



**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: April 15, 2016

Re: PD #2016-2  
Cambridge Properties, Inc., applicant  
Parcel ID# 90176 and 34534 (portions of each)

*The following information is for use by the Lincoln County Board of Commissioners and Planning Board at their joint meeting/public hearing on May 2, 2016.*

**REQUEST**

The applicant is requesting the rezoning of 15.3 acres from R-T (Transitional Residential) and B-G (General Business) to PD-R (Planned Development Commercial) to permit up to 90,000 square feet of commercial space, including a 50,000-square-foot grocery store, 12,500 square feet of shops, and three outparcels. Under the Lincoln County Unified Development Ordinance, any proposed commercial development in excess of 50,000 square feet is subject to review through the planned development process.

A site plan and guidelines for the proposed development, Cambridge Village, have been submitted as part of the rezoning application and would serve as the master plan for the development if the rezoning request is approved. A traffic study has also been submitted, recommending road improvements to mitigate the impact of the proposed development.

**SITE AREA AND DESCRIPTION**

The property is located on the east side of N.C. 16 Business about 1,000 feet north of N.C. 73. It is adjoined by property zoned R-T and B-G. Land uses in this area are primarily commercial with some residential uses. A Wednesday's restaurant is located directly to the north of this property. A Kangaroo gas station is located to the south. Riverwalk Apartments is located on the opposite side of N.C. 16 Business. County water and sewer are available at this location.

## ENVIRONMENTAL

This property is not located in a water-supply watershed district. However, it is located in an area that's subject to state stormwater regulations and permitting.

A stream originates on the proposed development site and runs under N.C. 16 Business. The site also contains some wetlands. The applicant plans to apply for a permit through the U.S. Army Corps of Engineers to impact the wetlands and a portion of the stream. Under such a permit, a developer is required to provide compensatory mitigation.

## WAIVER REQUEST

Under the UDO, a 50-foot buffer is required along each side of a stream. The site plan shows that the required buffer would be provided along the portion of the stream that would not be impacted by the development. The applicant is requesting a waiver from the buffer requirements for the impacted portion of the stream.

## PLAN CONFORMANCE

This property is part of an area designated by the Lincoln County Land Use Plan as Regional Business, suitable for larger sized stores and other businesses that rely on large customer bases. Guiding Principle 6 of the Land Use Plan calls for well-designed and well-integrated developments in terms of internal connectivity and access to adjoining tracts.

## STAFF'S RECOMMENDATION

Staff recommends that the rezoning request be approved. 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 #2016-2**

Applicant **Cambridge Properties, Inc.,**

Parcel ID# **portions of 90176 and 34534**

Location **east side of N.C. 16 Business about 1,000 feet north of N.C. 73**

Proposed amendment **rezone from R-T and B-G to PD-C to permit up to 90,000 square feet of commercial space**

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

**This property is located in an area designated by the Land Use Plan as Regional Business. The rezoning plan is in conformance with Guiding Principle 6 of the Land Use Plan, which calls for well-integrated developments.**

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

**This property is located in an area that is largely commercial. The proposed development will attract new businesses, create jobs and increase the county's tax base. The plan will create a road grid with internal connections, access to N.C. 16 Business, N.C. 73 and North Pilot Knob Road, and connections to adjoining tracts of land, helping to disperse traffic and aiding future development in the area. The plan will provide other road improvements to mitigate the traffic impact.**



### **Zoning Map Change Application**

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 Cambridge Properties, Inc.

Applicant Address 831 E. Morehead Street, Ste 245, Charlotte, NC 28202

Applicant Phone Number 704-333-2393, ext. 108

Property Owner's Name Cecil M. Dellinger and Doris D. Keever

Property Owner's Address 307 N. Pilot Knob Road, Denver, NC

Property Owner's Phone Number 828-461-1260

#### **Part II**

Property Location 202 N. NC Highway 16, Denver, NC 28037  
4602-64-4144

Property ID # (10 digits) 4602-54-1002      Property Size +/- 15.3 acres

Parcel # (5 digits) 90176/34534    Deed Book(s) 89E/1088    Page(s) 327 / 663

#### **Part III**

Existing Zoning District RT      Proposed Zoning District PD-C

Briefly describe how the property is currently being used and any existing structures.

The property currently has a single family home on it and the balance  
of the property is vacant.

Briefly explain the proposed use and/or structure which would require a rezoning.

SEE EXHIBIT A ATTACHED HERETO

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**APPLICATION FEE (up to 2 acres \$300, 2-5 acres \$500, 5+ acre \$1,000)**  
**MUST BE RECEIVED BEFORE PROCESSING.**

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

Doris D. Keever  
\_\_\_\_\_  
Applicant  
Cecil M. Dellinger

March 16, 2016  
\_\_\_\_\_  
Date

## **Zoning Map Change Application**

### **EXHIBIT A**

Cambridge Properties, Inc., as petitioner, is seeking to rezone the referenced parcel(s) from RT to PD-C. The intent of the rezoning is to allow the development of a neighborhood grocery anchored shopping center with associated retail/office space, as well as three outparcels. The total building square footage within the development shall not exceed 90,000 square feet.

## **Meeting Minutes Summary**

**Date/Time:** **Tuesday, April 12, 2016 – 7:00 PM**

**Location:** **East Lincoln Community Center, 8160 Optimist Club Road, Denver, NC**

**Purpose:** **Lincoln County Community Involvement Meeting to provide information regarding Cambridge Properties, Inc. proposed retail development known as Cambridge Village and to receive comments prior to the public hearing.**

**Presenters:** **Robert Davis; Jay Priester – Cambridge Properties, Inc.; Matthew Peach – A. Morton Thomas and Associates, Inc.**

### **Introduction:**

Mr. Robert Davis opened the meeting by welcoming those in attendance and introduced the representatives of Lincoln County, the Planning Board and Commissioner Martin Oakes who were in attendance. Mr. Davis then introduced Jay Priester with Cambridge Properties as the developer and Mr. Matthew Peach with A. Morton Thomas and Associates as the traffic consultant for the development. Mr. Davis identified the location of the proposed rezoning, along Business Highway 16 and Highway 73 and explained that the property is being proposed for a commercial development. Mr. Davis then turned over the presentation to Jay Priester to present the power point presentation.

Mr. Priester thanked those in attendance and began by giving some background information on Cambridge Properties. He explained the Cambridge was started in 1990 to pursue retail development and multi-use development and now develops properties in several states throughout the southeast. He shared a few examples of Cambridge's previous development including residential land development, single tenant build to suits, grocery anchored and regional shopping center, as well as, a multi-use developments combining retail/office and residential.

The following two slides of the power point showed the location of the proposed development and the existing retailers in the market to show the location of Cambridge Village.

Mr. Priester then shared an aerial showing the existing roads and new private roads to be built by the developer. The new private roads show and provide interconnectivity to and from Highway 73, Business Highway 16, and North Pilot Knob Road. The access into the site was further explained: 1) an access point would be at Highway 73 across from the entrance into the Harris Teeter center adjacent to the new Harris Teeter fueling station, this entrance would have a right in/right out with protected left into the site; 2) on Business 16 a new right in/right out would be constructed about 400 feet north of intersection of 16/73; 3) a full turn intersection would be constructed with a proposed signal on Highway 16 next to the Wendy's and would align with the Riverwalk Apartment entrance; and 4) a full turn unsignalized access on North Pilot Knob Road.

The last slide showed the conceptual site plan with a grocery anchor and related retail shop space and 3 outparcels which may include a sit down restaurant, a branch bank or credit union, or other complementary users.

Mr. Priester then discussed the TIA recommended offsite road improvements which Mr. Priester stated have been submitted to NCDOT and Lincoln County and the recommendations are subject to final approval. However, the current recommendation are: 1) adding a new thru/right turn lane on north bound Business 16, just south of Highway 73; 2) a right turn lane on Business 16 into the first access into the site north of the Kangaroo; 3) re-aligning the access of Riverwalk Apartment to the proposed full access on Business 16 to create a four way intersection; 4) on North Pilot Knob Road add a dedicated left turn lane and right turn lane into the site; 4) at the intersection of North Pilot Knob Road and Highway 73 intersection extend the existing left turn lane on Pilot Knob going east on Highway 73; and 5) on Highway 73 at the new proposed entrance the developer would be required to restrict left turn movement exiting the Harris Teeter Center and the new proposed Road leaving Cambridge Village.

Mr. Priester then welcomed questions.

It was asked when the construction would start. Mr. Priester responded pending all approvals and permits they would like to begin construction in the first quarter of 2017.

A follow up question asked was if the grocery store was Publix. Mr. Priester responded that the grocery store had not been announced but hopes to within the next 2 months.

Questions were asked specifically of the traffic and they were addressed by Mr. Peach.

How many new trips would be created by the development? Mr. Peach stated that it would create about 2 new trips per turn movement.

What day of the week was the traffic counts completed? Mr. Peach responded, it was a normal Tuesday during AM and PM Peak hours of 7-9 and 4-6 respectively. Normal day refers to non-holiday and schools must be in session.

Why did you pick a Tuesday for the counts? Mr. Peach replied, it is a requirement of NCDOT to count during a normal day and excludes Friday-Sunday.

What are the road improvements and how long are the new lanes. Mr. Peach went through the recommendations from the TIA and said they varied and then explained the length of stacking for each of the new lanes.

A question was asked about the stream on the property. Mr. Priester stated that they have worked with several wetland and stream consultants and they would need to impact a portion of the stream; however, the higher quality portion of the stream would be preserved and not impacted. The impacted portion of the stream would be permitted through the Army Corps of Engineers and the impacted portion of the stream would be about 300'.

A question was asked about downstream impacts of creating new impervious coverage on the proposed development. Mr. Priester stated that they would be doing storm water management onsite which would include both storm water quality and storm water detention.

A question was asked about the open space within the development. Mr. Priester stated they would have at least 2 acres of open space and would include a pocket park within the development.

A question was asked about future development on the adjacent land. Mr. Priester stated Cambridge did not have a contract on the adjacent property and was not sure what the land owners envision for their property. Mr. Priester stated in his opinion that it could include a mix of uses and that the road network constructed by Cambridge allows for interconnectivity for future development.

Mr. Davis thanked those who attended the meeting and for the good questions they asked. He stated the development team would stay to answer any additional questions.



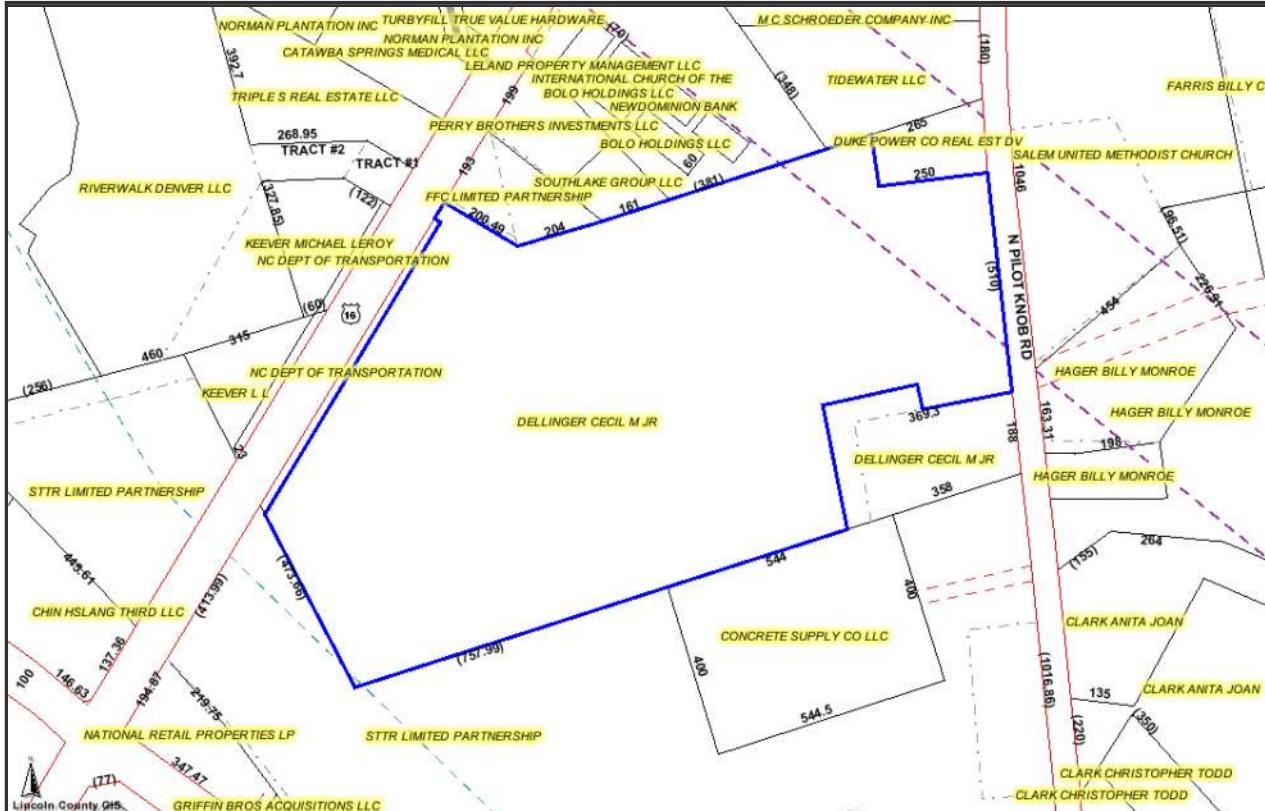
## Lincoln County, NC

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: 4/14/2016 Scale: 1 Inch = 400 Feet



### PHOTOS



60079

### PARCEL INFORMATION FOR 4602-64-4144

Parcel ID	60079	Owner	DELLINGER CECIL M JR KEEVER DORIS D
Map	4602-04	Mailing	202 HWY 16N
Account	0127179	Address	DENVER NC 28037
Deed	89E-327	Recorded	9/27/1989
Land Value	\$324,857	Total Value	\$392,399
----- All values are for tax year 2016. -----			
Description	HAGER LAND SEE PAR #90176		
Address	202 N NC 16 BUSINESS HWY		
Township	CATAWBA SPRINGS		
Main Improvement	CONVENTIONAL		
Main Sq Feet	1437	Stories	1
Unfinished Basement	647	Year Built	1950
Value			\$67,542

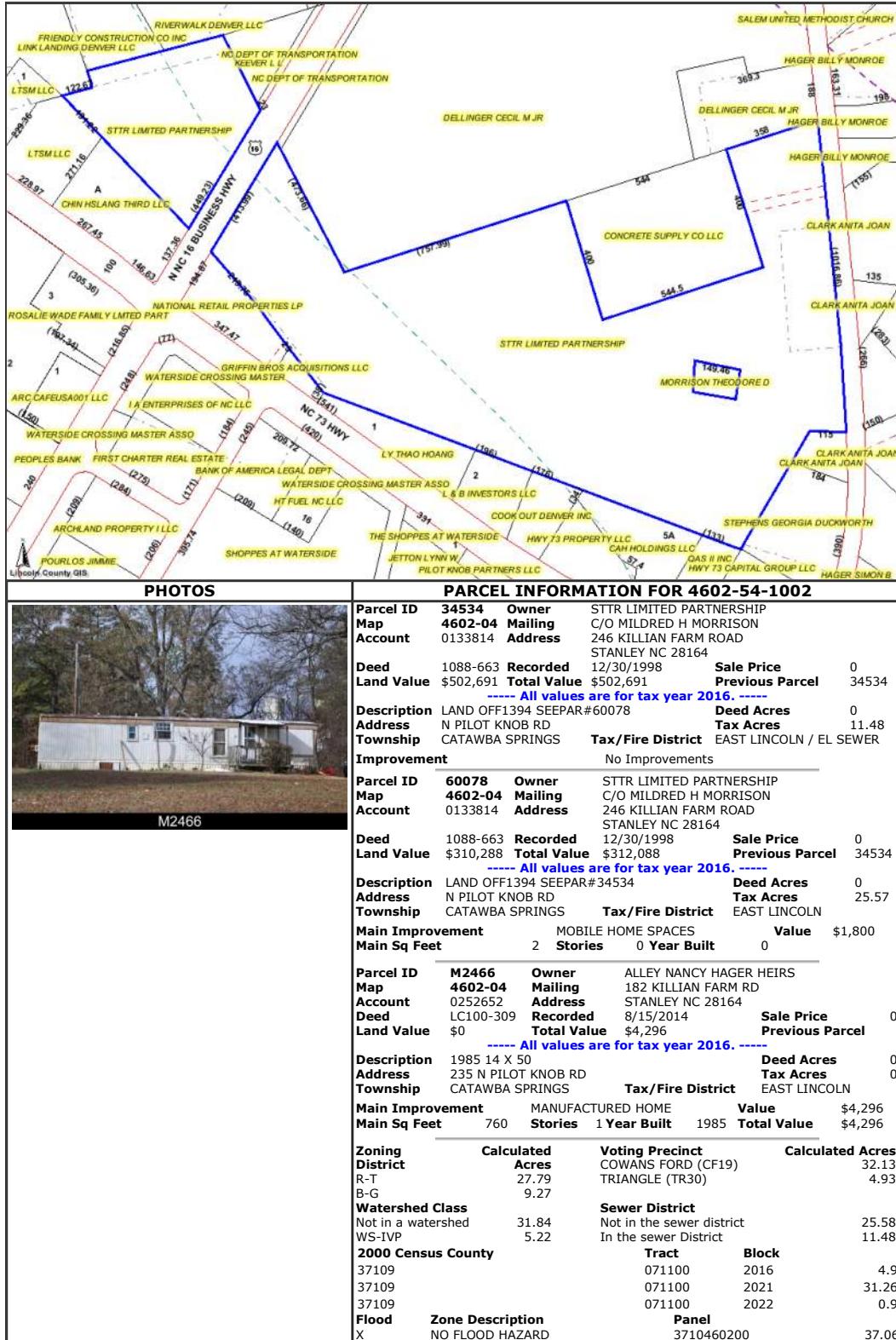
Parcel ID	90176	Owner	DELLINGER CECIL M JR KEEVER DORIS D
Map	4602-04	Mailing	202 HWY 16N
Account	0127179	Address	DENVER NC 28037
Deed	89E-327	Recorded	9/27/1989
Land Value	\$51,107	Total Value	\$51,107
----- All values are for tax year 2016. -----			
Description	HAGER LAND SEE PAR #60079		
Address	202 N NC 16 BUSINESS HWY		
Township	CATAWBA SPRINGS		
Improvement	No Improvements		

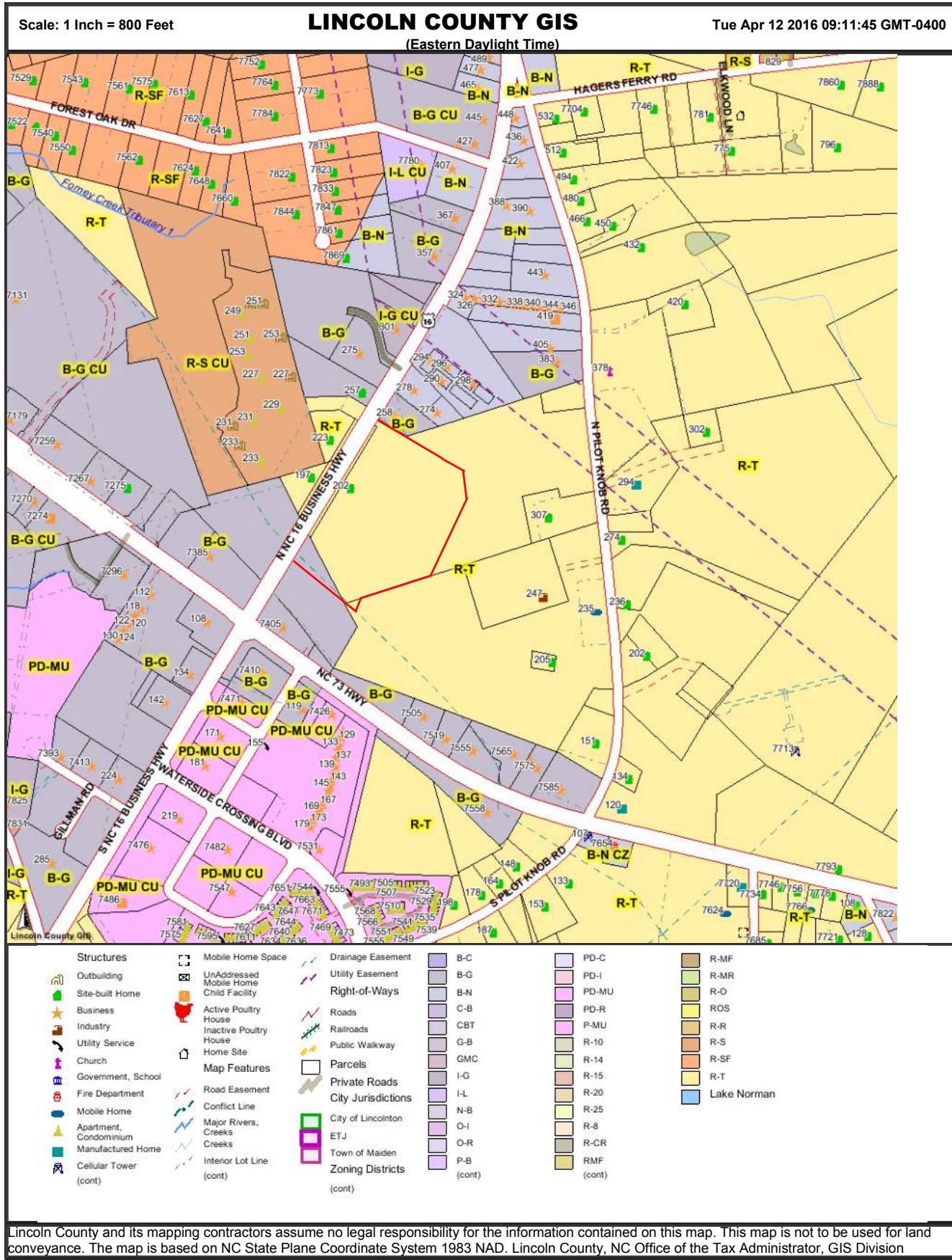
Zoning District	Calculated Acres	Voting Precinct	Calculated Acres
R-T	29.38	COWANS FORD (CF19)	29.38
Watershed Class			
Not in a watershed			25.07
WS-IVP			4.3
2000 Census County			
37109			
Tract			
071100			29.38
Block			
2021			
Panel			
3710460200			29.38

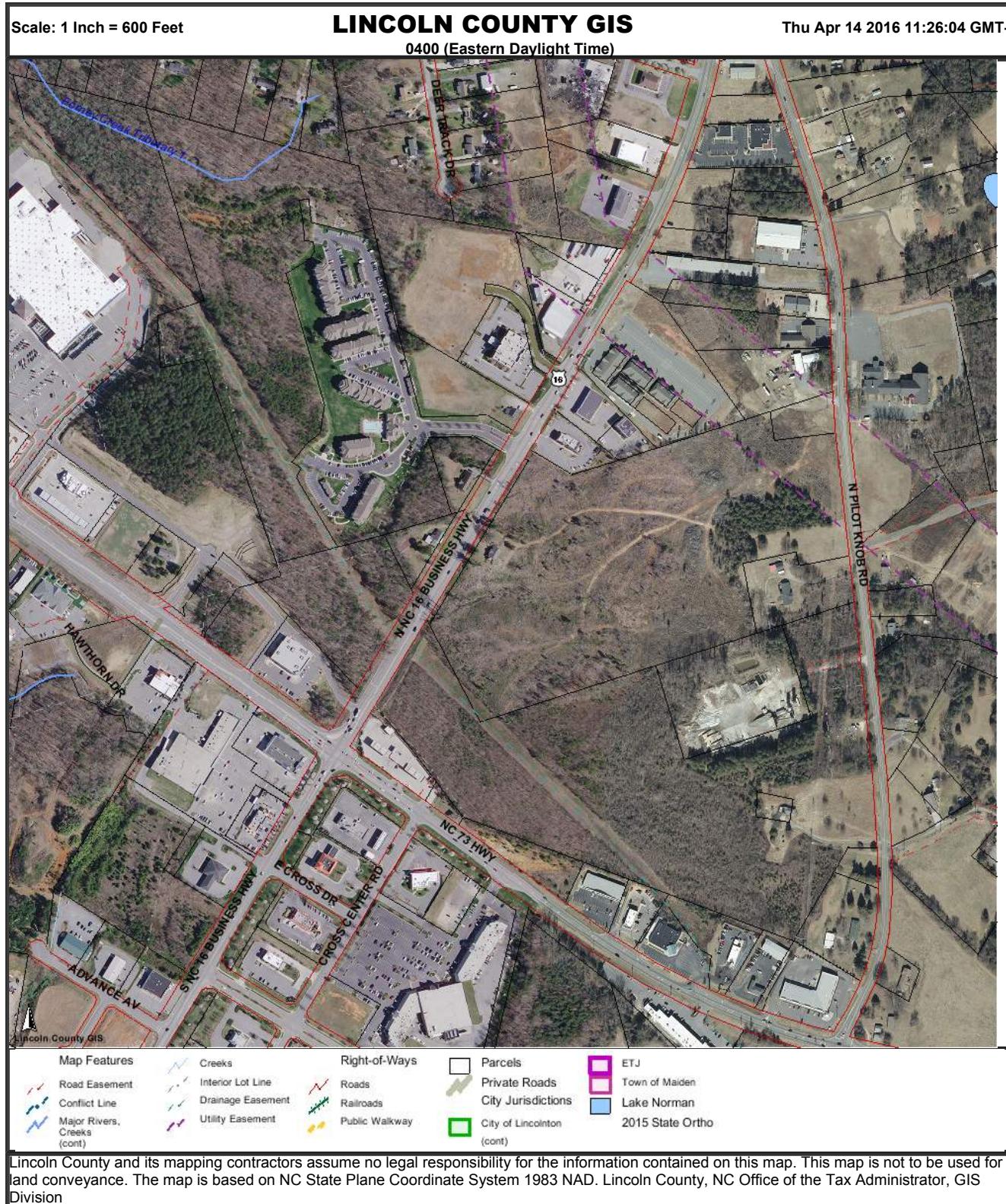


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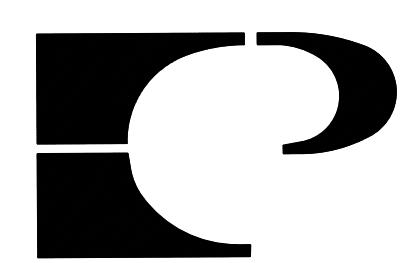






# REZONING FOR: CAMBRIDGE VILLAGE DENVER, NC

## PREPARED BY:



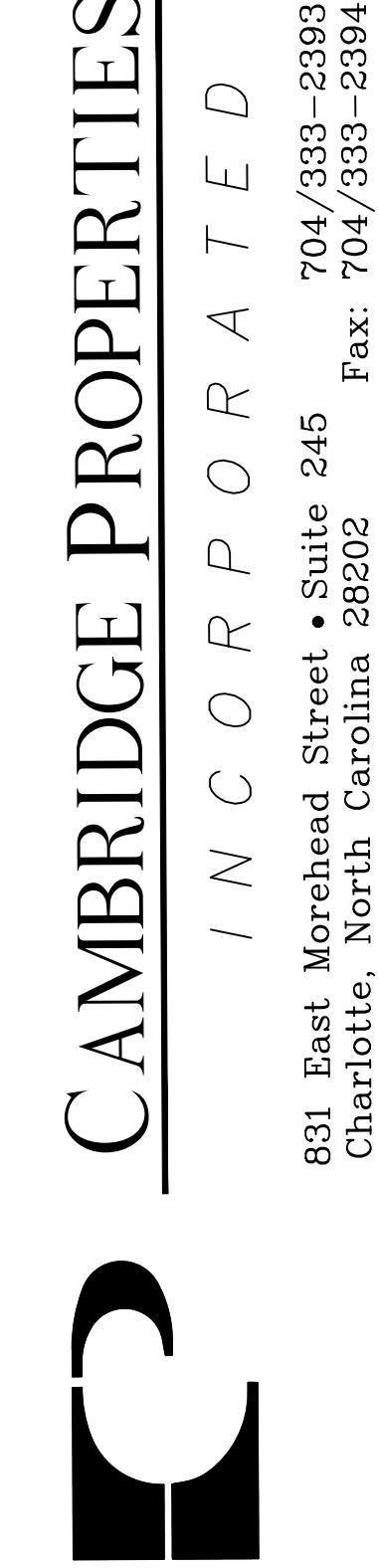
CAMBRIDGE PROPERTIES

INCORPORATED

831 East Morehead Street • Suite 245      704/333-2393  
Charlotte, North Carolina 28202      Fax: 704/333-2394

## SHEET INDEX

- RZ-1 COVER SHEET
- RZ-2 ROAD NETWORK
- RZ-3 CONCEPTUAL SITE PLAN
- RZ-4 CONDITIONAL NOTES



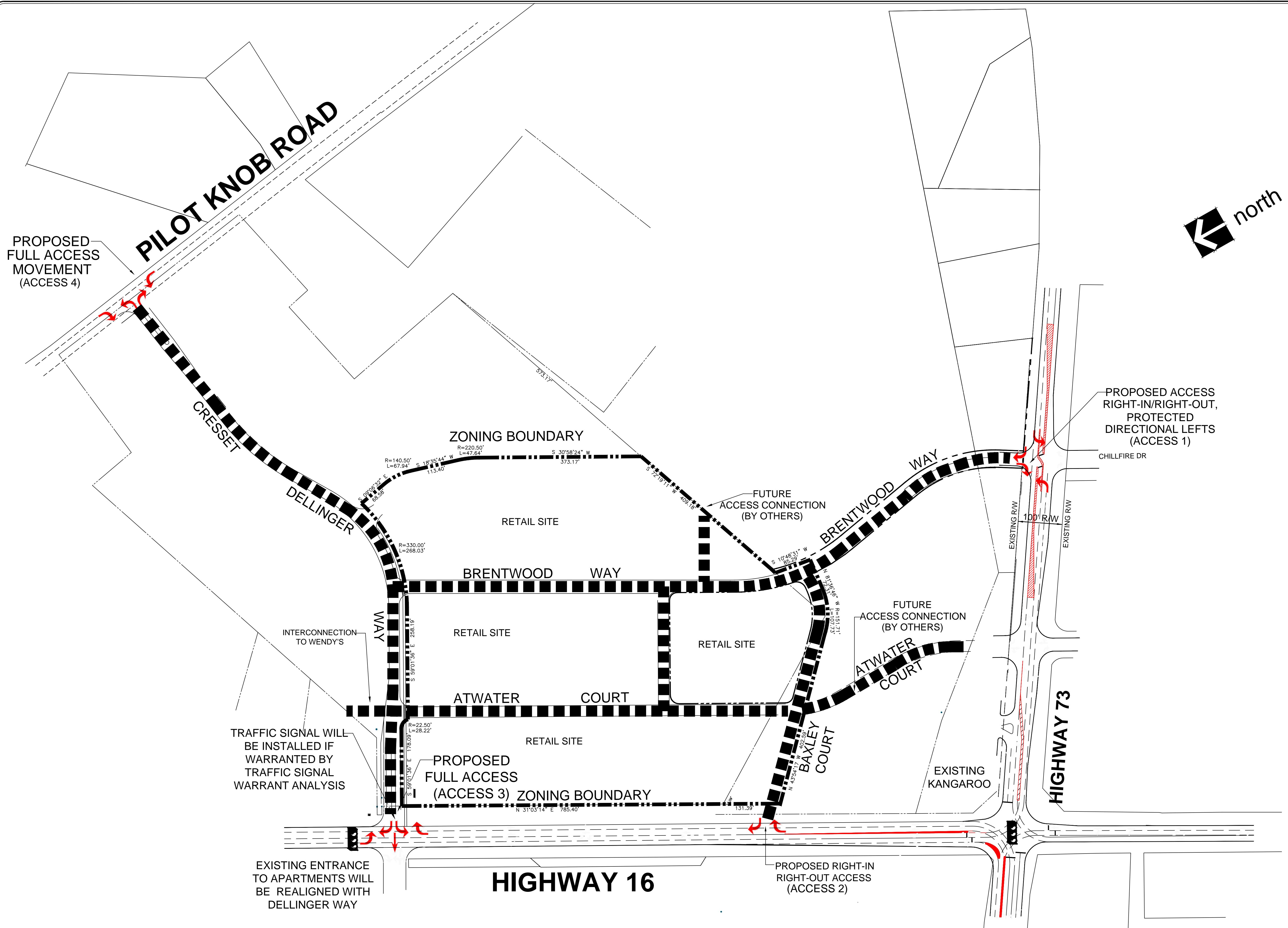
CAMBRIDGE PROPERTIES

IN CORPORATED  
831 East Morehead Street • Suite 245  
Charlotte, North Carolina 28202      704/333-2393  
Fax: 704/333-2394

CAMBRIDGE VILLAGE  
DENVER, NORTH CAROLINA

COVER SHEET

DATE	ITEM
DATE 4-14-16	SCALE
DRAWN BY D.T.	CHECKED BY CPI
	F.B. #
	SHEET # RZ-1



# CAMBRIIDGE PROPERTIES

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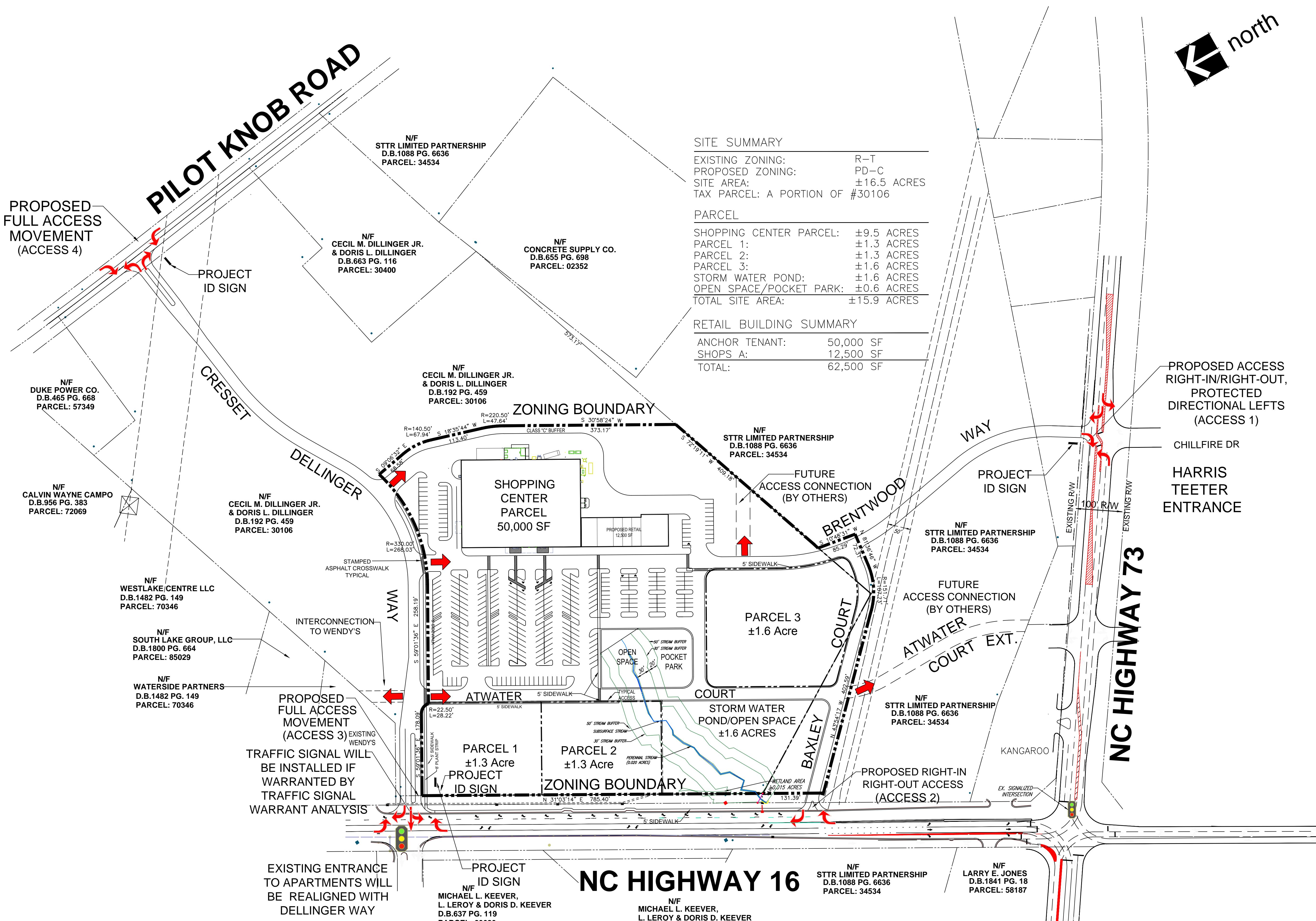
IN CORPORA'TE

831 East Morehead Street • Suite 245      704/333-2393  
Charlotte, North Carolina 28202      Fax: 704/333-2394

100

# CAMBRIDGE VILLAGE DENVER, NORTH CAROLIN

# ROAD NETWORK



# CAMBRIDGE PROPERTIES

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INCORPORATED  
831 East Morehead Street • Suite 245  
Charlotte, North Carolina 28202  
704/333-2393  
Fax: 704/333-2394

Charlotte, North Carolina 28202      Fax: 704/333-2394

100

# CAMBRIDGE VILLAGE DENVER, NORTH CAROLINA

# CONCEPTUAL SITE PLAN

THE JOURNAL OF CLIMATE

## REVISIONS

ITEM

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*DATE*

4-14-16

1" <sup>SCALE</sup> = 100'

*DRAWN BY*  
D. T.

D. I.

checked by  
CPI

*F.B. #*

SHEET #

RZ-3



# CAMBRIDGE COMMERCIAL DEVELOPMENT

## LINCOLN COUNTY, NC

### DRAFT Traffic Impact Analysis

April 7, 2016

PREPARED BY:

Mike Surasky, PE, PTOE  
A. Morton Thomas and Associates, Inc.  
6131 Falls of Neuse Rd, Suite 106  
Raleigh, NC 27609  
919-855-9989

AMT Project File 16-0069.001  
NC License No: F-1049



## CAMBRIDGE COMMERCIAL DEVELOPMENT LINCOLN COUNTY, NC

### DRAFT Traffic Impact Analysis

April 7, 2016

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## EXECUTIVE SUMMARY

The proposed Cambridge Commercial Development is located on approximately 15 acres between Pilot Knob Road and NC 16 Business near Denver, North Carolina. The proposed development will consist of a commercial/retail shopping center including a supermarket containing an in-store pharmacy with a drive-thru window, retail stores, a fast-food restaurant with a drive-thru window, retail store space, and a branch bank with a drive-thru window.

Traffic analysis will consider Future Build conditions at the build-out year. The development is assumed to be fully built out by 2019. This report summarizes the analyses of 2016 Existing conditions, 2019 No-Build conditions (without proposed development), 2019 Build conditions (with the proposed development in place), and 2019 Build Improved conditions (with proposed development and Recommended Improvements in place) during the AM and PM peak hours.

AMT (A. Morton Thomas and Associates, Inc.) was retained to determine the potential traffic impacts of this development in accordance with the traffic study guidelines set forth by Lincoln County and the North Carolina Department of Transportation (NCDOT) and the transportation improvements that may be required to accommodate these impacts. This report presents trip generation, distribution, capacity analyses, and recommendations for transportation improvements required to meet anticipated traffic demands.

As approved by Lincoln County and NCDOT and included in the MOU (Memorandum of Understanding), the following seven (7) existing and two (2) proposed intersections are included as part of the area of influence for the development:

- NC 73 & N. Pilot Knob Road *(Signalized four-legged intersection)*
- NC 73 & The Shoppes at Waterside/Site Access #3 *(Proposed four-legged intersection)*
- NC 16 Bus. & NC 73 *(Signalized four-legged intersection)*
- NC 16 Bus. & Riverwalk Apartments/Site Access #1 *(Proposed four-legged intersection)*
- NC 16 Bus./Hagers Ferry Road/N. Pilot Knob Ints. *(Three unsignalized intersections)*
- NC 16 Bus. & Proposed Site Access #2 *(Proposed three-legged right-in/right out)*
- N. Pilot Knob Road & Proposed Site Access #4 *(Proposed three-legged full-movement)*

Below is a detailed description of the existing study area roadway network. All Average Annual Daily Traffic (AADT) information provided in this description was obtained from the NCDOT via the [www.ncdot.gov](http://www.ncdot.gov) website.

NC 16 Business is a three-lane undivided roadway facility with a center two-way left-turn lane in the vicinity of the development that travels north-south, basically paralleling NC 16 between Lucia and Denver in eastern Lincoln County. The land use along NC 16 Business is mixed use with intermittent areas of residential and open space. The posted speed on this section of NC 16 Business is 45 miles per hour (mph). NCDOT indicates that NC 16 Business in the study area is a minor arterial and the AADT is 14,000 vehicles per day (vpd) within the study area in 2013.

NC 73 is a two-lane undivided roadway facility that travels east/west in Lincoln County. It has a center turn lane and intermittent dedicated left turn lanes in the project vicinity. The land use along NC 73 is mostly commercial properties in the project vicinity transitioning to residential and open space to the east and commercial to the west towards NC 16. The posted speed on this section of NC 73 is 45 mph. NCDOT indicates that NC 73 in the study area is an 'other principal arterial' and the AADT is 14,000 vpd in 2013.

N. Pilot Knob Road (SR 1394) is a two-lane undivided roadway with no shoulders that runs north-south in the vicinity of the development, diagonally connecting NC 73 to NC 16 Business. The land use on N. Pilot Knob Road is mixed between residential and low-density commercial. The posted speed on N. Pilot Knob Road is 45 mph. NCDOT indicates that N. Pilot Knob Road is a local road and the AADT is 5,500 vpd in 2013.

The purpose of this Traffic Impact Analysis Report is to assess the traffic carrying capacity of surrounding roadway network. There are a total of four (4) types of analyses for the intersections affected by the proposed development. The "Existing Conditions" analysis uses the traffic counts available to evaluate the current intersection operational performance. Traffic counts were performed by National Data & Surveying Services on February 23, 2016. Traffic counts were collected while traditional calendar schools were in-session.

### **Site Trip Generation and Distribution**

The proposed site will be a commercial development in Lincoln County. It is anticipated that the site will be a commercial / retail shopping center consisting of a supermarket containing an in-store pharmacy with a drive-thru window, retail store space, a fast-food restaurant with a drive-thru window, and a branch bank with a drive-thru window. Trip generation equations for the land use types are provided in the *ITE Trip Generation Manual, 9<sup>th</sup> Edition*. It was estimated that a total of 347 new trips (206 in, 141 out) will be generated from the proposed site in the AM peak hour and 567 trips (287 in, 280 out) will be generated in the PM peak hour.

The site generated trips to and from the proposed site were distributed in accordance with the apparent traffic patterns by the users of the proposed facility and the existing traffic patterns and land uses in the vicinity as follows:

- 40% to/from the west on NC 73
- 20% to/from the east on NC 73
- 20% to/from the north on NC 16 Business
- 15% to/from the south on NC 16 Business
- 5% to/from the east on Hagers Ferry Road

### **2016 Existing Conditions**

Traffic counts were performed by National Data & Surveying Services on February 23, 2016. The traffic counts were collected while traditional calendar schools were in-session.

The results of this analysis indicate that the southbound approach of Pilot Knob Road at NC 73 is operating at LOS F in the AM peak hour. The other approaches of the intersection operate at acceptable levels of service in the AM and PM peak hours. The northbound NC 16 Business approach at NC 73 operates at LOS E during the PM peak hour. The westbound approach of Hagers Ferry Road at NC 16 Business operates at LOS F and LOS E during the AM and PM peak hours respectively. This condition will be removed due to the proposed intersection reconstruction project.

### **2019 No-Build Conditions**

As agreed upon in the memorandum of understanding (MOU), existing traffic volumes were increased by 1 percent per year to reflect 2018 background traffic volumes. Approved developments were indicated in the study area as discussed in the MOU. These are as follows:

- Carrington Subdivision;
- Cottonwood Village; and
- Rivercross Subdivision.

As such, the 2019 background traffic represents the 2015 existing traffic increased by 1 percent per year and the addition of approved development traffic.

The operating conditions for the 2019 No-Build Analysis are similar to Existing conditions with most movements showing increases in delay. The NC 73 at Pilot Knob Road intersection overall LOS drops to LOS E during the AM peak period due to the increase in the southbound Pilot Knob Road delay. During the PM peak hour, the northbound NC 73 approach at The Shoppes at Waterside declines to LOS E. The northbound approach of NC 16 Business at NC 73 declines further to LOS E and LOS F during the AM and PM peak periods; respectively. The overall intersection LOS degrades to LOS E at this location for the PM peak hour.

### **2019 Build Conditions**

The total Build traffic volumes include both the site traffic and traffic volumes from the No-Build Analysis. The Build Analysis evaluates the traffic conditions before any improvements are implemented.

Analysis indicates that with the addition of traffic anticipated to be generated by the proposed development, the intersection of NC 73 at Pilot Knob Road will operate LOS E during the AM peak hour. The NC 16 Business at NC 73 intersection will operate at LOS D and E during the AM and PM peak hours respectively. The northbound NC 16 Business approach will operate at LOS E and LOS F during the AM and PM peak hours respectively. The southbound NC 16 Business approach will operate at LOS E during both the AM and PM peak hours. The re-aligned intersection at NC 16 Business and N. Pilot Knob Road will operate at acceptable LOS during both peak hours under the 2019 Build conditions.

There are four proposed access points to the Cambridge Commercial Development. The access points and their proposed operations under 2019 Build Conditions are as follows:

#### *Site Access 1*

The first access point is proposed for NC 16 Business across from the Riverwalk Apartments driveway. This access point is approximately 1,450 feet north of the NC 16 Business at NC 73 intersection. This will create a four-legged, full movement intersection. The westbound approach at NC 16 Business at Riverwalk

Apartments Driveway/Proposed Site Access 1 will operate at LOS F during both the AM and PM peak hours.

#### ***Site Access 2***

The second access point is proposed for NC 16 Business approximately 500 feet north of the NC 16 Business at NC 73 intersection. This will create a three-legged, right-in/right-out only access point. This unsignalized access point will operate at acceptable LOS during the AM and PM peak hours.

#### ***Site Access 3***

The third access point is proposed for NC 73 across from The Shoppes at Waterside driveway. This access point is approximately 850 feet east of the NC 16 Business at NC 73 intersection. This will create a four-legged, intersection with a proposed left-over and right-in/right-out access in both directions. This unsignalized access point will operate at acceptable LOS during the AM and PM peak hours.

#### ***Site Access 4***

The fourth access point is proposed at N. Pilot Knob Road approximately 2,100 feet north of the NC 73 at N. Pilot Knob Road intersection. This site access point will create a three-legged, full movement intersection. This unsignalized access point will operate at acceptable LOS during the AM and PM peak hours.

### **2019 Build Improved Conditions**

With timing modifications to the traffic signal at the intersection of NC 16 Business at NC 73, the analysis shows improvements in operations to the northbound and southbound NC 16 Business approaches during the AM and PM peak hours. The intersection will continue to operate at LOS D and LOS E respectively during the AM and PM peak hours.

A signal is proposed at the NC 16 Business at Riverwalk Driveway/Proposed Site Access 1 intersection. This signal will greatly improve the westbound approach delay and the intersection will operate at LOS A and LOS B during the AM and PM peak hours respectively.

Other intersections will operate at acceptable LOS. Geometric improvements such as the installation of turn-lanes are recommended and were therefore analyzed in this scenario. The recommended improvements are located in the Conclusions/Recommendations section.

### **Conclusions/Recommendations**

The proposed Cambridge Commercial Development is located on approximately 15 acres between Pilot Knob Road and NC 16 Business near Denver, North Carolina. The proposed development will consist of a commercial/retail shopping center including a supermarket containing an in-store pharmacy with a drive-thru window, a fast-food restaurant with a drive-thru window, retail store space, and a branch bank with a drive-thru window.

It was estimated that a total of 347 new trips (206 in, 141 out) will be generated from the proposed site in the AM peak hour and 567 trips (287 in, 280 out) will be generated in the PM peak hour.

There are four proposed access points to the Cambridge Commercial Development. The access points and their proposed operations under 2019 Build Conditions are as follows:

#### Site Access 1

The first access point is proposed for NC 16 Business across from the Riverwalk Apartments driveway. This access point is approximately 1,450 feet north of the NC 16 Business at NC 73 intersection. This will create a four-legged, full movement intersection.

#### Site Access 2

The second access point is proposed for NC 16 Business approximately 500 feet north of the NC 16 Business at NC 73 intersection. This will create a three-legged, right-in/right-out only access point.

#### Site Access 3

The third access point is proposed for NC 73 across from The Shoppes at Waterside driveway. This access point is approximately 850 feet east of the NC 16 Business at NC 73 intersection. This will create a four-legged, intersection with a proposed left-over and right-in/right-out access in both directions. This unsignalized access point will operate at acceptable LOS during the AM and PM peak hours.

#### Site Access 4

The fourth access point is proposed for N. Pilot Knob Road approximately 2,100 feet north of the NC 73 at N. Pilot Knob Road intersection. This site access point will create a three-legged, full movement intersection.

Analysis of the 2019 Build condition indicates that with the addition of traffic anticipated to be generated by the proposed development multiple intersections and approaches will operate at an unacceptable LOS. The intersection of NC 73 at Pilot Knob Road will operate LOS E during the AM peak hour. The NC 16 Business at NC 73 intersection will operate at LOS D and E during the AM and PM peak hours respectively. The northbound NC 16 Business approach at NC 73 will operate at LOS E and LOS F during the AM and PM peak hours respectively. The southbound NC 16 Business approach at NC 73 will operate at LOS E during both the AM and PM peak hours. The re-aligned intersection at NC 16 Business and N. Pilot Knob Road will operate at acceptable LOS during both peak hours under the 2019 Build conditions.

The 2019 Build with Improvements analysis shows recommended improvements that will improve the effectiveness of the system. Those improvements are stated below. With timing modifications to the traffic signal at the intersection of NC 16 Business at NC 73, the analysis shows improvements in operations to the northbound and southbound NC 16 Business approaches during the AM and PM peak hours. The intersection will continue to operate at LOS D and LOS E respectively during the AM and PM peak hours.

A signal is proposed at the NC 16 Business at Riverwalk Driveway/Proposed Site Access 1 intersection. This signal will greatly improve the westbound approach delay and the intersection will operate at LOS A and LOS B during the AM and PM peak hours respectively. A full signal warrant and delay analysis should be conducted at this intersection to determine the final need for the signal as well as adhere to NCDOT standards for the installation of a signal on a state maintained road (NC 16 Business)

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. The NCDOT *"Policy on Street and Driveway Access to North Carolina Highways"* manual was consulted to determine the appropriate storage for the recommended auxiliary lanes if warranted.

### Recommended Improvements

#### **NC 16 Business at NC 73**

- Construct a shared through/right turn lane with 125 feet of full-width storage and appropriate taper on northbound NC 16 Business.
- The above recommendation will require the redesign and retiming of the intersection signalization.

#### **NC 16 Business at Riverwalk Apartments Driveway/Site Access 1 (Full Movement)**

- Construct site access 1 with one (1) ingress lane and one (1) egress lane. The egress lane will allow left, through, and right turning movements.
- Install a traffic signal to provide traffic control at the intersection.

#### **NC 73 at N. Pilot Knob Road**

- Extend the southbound exclusive left- turn by 250 feet of full-width storage from its current length of 50 feet. This will provide 300 feet of full-width storage and will include appropriate tapers.

#### **NC 16 Business at Prop. Site Access 2**

- Construct site access 2 with one (1) egress lane and one (1) ingress lane. The egress should be limited to right-turn only and designed with a standard raised triangular island to physically prohibit movements other than right turns out of this access.
- Construct an exclusive northbound right-turn lane with 75 feet of full-width storage and appropriate taper on NC 16 Business.

#### **NC 73 at The Shoppes at Waterside Commons/Prop. Site Access 3**

- Construct a directional crossover at the intersection.
- Construct site access 3 with one (1) egress lane and one (1) ingress lane. The egress should be limited to right-turn only.
- Construct an exclusive westbound right-turn lane with 50 feet of full-width storage and appropriate taper on NC 73.

#### **N. Pilot Knob Road at Proposed Site Access 4**

- Construct an exclusive northbound left-turn lane with 50 feet of full-width storage and appropriate taper
- Construct an exclusive southbound right-turn lane with 50 feet of full-width storage and appropriate taper
- Construct site access 4 with one (1) egress lane and one (1) ingress lane. The egress should be allow both right and left turning traffic at the intersection.

## INTRODUCTION

The proposed Cambridge Commercial Development is located on approximately 15 acres between Pilot Knob Road and NC 16 Business near Denver, North Carolina. The proposed development will consist of a commercial/retail shopping center including a supermarket containing an in-store pharmacy with a drive-thru window, a fast-food restaurant with a drive-thru window, retail store space and a branch bank with a drive-thru window.

Traffic analysis will consider Future Build conditions at the build-out year. The development is assumed to be fully built out by 2019. This report summarizes the analyses of 2016 Existing conditions, 2019 No-Build conditions (without proposed development), 2019 Build conditions (with the proposed development in place), and 2019 Build Improved conditions (with proposed development and Recommended Improvements in place) during the AM and PM peak hours.

AMT (A. Morton Thomas and Associates, Inc.) was retained to determine the potential traffic impacts of this development in accordance with the traffic study guidelines set forth by Lincoln County and the North Carolina Department of Transportation (NCDOT) and the transportation improvements that may be required to accommodate these impacts. This report presents trip generation, distribution, capacity analyses, and recommendations for transportation improvements required to meet anticipated traffic demands.

Lincoln County and NCDOT were contacted to obtain background information and to establish the elements to be covered in this traffic impact analysis (TIA). Please refer to **Appendix A** for a copy of the approved Memorandum of Understanding submitted to the County and the NCDOT.

## STUDY AREA DESCRIPTION

As approved by Lincoln County and NCDOT and included in the MOU (Memorandum of Understanding), the following seven (7) existing intersections and two (2) proposed access points are included as part of the area of influence for the development (**Figure 1**):

- NC 73 & N. Pilot Knob Road *(Signalized four-legged intersection)*
- NC 73 & The Shoppes at Waterside/Site Access #3 *(Proposed four-legged intersection)*
- NC 16 Bus. & NC 73 *(Signalized four-legged intersection)*
- NC 16 Bus. & Riverwalk Apartments/Site Access #1 *(Proposed four-legged intersection)*
- NC 16 Bus./Hagers Ferry Road/N. Pilot Knob Ints. *(Three unsignalized intersections)*
- NC 16 Bus. & Proposed Site Access #2 *(Proposed three-legged right-in/right out)*
- N. Pilot Knob Road & Proposed Site Access #4 *(Proposed three-legged full-movement)*

It should be noted that the traffic study includes the project planned to reconfigure the intersections of NC 16 Business at Hagers Ferry Road, NC 16 Business at N. Pilot Knob Road and N. Pilot Knob Road at Hagers Ferry Road. It is envisioned that this project will be completed in 2019 ahead of the opening of the proposed development. Therefore, the following two (2) planned intersections will replace the existing three intersections:

- NC 16 Bus.& N. Pilot Knob Road
- N. Pilot KnobRoad & Hagers Ferry Road

*(Planned signalized four-legged intersection)*

*(Planned unsignalized three-legged intersection)*

The proposed site plan is shown in **Figure 2** and is for illustrative purposes only for this traffic study. Access to the site is proposed to be provided by four driveways. Each of these are detailed below:

#### *Site Access 1*

The first access point is proposed for NC 16 Business across from the Riverwalk Apartments driveway. This access point is approximately 1,450 feet north of the NC 16 Business at NC 73 intersection. This will create a four-legged, full movement intersection.

#### *Site Access 2*

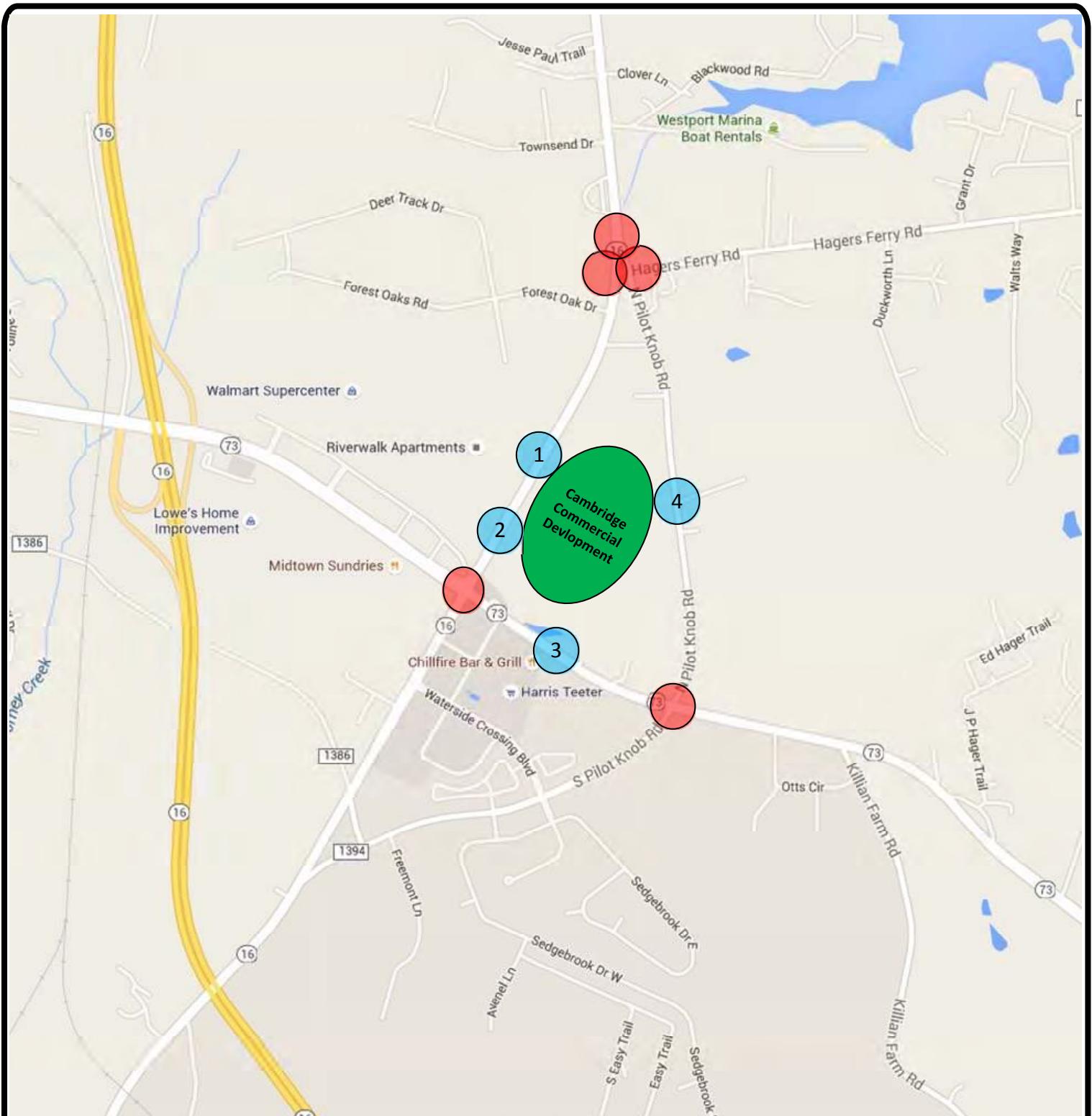
The second access point is proposed for NC 16 Business approximately 500 feet north of the NC 16 Business at NC 73 intersection. This will create a three-legged, right-in/right-out only access point.

#### *Site Access 3*

The third access point is proposed for NC 73 across from The Shoppes at Waterside driveway. This access point is approximately 850 feet east of the NC 16 Business at NC 73 intersection. This will create a four-legged, intersection with a proposed left-over and right-in/right-out access in both directions.

#### *Site Access 4*

The fourth access point is proposed for N. Pilot Knob Road approximately 2,100 feet north of the NC 73 at N. Pilot Knob Road intersection. This site access point will create a three-legged, full movement intersection.



### LEGEND

- Cambridge Commercial Development** (Green oval)
- = External Intersections** (Red circle)
- = Site Driveways** (Blue circle)

**AMT**



### Cambridge Commercial Development Traffic Impact Study

Study Area

DATE: April 2016

NOT  
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**FIGURE 1**

## Site Access #4: - Full Movement

### Site Access #3: - Left-In, Right-In/Right-Out

## Site Access #1: - Full Movement

## Site Access #2: - Right-In/Right-Out



## Cambridge Commercial Development Traffic Impact Study

## Site Plan

**DATE:** April 2016

## FIGURE 2

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## EXISTING ROADWAY CONDITIONS

Below is a detailed description of the existing study area roadway network. All Average Annual Daily Traffic (AADT) information provided in this description was obtained from the NCDOT via the [www.ncdot.gov](http://www.ncdot.gov) website.

NC 16 Business is a three-lane undivided roadway facility with a center two-way left-turn lane in the vicinity of the development that travels north-south, basically paralleling NC 16 between Lucia and Denver in eastern Lincoln County. The land use along NC 16 Business is mixed use with intermittent areas of residential and open space. The posted speed on this section of NC 16 Business is 45 miles per hour (mph). NCDOT indicates that NC 16 Business in the study area is a minor arterial and the AADT to be 14,000 vehicles per day (vpd) within the study area in 2013.

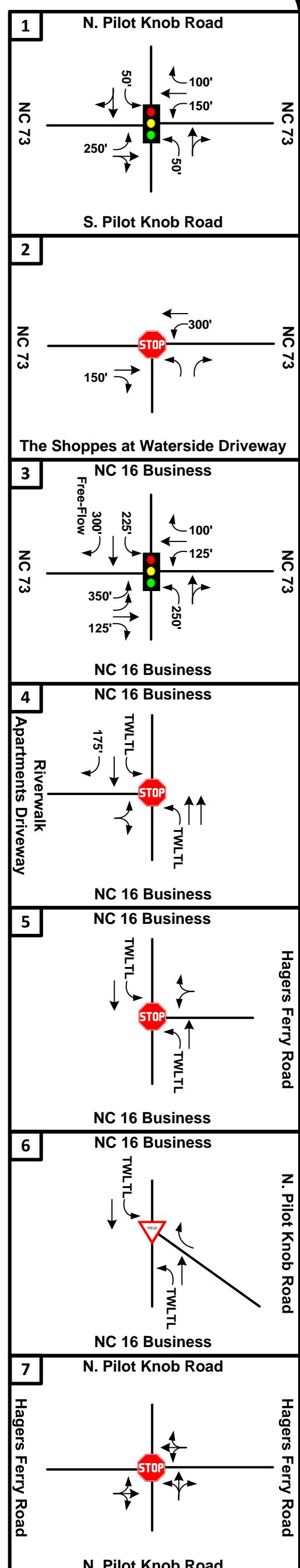
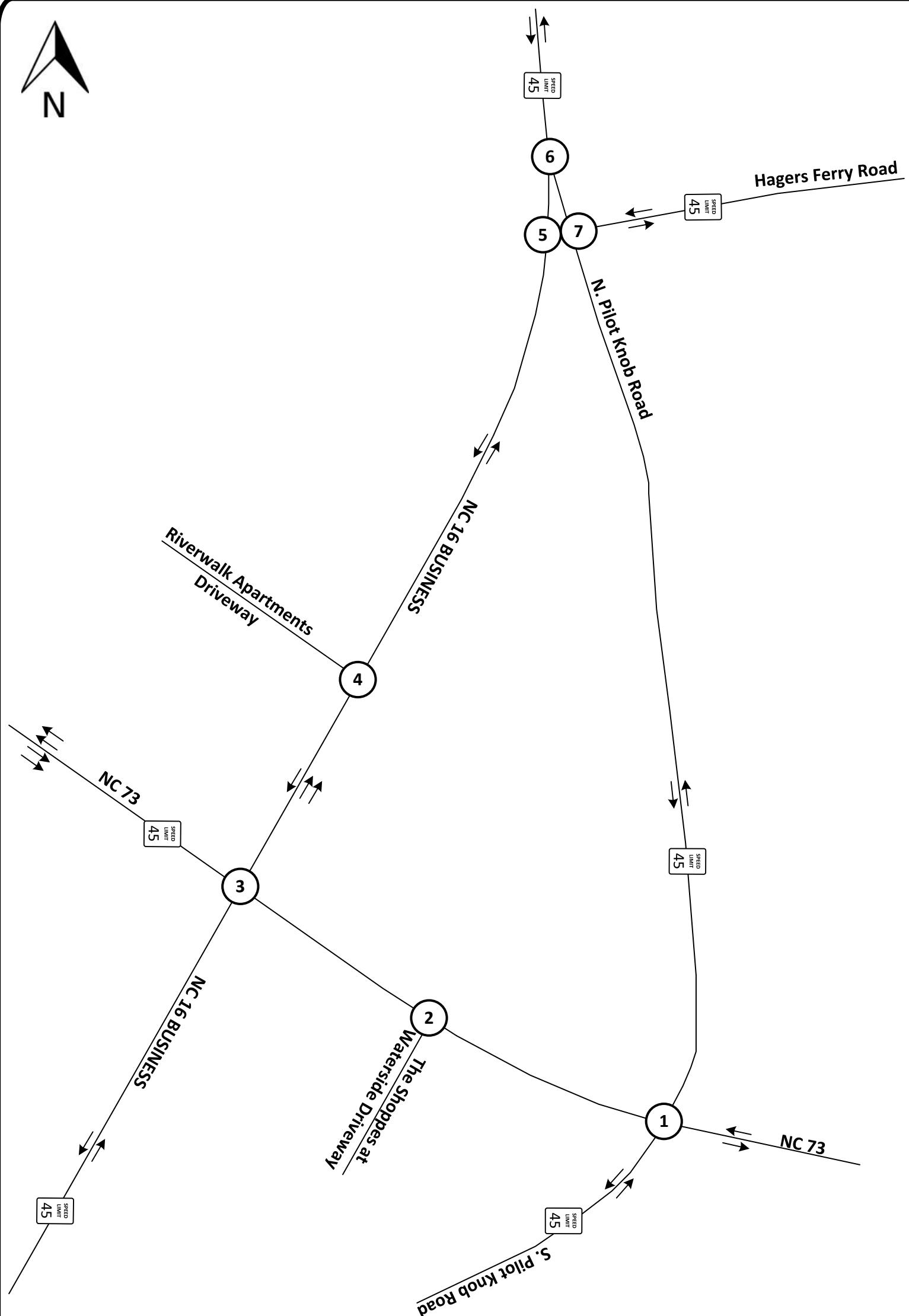
NC 73 is a two-lane undivided roadway facility that travels east/west in Lincoln County. It has a center turn lane and intermittent dedicated left turn lanes in the project vicinity. The land use along NC 73 is mostly commercial properties in the project vicinity transitioning to residential and open space to the east and commercial to the west towards NC 16. The posted speed on this section of NC 73 is 45 mph. NCDOT indicates that NC 73 in the study area is an 'other principal arterial' and the AADT to be 14,000 vpd in 2013.

N. Pilot Knob Road (SR 1394) is a two-lane undivided roadway with no shoulders that runs north-south in the vicinity of the development, diagonally connecting NC 73 to NC 16 Business. The land use on N. Pilot Knob Road is mixed between residential and low-density commercial. The posted speed on N. Pilot Knob Road is 45 mph. NCDOT indicates that N. Pilot Knob Road is a local road and the AADT to be 5,500 vpd in 2013.

The traffic signal at the intersection of NC 73 and NC 16 Business is maintained under the jurisdiction of NCDOT.

The existing intersection geometrics are shown in **Figure 3**.

The purpose of this Traffic Impact Analysis Report is to assess the traffic carrying capacity of surrounding roadway network. There are a total of four (4) types of analyses for the intersections affected by the proposed development. The "Existing Conditions" analysis uses the traffic counts available to evaluate the current intersection operational performance. Traffic counts were performed by National Data & Surveying Services on February 23, 2016. Traffic counts were collected while traditional calendar schools were in-session.



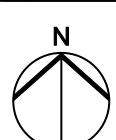
#### LEGEND

- Existing Traffic Control (STOP sign)
- Existing Roadway
- Existing Laneage (arrow)

XXX' Storage Bay Length



Existing Posted Speed



#### Cambridge Commercial Development Traffic Impact Study

Existing Lane Configurations

DATE: April 2016

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AMT

FIGURE 3

## TRIP GENERATION

The proposed site will be a commercial development in Lincoln County. It is anticipated that the site will be a commercial / retail shopping center consisting of a supermarket containing an in-store pharmacy with a drive-thru window, retail store space, a fast-food restaurant with a drive-thru window and a branch bank with a drive-thru window.

Trip generation equations for the land use types are provided in the *ITE Trip Generation Manual, 9<sup>th</sup> Edition*. It was estimated that a total of 347 new trips (206 in, 141 out) will be generated from the proposed site in the AM peak hour and 567 trips (287 in, 280 out) will be generated in the PM peak hour.

**Table 1** lists anticipated trip increases attributed to the proposed development.

**Table 1: Trip Generation**

Land Use	Land Use			AM Peak Hour		PM Peak Hour				
	Code	Intensity	Units	Trips In	Trips Out	Trips In	Trips Out			
Supermarket	850	50,000	SF	105	65	242	232			
	<i>Pass-By Trip Reduction (AM=0%, PM=36%)</i>			0	0	-85	-85			
	<i>New Peak Hour Trips</i>			<b>105</b>	<b>65</b>	<b>157</b>	<b>147</b>			
Shopping Center	820	20,000	SF	36	22	98	106			
	<i>Pass-By Trip Reduction (AM=0%, PM=34%)</i>			0	0	-34	-35			
	<i>New Peak Hour Trips</i>			<b>36</b>	<b>22</b>	<b>64</b>	<b>71</b>			
Fast-Food Restaurant w/ Drive-Thru	934	3,500	SF	81	78	59	55			
	<i>Pass-By Trip Reduction (AM=49%, PM=50%)</i>			-39	-39	-29	-28			
	<i>New Peak Hour Trips</i>			<b>42</b>	<b>39</b>	<b>30</b>	<b>27</b>			
Drive-In Bank	912	4,500	SF	31	23	55	54			
	<i>Pass-By Trip Reduction (AM=29%, PM=35%)</i>			-8	-8	-19	-19			
	<i>New Peak Hour Trips</i>			<b>23</b>	<b>15</b>	<b>36</b>	<b>35</b>			
				<b>Total Pass-By Trips</b>	<b>-47</b>	<b>-47</b>	<b>-167</b>			
				<b>Net New Peak Hour Trips</b>	<b>206</b>	<b>141</b>	<b>287</b>			
							<b>280</b>			

Note that total pass-by trips (i.e. the sum of entering and exiting) will not exceed ten percent (10%) of the hourly traffic volume on the adjacent street as required by NCDOT Congestion Management Capacity Analysis Guidelines.

## TRIP DISTRIBUTION

The site generated trips to and from the proposed site were distributed in accordance with the apparent traffic patterns by the users of the proposed facility and the existing traffic patterns and land uses in the vicinity as follows:

- 40% to/from the west on NC 73
- 20% to/from the east on NC 73
- 20% to/from the north on NC 16 Business
- 15% to/from the south on NC 16 Business
- 5% to/from the east on Hagers Ferry Road

## PROJECT TRAFFIC VOLUMES

### Existing Traffic Volumes

Traffic counts were performed by National Data & Surveying Services on February 23, 2016. Traffic counts were collected while traditional calendar schools were in-session.

There are two signalized intersections in the study area. These are NC 73 at NC 16 Business and N. Pilot Knob Road. The phasing and timing parameters were based on the signal plans and timing / coordination plans that were obtained from the NCDOT. The two project signals on NC 73 are interconnected and contained within the NC 73 closed loop system. The traffic counts are located in **Appendix B** and the 2016 Existing Traffic Volumes are shown in **Figure 4**.

### Historical Growth Traffic (2019 Background Traffic)

Historical growth traffic is the increase in existing traffic volumes due to general usage increases and non-specific growth throughout the area. As directed by the MOU, existing traffic volumes were increased by 1 percent per year. Historical Growth Traffic volumes are shown in **Figure 5**.

### Approved Development Traffic

Approved developments were indicated by the County and NCDOT during the MOU approval process. These Future Traffic Volumes were added to the existing volumes to determine the 2019 No-Build Traffic Volumes. Approved Development Traffic volumes are shown in **Figure 6**. The traffic calculations are shown in **Appendix D**.

The traffic expected to be generated by three (3) approved adjacent developments is included as part of the future traffic scenarios and is included in the No-Build, Build and Build Improved scenarios. These developments are as follows:

- Carrington Subdivision;
- Cottonwood Village; and
- Rivercross Subdivision.

Traffic generated from these developments has been taken from the approved studies. At this time, no other approved developments are known to the project team. NCDOT provided information regarding

the funded project to revise the intersections of NC 16 Business at Hagers Ferry Road, NC 16 Business at N. Pilot Knob Road and N. Pilot Knob Road at Hagers Ferry Road. It is envisioned that this project will be completed in 2019 ahead of the opening of the proposed development. The 2019 laneage is shown in **Figure 7** and Rerouted Traffic Volumes are shown in **Figure 8**.

2019 No-Build Traffic Volumes containing Historical Growth, Approved Development and Re-Routed Traffic are shown in **Figure 9**.

## Proposed Cambridge Commercial Development Traffic

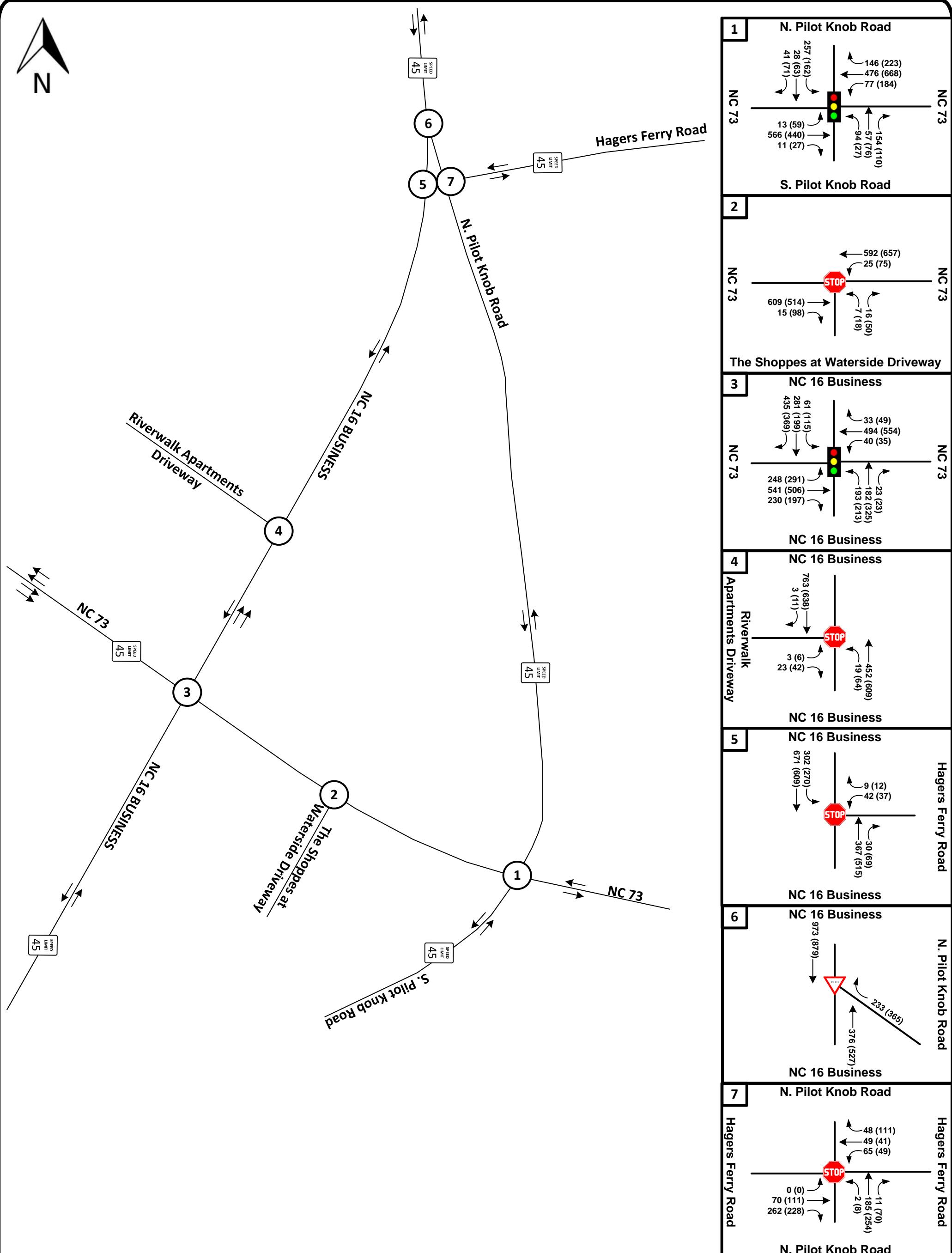
The proposed development traffic was generated, distributed, and assigned to the adjacent roadway network as discussed previously. The Site Trip Distribution Percentages are shown in **Figure 10** and the Proposed Site Trip Assignments are shown in **Figure 11**. The traffic calculations are shown in **Appendix D**.

### Pass-By Trips

Certain land uses incur trips accessing the site which are not new trips added to the adjacent street network. Typically, these trips are intermediate stops on the way from an origin to a destination. Examples of such trips are stops to fill-up on fuel or a stop at a store on the way home from work. Such trips are referred to as pass-by trips. The percentage of pass-by trips allowed by NCDOT were obtained in the Rate vs. Equation spreadsheet on the NCDOT Congestion Management website and are listed in **Table 1**. The pass-by trips were verified to not be above ten percent (10%) of the volume on the adjacent street. The pass-by trip percentages are shown on **Figure 12** and the pass-by trip assignment is shown on **Figure 13**.

### 2019 Build-Out Traffic

The 2019 build-out traffic volumes include the 2019 No-Build traffic and the proposed development traffic. The AM and PM peak-hour 2019 Build Traffic Volumes are shown in **Figure 14**.



## LEGEND

Legend for traffic control symbols and movement types:

- STOP** (Red octagon) and **Traffic Light** (Red, Yellow, Green) = Existing Traffic Control
- (Horizontal line) = Existing Roadway
- (Horizontal arrow) = Existing Movement
- XX (XX)** = AM (PM) Peak Hour Volumes
- SPEED LIMIT** (Sign icon) = Existing Posted Speed



Cambridge Commercial Development  
Traffic Impact Study

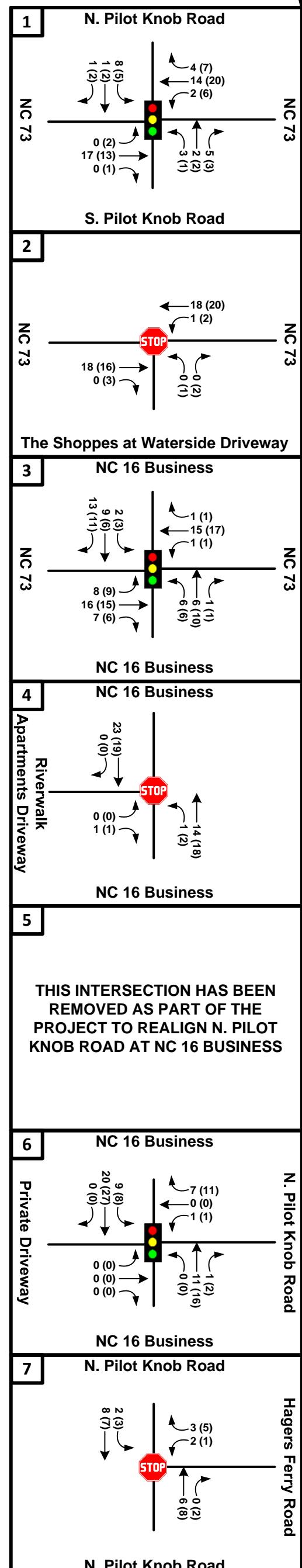
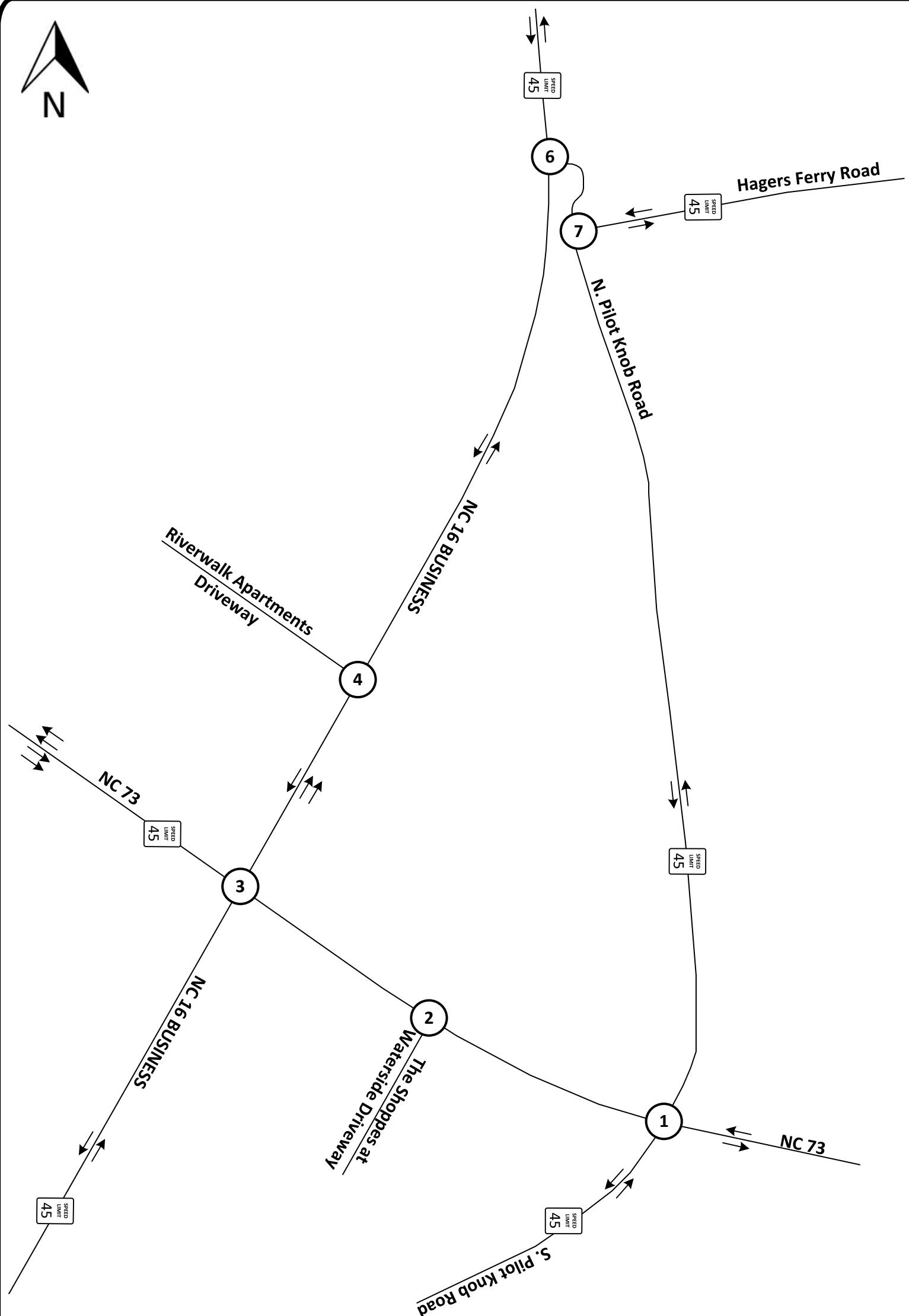
## 2016 Existing Traffic Volumes

**DATE:** April 2016

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SCALE**

### FIGURE 4

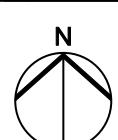
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#### LEGEND

- Existing Traffic Control
- Existing Roadway
- Existing Movement
- AM (PM) Peak Hour Volumes
- Existing Posted Speed

AMT



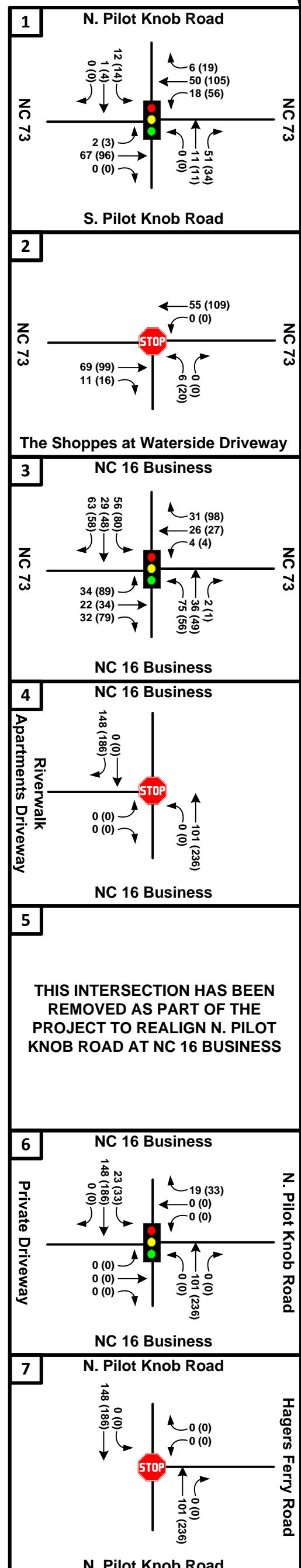
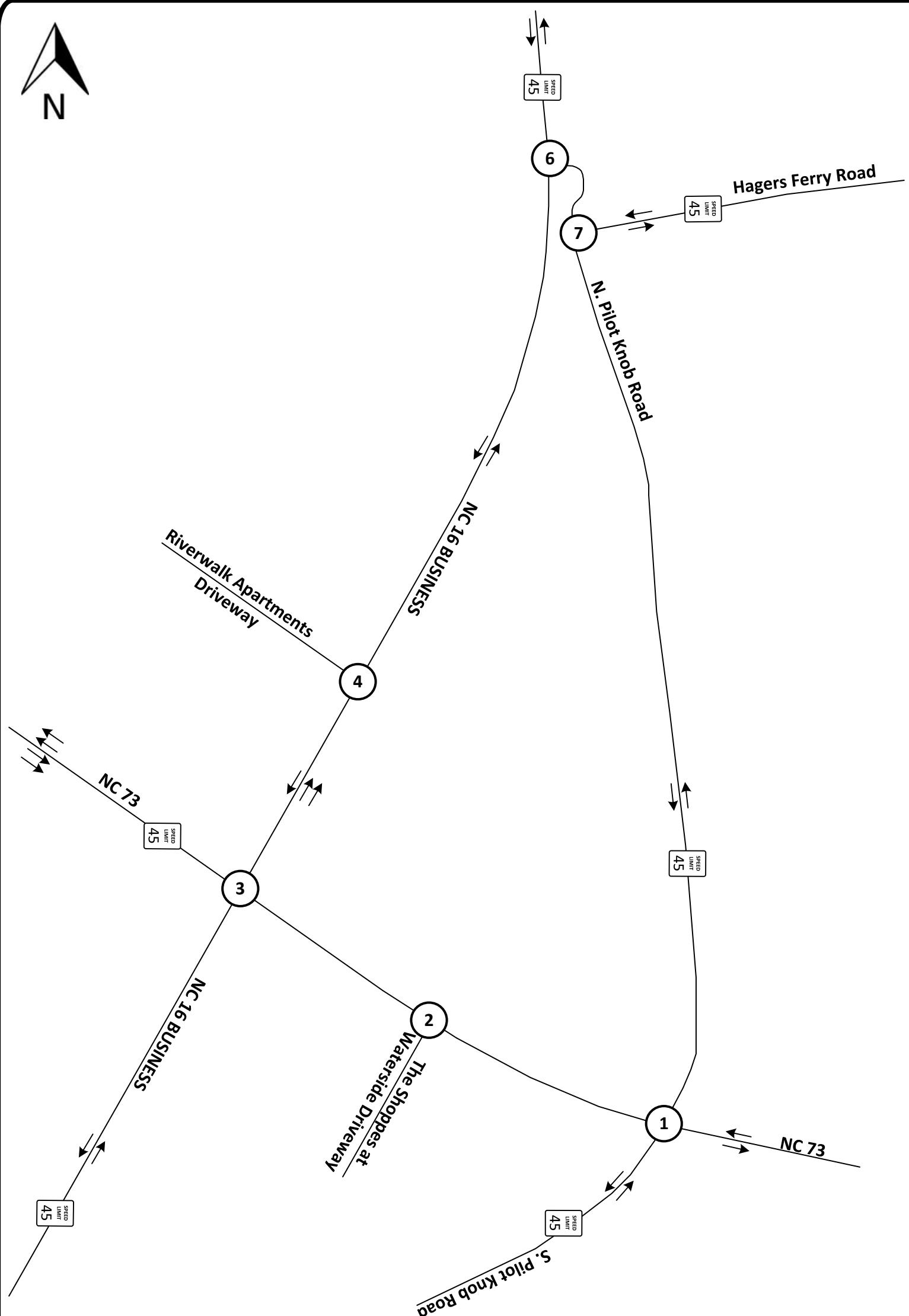
Cambridge Commercial Development  
Traffic Impact Study

2019 Historic Growth Traffic Volumes

DATE: April 2016

FIGURE 5

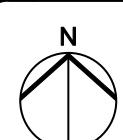
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#### LEGEND

- Existing Traffic Control
- Existing Roadway
- Existing Movement
- AM (PM) Peak Hour Volumes (XX (XX))
- Existing Posted Speed (SPEED LIMIT XX)

AMT

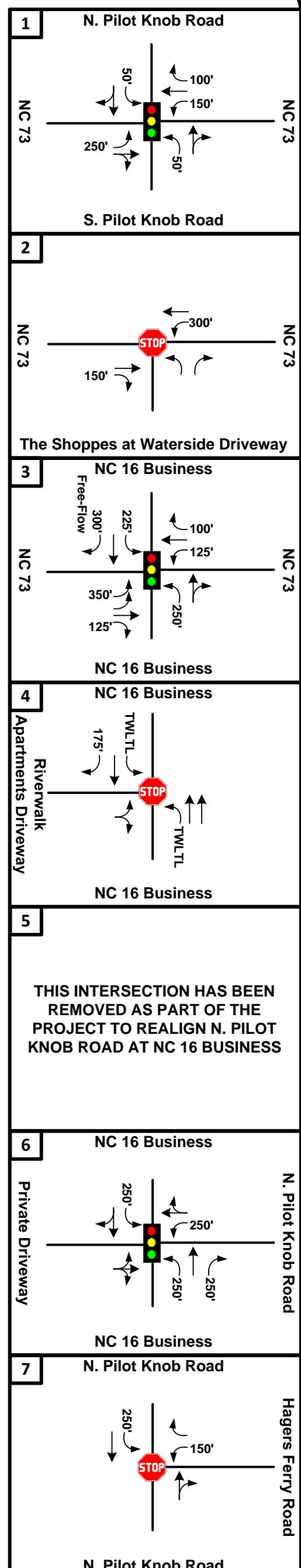
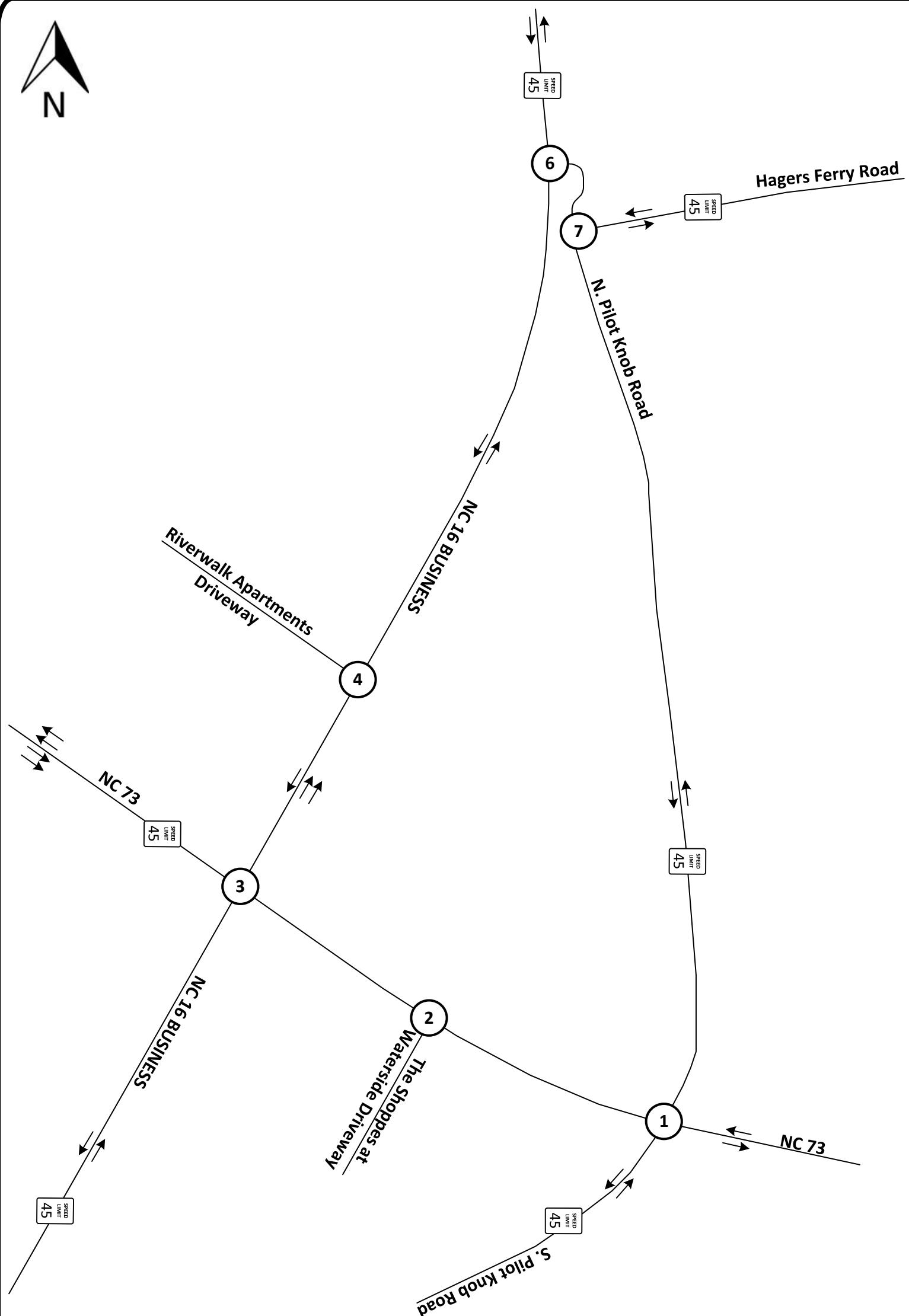


#### Cambridge Commercial Development Traffic Impact Study

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FIGURE 6

N



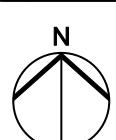
#### LEGEND

- Existing Traffic Control (STOP sign with red and green lights)
- Existing Roadway (solid line)
- Existing Laneage (arrow)

XXX' Storage Bay Length



Existing Posted Speed



#### Cambridge Commercial Development Traffic Impact Study

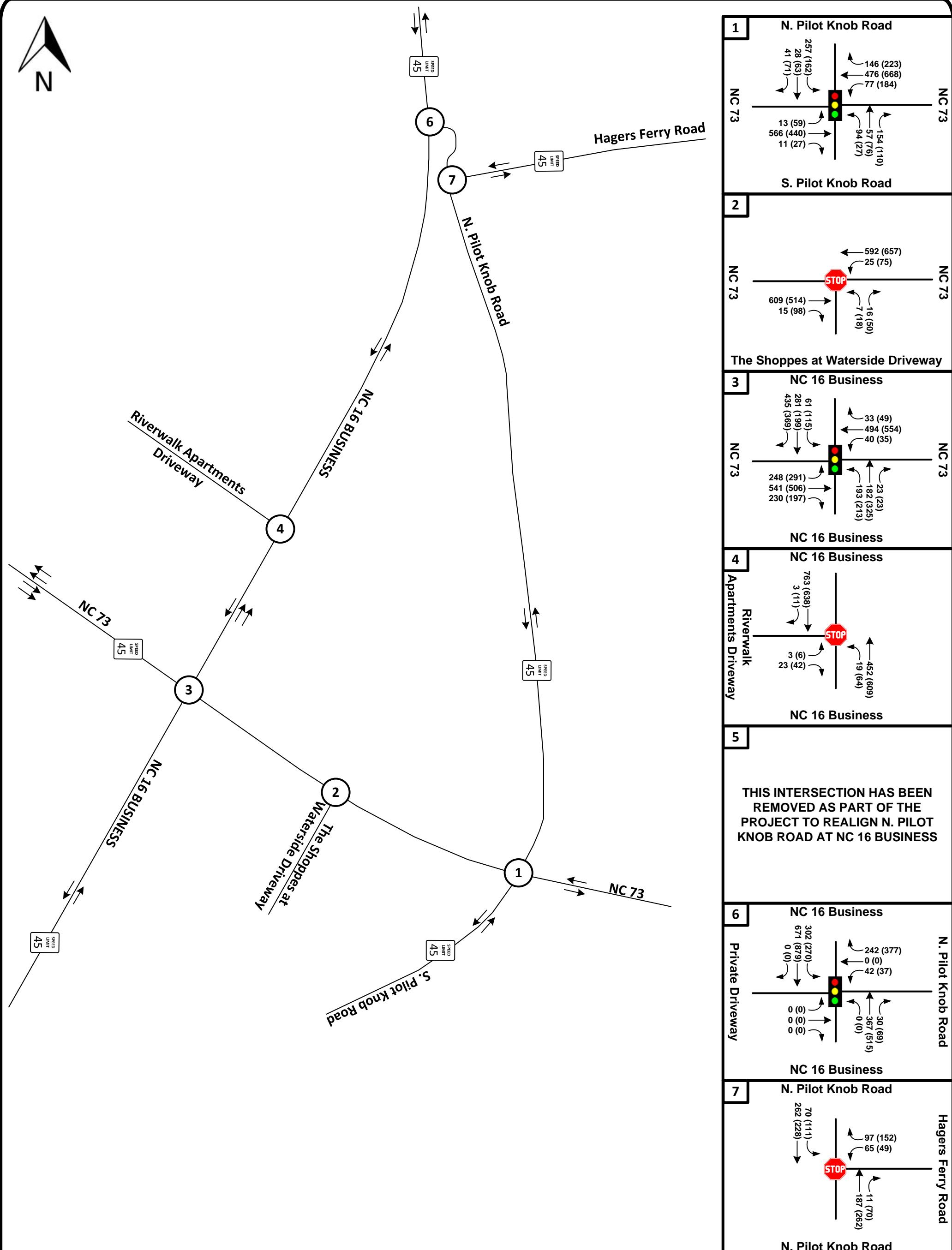
2019 Lane Configurations

DATE: April 2016

NOT TO SCALE

AMT

FIGURE 7



## LEGEND

  Existing Traffic Control

— Existing Roadway

### → Existing Movement

### **XX (XX) AM (PM) Peak Hour Volumes**

SPEED  
LIMIT  
XX



N

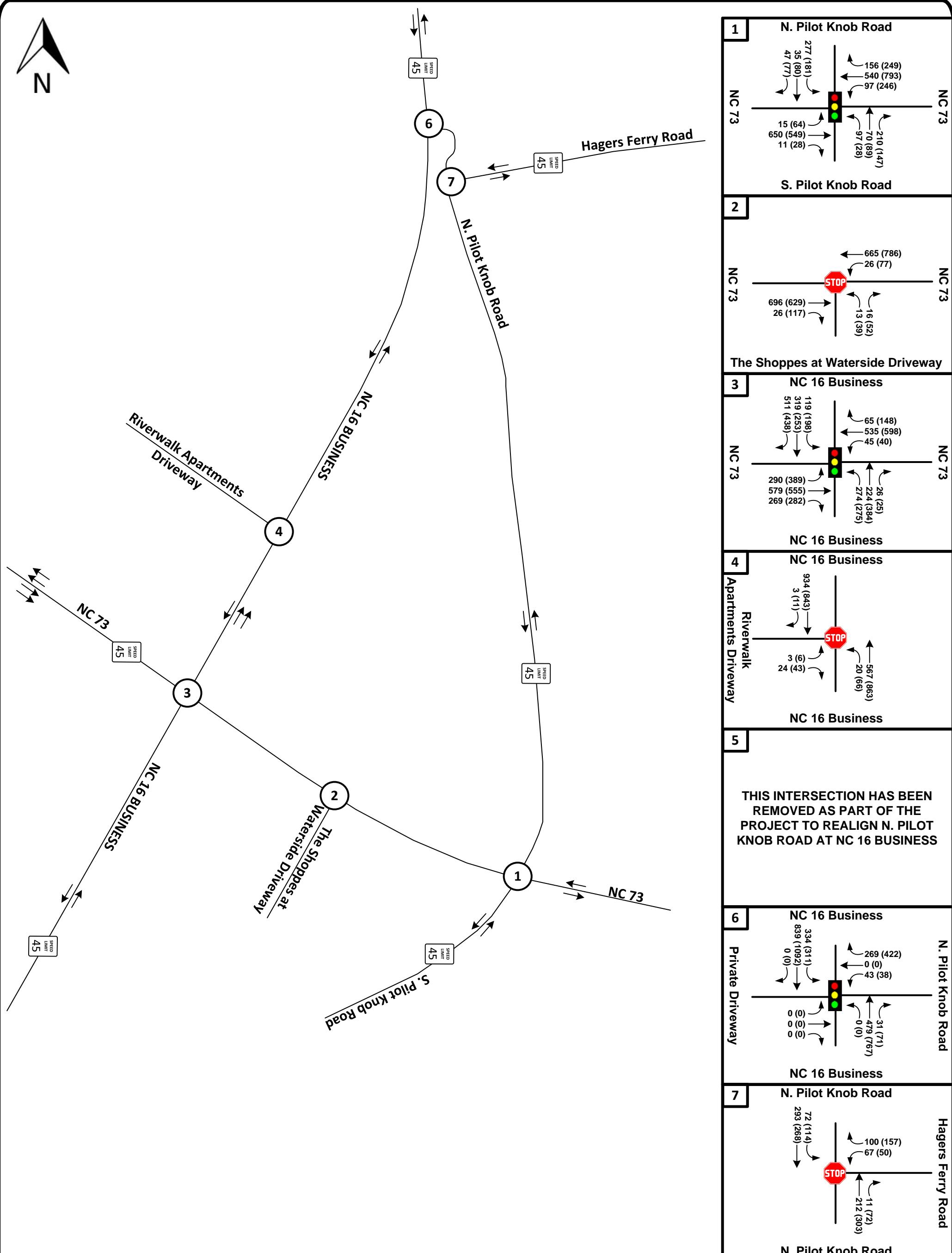
Cambridge Commercial Development  
Traffic Impact Study

## Rerouted Traffic Volumes

**DATE:** April 2016

DATE: April 2016

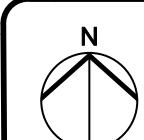
N



#### LEGEND

- Existing Traffic Control
- Existing Roadway
- Existing Movement
- AM (XX/XX) AM (PM) Peak Hour Volumes
- Existing Posted Speed

AMT



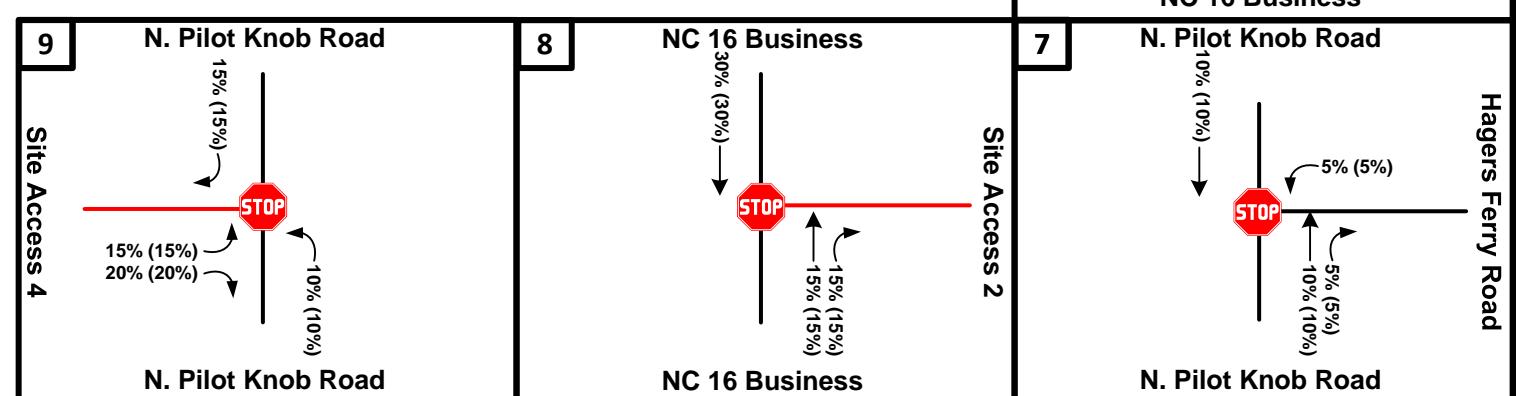
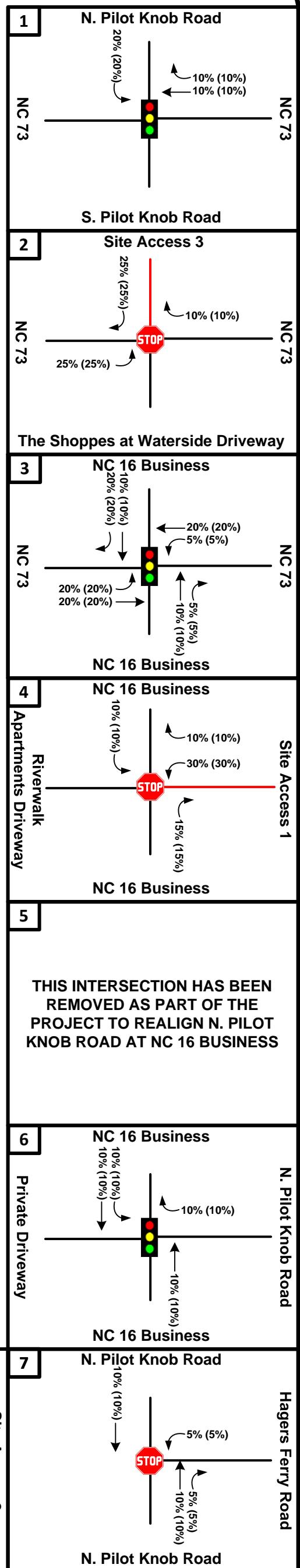
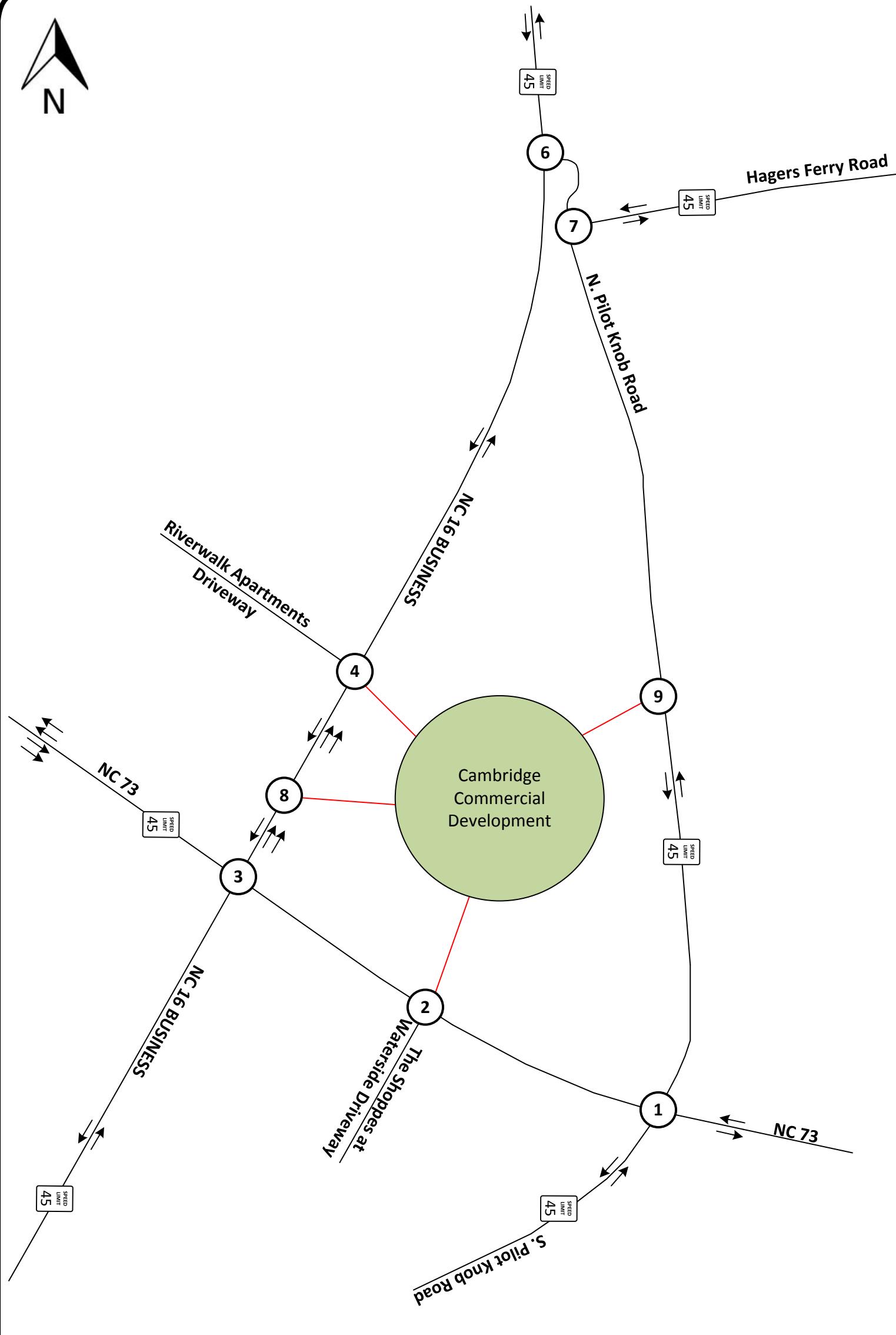
#### Cambridge Commercial Development Traffic Impact Study

2019 No-Build Traffic Volumes

DATE: April 2016

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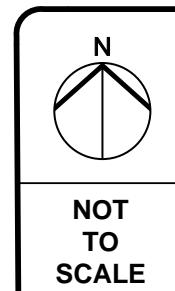
FIGURE 9



#### LEGEND

- Existing Traffic Control
- Existing Posted Speed
- Existing Roadway
- Proposed Site Access
- Existing Laneage
- XX% Entering Trip Percentage
- XX% Trip Distribution Percentage
- (XX%) Exiting Trip Percentage

AMT

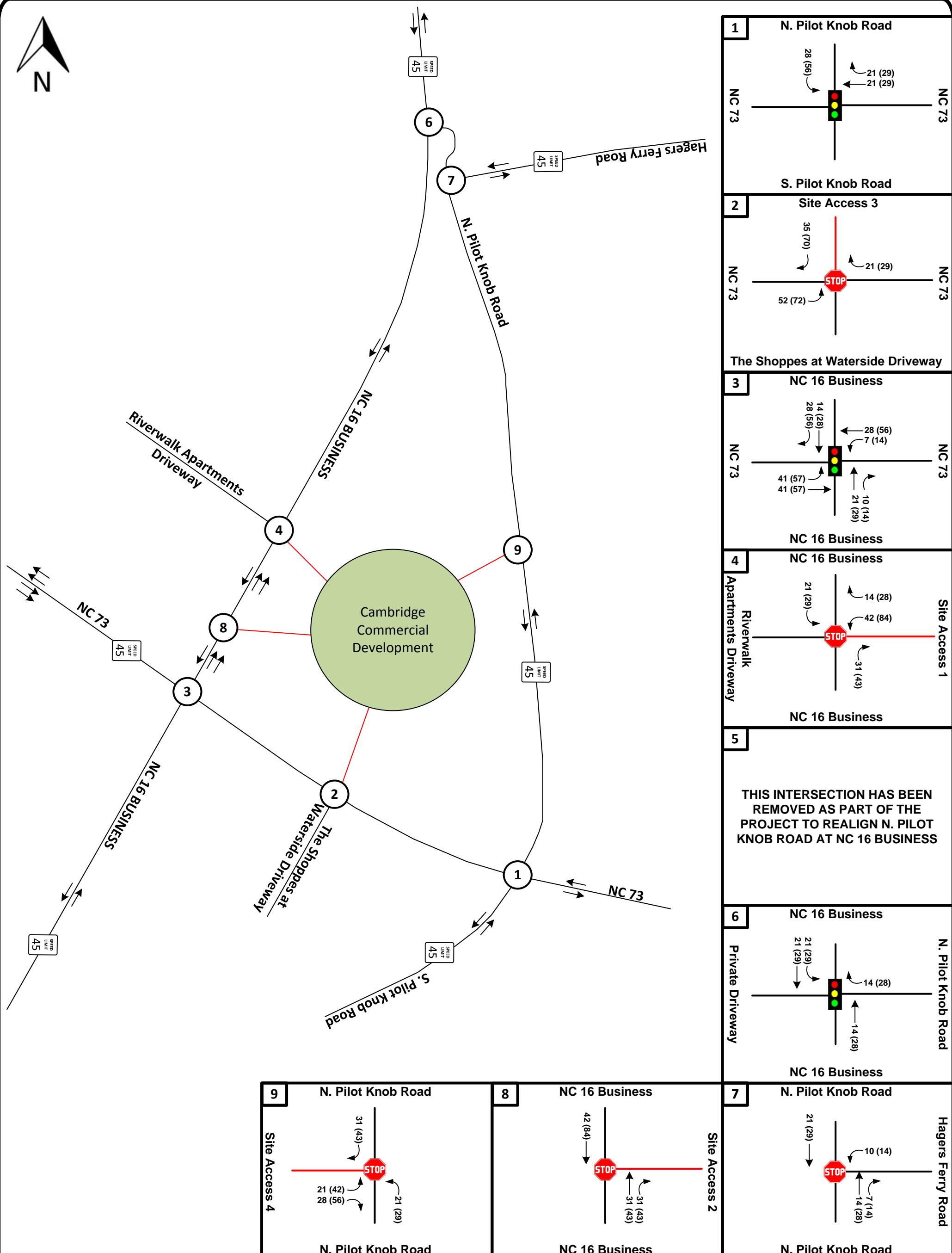


#### Cambridge Commercial Development Traffic Impact Study

New Site Trip Distribution

DATE: April 2016

FIGURE 10



#### LEGEND

- STOP Existing Traffic Control
- Existing Posted Speed SPEED LIMIT XX
- Existing Roadway
- Existing Laneage
- XX (XX) AM (PM) Peak Hour Volumes
- XX% Trip Distribution Percentage



#### Cambridge Commercial Development Traffic Impact Study

New Site Trip Assignment

DATE: April 2016

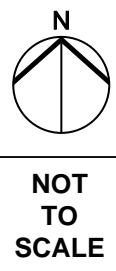
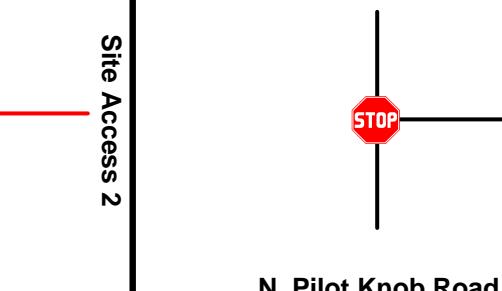
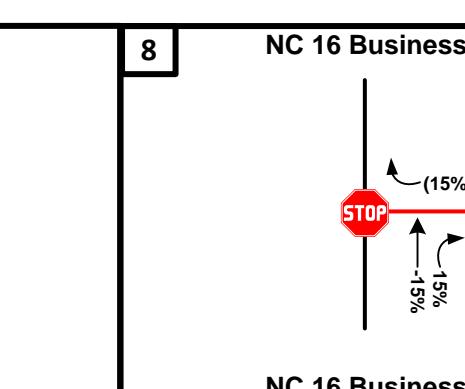
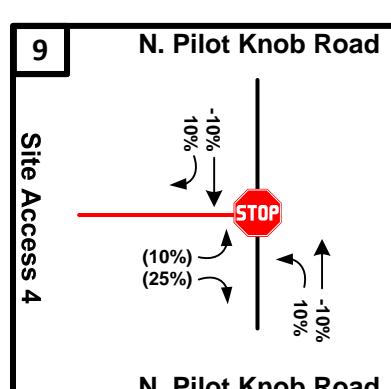
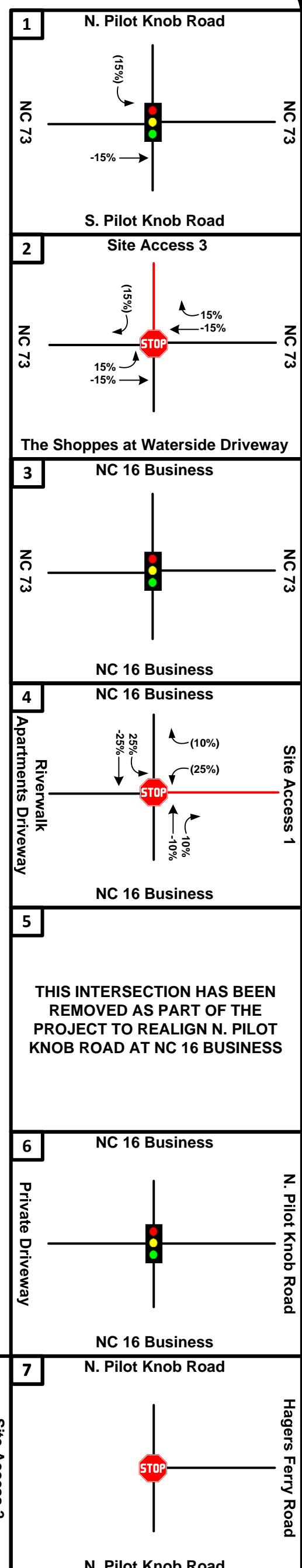
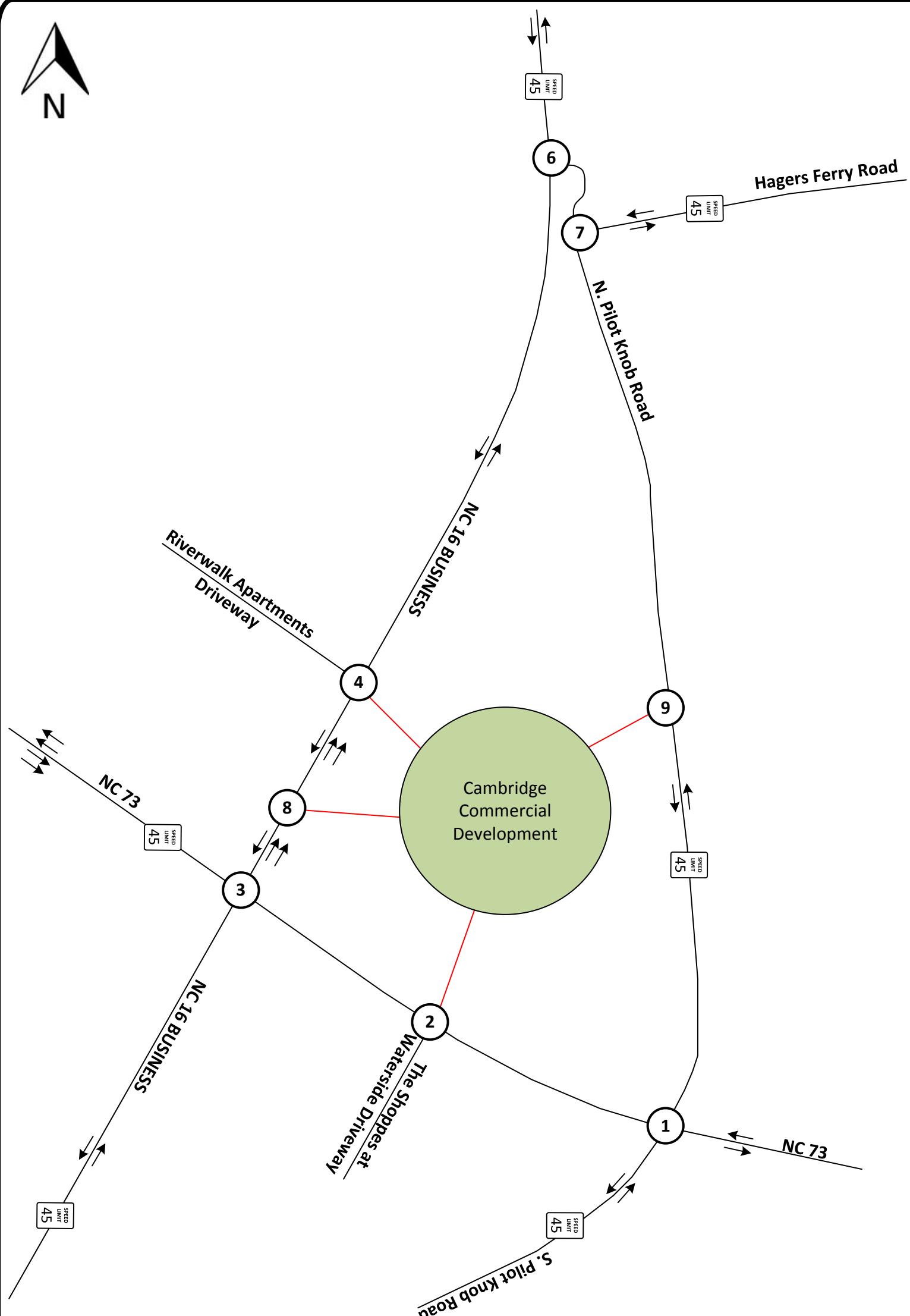
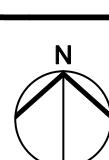


FIGURE 11



#### LEGEND

- Existing Traffic Control (STOP sign with red, yellow, green lights)
- Existing Roadway (Black line)
- Existing Laneage (Black line with arrows)
- Proposed Site Access (Red line)
- XX% Entering Trip Percentage
- (XX%) Exiting Trip Percentage



#### Cambridge Commercial Development Traffic Impact Study

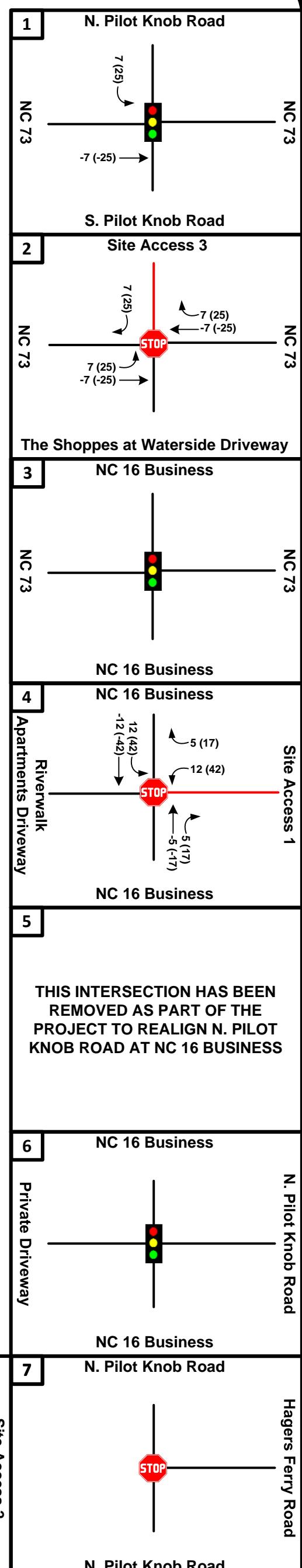
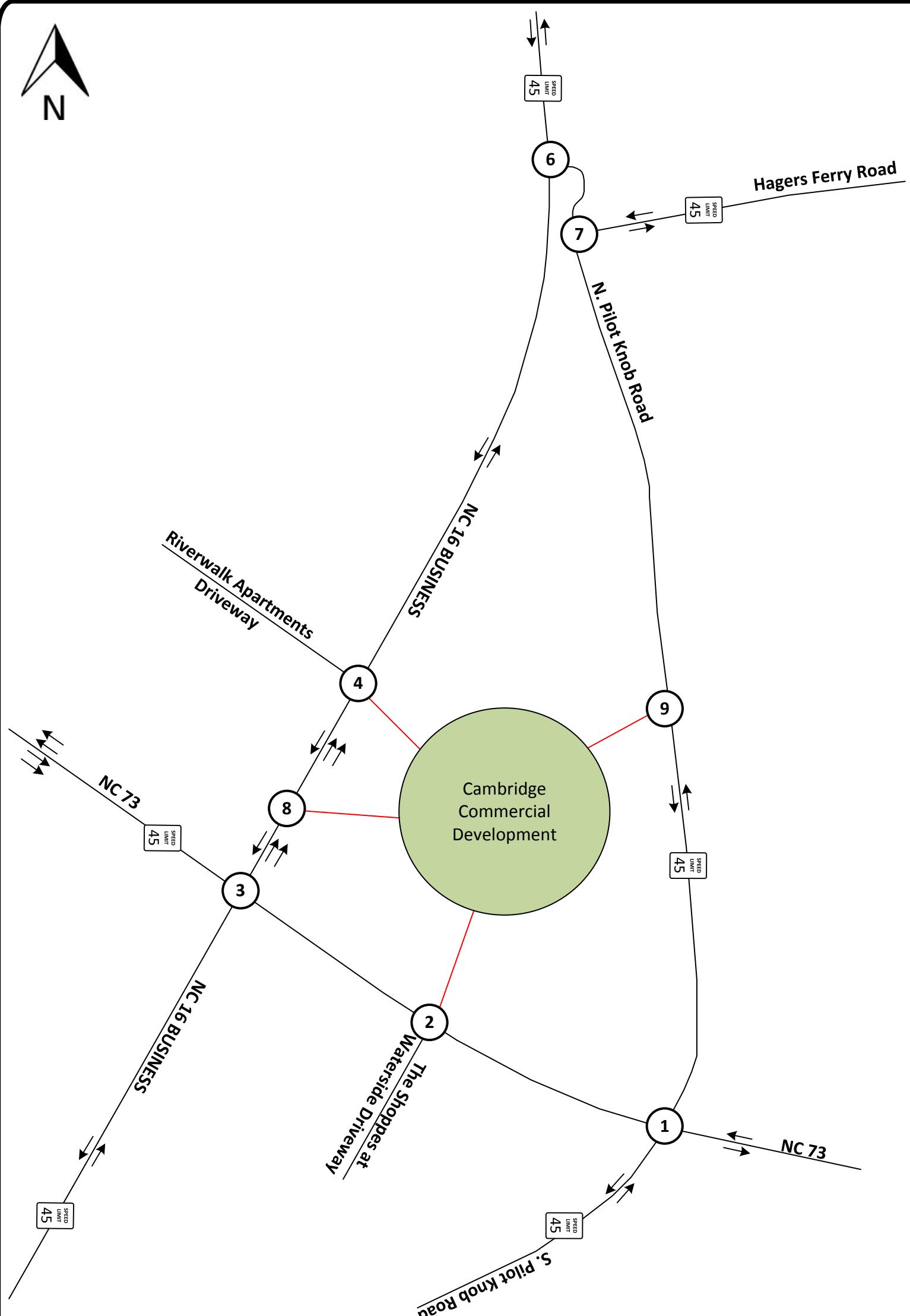
Pass-By Trip Distribution

DATE: April 2016

AMT

NOT TO SCALE

FIGURE 10



#### LEGEND

- Existing Traffic Control
- Existing Posted Speed
- Existing Roadway
- Proposed Site Access
- Existing Laneage
- XX (XX) AM (PM) Peak Hour Volumes

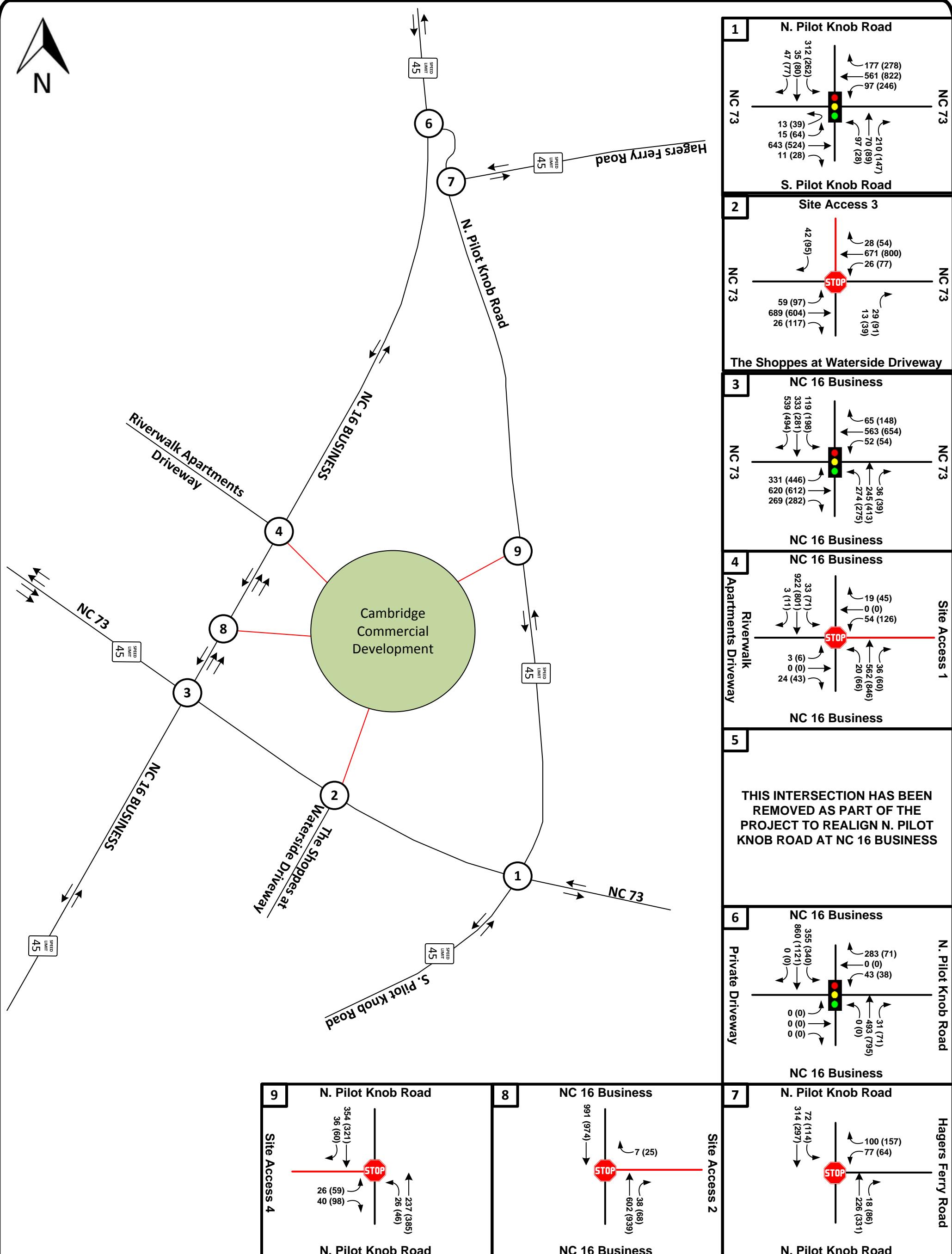


#### Cambridge Commercial Development Traffic Impact Study

Pass-By Trip Assignment

DATE: April 2016

**FIGURE 10**



#### LEGEND

	Existing Traffic Control
	Existing Posted Speed
— Existing Roadway	— Proposed Site Access
→ Existing Laneage	XX (XX) AM (PM) Peak Hour Volumes
XX% Trip Distribution Percentage	

	Cambridge Commercial Development Traffic Impact Study	
	2019 Build Traffic Volumes	
DATE: April 2016		
FIGURE 14		

## CAPACITY ANALYSIS

### 2016 Existing Analysis

The Highway Capacity Manual defines *capacity* as the maximum suitable flow rate at which vehicles reasonably can be expected to traverse a point during a specified time period. Capacity uses the measure of efficiency, *Level-of-Service* (LOS), to describe the traffic performance at intersections. LOS is defined for the overall intersection delay for signalized intersections. An acceptable LOS for a signalized intersection is considered to be LOS D or better (i.e. A, B, C or D).

At unsignalized intersections, the LOS is defined by the control delay for the movement that must yield right-of-way. It may be typical for stop-controlled minor streets to experience long delays during peak periods, while the majority of the traffic flows through the intersection on the major street experiencing little or no delay.

The procedures outlined in the Highway Capacity Manual, 2010 Update were used as guidelines for the analysis of the study area intersections. This manual provides procedures for the analysis of both signalized and unsignalized intersections. LOS categories range from LOS "A" (best) to "F" (worst) as shown in **Table 2**.

**Table 2: Level of Service Criteria**

Level of Service	SIGNALIZED Intersection Control Delay (sec/veh)	UN SIGNALIZED Intersection Control Delay (sec/veh)	Intersection LOS Description
A	< 10.0	< 10.0	Free flow, insignificant delays.
B	10.1-20.0	10.1-15.0	Stable operation, minimal delays.
C	20.1-35.0	15.1-25.0	Stable operation, acceptable delays.
D	35.1-55.0	25.1-35.0	Restricted flow, common delays.
E	55.1-80.0	35.1-50.0	Maximum capacity, extended delays. Volumes at or near capacity. Long queues form upstream from intersection.
F	> 80.0	> 50.0	Forced flow, excessive delays. Represents jammed conditions. Intersection operates below capacity with low volumes. Queues may block upstream intersections.

The LOS analysis was completed through the use of Synchro, version 9.1. The software package categorizes the LOS based on HCM methodology and criteria. According to industry standards, any signalized intersection or any approach of an unsignalized intersection is considered acceptable if the average delay is at LOS D or better with the LOS A representing little or no delay. Any signalized intersection or approach with a LOS of E or F is considered substandard and may need solutions to improve the operational performance.

The signal plans and timing data used in the analysis are included in **Appendix E**. The Synchro output for the analyses performed are included in **Appendix F**.

**Table 3** lists the LOS results from the Synchro capacity analysis for the 2016 Existing Traffic Conditions.

**Table 3: Level of Service Analysis – 2016 Existing Traffic Conditions**

Location	2016 Existing Traffic Conditions	
	AM Peak	PM Peak
Intersection 1 – NC 73 at Pilot Knob Road (signalized)		
Eastbound	B (18.8)	A (5.1)
Westbound	A (8.6)	A (9.1)
Northbound	B (11.3)	B (13.8)
Southbound	<b>F (96.0)</b>	C (32.1)
Overall	C (27.8)	B (11.8)
Intersection 2 – NC 73 at Shoppes at Waterside Driveway (stop-control)		
Westbound Left-Turn	A (9.1)	A (8.9)
Northbound	C (18.8)	C (18.8)
Intersection 3 – NC 16 Business at NC 73 (signalized)		
Eastbound	C (31.0)	D (35.9)
Westbound	D (37.2)	D (45.0)
Northbound	D (41.7)	<b>E (67.0)</b>
Southbound	C (32.6)	C (25.6)
Overall	C (34.3)	D (41.5)
Intersection 4 – NC 16 Bus. at Riverwalk Apartments Dwy. (stop-control)		
Eastbound	C (17.6)	B (14.8)
Northbound Left-Turn	A (9.9)	A (9.3)
Intersection 5 – NC Business 16 at Hagers Ferry Road (stop-control)		
Westbound	<b>F (87.3)</b>	<b>E (46.6)</b>
Southbound Left-Turn	A (9.8)	B (10.5)
Intersection 6A – NC 16 Business at Pilot Knob Road (yield-control)		
Westbound	C (18.3)	D (31.0)
Southbound Left-Turn	A (0.0)	A (0.0)
Intersection 7 – N. Pilot Knob Road at Hagers Ferry Road (stop-control)		
Westbound	B (13.5)	B (13.4)

The results of this analysis indicate that the southbound approach of Pilot Knob Road at NC 73 is operating at LOS F in the AM peak hour. The other approaches of the intersection operate at acceptable levels of

service in the AM and PM peak hours. The northbound NC 16 Business approach at NC 73 operates at LOS E during the PM peak hour. The westbound approach at NC 16 Business at Hagers Ferry Road operates at LOS E and LOS F during the AM and PM peak hours; respectively.

## 2019 No-Build Analysis

The site is proposed to be completed by year 2019. As directed by the MOU, existing traffic volumes were increased by 1 percent per year to reflect 2019 background traffic volumes. Approved developments were indicated in the area. Therefore, the 2019 background traffic consists of 2016 existing traffic with the addition of the historic growth and approved development traffic. Additionally, NCDOT provided information regarding the funded project to revise the intersections of NC 16 Business at Hagers Ferry Road, NC 16 Business at N. Pilot Knob Road and N. Pilot Knob Road at Hagers Ferry Road. It is envisioned that this project will be completed in 2019 ahead of the opening of the proposed development. The 2019 laneage is shown in **Figure 7** and Rerouted Traffic Volumes are shown in **Figure 8**.

The intersection and individual approach LOS results from the 2019 No-Build Analysis are displayed in **Table 4**.

**Table 4: Level of Service Analysis – 2019 No-Build Traffic Conditions**

Location	2019 No-Build Traffic Conditions	
	AM Peak	PM Peak
Intersection 1 – NC 73 at Pilot Knob Road (signalized)		
Eastbound	C (21.5)	A (7.6)
Westbound	B (10.6)	B (16.0)
Northbound	B (13.9)	B (14.4)
Southbound	<b>F (250.1)</b>	D (42.1)
Overall	<b>E (55.7)</b>	B (17.2)
Intersection 2 – NC 73 at Shoppes at Waterside Driveway (stop-control)		
Westbound Left-Turn	A (9.4)	A (9.4)
Northbound	D (27.0)	<b>E (40.3)</b>
Intersection 3 – NC 16 Business at NC 73 (signalized)		
Eastbound	C (33.8)	D (47.7)
Westbound	D (39.2)	D (44.5)
Northbound	<b>E (60.6)</b>	<b>F (116.7)</b>
Southbound	D (55.0)	D (49.9)
Overall	D (45.7)	<b>E (61.1)</b>
Intersection 4 – NC 16 Business at Riverwalk Apartments Dwy. (stop-control)		
Eastbound	C (22.4)	C (18.7)
Northbound Left-Turn	B (10.9)	B (10.3)
Intersection 6B – NC 16 Bus. at N. Pilot Knob Road/Private Driveway (signalized)		
Westbound	B (13.1)	C (28.4)
Northbound	B (16.0)	C (23.2)
Southbound	A (6.8)	B (12.6)
Overall	B (10.4)	B (18.6)
Intersection 7 – N. Pilot Knob Road at Hagers Ferry Road (stop-control)		
Westbound	B (14.1)	B (14.7)
Southbound Left-Turn	A (8.1)	A (8.5)

The operating conditions for the 2019 No-Build Analysis are similar to Existing conditions with most movements showing increases in delay. The NC 73 at Pilot Knob Road intersection overall LOS drops to LOS E during the AM peak period due to the increase in the southbound Pilot Knob Road delay. During the PM peak hour, the northbound Shoppes at Waterside approach to NC 73 declines to LOS E. The

northbound approach of NC 16 Business at NC 73 declines further to LOS E and LOS F during the AM and PM peak periods; respectively. The overall intersection LOS degrades to LOS E at this location for the PM peak hour.

## 2019 Build Analysis

The total future build traffic volumes include both the site traffic and traffic volumes from the No-Build Analysis. The Build Analysis evaluates the traffic conditions before any improvements are implemented. **Table 5** shows the LOS results for the intersections within the study area.

**Table 5: Level of Service Analysis – 2019 Build Traffic Conditions**

Location	2019 Build		
	Traffic Conditions		PM Peak
AM Peak	PM Peak		
Intersection 1 – NC 73 at Pilot Knob Road (signalized)	Eastbound	C (20.6)	B (14.7)
	Westbound	B (10.6)	B (19.3)
	Northbound	B (13.7)	B (13.5)
	Southbound	<b>F (324.7)</b>	<b>E (75.7)</b>
	Overall	<b>E (71.1)</b>	C (26.4)
Intersection 2 – NC 73 at The Shoppes at Waterside Dwy. / Proposed Site Access 3 (stop-control)	Eastbound Left-Turn	A (9.8)	B (10.7)
	Westbound Left-Turn	A (9.4)	A (9.2)
	Northbound	B (14.8)	B (14.8)
	Southbound	C (15.6)	C (20.3)
Intersection 3 – NC 16 Business at NC 73 (signalized)	Eastbound	D (39.5)	<b>E (65.3)</b>
	Westbound	D (42.4)	D (53.9)
	Northbound	<b>E (62.4)</b>	<b>F (149.8)</b>
	Southbound	<b>E (61.4)</b>	<b>E (57.7)</b>
	Overall	D (50.5)	<b>E (77.0)</b>
Intersection 4 – NC 16 Business at Riverwalk Apartments Dwy. / Proposed Site Access 1 (stop-control)	Eastbound	D (25.2)	C (24.2)
	Westbound	<b>F (520.0)</b>	<b>F (2500.9)</b>
	Northbound Left-Turn	B (10.8)	B (10.1)
	Southbound Left-Turn	A (9.2)	B (10.8)
Intersection 6B – NC 16 Bus. at N. Pilot Knob Road/Private Dwy. (signalized)	Westbound	B (14.6)	C (30.0)
	Northbound	B (18.0)	C (26.4)
	Southbound	A (6.9)	B (13.2)
	Overall	B (11.3)	C (20.2)
Intersection 7 – N. Pilot Knob Road at Hagers Ferry Road (stop-control)	Westbound	C (15.4)	C (16.2)
	Southbound Left-Turn	A (8.1)	A (8.7)
Intersection 8 – NC 16 Business at Proposed Site Access 2 (stop-control)	Westbound	B (10.7)	B (12.9)
Intersection 9 – Pilot Knob Road at Proposed Site Access 4 (stop-control)	Eastbound	B (13.4)	C (18.5)
	Northbound Left-Turn	A (8.3)	A (8.3)

Analysis indicates that with the addition of traffic anticipated to be generated by the proposed development, the intersection of NC 73 at Pilot Knob Road will operate LOS E during the AM peak hour. The NC 16 Business at NC 73 intersection will operate at LOS D and E during the AM and PM peak hours; respectively. The northbound NC 16 Business approach will operate at LOS E and LOS F during the AM and PM peak hours respectively. The southbound NC 16 Business approach will operate at LOS E during both the AM and PM peak hours. The re-aligned intersection at NC 16 Business and N. Pilot Knob Road will operate at acceptable LOS during both peak hours under the 2019 Build conditions.

There are four proposed access points to the Cambridge Commercial Development. The access points and their proposed operations under 2019 Build Conditions are as follows:

#### *Site Access 1*

The first access point is proposed for NC 16 Business across from the Riverwalk Apartments driveway. This access point is approximately 1,450 feet north of the NC 16 Business at NC 73 intersection. This will create a four-legged, full movement intersection. The westbound approach at NC 16 Business at Riverwalk Apartments Driveway/Proposed Site Access 1 will operate at LOS F during both the AM and PM peak hours.

#### *Site Access 2*

The second access point is proposed for NC 16 Business approximately 500 feet north of the NC 16 Business at NC 73 intersection. This will create a three-legged, right-in/right-out only access point. This unsignalized access point will operate at acceptable LOS during the AM and PM peak hours.

#### *Site Access 3*

The third access point is proposed for NC 73 across from The Shoppes at Waterside driveway. This access point is approximately 850 feet east of the NC 16 Business at NC 73 intersection. This will create a four-legged, intersection with left-over and right-in/right-out access. This unsignalized access point will operate at acceptable LOS during the AM and PM peak hours.

#### *Site Access 4*

The fourth access point is proposed for N. Pilot Knob Road approximately 2,100 feet north of the NC 73 at N. Pilot Knob Road intersection. This site access point will create a three-legged, full movement intersection. This unsignalized access point will operate at acceptable LOS during the AM and PM peak hours.

## **2019 Build Improved Analysis**

The 2019 build analysis indicated several locations which are projected to operate at unacceptable levels with long delays. Geometric improvements such as the installation of turn-lanes are recommended and therefore analyzed in this scenario. One such improvement is the installation of a traffic signal at the intersection of NC 16 Business at Riverwalk Apartments Driveway / Site Access 1. A traffic signal is analyzed at this intersection to allow it to operate at an acceptable level of service. A full signal warrant and delay analysis should be conducted at this intersection to determine the final need for the signal as well as adhere to NCDOT standards for the installation of a signal on a state maintained road (NC 16 Business). The recommended improvements are listed in the Recommendations section.

**Table 6** shows the analysis results at the intersections within the study area with the recommended improvements.

**Table 6: Level of Service Analysis – 2019 Build Improved Traffic Conditions**

Location	2019 Build Improved Traffic Conditions	
	AM Peak	PM Peak
Intersection 1 – NC 73 at Pilot Knob Road (signalized)		
Eastbound	C (21.0)	C (24.0)
Westbound	B (10.6)	C (28.2)
Northbound	B (13.7)	B (10.5)
Southbound	<b>F (324.7)</b>	<b>D (41.9)</b>
Overall	<b>E (71.2)</b>	C (27.6)
Intersection 2 – NC 73 at Shoppes at Waterside Dwy. / Proposed Site Access 3 (stop-control)		
Eastbound Left-Turn	A (9.7)	B (10.4)
Westbound Left-Turn	A (9.4)	A (9.2)
Northbound	B (14.8)	B (14.8)
Southbound	C (15.3)	C (19.5)
Intersection 3 – NC 16 Business at NC 73 (signalized)		
Eastbound	D (39.5)	<b>E (65.3)</b>
Westbound	D (42.4)	D (51.4)
Northbound	D (54.7)	<b>E (57.7)</b>
Southbound	<b>E (60.9)</b>	D (53.0)
Overall	D (49.1)	<b>E (57.7)</b>
Intersection 4 – NC 16 Business at Riverwalk Apartments Dwy./ Proposed Site Access 1 (signalized)		
Eastbound	A (2.8)	A (3.0)
Westbound	B (10.7)	C (22.4)
Northbound	A (3.0)	A (6.1)
Southbound	B (10.0)	B (11.7)
Overall	A (7.3)	A (9.7)
Intersection 6B – NC 16 Bus. at N. Pilot Knob Road/ Private Driveway (signalized)		
Westbound	B (14.6)	C (30.3)
Northbound	B (18.0)	C (26.4)
Southbound	A (6.9)	B (13.3)
Overall	B (11.3)	C (20.3)

**Table 6 (continued): Level of Service Analysis – 2019 Build Improved Traffic Conditions**

Location	2019 Build Improved Traffic Conditions	
	AM Peak	PM Peak
Intersection 7 – N. Pilot Knob Road at Hagers Ferry Road (stop-control)	Westbound	C (15.4)
	Southbound Left-Turn	A (8.1)
Intersection 8 – NC 16 Business at Proposed Site Access 2 (stop-control)	Westbound	B (10.5)
		B (12.5)
Intersection 9 – Pilot Knob Road at Proposed Site Access 4 (stop-control)	Eastbound	B (13.1)
	Northbound Left-Turn	A (8.2)
		C (17.4)
		A (8.1)

With timing modifications to the traffic signal at the intersection of NC 16 Business at NC 73, the analysis shows improvements in operations to the northbound and southbound NC 16 Business approaches during the AM and PM peak hours. The intersection will continue to operate at LOS D and LOS E respectively during the AM and PM peak hours.

A signal is proposed at the NC 16 Business at Riverwalk Driveway/Proposed Site Access 1 intersection. This signal will greatly improve the westbound approach delay and the intersection will operate at LOS A and LOS B during the AM and PM peak hours respectively.

Other intersections will operate at acceptable LOS. Geometric improvements such as the installation of turn-lanes are recommended and were therefore analyzed in this scenario. The recommended improvements are located in the Conclusions/Recommendations section. The recommended improvements are illustrated in **Figure 15**.

## Traffic Simulation

In-order to verify queue lengths at locations which may warrant the installation of turn lanes, a simulation of traffic was performed according to NCDOT Congestion Management Capacity Analysis Guidelines. The results of this simulation are shown in **Table 7**. SimTraffic reports are shown in **Appendix G**.

**Table 7: SimTraffic Queuing Results**

Location	2019 Build Improved Queuing			
	AM 95 <sup>th</sup> % (ft.)	AM Max (ft.)	PM 95 <sup>th</sup> % (ft.)	PM Max (ft.)
Intersection 1 – NC 73 at Pilot Knob Road (signalized)				
Southbound Left Turn	297	425	235	425
Intersection 2 – NC 73 at Shoppes at Waterside Dwy. / Proposed Site Access 3 (stop-control)				
Eastbound Left-Turn	8	49	13	111
Westbound Left-Turn	3	43	8	74
Northbound Right-Turn	8	62	20	63
Southbound Right-Turn	10	46	30	85
Intersection 3 – NC 16 Business at NC 73 (signalized)				
Northbound Through-Right Turn	140	165	264	250
Intersection 4 – NC 16 Business at Riverwalk Apartments Dwy. / Proposed Site Access 1 (signalized)				
Eastbound	6	52	11	74
Westbound	35	114	108	182
Northbound Through-Right Turn	54	107	103	196
Southbound Left Turn	11	300	27	300

## CONCLUSIONS

The proposed Cambridge Commercial Development is located on approximately 15 acres between Pilot Knob Road and NC 16 Business near Denver, North Carolina. The proposed development will consist of a commercial/retail shopping center including a supermarket containing an in-store pharmacy with a drive-thru window, a fast-food restaurant with a drive-thru window, retail store space and a branch bank with a drive-thru window. It was estimated that a total of 347 new trips (206 in, 141 out) will be generated from the proposed site in the AM peak hour and 567 trips (287 in, 280 out) will be generated in the PM peak hour.

It is proposed to have four access points to the development. There are as follows:

### *Site Access 1*

The first access point is proposed for NC 16 Business across from the Riverwalk Apartments driveway. This access point is approximately 1,450 feet north of the NC 16 Business at NC 73 intersection. This will create a four-legged, full movement intersection.

### *Site Access 2*

The second access point is proposed for NC 16 Business approximately 500 feet north of the NC 16 Business at NC 73 intersection. This will create a three-legged, right-in/right-out only access point.

### *Site Access 3*

The third access point is proposed for NC 73 across from The Shoppes at Waterside driveway. This access point is approximately 850 feet east of the NC 16 Business at NC 73 intersection. This will create a four-legged, intersection with left-over and right-in/right-out access.

### *Site Access 4*

The fourth access point is proposed for N. Pilot Knob Road approximately 2,100 feet north of the NC 73 at N. Pilot Knob Road intersection. This site access point will create a three-legged, full movement intersection. This unsignalized access point will operate at acceptable LOS during the AM and PM peak hours.

The 2019 build analysis indicated several locations which are projected to operate at unacceptable levels with long delays. Geometric improvements such as the installation of turn-lanes are recommended and therefore analyzed in this scenario. One such improvement is the installation of a traffic signal at the intersection of NC 16 Business at Riverwalk Apartments Driveway / Site Access 1. A traffic signal is analyzed at this intersection to allow it to operate at an acceptable level of service. A full signal warrant and delay analysis should be conducted at this intersection to determine the final need for the signal as well as adhere to NCDOT standards for the installation of a signal on a state maintained road (NC 16 Business). The recommended improvements are listed in the Recommendations section.

## RECOMMENDATIONS

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. The NCDOT *“Policy on Street and Driveway Access to North Carolina Highways”* manual was consulted to determine the appropriate storage for the recommended auxiliary lanes if warranted.

**Recommended Improvements****NC 16 Business at NC 73**

- Construct a shared through/right turn lane with 125 feet of full-width storage and appropriate taper on northbound NC 16 Business.
- The above recommendation will require the redesign and retiming of the intersection signalization.

**NC 16 Business at Riverwalk Apartments Driveway/Site Access 1 (Full Movement)**

- Construct site access 1 with one (1) ingress lane and one (1) egress lane. The egress lane will allow left, through, and right turning movements.
- Install a traffic signal to provide traffic control at the intersection.

**NC 73 at N. Pilot Knob Road**

- Extend the southbound exclusive left- turn by 250 feet of full-width storage from its current length of 50 feet. This will provide 300 feet of full-width storage and will include appropriate tapers.

**NC 16 Business at Prop. Site Access 2**

- Construct site access 2 with one (1) egress lane and one (1) ingress lane. The egress should be limited to right-turn only and designed with a standard raised triangular island to physically prohibit movements other than right turns out of this access.
- Construct an exclusive northbound right-turn lane with 75 feet of full-width storage and appropriate taper on NC 16 Business.

**NC 73 at The Shoppes at Waterside Commons/Prop. Site Access 3**

- Construct a directional crossover at the intersection.
- Construct site access 3 with one (1) egress lane and one (1) ingress lane. The egress should be limited to right-turn only.
- Construct an exclusive westbound right-turn lane with 50 feet of full-width storage and appropriate taper on NC 73.

**N. Pilot Knob Road at Proposed Site Access 4**

- Construct an exclusive northbound left-turn lane with 50 feet of full-width storage and appropriate taper
- Construct an exclusive southbound right-turn lane with 50 feet of full-width storage and appropriate taper
- Construct site access 4 with one (1) egress lane and one (1) ingress lane. The egress should be allow both right and left turning traffic at the intersection.

The Recommended Improvements are shown in **Figure 15**.

