

NC 55 BYPASS STUDY

Holly Springs and Apex, NC

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NC 55 BYPASS STUDY

HOLLY SPRINGS AND APEX, NORTH CAROLINA

1. INTRODUCTION

This document summarizes the findings of a traffic study and functional design of the NC 55 Bypass corridor with future improvements identified in the Town of Holly Springs Transportation Plan. The 2040 Metropolitan Transportation Plan recommends widening the NC 55 Bypass from four lanes to six lanes by 2030 due to increasing traffic volumes from additional development in the area. Future traffic volumes are expected to exceed capacity with the current roadway geometry. As traffic volumes and turning movements at existing and future intersections along the corridor increase, operational deficiencies supporting the need for interchanges and grade separations along the bypass are anticipated, as recommended in the Capital Area Metropolitan Planning Organization (CAMPO) Southwest Area Study. This study provides a feasible functional design along the corridor to implement the widening and grade separations while minimizing impacts to adjacent land uses and environmental features. This document and associated drawing is a preliminary assessment of the impacts of widening NC 55 Bypass and providing grade separations.

1.1. Project Location

The study area extends from the intersection of NC 55 Bypass and Williams Street in the north to the intersection with Main Street in the south. The northern portion of NC 55 Bypass is in Apex while most of the roadway corridor is in Holly Springs. Refer to Figure 1 for a project location map and illustration of the NC 55 Bypass corridor.

1.2. Project Team

The scope of work for the study was developed through coordination with CAMPO and NCDOT and finalized following a kick-off meeting with the stakeholders. This initial meeting addressed details of the project that set the framework and requirements of the study. Two additional meetings were held to review the study findings and draft functional design plans. Members from the Town of Apex, Town of Holly Springs, NCDOT Congestion Management, CAMPO, and

NCDOT Division Office attended the meetings to provide comments and feedback. See Appendix A for a list of the meeting attendees.

1.3. Methodology and Study Area

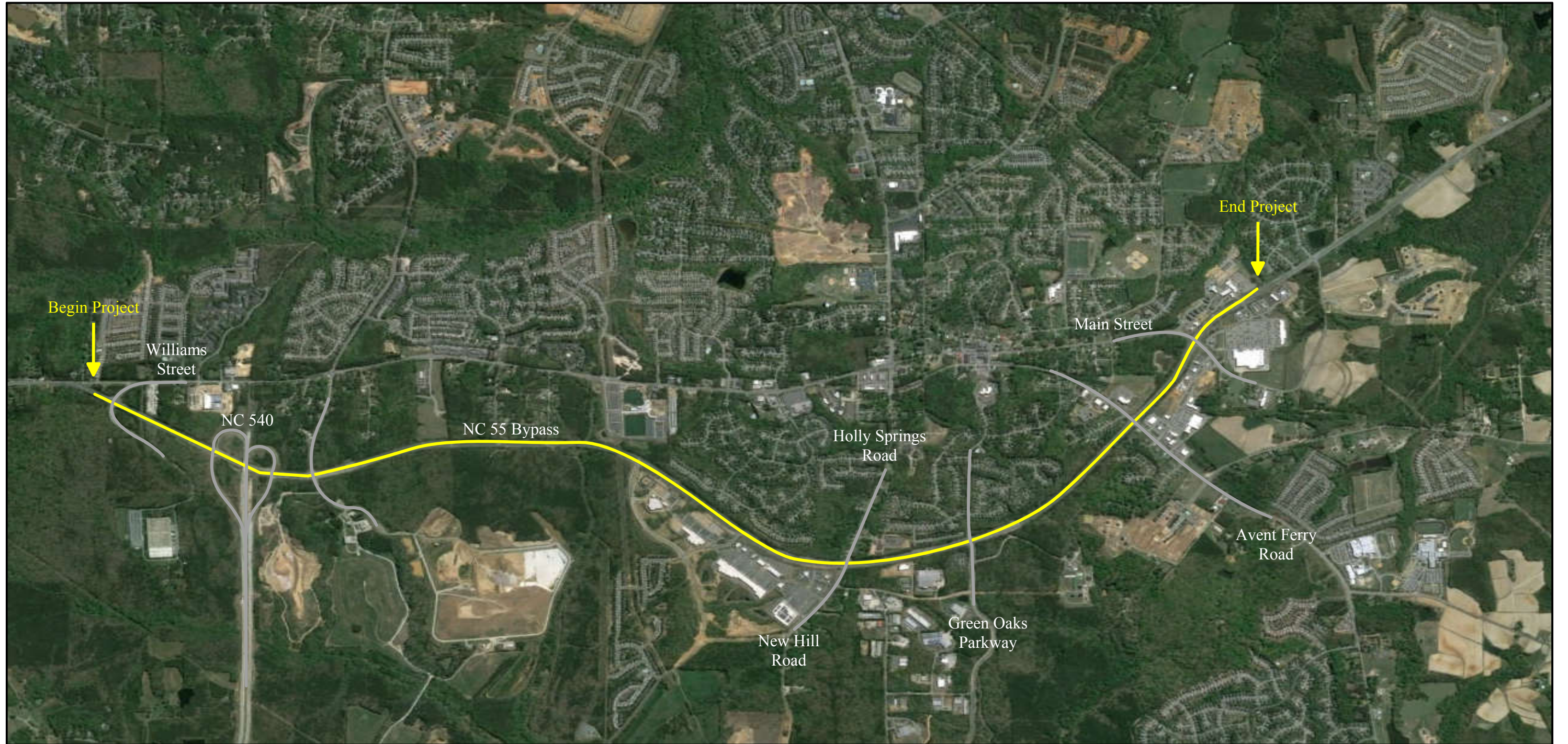
The study provides an analysis and evaluation of traffic operations for the following scenarios:

- Existing Conditions
- Future 2040 Conditions with Town Transportation Plan Improvements and 2040 MTP

Study Intersections

- NC 55 Bypass and Main Street / Ralph Stevens Road (future interchange)
- NC 55 Bypass and Avent Ferry Road (future overpass)
- NC 55 Bypass and Green Oaks Parkway
- NC 55 Bypass and Holly Springs Road (future interchange)
- NC 55 Bypass and Old Smithfield Road
- NC 55 Bypass and NC 540 Ramps
- NC 55 Bypass and Williams Street / Technology Drive

In addition to operational analyses, the study provides an evaluation of safety, environmental screening results, and conceptual designs for the improvements. The conceptual design includes roadway configuration, potential right-of-way needs, and potential environmental impacts identified in an environmental screening.



NC 55 Bypass Corridor Study
Holly Springs, North Carolina

Project Location Map

Figure 1

SCALE: Not to Scale



2. EXISTING CONDITIONS

2.1. Existing Land Uses

Existing land uses along NC 55 Bypass are generally industrial, commercial, and undeveloped to the west of the roadway and residential to the east. The Holly Springs Towne Center retail center is located just north of New Hill Road, near the northern end of the Bypass. Southpark Village and The Shoppes at Holly Springs retail centers are located just south of Avent Ferry Road and Ralph Stevens Road, at the southern end of the Bypass. Avent Ferry Road and New Hill Road provide access to several residential developments to the west of NC 55 Bypass.

2.2. Existing Roadways

Existing roadways were inventoried to determine existing geometry and traffic control. Table 1 shows each roadway in the study area along with a general description of the roadway and posted speed limit.

NC 55 Bypass is approximately 4.5 miles in length with control-of-access along the entire corridor. Breaks in the control-of-access are provided for existing intersections and driveways. NC 55 Bypass does not currently provide sidewalks, bike lanes, or public transportation stops.

Table 1: Existing Roadway Summary

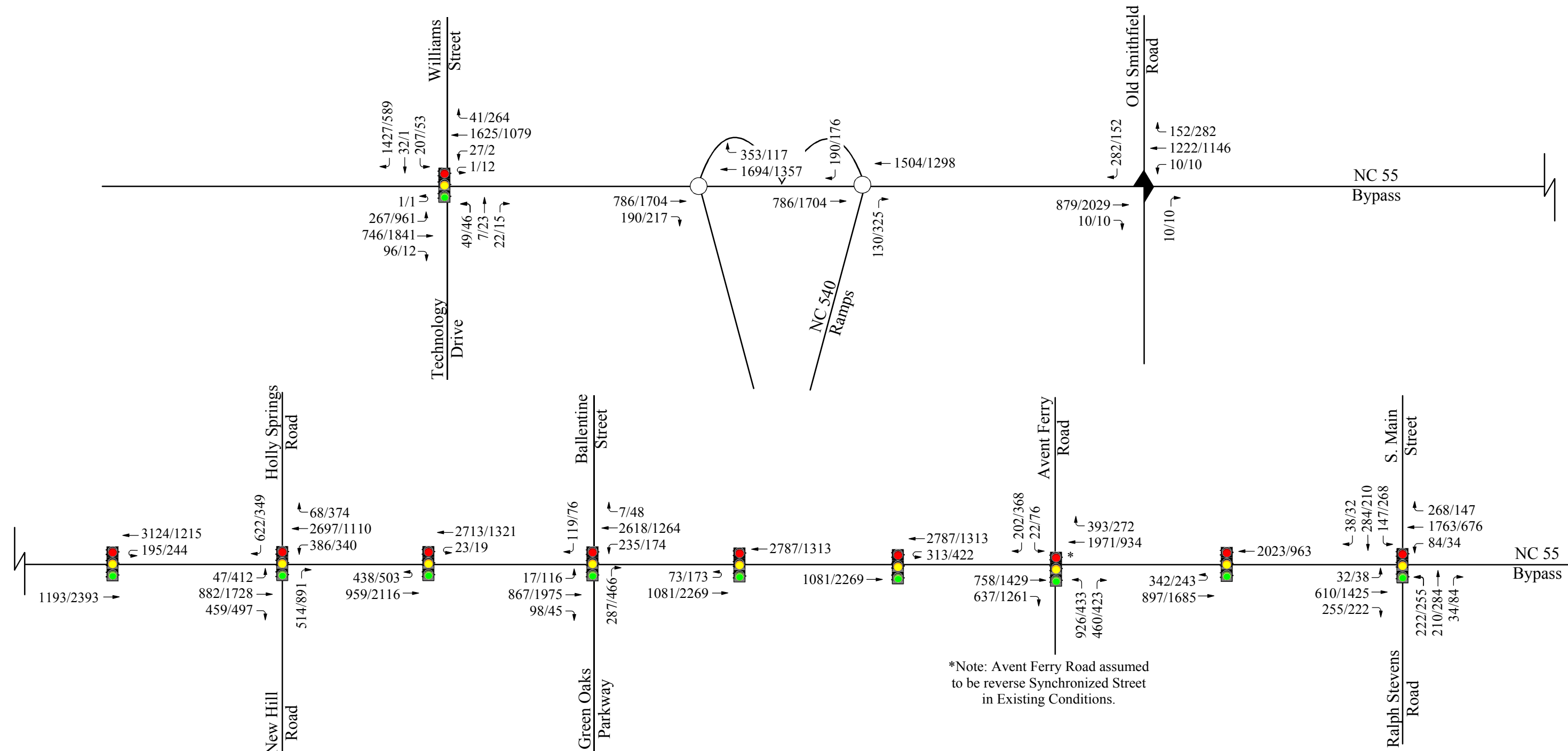
Roadway	Description	Posted Speed Limit
NC 55 Bypass	4-lane	55 mph
Williams Street	2-lane/TWLTL	45 mph
Old Smithfield Road	2-lane/TWLTL	35 mph
New Hill Road	2-lane/some turn lanes	35 mph
Holly Springs Road	2-lane	35 mph
Green Oaks Parkway	4-lane	35 mph
Ballentine	2-lane	20 mph
Avent Ferry Road	2-lane/turn lanes	35 mph
Main Street	2-lane	35 mph

2.3. Existing Traffic Volumes

Existing traffic volumes were determined based on traffic counts from previously completed traffic studies in the area and from data in the Triangle Regional Model (TRM). Weekday AM and PM peak hour traffic volumes were taken from the following traffic studies completed for future developments or for the Town of Holly Springs:

- Veridea
- New Hill Place
- Holly Springs Professional Park
- Green Oaks Retail Development
- Main Street Extension.

Refer to Figure 2 for an illustration of the existing AM and PM peak hour traffic volumes at study intersections. It should be noted that the Avent Ferry Road intersection is assumed to be a reverse synchronized street under existing conditions although this improvement is currently under construction.



*Note: Avent Ferry Road assumed to be reverse Synchronized Street in Existing Conditions.



NC 55 Bypass Corridor Study
 Holly Springs, North Carolina

Existing Peak Hour Traffic Volumes

Figure 2 SCALE: Not to Scale

3. FUTURE (2040) CONDITIONS

Per discussions with the project team members, the future analysis year for this study is 2040. Traffic conditions for 2040 were developed, in part, using the Triangle Regional Model (TRM) version 5.0. The 2040 conditions in the TRM include many of the planned and funded transportation projects within the study, such as:

- the widening of NC 55 Bypass;
- the Perry Road Extension from what is the existing intersection of NC 55 Bypass and E. Williams Street / Technology Drive north west to Perry Road in Apex;
- the completion of NC 540; and
- the Main Street Extension from Ralph Stevens Road to Piney Grove-Wilbon Road.

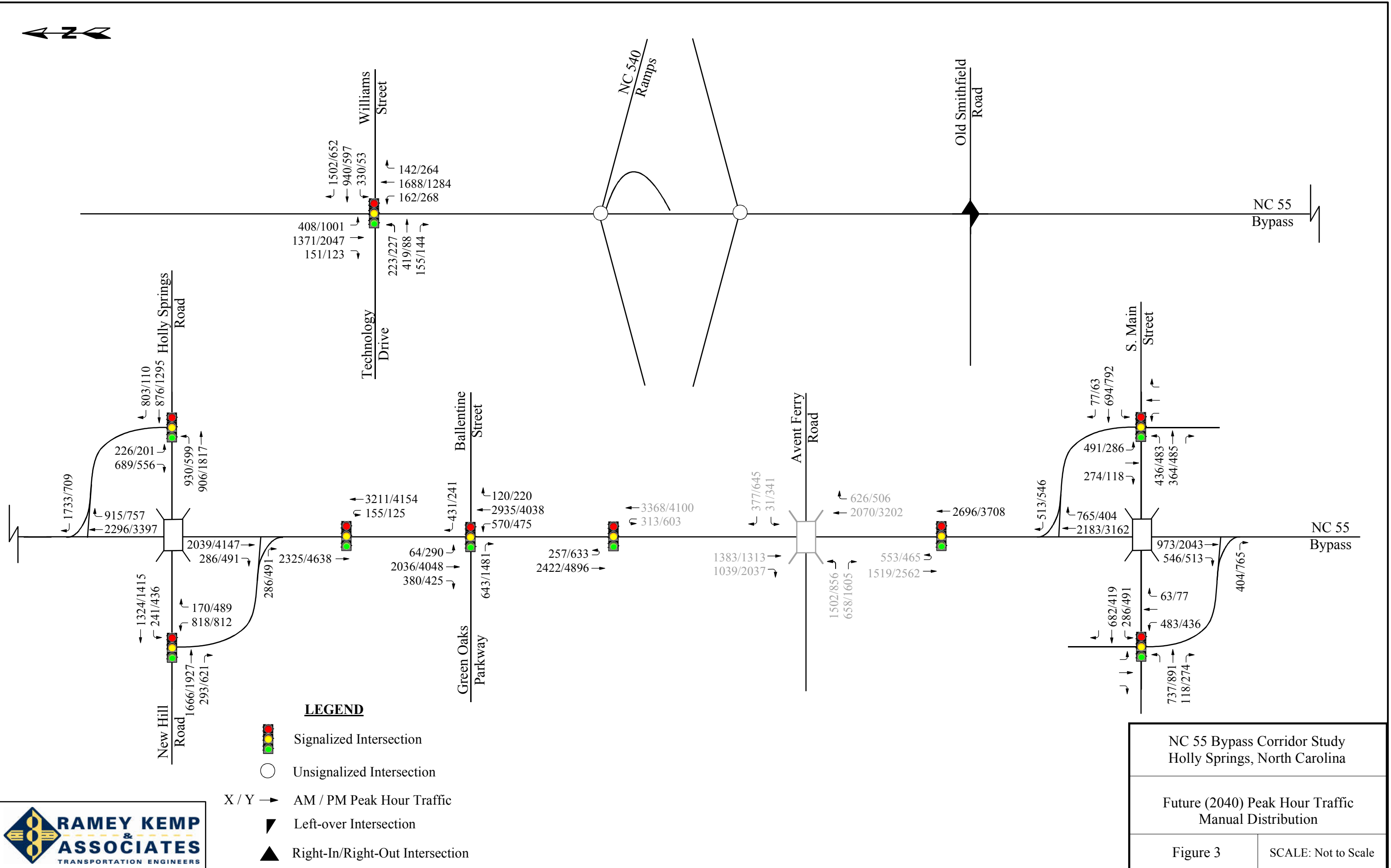
However, the TRM does not include some of the roadway improvements that were studied. This includes a modified at-grade superstreet at Avent Ferry Road and NC 55 Bypass, as well as interchanges at Holly Springs Road / New Hill Road and Main Street.

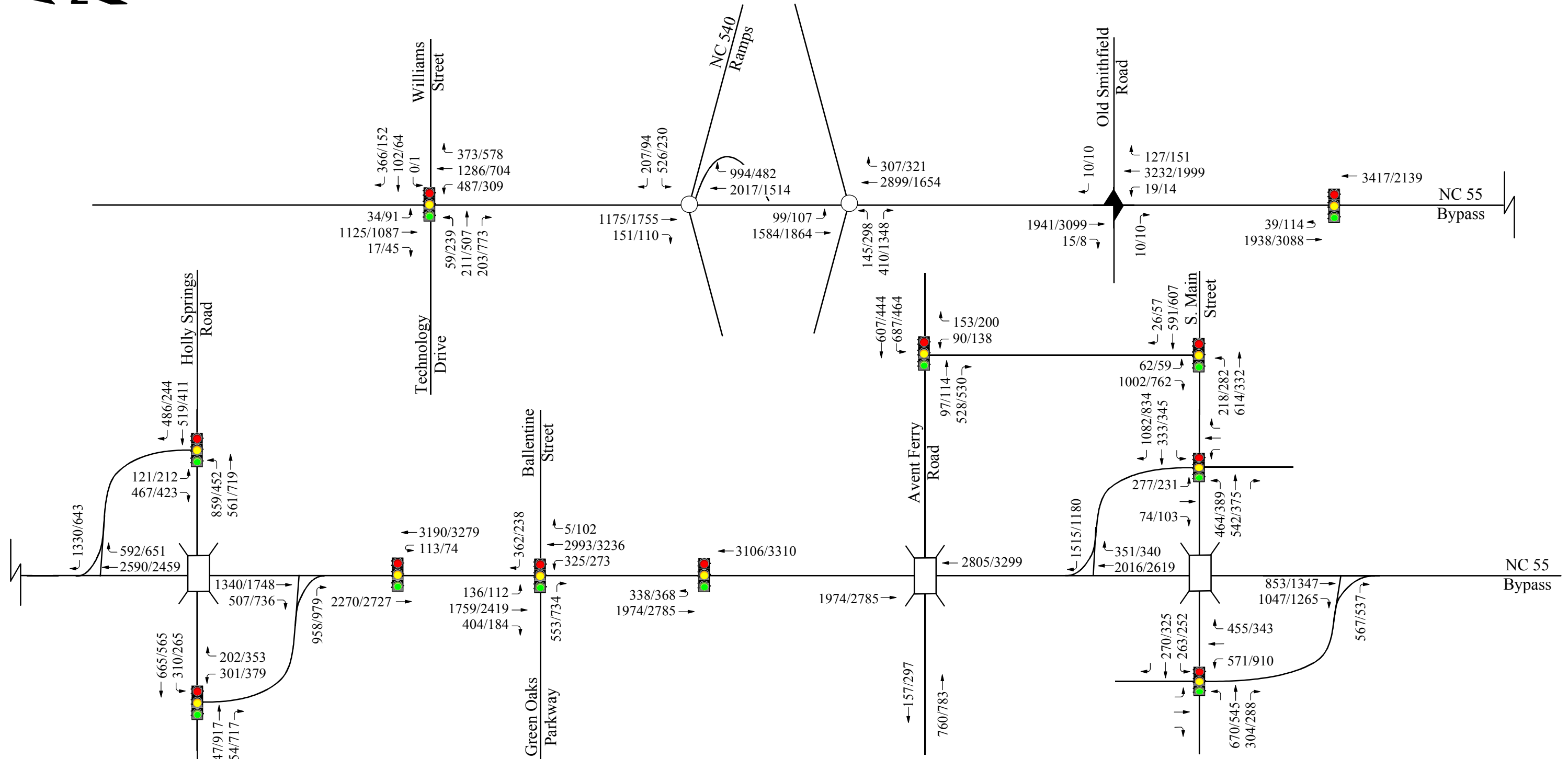
3.1. Traffic Forecasts (2040)

Future traffic forecasts were determined for intersection peak hour turning movement volumes based on 2040 data in the TRM. The 2040 AM and PM peak hour volumes at each external node of the study area were taken from the TRM. Trips from future developments are not considered separately from the TRM volumes for 2040 conditions as the analysis zones developed as part of the TRM would account for future development along the corridor. These volumes at the external nodes were then assigned to the study intersections using two methods. First, the volumes were assigned to individual turning movements based on current count distributions and engineering judgment. The second method used an Origin-Destination (O-D) matrix within TransModeler to assign the trips to individual turning movements. The future (2040) build traffic volumes shown in Figure 4 were based on one individual TransModeler simulation. Each time the simulation is run, different turning movement volumes will be recorded due to the nature of the origin-destination matrix TransModeler utilizing to simulate vehicle trips. Refer to Figure 3 for the Future (2040) volumes based on the manual distribution and Figure 4 for the Future (2040) volumes based on the TransModeler O-D Matrix.





In general, many turning volumes and side street traffic volumes are lower with the TransModeler distribution than with the manual distribution. The TransModeler O-D Matrix assigns traffic to the intersections based on the network of roads contained within the model. Since the roadway network used for this study in TransModeler was limited to NC 55 Bypass with limited connectivity to side streets, the O-D Matrix traffic assignment may not be an accurate representation of travel patterns.

The proposed improvements along NC 55 Bypass will significantly change future traffic patterns in the area. Since the TRM does not consider several of the modifications evaluated for this project, the future volume assignments are estimated and vary somewhat significantly based on the method used. Modifications to the TRM may be necessary to better project future volumes along this corridor.





LEGEND

-  Signalized Intersection
-  Unsignalized Intersection
- X / Y → AM / PM Peak Hour Traffic
-  Left-over Intersection
-  Right-In/Right-Out Intersection



NC 55 Bypass Corridor Study Holly Springs, North Carolina	
Future (2040) Peak Hour Traffic Transmodeler Distribution	
Figure 4	SCALE: Not to Scale

4. CAPACITY ANALYSIS

Capacity analyses for this project were completed to determine the impacts and improvements needed along the roadway network with the long range plan improvements. Capacity and level of service are the design criteria for this traffic study. Caliper’s TransModeler SE software was used to complete the analyses.

The HCM defines capacity as “the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.” Level of service (LOS) is a term used to represent different driving conditions, and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers.” Level of service varies from Level “A” representing free flow, to Level “F” where breakdown conditions are evident. Refer to Table 2 for HCM levels of service and related average control delay per vehicle for both signalized and unsignalized intersections. Control delay as defined by the HCM includes “initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay”. An average control delay of 50 seconds at a signalized intersection results in LOS “D” operation at the intersection.

Table 2: Highway Capacity Manual – Levels-of-Service and Delay

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

Capacity analysis results for existing conditions and future (2040) build conditions are summarized in Table 3. Refer to Appendix B for the TransModeler SE analysis reports.

Table 3: Capacity Analysis Summary

Intersection	Approach	Existing		Future 2040	
		AM	PM	AM	PM
Technology Drive / (Williams St) at NC 55 Bypass - Full Movement	EB	D	E		
	WB	F	F		
	NB	C	C	--	--
	SB	C	F		
	Overall	C (31)	E (70)		
U-turn for Williams St at NC 55 Bypass	SB			F	F
	NBU	--	--	E	D
	Overall			F (135)	F (147)
Technology Drive at NC 55 Bypass (Southbound)	EB			F	F
	SB	--	--	D	D
	NBL			D	C
	Overall			D (51)	E (58)
Williams St at NC 55 Bypass (Northbound)	WB			E	F
	NB	--	--	E	C
	SBL			A	B
	Overall			E (76)	D (45)
U-turn for Technology Drive at NC 55 Bypass	NB			B	B
	SBU	--	--	F	D
	Overall			B (19)	B (17)
NC 540 WB Ramp at NC 55 Bypass*	EB			C	F
	WB			E	B
	NB	--	--	C	C
	SB			A	F
	Overall			C (24)	E (77)
NC 540 EB Ramp at NC 55 Bypass*	EB			--	--
	WB			F	D
	NB	--	--	--	--
	SB			A	B
	Overall			E (62)	B (18)
Old Smithfield Road at NC 55 Bypass	EB	A	B	--	--
	WB	F	E	--	--
	NB	A	A	A	A
	SB	A	A	A	A
	Overall	B (19)	A (2)	A (1)	A (1)
U-turn for W Holly Springs Rd at NC 55 Bypass	SB	--	--		
	NBU	D	D	--	--
	Overall	D (38)	D (45)		
New Hill Rd at NC 55 Bypass	SB	A	A		
	EB	B	F	--	--
	NBL	C	C		
	Overall	B (14)	D (39)		
W Holly Springs Rd at NC 55 Bypass	NB	A	B		
	SBL	D	D	--	--
	WB	F	B		
	Overall	D (37)	C (21)		
U-turn for New Hill Rd at NC 55 Bypass	NB	B	A		
	SBU	D	D	--	--
	Overall	C (21)	B (18)		
Holly Springs Rd at NC 55 Bypass NB Ramp	SB			D	F
	EB			E	D
	WB	--	--	E	E
	Overall			E (56)	E (59)
New Hill Rd at NC 55 Bypass SB Ramp	NB			C	C
	EB			B	C
	WB	--	--	B	B
	Overall			B (19)	C (23)

* Existing intersection is modeled as unsignalized with no minor street movements or major street left-turn movements due to the layout of the intersection

Table 3: Capacity Analysis Summary

Intersection	Approach	Existing		Future 2040	
		AM	PM	AM	PM
U-turn for Ballentine St at NC 55 Bypass	SB	A	A	F	C
	NBU	D	D	F	F
	Overall	A (1)	A (1)	F (111)	D (36)
Green Oaks Pkwy at NC 55 Bypass	SB	A	A	F	D
	EB	B	C	F	F
	NBL	C	C	C	C
	Overall	B (12)	B (13)	F (113)	E (69)
Ballentine St at NC 55 Bypass	NB	A	A	C	A
	SBL	D	C	D	C
	WB	F	B	F	D
	Overall	B (10)	A (6)	D (42)	A (5)
U-turn for Green Oaks Pkwy at NC 55 Bypass	NB	A	A	F	B
	SBU	D	D	F	F
	Overall	A (5)	A (7)	F (101)	C (33)
NB U-turn for Avent Ferry Rd Westbound	SB	A	B		
	NBU	C	D	--	--
	Overall	A (8)	B (17)		
Avent Ferry Rd at NC 55 Bypass	EB	D	D		
	WB	F	D		
	NB	B	B	--	--
	SB	A	C		
	Overall	D (36)	C (27)		
SB U-turn for Avent Ferry Rd Eastbound	NB	B	A		
	SBU	C	D	--	--
	Overall	B (18)	B (11)		
Ralph Stevens Rd at NC 55 Bypass	EB	D	F		
	WB	F	F		
	NB	C	B	--	--
	SB	C	C		
	Overall	D (53)	E (68)		
Avent Ferry Rd at Eastern connector	NB			C	C
	EB	--	--	F	F
	WB			F	F
	Overall			F (324)	F (234)
South Main St at Eastern connector	EB			F	F
	NB	--	--	C	B
	SB			C	F
	Overall			E (70)	F (102)
Ralph Stevens Rd at NC 55 Bypass SB Ramp	NB			B	F
	EB	--	--	F	F
	WB			B	C
	Overall			D (50)	E (70)
South Main St at NC 55 Bypass NB Ramp	SB			C	B
	EB	--	--	D	B
	WB			F	E
	Overall			E (58)	D (47)

4.1 Existing Conditions Analysis Results

Under existing conditions, much of the corridor operates at acceptable levels of service during the weekday AM and PM peak hour analyzed. Some delays currently experienced along the corridor are due to traffic signals that are not synchronized properly to minimize delays.

Analysis results indicate that the intersection of Technology Drive / Williams Street and NC 55 Bypass experiences heavy delays southbound during the PM peak hour and therefore operates at a poor overall level of service. The intersection of Avent Ferry Road and NC 55 Bypass currently experiences long queues in the AM peak hour on Avent Ferry Road and long queues on southbound NC 55 Bypass in the PM peak hour. With the synchronized street improvements at Avent Ferry Road and NC 55 Bypass, the intersection is anticipated to operate at improved levels of service under existing conditions. The Main Street intersection currently operates worse than typically accepted levels of service.

4.2 Future (2040) Analysis Results

Under future conditions, several intersections operate at less than ideal levels of service. Optimizing the flow of traffic along NC 55 Bypass will inherently worsen the operation of the minor street approaches; however, additional modifications to the surrounding roadway network (side streets) may help improve the minor approach levels of service as well as traffic flow along the NC 55 Bypass by removing traffic from the ramps more efficiently. Additional analysis based on traffic volumes obtained from a TRM scenario that includes the functional design concepts would provide more insight into appropriate improvements for the surrounding roadway network.

5. SAFETY EVALUATION

Crash data along NC 55 Bypass in the study area was requested from the NCDOT for the most recent five-year period, which was May 1, 2011 to April 30, 2016. Refer to Appendix C for the crash reports provided by NCDOT.

Based on the data received, the crash rate for this segment is 215.8 crashes per million vehicle miles traveled. Of the total crashes on this section of roadway, about half of the crashes that occurred were caused by rear-end collisions. The total accidents per major intersection as well as any fatalities are listed below for the time period of May 1, 2011 to April 30, 2016:

- NC 55 Bypass at Ralph Stevens Road / S. Main Street – 53 total crashes
- NC 55 Bypass at Avent Ferry Road – 80 total crashes
- NC 55 Bypass at Ballentine Street / Green Oaks Pkwy. – 40 total crashes
- NC 55 Bypass at Holly Springs Road / New Hill Road – 90 total crashes, 2 fatalities (1 pedestrian and 1 left-turn on same roadway)
- NC 55 Bypass at Old Smithfield Road – 76 total crashes
- NC 55 Bypass at NC 540 EB Ramps – 16 total crashes, 1 fatality (fixed object with a speed of 90 mph)
- NC 55 Bypass at 540 WB Ramps – 0 crashes
- NC 55 Bypass at NC 55 / Technology Drive – 65 total crashes

Widening NC 55 Bypass to six lanes and the addition of interchanges should help reduce the number of collisions at the major intersections. Interchanges will separate conflict movements that were occurring at the intersection. The additional through lanes should help shorten queues on NC 55 Bypass and reduce the potential for rear-end collisions.

6. FUNCTIONAL DESIGN

Functional design drawings were prepared based on the Town of Holly Springs Transportation Plan and Town of Apex Transportation Plan with lane geometry and traffic control determined based on the capacity analysis. Refer to Appendix H for the functional design drawings for the build scenario.

6.1. Design Criteria

The design criteria used to develop the functional design for the NC 55 Bypass are below. The criteria are based on NCDOT Roadway Design Standards. Design criteria are also included on the concept drawing. Refer to Appendix D for depictions of the proposed typical sections and more detailed design criteria.

- Six-lane divided highway with 300 ft proposed right-of-way
 - NCDOT Typical Section 6A with 12 ft lanes and 6 ft median shoulders including a 4 ft paved shoulder,
 - No sidewalks or bicycle lanes,
- Design Speed of 60 miles per hour (mph) for NC 55 Bypass and 50 mph for side roads,
- Minimum radius of 750 ft for ramps and 230 ft for loops.

Topography information from LIDAR was used for the conceptual design. Though it may not include recent grading changes, overall it appears to be a reasonable representation of existing topography along the study corridor.

6.2. Future Improvement Alternatives

Improvements were considered at intersections along the NC 55 Bypass corridor to accommodate future 2040 peak hour traffic volumes. Multiple improvement alternatives were considered at some locations. A brief explanation of the alternatives considered for each location is below.

Williams Street

Currently, the intersection of NC 55 Bypass and Williams Street functions as an at-grade full-movement intersection. An improvement is planned by NCDOT in the short-term to construct a

second southbound left turn lane on NC 55 at this location. Due to heavy traffic, in part due to the Perry Road Extension, the intersection is not expected to operate adequately as a full movement intersection. Future (2040) conditions considered this as a synchronized street (aka superstreet) with new u-turn locations approximately 800-1,000 feet in each direction from Williams Street. The northern u-turn location could conflict with future access intersections along NC 55 Bypass north of Williams Street. It is our understanding that an interchange was considered for this location in previous planning studies; however, the interchange was not recommended in the final documents. An interchange was not evaluated as part of this project; however, grade separation and / or an interchange may need to be considered in the future with or following completion of the Perry Road Extension.

NC 540 Ramps

Currently, NC 540 ends at its interchange with NC 55 Bypass. In the future, once NC 540 is completed, a partial cloverleaf interchange was considered for analysis. A diamond interchange was also considered but was not evaluated or recommended since the most recent design plans for the NC 540 extension included loop ramps as considered in this study.

Holly Springs Road / New Hill Road

Currently, the intersection of NC 55 Bypass and Holly Springs Road / New Hill Road functions as a superstreet. Residential development, such as the 12 Oaks community, is anticipated to continue to the west of the study area with New Hill Road providing the most direct connection to NC 55 Bypass. To manage this increase in traffic and preserve the mainline traffic flow along NC 55 Bypass, an interchange with quadrant ramps was analyzed. This design would bridge Holly Springs Road / New Hill Road over NC 55 Bypass and provide access ramps in the northeast and southwest quadrants. The right-of-way potentially needed for such a design is limited due to developments including the Holly Springs Towne Center shopping center (New Hill Place) and residential subdivisions on the east side of NC 55 Bypass near the intersection. Some other considerations included tighter loop ramps to minimize property impacts, but the tighter ramps would result in a loss in storage for turn lanes at the ramp intersections. In addition, it is assumed that any property inside the loop ramp would be acquired as part of the interchange project.

Green Oaks Parkway

Currently, the intersection operates as a superstreet intersection and provides access to the Green Oaks Business Park. The intersection is expected to experience heavy traffic volumes in the future. There was consideration to use Irving Parkway as a loop road connection between New Hill Road and Green Oaks Parkway, but this was not recommended due to traffic volumes from a potential commercial development to be constructed on Green Oaks Parkway in the southwest quadrant of Green Oaks Parkway and NC 55 Bypass. A continuous flow intersection was also considered, but the future interchange at New Hill Road / Holly Springs Road is too close to provide adequate separation. In addition, the side street right-of-way is too narrow for a full continuous flow intersection.

Avent Ferry Road

Currently the intersection of NC 55 Bypass and Avent Ferry Road operates as a full-movement intersection. By the end of 2016/early 2017, the intersection will be modified to operate as a reverse synchronized street (aka superstreet) intersection with respective u-turn locations up- and down-stream of the intersection on NC 55 Bypass. This is expected to be a short-term solution to address congestion at this intersection. In the future (2040) conditions, a partial interchange was considered but the ramps and intersections are too close to the future interchange ramps at NC 55 Bypass and Main Street. A modification to the short-term reverse synchronized street may allow for through movements on Avent Ferry across NC 55 Bypass. This alternative is shown on the drawing. Another alternative considered a possible service road connection on the eastern side of NC 55 Bypass to connect between Main Street and Avent Ferry Road. This alternative was not recommended due to potential impacts to property.

Main Street

The Main Street Extension project, which will connect Ralph Stevens Road to Piney Grove-Wilbon Road and ultimately Avent Ferry Road, is anticipated to divert many trips from the intersection of Avent Ferry Road and NC 55 Bypass. In planning documents for 2040 conditions, this extension is anticipated to replace the access Avent Ferry provides to NC 55 Bypass as Avent Ferry will bridge over the bypass. Similar to the proposed interchange at Holly Springs

Road / New Hill Road, the proposed interchange would bridge Main Street over NC 55 Bypass and provide access ramps in the northeast and southwest quadrants. This design includes consideration for a connector road from Avent Ferry Road east of the existing Rex Hospital, tying into Maple Avenue and connecting to Main Street. The specific design of this connector road would consider the Rex Hospital expansion and development of the vacant property south of Rex. Additionally, on the west side of NC 55 Bypass, the existing Fidelity Bank may need to be removed, as well as access along the existing Wal-Mart driveway. This location also has potentially limited right-of-way due to the Wal-Mart and Harris Teeter shopping centers as well as the residential subdivision to the east of the bypass.

Both potential interchange locations will need acceleration lanes on NC 55 Bypass due to the high traffic volumes in the future.

NC 55 Bypass

Widening NC 55 Bypass to six lanes presents conflicts with several existing bridge structures. The two bridges (northbound and southbound) on NC 55 Bypass located approximately 0.25 miles north of Bennett Knoll Parkway will need to be widened to accommodate the new lanes.

Due to the construction of the NC 540 bridge over the NC 55 Bypass (offset pier), southbound NC 55 Bypass must be widened in the median to the inside of the roadway to create three lanes. Northbound NC 55 Bypass under the NC 540 bridge is currently three lanes – two through lanes and one auxiliary lane that connects the NC 540 eastbound off-ramp and NC 540 westbound on-ramp. Additional widening is limited by the bridge pier location and outside wall.

6.3. Bicycle and Pedestrian Plans

Town of Holly Springs and Town of Apex Transportation Plans were reviewed as part of this project to identify future considerations for pedestrians and bicycles. It should be noted that the Town of Apex Transportation Plan proposes sidewalks to be constructed on NC 55 Bypass within Town of Apex limits, and Town of Holly Springs does not consider sidewalks on NC 55 Bypass. RKA does not recommend sidewalks be constructed on NC 55 Bypass south of Williams Street since the sidewalk would not connect to other pedestrian infrastructure. The

Town of Holly Springs Transportation Plan recommends pedestrian facilities such as underpasses or overpasses at a few locations along the study area. These locations are noted on the drawings, along with grade separations and accommodations. Refer to Appendix E for the Bicycle and Pedestrian Plans for each municipality.

6.4. Environmental Screening

A preliminary Environmental Screening Report was prepared by ESI, Inc. for the NC 55 Bypass project on June 6, 2016. The findings of the report indicate that several unnamed tributaries of the Little Branch and White Oak Creeks and associated wetlands appear to occur within the study area. The report indicates that streams and wetlands identified and delineated during ground reconnaissance will likely be subject to permitting requirements with the US Army Corps of Engineers and NC Division of Water Resources. Refer to Appendix F for a copy of the report in its entirety.

6.5. Cost Estimate

Preliminary cost estimates were calculated for the proposed functional design assuming the interchanges and corresponding roadways will be constructed to NCDOT standards. The cost estimates shown are based on limited information, and therefore, provide a general estimate only. Cost estimates are typically separated into three parts: Construction, Design/Permitting, and Right-of-Way acquisition. Cost estimates for construction and design/permitting are based on planning level cost data provided by NCDOT. Refer to Appendix G for a breakdown of the cost estimate calculations. A summary of the cost estimate is provided in Table 4.

As summarized in Table 4, the total project cost is estimated to be approximately \$98.5 Million for the widening of NC 55 Bypass and the construction of the new grade separations.

Table 4: Cost Estimate Summary

Category	Cost Estimate (Current Dollars)
Lane Widening Construction Cost (pavement, grading, etc.)	\$ 22 M
Interchanges and Bridge Widening	\$ 24.5 M
Miscellaneous and Contingencies	\$19 M
Total Construction Cost	\$65.5 M
Planning, Design, and Permitting	\$ 6.5 M
Right-of-Way	\$ 26.5 M
Total Cost Estimate	\$ 98.5 M

Construction cost includes pavement, drainage features, general grading, and structures. A cost per mile for the additional lane on NC 55 Bypass is provided. Separate costs are provided for two new interchanges and the widening of the existing bridge structures just north of the athletic complex. Contingencies and adjustments are also provided based on NCDOT guidance to account for terrain and miscellaneous items. Construction cost estimates do not include widening necessary along each side street to provide additional lanes needed to provide adequate traffic operations or future improvements at NC 540. In addition, the construction cost estimate excludes significant utility relocations such as water and sewer lines.

Planning, design and permitting is assumed to be 10% of the total construction cost estimate.

Although a cost estimate for right-of-way is provided, the cost for right-of-way acquisition could vary greatly depending on the severity of impacts to businesses or properties that cannot be

determined without more detailed designs. The new right-of-way was determined by calculating the area between the existing right-of-way (based on GIS) and the future right-of-way (300 feet in width). The new right-of-way area for the entire project includes approximately 60 acres. Since numerous properties are located in this area, percentages were estimated for general land use categories of commercial (retail, office), residential, and industrial. Through an examination of land use zoning along the corridor, it was estimated that commercial-zoned property accounts for approximately 35% of the frontage along NC 55 Bypass, while residential zoning accounts for approximately 50% and industrial zoning accounts for approximately 15% of the frontage along NC 55 Bypass. These percentages were used to estimate the acreage of each use needed for right-of-way acquisition. Property values were assigned to each category based on a review of tax records for a few properties in each category along the corridor. It should be noted that each property could vary greatly from the value used in the estimate. The total right-of-way cost is estimated to be approximately \$26.5 Million based on the rough planning estimates. This right-of-way cost estimate does not account for dedication that may occur through future development. The right-of-way cost estimate excludes the cost for taking of vertical structures such as homes and businesses; however, the conceptual design is likely to impact several vertical structures, especially in areas near interchanges and grade separations.

7. RECOMMENDED ITEMS FOR FURTHER CONSIDERATION

The Town of Holly Springs' Transportation Plan calls for NC 55 Bypass to be a six-lane divided facility in the future with new interchanges at intersections with Holly Springs Road/New Hill Road as well as at Main Street. This study provides a planning-level evaluation and conceptual design of the improvements associated with the future transportation plan on the NC 55 Bypass corridor. Based on the results of this study, several items will require additional consideration for future studies.

In general, widening NC 55 Bypass from four lanes to six lanes will improve traffic flow along the mainline. When this project is complete, a primary challenge will be to efficiently move traffic to and from the bypass on the surrounding roadway network.

Future 2040 Conditions

Additional work with the Triangle Regional Model (TRM) is recommended to incorporate the Town's Transportation Plan improvements evaluated in this study to refine traffic projections for future conditions. Traffic volumes and patterns used in this study are estimated based on the currently available information in the TRM, which does not include the two new interchanges or improvements at Avent Ferry Road (reverse synchronized street or grade separation). It is recommended that the TRM be modified in the future to provide a scenario with the Town Transportation Plan (six-lane widening and interchanges) so that traffic volumes based on more relevant traffic patterns could be used in a TransModeler analysis of the corridor.

TransModeler Analyses

The improvements considered in this study could significantly change traffic patterns near the NC 55 Bypass which could have impacts on the surrounding roadway network that need to be addressed. The simulations for 2040 conditions indicate slow traffic progression along NC 55 Bypass; however, upon further inspection these mainline backups may be a result of overcapacity ramps and surrounding roadway network. Based on analysis results for 2040 conditions, additional turn lanes will likely need to be considered at the intersection of Avent Ferry Road and Piney Grove-Wilbon to add capacity for the heavy left-turn movement from Piney Grove-Wilbon Road to Avent Ferry Road. Additionally, refined signal timings and

operations at ramp locations will likely ease negative impacts to NC 55 Bypass by clearing traffic from the ramps more efficiently.

Avent Ferry Road Overpass/Intersection

Two options were considered for the intersection of Avent Ferry Road and NC 55 Bypass – an at-grade intersection operating as a synchronized street or bridging Avent Ferry Road over NC 55 Bypass. Bridging Avent Ferry Road will impact properties and remove an existing access to a subdivision on the east side of NC 55 Bypass. It also has the potential to send high traffic volumes to cut through streets on the east side of the bypass as this may be shorter (due to right turns) than using Piney Grove-Wilbon Road to the Main Street Extension (requires left turns). A potential solution for this is to leave the intersection at-grade with all left-turns restricted (modified superstreet). However, this scenario is not without its challenges including providing a U-turn location south of Avent Ferry Road near the merging acceleration lane from the Main Street on-ramp. Another potential solution for evaluation is bridging NC 55 Bypass over Avent Ferry Road; this was not evaluated as part of this study but is likely not without issues.

NC 540

There is not likely enough width under the existing NC 540 bridge to add two northbound lanes on NC 55 Bypass. The second additional northbound lane would be a merge lane and deceleration lane between the two loop ramps (as is currently provided). The merge lane and deceleration lane may need to be short so that neither extends under the bridge.

Main Street Interchange

The proposed ramp in the southwest quadrant would impact access to the existing Wal-Mart shopping center. If and when an acceleration lane is provided on NC 55 Bypass for the on-ramp, it will create a weaving issue between the ramp and the existing Wal-Mart left-over access. One solution is to close the left-over access and shift the Wal-Mart traffic to an access further south near the IHOP. Access connections to the loop ramps are not recommended based on heavy future traffic volumes. A short-term solution for this interchange may be to allow access on the loop ramps and not provide an acceleration lane on southbound NC 55 Bypass which would allow Wal-Mart to maintain access. This may allow the interchange to be built without

significant impacts to properties; however, it would not be a viable solution for long-term conditions if traffic volumes increase as anticipated in the Triangle Regional Model.

Green Oaks Road

This intersection could become a bottleneck of NC 55 Bypass for the section between Main Street and New Hill Road since it could potentially be the only at-grade intersection between interchanges and a grade separation at Avent Ferry Road. If acceleration lanes are provided at on-ramps at the interchanges, the intersection at Green Oaks Road could have more impact on traffic flow and speeds along NC 55 Bypass.

Right-of-Way Impacts

This study considers a total right-of-way width of 300 feet along the study area. A more detailed study of the potential impacts to existing residential and commercial property for the proposed interchanges is necessary to better evaluate design alternatives. There are several properties that may require full acquisition, including vertical structures (homes and/or businesses). It is possible that narrowing the right-of-way in some areas will lessen the impacts to properties.

Funding and Implementation

It is recommended that the Town of Holly Springs and Town of Apex obtain additional right-of-way along NC 55 Bypass and at side streets through dedication as development occurs along the corridor in the future. If developments are large enough to create significant traffic impacts, it is possible that developments may be able to construct portions of the additional through lanes in addition to right-of-way dedication.

It may be possible to phase portions of the overall improvements. Constructing the additional through lanes on NC 55 Bypass without the new interchanges could reduce the project cost by 25% - 30% or more depending on right-of-way impacts due to the new bridges and ramps.

Consideration was given to constructing the interchange at Main Street prior to completing the widening to six lanes and prior to the new interchange at Main Street/Holly Springs Road. Although this improvement may help relieve Avent Ferry Road, the new interchange has

challenges with maintaining access to existing development (including Wal-Mart shopping center and residential development) that would likely prevent the construction of acceleration lanes for on-ramps from Main Street. A potential solution for the early construction of this interchange is discussed above.