

**FEASIBILITY STUDY**

**Upgrade Intersection of US 401  
at Mitchell Mill Road (SR 2224)  
and Ligon Mill Road (SR 2044)**

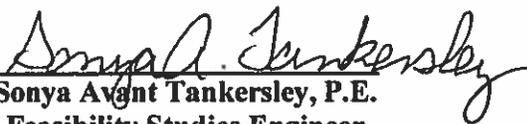
**Wake County**

**Division 5**

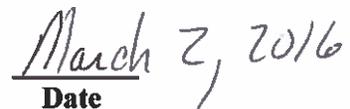
**FS-1205B**



**Prepared by the  
Program Development Branch  
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Date**

Upgrade Intersection of US 401(Louisburg Road)  
at SR 2224 (Mitchell Mill Road)  
and SR 2044 (Ligon Mill Road)

Wake County

FS-1205B

**I. General Description**

This feasibility study describes the upgrade of the intersection of US 401(Louisburg Road) at SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road). The project location is shown on Figure 1. An at-grade intersection was investigated, but due to its poor level of service, an at-grade intersection was discarded. As part of this study, a modified clover and diverging diamond interchange configuration was investigated. Because of the close proximity of the existing intersection to the Neuse River, each interchange configuration was evaluated at two locations north of the existing intersection as specified in the following alternative descriptions:

- ❖ Modified Half Clover approximately 1400 feet north of the existing intersection  
Alternate 1
- ❖ Modified Half Clover approximately 700 feet north of the existing intersection  
Alternate 2
- ❖ Diverging Diamond approximately 1400 feet north of the existing intersection  
Alternate 3
- ❖ Diverging Diamond approximately 700 feet north of the existing intersection  
Alternate 4

This is the initial step in the planning and design process for this project and is not the product of exhaustive environmental or design investigations. The purpose of this study is to describe the proposed project including cost, and to identify potential problems that may require consideration in the planning and design phases.

**II. Background**

The purpose of this project is to improve the traffic safety and operations at the intersection of US 401 (Louisburg Road) and SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road).

US 401 is designated an Other Principal Arterial according to NCDOT Functional Classification. The US 401 corridor connects Raleigh and Fayetteville to Virginia and South Carolina. US 401 varies from two lanes in rural areas to four-lane divided in urban areas of North Carolina.

SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road) are designated as a Major Collector. Both roads are currently two lane facilities.

There are several City projects within the proposed study area of FS-1205B. There are no State Transportation Improvement Program (STIP) projects in the vicinity of the project.

- Mitchell Mill Road: The City of Raleigh is planning to widen Mitchell Mill Road from US 401 to just east of Forestville Road to a four-lane median divided curb and gutter section with bike lanes, sidewalks, streetlights, and street trees. Project will commence in Spring 2016.
- The City of Raleigh is opening Horseshoe Farm Park off of existing Ligon Mill Road. This project does not include any street improvements.

There are two bridges in the project study area. These bridges will need to be modified or replaced to accommodate additional travel lanes. Please see Table 4 for detailed bridge information.

### **III. Traffic and Safety**

Currently an existing traffic signal is located at the intersection of US 401 (Louisburg Road) and SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road).

The 2012 Average Daily Traffic (ADT) at the existing US 401 and SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road) intersection is 23,200 vpd on US 401 northeast, 15,300 vpd on SR 2224 (Mitchell Mill Road) southeast, 42,100 vpd on US 401 southwest, and 8,600 vpd on SR 2044 (Ligon Mill Road). For the design year 2035 under the build scenario, the traffic volume along US 401 is estimated to be 36,300 vpd on US 401 northeast, 27,000 vpd on SR 2224 (Mitchell Mill Road) southeast, 66,400 vpd on US 401 southwest, and 15,200 vpd on SR 2044 (Ligon Mill Road). Truck traffic on US 401 is estimated to make up approximately 6 percent of the daily traffic. Truck traffic on SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road) is estimated to make up approximately 3 percent of the daily traffic.

The existing segment of US 401 and the SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road) intersection operates at a level of service (LOS) E in the AM peak hour and LOS D in the PM peak hour under 2012 traffic volumes. If no improvements are made in the 2035 design year, it is projected that the intersection at US 401 and SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road) will operate at a LOS F in both AM and PM peak hour.

Several alternates have been investigated to increase of service by the design year 2035 to the intersection at US 401 (Louisburg Road) and SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road). The following table displays the results.

**Table 1: No Build Level of Service**

Alternate	LOS		Recommendations
	AM Peak Hour	PM Peak Hour	
2012 At-Grade Intersection	E	D	Discarded
2035 At-Grade Intersection	F	F	Discarded

**Table 2: 2035 Level of Service**

Alternate	LOS		LOS		Recommendations
	AM Peak Hour		PM Peak Hour		
	West	East	West	East	
Modified Half Clover Alternate 1 & 2	B	A	B	C	Alternate to be considered
Diverging Diamond Alternate 3 & 4	B	C	B	B	Alternate to be considered
Diamond Alternate	F	C	B	D	Discarded
Half Clover Alternate	F	D	B	E	Discarded

The Modified half clover and diverging diamond alternates were fully evaluated during this study while the Diamond and half clover configurations were discarded. Depending on the conditions and traffic in the future, additional interchange configurations including those currently discarded may be considered during later planning and design phases.

To gather all safety information pertaining to the study area, two strip analyses were requested for this project. The first strip analysis covered US 401 (Louisburg Road) from SR 2006 (Perry Creek Road) to SR 2079 (Forestville Road). Between 2009 and 2014, 383 total accidents were reported along this route. The total crash rate for this section of US 401 (Louisburg Road) is 340.27 crashes per 100 million vehicle miles (crashes/100 MVM) traveled and the crash rate of 210.37 crashes/100MVM for urban US Routes. There was 1 fatal crash, 55 non-fatal injury crashes, 265 property damage only crashes. The most prevalent types of crashes were Rear End, Slow or Stop (44.13%), Angle (19.06%), Sideswipe – Same Direction (12.79%), Fixed Object (4.18%), and Left Turn – Different Roadways (3.92%).

The second strip analysis covers SR 2044 (Ligon Mill Road) / SR 2224 (Mitchell Mill Road) from Hartham Park Avenue to SR 2049 (Forestville Road). Between 2009 and 2014, 131 total accidents were reported along this route. The total crash rate for this section of SR 2044 (Ligon Mill Road) / SR 2224 (Mitchell Mill Road) is 315.87 crashes per 100 million vehicle miles (crashes/100 MVM) traveled and the crash rate of

266.29 crashes/100MVM for urban secondary roads. There was 1 fatal crash, 41 non-fatal injury crashes, 89 property damage only crashes. The most prevalent types of crashes were Rear End, Slow or Stop (37.40%), Angle (15.27%), Animal (9.16%), Left Turn – Different Roadways and Sideswipe – Same Direction (8.40%), and Fixed Object (7.63%).

Between 2009 and 2014, 83 total accidents were reported at the intersection of US 401 and SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road). There were 0 fatal crash, 26 non-fatal injury crashes, and 57 property damage only crashes. The most prevalent types of crashes were Rear End, Slow or Stop (50.60%), Angle (15.66%), Left Turn, Different Roadways (7.23%), and Rear End, Turn (6.02%).

#### **IV. Description of Alternatives**

The scope of the project is to upgrade the existing intersection at US 401 (Louisburg Road) and SR 2224 (Mitchell Mill Road) and SR 2044 (Ligon Mill Road) to accommodate the increased traffic volume expected in 2035. The project location is shown on Figure 1. Included in the cost of building the project shown below is the widening of existing Bridge No. 131 and 1020 over the Neuse River. See Table 1 for the estimated project cost for each alternative. In addition, see Table 2 for existing bridge information.

##### **Alternate 1 – Modified Half Clover:**

- Widen SR 2224 (Mitchell Mill Road) to a four-lane divided facility with five foot bike lanes and two auxiliary lanes, curb and gutter and five foot sidewalks on 150 to 175 feet of right of way.
- Widen SR 2044 (Ligon Mill Road) to a four-lane divided facility with five foot bike lanes, curb and gutter and five foot sidewalks on 150 feet of right of way.
- Y-Lines other than Mitchell Mill Road and Ligon Mill Road are two lane facilities with lane widths that range from 10 to 12 feet with two foot paved shoulders.
- Widen US 401 to accommodate an additional 12 foot lane in each direction.

With this proposed cross-section, it is anticipated that there will be ninety (90) residences and zero (0) businesses relocated due to this project. The total cost of this alternative, including right of way, utility relocation, construction, and Intelligent Transportation Systems (ITS) deployment is estimated to be \$66,320,000.

Right-of-way.....	\$36,430,000
Utility Relocation.....	\$550,000
Construction.....	\$29,300,000
<u>ITS Deployment.....</u>	<u>\$ 40,000</u>
Total Cost .....	\$66,320,000

**Alternate 2 – Modified Half Clover:**

- Widen SR 2224 (Mitchell Mill Road) to a four-lane divided facility with five foot bike lanes and two auxiliary lanes, curb and gutter and five foot sidewalks on 150 to 175 feet of right of way.
- Widen SR 2044 (Ligon Mill Road) to a four-lane divided facility with five foot bike lanes, curb and gutter and five foot sidewalks on 150 feet of right of way.
- Y-Lines other than Mitchell Mill Road and Ligon Mill Road are two lane facilities with lane widths that range from 10 to 12 feet with two foot paved shoulders.
- Widen US 401 to accommodate an additional 12 foot lane in each direction.

With this proposed cross-section, it is anticipated that there will be ninety-three (93) residences, zero (0) businesses, one (1) family cemetery plot relocated due to this project. The total cost of this alternative, including right of way, utility relocation, construction, and Intelligent Transportation Systems (ITS) deployment is estimated to be \$72,610,000.

Right-of-way.....	\$39,950,000
Utility Relocation.....	\$620,000
Construction.....	\$32,000,000
<u>ITS Deployment.....</u>	<u>\$ 40,000</u>
<u>Total Cost .....</u>	<u>\$72,610,000</u>

**Alternate 3 – Diverging Diamond:**

- Widen SR 2224 (Mitchell Mill Road) to a four-lane divided facility with five foot bike lanes and two auxiliary lanes, curb and gutter and five foot sidewalks on 150 to 175 feet of right of way.
- Widen SR 2044 (Ligon Mill Road) to a four-lane divided facility with five foot bike lanes, curb and gutter and five foot sidewalks on 150 feet of right of way.
- Y-Lines other than Mitchell Mill Road and Ligon Mill Road are two lane facilities with lane widths that range from 10 to 12 feet with two foot paved shoulders.
- Widen US 401 to accommodate an additional 12 foot lane in each direction.

With this proposed cross-section, it is anticipated that there will be eighty-six (86) residences and zero (0) businesses relocated due to this project. The total cost of this alternative, including right of way, utility relocation, construction, and Intelligent Transportation Systems (ITS) deployment is estimated to be \$63,320,000.

Right-of-way.....	\$34,930,000
Utility Relocation.....	\$550,000
Construction.....	\$27,800,000
<u>ITS Deployment.....</u>	<u>\$ 40,000</u>
Total Cost .....	\$63,320,000

**Alternate 4 – Diverging Diamond:**

- Widen SR 2224 (Mitchell Mill Road) to a four-lane divided facility with five foot bike lanes and two auxiliary lanes, curb and gutter and five foot sidewalks on 150 to 175 feet of right of way.
- Widen SR 2044 (Ligon Mill Road) to a four-lane divided facility with five foot bike lanes, curb and gutter and five foot sidewalks on 150 feet of right of way.
- Y-Lines other than Mitchell Mill Road and Ligon Mill Road are two lane facilities with lane widths that range from 10 to 12 feet with two foot paved shoulders.
- Widen US 401 to accommodate an additional 12 foot lane in each direction.

With this proposed cross-section, it is anticipated that there will be ninety (90) residences and zero (0) businesses, one (1) family cemetery plot relocated due to this project. The total cost of this alternative, including right of way, utility relocation, construction, and Intelligent Transportation Systems (ITS) deployment is estimated to be \$73,080,000.

Right-of-way.....	\$39,500,000
Utility Relocation.....	\$640,000
Construction.....	\$32,900,000
<u>ITS Deployment.....</u>	<u>\$ 40,000</u>
Total Cost .....	\$73,080,000

**V. Community Issues**

A detailed investigation was not conducted for this feasibility study; however, no impacts to schools, parks, recreation areas, or community facilities are anticipated with this project.

The Geographic Information System Service of the North Carolina State Historic Preservation Office were used to determine if any historic properties on the National Register of Historic Places (NRHP) or state study lists exist within the project study area. There are no National Register of Historic districts or structures located in the project area.

## VI. Natural Environment Issues

The following is a preliminary review of environmental issues that might have a potential impact to the project. The information obtained for the environmental screening is from a Geographic Information System (GIS) database. The purpose of the environmental screening is to identify potential environmental issues early in the process.

### Stream Classification

The project study area is located in the Neuse River Basin. US 401 crosses the Neuse River approximately 0.2 Mile south of the existing location with SR (2224) Mitchell Mill Road and SR 2044 (Ligon Mill Road). The Neuse River has a stream classification of C NSW. This water body will likely need to be surveyed and have the appropriate coordination with the North Carolina Department of Environment and Natural Resources (NCDENR) and the U.S. Army Corps of Engineers (USACE) during any environmental document study.

### Wetlands

There are three small ponds located in the vicinity of SR 2044 (Ligon Mill Road). These ponds should not be affected by the construction of this project. In case a portion of the project affects one or more of the ponds, all necessary permits, 404 and 401, with the U.S. Army Corps of Engineers (USACE) and NC DENR Division of Water Resources, respectively, will likely need to be obtained before construction of the project, and appropriate mitigation measures should be taken if deemed necessary. A portion of the project study area is located in a 100 and 500-year floodplain.

### Threatened and Endangered Species

The following threatened and endangered species were identified in the project study area:

- Neuse River Waterdog (*Necturus lewisi*)

## VII. Recommendations

**Alternate 3 – Diverging Diamond:** After reviewing the four alternates, the preferred alternate is Alternate 3. Alternate 3 provides an acceptable level of service and the least number of impacts to residence and businesses. See Table 3 below for a cost comparison on each alternate.

Our recommendation is to carry forward the remaining Alternates 1, 2 and 4 in later planning and design phases. The remaining Alternates have passing levels of service. From a programming standpoint, it is preferred to use the cost estimate for Alternate 3 – Diverging Diamond.

**Table 3: Total Estimated Project Cost**

Alternate	Right of way Cost	Utility Relocation Cost	Construction Cost	ITS Deployment	Total Cost	Residential Relocation	Business Relocation
1	\$36,430,000	\$550,000	\$29,300,000	\$40,000	\$66,320,000	90	0
2*	\$39,950,000	\$620,000	\$32,000,000	\$40,000	\$72,610,000	93	0
3	\$34,930,000	\$550,000	\$27,800,000	\$40,000	\$63,320,000	86	0
4*	\$39,500,000	\$640,000	\$32,900,000	\$40,000	\$73,080,000	90	0

\*This total includes the cost of the relocation of one (1) grave.

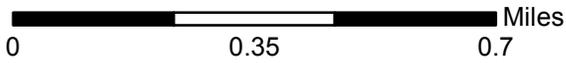
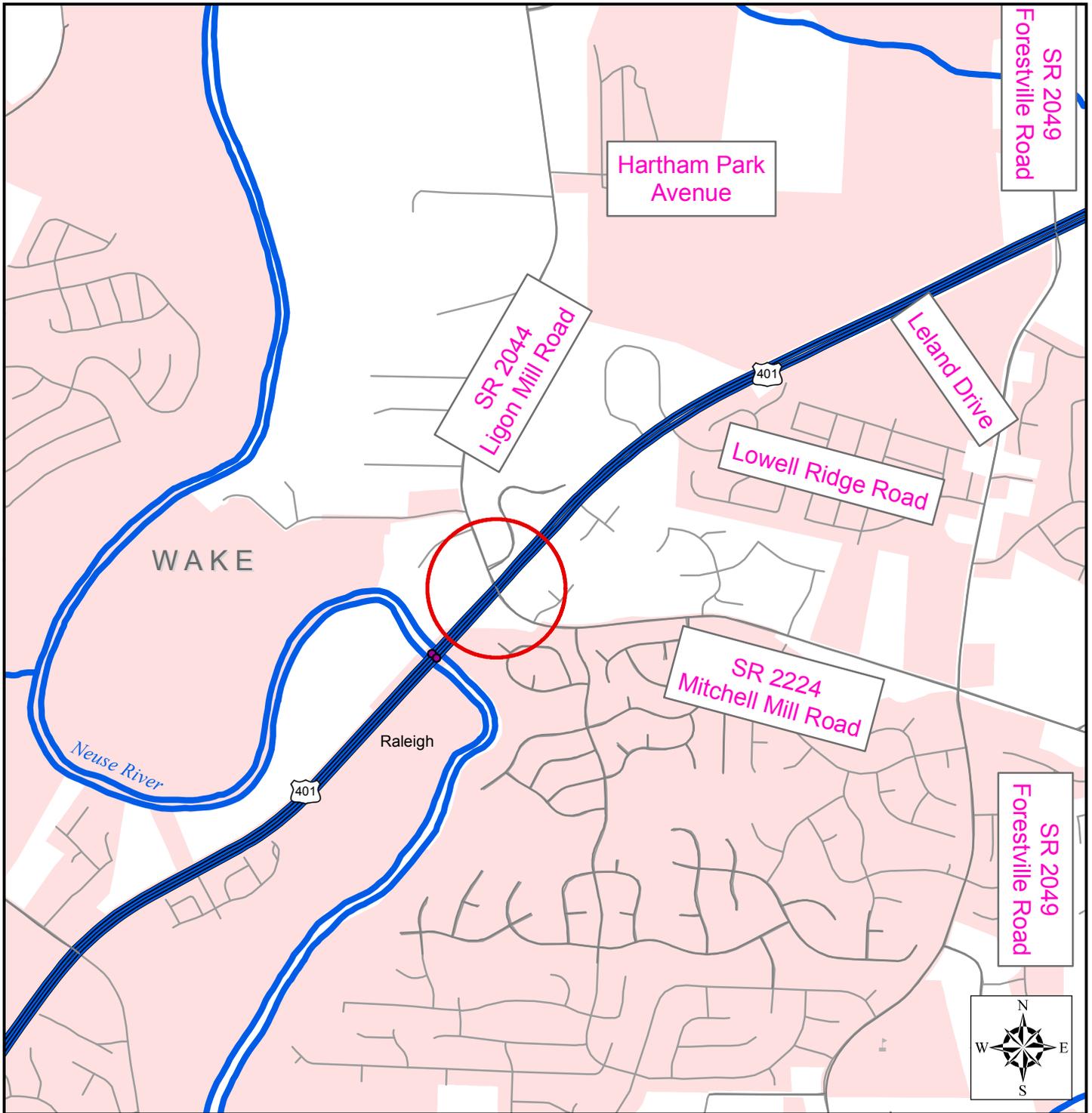
### VIII. Other Alternatives Considered

Several other alternates were discussed at the stakeholders meeting. After analyzing these alternates they were eliminated. The other alternates investigated are listed below:

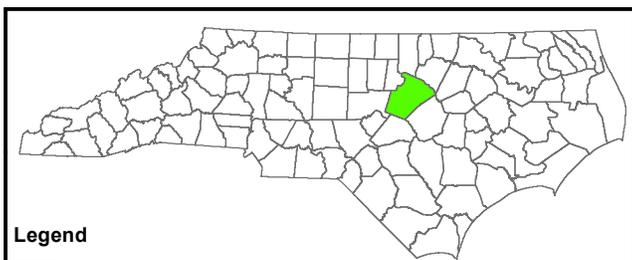
- ◆ **Half Clover Design:** The design required dual lanes on the southbound loop which did not improve the level of service for this alternate. The level of service was F in the design year so it was not fully evaluated in this study.
- ◆ **Diamond Interchange:** This design was eliminated due to a high number of left turns at the signal. The level of service was F in the design year so it was not fully evaluated in this study.

**Table 4: Existing Bridge Information**

Structure Number	Facility Carried	Feature Intersected	Structure Description	Structure Length	Vertical Clearance	Horizontal Clearance	Year Constructed	Sufficiency Rating
131	US 401 SBL	Neuse River	RC Floor / PPC Girders	299'	N/A	39.33'	2002	67.82
1021	US 401 NBL	Neuse River	RC Floor / PPC Girders	299'	N/A	39.4'	2000	67.82



— FS-1205B Project Limits



**Legend**  
■ Wake Co



STATE OF NORTH CAROLINA  
**DEPARTMENT OF TRANSPORTATION**  
 PROGRAM DEVELOPMENT BRANCH  
 FEASIBILITY STUDIES UNIT

**Figure 1: Project Location Map FS-1205B**

US 401: Interchange construction for SR 2044 (Ligon Mill Road) / SR 224 (Mitchell Mill Road)

Wake County, Division 5