



**LINCOLN COUNTY PLANNING & INSPECTIONS DEPARTMENT**  
302 NORTH ACADEMY STREET, SUITE A, LINCOLNTON, NORTH CAROLINA 28092  
704-736-8440 OFFICE    704-736-8434 INSPECTION REQUEST LINE    704-732-9010 FAX

To: Board of Commissioners  
Planning Board

From: Randy Hawkins, Zoning Administrator

Date: October 20, 2017

Re: PD #2016-5-A  
Rufus Road Partners, LLC, applicant  
Parcel ID# 32850

*The following information is for use by the Lincoln County Board of Commissioners and Planning Board at their joint meeting/public hearing on November 6, 2017.*

**REQUEST**

The applicant is requesting to amend the master plan for the Wildbrook residential development to permit a charter school with grades K-8 on a 10.6-acre portion of the development site. The 73-acre Wildbrook site was rezoned to Planned Development Residential (PD-R) and approved for up to 180 single-family detached homes in October 2016. Grading has started on the first phases.

Under the Unified Development Ordinance, a PD-R district may include any uses that are permitted or conditional uses in regular residential districts, subject to approval by the Board of Commissioners. Elementary and secondary schools are permitted uses in residential districts.

The proposed location for the charter school is on the eastern portion of the Wildbrook site, where 30 homes had been planned. No other changes are proposed in the master plan. The road network would remain the same.

Wildbrook is adjacent to the site of the planned Rivercross mixed-use development. One of the accesses to Wildbrook will be via Rivercross, which has entrances planned off Triangle Circle and off N.C. 16 Business. Other access points to Wildbrook are on Rufus Road and Airlie Parkway.

No use is shown on the proposed amended plan for two smaller areas of the 10.6-acre portion of the Wildbrook site. Future use of these areas would have to be approved through a plan amendment/public hearing process.

A development report, minutes from a community involvement meeting, and a traffic impact analysis have been submitted as part of this application.

## SITE AREA AND DESCRIPTION

The Wildbrook site borders Triangle Circle, Rufus Road and Airlie Parkway in Catawba Springs Township. It is adjoined by property zoned PD-MU (Planned Development Mixed Use), I-G (General Industrial), R-T (Transitional Residential), R-SF (Residential Single Family) and B-N (Neighborhood Business). Land uses in the area include residential, business and industrial.

## PLAN CONFORMANCE

Guiding Principle 3 of the Lincoln County Land Use Plan calls for integrating community facilities such as schools into the planning process for residential and commercial development, in order to maximum the investment benefits.

The proposed site for the charter school is part of an area designated in the NC 16 Corridor Vision Plan as a potential community center. The plan calls for a mix of commercial uses built in an urban or downtown-type setting with on-street parking, an urban green or open space, as well as a natural area with a small amphitheater. These elements are incorporated in the Rivercross plan.

The Corridor Vision Plan calls for a new road network in this area that would provide alternate travel routes between N.C. 16 Business and Optimist Club Road, Rufus Road and Triangle Circle.

## STAFF'S RECOMMENDATION

Staff recommends approval of the proposed master plan amendment. See proposed statement on following page for rationale.



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### **Zoning Amendment Staff's Proposed Statement of Consistency and Reasonableness**

Case No. **PD #2016-5-A**

Applicant **Rufus Road Partners, LLC**

Parcel ID# **32850**

Location **Triangle Circle**

Proposed master plan amendment **permit a charter school on a portion of the Wildbrook development site in place of 30 homes**

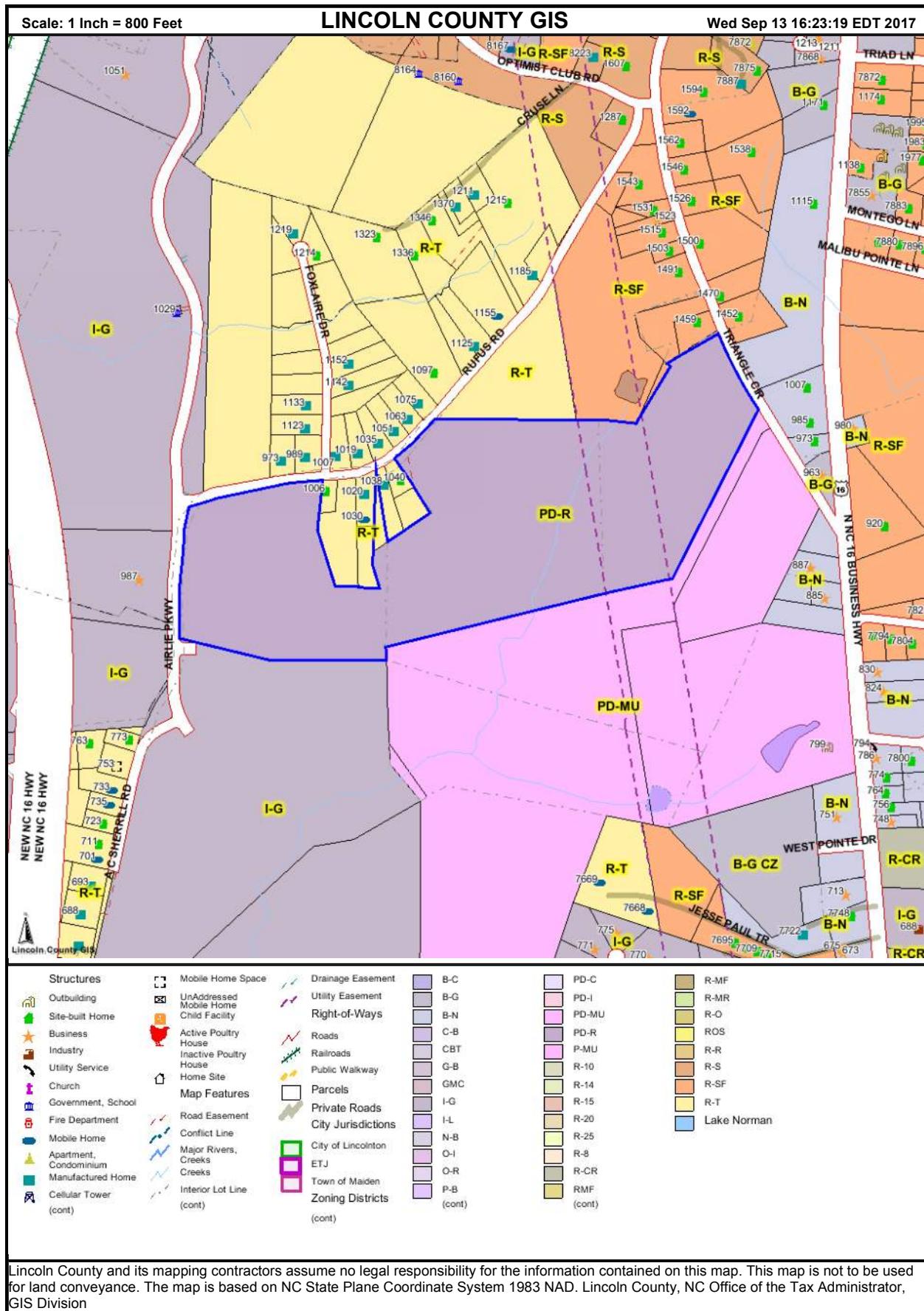
This proposed amendment **is consistent** with the Lincoln County Comprehensive Land Use Plan and other adopted plans in that:

**Guiding Principle 3 of the Land Use Plan calls for integrating community facilities such as schools into the planning process for new residential and commercial development, in order to maximize the investment benefits. A charter school and nearby residential and commercial development would mutually benefit from their proximity to each other. A charter school at this location is also consistent with the NC 16 Corridor Vision Plan's goal of creating a community center in this area.**

This proposed amendment **is reasonable and in the public interest** in that:

**A charter school will offer another educational option for students in Lincoln and surrounding counties and reduce the need for the county to provide additional classrooms. This location is appropriate for a school because it will have multiple access points and because it is close to existing and planned residential developments.**

PD #2016-5-A  
Subject property is outlined in blue

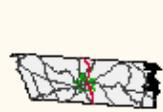




## Lincoln County, NC

### Office of the Tax Administrator, GIS Mapping Division

Lincoln County and its mapping contractors assume no legal responsibility for the information contained on this map. This map is not to be used for land conveyance. The map is based on NC State Plane Coordinate System 1983 NAD.



Date: 9/13/2017 Scale: 1 Inch = 600 Feet

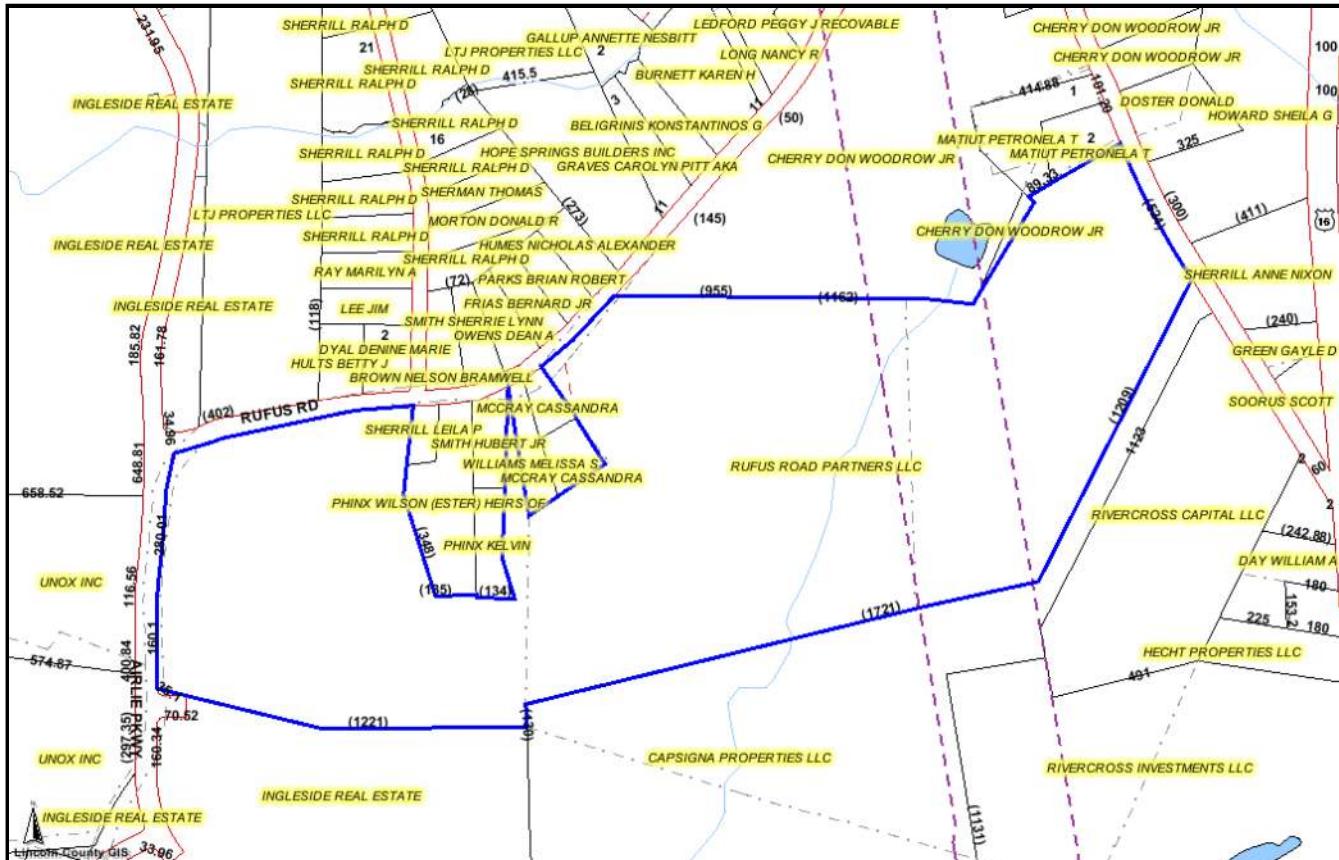


Photo Not Available

### PARCEL INFORMATION FOR 4603-41-2197

Parcel ID	32850	Owner	RUFUS ROAD PARTNERS LLC
Map	4603-00	Mailing	617 N MAIN STREET
Account	0262292	Address	BELMONT NC 28012
Deed	2656-994	Last Transaction Date	4/4/2017
Value		Sale Price	\$1,580,000
		Previous Parcel	-----
<b>Work in Progress</b>			
----- All values are for tax year 2017. -----			
Description	SIGMON LAND RD 1387	Deed Acres	73.67
Address	RUFUS RD	Tax Acres	73.32
Township	CATAWBA SPRINGS	Tax/Fire District	EAST LINCOLN
Improvement		No Improvements	
Zoning District	Calculated Acres	Voting Precinct	Calculated Acres
PD-R	72.87	TRIANGLE (TR30)	73.32
R-T	0.46		
Watershed Class		Sewer District	
Not in a watershed	72.48	Not in the sewer district	69.26
WS-IVC	0.84	In the sewer District	4.06
<b>2000 Census County</b>		<b>Tract</b>	<b>Block</b>
37109		071100	2015
37109		071100	2016
<b>Flood</b>	<b>Zone Description</b>	<b>Panel</b>	
X	NO FLOOD HAZARD	3710460300	73.32



## **Application to Amend Planned Development Plan**

Lincoln County Planning and Inspections Department  
Zoning Administrator  
302 N. Academy St., Lincolnton, NC 28092  
Phone: (704)736-8440 Fax: (704)732-9010

### **PART I**

Applicant Name Rufus Road Partner, LLC

Applicant Address 11220 Elm Lane, Suite 107, Charlotte, NC 28277

Applicant Phone Number 704-607-5059

Property Owner Name Same

Property Owner Address \_\_\_\_\_

Property Owner Phone Number \_\_\_\_\_

### **PART II**

Property Location Triangle Circle, just north of Bus Hwy 16

Property ID (10 digits) 4603-41-2197 Property size 10.6 Acres

Parcel # 32850 Deed Book(s)/Page(s) 2656/994

### **PART III**

Zoning District PD-R

Briefly explain the proposed modification(s) to the Planned Development master plan.

We would like to change the approved use of 30 single-family homes to a Charter School

**\*SEE PLANNING DEPT. FOR PLANNED DEVELOPMENT FEES.**

*I hereby certify that all knowledge of the information provided for this application and attachments is true and correct to the best of my knowledge.*

\_\_\_\_\_  
Applicant's Signature

9-1-17

Date

**PD-R TERMS & CONDITIONS**  
**WEST LAKE PREPARATORY ACADEMY**  
**SOUTH TRIANGLE CIRCLE**  
**LINCOLN COUNTY, NC**

The purpose of this report is to amend the Terms and Conditions previously approved by Lincoln County for Wildbrook. The terms and conditions presented in this report will replace all previously agreed-to requirements pertaining to the section of Wildbrook east of the power line right-of-way. All other sections of Wildbrook shall continue to be governed by the original Terms and Conditions.

### **1. Project Information**

West Lake Preparatory Academy is located a few hundred feet north of Business Hwy 16 on South Triangle Circle. The total site area is approximately 10.6 acres. This new Planned District Plan reduces the total number lots from 180 to 150 and adds a 765 student charter school.

### **2. General Provisions**

The Planned District Plan is intended to reflect a generalized arrangement of the site in terms of lot layout, building layout, street network, and open space areas. Final configuration, placement and size of individual site elements, streets alignments, etc. may be altered or modified within the limits of the Ordinance as described in Section 9.5.13, and the standards established within these conditional notes during the design development (platting) and construction phases. The Petitioner reserves the right to make minor modifications and adjustments to the approved Planned District Plan, subject to staff approval, provided that the total number of residential units does not exceed the maximum permitted. Any major modifications will require resubmittal to the Board of Commissioners.

### **3. Development Standards**

Pursuant to Sections 2.4.9 and 9.5 of the Lincoln County Unified Development Ordinance (UDO) entitled Planned Development Districts and Planned Development Review respectively; the Petitioner seeks to obtain approval of the use of the following Development Standards concurrently with the approval of the Rezoning Petition. These standards, as established both by the conditional notes as set out below and as depicted on the Preliminary Concept Plan shall be followed for development of the property. Unless otherwise approved as part of these conditional notes, the Lincoln County Unified Development Ordinance shall prevail when developing the site.

### **4. Permitted Uses/Densities**

The portion of the property east of the power lines shall be limited to a 765 student charter school.

## **5. Open Space, Buffer Yards, and Landscaping**

A Class 'C' Buffer yard is required along project boundaries per section 2.4.E.3 of the UDO.

Landscaping for the development shall meet or exceed all requirements of the UDO. A detailed landscaping plan will be submitted to County staff along with the construction plans.

## **6. Parking, Lighting, and Signage**

Parking, lighting, and signage shall comply with all requirements in the UDO.

## **7. Storm Water Compliance**

West Lake Preparatory Academy shall comply with all required storm water management regulations.

## **8. Permitting**

The Petitioner understands that all permits from the appropriate agencies must be obtained prior to construction activities.

## **9. Water and Sewer Availability**

This property is located in the East Lincoln Water and Sewer District and the Petitioner understands that water and sewer availability must be approved by Lincoln County prior to development. It is the Petitioner's responsibility to incur all fees and infrastructure costs for providing water and sewer throughout the development. The Petitioner will comply with all district water and sewer standards.

## **10. Vehicular Access and Road Improvements**

Access to the charter school will be from the access road alongside the Rivercross Apartments, the Boulevard from Business 16 through Rivercross, and Rufus Road via the road network through Wildbrook. A Traffic Impact Phasing analysis has been submitted to NCDOT.

**West Lake Preparatory Academy Meeting Minutes**  
**7pm, 10.19.2017**  
**East Lincoln Community Center**

Robert Davis welcomed those attending, introduced elected & appointed officials, County staff, Steve Bailey of Hawthorne Dev. Group, Sandy Castro of Charter Schools USA, and himself. Steven Bailey and Sandy Castro presented a 10-minute slideshow describing the proposed Charter School, surrounding neighborhood developments, Charter Schools USA's information, and traffic study findings.

Steven Bailey, Sandy Castro and Robert Davis then answered and discussed the following concerns raised by the audience:

1. Commissioner Oaks asked about a right-turn lane from HWY 16 into the new Rivercross main entrance. If no right turn lane, he suggested banning right turns. Mike Surasky, PE (traffic engineer) confirmed there will be a right turn lane there.
2. One neighbor ("Rudy") does not like the amount of proposed traffic from all the rooftops planned in the area.
3. Rudy questioned why a charter school is planned instead of a public school. He also referenced the 17-acre school site on the Stratford site. Commissioner Oakes answered him that the school board has not committed to building on that site.
4. Commissioner Oakes asked when the lanes required with the Rivercross residential and Rivercross multifamily will be constructed. Senator Davis answered that they would be built when those sections of the development are built.
5. Commissioner Oakes asked about the \$125,000 contribution towards a traffic signal from Rivercross residential developer. Senator Davis answered that that money would be available for other improvements in the area if the school funds the traffic signal.
6. Commissioner Permenter asked if the school anticipates the school to be full the first year and about the lottery. He also asked what percentage of the students do we anticipate will come from the adjoining subdivisions. Sandy stated that they expect the school to fill immediately and have a lottery/waiting list. Michael Surasky stated that similar schools have had several parents in adjacent developments walk their kids to school. He confirmed that the TIA assumes the worst-case scenario that all students will be driven to school. Steven Bailey confirmed there will be sidewalks along all the streets in the surrounding developments.
7. Commissioner Permenter asked which streets in the adjoining developments would be fully constructed at the time the school opens. Steven Bailey indicated on the map which streets be built: the street along the multifamily out to Triangle Circle, the streets through Rivercross and out to Business 16, and the street through Wildbrook out to Rufus Road. The traffic signal at the main Rivercross entrance from Business 16 will also be installed.

The presentation ended around 7:40pm. Steven Bailey, Sandy Castro, and Robert Davis stayed to continue discussions with individual neighbors for about 20 minutes.



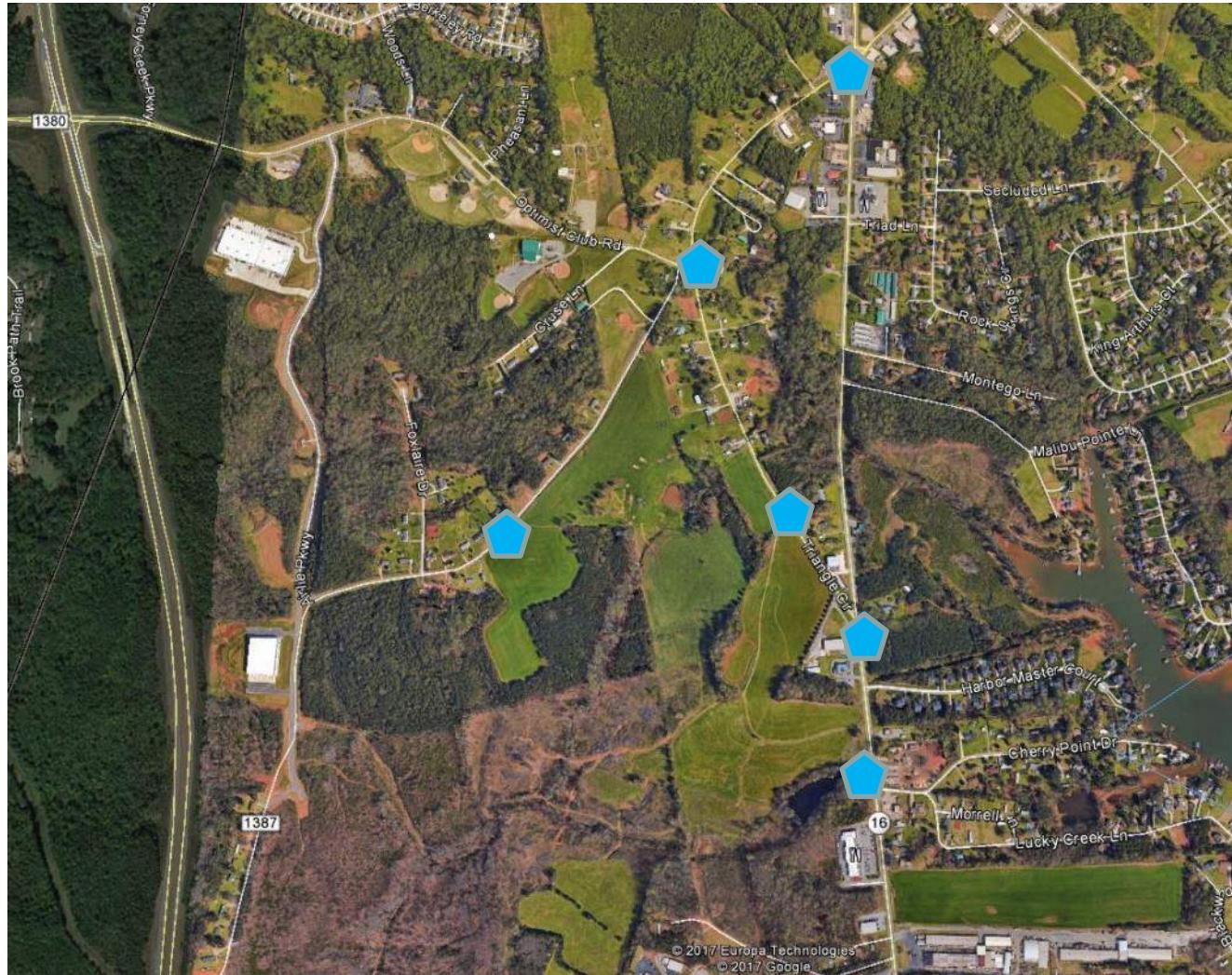
# West Lake Preparatory Academy

Tuition-Free Charter School

# Vicinity Map



# Traffic Study



## Intersections Studied:

1. NC 16 & Triangle Circle/Unity Church Road  
(This intersection is part of a proposed NCDOT STIP project)
2. NC 16 & Triangle Circle South
3. Optimist Club Road & Triangle Circle
4. Proposed New Connections:
  - Onto Triangle
  - Onto Rufus Road
  - Onto NC 16

# Traffic Improvements

150 foot southbound right turn lane from NC 16 onto Triangle Road South



Traffic Signal at NC 16 & Cherry Point Drive / New Rivercross Connection



# West Lake Preparatory Academy

## MISSION STATEMENT

West lake Preparatory Academy's mission is to provide students with a rigorous education program offering personalized learning plans in a technology rich environment preparing each student to excel and compete in a global environment.

*West Lake Preparatory Academy  
will not discriminate or limit enrollment based on race, religion or disability.*

# West Lake Education Foundation, Inc.

## Governing Board Members

- Aaron Hoegle
- Tom Anderson
- Ivonne Reed
- Preston Curtis
- Matt Hunoval, Esq.
- Danny Hester

# Managed by Charter Schools USA

- Charter Schools USA (CSUSA), a nationally recognized leader in education management.
- CSUSA is the first education management company in the nation to receive accreditation through AdvancEd. This designation assures that all schools opened and operated under CSUSA's model will be accredited in the first year of operation.
- CSUSA manages 84 schools in seven states, serving 65,000+ students.

# West Lake Preparatory Academy

- Focus on Career and College Readiness
- Personalized Learning Plans
- Parental Involvement Encouraged
- Character education and community leadership program is integrated into curriculum
- Data-driven instruction
- Comprehensive curriculum including music, arts and sciences
- All students wear uniforms
- Certified, dedicated teachers
- State-of-the-art, secure, nurturing educational environment
- All CSUSA schools are SACS accredited

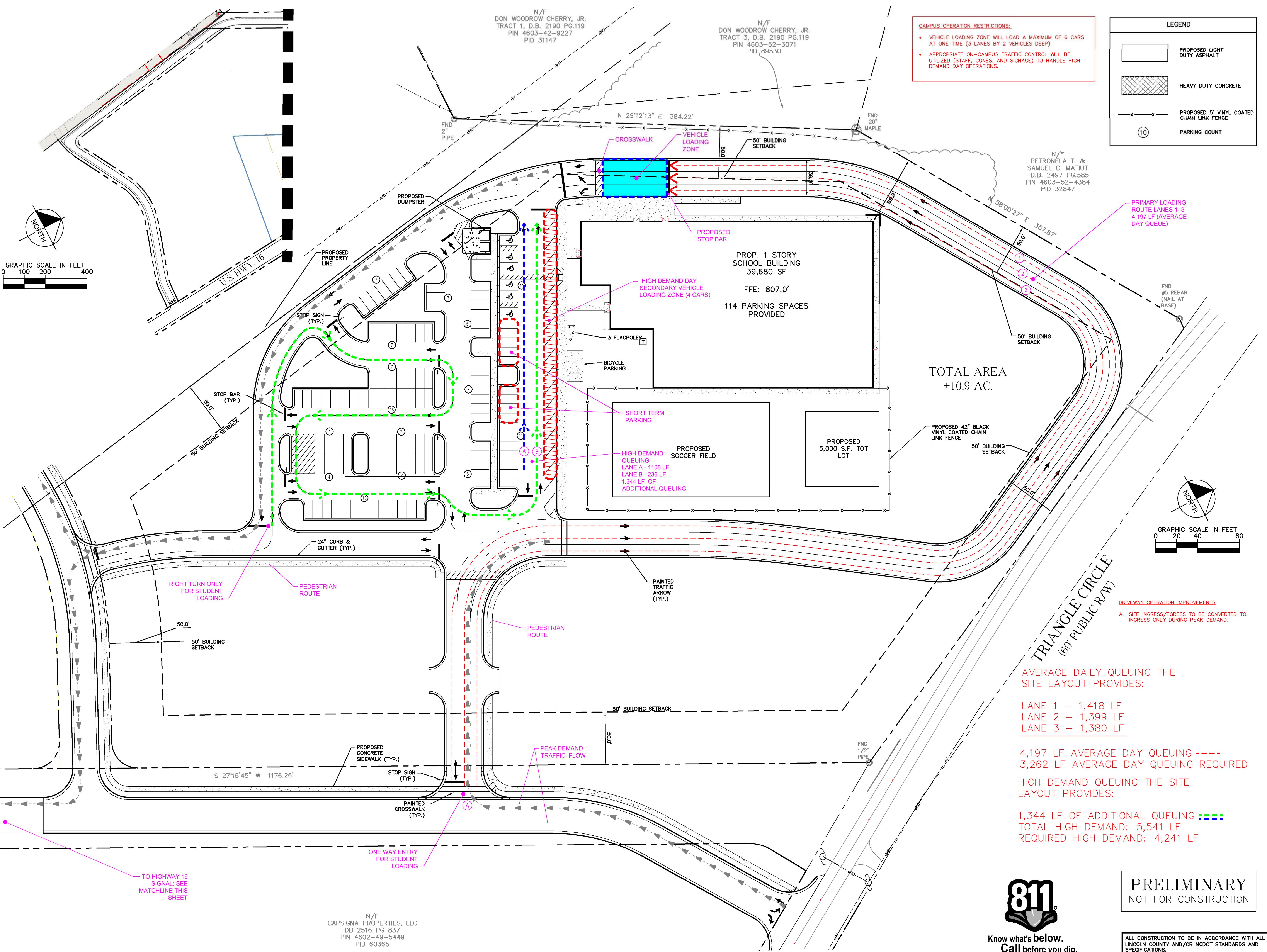


# West Lake Preparatory Academy

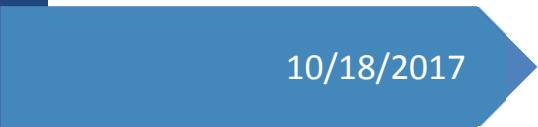
- Two-Story facility
- Gymnasium
- Computer Labs
- Science Labs
- Cafeteria/Multi-purpose room
- Playground & Sports Field
  
- Serving students in grades K-8
  - 615 in year one
  - 690 in year two
  - 765 in year three



Plotted By: Hall, Wes Sheet Set: LINCOLN CHARTER SCHOOL Layout: EX-1 SITE LAYOUT & VEHICLE QUEUING EXHIBIT October 19, 2017 06:03:34pm K:\RAL\UDEV\012587016 LincolnCounty\P15 CAD Files\Exhibits\2017-10-19 Site Plan Exhibit\EX-1 SITE PLAN EXHIBIT.dwg  
This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.



<b>LINCOLN CHARTER SCHOOL</b>		PREPARED FOR <b>RYAN COMPANIES US, INC</b>	
SHEET NUMBER <b>EX-1</b>		NORTH CAROLINA LINCOLN COUNTY	
012587019	DATE 10/19/2017	DESIGNED BY JCB	REVISIONS
SCALE AS SHOWN	DRAWN BY JCB	CHECKED BY COB	DATE BY
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10/18/2017

# Traffic Impact Analysis

Rivercross Charter School:  
Lincoln County, NC



Mike Surasky, PE, PTOE  
WSP  
LICENSE NUMBER: F-0165

10/18/2017

# Traffic Impact Analysis

Rivercross Charter School:  
Lincoln County, NC



Mike Surasky, PE, PTOE  
WSP  
LICENSE NUMBER: F-0165

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## I. EXECUTIVE SUMMARY

WSP USA, Inc. (hereafter referred to as WSP) was contracted by Rufus Road Partners, LLC to prepare a Traffic Impact Analysis (TIA) for a proposed K-8 charter school that would serve 765 students in Lincoln County, North Carolina. The proposed site is located on an undeveloped parcel of 10.6 acres on the west side of Triangle Circle just northwest of the Triangle Circle Road and NC 16 Business intersection and between the Rivercross Apartments and the Wildbrook (formerly Brookdale) Subdivision, which are proposed background developments for the future.

The objective of the study is to determine the impact that the additional traffic generated by the proposed development will have on study area traffic operations within the study area. Capacity analyses were completed for the following scenarios: 2017 existing conditions, 2019 horizon build-out with and without proposed development, and 2019 horizon build out with the recommended improvements. The study area will include two access points to the proposed development that are linked to the Rivercross Connector Road and Rufus Road Connector, which are to be completed by 2018. One access point is a proposed entrance only driveway from Rivercross Connector Road which is directly off the Triangle Circle. The other access point is proposed exit only driveway which connects the proposed site to the Rufus Road Connector. The study area includes two (2) existing unsignalized intersections and one (1) existing signalized intersection at the intersection of South Triangle Circle and NC 16 Business. Additionally, the future year build scenarios include three (3) additional unsignalized intersections and one (1) additional signalized intersection.

Evaluation of traffic impacts within the defined study area included the following intersections:

- NC 16 Business & Triangle Circle/Unity Church Road (existing signalized four-legged intersection)
- NC 16 Business & Triangle Circle (existing unsignalized 3-legged intersection)
- Optimist Club Road & Triangle Circle (existing unsignalized 3-legged intersection)
- Triangle Circle & Rivercross Connection Road (future year unsignalized 3-legged intersection)
- Site Entrance & Rivercross Connection Road (proposed unsignalized Driveway Access)
- Site Exit & Rufus Road Connector (proposed unsignalized Driveway Access)
- NC 16 Business & Rivercross Connection Road / Cherry Point Road (future year signalized 4-legged intersection)

The trip generation was performed for the proposed site using the NCDOT Municipal School Transportation Assistance (MSTA) calculator. Trip generation was performed for the school AM (7-9am) and PM (2-4pm) peak periods due to the proposed charter school. The proposed charter school at full capacity (765 students) will generate 1,645 trips a day, 951 trips in the AM peak hour and 695 trips in the PM peak hour. Although the school is expected to accommodate 765 students from grades K-8, the school will implement a 30-minute stagger to the bell schedule to offset the arrival and departure times. The 30-minute stagger to the bell schedule would be applied to grades K-5 (510 students) and 5-8 (255 students). For analysis purposes the highest 30-minute trips will be applied to the network. The number of trips at

the highest 30-minute stagger time (510 students) will generate 1,160 trips a day, 665 trips in the AM peak hour and 495 trips in the PM peak hour. It is to be noted, based on the school full capacity (765 students) 95 staff trips are included to the AM trips in and the PM trips out.

For the future build-out year of 2019, three other projects were included as part of the background developments in the area. The approved developments are known as Rivercross (Phase 1), Rivercross Apartments, and Brookdale (now Wildbrook) Residential Development. The Rivercross developments will be located to the south and west of the proposed charter school and the Wildbrook Residential development is proposed on the north of the school.

Rivercross (Phase 1) will be connected to NC 16 Business and Triangle Circle and will consist of 35 Single Family Homes & 133 Town Homes. The Rivercross Apartments will be connected to Rivercross Connector Road and will consist of 200 Apartments. The Wildbrook Residential Development will be connected to Rufus Road and Airlie Parkway and will consist of 180 Single Family Units.

The analysis of existing conditions indicates that the signalized intersection of NC 16 & Triangle Circle / Unity Church Road operates at LOS C in the AM peak hour with a delay of 33.9 seconds and at LOS D during PM peak hour with a delay of 38.7 seconds. The eastbound and westbound through movements at this intersection experience delay times of 56.3 seconds and 55.9 seconds respectively in the AM peak hour and 60.1 seconds and 74.1 seconds respectively in the PM peak hour. The remaining existing intersections in the study area are all unsignalized intersections with each movement having an intersection LOS C or better.

In the 2019 No-Build conditions the signalized intersection in the study area at Triangle Circle / Unity Church Road and NC 16 Business experience degradation in LOS along with an increase in delay times. This degradation in LOS and increase in delay is a result of traffic added due to background developments of Rivercross Phase 1, Rivercross Apartments and Wildbrook. The new signalized intersection at NC 16 business and Rivercross Connector Road / Cherry Point Road operate at an LOS B as a two-phase signal for both the peak hours. The unsignalized intersections tend to operate satisfactorily in the 2019 no-build scenario despite the added volumes, due to including the intersections geometry improvements proposed by the background development TIAs. For unsignalized intersections, LOS and delay are based on minor approach. It is to be noted that in Table 4 and Table 4A depict the minor movement results as the unsignalized intersection LOS and delay, as these approaches experience the highest delays.

For the Build conditions analysis, a one-way site entrance on Rivercross Connector Road which is directly off the Triangle Circle is proposed. The other access point is a proposed exit only driveway which connects the proposed site to the Rufus Road Connector. The two new unsignalized intersections for the build scenarios include site entrance and the exit links provided as ingress and egress to the proposed development. The new links and the resulting 2 intersections are modelled in SYNCHRO as one lane driveways with one-directional flow. The Rufus Road Connector and Rivercross Connector Road have been coded with a speed limit 35 MPH. The cherry point drive was coded with a speed limit of 25 MPH in synchro.

The internal links connecting the entry and exit driveways in the study area have been coded in synchro for queuing analysis. Based on the site plan, a three-lane loading and unloading bay link with a length of 1250 feet has been analyzed for any possible queues spilling back into the entrance driveway and back to the Triangle Circle. As suggested by the MSTA, a dummy signalized intersection has been placed the first loading bay with a green time of 20 seconds and red time of 20 seconds for the southbound approach (3-lane loading and unloading link). The speed limits for the internal links, including entrance and exit driveways of the school in the build scenarios, have been coded as 10 MPH.

The signalized intersections at NC 16 Business & Triangle Circle / Unity Church Road and NC 16 Business and Rivercross Connector Road / Cherry Point Drive in the Build scenario were performing at an LOS E or worse for both AM and PM peak hours. For the NC 16 Business & Triangle Circle / Unity Church Road, the eastbound and westbound approaches have approach delays of 68.9 seconds and 63.3 seconds for the during the AM peak hour and have approach delays of 83.6 seconds and 49.1 seconds for the PM peak hour. During AM peak, the southbound approach at NC 16 Business & Triangle Circle / Unity Church Road performs worse at an LOS F and approach delay of 172.7 seconds. During the PM peak, the northbound approach at NC 16 Business & Triangle Circle / Unity Church Road perform worse at an LOS F and approach delay of 149.2 seconds. During the AM peak, the southbound approach at NC 16 Business & Triangle Circle / Unity Church Road perform worse at an LOS E and approach delay of 63.7 seconds.

The unsignalized intersection at Triangle Circle & Optimist Club Rd and Triangle Circle & Rivercross Connection Road seem to operate satisfactorily in the build scenario, during AM and PM peak hours. The unsignalized intersection at NC 16 Business & South Triangle Circle experience worsening operation from LOS D to LOS F and minor approach delay from 34.7 seconds to 89.8 seconds during AM peak hour and is performing well during the PM peak hour. The major cause for degradation of LOS and delay times for eastbound approach during AM peak hour at NC 16 Business & South Triangle Circle is the added southbound right turning vehicles. There is only one receiving lane for the southbound movements at this intersection. The minor approach, being the stop controlled approach, usually experiences higher delay times at such intersections.

The proposed charter school did not add any eastbound left-turn or right-turn vehicles nor any southbound through vehicles at NC 16 Business and Triangle Circle intersection. During the AM peak, the primary addition to this intersection is the 267 southbound right and 99 northbound through vehicles, due to the charter school. Also, the only location where the crossing traffic were added is the unsignalized intersection at NC 16 and Triangle Circle.

The phasing used by the previous TIAs has been used for the signalized intersection at NC 16 and Triangle Circle/Unity Church Road for the existing and 2019 No Build and 2019 Build scenarios. For the Build + Improvements scenario, the splits were optimized for the NC 16 and Triangle Circle/Unity Church Road intersection. The new signalized intersection has been coded with a protected left turn phasing on northbound, eastbound and southbound approaches and permitted left turn phasing at westbound one lane approach. At all the existing intersections, we were mimicking the signalized and unsignalized intersection designs based on the previous TIAs.

At the internal signalized intersection at the 3-lane Loading bay and links to exiting driveways, the maximum queue length during the AM peak hour will be 143 feet in the Build scenario and 165 feet during the Build + Improvements scenario. The maximum queue length during the PM peak is 120 feet in the Build scenario and 147 feet during the Build + Improvements scenario. These values are the maximum recorded queue lengths among all the three through lanes of the loading/unloading bay approach (southbound). The queue lengths have been indicated in the SimTraffic results in Appendix G. Also, based on the MSTA calculator, the high demand length for 510 students and full staff has been obtained as 2,827 feet, which can be accommodated in the available three lanes, in a loading bay length of 1250 feet.

**RECOMMENDATIONS:**

The proposed lane configuration has been depicted in **Figure 9: Proposed Lane Configuration**. Based on the impact of site generated trips, the following improvements are recommended:

**NC 16 Business and Triangle Circle/ Unity Church Road**

- Provide a northbound 100-foot right-turn storage lane on NC 16 Business with appropriate tapers
- Optimize the splits for the same phasing scheme

**NC 16 Business and Rivercross Connector Road/ Cherry Point Road (future signalized intersection)**

- Optimize the cycle lengths for the protected left turn phasing at eastbound, northbound and southbound left turns and permissive left turn phasing for the shared left through and right lane for westbound approach

**NC 16 Business and Triangle Circle (Unsignalized)**

- Add a right turn storage length of 150' on the southbound approach of NC 16 Business.

## II. INTRODUCTION

WSP USA, Inc. (hereafter referred to as WSP) was contracted by Rufus Road Partners, LLC to prepare a Traffic Impact Analysis (TIA) for a proposed K-8 charter school that would serve 765 students in Lincoln County, North Carolina. The proposed site is located on an undeveloped parcel of 10.6 acres on the west side of Triangle Circle just northwest of the Triangle Circle Road and NC 16 Business intersection and between the Rivercross Apartments and the Wildbrook (formerly Brookdale) Subdivision, which are proposed background developments for the future. The objective of the study is to determine the impact that the additional traffic generated by the proposed development will have on traffic operations within the study area.

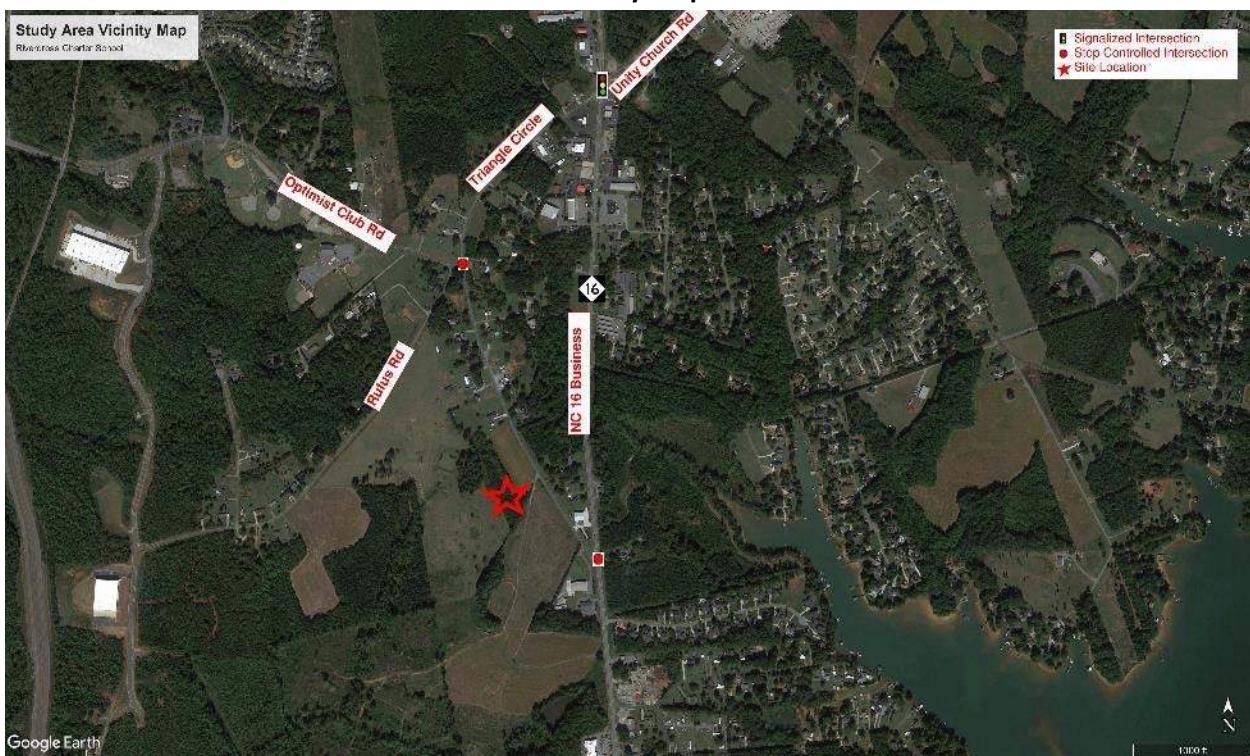
The study area will include two access points to the proposed development that are linked to Rivercross Connector Road and Rufus Road Connector, which are to be completed by 2019. One access point is a proposed entrance only driveway from Rivercross Connector Road which is directly off the Triangle Circle. The other access point is proposed exit only driveway which connects the proposed site to the Rufus Road Connector. The study area includes two existing unsignalized intersections and one existing signalized intersection at the intersection of Triangle Circle and NC 16 Business. Additionally, the future year scenarios include additionally, three unsignalized intersections and one signalized intersection. The study analyzes the traffic operations of study area intersections based on the following scenarios:

- 2017 Existing
- 2019 Horizon No-Build
- 2019 Horizon Build
- 2019 Horizon Build + Improvements

## III. AREA CONDITIONS

The **Vicinity Map** shown below provides an overview of the study area and identifies the existing intersections that were analyzed.

### Vicinity Map



Copyright: 2017 Google Earth

Evaluation of traffic impacts within the defined study area included the following intersections:

- NC 16 Business & Triangle Circle/Unity Church Road (existing signalized)
- NC 16 Business & Triangle Circle (existing unsignalized)
- Optimist Club Road & Triangle Circle (existing unsignalized)
- Triangle Circle & Rivercross Connector Road (future unsignalized)
- Site Entrance & Rivercross Connector Road (future unsignalized)
- Site Exit & Rufus Road Connector (future unsignalized)
- NC 16 Business & Rivercross Connection Road / Cherry Point Road (future year signalized 4-legged intersection)

A description of the roads within the study area limits is provided below, and the network's existing lane geometry is shown in **Figure 1: Existing Lane Configuration** (figures are attached at the end of report).

- *NC 16 Business* is a three-lane facility with a center two-way left-turn lane that runs north and south in the study area. It is classified as a minor arterial road with a posted speed limit of 45 miles per hour (mph). The 2016 AADT on NC 16 Business was 18,000 vehicles per day (vpd) just north of the NC 16 Business and South Triangle Circle intersection and 22,000 vpd just south of the intersection.

- *Triangle Circle* is a two-lane facility that runs parallel to NC 16 Business in the study area and intersects with NC 16 Business at the north as a four-legged signalized intersection and south as an unsignalized T-intersection. It is classified as a collector road with a posted speed limit of 45 mph. Triangle Circle intersects Optimist Club Road midway along its segment. The 2016 AADT on Triangle Circle was 1,800 vpd just south of the Triangle Circle and Optimist Club Road intersection and 4,000 vpd just north of the intersection.
- *Optimist Club Road* is a two-lane local residential road that runs along the west side of Triangle Circle in an east and west direction in the study area. It is having a posted speed limit of 45 mph. Optimist Club Road provides connectivity between NC 16 Business and NC 16 and ends at North Little Egypt Road and contains multiple intersections as connections to the adjacent developments. Optimist Club Road intersects Triangle Circle to form an unsignalized three-leg or T-intersection which is stop controlled on approach from Optimist Club Drive. The 2015 AADT for Optimist Club Drive is 5,700 close to the intersection with Triangle Circle.
- *Unity Church Road* is a two-lane facility that runs eastward from NC 16 Business in the study area and intersects with NC 16 Business and Triangle Circle at the north as a four-legged signalized intersection. It is classified as a collector road with a posted speed limit of 45 mph. Unity Church Road has multiple intersections and driveways along its segment. The 2016 AADT on Unity Church Road was 5,900 vpd.

In addition to these four roads, the following roads are expected to be completed by the future year (2019):

- *Cherry Point Road* is an existing local residential road that runs east at intersection with NC 16 Business and has a posted speed limit of 25 mph. In the future No-Build and Build scenarios, Cherry Point Road intersects NC 16 Business from the east to form a four-legged signalized intersection with proposed Rivercross Connector Road as eastbound approach. This intersection is currently existing as a three-legged unsignalized intersection and is not analyzed for the existing conditions due to very minimal traffic generated from Cherry Point Road.
- *Rivercross Connector Road* is a two-lane residential collector road that runs north and south between Triangle Circle and NC 16 Business. It is classified as a minor collector road with a posted speed limit of 35 mph. In the study area, Rivercross Connector Road intersects Triangle Circle from the north and intersects NC 16 Business and Cherry Point Drive at the south.
- *Rufus Road Connector* is a two-lane local residential road that runs north and south in the study area with a posted speed limit of 35 mph. Connector intersects Rivercross Connector Road on the south and Rufus Road on the north to form a three-leg unsignalized intersection.

The entry access point for the charter school is a proposed site driveway off Rivercross Connector Road that will provide access to the site from Triangle Circle, west of Triangle Circle & Rivercross Connector Road Intersection. The exit access point connects the site to Rufus Road Connector just north of the Rivercross Connector Road & Connector to Rufus Road intersection.

Turning movement counts were collected at the three existing study area intersections on Tuesday, September 12, 2017. These counts were conducted between the hours of 6:30 AM – 8:45 AM and 2:00 – 4:15 PM. The existing peak hour traffic volumes are shown in **Figure 2: 2017 Existing Peak Hour Traffic Volumes**. The turning movement counts were collected at the intersections: NC 16 Business & Triangle Circle/Unity Church Road (Signalized) NC 16 Business & Triangle Circle (unsignalized) and Triangle Circle & Optimist Club Road. The AM peak hour for the intersections at Triangle Circle & NC 16 Business (north) and Triangle Circle & NC 16 Business (south) was identified as being from 7:15 to 8:15 AM, and the AM peak hour for Triangle Circle & Optimist Club Road was identified as being from 7:00 to 8:00 AM. The PM peak hour was identified as being from 3:30 – 4:30 PM for all three intersections within the study area.

The intersections of Triangle Circle / Unity Church Road & NC 16 Business (north, signalized) and Triangle Circle & NC 16 Business (south, unsignalized) are approximately 4,050 feet apart with minimal driveways in between. From the turning movement counts, the volumes between these two intersections balanced within a few vehicles. The intersections of Triangle Circle & NC 16 and Triangle Circle & Optimist Club Road are approximately 2,750 feet apart with multiple minor driveways in between. Due to the presence of driveways along Triangle Circle, traffic volumes were not balanced along Triangle Circle. The raw turning movement count data is included in **Appendix B**.

## IV. APPROVED STATE PROJECTS

For the 2018-2027 Statewide Transportation Improvement Program (STIP) the following two Transportation Improvement Programs (TIPs) have been proposed in the study area location:

1. R – 5712: Adding turn lanes at the Intersection of NC 16 Business and SR 1439 (Unity Church Road) for a cost of \$1,163,000
2. R – 5859: NC 73 to SR 1389 (Fairfield Forest Road). Widen to Multi-lanes for a segment length of 3.8 miles and project cost of \$ 51,800,000

## V. APPROVED OFFSITE DEVELOPMENT

After discussions with the Lincoln County, it was determined that off-site traffic from three other developments in the area should be included in the future year traffic volumes as background development traffic. The approved developments are known as Rivercross (Phase 1), Rivercross Apartments, and Brookdale (now Wildbrook) Residential Development. The Rivercross developments will

be located to the south and west of the proposed charter school and the Wildbrook Residential development is proposed on the north of the school.

Rivercross (Phase 1) will be connected to NC 16 Business and Triangle Circle and will consist of the following land uses and intensities:

- 135 Single Family Homes
- 133 Town Homes

Rivercross Apartments will be connected to Rivercross Connector Road and will consist of the following land uses and intensities:

- 200 Apartments

The Wildbrook Residential Development will be connected to Rufus Road and Airlie Parkway and will consist of the following land uses and intensities:

- 180 Single Family Units

This development is expected to be built-out in the year 2018 and the analysis was performed for the year 2019, to include all the background developments. As part of the proposed site development, intersection improvements were required at the signalized intersection of NC 16 Business & Triangle Circle/Unity Church Road and NC 16 Business & Rivercross Connector Road/Cherry Point Drive and are shown in **Figure 3: 2019 No Build Lane Configuration**. The AM and PM peak hour volumes are shown in **Figure 4: Background Development Volumes**. All the background developments were distributed throughout the study area for the AM peak as the AM peak hour considered for this study (7AM – 9AM) and the background developments are the same. For the PM peak, only 50 % of the background development volumes are added for the no-build and build scenarios as the PM peak hour for the charter school is 2PM – 4PM and the PM peak hour considered for the background development traffic is from 4PM-6PM. All the three approved TIAs for the development are included in **Appendix C**.

## VI. HISTORICAL GROWTH

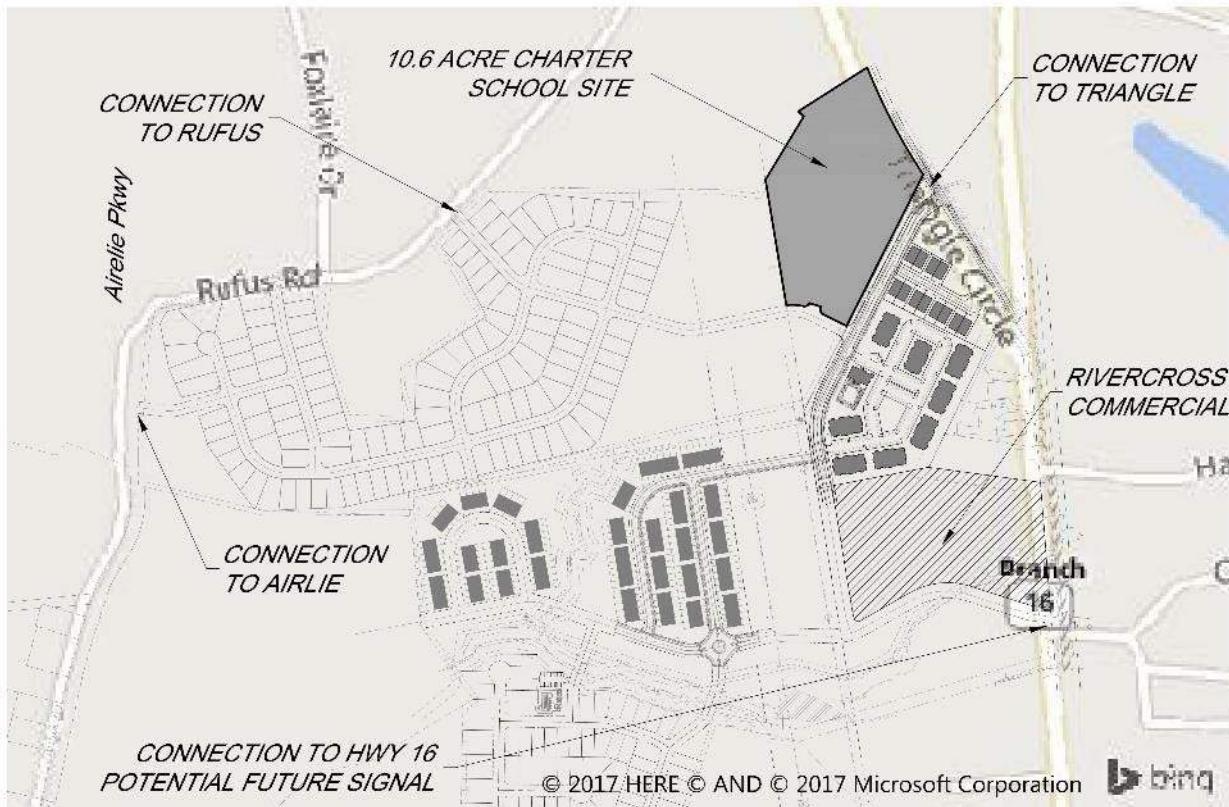
A background growth rate of 2 % was used to project the normal growth of traffic on all the adjacent roadways for all the future scenarios. The background growth rate was chosen based on the background development TIA of Rivercross Apartments.

## VII. PROPOSED DEVELOPMENT

The proposed development known as Rivercross Charter School will be constructed on 10.6 acres of land and will be in the northwest quadrant of the Triangle Circle and Rivercross Connector Road. This Charter School will serve for 765 students from grades K-8. The proposed site will have two one-directional access

points; one serving as an entry movement driveway linked to the future street of Rivercross Connector Road and the other as an exit movement driveway linked to the future Rufus Road Connector. The site location and site plan are presented below.

**Proposed Site Location**



## VIII. TRIP GENERATION

The trip generation was performed for the proposed site using the NCDOT Municipal School Transportation Assistance (MSTA) calculator. Trip generation was performed for the school AM (7-9am) and PM (2-4pm) peak periods due to the proposed charter school. The proposed charter school at full capacity (765 students) will generate 1,645 trips a day, 951 trips in the AM peak hour and 695 trips in the PM peak hour. Although the school is expected to accommodate 765 students from grades K-8, the school will implement a 30-minute stagger to the bell schedule to offset the arrival and departure times. The 30-minute stagger to the bell schedule would be applied to grades K-5 (510 students) and 6-8 (255 students). For analysis purposes the highest 30-minute trips will be applied to the network. The number of trips at the highest 30-minute stagger time (510 students) will generate 1,160 trips a day, 665 trips in the AM peak hour and 495 trips in the PM peak hour. It is to be noted, based on the school full capacity (765 students) 95 staff trips are included to the AM trips in and the PM trips out.

The results are presented in **Table 1** below.

**Table 1: Trip Generation – Proposed Charter School (Based on MSTA Calculator)**

Land Use	Size	Daily			AM Total Trips			PM Total Trips		
		Total	In	Out	Total	In	Out	Total	In	Out
Charter School	765 Students	1,645	823	823	951	523	428	695	300	395
	510 Students	1,160	580	580	665	380	285	495	200	295

Trip generation for the 25 (approx.) identified single family housing units along Cherry Point Road was found using the ITE Trip Generation Manual, 9<sup>th</sup> edition. Those trips were included in the future No-Build and Build scenarios as a part of background traffic. The housing units along Cherry Point Drive generates 19 trips during AM peak hour, with 14 exiting and 5 entering vehicles and generates 25 trips during PM peak hour, with 9 exiting and 16 entering vehicles.

The results are presented in the following **Table 2**.

**Table 2: Trip Generation – Cherry point Drive**

Land Use Code	Land Use	24 Hour			AM Peak Hour			PM Peak Hour		
		Total	In	Out	Total	In	Out	Total	In	Out
210	Single Family (25 Dwelling Units)	46	21	25	19	5	14	25	16	9

## IX. SITE TRIP DISTRIBUTION AND ASSIGNMENT

The trips generated by the proposed site, including parent and staff trips, were distributed in the study area based on the existing traffic patterns and location of adjacent residential land uses. Based on the proposed layout and driveway locations for the charter school, the trip distribution was slightly different for AM and PM peak hours. For the internal loading analysis, only the proposed parent trips were used.

### For the AM peak:

1. 60 percent of the traffic was assumed to originate from the north (NC 16 Business), 10 percent would originate from east (Unity Church Road) and 30 percent would originate from west (Optimist Club Road).
2. 30 percent of the traffic was assumed to be destined to the north (NC 16 Business), 35 percent of the traffic was assumed to be destined to the south (NC 16 Business), 5 percent would be destined to east (Unity Church Road) and 30 percent would be destined to west (Optimist Club Road).

### For the PM Peak:

3. 30 percent of the traffic was assumed to originate from the north (NC 16 Business), 35 percent would originate from the south (NC 16 Business), 5 percent would originate from east (Unity Church Road) and 30 percent would originate from west (Optimist Club Road).
4. 60 percent of the traffic was assumed to be destined to the north (NC 16 Business), 10 percent would be destined to east (Unity Church Road) and 30 percent would be destined to west (Optimist Club Road).

The detailed breakdown of the trip distribution percentages throughout the study area are shown in **Figure 6A: Site Trip Distribution (AM Peak)** and **Figure 6B: Site Trip Distribution (PM Peak)**. The assignment volumes from the site are shown in **Figure 7A: Site Traffic Assignment (AM Peak)** and **Figure 7B: Site Traffic Assignment (PM Peak)**. The Build volumes for the network has been shown in **Figure 8: 2019 Build Peak Hour Traffic Volumes**.

The trip assignment was performed with all the entering and exiting traffic distributed to different links. The traffic generated due to the proposed charter school has been assigned at the intersections in such a pattern so that the entering and exiting traffic does not overlap with each other, during both AM and PM peak periods.

## X. CAPACITY ANALYSIS METHODOLOGY

The traffic operations were analyzed for the following scenarios:

- 2017 Existing
- 2019 Horizon No-Build
- 2019 Horizon Build
- 2019 Horizon Build + Improvements

The transportation industry measures intersection delay and congestion based on a level of service (LOS) scale. The LOS scale rates existing or projected intersection operations on a scale of A (best) to F (worst) according to the average motorist delay and congestion levels at that intersection. The LOS criteria for signalized and unsignalized intersections as provided in the *2010 Highway Capacity Manual* (HCM) are described in **Table 3: Level of Service Criteria** shown below.

Table 3: Level of Service Criteria

Signalized Intersections		Unsignalized Intersections	
LOS	Delay per Vehicle (seconds)	LOS	Delay per Vehicle (seconds)
A	$\leq 10$	A	$\leq 10$
B	$>10$ and $\leq 20$	B	$>10$ and $\leq 15$
C	$>20$ and $\leq 35$	C	$>15$ and $\leq 25$
D	$>35$ and $\leq 55$	D	$>25$ and $\leq 35$
E	$>55$ and $\leq 80$	E	$>35$ and $\leq 50$
F	$>80$	F	$>50$

Based on the NCDOT Congestion Management Capacity Analysis Guidelines a peak hour factor (PHF) 0.90 was used throughout the network for the normal traffic in all analysis scenarios. MSTA suggests a PHF of 0.5 to be used for the traffic generated for proposed charter school. Likewise, based on the guidelines right-turn on red (RTOR) operation was not permitted in the analysis of the signalized intersection, as per NCDOT capacity analysis guidelines. For all the future year build scenarios a PHF for each individual

movement was obtained through straight proportioning of the two PHFs based on the volumes of normal and school generated traffic. For example, if there are 10 site generated vehicles and 10 background development and existing vehicles, the PHF used for this movement is:  $(10*0.5 + 10*0.9) / 20 = 0.7$ .

For the existing signal at NC 16 Business and Triangle Circle / Unity Church Road, the phasing details have been obtained from the Wildbrook Residential Development study. For the future year no-build scenario, geometric conditions are shown in **Figure 3: 2019 No Build Lane Configuration**. Additionally, for the future year, the new signalized intersection was allowed a default permissive phasing for all the left turns with a cycle length of 50 seconds and is proposed as a two-phase signal for the no-build and build (without improvements) scenarios.

SYNCHRO Version 9.1 was used to analyze the intersections identified within the study area limits. The roadway network, intersection geometries, traffic volumes and signal timings were input into a SYNCHRO network to analyze the intersection operations.

## XI. CAPACITY ANALYSIS RESULTS

The study area intersections were analyzed to determine the impact that site traffic generated by the proposed development would have on traffic operations. The existing signal plan along with the existing timing plan (cycle length, offset and splits) for the signalized intersection of NC 16 Business & Triangle Circle/ Unity Church Road has been obtained from the Wildbrook TIA. The signal timings and phasing from the plans were used in the SYNCHRO models for all scenarios. The intersection delay and LOS results for each scenario are summarized in **Table 4: AM Peak Hour Analysis Results** and **Table 4A: PM Peak Hour Analysis Results** and the full SYNCHRO reports are included in **Appendix F**.

The analysis of existing conditions indicates that the signalized intersection of NC 16 & Triangle Circle / Unity Church Road operates at LOS C in the AM peak hour with a delay of 33.9 seconds and at LOS D during PM peak hour with a delay of 38.7 seconds. The eastbound and westbound through movements at this intersection experience delay times of 56.3 seconds and 55.9 seconds respectively in the AM peak hour and 60.1 seconds and 74.1 seconds respectively in the PM peak hour. The remaining existing intersections in the study area are all unsignalized intersections with each movement having an intersection LOS C or better.

In the 2019 No-Build conditions the signalized intersection in the study area at Triangle Circle / Unity Church Road and NC 16 Business experience degradation in LOS along with an increase in delay times. This degradation in LOS and increase in delay is a result of traffic added due to background developments of Rivercross Phase 1, Rivercross Apartments and Wildbrook. The new signalized intersection at NC 16 business and Rivercross Connector Road / Cherry Point Road operate at an LOS C as a two-phase signal during the AM peak hour and at an LOS B during the PM peak hour, during future year no-build scenario.

The unsignalized intersections tend to operate satisfactorily at LOS D or better in the 2019 no-build scenario despite the added volumes, due to including the intersection geometry improvements proposed by the background development TIAs. For unsignalized intersections, LOS and delay are based on minor approach. It is to be noted that in Table 4 and Table 4A depict the minor movement results as the unsignalized intersection LOS and delay, as these approaches experience the highest delays.

**Table 4: AM Peak Hour Analysis Results**

Intersection	Existing (2017)		No-Build (2019)		Build (2019)		Build + Improvements (2019)		Control
	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	
NC 16 B & N Triangle Cir/Unity Church Rd	C	33.9	D	36	E	55.8	D	46.4	Signalized
NC 16 B & South Triangle Cir	C	21.8	D	34.7	F	89.8	D	34.5	Un-Signalized
Triangle Circle & Optimist Club Rd	B	11.4	B	12	B	11.9	B	11.9	Un-Signalized
Triangle Circle & Rivercross Con Rd	-	-	A	9.7	D	25.9	D	25.9	Un-Signalized
NC 16 B & Rivercross Con Rd / Cherry Pt Rd	-	-	C	24.9	F	95	D	39.7	Signlazied
Rivercross Con Rd & Site Access 1	-	-	-	-	A	NA	A	NA	Un-Signalized
Rivercross Con Rd & Site Access 2	-	-	-	-	B	13.5	B	13.4	Un-Signalized

**Table 4A: PM Peak Hour Analysis Results**

Intersection	Existing (2017)		No-Build (2019)		Build (2019)		Build + Improvements (2019)		Signalized?
	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	
NC 16 B & N Triangle Cir/Unity Church Rd	D	38.7	D	41.2	F	89.4	D	44.1	Signalized
NC 16 B & South Triangle Cir	C	18	C	21.3	C	24.6	C	21.8	Un-Signalized
Triangle Circle & Optimist Club Rd	B	14.7	C	16.6	C	16.5	C	15.5	Un-Signalized
Triangle Circle & Rivercross Con Rd	-	-	A	9.8	B	13.3	B	13.3	Un-Signalized
NC 16 B & Rivercross Con Rd / Cherry Pt Rd	-	-	B	10.8	F	136.2	D	46.8	Signlazied
Rivercross Con Rd & Site Access 1	-	-	-	-	A	NA	A	NA	Un-Signalized
Rivercross Con Rd & Site Access 2	-	-	-	-	B	13.3	B	13.4	Un-Signalized

For the Build conditions analysis, a one-way site entrance on Rivercross Connector Road which is directly off the Triangle Circle is proposed. The other access point is a proposed exit only driveway which connects the proposed site to the Rufus Road Connector. The two new unsignalized intersections for the build scenarios include site entrance and the exit links provided as ingress and egress to the proposed development. The new links and the resulting 2 intersections are modelled in SYNCHRO as one lane driveways with one-directional flow. The Rufus Road Connector and Rivercross Connector Road have been coded with a speed limit 35 MPH. The cherry point drive was coded with a speed limit if 25 MPH in synchro.

The internal links connecting the entry and exit driveways in the study area have been coded in synchro for queuing analysis. Based on the site plan, a three-lane loading and unloading bay link with a length of 1250 feet has been analyzed for any possible queues spilling back into the entrance driveway and back to the Triangle Circle. As suggested by the MSTA, a dummy signalized intersection has been places the first loading bay with a green time of 20 seconds and red time of 20 seconds for the southbound approach (3-lane loading and unloading link). The speed limits for the internal links, including entrance and exit driveways of the school in the build scenarios, have been coded as 10 MPH.

The signalized intersections at NC 16 Business & Triangle Circle / Unity Church Road and NC 16 Business and Rivercross Connector Road / Cherry Point Drive in the Build scenario were performing at an LOS E or worse for both AM and PM peak hours. For the NC 16 Business & Triangle Circle / Unity Church Road, the

eastbound and westbound approaches have approach delays of 68.9 seconds and 63.3 seconds for the during the AM peak hour and have approach delays of 83.6 seconds and 49.1 seconds for the PM peak hour. During AM peak, the southbound approach at NC 16 Business & Triangle Circle / Unity Church Road performs worse at an LOS F and approach delay of 172.7 seconds. During the PM peak, the northbound approach at NC 16 Business & Triangle Circle / Unity Church Road perform worse at an LOS F and approach delay of 149.2 seconds. During the AM peak, the southbound approach at NC 16 Business & Triangle Circle / Unity Church Road perform worse at an LOS E and approach delay of 63.7 seconds.

The unsignalized intersection at Triangle Circle & Optimist Club Rd and Triangle Circle & Rivercross Connection Road seem to operate satisfactorily in the build scenario, during AM and PM peak hours. The unsignalized intersection at NC 16 Business & South Triangle Circle experience worsening operation from LOS D to LOS F and minor approach delay from 34.7 seconds to 89.8 seconds during AM peak hour and is performing well during the PM peak hour. The major cause for degradation of LOS and delay times for eastbound approach during AM peak hour at NC 16 Business & South Triangle Circle is the added southbound right turning vehicles. There is only one receiving lane for the southbound movements at this intersection. The minor approach, being the stop controlled approach, usually experiences higher delay times at such intersections.

The proposed charter school did not add any eastbound left-turn or right-turn vehicles nor any southbound through vehicles at NC 16 Business and Triangle Circle intersection. During the AM peak, the primary addition to this intersection is the 267 southbound right and 99 northbound through vehicles, due to the charter school. Also, the only location where the crossing traffic were added is the unsignalized intersection at NC 16 and Triangle Circle.

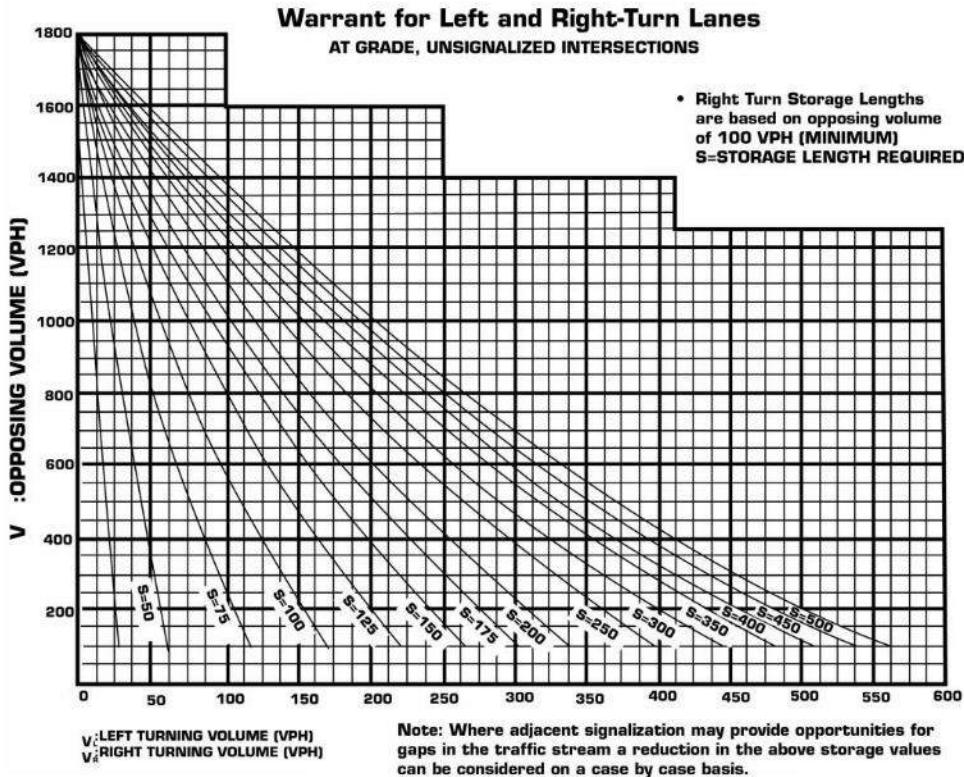
The phasing used by the previous TIAs has been used for the signalized intersection at NC 16 and Triangle Circle/Unity Church Road for the existing and 2019 No Build and 2019 Build scenarios. For the Build + Improvements scenario, the splits were optimized for the NC 16 and Triangle Circle/Unity Church Road intersection. The new signalized intersection has been coded with a protected left turn phasing on northbound, eastbound and southbound approaches and permitted left turn phasing at westbound one lane approach. At all the existing intersections, we were mimicking the signalized and unsignalized intersection designs based on the previous TIAs.

At the internal signalized intersection at the 3-lane Loading bay and links to exiting driveways, the maximum queue length during the AM peak hour will be 143 feet in the Build scenario and 165 feet during the Build + Improvements scenario. The maximum queue length during the PM peak is 120 feet in the Build scenario and 147 feet during the Build + Improvements scenario. These values are the maximum recorded queue lengths among all the three through lanes of the loading/unloading bay approach (southbound). The queue lengths have been indicated in the SimTraffic results in Appendix G. Also, based on the MSTA calculator, the high demand length for 510 students has been obtained as 2,827 feet, which can be accommodated in the available three lanes. The minimum required length for the loading bay area therefore is 942 feet for 510 students. For the full 765 students, the minimum required loading bay length

is 1,414 feet for a 3-lane loading bay. The analysis was performed for a loading bay length of 1,250 feet, which falls between the requirements of 510 students (grades K-5) and 765 students (all grades).

A right-turn lane warrant analysis, based on NCDOT's Policy on Street and Driveway Access to North Carolina Highways (2003), was conducted to determine if the northbound approach at NC 16 Business and Triangle Circle / Unity Church Road can be warranted a right-turn lane. The number of right turning vehicles for the northbound approach during PM peak are 153 vph. Based on the 2019 Build traffic volumes the signalized intersection of NC 16 Business and Triangle Circle / Unity Church Road meets the warrant for a right turn lane of storage length between 75 feet and 100 feet. A 100-foot storage length is therefore proposed for the northbound right movement at NC 16 Business & Triangle Circle / Unity Church Road intersection. The warrant analysis was performed based on the following 'Warrants for Left and Right-Turn Lanes' for an opposing volume of 100 vph, as specified in NCDOT's Policy on Street and Driveway Access to North Carolina Highways.

Based on NCDOT's Policy on Street and Driveway Access to North Carolina Highways (2003), a right-turn lane warrant analysis was conducted to determine if the southbound approach at NC 16 Business and Triangle Circle (unsignalized) can be warranted a right-turn lane. The number of right turning vehicles for the southbound approach during AM peak are 267 vph. Based on the 2019 Build traffic volumes the signalized intersection of NC 16 Business and Triangle Circle (signalized) meets the warrant for a right turn lane of storage length of 150 feet for the southbound approach.



## XII. MITIGATION & RECOMMENDATIONS

The proposed lane configuration has been depicted in **Figure 9: Proposed Lane Configuration**. Based on the impact of site generated trips, the following improvements are recommended:

### **NC 16 Business and Triangle Circle/ Unity Church Road**

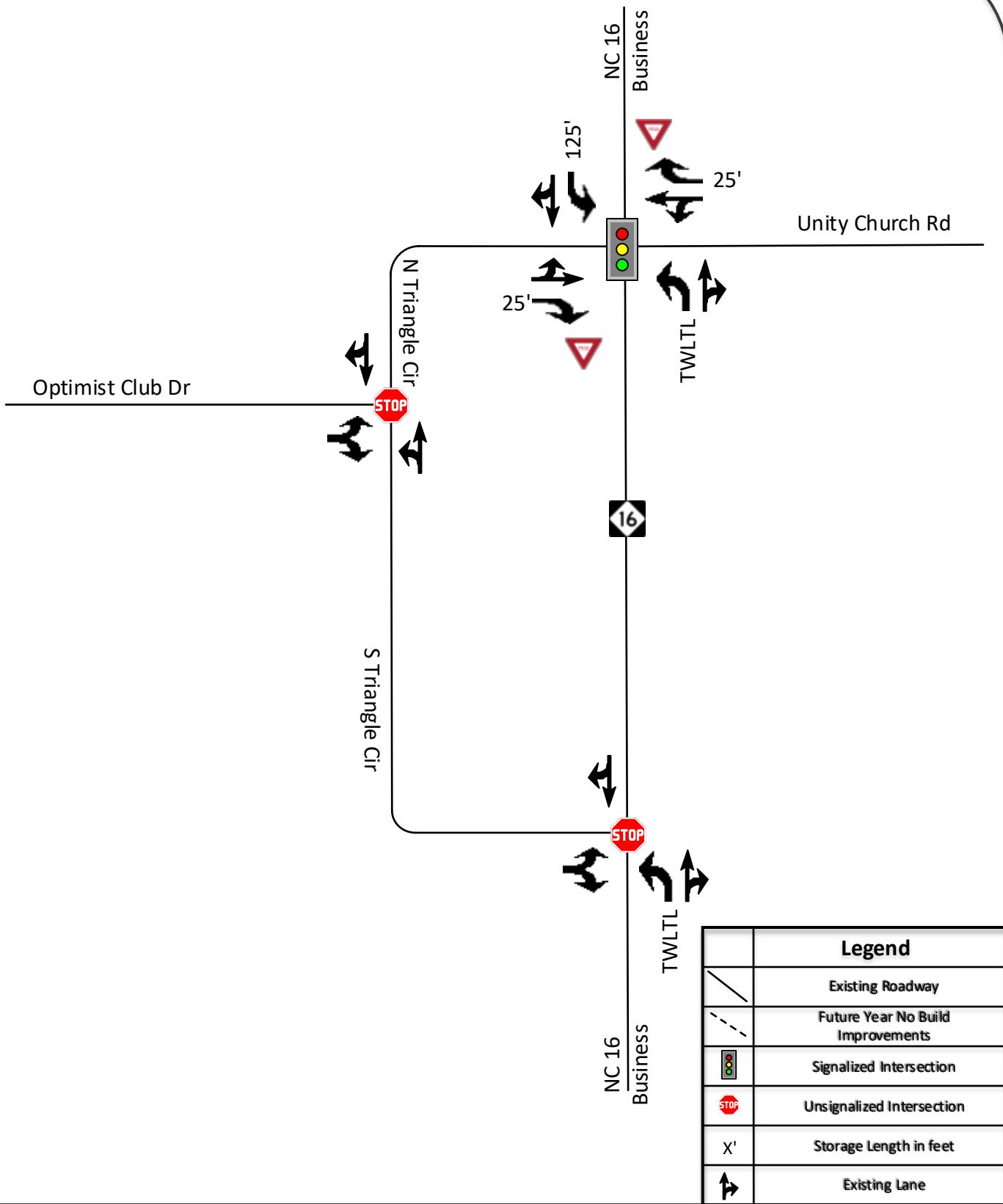
- Provide a northbound 100-foot right-turn storage lane on NC 16 Business with appropriate tapers
- Optimize the splits for the same phasing scheme

### **NC 16 Business and Rivercross Connector Road/ Cherry Point Road (future signalized intersection)**

- Optimize the cycle lengths for the protected left turn phasing at eastbound, northbound and southbound left turns and permissive left turn phasing for the shared left through and right lane for westbound approach

### **NC 16 Business and Triangle Circle (Unsignalized)**

Add a right turn storage length of 150' on the southbound approach of NC 16 Business.

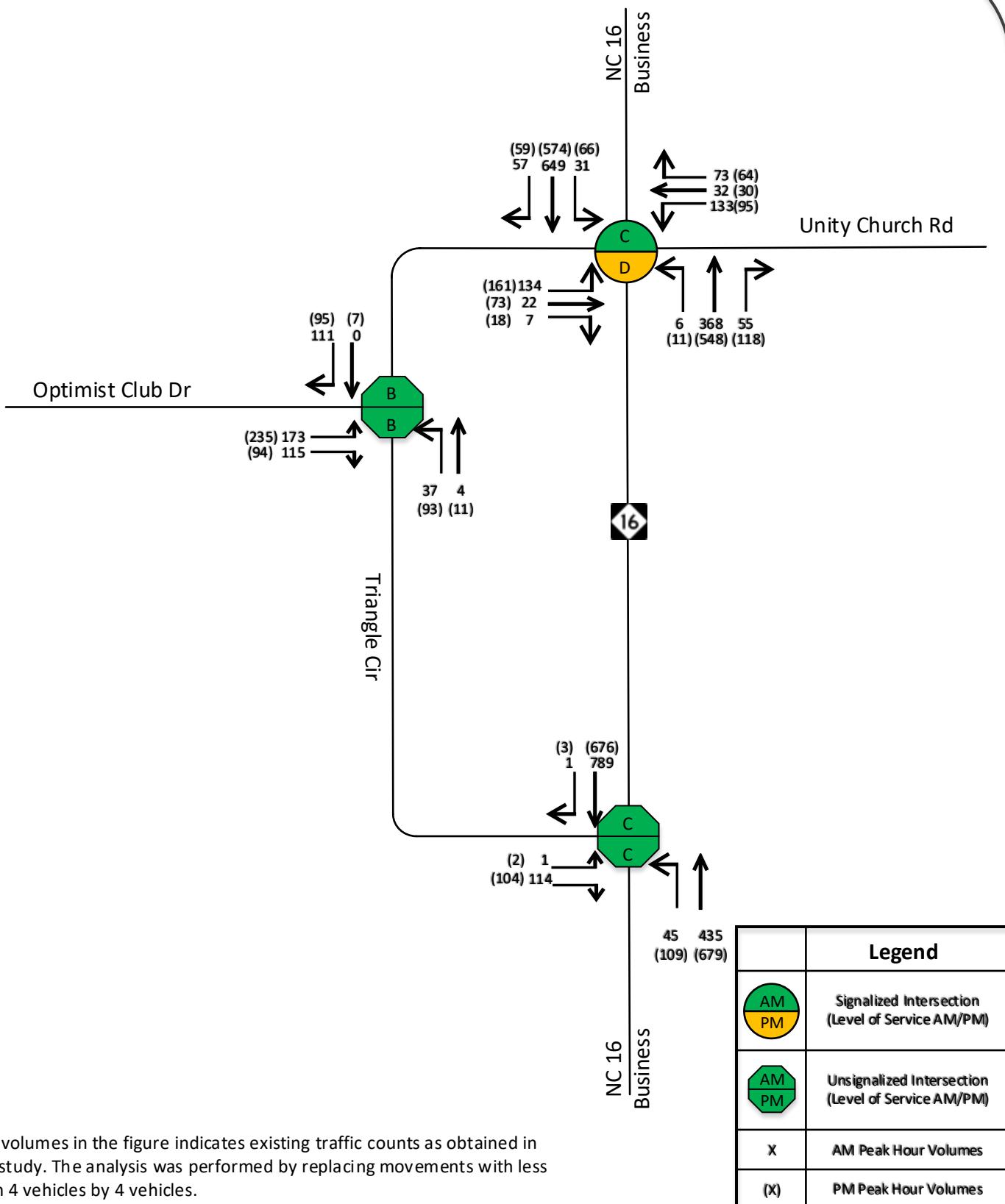


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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

**Figure 1 Existing Lane Configuration**



The volumes in the figure indicates existing traffic counts as obtained in the study. The analysis was performed by replacing movements with less than 4 vehicles by 4 vehicles.



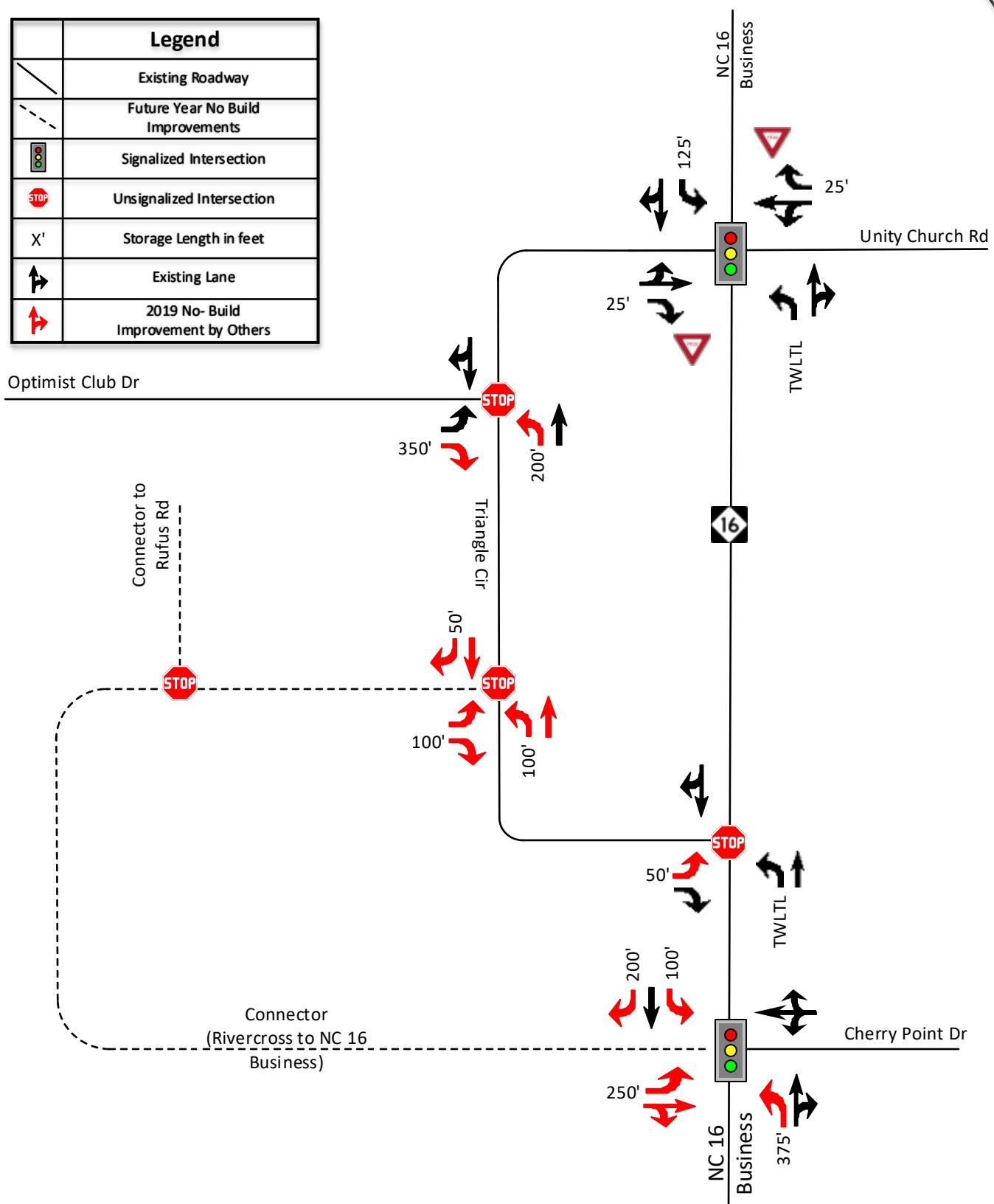
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<http://www.wspgroup.com>

## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

Figure 2 Existing Peak Hour Traffic Volumes

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Signalized Intersection
	Unsignalized Intersection
X'	Storage Length in feet
	Existing Lane
	2019 No- Build Improvement by Others



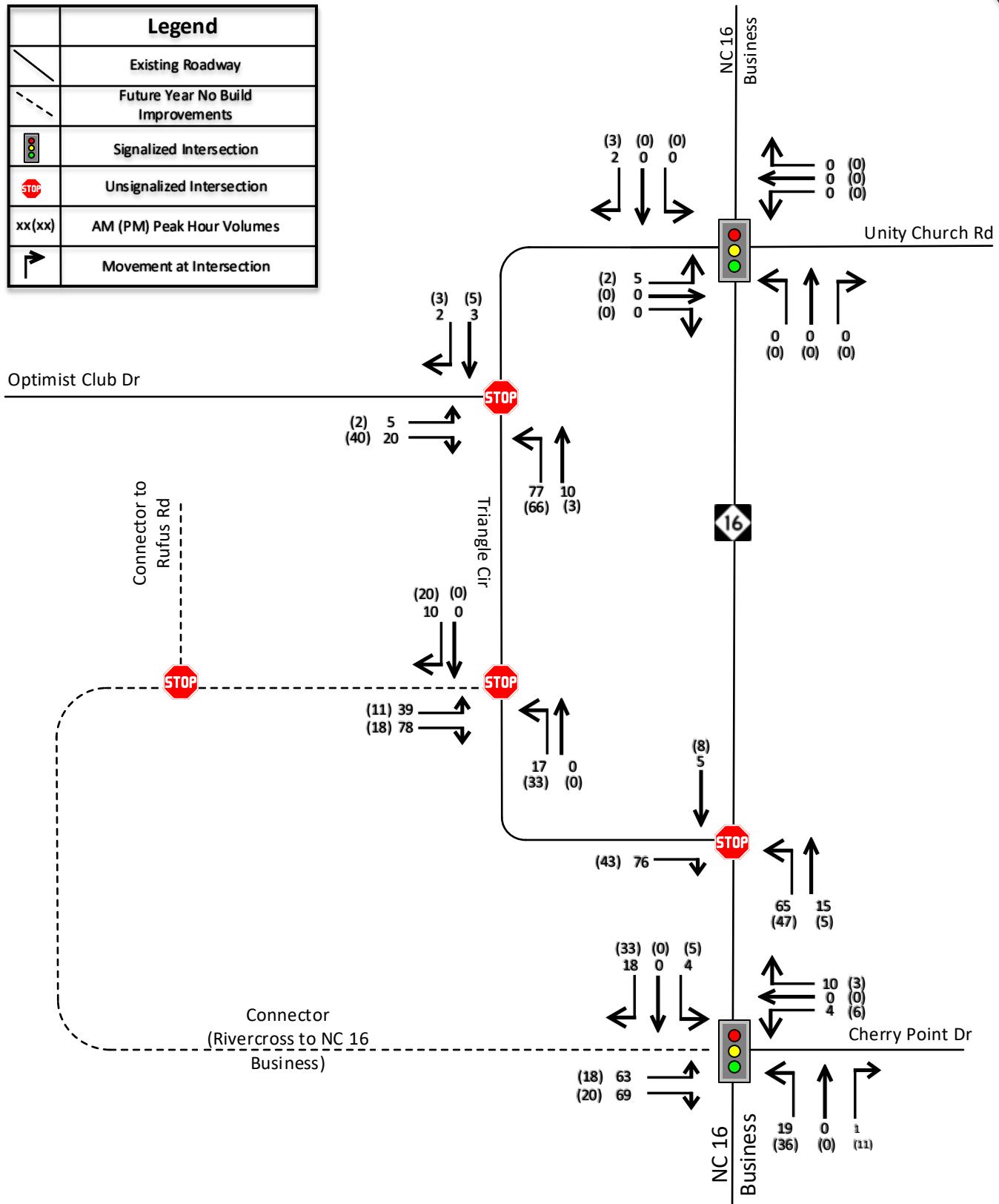
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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

Figure 3  
2019 No-Build Lane Configuration

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Signalized Intersection
	Unsignalized Intersection
xx(xx)	AM (PM) Peak Hour Volumes
	Movement at Intersection



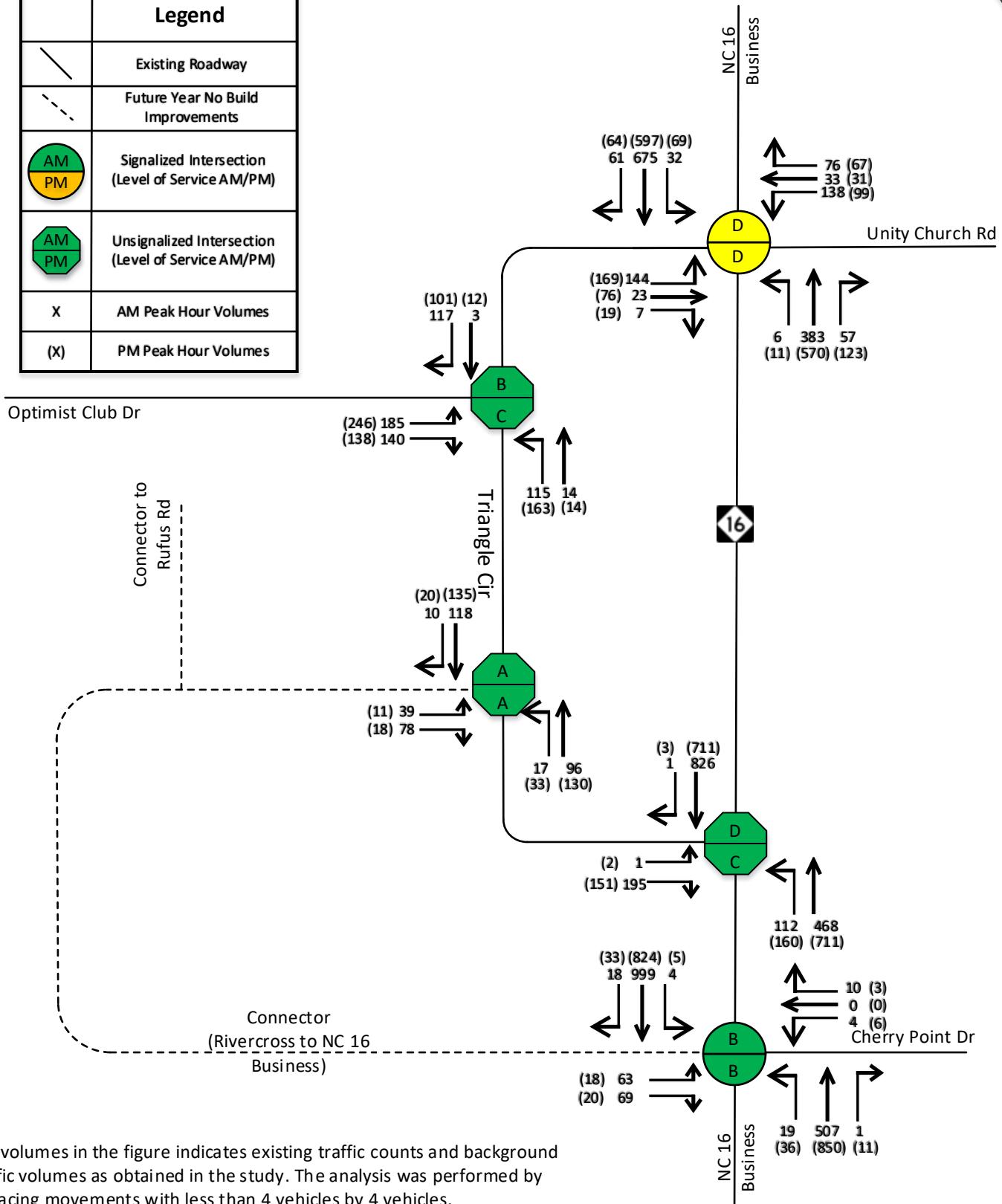
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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

Figure 4  
Background Development Volumes

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Signalized Intersection (Level of Service AM/PM)
	Unsignalized Intersection (Level of Service AM/PM)
X	AM Peak Hour Volumes
(X)	PM Peak Hour Volumes



The volumes in the figure indicates existing traffic counts and background traffic volumes as obtained in the study. The analysis was performed by replacing movements with less than 4 vehicles by 4 vehicles.



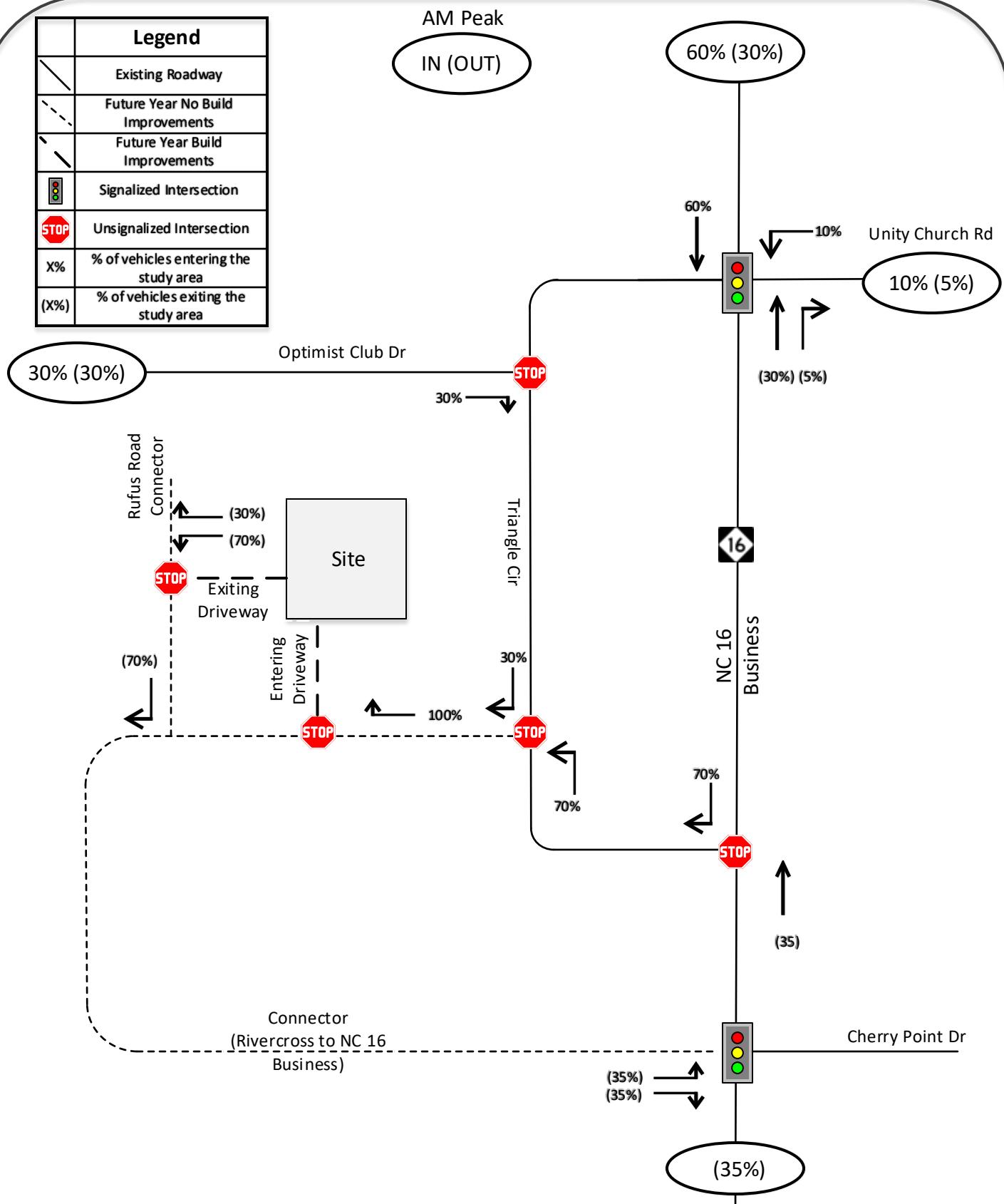
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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

Figure 5  
 2019 No-Build Peak Hour Traffic Volumes

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Future Year Build Improvements
	Signalized Intersection
	Unsignalized Intersection
X%	% of vehicles entering the study area
(X%)	% of vehicles exiting the study area



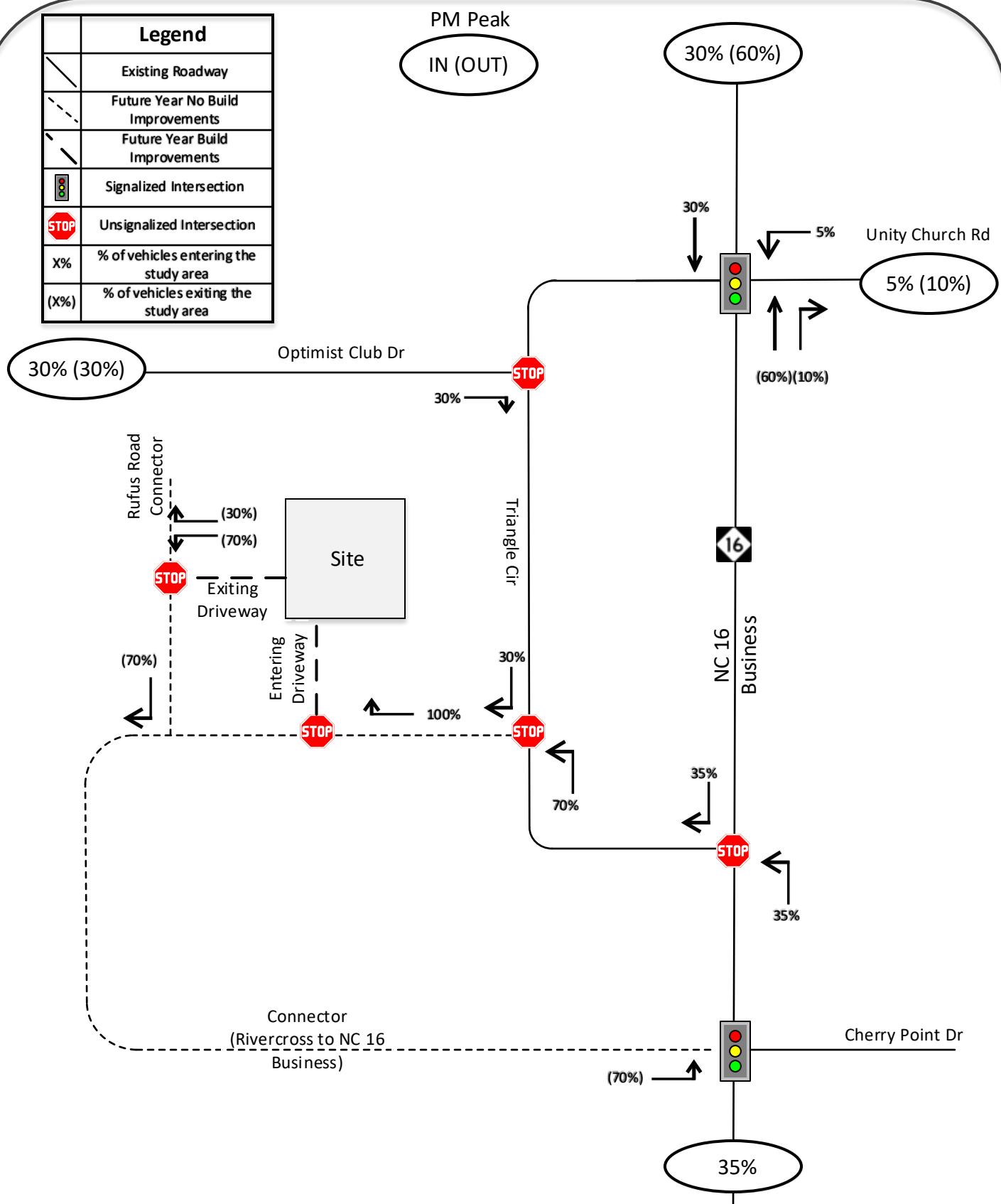
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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

Figure 6A  
Site Distribution  
(AM Peak Hour)

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Future Year Build Improvements
	Signalized Intersection
	Unsignalized Intersection
	% of vehicles entering the study area
	% of vehicles exiting the study area



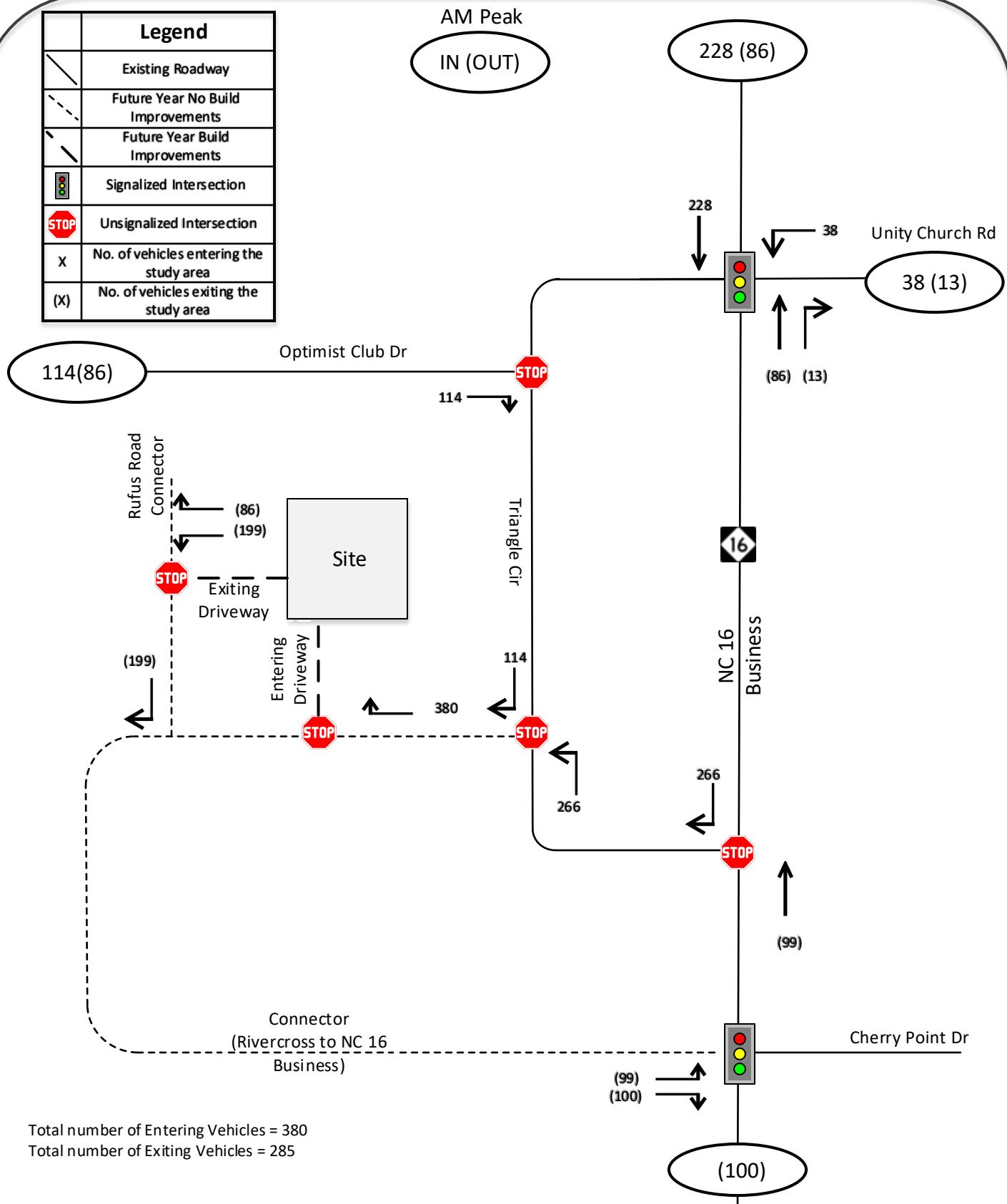
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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

**Figure 6B**  
**Site Distribution**  
**(PM Peak Hour)**

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Future Year Build Improvements
	Signalized Intersection
	Unsignalized Intersection
X	No. of vehicles entering the study area
(X)	No. of vehicles exiting the study area



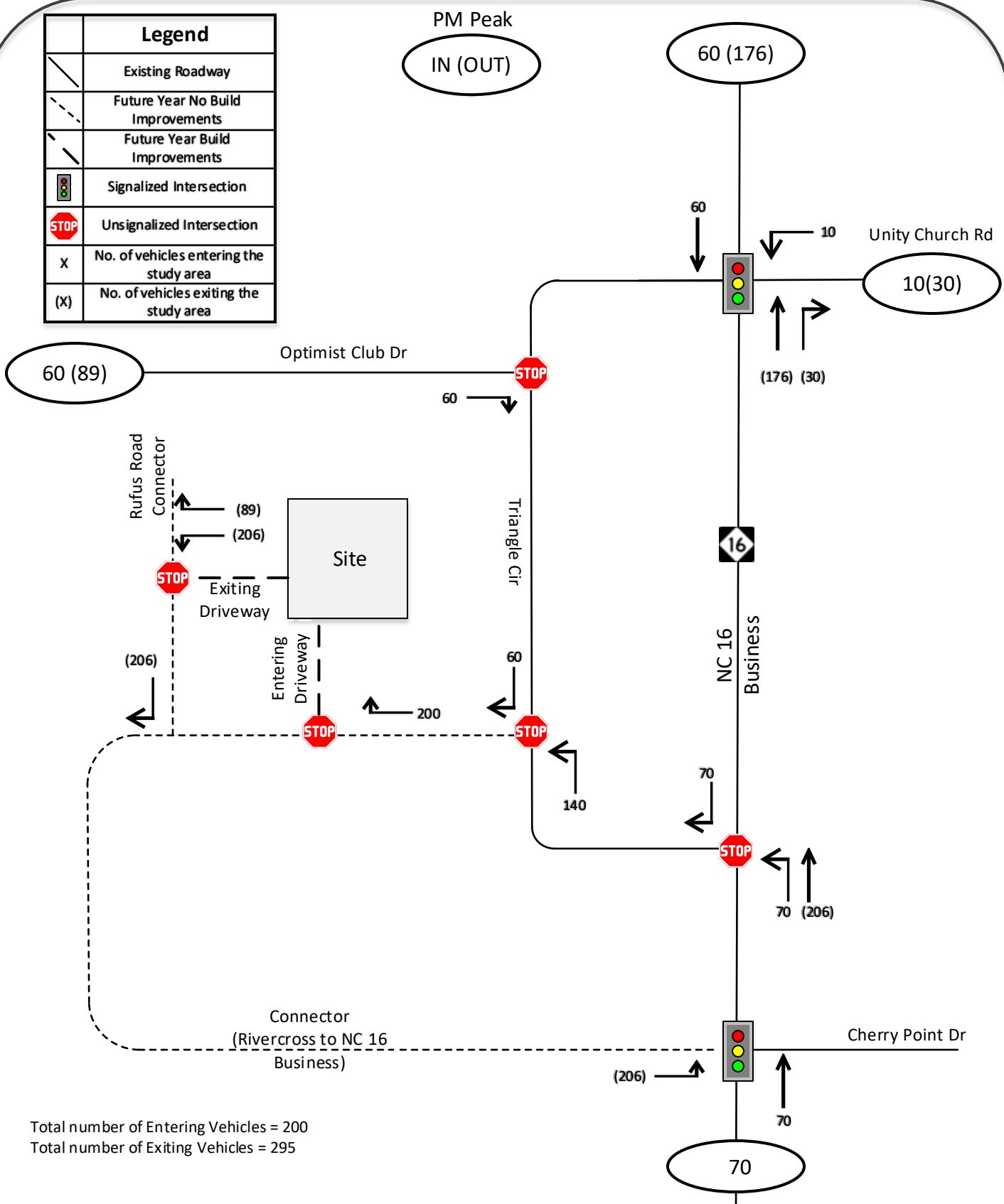
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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

Figure 7A  
Site Traffic  
(AM Peak Hour)

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Future Year Build Improvements
	Signalized Intersection
	Unsignalized Intersection
X	No. of vehicles entering the study area
(X)	No. of vehicles exiting the study area



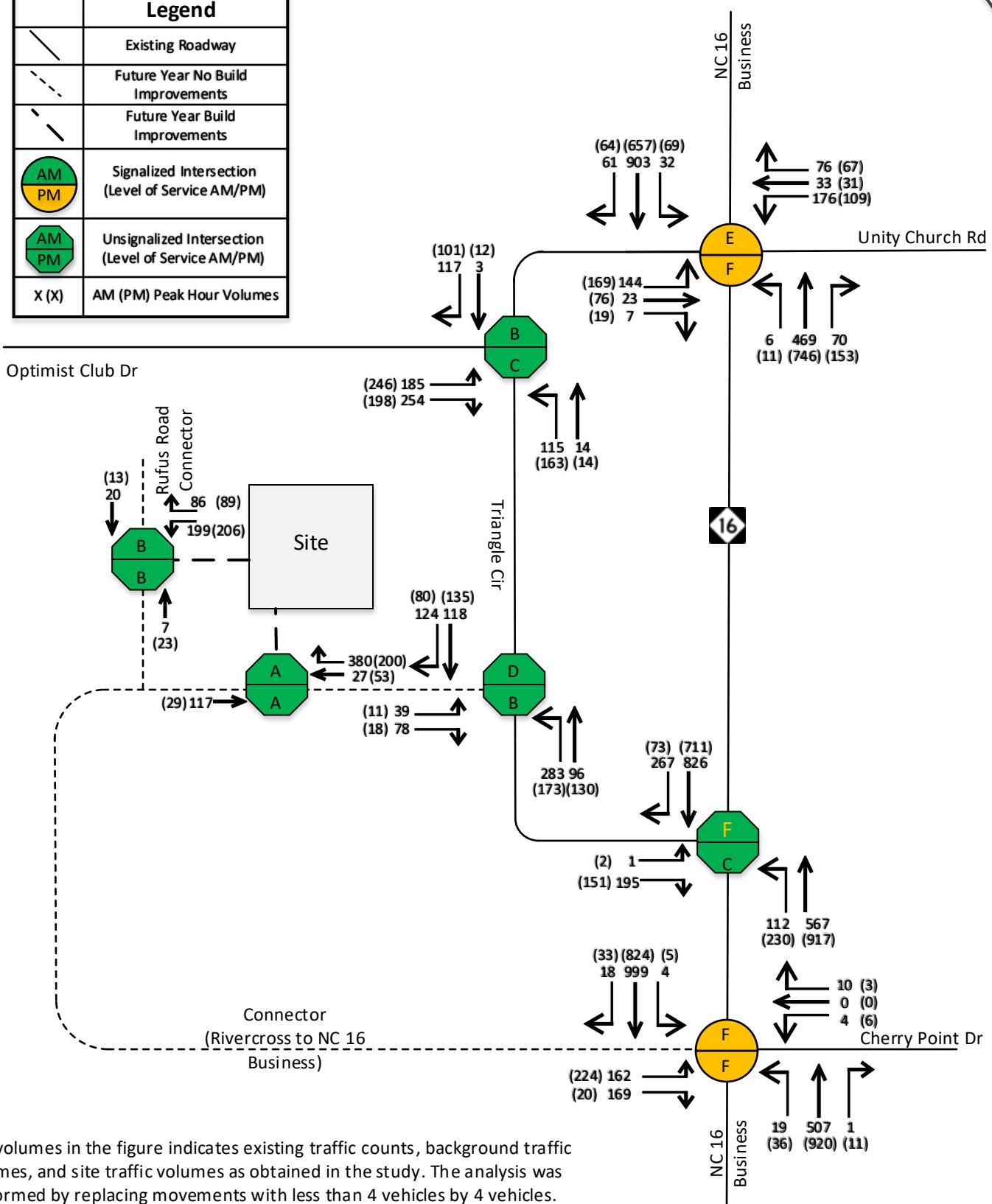
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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

Figure 7B  
Site Traffic  
(PM Peak Hour)

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Future Year Build Improvements
	Signalized Intersection (Level of Service AM/PM)
	Unsignalized Intersection (Level of Service AM/PM)
	AM (PM) Peak Hour Volumes



The volumes in the figure indicates existing traffic counts, background traffic volumes, and site traffic volumes as obtained in the study. The analysis was performed by replacing movements with less than 4 vehicles by 4 vehicles.



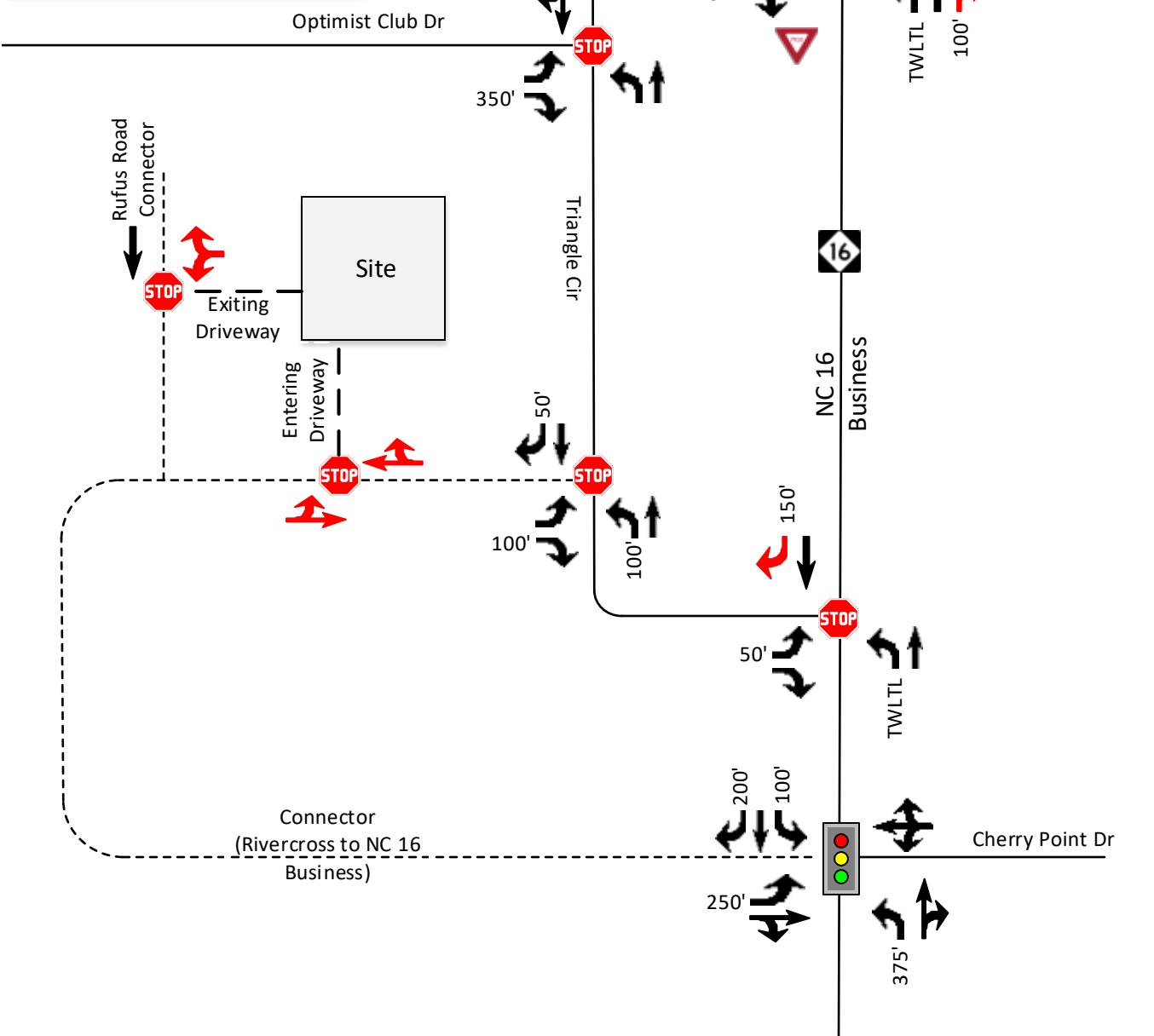
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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

Figure 8  
2019 Build Peak Hour  
Traffic Volumes

Legend	
	Existing Roadway
	Future Year No Build Improvements
	Signalized Intersection
	Unsignalized Intersection
	Storage Length in feet
	Existing Lane
	Proposed Improvements by Developer



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## Rivercross Charter School – Traffic Impact Analysis

Lincoln County, NC

**Figure 9**  
**2019 Proposed Lane Configuration**