



# US 1/US 1A/FALLS OF NEUSE ROAD INTERSECTION ANALYSIS

## FINAL REPORT





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## 1.0 INTRODUCTION

### 1.1 Study Purpose

The purpose of this “hot spot” analysis is to build upon the Capital Area Metropolitan Planning Organization’s (CAMPO) US 1 North Corridor Phase I Study to consider interim and future improvements for the intersection of Capital Boulevard (US 1)/ US 1A/Falls of Neuse Road located in Wake Forest. The study team will identify three potential future interchanges at the Falls of Neuse/South Main Street (US1A) intersection. The adopted Metropolitan Transportation Plan (MTP) calls for the US 1 Corridor to be upgraded to a freeway facility by 2030. As part of this conversion, the intersection at US 1/US 1A/Falls of Neuse will be converted from an at-grade intersection to a grade separation interchange. The study team will also analyze and recommend interim safety and operational improvement recommendations to improve the efficiency and extend the life of the existing intersection.

This technical memorandum will document the existing and future development baseline conditions in the vicinity of the US 1/US 1A/Falls of Neuse Road intersection and will take into consideration current and future development trends in this densely populated urban setting. Drawing traffic volumes from the Triangle Regional Demand Model, the baseline future year is 2040, with construction of the future interchange occurring in 2030.

### 1.2 Study Area and Environmental Constraints

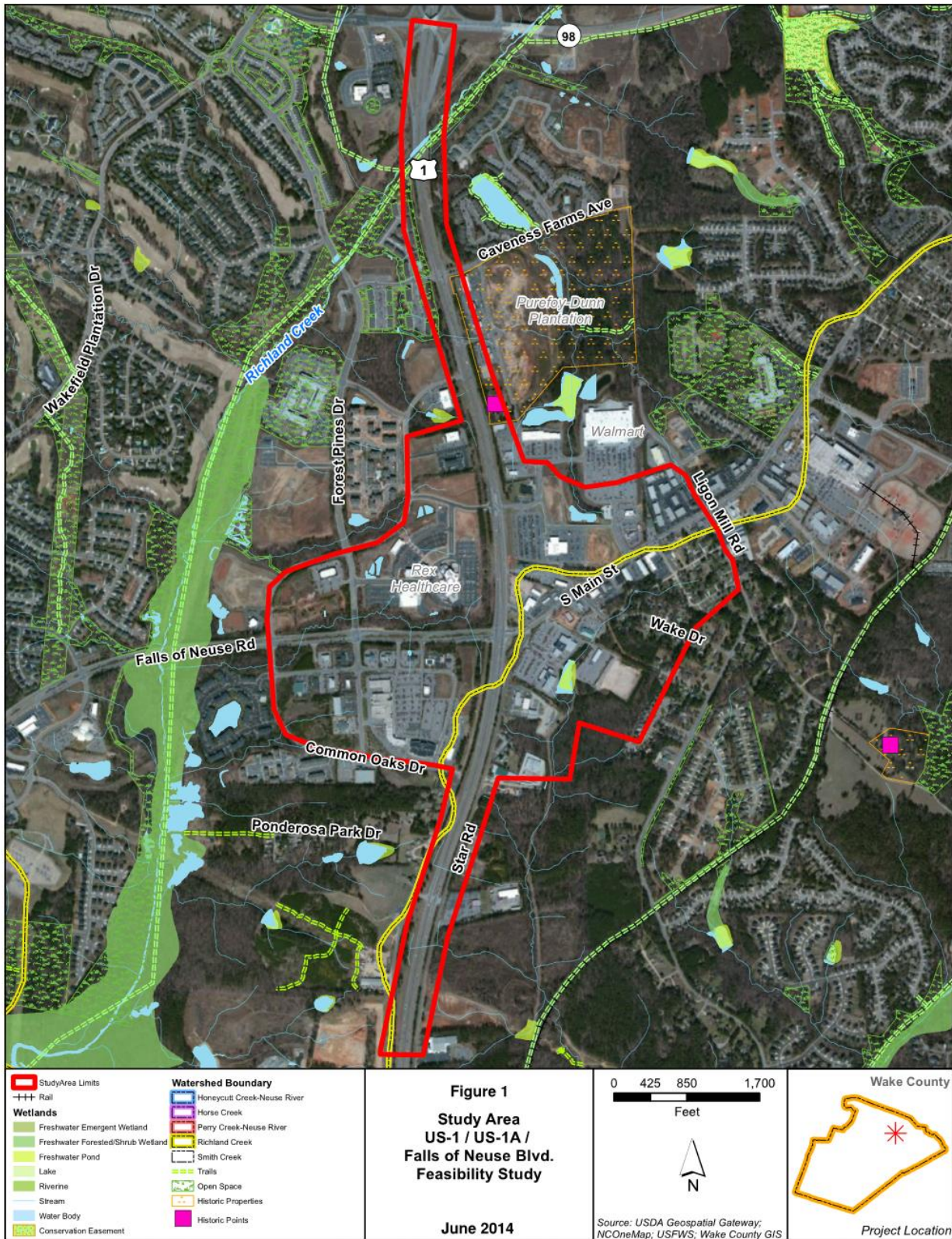
The project study area was defined to be a 500 foot corridor centered on the US 1 and Falls of Neuse/South Main Street corridors and includes the following intersections (Figure 1):

- US 1/US 1A/ Falls of Neuse Road
- US 1 and Directional Crossover (approximately 1,500 feet north of US 1A/South Main Street/Falls of Neuse Road)
- Falls of Neuse Road and Directional Crossover (approximately 870 feet west of US1)
- US 1A (South Main Street) and Star Road
- US 1A (South Main Street) and Wake Drive
- US 1A (South Main Street) and Walmart Entrance

According to a GIS database search, the Purefoy-Dunn House is located adjacent to the US 1 corridor north of the US 1/ US 1A/ Falls of Neuse intersection and is registered as a historic site on the National Register. GIS database information indicates that the parcel as well as the house has historic significance, however portions of the identified parcel have been developed or have development plans underway by private developers. An effort to avoid or minimize impacts to this historic property is anticipated if State and Federal funding will be expended for future interchange or corridor improvements.

The US 1/US 1A/Falls of Neuse intersection falls in both the Richland Creek and Smith Creek Watersheds and may cause impacts to several tributaries within the vicinity of the interchange. Both the Richland Creek sub-watershed (HUC 030202010702) to the west and the Smith Creek sub-watershed (HUC 030202010702) to the east drain to the Neuse River and are subject to Neuse buffer regulations. Richland Creek (WS-IV; NSW) and Smith Creek (C;NSW) both drain to the Neuse River and are subject to Neuse buffer regulations. Smith Creek is listed on the 2014 303(d) draft list of impaired waters.







## 2.0 EXISTING CONDITIONS

### 2.1 Existing Plans and Studies

The following relevant studies and plans were reviewed:

- US 1 Study Phase I & II Mapping Consolidation (underway)
- US 1 Corridor Study Phase II (2012)
- US 1 Corridor Study Phase I (2006)
- CAMPO Metropolitan Transportation Improvement Program
- CAMPO Congestion Management Process (CMP)
- NCDOT 2040 Plan
- Wake Forest Transportation Plan Update (2010)
- Wake Forest Land Development Plan
- Town of Wake Forest US 1 Corridor Plan (1999)

### 2.2 Existing Roadway and Traffic Conditions

#### **US 1**

US 1 is a regionally significant Principle Arterial which NCDOT has designated as a Strategic Highway Corridor in the areas of Wake, Franklin, and Vance County. It serves as connection between the City of Raleigh to the Towns of Wake Forest, Youngsville, and Franklinton. In the immediate study area US 1 is a four-lane divided facility with paved and turf shoulders. The Right-of-Way is approximately 270 feet north of the intersection, but varies throughout the interchange area and southward. US 1 is a partially controlled access facility. The posted speed limit is 55 MPH. South of the intersection with US 1A/ Falls of Neuse the 2011 AADT is 47,000 vehicles per day (vpd), and north of the intersection the AADT is 41,000 vpd. The primary land use along US 1 in the study area is industrial with some high density residential. There are no bicycle or pedestrian facilities along the US 1 corridor in the study area, however recommendations from the Phase I corridor study indicated that bicyclist and pedestrian accommodations will be accommodated on future frontage and backage roads, adjacent to development.

There are two primary transit services that operate in the area although neither offers a fixed route along US 1. Capital Area Transit (CAT) has a Wake Forest Loop which services retail locations along US 1 A and Falls of Neuse to include the Rex Healthcare Campus as well as Downtown Wake Forest and Park and Rides. Triangle Transit (TTA) offers an Express Route which is operated by CAT and services Park and Ride locations from North Raleigh to Downtown Wake Forest.

#### **Falls of Neuse Road/South Main Street**

Falls of Neuse Road is a Minor Arterial and serves as a major thoroughfare that extends from downtown Raleigh, interchanges with I-540, and connects with US 1 in the location of the former New Falls of Neuse Road. This connection was completed in 2012 and now serves as an alternate route to US 1 for points south to include Downtown Raleigh. Within the study area, Right-of-Way along Falls of Neuse is 150 feet, and there is no control of access along Falls of Neuse. Inside the study area, Falls of Neuse is a divided facility with a raised median and curb and gutter. It is posted at 45 MPH. There is no historical AADT available for this section since it was completed in 2012. There are sidewalks on both sides of Falls of Neuse that provide a



pedestrian link between high density residential areas and commercial areas such as the retail and restaurants at Wakefield Commons on the south side and the Rex Healthcare Campus and retail/restaurants on the north side of Falls of Neuse.

### ***US 1A (South Main Street)***

US 1A is a major collector and serves as a major thoroughfare connecting US 1 to Downtown Wake Forest. In the study area South Main Street is a 5-lane Undivided Facility with a 2-way left turn lane. Right-of-Way along US 1A varies, but is primarily 100 feet wide and there is no control of access. The posted speed limit is 35 MPH. AADT along US 1A is 24,000 vpd (2011). Through most of the study area South Main Street has curb and gutter and sidewalks, however at the connection with US 1, South Main Street is a shoulder section with no pedestrian facilities. Land use along South Main Street is primarily commercial and boasts big box retail, restaurants, and several outparcel retail locations. There is some residential adjacent to the study area. There are several closely spaced driveways and access points along US 1A.

## **2.3 Capacity Analysis**

Baseline analyses for the existing year, 2014, and a future build year of 2040 were modeled in accordance with the Transportation Research Board's 2010 Highway Capacity Manual (HCM). The HCM utilizes a term "level of service" to measure how traffic operates in intersections and on roadway segments. There are currently six levels of service (LOS). The LOS is an important measure of roadway congestion. The LOS is determined by calculating the delay for the intersection and converting it to a letter grade. The LOS ranges from A (no congestion) to F (severe congestion).

Turning movement counts were collected on 4/23/2014 and 5/7/2014 for the morning (7-9 AM) and afternoon (4-6 PM) peak hours at each of the intersections within the study area. These traffic volumes were input into the Synchro model along with the speed limits, lane geometry and signal timing/phasing. The lane geometry was measured through field visits and the signal timing plans were obtained from NCDOT and the City of Raleigh.

Synchro/SimTraffic 8.0 was used to analyze the intersections in the study area for the existing conditions analyses. The Synchro results give a LOS and delay per vehicle for the unsignalized and signalized intersections. SimTraffic was used to simulate the traffic during each peak hour and calculate the queuing throughout the network. Five, sixty minute simulation runs of SimTraffic were averaged using a seed time of fifteen minutes on each. The NCDOT Congestion Management guidelines were adhered to in every aspect.

The results of the 2014 Existing Conditions Level of Service analysis indicate that four of the six intersections operate at an acceptable LOS D or better during both of the peak hours. The key study intersection, US 1 (Capital Boulevard) and US 1A (Falls of Neuse Road/South Main Street), operates at a LOS E during both the morning and afternoon peak hours, with all four of the approaches operating deficiently during the afternoon commute. Additionally, the directional crossover located to the north on Capital Boulevard at Popes Creek Drive/Wake Pointe operates at a LOS F during the afternoon peak hour. The southbound and westbound approaches are the contributing factors to the failing LOS at this intersection.



Table 1 below presents the 2014 Existing Conditions Level of Service and Delay for each of the intersections.

Table 1: 2014 Existing Conditions LOS

Level of Service																					
Intersection	Type	Intersection				Northbound				Southbound				Eastbound				Westbound			
		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
		LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY
1. Falls of Neuse Road and Wakefield Commons	Directional Crossover	B	12.7	C	16.4	B	12.7	C	16.4	-	-	-	-	A	0.0	A	0.0	B	10.8	B	13.3
2. Capital Boulevard & Falls of Neuse Road/South Main Street	Signalized	E	58.2	E	67.2	D	44.4	E	59.3	D	48.4	E	56.4	E	77.2	E	78.9	F	89.8	F	90.1
3. South Main Street and Star Road	Unsignalized	A	9.8	B	10.4	A	9.8	B	10.4	-	-	-	-	A	0.0	A	0.0	A	0.0	A	0.0
4. South Main Street and Wake Drive	Unsignalized	C	15.9	D	30.4	C	15.9	D	30.4	A	9.7	C	16.8	A	9.6	A	9.8	A	9.6	B	12.4
5. South Main Street and WalMart Driveway	Signalized	B	14.3	C	30.9	D	52.3	D	47.8	D	51.3	E	56.7	A	9.3	C	22.6	B	10.2	C	31.3
6. Capital Boulevard and Popes Creek Drive/Wake Pointe	Directional Crossover	D	29.1	F	117.4	D	28.2	C	19.0	C	15.5	E	43.0	D	29.1	C	21.5	C	17.1	F	117.4

## 2.4 Crash History

According to the Wake Forest Transportation Plan Update (2010), this intersection was identified as one of five high priority crash locations. The NCDOT provided Traffic Engineering Accident Analysis System (TEAAS) reports for a five year period from April 1, 2009 through March 31, 2014. The data included the following two segments and four intersections:

### Segments

- US 1 (Capital Boulevard) from 1000 feet south of US 1A (South Main Street)/ Falls of Neuse Road/to 500 feet north of Popes Creek Drive/Wake Pointe
- US 1A (South Main Street)/Falls of Neuse Road from Forest Pines Drive to Carter Street

### Intersections

- Falls of Neuse Road and Wakefield Commons Drive (Directional Crossover)
- US 1 (Capital Boulevard) and US 1A (South Main Street)/Falls of Neuse Road (signalized)
- US 1A (South Main Street) and Wake Drive (Full Movement Stop Control)
- US 1A (South Main Street) and Wal-Mart Driveway (Signalized)

The data provided for the five-year period included the total amount of vehicle crashes with a breakdown of fatalities, lighting and road surface conditions and crash type. The 2012 NCDOT Crash Report was also obtained from the Traffic Safety Unit which details the statewide crash rates for the years 2009-2011.

The roadway segment analysis was performed on US 1 (Capital Boulevard) and US 1A (South Main Street)/Falls of Neuse Road. Table 2A and 2B below lists the total number of crashes in each of the segments along with the statewide crash rates.



**Table 2A: US 1 (Capital Boulevard)  
Total Crash Data**

Rate	Crashes	Crashes per 100 MVM	Statewide Rate <sup>1</sup>
Total	161	371.47	172.49
Fatal	0	0	0.86
Non-Fatal	47	108.44	52.31
Night	41	94.6	38.77
Wet	34	78.45	31.3

<sup>1</sup> 2009 - 2011 statewide crash rate for Urban US Route 4+ lane divided with partial control access

**Table 2B: US 1A (South Main Street)/Falls of Neuse Road  
Total Crash Data**

Rate	Crashes	Crashes per 100 MVM	Statewide Rate <sup>1</sup>
Total	282	695.66	302.26
Fatal	0	0	1.14
Non-Fatal	81	199.82	99.31
Night	55	135.68	55.83
Wet	37	91.27	49.17

<sup>1</sup> 2009 - 2011 statewide crash rate for rural 4+ lane with continuous left turn lane Urban Primary Route

The intersections reports vehicle types and movements, contributing causes for crashes, and the number of injuries at specific locations within the corridor. Table 2C lists the number of crashes that occurred at each of the intersections.

**Table 2C: Intersection Crash Data**

Intersection	Rear End	Turning	Sideswipe	Angle	Headon	Involved Pedestrian/Cyclist	Fatality	Total
1. Falls of Neuse Road and Wakefield Commons (Westbound Directional Crossover)	0	0	0	1	0	0	0	1
2. Capital Boulevard and Falls of Neuse Road/South Main Street (Signalized)	105	4	9	22	1	1	0	140
3. South Main Street and Star Road**	-	-	-	-	-	-	-	-
4. South Main Street and Wake Drive (Full movement Stop Control)	9	13	2	39	1	0	0	63
5. South Main Street and Wal-Mart Driveway (Signalized)	2	3	1	1	0	0	0	7
6. Capital Boulevard and Popes Creek Drive/Wake Pointe (North/Southbound Directional Crossover)**	-	-	-	-	-	-	-	-
<b>TOTAL</b>	<b>116</b>	<b>20</b>	<b>12</b>	<b>63</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>211</b>

Source: NCDOT Traffic Engineering Accident Analysis System reports from April 1, 2009 - March 31, 2014

\*\* Intersection accident data not available.

Of the total of 116 crashes reported, the following highlight major findings of the crash analysis:

- The majority of the crashes (66 percent) occur at the intersection of US 1 (Capital Boulevard) and US 1A (South Main Street)/Falls of Neuse Road, with rear-end crashes being the predominant accident type



- 30 percent of the crashes occur at the intersection of US 1A (South Main Street) and Wake Drive with angled crashes happening most frequently
- 55 percent of the crashes are rear-end collisions
- 30 percent of the crashes involved are angled collisions
- 0 fatalities have occurred in this corridor over a five-year period
- 1 pedestrian was involved in reported a crash over a five-year period

As the majority of the crashes were rear-end type collisions, some could be eliminated when a grade separated interchange is built.

### 3.0 FUTURE TRENDS

#### *Proposed/Potential Development*

In analyzing Census data for the area surrounding the study area, population increased nearly 300% between 2000 and 2010. As there are several large undeveloped tracts of land along the study area, this northern section of Wake County is anticipated to continue to grow.

Wakefield Commons, a 160,000 square foot shopping center anchored by Marquee Cinemas, lies in the southwest quadrant of the intersection. The current uses include retail, financial, medical, restaurants, services, entertainment, and educational. This existing development has vacancies, including the former Kroger shopping center, and several outparcels that could be developed in the future.

In the northwest quadrant there is mixed-use existing development which includes a Harris Teeter grocery store, other retail, restaurants, and the Rex Healthcare of Wakefield. The current Rex Healthcare location is approximately 125,000 square feet and is anticipated to be at 100% capacity by 2015. In the past Rex Healthcare has applied for a 40-bed hospital which was denied during the Certificate of Need process. Once future bed allocations occur in Wake County, Rex Healthcare will again consider the Wakefield Campus for potential beds based on population and community health needs. Other future development plans of the campus include development of two retail “pads” which are approximately 10,000 square feet each. Currently these retail pads are owned by Rex Healthcare, but could be sold to private developers. Rex also anticipates the addition of another 30,000 square foot medical office building by 2030.

In the northeast quadrant of the intersection is fully developed with commercial land uses which includes a car dealer, gas station, a Walmart, grocery store, restaurants, and retail outparcels. A car dealer occupies the southeast quadrant.

The Shoppes at Caveness Farms is a proposed development northeast of the intersection which will be anchored by a 140,000 square foot Sam's Club, a 50,000 square foot retail space, and two smaller 24,000 square feet retail spaces. There are four existing outparcels with retail and restaurants and an additional two outparcels available for future development. The Sam's Club site plan is anticipated to be approved by the Town of Wake Forest.



## 4.0 INTERIM IMPROVEMENTS

### 4.1 US 1 Widening from US 1A to NC 98 Bypass

NCDOT Division 5 has preliminary plans (Project Number 13097) in development for the widening of US 1 from the US 1A/Falls of Neuse intersection to the interchange with NC 98 Bypass. Preliminary plans have been completed, and finals plans are underway. The widening includes an additional lane in the NB and SB directions as well as right turn lanes. Preliminary plans also call for a signalized intersection at the intersection of US 1 and Caveness Farms (Figure 1) and adding an additional left turn lane in the SB direction at that intersection. The plans also call for the removal of the SB left turns at the shopping center entrance just south of Caveness Farms (See Appendix). According to Division 5, it is anticipated that this interim widening will be constructed by 2017.

### 4.2 US 1A Capacity Improvements

NCDOT Division 5 Engineers have also reviewed the current lane configuration along US 1A at the intersection with US 1. In its current configuration, Falls of Neuse has 2 westbound lanes, but US 1A only has one westbound through lane. This configuration causes traffic to queue significantly which prevents northbound right turns on red, further compounding the problem. NCDOT recommends a slight widening along the north side US 1A to allow for a second westbound through lane and still provide a right turn lane. The existing shoulder section would be converted to curb and gutter to limit the impacts to the adjacent parcel (Figure 2). This would also require some drainage updates at the current shoulder area. Currently there are no formal plans in place and the improvements are unfunded.

Figure 2: US 1A Capacity Improvements





#### 4.3 US 1A/Falls of Neuse Signal Upgrades

One recommendation as part of this study is signal timing adjustments. Signal timing plans were obtained from the City of Raleigh and reviewed. STV was able to run through a cycle of iterations to optimize the intersection splits and cycle length for the intersection. The City of Raleigh has studied this location to optimize the signal timing and has found that running the signals based on its own demand and timing parameters based on information provided by its detectors (presence of vehicles) was the optimal solution. Their analysis likely did not take into account the additional improvements which have been recommended or currently in plan development. The signal timing adjustments of this study takes into account the US 1 Widening from US 1A to NC 98 Bypass improvement plans (Section 4.1) are completed and constructed as shown in the Preliminary Plans (Appendix). It also assumes the US 1A Capacity Improvements (Section 4.2), which is currently unfunded, will be constructed.

#### 4.4 Safety Improvements

Interim roadway improvements aimed to reduce congestion, and the reduction of driveway access in the close proximity of intersection will improve vehicular safety. Currently US 1A has closely spaced driveways and access points to commercial development. Potential safety improvements could include limiting access points by monolithic islands or delineators which would limit leftovers. Along US 1 there are safety improvements under design as part of NCDOT's preliminary plans between the intersection with US 1 and US 1A/Falls of Neuse to the interchange with NC 98 Bypass (Section 4.1).

#### 4.5 Implementation of Recommended Improvements

Table 3 presents the intersections where improvements have been recommended or are already committed to by others.

Table 3: 2014 LOS Analysis with Recommended Improvements

Level of Service																					
Intersection	Type	Intersection				Northbound				Southbound				Eastbound				Westbound			
		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
		LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY
2A. Capital Boulevard & Falls of Neuse Road/South Main Street	Signalized	D	37.6	D	47.9	C	29.6	D	50.3	C	30.9	D	41.6	D	53.1	D	52.5	D	53.5	D	48.5
6B. Capital Boulevard and Popes Creek Drive/Wake Pointe	Directional Crossover	D	33.9	F	181.3	A	1.5	A	0.6	A	1.8	A	0.0	D	33.9	C	24.8	C	19.8	F	181.3
A - Improvements include restriping/widening the westbound approach to replace the right turn lane with a combination through/right lane and adjusting the cycle length to 120 second cycle.																					
B - Improvements (COMMITTED BY OTHERS, Currently in Design) include widening of US 1 (Capital Boulevard) to 3-lanes in each direction, from the current six-lane section to tie into existing section south of NC 98																					

With the implementation of the signal timing adjustments at the Capital Boulevard and Falls of Neuse Road/South Main Street intersection and capacity improvements on US 1A (South Main Street), the level of service of the intersection increased from an LOS E in the AM and PM peak hours to an LOS D with a reduction in delay. In addition the LOS improved with a decrease in delay in all intersection approaches.

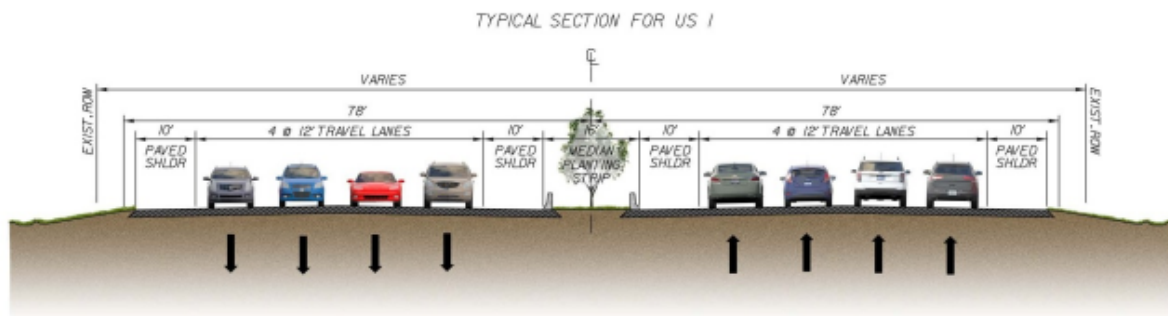


With the US 1 Widening, the Northbound and Southbound LOS substantially improved to an LOS A for both US 1 Northbound and Southbound as well as a decrease in delay. The original alignments for US 1, US 1A, and Falls of Neuse Road were set up to Conceptual designs were developed for the three interchange concepts, based on design criteria developed during the Phase I Report and 2040 traffic volumes pulled from the Triangle Regional Demand Model.

### Typical Section

The Phase I Report calls for US 1 to be upgraded to an urban freeway facility in the year 2030. US 1 will have a total of 4 lanes in each direction along with any required auxiliary lanes. For this feasibility study, the interchange entrance/exit ramps each use auxiliary lanes (acceleration/deceleration). US 1 is assumed to go over US 1A/Falls of Neuse Road which is also consistent with the Phase I Report.

Figure 3: US 1 Typical Section



### Design Criteria

Along with the facility upgrade, the US 1 design speed is assumed to be 70 MPH. This will require a change in the posted speed from 55 MPH to 65 MPH. Each of the ramps for this interchange was conceptually laid out for a 50 MPH design speed. In the existing conditions Falls of Neuse has a posted speed at 45 MPH (50 MPH design speed) and US 1A is posted at 35 MPH (40 MPH design speed). The future interchange approaches will be posted at 35 MPH and designed for 40 MPH. This will require a reduction of speed along the EB approach on Falls of Neuse Road.

### Alignment

The original alignments for US 1, US 1A, and Falls of Neuse Road were set up to be consistent among the three alternatives. There was no vertical element to this study, so there was no distinct advantage for changing the alignments for each. The alignment of US 1 was shifted slightly to the east which, along with leaving US 1 mostly at existing grade, could assist in the construction of the interchange. The recommended alignment along US 1A was shifted slightly to the south which creates a more desirable alignment for the interchange and could provide the same constructability benefit of the US 1 alignment shift.



## 5.0 TRAFFIC FORECAST

The Triangle Regional Travel Demand Model was used to develop the traffic forecasts used in the assessment of the improvement alternatives. Alternatives were run using the current “Base Year” models for the 2015, 2030 and 2040 scenarios. The term “Base Year” refers to the current models used by CAMPO for various scenarios. These models vary between scenarios because of differences in the networks that represent transportation improvement projects that are planned/programmed as part of the federally mandated planning process. Depending on the content of the Base Year models, modifications were made to the model networks to allow for modeling of no-build and improvement alternatives in the 2030 and 2040 scenarios.

### 5.1 Review of the Model Networks

The model network and associated link data in the vicinity of the study area were reviewed to identify the Base Year conditions in the 2015, 2030 and 2040 scenarios.

In the 2015 Base Year model network, the model network in the vicinity of the study area incorporates an at-grade intersection on Capital Boulevard at New Falls of Neuse Road/South Main Street. In the 2015 model network, centroid connections from traffic analysis zones intersect with Capital Boulevard on the links north and south of the subject intersection, implying that access to properties is permitted and no limitation of access is in place. Capital Boulevard is coded as a pair of one-way links providing 2 lanes in each direction with a posted speed of 55 miles per hour.

Falls of Neuse Road is coded as a series of two-way links west of Capital Boulevard providing 2 lanes in each direction. South Main Street is similarly coded as a series of two-way links, providing two lanes in each direction east of Capital Boulevard to Rogers Road. East of Rogers Road, South Main Street provides one lane in each direction. Falls of Neuse Road and South Main Street are both coded with a posted speed of 45 miles per hour.

In the 2030 and 2040 Base Year model scenarios, the centroid connectors to Capital Boulevard are removed, eliminating access to traffic analysis zones adjacent to the roadway. This indicates a planned conversion of Capital Boulevard to a limited access facility in these model networks. The links for Capital Boulevard also provide three lanes in each direction, representing an increase in capacity over what is shown in the 2015 model network. The coded posted speed limit is also increased from 55 miles per hour to 65 miles per hour.

The at-grade intersection with Falls of Neuse Road/South Main Street that is present in the 2015 model is replaced in the 2030 and 2040 Base Year models by a diamond interchange. The diamond interchange is modeled as one lane ramps with a posted speed limit of 35 miles per hour. There is no change in coding for the Falls of Neuse and South Main Street links compared to the 2015 scenario.

### 5.2 Model Alternatives

The Base Year models for the three scenarios represent both a no-build condition (2015 scenario) and a diamond interchange “build” condition (2030 and 2040 scenarios) at the intersection of Capital Boulevard and New Falls of Neuse Road/South Main Street.



Modifications were made to the Base Year networks for the 2030 and 2040 scenarios to model a No-Build condition that maintains the at-grade intersection in the 2015 scenario while maintaining the other Base Year network improvements along Capital Boulevard (elimination of centroid connectors, increasing capacity from two to three lanes, and increasing the speed from 55 to 65 miles per hour). The portion of the at-grade intersection was coded in the 2030 and 2040 No-Build scenarios consistent with the link data for that portion of the intersection in the 2015 Base Year scenario.

Modifications were also made to the Base Year networks for the 2030 and 2040 scenarios to model a build condition alternative to the diamond interchange coded in these Base Year models. In each of these scenarios, the coded diamond interchange was modified to represent a Single Point Urban Interchange (SPUI). The SPUI in the model was coded with single lane ramps connecting to Capital Boulevard and carrying right turn traffic to and from Falls of Neuse Road/South Main Street. The short portions of the ramps carrying left turn traffic to and from Falls of Neuse Road/South Main Street were coded with two lanes, consistent with the conceptual design of the SPUI. All the ramp segments were coded with posted speed limits of 35 miles per hour.

In addition to the diamond and SPUI interchanges, a third improvement alternative, a diverging diamond interchange (DDI) was considered for evaluation. For travel demand modeling purposes, the coding of a DDI into the networks is only a slight variation on the coding of a SPUI and would likely result in similar, if not nearly identical, traffic assignments. Consequently, it was judged that the traffic assignments obtained for the SPUI alternative should be sufficiently representative of the traffic assignments for the DDI alternative for use in evaluating the two concepts.

The travel demand model projections were generated after completing traffic assignments for the no-build and build alternatives for the 2030 and 2040 scenarios and for the 2015 Base Year scenario. These projections were then used to develop the morning and afternoon peak hour traffic volumes for use in the more detailed traffic analysis of the operation of the no-build conditions and the proposed improvement alternatives.

### 5.3 Turning Movement Volumes

The turning movement data for the interchange was utilized as the source for development of the remaining intersections in the study area. Link growth rates were determined from the TransCAD model and were found to be 3% along the US 1A/Falls of Neuse Road/South Main Street corridor and closer to 4% along the US 1/Capital Boulevard corridor. The through volumes for each of the corridors were carried throughout the mainline and the growth rates were applied to the turning movements at each of the study intersections to balance the network for the future year 2040 conditions.

### 5.4 2040 Traffic Volumes

Tables 4 and 5 show the AADTs of the Diamond, SPUI, and No-Build Alternatives respectively. Table 6 shows the average of each of the alternatives. As mentioned above, the AADT for the Diverging Diamond Interchange was not modeled therefore there was no AADT data for that alternate; however the results would be similar to the AADT from the SPUI alternative.



Table 4: Diamond Interchange AADT		
	North of Intersection	South of Intersection
US 1 NB	49,590 vpd	53,510 vpd
US 1 SB	49,208 vpd	55,011 vpd
<b>Combined NB/SB</b>	<b>98,798 vpd</b>	<b>108,521 vpd</b>
Falls of Neuse	43,370 vpd	
US 1A (Main Street)	50,647 vpd	

Table 5: SPUI AADT		
	North of Intersection	South of Intersection
US 1 NB	48,860 vpd	53,015 vpd
US 1 SB	49,721 vpd	55,328 vpd
<b>Combined NB/SB</b>	<b>98,581 vpd</b>	<b>108,343 vpd</b>
Falls of Neuse	43,273 vpd	
US 1A (Main Street)	52,946 vpd	

Table 6: Average of Alternatives AADT		
	North of Intersection	South of Intersection
US 1 NB	49,167 vpd	53,745 vpd
US 1 SB	49,680 vpd	55,338 vpd
<b>Combined NB/SB</b>	<b>98,847 vpd</b>	<b>109,083 vpd</b>
Falls of Neuse	43,322 vpd	
US 1A (Main Street)	51,797 vpd	

## 6.0 FUTURE TRAFFIC CONDITIONS

Projected analyses for the future build year of 2040 were modeled in accordance with the Transportation Research Board's 2010 Highway Capacity Manual (HCM). The HCM utilizes a term "level of service" to measure how traffic operates in intersections and on roadway segments. There are currently six levels of service (LOS). The LOS is an important measure of roadway congestion. The LOS is determined by calculating the delay for the intersection and converting it to a letter grade. The LOS ranges from A (no congestion) to F (severe congestion).

Turning movement data was obtained from the TransCAD model for the main intersection of US 1/US 1A. Growth rates of 3.0-4.0% were determined from the model and were applied to the side street volumes. The through volumes from the US 1/US 1A intersection were then distributed throughout the US 1/Capital Boulevard and US 1A/Falls of Neuse Road/South Main Street corridors. These traffic volumes were input into the Synchro models and the following models were developed:

- 2040 No Build (Existing Conditions with Improvements)
- 2040 Build – CDI (Existing Conditions with Improvements, with US 1/US 1A Diamond Interchange)
- 2040 Build – SPUI (Existing Conditions with Improvements, with US 1/US 1A SPUI Interchange)
- 2040 Build – DDI (Existing Conditions with Improvements, with US 1/US 1A DDI Interchange)

Again, Synchro/SimTraffic 8.0 was used to analyze the intersections in the study area and obtain a LOS and delay per vehicle for the unsignalized and signalized intersections. SimTraffic was again used to simulate the traffic during each peak hour and observe how each of the interchange models affected the intersections in the project vicinity.



## 6.1 2040 No Build Conditions

The results of the 2040 No Build Conditions Level of Service analysis indicate each of the intersections during the PM peak hour; operate at a failing LOS F. Four of these intersections operate at a LOS F during the AM peak hour. The key study intersection, US 1 (Capital Boulevard) and US 1A (Falls of Neuse Road/South Main Street), operates at a LOS F during both the AM and PM peak hours, with all four of the approaches operating deficiently during both of the morning and afternoon commute. Observations made during the simulation, are that the eastbound and westbound directions during both peak hours, are backed up along the corridor outside the project vicinity. Along US 1, in the AM peak hour, the NB lefts spillback into the inside through lane and in the southbound direction, the through volume backs up beyond the Popes Creek Drive/Wake Point intersection, blocking the turn lanes at each of the intersections. In the PM peak hour, there were no northbound issues noted, and the southbound approach was similar to the AM observations.

Table 7 below presents the 2040 No Build Conditions Level of Service and Delay for each of the intersections.

Table 7: 2040 No Build Conditions LOS

Level of Service																					
Intersection	Type	Intersection				Northbound				Southbound				Eastbound				Westbound			
		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
		LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY
1. Falls of Neuse Road and Wakefield Commons	Directional Crossover	D	26.2	F	359.2	D	26.2	F	359.2	-	-	-	-	A	0.0	A	0.0	C	24.1	F	52.5
2A. Capital Boulevard & Falls of Neuse Road/South Main Street	Signalized	F	376.4	F	494.6	F	200.4	F	590.4	F	424.2	F	365.3	F	303.6	F	410.5	F	582.3	F	574.5
3. South Main Street and Star Road	Unsignalized	C	16.6	F	131.6	C	16.6	F	131.6	-	-	-	-	A	0.0	A	0.0	A	0.0	A	0.0
4. South Main Street and Wake Drive	Unsignalized	F	***	F	***	F	***	F	***	B	14.6	F	***	F	354.3	E	35.6	C	16.0	F	214.8
5. South Main Street and WalMart Driveway	Signalized	F	178.1	F	245.0	D	54.4	D	43.2	F	196.6	F	198.5	C	22.4	F	246.7	F	255.3	F	265.9
6B. Capital Boulevard and Popes Creek Drive/Wake Pointe	Directional Crossover	F	2057.7	F	***	F	249.3	F	110.7	F	164.7	F	***	F	2057.7	F	1590.8	F	1566.0	F	***

\*\*\* - Volume greatly exceeds capacity and delay cannot be computed.

A - Existing Conditions Improvements include restriping/widening the westbound approach to replace the right turn lane with a combination through/right lane and adjusting the cycle length to 120 second cycle.

B - Existing Conditions Improvements (COMMITTED BY OTHERS, Currently in Design) include widening of US 1 (Capital Boulevard) to 3-lanes in each direction, from the current six-lane section to tie into existing section south of NC 98

## 6.2 2040 CDI Level of Service

For the 2040 Build Conditions, three interchange scenarios were modeled as mentioned above, Diamond, SPUI and DDI. The Diamond Interchange scenario resulted in a LOS F operation at the main intersection of US 1/US 1A. The westbound-to-southbound US 1 left turn volume in the morning peak hour is projected to be more than 900 vehicles with over 300 vehicles making the eastbound-to-northbound US 1 maneuver. With this type of left turn volume, there is not enough storage along the bridge deck to accommodate the volume without constructing multiple turn and through lanes under a non-compressed design. The simulation for this model indicated a



free flowing US 1/Capital Boulevard; however, there was major congestion on both the east/westbound directions due to the spillback of the left turn lanes into the through lanes.

Table 8 below presents the 2040 Build Conditions Level of Service and Delay for each of the intersections under the Diamond Interchange configuration.

Table 8: 2040 Build – Diamond Interchange Conditions LOS

Level of Service																					
Intersection	Type	Intersection				Northbound				Southbound				Eastbound				Westbound			
		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
		LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY
1. Falls of Neuse Road and Wakefield Commons	Directional Crossover	D	25.8	F	455.6	D	25.8	F	424.0	-	-	-	-	A	0.0	A	0.0	C	23.7	F	455.6
2C. Capital Boulevard & Falls of Neuse Road/South Main Street - SB	Diamond Interchnage	F	115.4	F	219.0	-	-	-	-	F	277.5	F	177.7	F	147.9	F	372.6	C	34.7	C	26.4
2C. Capital Boulevard & Falls of Neuse Road/South Main Street - NB		F	212.0	F	325.7	E	61.5	F	591.8	-	-	-	-	D	42.1	C	29.2	F	352.5	F	363.9
3. South Main Street and Star Road	Unsignalized	B	11.4	C	21.3	B	11.4	C	21.3	-	-	-	-	A	0.0	A	0.0	A	0.0	A	0.0
4. South Main Street and Wake Drive	Unsignalized	F	***	F	***	F	***	F	***	F	57.6	F	***	F	59.7	D	32.6	C	15.7	F	129.4
5. South Main Street and WalMart Driveway	Signalized	F	191.2	F	262.7	D	54.4	D	35.6	F	199.4	F	191.2	B	19.1	F	249.3	F	273.0	F	313.6
*** - Volume greatly exceeds capacity and delay cannot be computed.																					
B - Improvements (COMMITTED BY OTHERS, Currently in Design) include widening of US 1 (Capital Boulevard) to 3-lanes in each direction, from the current six-lane section to tie into existing section south of NC 98																					
C - Intersection converted to a Compressed Diamond Interchange																					

### 6.3 2040 SPUI Level of Service

The SPUI Interchange scenario resulted in an acceptable LOS operation at the main intersection of US 1/US 1A during both of the peak periods. Both the AM and PM peak hours resulted in a LOS C under the SPUI configuration. In the AM peak hour, all approaches to the intersection with the exception of the northbound leg operate acceptably as well; the northbound leg operates at a LOS E during both peak hours. The simulation for this model indicated a free flowing US 1/Capital Boulevard and smooth progression along US 1A. The PM peak hour simulation showed similar results along the US 1 corridor; however there was some eastbound congestion due to the signal at WalMart but nothing that caused backups along the ramps onto US 1.

Table 9 below presents the 2040 Build Conditions Level of Service and Delay for each of the intersections under the SPUI Interchange configuration.



Table 9: 2040 Build – SPUI Interchange Conditions LOS

Level of Service																					
Intersection	Type	Intersection				Northbound				Southbound				Eastbound				Westbound			
		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
		LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY
1F. Falls of Neuse Road and Wakefield Commons	Directional Crossover	B	14.3	F	86.6	E	56.7	F	186.6	-	-	-	-	C	26.9	F	126.5	A	4.2	C	25.0
2D. Capital Boulevard & Falls of Neuse Road/South Main Street	SPUI Interchange	C	27.0	C	28.0	E	58.7	E	61.9	D	46.9	D	49.2	C	31.4	C	22.6	B	14.6	B	17.4
3. South Main Street and Star Road	Unsignalized	A	9.2	B	10.6	A	9.2	B	10.6	-	-	-	-	A	0.0	A	0.0	A	0.0	A	0.0
4. South Main Street and Wake Drive	Unsignalized	F	***	F	***	F	***	F	***	B	13.8	F	***	F	527.6	E	44.9	C	16.3	F	445.1
5. South Main Street and WalMart Driveway	Signalized	F	217.3	F	257.7	D	54.4	D	37.2	F	197.8	F	217.0	A	8.4	F	236.4	F	324.8	F	306.1
*** - Volume greatly exceeds capacity and delay cannot be computed.																					
B - Improvements (COMMITTED BY OTHERS, Currently in Design) include widening of US 1 (Capital Boulevard) to 3-lanes in each direction, from the current six-lane section to tie into existing section south of NC 98																					
D - Intersection converted to a Single Point Urban Interchnage																					
F - Intersection includes signal installation for EB left turn movement only																					

## 6.4 2040 DDI Level of Service

The DDI Interchange scenario resulted in an acceptable LOS operation at the main intersection of US 1/US 1A during the AM and PM peak hours at both interchange ramps. The simulation model was very similar to the conditions under the SPUI configuration.

Table 10 below presents the 2040 Build Conditions Level of Service and Delay for each of the intersections under the DDI Interchange configuration. Table 8: 2040 Build – DDI Interchange Conditions LOS

Table 10: 2040 Build – DDI Interchange Conditions LOS

Level of Service																					
Intersection	Type	Intersection				Northbound				Southbound				Eastbound				Westbound			
		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
		LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY
1. Falls of Neuse Road and Wakefield Commons	Directional Crossover	B	15.1	F	87.2	E	56.7	F	186.6	-	-	-	-	C	26.9	F	119.3	A	5.4	C	30.2
2E. Capital Boulevard & Falls of Neuse Road/South Main Street - SB RAMP	DDI Interchange	C	29.1	C	22.7	-	-	-	-	B	14.8	C	31.8	C	35.6	B	11.2	C	34.1	D	54.0
2E. Capital Boulevard & Falls of Neuse Road/South Main Street - NB RAMP		D	47.4	C	26.2	D	41.1	D	36.5	-	-	-	-	D	44.7	F	212.1	E	76.1	A	8.7
3. South Main Street and Star Road	Unsignalized	C	21.1	F	263.1	C	22.3	F	282.4	-	-	-	-	A	0.0	A	0.0	A	0.0	A	0.0
4. South Main Street and Wake Drive	Unsignalized	F	***	F	***	F	***	F	***	B	13.8	F	***	F	527.6	E	44.9	C	16.9	F	144.0
5. South Main Street and WalMart Driveway	Signalized	F	217.6	F	248.6	D	54.4	D	37.2	F	197.8	F	218.0	A	9.4	F	245.0	F	324.8	F	272.8
*** - Volume greatly exceeds capacity and delay cannot be computed.																					
B - Improvements (COMMITTED BY OTHERS, Currently in Design) include widening of US 1 (Capital Boulevard) to 3-lanes in each direction, from the current six-lane section to tie into existing section south of NC 98																					
E - Intersection converted to a Diverging Diamond Interchange																					



## 7.0 COMPARISON OF CONCEPTUAL ALTERNATIVES

In collaboration with the US 1 Planning Council and CAMPO, the study team identified three interchange concepts, the Single Point Urban Interchange (SPUI), the Diverging Diamond Interchange (DDI) and the Compressed Diamond Interchange (CDI). It was assumed that Starr Road, which serves as a frontage road in the southeast quadrant of the intersection, would be relocated as shown in the 2006 US 1 Phase I Report. While developing the conceptual design for each alternative based on a planning level 2040 level of service traffic analysis, the study team assessed each alternative based on the following criteria:

- Cost
- Environmental, Cultural, Right of Way, and Development Access Impacts
- Traffic Operations
- Bicycle, Pedestrian, and Transit Considerations
- Additional Advantages and Disadvantages

## 8.0 IMPACT ASSESSMENT

### 8.1 Mobility and Access

Construction of an interchange at the US 1/ US 1A/Falls of Neuse location would reduce travel times for regional traffic on US 1, as well as for east-west vehicular traffic along US 1A / Falls of Neuse. The SPUI and the DDI offers a higher 2040 LOS from a traffic operations perspective, in comparison to the CDI, which experiences heavy left turn volumes on US 1 and insufficient vehicular storage on the bridge deck. Access impacts to businesses in the four quadrants of the intersection were relatively similar between the three interchange alternatives, with the SPUI having the most impacts to business driveways over the DDI and CDI.

### 8.2 Multimodal Considerations

All three alternatives benefit from comparable improved LOS and reduced delay on US 1/ Capital Boulevard, which would benefit transit along the US 1 corridor. The Capital Area Transit (CAT) Wake Forest Loop route, as well as the TTA Express Route would benefit from any of the three interchange alternatives considered.

US 1 will be a freeway facility in 2030 and non conducive to bicycle or pedestrian travel; therefore these modes were not the focus of this study. For pedestrians and bicyclists crossing US 1, the DDI offers the most protection. Both the SPUI and the CDI are less conducive, with the SPUI having a large area of uncontrolled pavement which could lead to safety concerns.

### 8.3 Environmental Impacts

Land use in the vicinity of the interchange is predominately commercial, and based on a GIS database search, there are no wetlands within the vicinity of the interchange. The US1/ US 1A/Falls of Neuse intersection falls in both the Richland Creek and Smith Creek Watersheds, and runoff from the construction of and of the interchange itself may cause impacts to several tributaries within the vicinity. Smith Creek is listed on the NCDENR 2014 303(d) list of impaired



waters. Additional water quality analysis may be required during the NEPA/ permitting phase, regardless of the interchange configuration selected.

#### 8.4 Socioeconomic Impacts

As this area has grown nearly 300% between 2000 and 2010, and is anticipated to continue to grow, improving mobility to allow residents, goods and materials to flow more freely benefits the community. Constructing a grade separated facility at US 1/ US 1A / Falls of Neuse will Improve safety at this intersection which was identified as one of five high priority crash locations according to the Wake Forest Transportation Plan (2010). Transportation infrastructure investments, such as this interchange would ensure continued economic development along the US 1 corridor, including the anticipated 30,000 square foot expansion by Rex Healthcare.

#### 8.5 Costs

As expected the SPUI was the most expensive mostly due to the additional spur ramps (compared to the Compressed Diamond) and the large dual bridges along US 1 required to span the intersection below. The DDI was also required additional cost considerations for the additional spur ramps required. The bridge span was shorter than the SPUI which resulted in a cheaper alternative. The least expensive alternative was the CDI. With the traditional layout the bridge span lengths are significantly cheaper than the SPUI and DDI and no spur ramps are required.

#### 8.6 Additional Considerations

Interchange skew, and over/under configuration considerations for the SPUI, DDI, and CDI alternatives were relatively similar. Constructability constraints for US 1, Falls of Neuse and US 1A were also comparable between the three alternatives. .



Table 11: US 1/US 1A/Falls of Neuse Road Comparison of Conceptual Alternatives

Option	Cost*	Impacts*	Traffic Operations: LOS AM/PM	Bicycle/Pedestrian/Transit Considerations	Other Advantages	Disadvantages
Single Point Urban Interchange (SPUI)	\$35.0M FY 2014	<i>Environmental:</i> More <i>Cultural:</i> Most <i># Driveways:</i> 12 <i>Right of Way:</i> 8.5 Acres 10 Parcels	C / C	<i>Bicycle and Pedestrian:</i> Loss of some sidewalk in NE quadrant of intersection near dealership  <i>Transit:</i> Improved LOS and Delay on US 1 / Capital Boulevard	<ul style="list-style-type: none"> <li>Free flowing US 1</li> <li>Smooth progression along US 1A</li> <li>Fewer conflict points than a traditional intersection</li> <li>Driver familiarity with interchange configuration</li> <li>Single signalized intersection</li> <li>Reduction of driveways in vicinity of intersection reduces number of crashes</li> </ul>	<ul style="list-style-type: none"> <li>Less conducive to accommodating bicyclists and pedestrians crossing Capital Boulevard</li> <li>Large area of uncontrolled pavement which could leave to safety concerns</li> </ul>
Diverging Diamond Interchange (DDI)	\$32.5M FY 2014	<i>Environmental:</i> More <i>Cultural:</i> More <i># Driveways:</i> 9 <i>Right of Way:</i> 8 acres 13 parcels	SB Ramp: C/C NB Ramp: D/D	<i>Bicycle and Pedestrian:</i> Loss of sidewalk in NE quadrant of intersection near dealership  <i>Transit:</i> Improved LOS and Delay on US 1 / Capital Boulevard	<ul style="list-style-type: none"> <li>Free flowing US 1</li> <li>Fewer conflict points</li> <li>Less phases than traditional interchange (2-phase)</li> <li>More conducive to accommodating bicyclists and pedestrians crossing US 1</li> </ul>	<ul style="list-style-type: none"> <li>Unconventional interchange configuration</li> </ul>
Compressed Diamond Interchange (CDI)	\$27.8M M FY 2014	<i>Environmental:</i> Least <i>Cultural:</i> Least <i># Driveways:</i> 9 <i>Right of Way:</i> 8 acres 14 parcels	SB Ramp: F/F NB Ramp: F/F	<i>Bicycle and Pedestrian:</i> Loss of sidewalk in NE quadrant of intersection near dealership  <i>Transit:</i> Improved LOS and Delay on US 1 / Capital Boulevard	<ul style="list-style-type: none"> <li>Free flowing US 1</li> </ul>	<ul style="list-style-type: none"> <li>Intersection still experiences queuing</li> <li>Substantial left turn volumes onto US 1 and not enough storage on the bridge deck</li> </ul>

\*Excludes frontage and backage roads



## 9.0 LOCALLY PREFERRED ALTERNATIVE

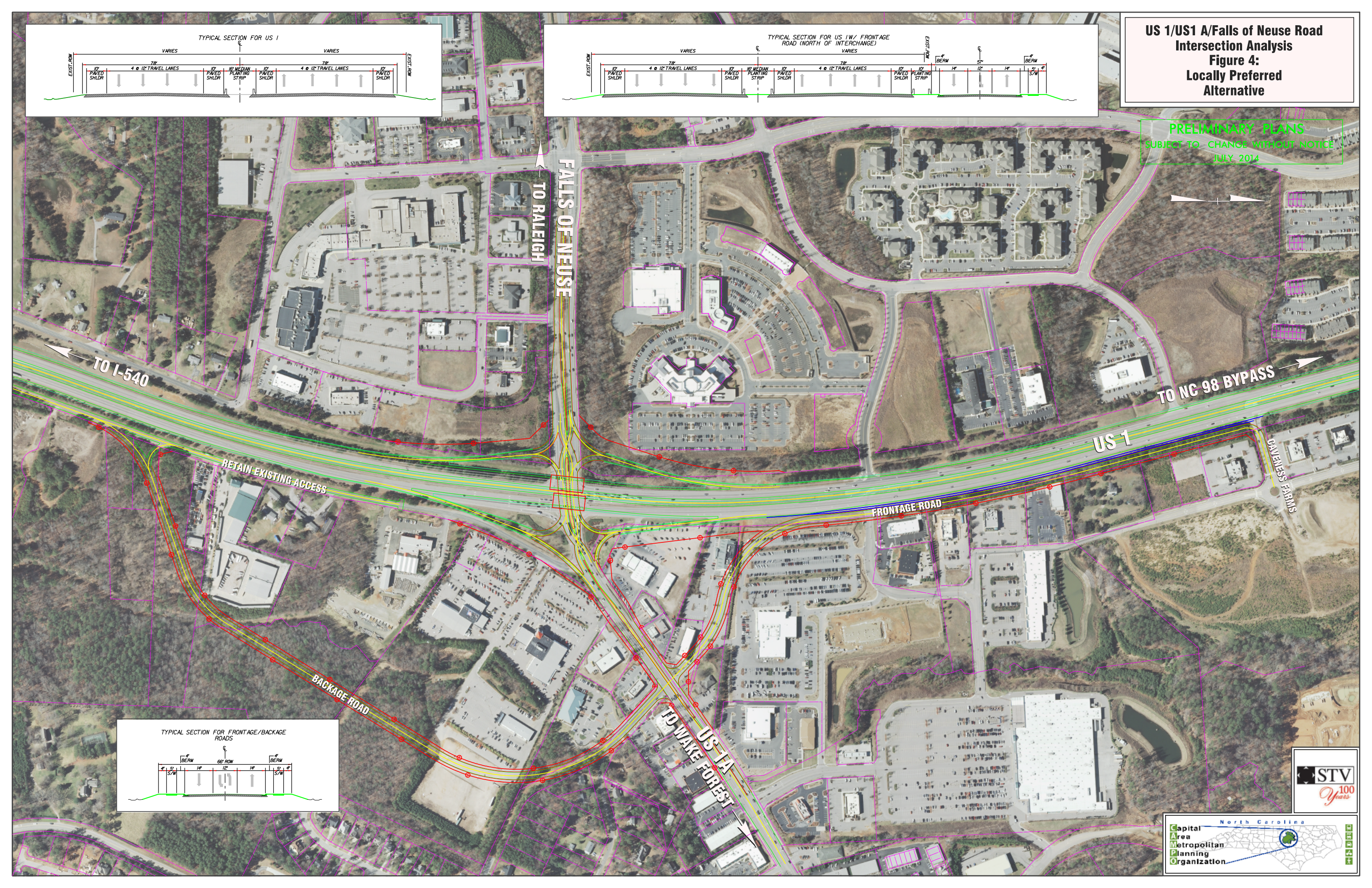
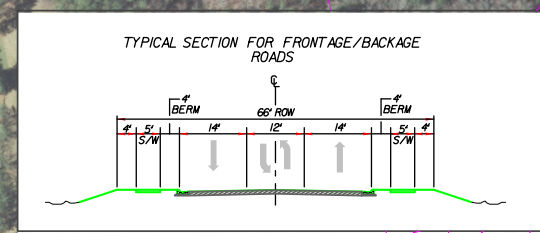
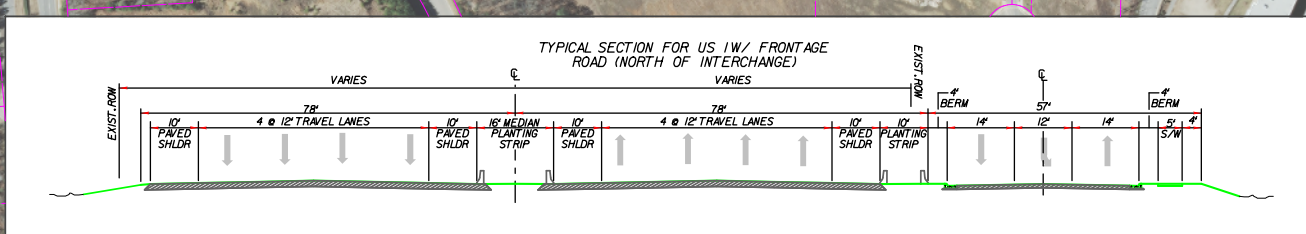
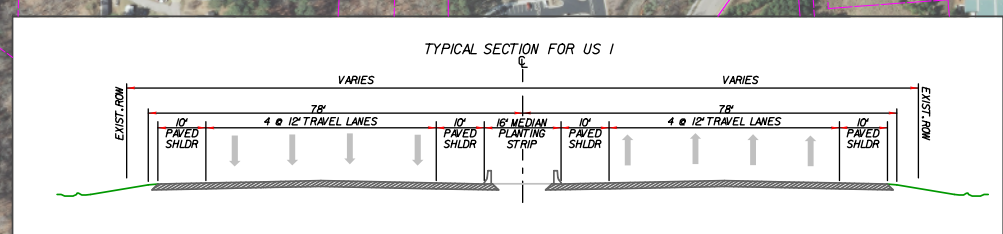
Once the feasibility study and evaluation of impacts were completed for each alternative the Study Team presented its findings with the US 1 Council of Planning. Each alternative was evaluated based on the criteria previously mentioned. Based on the evaluation and collaborative discussions, it was determined that the Diverging Diamond Interchange was the most desirable alternative.

Based on feedback from the US 1 Council of Planning, the alignment was modified and the alignment was shifted to the west to be consistent with the Phase I Report recommendation. With the realignment concept of Starr Road consistent with the Phase I Report, a planning level cost estimate was completed along with a reevaluation of impacts to Right of Way, environmental, and access to businesses. Figure 4 shows the revised alignment along with the functional layout of the Diverging Diamond which was selected as the locally preferred alternative.



**US 1/US1 A/Falls of Neuse Road  
Intersection Analysis**  
**Figure 4:  
Locally Preferred  
Alternative**

PRELIMINARY PLANS  
SUBJECT TO CHANGE WITHOUT NOTICE  
JULY 2014





## 10.0 COST ESTIMATE AND RIGHT OF WAY IMPACTS

A planning level cost analysis was completed for the Locally Preferred Alternative, the DDI Interchange as well as for the frontage and backage roads. The costs associated with each item came from data sources such as recent bid tabulations, NCDOT's 2014 Revised Cost per Mile spreadsheet, and previous cost estimating experiences. The widening along US 1 for the purpose of this study assumes 2000 feet of widening along US 1 to the south and north of the interchange location. The widening would consist of widening from a 4-lane section to an 8-lane section to the south of the interchange, and widening from a 6-lane section to an 8-lane section to the north. The widening takes into account the planned widening along US 1 as part of the Caveness Farms development. The total construction costs for the locally preferred alternative is approximately \$40.1 Million (FY 2014) which includes a 30% Miscellaneous and Mobilization cost and a 15% Engineering and Contingencies cost. The costs are also shown for 2030 which uses a 2.5% growth rate which is compounded annually. Table 12 shows the detailed breakdown of costs for the preferred alternative.

Table 12: Locally Preferred Alternative Cost Estimate

Functional Diverging Diamond Interchange Cost Estimate					
Description	Quantity		Unit Price	Amount (2014)	Amount (2030) <sup>1</sup>
US 1					
Widen Existing 4-Lane w/ Median to 8-Lane Interstate (US 1 - 2000' South of Interchange)	0.38	miles	\$12,000,000	\$4,560,000	\$6,769,346
Widen Existing 6-Lane w/ Median to 8-Lane Interstate (US1 - 2000' North of Interchange)	0.38	miles	\$7,600,000	\$2,888,000	\$4,287,252
Interchange					
Dual Bridges along US 1 over DDI	23,500	SF	\$200	\$4,700,000	\$6,977,176
Approach Slabs (4 @ 72' x 25')	7200	SF	\$45	\$324,000	\$480,980
Ramp Connections from US 1 to DDI	4	EA	\$900,000	\$3,600,000	\$5,344,220
Spur ramps	4	EA	\$375,000	\$1,500,000	\$2,226,758
US 1A/Falls of Neuse Road					
New Location 4-Lane Curb & Gutter w/ Raised Median + Bike Lanes and Sidewalk (Falls of Neuse through Interchange Ramps) <sup>2</sup>	0.45	miles	\$5,233,000	\$2,354,850	\$3,495,788
Widening US 1A + Bike Lanes and Sidewalk (From Ramp Termini to Walmart Entrance)	0.27	miles	\$5,033,000	\$1,358,910	\$2,017,310
Frontage and Backage Roads <sup>3</sup>					
New Location 3-Lane w/ Curb & Gutter and Sidewalk on Both Sides (Backage Road from Starr Road to US 1A)	0.77	miles	\$3,820,000	\$2,941,400	\$4,366,525
New Location 3-Lane w/ Curb & Gutter and Sidewalk on One Side (Frontage Road from US 1A to Caveness Farms)	0.7	miles	\$3,710,000	\$2,597,000	\$3,855,261
	Subtotal			\$26,824,160	\$39,820,616
	Misc & Mobilization (30%)			\$8,047,248.00	\$11,946,184.89
	CONTRACT COST			\$34,871,408	\$51,766,801
	Engineering & Contingencies (15%)			\$5,230,711	\$7,765,020
	CONSTRUCTION COST			\$40,102,119	\$59,531,821
	TOTAL			\$40,102,119	\$59,531,821
Notes:					
Costs are based on 2014 NCDOT Cost per Mile and reasonable bid estimates					
<sup>1</sup> Assumes a 2.5% growth rate per year compounded annually					
<sup>2</sup> No vertical element to this study, so assume this section is entirely new location					
<sup>3</sup> Assumes same general alignment as 2006 Phase I Report					



The ROW impacts were quantified by acres of required ROW to be purchased, number of parcels affected, and total takes. Constructing the DDI would require acquisition of 5 parcels and 16.76 acres of right of way. The construction costs do not include the acquisition of the parcels or the acreage required for the interchange. Table 13 reflects those impacts.

Table 13: Locally Preferred Alternative ROW Impacts

Functional Diverging Diamond Interchange ROW Impacts				
Description	ROW Required		Parcels Impacted	Total Takes
Interchange				
Ramps	4.96	acres	10	1
US 1A				
US 1A Widening east of Interchange Ramps	0.52	acres	7	0
Frontage and Backage Roads <sup>1</sup>				
Southeast Backage Road (Starr Road to US 1A)	5.77	acres	9	1
Northeast Frontage Road (US 1A to Caveness Farms)	2.72	acres	13	2
	Subtotal	13.97 acres	39	4
	Additional 20%	2.79 acres	8	1
	TOTAL	16.76 acres	47	5
<sup>1</sup> Assumes same general alignment as 2006 Phase I Report				

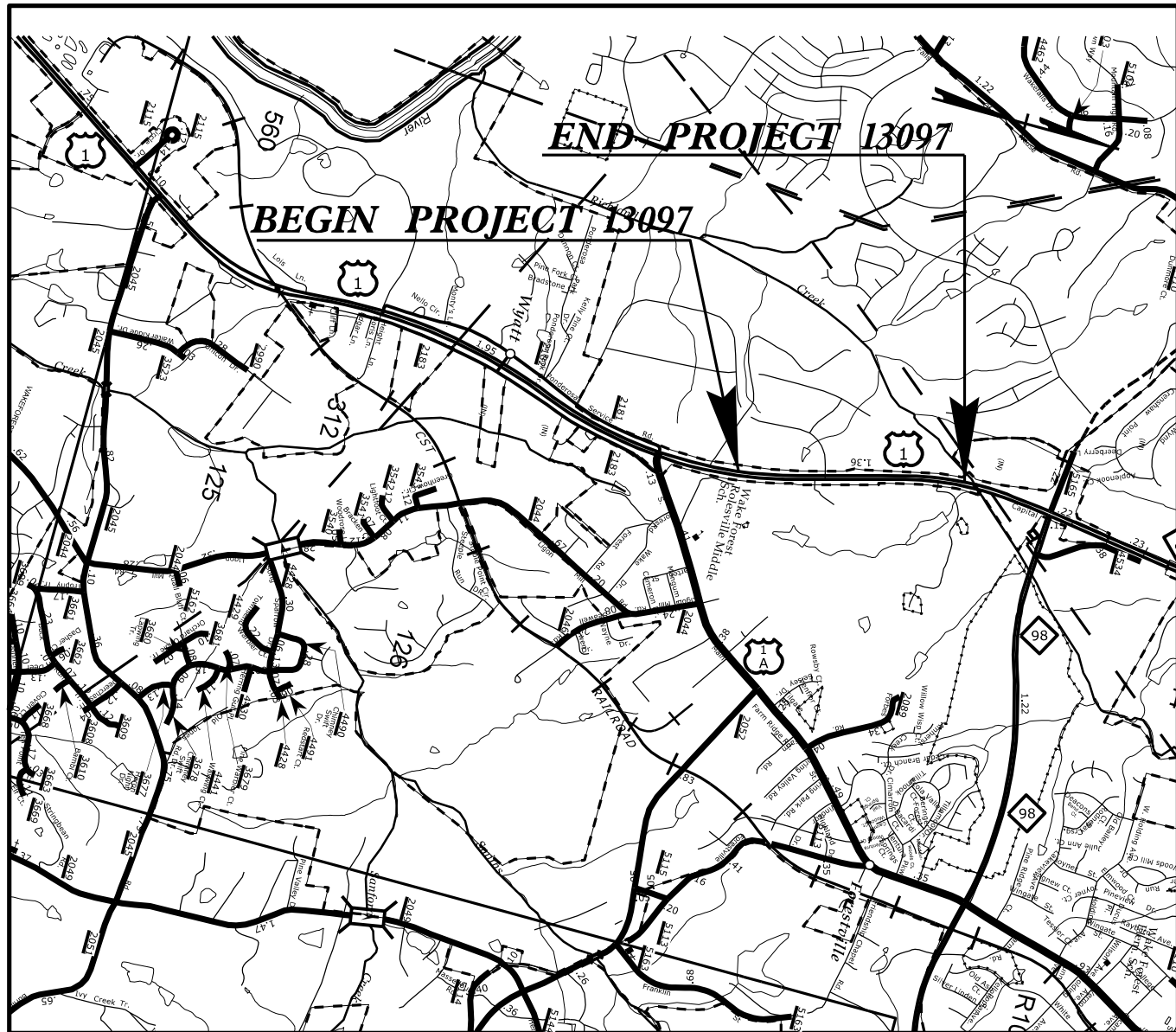




# APPENDIX



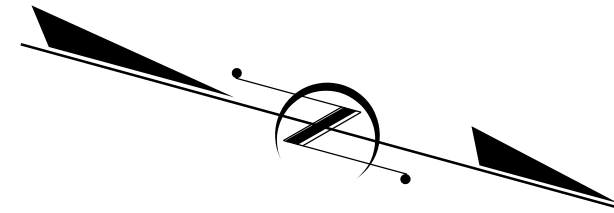
See Sheet 1-A For Index of Sheets



VICINITY MAP

STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

WAKE COUNTY

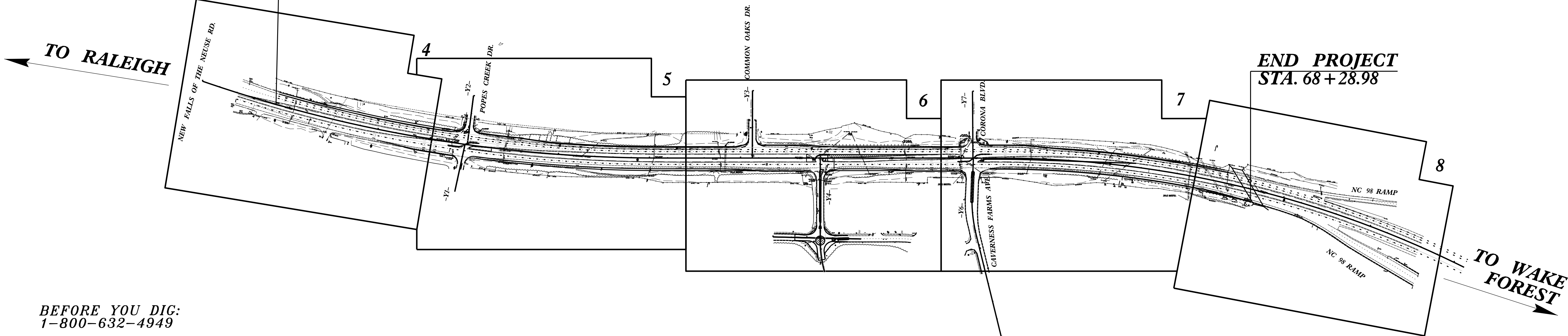


STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	13097	1	
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	

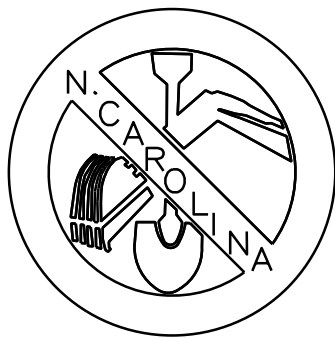
LOCATION: US 1 - CAPTIAL BOULEVARD  
FROM NEW WAKE FOREST ROAD TO NC 98 BYPASS  
WAKE FOREST, NORTH CAROLINA

TYPE OF WORK: GRADING, DRAINAGE, PAVING, CONC. CURB AND GUTTER,  
PAVEMENT MARKING, TRAFFIC CONTROL, AND EROSION CONTROL

BEGIN PROJECT  
STA. 14 + 23.62



BEFORE YOU DIG:  
1-800-632-4949






**RAMEY KEMP  
&  
ASSOCIATES, INC.**  
Transportation Engineers  
5808 Faringdon Place, Suite 100  
Raleigh, North Carolina 27609  
919-872-5115 Tel. 919-878-5416 Fax.  
www.rameykemp.com  
NC License No. C-0910

PROJECT NUMBER: 13097


**GRAPHIC SCALES**

50 25 0 50 100




PLANS

50 25 0 50 100



PROFILE (HORIZONTAL)

10 5 0 10 20



PROFILE (VERTICAL)

**DESIGN DATA**

ADT 2011 = 41,000  
ADT =  
DHV = 10 %  
D = 60 %  
T = 5 % \*  
V = 60 MPH  
\* TTST = 3 DUAL 2  
FUNC CLASS = FREEWAY

**PROJECT LENGTH**

LENGTH ROADWAY PROJECT = 1.02 MILES  
TOTAL LENGTH OF PROJECT = 1.02 MILES

Prepared in the Office of:  
**DIVISION OF HIGHWAYS**  
1000 Birch Ridge Dr., Raleigh NC, 27610

2012 STANDARD SPECIFICATIONS	
RIGHT OF WAY DATE:	MERRICK "TRE" DUGAL, III, P.E. PROJECT ENGINEER
LETTING DATE:	LUCAS HELMS, EI; BRET PALIS PROJECT DESIGNERS

**HYDRAULICS ENGINEER**

INCOMPLETE PLANS  
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS  
DO NOT USE FOR CONSTRUCTION

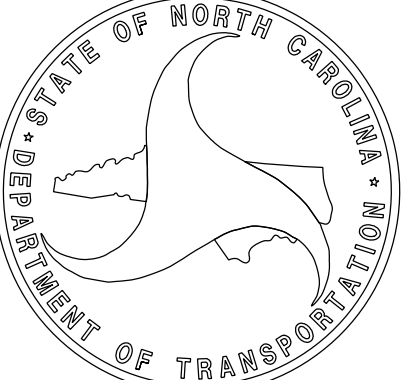
SIGNATURE: KYLE PHINN P.E.

**ROADWAY DESIGN ENGINEER**

INCOMPLETE PLANS  
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS  
DO NOT USE FOR CONSTRUCTION

SIGNATURE: MERRICK A. DUGAL P.E.





REVISIONS

8/17/99

5/6/2014  
\\F9J13097\_RdL\_psh\_S04.dgn  
User: locuser

PC Sta 10+00.00 -L- 10  
FALLS OF THE NEUSE RD./ US 1A

-L- STA.14+23.80  
BEGIN PROJECT  
TIE TO EXIST.

-L- /5

-L- 20

1  
REX CDP PARK LAND  
CONDO OWNERS ASSN INC  
PIN 1830504179  
DB 12866 PG 2404  
BM 2010 996

RESET GUARDRAIL

RELOCATE SIGN

PROPOSED GUARDRAIL

GRAU 350

US 1 - CAPITAL BLVD. -L-

10' FDPS

TIE TO EXIST.

200' TAPER

250' STORAGE

MATCHLINE -L- STA. 23 + 00.00


2  
CONSISTANT  
MANAGEMENT INC  
PIN 1739695677  
DB 8281 PG 2258  
BM PG

3  
CONSISTANT  
MANAGEMENT INC  
PIN 1739696887  
DB 8281 PG 2258  
BM PG

4  
HP WAKE FOREST  
GC LLC  
PIN 1830609136  
DB 12889 PG 654  
BM 2004 PG 619

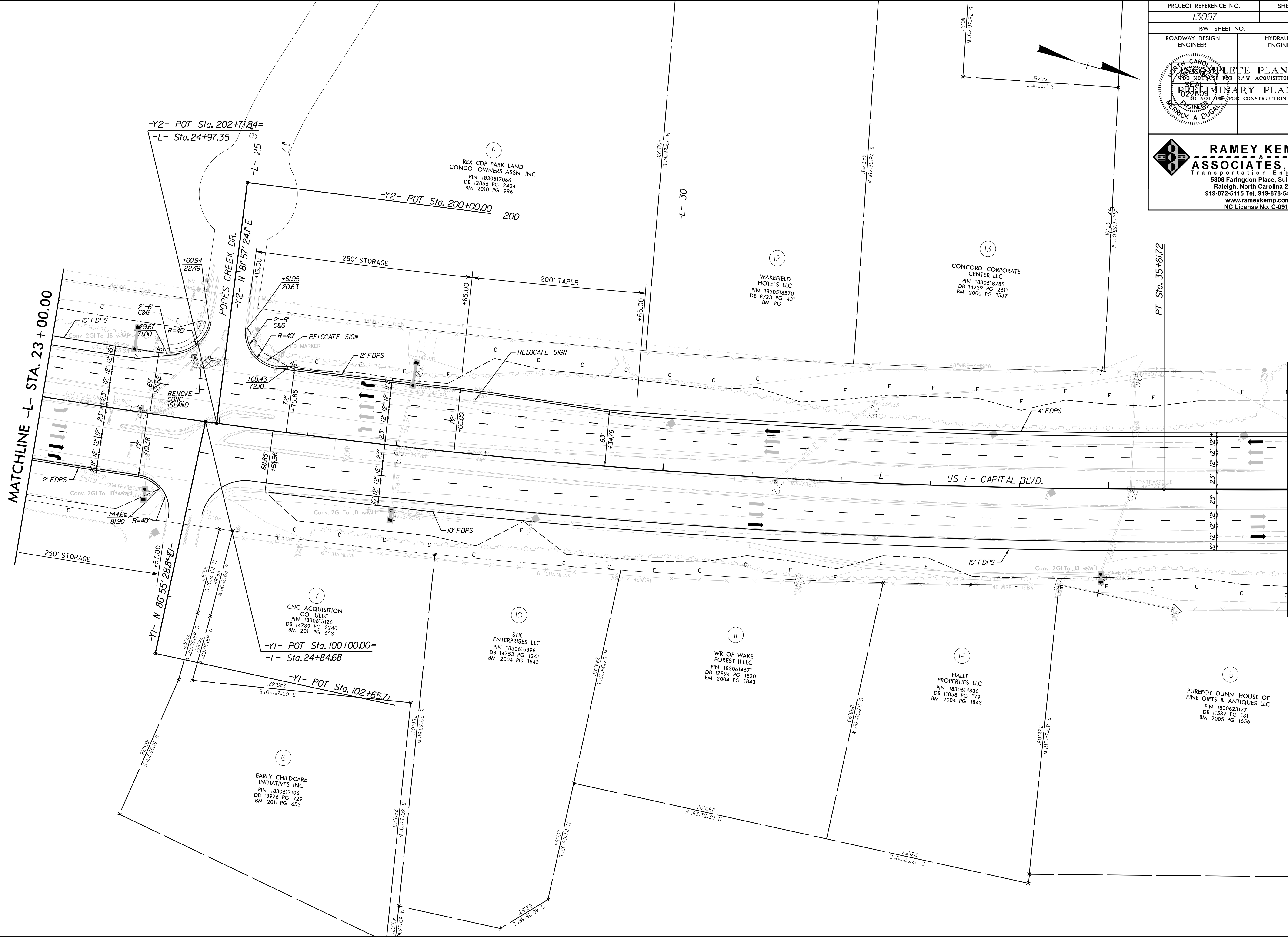
4  
CROSSROADS  
HOLDINGS LLC  
PIN 1830609774  
DB 11289 PG 2223  
BM 2011 PG 117

-L-  
PI Sta 22+92.81  
 $\Delta = 19^{\circ}03'42.5"$  (LT)  
 $D = 0^{\circ}44'38.8"$   
 $L = 2,561.72'$   
 $T = 1,292.81'$   
 $R = 7,700.00'$

PROJECT REFERENCE NO. 13097		SHEET NO. 4
RW SHEET NO.		
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER	
<div>DO NOT COMPLETE PLANS FOR R/W ACQUISITION DO NOT SEAL FOR CONSTRUCTION DO NOT USE FOR CONSTRUCTION</div>		
<div><b>RAMEY KEMP &amp; ASSOCIATES, INC.</b> Transportation Engineers 5808 Farlington Place, Suite 100 Raleigh, North Carolina 27609 919-872-5115 Tel. 919-878-5416 Fax. www.rameykemp.com NC License No. C-0910</div>		

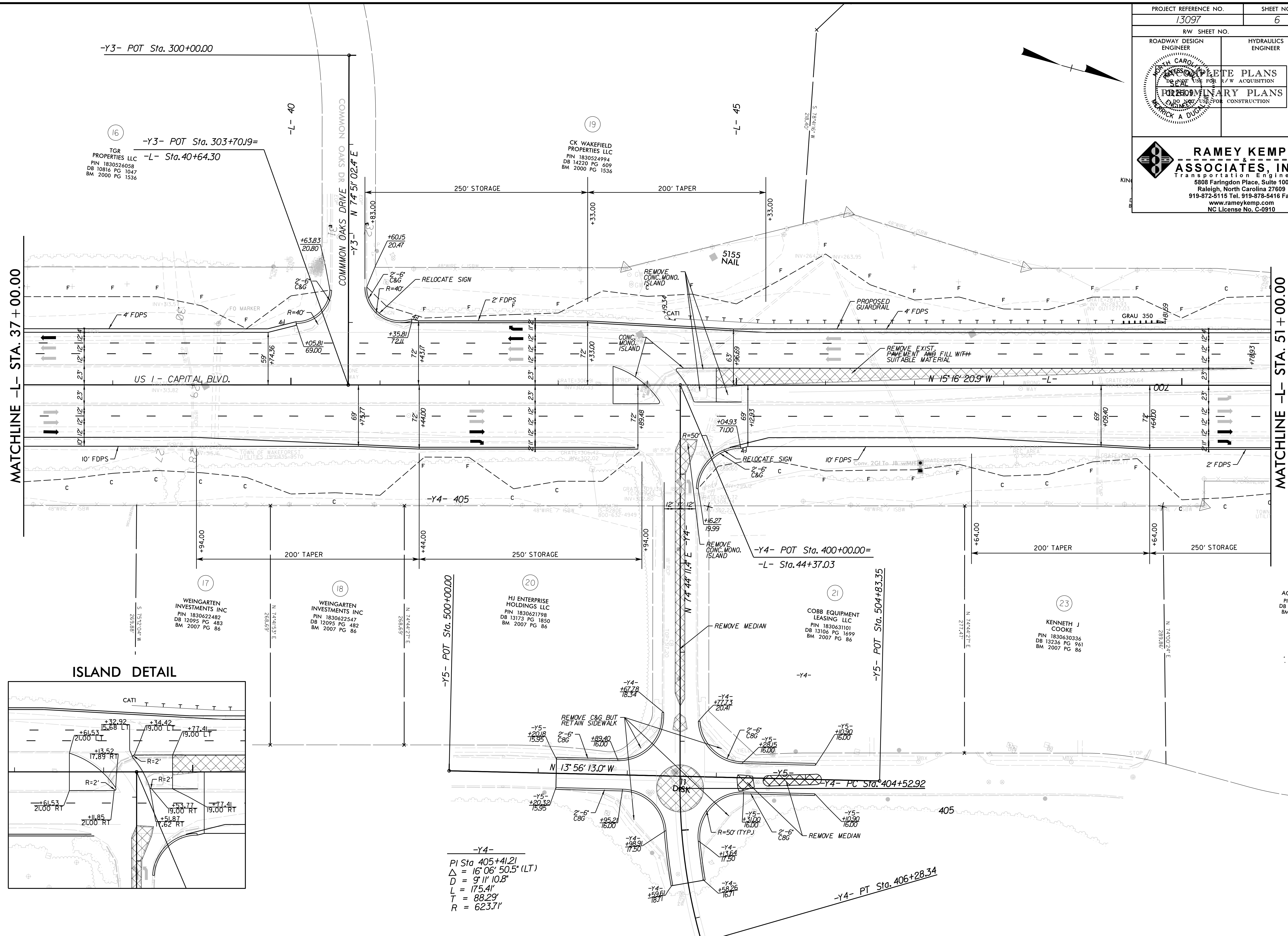


REVISIONS



PROJECT REFERENCE NO. 13097		SHEET NO. 5	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
<div><div></div><div><b>COMPLETE PLANS</b> FOR R/W ACQUISITION <b>SEAL</b> <b>PRELIMINARY PLANS</b> DO NOT USE FOR CONSTRUCTION ENGINEER RAMEY A DUGAN</div></div>			
<div><div></div><div><b>RAMEY KEMP &amp; ASSOCIATES, INC.</b> Transportation Engineers 5808 Farlington Place, Suite 100 Raleigh, North Carolina 27609 919-872-5115 Tel. 919-878-5416 Fax. www.rameykemp.com NC License No. C-0910</div></div>			



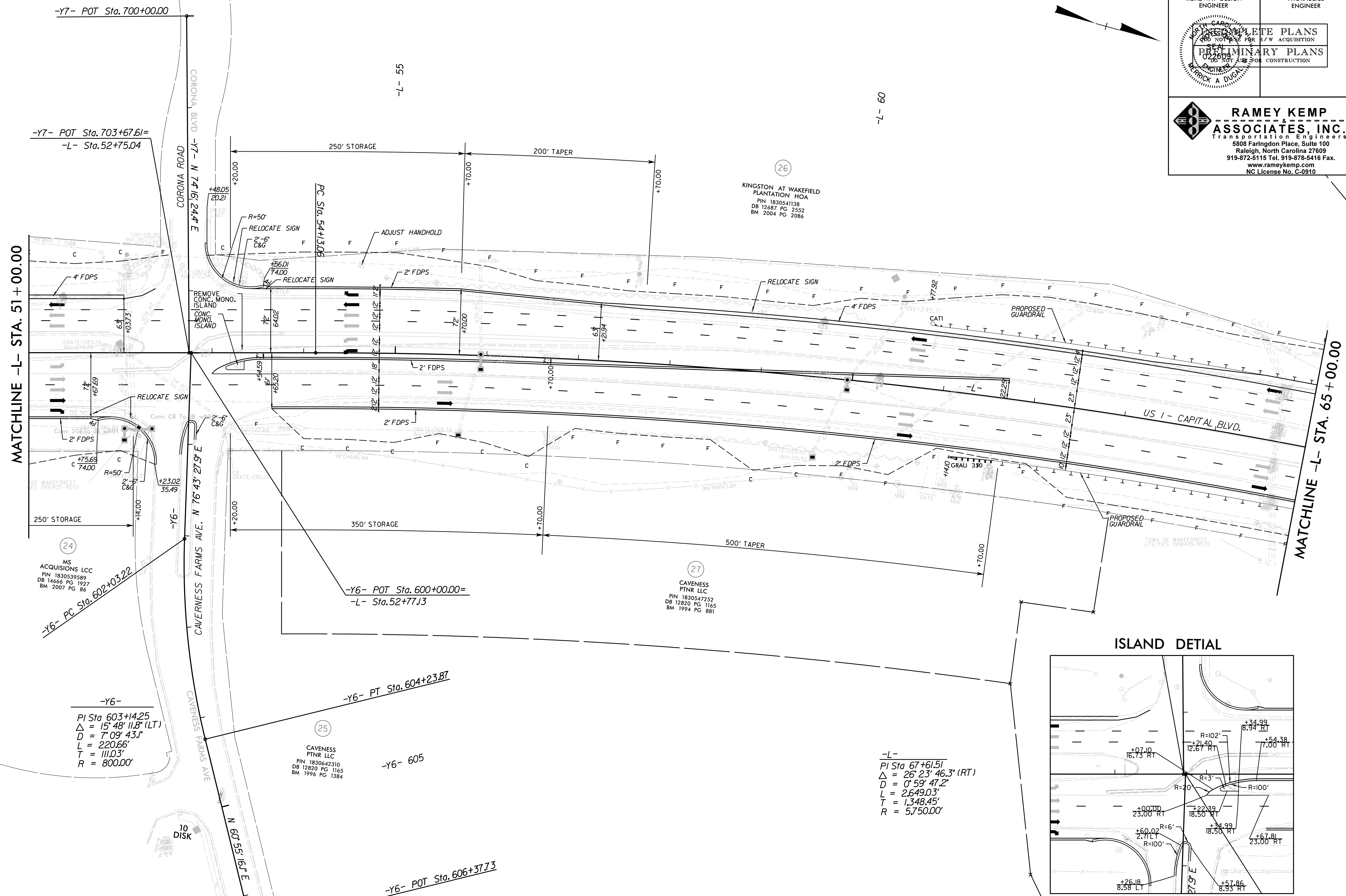


## REVISIONS

8/17/99

5/6/2014  
...\\Proj\13097\_Rdy-psh-S06.dgn  
user:localuser







8/17/99

REVISIONS

5/6/2014  
J:\13097\_Rd\psh\_S08.dgn  
User

MATCHLINE -L- STA. 65 + 00.00

-L- 65

-L- 70

-L- 75

(28)  
VILLAS OF WAKE  
FOREST CONDO HOA  
PIN 1830548863  
DB 14908 PG 870  
CM 2007 PG 427

(29)  
VILLAS OF WAKE  
FOREST CONDO HOA  
PIN 1830557004  
DB 14196 PG 12025  
CM 2007 PG 427

(30)  
TOWN OF  
WAKE FOREST  
PIN 1830652860  
DB 12401 PG 889  
BM 2006 PG 1858

-L-  
PI Sta 67+61.51  
 $\Delta = 26^{\circ} 23' 46.3" (RT)$   
 $D = 0^{\circ} 59' 47.2"$   
 $L = 2,649.03'$   
 $T = 1,348.45'$   
 $R = 5,750.00'$

-L- STA.68+28.98  
END PROJECT  
TIE TO EXIST.

NC 98 RAMP

US 1 - CAPITAL BLVD.

NC 98 RAMP

NC 98

PROJECT REFERENCE NO.

13097

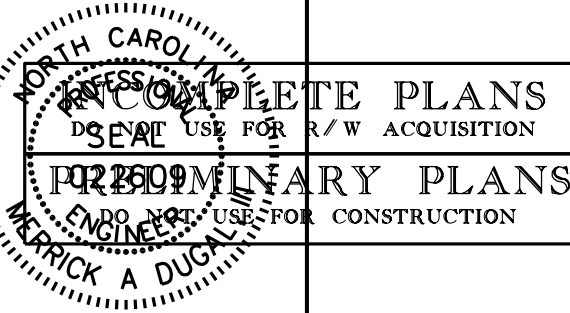
SHEET NO.

8

R/W SHEET NO.

ROADWAY DESIGN  
ENGINEER

HYDRAULICS  
ENGINEER



**RAMEY KEMP  
&  
ASSOCIATES, INC.**  
Transportation Engineers  
5808 Farlington Place, Suite 100  
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www.rameykemp.com  
NC License No. C-0910



# 2040 AADT

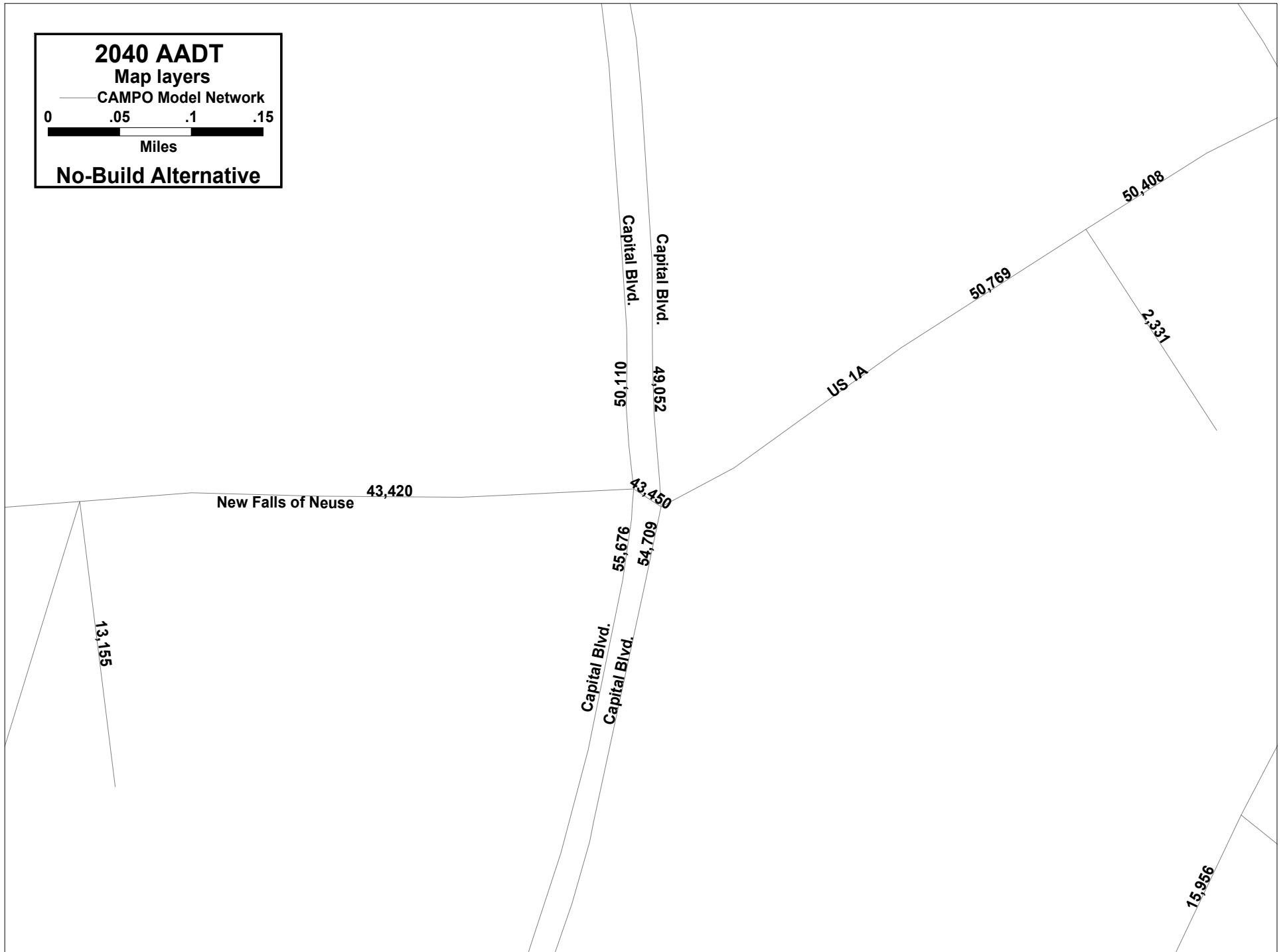
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CAMPO Model Network

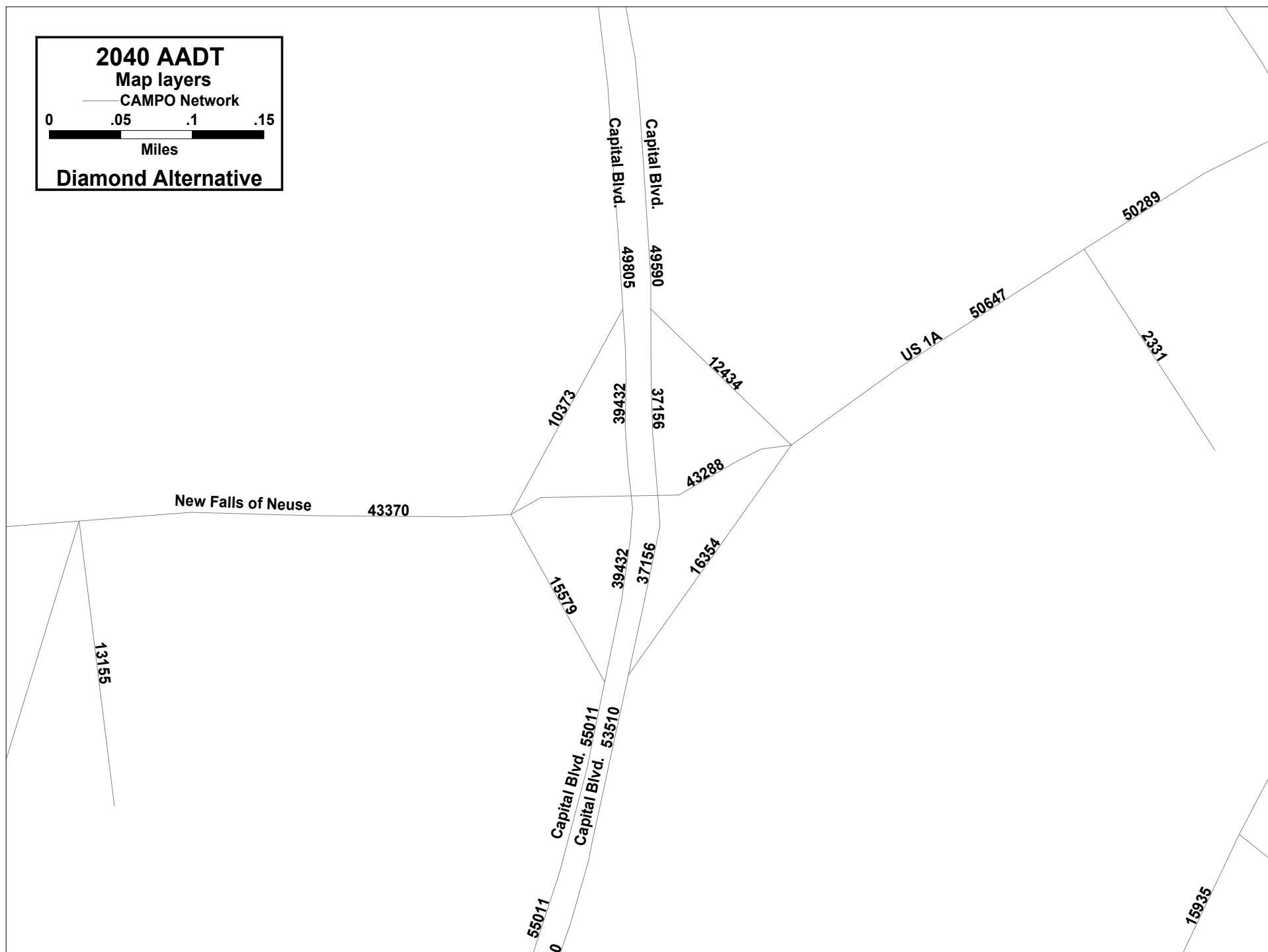
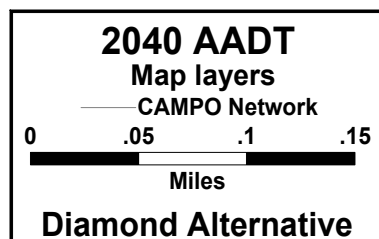
0 .05 .1 .15

Miles

No-Build Alternative









2040 AADT

Map layers

CAMPO Network :1

0

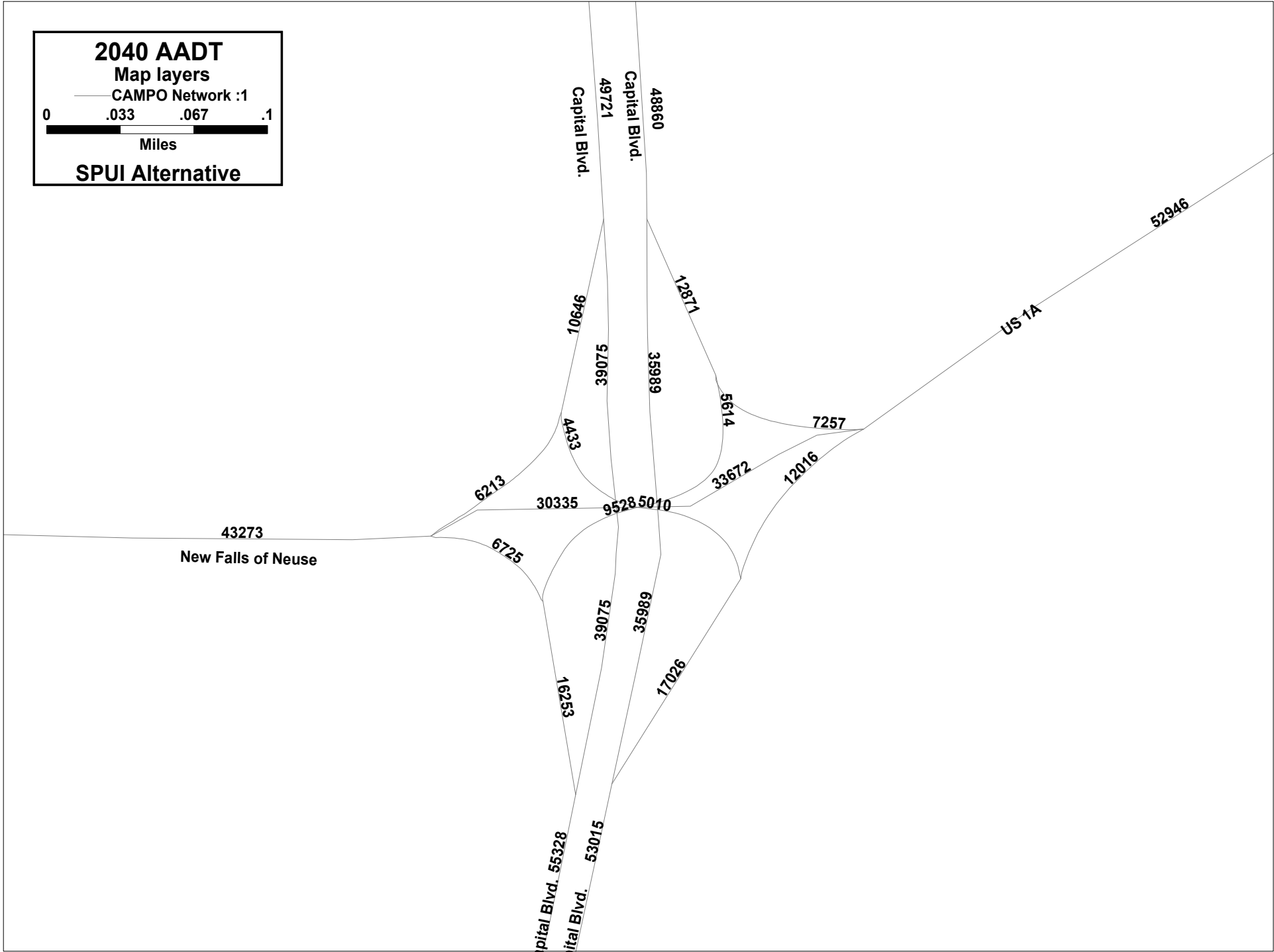
.033

.067

.1

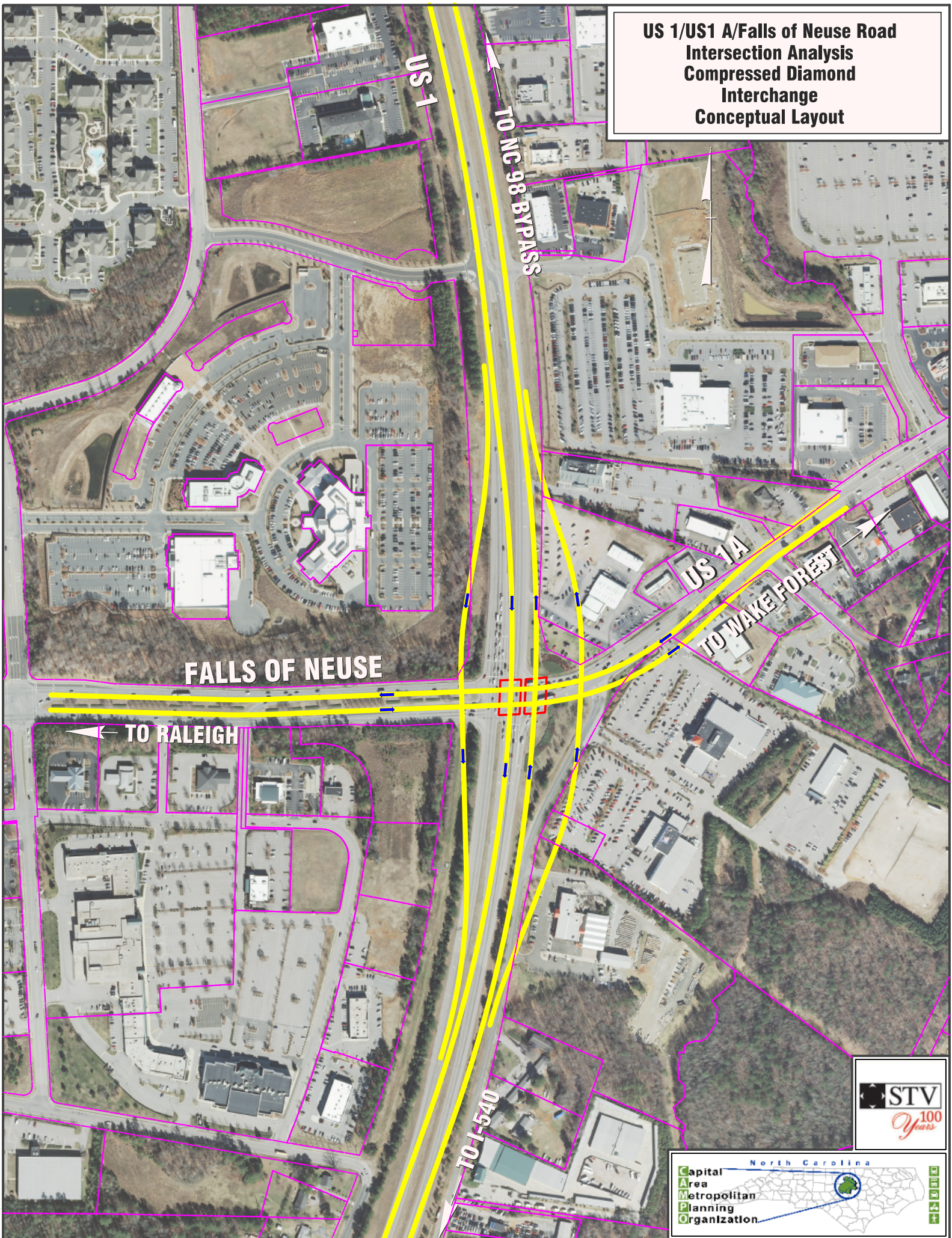
Miles

SPUI Alternative





**US 1/US1 A/Falls of Neuse Road  
Intersection Analysis  
Compressed Diamond  
Interchange  
Conceptual Layout**





## Conceptual Compressed Diamond Interchange Cost Estimate

Description	Quantity		Unit Price	Amount (2014)	Amount (2030) <sup>1</sup>
<b>US 1</b>					
Widen Existing 4-Lane w/ Median to 8-Lane Interstate (US 1 - 2000' South of Interchange)	0.38	miles	\$12,000,000	\$4,560,000	\$6,769,346
Widen Existing 6-Lane w/ Median to 8-Lane Interstate (US1 - 2000' North of Interchange)	0.38	miles	\$7,600,000	\$2,888,000	\$4,287,252
<b>Interchange</b>					
Dual Bridges along US 1 over Compressed Diamond	17,500	SF	\$200	\$3,500,000	\$5,195,770
Approach Slabs (4 @ 72' x 25')	7200	SF	\$45	\$324,000	\$480,980
Ramp Connections from US 1 to Compressed Diamond	4	EA	\$900,000	\$3,600,000	\$5,344,220
<b>US 1A/Falls of Neuse Road</b>					
New Location 4-Lane Curb & Gutter w/ Raised Median + Bike Lanes and Sidewalk (Falls of Neuse through Interchange Ramps) <sup>2</sup>	0.45	miles	\$5,233,000	\$2,354,850	\$3,495,788
Widening US 1A + Bike Lanes and Sidewalk (From Ramp Termini to Walmart Entrance)	0.27	miles	\$5,033,000	\$1,358,910	\$2,017,310
	Subtotal			\$18,585,760	\$27,590,665
	Misc & Mobilization (30%)			\$5,575,728.00	\$8,277,199.56
	CONTRACT COST			\$24,161,488	\$35,867,865
	Engineering & Contingencies (15%)			\$3,624,223	\$5,380,180
	CONSTRUCTION COST			\$27,785,711	\$41,248,044
	TOTAL			\$27,785,711	\$41,248,044

**Notes:**

Costs are based on 2014 NCDOT Cost per Mile and reasonable bid estimates

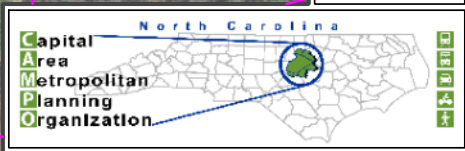
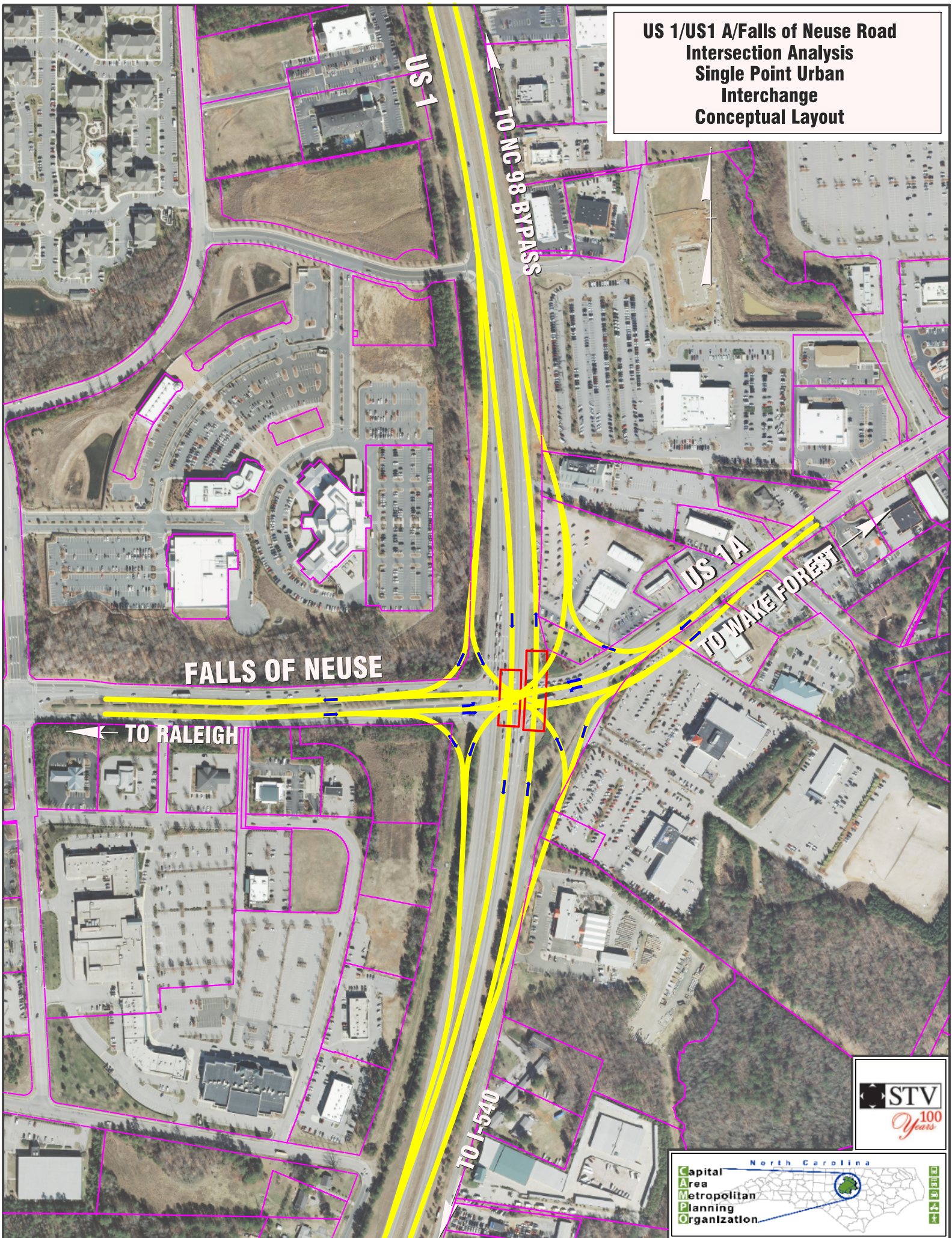
Conceptual costs do not include frontage and backage roads

<sup>1</sup> Assumes a 2.5% growth rate per year compounded annually

<sup>2</sup> No vertical element to this study, so assume this section is entirely new location



**US 1/US1 A/Falls of Neuse Road  
Intersection Analysis  
Single Point Urban  
Interchange  
Conceptual Layout**





## Conceptual SPUI Cost Estimate

Description	Quantity		Unit Price	Amount (2014)	Amount (2030) <sup>1</sup>
<b>US 1</b>					
Widen Existing 4-Lane w/ Median to 8-Lane Interstate (US 1 - 2000' South of Interchange)	0.38	miles	\$12,000,000	\$4,560,000	\$6,769,346
Widen Existing 6-Lane w/ Median to 8-Lane Interstate (US1 - 2000' North of Interchange)	0.38	miles	\$7,600,000	\$2,888,000	\$4,287,252
<b>Interchange</b>					
Dual Bridges along US 1 over SPUI	34,000	SF	\$200	\$6,800,000	\$10,094,638
Approach Slabs (4 @ 72' x 25')	7200	SF	\$45	\$324,000	\$480,980
Ramp Connections from US 1 to SPUI	4	EA	\$900,000	\$3,600,000	\$5,344,220
Spur ramps	4	EA	\$375,000	\$1,500,000	\$2,226,758
<b>US 1A/Falls of Neuse Road</b>					
New Location 4-Lane Curb & Gutter w/ Raised Median + Bike Lanes and Sidewalk (Falls of Neuse through Interchange Ramps) <sup>2</sup>	0.45	miles	\$5,233,000	\$2,354,850	\$3,495,788
Widening US 1A + Bike Lanes and Sidewalk (From Ramp Termini to Walmart Entrance)	0.27	miles	\$5,033,000	\$1,358,910	\$2,017,310
	Subtotal			\$23,385,760	\$34,716,292
	Misc & Mobilization (30%)			\$7,015,728.00	\$10,414,887.65
	CONTRACT COST			\$30,401,488	\$45,131,180
	Engineering & Contingencies (15%)			\$4,560,223	\$6,769,677
	CONSTRUCTION COST			\$34,961,711	\$51,900,857
	TOTAL			\$34,961,711	\$51,900,857

**Notes:**

Costs are based on 2014 NCDOT Cost per Mile and reasonable bid estimates

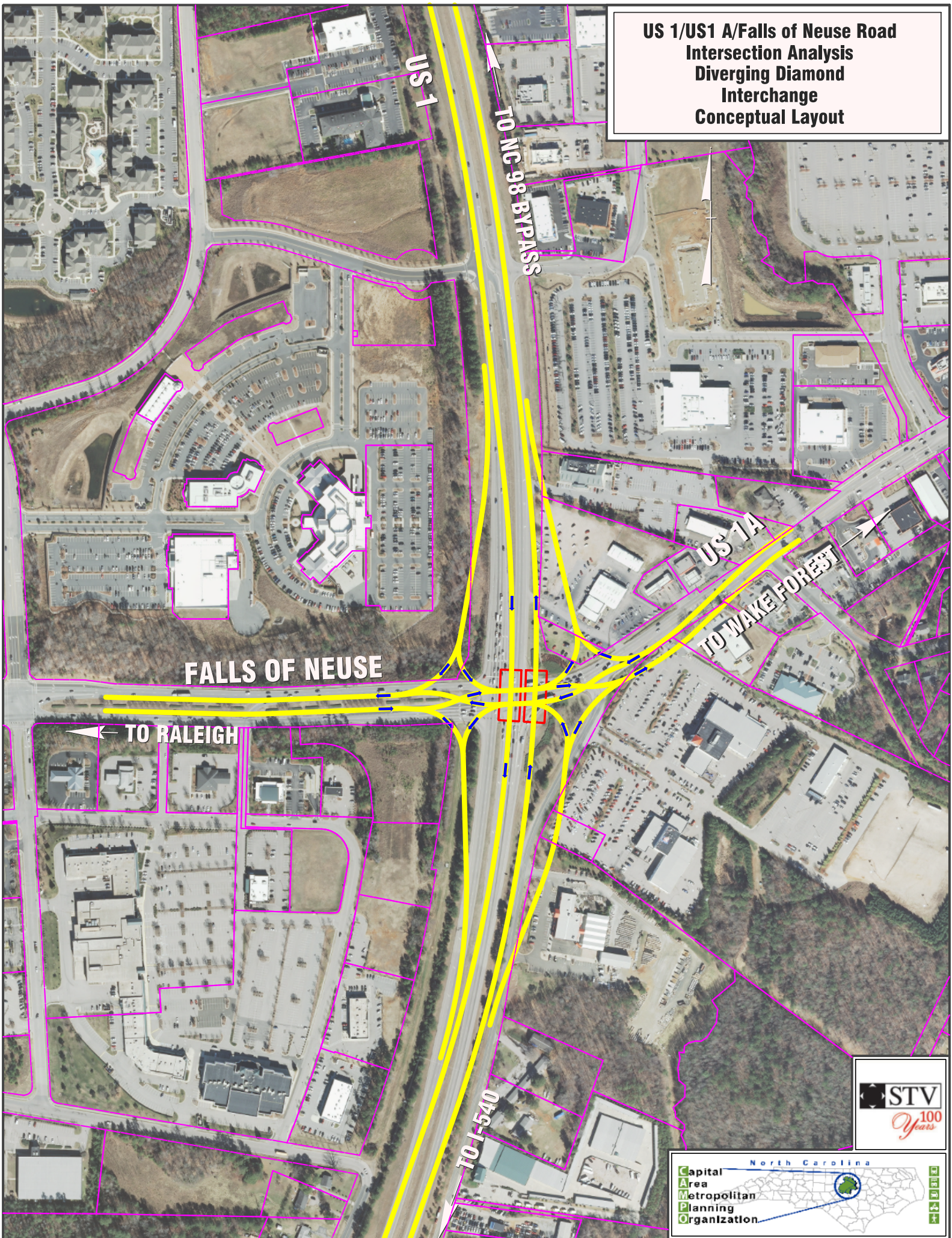
Conceptual costs do not include frontage and backage roads

<sup>1</sup> Assumes a 2.5% growth rate per year compounded annually

<sup>2</sup> No vertical element to this study, so assume this section is entirely new location



**US 1/US1 A/Falls of Neuse Road  
Intersection Analysis  
Diverging Diamond  
Interchange  
Conceptual Layout**





## Conceptual Diverging Diamond Interchange Cost Estimate

Description	Quantity		Unit Price	Amount (2014)	Amount (2030) <sup>1</sup>
<b>US 1</b>					
Widen Existing 4-Lane w/ Median to 8-Lane Interstate (US 1 - 2000' South of Interchange)	0.38	miles	\$12,000,000	\$4,560,000	\$6,769,346
Widen Existing 6-Lane w/ Median to 8-Lane Interstate (US1 - 2000' North of Interchange)	0.38	miles	\$7,600,000	\$2,888,000	\$4,287,252
<b>Interchange</b>					
Dual Bridges along US 1 over DDI	25,600	SF	\$200	\$5,120,000	\$7,600,669
Approach Slabs (4 @ 72' x 25')	7200	SF	\$45	\$324,000	\$480,980
Ramp Connections from US 1 to DDI	4	EA	\$900,000	\$3,600,000	\$5,344,220
Spur ramps	4	EA	\$375,000	\$1,500,000	\$2,226,758
<b>US 1A/Falls of Neuse Road</b>					
New Location 4-Lane Curb & Gutter w/ Raised Median + Bike Lanes and Sidewalk (Falls of Neuse through Interchange Ramps) <sup>2</sup>	0.45	miles	\$5,233,000	\$2,354,850	\$3,495,788
Widening US 1A + Bike Lanes and Sidewalk (From Ramp Termini to Walmart Entrance)	0.27	miles	\$5,033,000	\$1,358,910	\$2,017,310
	Subtotal			\$21,705,760	\$32,222,323
	Misc & Mobilization (30%)			\$6,511,728.00	\$9,666,696.82
	CONTRACT COST			\$28,217,488	\$41,889,020
	Engineering & Contingencies (15%)			\$4,232,623	\$6,283,353
	CONSTRUCTION COST			\$32,450,111	\$48,172,372
	TOTAL			\$32,450,111	\$48,172,372

**Notes:**

Costs are based on 2014 NCDOT Cost per Mile and reasonable bid estimates

Conceptual costs do not include frontage and backage roads

<sup>1</sup> Assumes a 2.5% growth rate per year compounded annually

<sup>2</sup> No vertical element to this study, so assume this section is entirely new location