1 LT, 1 RT	-- A ¹ E ²	N/A	-- A ¹ D ²	N/A
2041 No-Build	EB WB NB	1 TH-RT 1 LT-TH 1 LT-RT	-- A ¹ C ²	N/A	-- A ¹ C ²	N/A
2041 Build	EB WB NB	1 TH, 1 RT 1 LT-TH 1 LT, 1 RT	-- A ¹ E ²	N/A	-- A ¹ D ²	N/A

Improvements to lane configurations are shown in bold.

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.

Capacity analysis of all traffic conditions indicates the major street left-turn movement on Old Faison Road is expected to operate at LOS A during both weekday AM and PM peak hours. With a two-lane egress, the minor-street approach of existing Tart Farm Road (future Site Access A) is expected to operate at LOS D or better under all future build traffic conditions during the PM peak hour. The minor street approach is expected to operate at LOS E or better during the AM under 2032 and 2041 build conditions. No significant queuing is expected at the intersection.

Turn lane warrants on Old Faison Road were analyzed using the Policy On Street and Driveway Access to North Carolina Highways to determine if exclusive turn lanes were warranted. An eastbound right turn lane with 75 feet of storage and appropriate decel and taper is warranted at this intersection. Refer to Appendix P for the turn lane warrant charts.

No other improvements are recommended by the developer.

7.3. Old Faison Road and Pleasant Colony Drive

The existing unsignalized intersection was analyzed under all traffic conditions with the existing lane configurations and traffic control shown in Table 7. Refer to Table 7 for a summary of the analysis results. Refer to Appendix G for the Synchro capacity analysis reports.

Table 7: Analysis Summary of Old Faison Road and Pleasant Colony Drive

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	EB	1 LT, 1 TH	A ¹	N/A	A ¹	N/A
	WB	1 TH-RT	--		--	
	SB	1 LT-RT	B ²		B ²	
2032 No-Build	EB	1 LT, 1 TH	A ¹	N/A	A ¹	N/A
	WB	1 TH-RT	--		--	
	SB	1 LT-RT	C ²		C ²	
2032 Build	EB	1 LT, 1 TH	B ¹	N/A	A ¹	N/A
	WB	1 TH-RT	--		--	
	SB	1 LT-RT	D ²		D ²	
2041 No-Build	EB	1 LT, 1 TH	B ¹	N/A	A ¹	N/A
	WB	1 TH-RT	--		--	
	SB	1 LT-RT	D ²		C ²	
2041 Build	EB	1 LT, 1 TH	B ¹	N/A	A ¹	N/A
	WB	1 TH-RT	--		--	
	SB	1 LT-RT	E ²		D ²	

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.

Capacity analysis of all traffic conditions indicates the major street left-turn movement on Old Faison Road is expected to operate at LOS B or better during both weekday AM and PM peak hours. The minor-street approach is expected to operate at LOS D or better with the exception of the AM peak hour under 2041 build conditions.

The proposed site is only expected to contribute trips to the major-street through volumes along Old Faison Road at the intersection. Due to the minimal impacts of the proposed development on the intersection, no improvements are recommended by the developer.

7.4. Old Faison Road and Churchill Glen Boulevard/Quiet Way

The existing unsignalized intersection was analyzed under all traffic conditions with the existing lane configurations and traffic control shown in Table 8. Refer to Table 8 for a summary of the analysis results. Refer to Appendix H for the Synchro capacity analysis reports.

Table 8: Analysis Summary of Old Faison Road and Churchill Glen Boulevard/Quiet Way

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	EB	1 LT, 1 TH-RT	A ¹	N/A	A ¹	N/A
	WB	1 LT, 1 TH-RT	A ¹			
	NB	1 LT-TH-RT	C ²			
	SB	1 LT-TH-RT	C ²			
2032 No-Build	EB	1 LT, 1 TH-RT	B ¹	N/A	A ¹	N/A
	WB	1 LT, 1 TH-RT	A ¹			
	NB	1 LT-TH-RT	E ²			
	SB	1 LT-TH-RT	F ²			
2032 Build	EB	1 LT, 1 TH-RT	B ¹	N/A	A ¹	N/A
	WB	1 LT, 1 TH-RT	A ¹			
	NB	1 LT-TH-RT	F ²			
	SB	1 LT-TH-RT	F ²			
2041 No-Build	EB	1 LT, 1 TH-RT	B ¹	N/A	A ¹	N/A
	WB	1 LT, 1 TH-RT	A ¹			
	NB	1 LT-TH-RT	F ²			
	SB	1 LT-TH-RT	F ²			
2041 Build	EB	1 LT, 1 TH-RT	B ¹	N/A	A ¹	N/A
	WB	1 LT, 1 TH-RT	A ¹			
	NB	1 LT-TH-RT	F ²			
	SB	1 LT-TH-RT	F ²			

- 1. Level of service for major-street left-turn movement.
- 2. Level of service for minor-street approach.

Capacity analysis of all traffic conditions indicates the major street left-turn movements on Old Faison Road are expected to operate at LOS B or better during both weekday AM and PM peak hours. The minor-street approaches are expected to experience heavier delays under all future traffic conditions, even without the proposed development. It should be noted that it is not uncommon for minor-street approaches at unsignalized intersections to experience

high delays, especially during the peak times of the day when mainline volumes are the heaviest.

The proposed site is only expected to contribute trips to the major-street through volumes at the intersection. Congestion management requires all turning movements to have a minimum of four vehicles. For this intersection, this rule was applied for several movements including the northbound and southbound through movements crossing from Churchill Glen Boulevard to Quiet Way and vice versa. This leads to inflated delays due to the difficulty of these movements (that are not currently being made).- Additionally, exclusive turn lanes are already provided on Old Faison Road at this intersection. Due to the minimal impacts of the proposed development on the intersection, no improvements are recommended by the developer.

7.5. Bethlehem Road and Crosscut Place/Site Access B

The existing unsignalized intersection was analyzed under existing and no-build traffic conditions with the existing lane configurations and traffic control shown in Table 9. With the additional proposed Site Access B as the fourth leg to the intersection, the Town is requiring the installation of a roundabout if any improvements are necessary. Therefore, the intersection was analyzed as a single lane roundabout under the build with improvements and future scenarios. Refer to Table 9 for a summary of the analysis results. Refer to Appendix I for the Synchro capacity analysis reports.

Table 9: Analysis Summary of Bethlehem Road/Crosscut Place (Site Access B)

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	C ² -- A ¹	N/A	C ² -- A ¹	N/A
2032 No-Build	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	E ² -- B ¹	N/A	D ² -- A ¹	N/A
2032 Build	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT	F ² F ² A ¹ B ¹	N/A	F ² F ² A ¹ A ¹	N/A
2032 Build Roundabout	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT	A ³ B ³ C ³ A ³	C (16)	A ³ A ³ A ³ B ³	A (10)
2041 No-Build	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	F ² -- B ¹	N/A	E ² -- A ¹	N/A
2041 Build Roundabout	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT	A ³ B ³ D ³ A ³	C (22)	A ³ A ³ A ³ B ³	B (11)

Improvements to lane configurations and traffic control are shown in bold.

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.
3. Level of service for approaching the proposed roundabout improvement.

Capacity analysis of existing and no-build conditions indicates the major street left-turn movement on Bethlehem Road is expected to operate at LOS B or better during both weekday AM and PM peak hours. Under 2032 build conditions, with the addition of the proposed Site Access B as the fourth leg to the intersection, and with no improvements the minor street approaches are expected to operate at LOS F during the AM and PM peak hours.

As mentioned previously, through coordination with NCDOT and the Town, a roundabout intersection is required to be constructed with the addition of proposed Site Access B. Under build conditions with the roundabout, the intersection is expected to operate at an overall LOS C or better during the AM and PM peak hours.

Other than the installation of a single lane roundabout, no other improvements are recommended by the developer.

7.6. I-87 Eastbound Ramps and Hodge Road

The existing signalized intersection was analyzed under all traffic conditions with the existing lane configurations and traffic control shown in Table 10. Refer to Table 10 for a summary of the analysis results. Refer to Appendix J for the Synchro capacity analysis reports.

Table 10: Analysis Summary of I-87 Eastbound Ramps and Hodge Road

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	EB	2 LT, 1 RT	A	A (10)	B	B (17)
	NB	1 LT, 1 TH	A		B	
	SB	1 TH, 1 RT	B		C	
2032 No-Build	EB	2 LT, 1 RT	C	C (27)	D	D (49)
	NB	1 LT, 1 TH	C		D	
	SB	1 TH, 1 RT	C		E	
2032 Build	EB	2 LT, 1 RT	C	C (29)	E	E (57)
	NB	1 LT, 1 TH	C		D	
	SB	1 TH, 1 RT	C		E	
2032 Build – <i>Field Conditions</i>	EB	2 LT, 1 RT	C	C (23)	D	D (50)
	NB	1 LT, 1 TH	B		D	
	SB	1 TH, 1 RT	C		D	
2041 No-Build	EB	2 LT, 1 RT	C	C (32)	E	E (62)
	NB	1 LT, 1 TH	C		D	
	SB	1 TH, 1 RT	D		E	
2041 Build	EB	2 LT, 1 RT	D	C (34)	E	E (72)
	NB	1 LT, 1 TH	C		E	
	SB	1 TH, 1 RT	D		F	
2041 Build – <i>Field Conditions</i>	EB	2 LT, 1 RT	C	C (28)	E	E (64)
	NB	1 LT, 1 TH	C		E	
	SB	1 TH, 1 RT	D		E	

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.

Capacity analysis of all future traffic conditions indicates the signalized intersection is expected to operate at an overall LOS C during the weekday AM peak hour and LOS E during

and the weekday PM peak hour. Significant queuing is expected at the intersection under all future traffic conditions.

Congestion Management capacity analysis guidelines require all permitted/protected phases to be changed to protected only which results in a higher delay at the study intersection. An alternative analysis showing how the intersection operates in the field was performed to better simulate how the intersection functions. The protected phase was changed back to permitted/protected and signal splits were optimized for the intersection. Right-turn-on-red (RTOR) was also permitted in the field conditions analysis.

Due to the proposed site's minimal impacts on the intersection, no improvements are recommended.

7.7. I-87 Westbound Ramps/Old Faison Road and Hodge Road

The existing signalized intersection was analyzed under all traffic conditions with lane configurations and traffic control shown in Table 11. Refer to Table 11 for a summary of the analysis results. Refer to Appendix K for the Synchro capacity analysis reports.

Table 11: Analysis Summary of I-87 Westbound Ramps/Old Faison Road and Hodge Road

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	EB	1 LT-TH, 1 RT	A	C (29)	B	B (19)
	WB	1 LT-TH-RT	D			
	NB	1 LT, 1 TH-RT	C			
	SB	1 LT, 1 TH, 1 RT	B			
2023 No-Build	EB	1 LT-TH, 1 RT	B	E (56)	D	D (40)
	WB	<u>1 LT, 1 TH, 1 RT</u>	E			
	NB	1 LT, 1 TH-RT	E			
	SB	1 LT, 1 TH, 1 RT	B			
2023 Build	EB	1 LT-TH, 1 RT	B	E (71)	D	E (67)
	WB	<u>1 LT, 1 TH, 1 RT</u>	F			
	NB	1 LT, 1 TH-RT	E			
	SB	1 LT, 1 TH, 1 RT	C			
2023 Build – Field Conditions	EB	1 LT-TH, 1 RT	A	D (47)	C	D (47)
	WB	<u>1 LT, 1 TH, 1 RT</u>	E			
	NB	1 LT, 1 TH-RT	D			
	SB	1 LT, 1 TH, 1 RT	B			
2024 No-Build	EB	1 LT-TH, 1 RT	B	E (76)	C	E (71)
	WB	<u>1 LT, 1 TH, 1 RT</u>	F			
	NB	1 LT, 1 TH-RT	F			
	SB	1 LT, 1 TH, 1 RT	B			
2024 Build	EB	1 LT-TH, 1 RT	B	F (91)	D	F (112)
	WB	<u>1 LT, 1 TH, 1 RT</u>	F			
	NB	1 LT, 1 TH-RT	F			
	SB	1 LT, 1 TH, 1 RT	C			
2024 Build – Field Conditions	EB	1 LT-TH, 1 RT	B	E (60)	C	E (61)
	WB	<u>1 LT, 1 TH, 1 RT</u>	F			
	NB	1 LT, 1 TH-RT	D			
	SB	1 LT, 1 TH, 1 RT	B			

Lane modifications by STIP W-5705AK are underlined.

Even with the improvements associated with NCDOT STIP W-5705AK, capacity analysis of all future traffic conditions indicates that the intersection is expected to operate at an overall E or better, with the exception of the 2041 build conditions. Significant queuing is expected under all future scenarios.

As mentioned previously, Congestion Management capacity analysis guidelines, require all permitted/protected movements at future intersections to be changed to protected phasing only. This would change some of the signal improvements installed by the STIP. An alternative analysis was performed to include the improvements by the STIP and more accurately model field conditions. RTOR was also permitted under the field conditions analysis. Signal timings were optimized for the purposes of this analysis.

Under the field conditions scenario, the intersection is expected to operate at LOS D or better under 2032 build conditions. To mitigate queue lengths exceeding storage lengths, turn lane extensions are recommended by the developer based on 95th percentile queuing. The westbound left-turn lane should be extended to contain 175 feet of storage with appropriate decel and taper. The eastbound left-through lane should be extended to contain 275 feet of storage. The southbound left turn lane should be extended to contain 275 feet of storage.

7.8. Smithfield Road and Old Ferrell Road

The existing unsignalized intersection was analyzed under all traffic conditions with existing lane configurations and traffic control shown in Table 12. Refer to Table 12 for a summary of the analysis results. Refer to Appendix L for the Synchro capacity analysis reports.

Table 12: Analysis Summary of Smithfield Road and Old Ferrell Road

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	B ² A ¹ --	N/A	B ² A ¹ --	N/A
2032 No-Build	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	B ² A ¹ --	N/A	C ² A ¹ --	N/A
2032 Build	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	B ² A ¹ --	N/A	C ² A ¹ --	N/A
2041 No-Build	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	B ² A ¹ --	N/A	C ² A ¹ --	N/A
2041 Build	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	B ² A ¹ --	N/A	C ² A ¹ --	N/A

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.

Capacity analysis of all traffic conditions indicates that the major street left turn movement on Smithfield Road is expected to operate at LOS A during the AM and PM peak hour. The minor street approach is expected to operate at LOS C or better during the AM and PM peak hour under all conditions. No significant queuing is expected.

No improvements are recommended by the developer.

7.9. Bethlehem Road and Poole Road

The existing signalized intersection was analyzed under all traffic conditions with the existing lane configurations and traffic control shown in Table 13. Refer to Table 13 for a summary of the analysis results. Refer to Appendix M for the Synchro capacity analysis reports.

Table 13: Analysis Summary of Bethlehem Road and Poole Road

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2023 Existing	EB	1 LT-TH-RT	A	D (36)	A	C (34)
	WB	1 LT-TH-RT	B		A	
	NB	1 LT-TH-RT	E		B	
	SB	1 LT-TH-RT	C		E	
2032 No-Build	EB	1 LT-TH-RT	A	F (152)	B	F (104)
	WB	1 LT-TH-RT	B		A	
	NB	1 LT-TH-RT	F		C	
	SB	1 LT-TH-RT	F		F	
2032 Build	EB	1 LT-TH-RT	A	F (168)	B	F (115)
	WB	1 LT-TH-RT	B		A	
	NB	1 LT-TH-RT	F		C	
	SB	1 LT-TH-RT	F		F	
2041 No-Build	EB	1 LT-TH-RT	A	F (226)	B	F (142)
	WB	1 LT-TH-RT	B		A	
	NB	1 LT-TH-RT	F		C	
	SB	1 LT-TH-RT	F		F	
2041 Build	EB	1 LT-TH-RT	A	F (246)	B	F (156)
	WB	1 LT-TH-RT	B		A	
	NB	1 LT-TH-RT	F		C	
	SB	1 LT-TH-RT	F		F	

Capacity analysis of all future traffic conditions indicates that the intersection is expected to operate at LOS F during the AM and PM peak hour. Significant queuing is expected under all future traffic conditions.

The proposed development is expected to account for less than 2 percent of the total traffic at the intersection during the AM peak hour and less than 3 percent during the PM peak hour. Therefore, due to the proposed site's minimal impacts on the intersection, no improvements are recommended by the developer.

8. CONCLUSIONS

The contents of this report present the findings of the Traffic Impact Analysis (TIA) conducted for the proposed Lyndon Oaks subdivision development to be located south of Old Faison Road and to the west of Bethlehem Road in Knightdale, North Carolina. The proposed development is proposed to consist of 308 single-family homes, 192 townhomes, and 15,000 square feet of commercial space and be built out in 2031. Site access is proposed via one (1) full-movement driveway at the existing location of Old Faison Road and Tart Farm Road and one roundabout at the existing intersection of Bethlehem Road and Crosscut Place.

The study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- 2023 Existing Traffic Conditions
- 2031+1 No-Build Traffic Conditions
- 2031+1 Build Traffic Conditions
- 2031+10 No-Build Traffic Conditions
- 2031+10 Build Traffic Conditions

Trip Generation

It is estimated that the proposed development will generate approximately 5,442 total site trips during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 378 trips (119 entering and 259 exiting) will occur during the weekday AM peak hour and 520 trips (313 entering and 207 exiting) will occur during the weekday PM peak hour. Not all trips are expected to occur as new trips as some are expected to be captured internally to the site, while others are expected to be drawn from traffic that is already on the adjacent roadway network.

Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to NCDOT Congestion Management Guidelines. Refer to section 6.1 of this report for a detailed description of any adjustments to these guidelines made throughout the analysis.

9. RECOMMENDATIONS

Based on the findings of this study, specific geometric improvements have been identified and are recommended to accommodate future traffic conditions. See a more detailed description of the recommended improvements below. Refer to Figure 14 for an illustration of the recommended lane configuration for the proposed development.

Recommended Improvements by STIP W-5705AK

Westbound I-87 Ramps and Hodge Road

- Construct westbound right turn lane with 100 feet of storage and appropriate decel and taper.
- Construct westbound left turn lane with 100 feet of storage and appropriate decel and taper.
- Modify signal timings and signal phasing

Recommended Improvements by Developer

Old Faison Road and Bethlehem Road

- Coordinate with Town on desired improvements. Provide fee in lieu contribution as necessary

Old Faison Road and Tart Farm Road/Site Access A

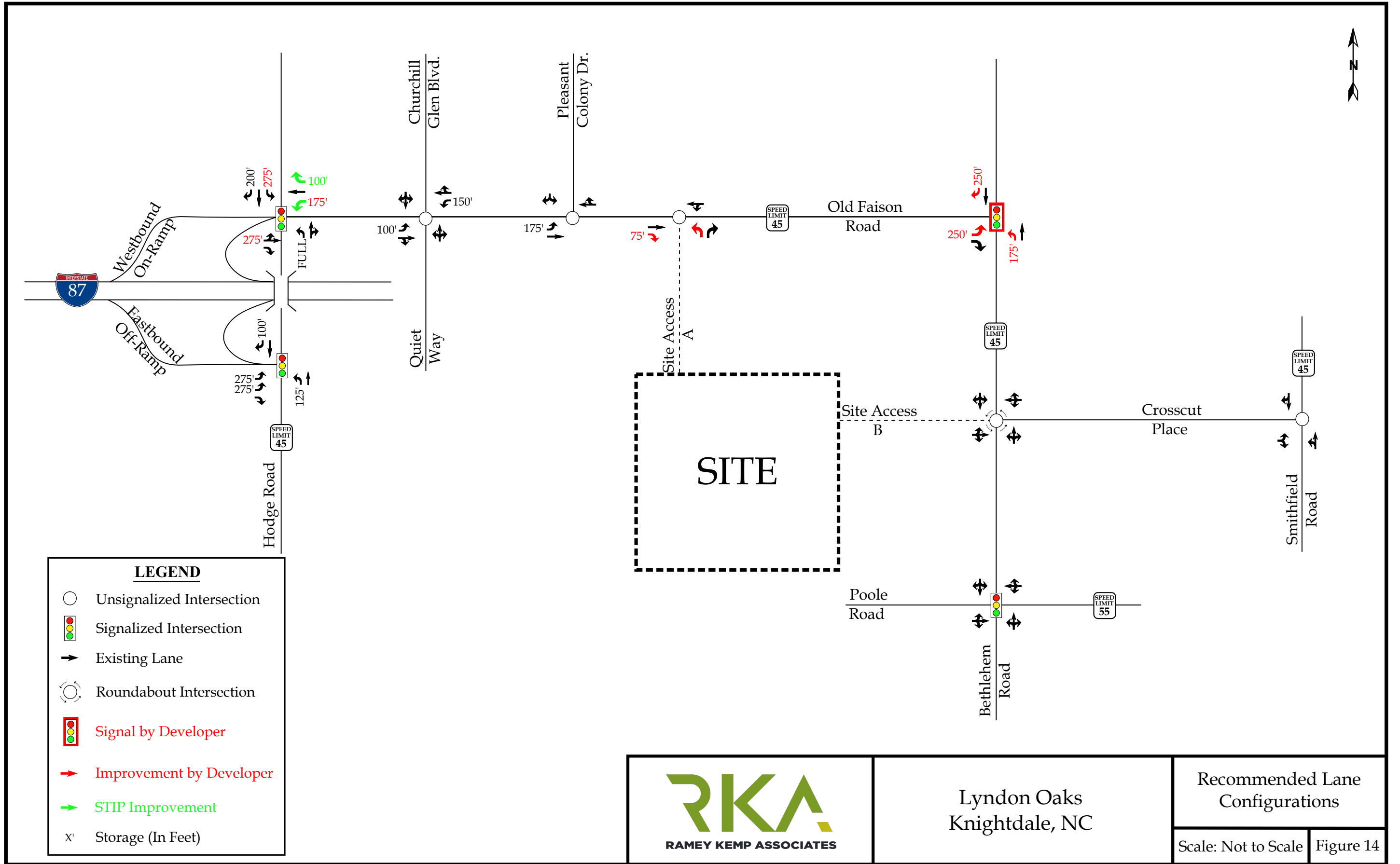
- Construct an eastbound right turn lane with 75 feet of storage and appropriate decel and taper.
- Construct exclusive northbound left turn lane with full storage.
- Provide stop control for northbound approach.

Bethlehem Road and Crosscut Place/Site Access B

- Construct a single-lane roundabout.
- Construct eastbound approach with one ingress and one egress lane.
- Provide yield control for eastbound approach.

Westbound I-87 Ramps and Hodge Road

- Extend westbound left turn lane to contain 175 feet of storage and appropriate decel and taper.
- Extend southbound left turn lane to contain 275 feet of storage and appropriate decel and taper.
- Extend eastbound left-through lane to contain 275 feet of storage and appropriate decel and taper.



Lyndon Oaks
Knightdale, NC

Recommended Lane
Configurations

Scale: Not to Scale Figure 14

