

FEASIBILITY STUDY

Relocated Mason Farm Road Between NC 86 (South Columbia Street) and US 15-501 Town of Chapel Hill, Orange County

Division 7

FS-0307A



Prepared for the
Program Development Branch
North Carolina Department of Transportation

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Relocated Mason Farm Road
Between NC 86 (South Columbia Street) and US 15-501
Town of Chapel Hill, Orange County

I. General Description

This Feasibility Study describes the relocation and widening of Mason Farm Road from NC 86 (South Columbia Street) to US 15-501 adjacent to the Chapel Hill campus of the University of North Carolina. The approximate project distance is one mile. The project location is shown on *Figure 1*. As part of the study, two preliminary alternatives were developed and details of each of the two preliminary alternatives are as follows:

- **Alternative 1** – 4-lane divided typical section on 110 feet of right of way with a grade separated partial interchange at US 15-501. Alternative 1 is shown on Figure 2.
- **Alternative 2** – 4-lane divided typical section on 110 feet of right of way with a superstreet design along US 15-501. Alternative 2 is shown on Figure 3.

This study 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 costs, and to identify potential problems that may require consideration in the future planning and design phase.

II. Background

In 1997, interest in creating a new Campus Master Plan arose from concern that development at UNC was straying from its historic roots. From the outset, university leaders directed that the plan reflect the mission, spirit, and culture of the University. The new Campus Master Plan was officially released in 2001. The Plan has since been modified; once in 2003 and again in 2004.

The Town of Chapel Hill approved a Comprehensive Land Use Plan in 2000 around 12 major themes. One of the themes is “Cooperatively Plan with the University of North Carolina”. UNC and the UNC Health Care System are the Town’s largest employers and function as the local “economic engine.” However, many Chapel Hill residents are concerned about less positive impacts such as traffic and changes in neighborhoods near campus caused by institutional growth.

The Town’s Comprehensive Plan and UNC’s Master Plan were prepared concurrently providing the opportunity to reinforce the established relationship as the two plans are implemented. Input from local citizens was requested throughout the planning phase for both plans.

Existing Conditions

Mason Farm Road is a two-lane road approximately 20 feet wide and classified as a collector street in the 2030 Long Range Transportation Plan (LRTP) developed by the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization. The study area land use consists of institutional, open space, low density residential and multifamily/campus housing. The existing roadway begins at the intersection of NC 86 (South Columbia Street) and travels east for approximately 1,500 feet to an intersection with Jackson Circle where it turns to the southeast and continues for approximately 4,000 feet to an intersection with US 15-501. Currently NC 86 (South Columbia Street) is a two-lane roadway and US 15-501 is a four-lane divided roadway.

TIP Projects in the Vicinity of the Project

The proposed project intersects with NCDOT Transportation Improvement Program (TIP) project number U-0624 that involves upgrading NC 86 (South Columbia Street) to a three-lane typical section and includes bicycle and pedestrian improvements. TIP Project U-0624 is scheduled in the 2007-2013 TIP for right-of-way acquisition in fiscal year 2007 and construction beginning in fiscal year 2010.

III. Traffic and Safety

Accident Analysis

A traffic safety analysis of the existing Mason Farm Road corridor was completed to determine if the accident rate exceeds either the statewide average crash rate or the critical crash rate and is summarized in Table 2 below.

Based on the statistical analysis of accidents along the existing roadway, Mason Farm Road is currently below the statewide average for accidents in all categories when compared to similar roadways.

Table 2: Crash Analysis Years 2003-2006				
Rate	Crashes	Crashes per 100 MVM	Statewide Rate ¹	Critical Rate ²
Total	18	169.3	429.81	539.11
Fatal	0	0.00	0.93	10.50
Non-Fatal	8	75.25	139.32	203.57
Night	2	18.81	92.15	145.28
Wet	5	47.03	75.6	124.17

1. 2001-2003 Statewide Crash Rate for 2-Lane Undivided Non-System Route
2. Based on the statewide crash rate (95% level of confidence). The critical crash rate is a statistically derived value against which a calculated rate can be compared to see if the rate is far enough above an average so that something besides chance must be the cause.

Traffic Capacity Analysis

The existing Mason Farm Road includes one signalized intersection at NC 86 (South Columbia Street). Major unsignalized intersections for which traffic was provided

include the intersection of Mason Farm Road and Jackson Circle and the intersection of Mason Farm Road and US 15-501 which includes a full median opening along US 15-501. Minor intersections along Mason Farm Road with minimal traffic volumes that are not included in the analysis include Purefoy Road, Whitehead Road and Oteys Road.

Along US 15-501 a signalized intersection is located to the east of the Mason Farm Road intersection at Manning Road while an interchange serves NC 86 (South Columbia Street) traffic to the west.

2006 Existing Conditions

The existing 2006 annual daily traffic (ADT) along Mason Farm Road ranges from 900 at the US 15-501 intersection to 9,400 at the intersection with NC 86 (South Columbia Street). The existing 2006 ADT along NC 86 (South Columbia Street) ranges from 16,400 to 19,500 and the ADT along US 15-501 is 43,800 in the vicinity of Mason Farm Road. The truck traffic along Mason Farm Road and US 15-501 makes up approximately four percent of the vehicles while NC 86 (South Columbia Street) has a truck percentage rate of five percent.

The traffic operations for existing Mason Farm Road show that the roadway is currently operating at Level of Service (LOS) D near NC 86 (South Columbia Street) and at LOS A for the section near US 15-501. The signalized intersection with NC 86 (South Columbia Street) is currently operating at LOS D while the unsignalized intersection at US 15-501 is operating at LOS F (which is due to the high traffic volumes along US 15-501).

2035 No Build Scenario

The projected 2035 ADT for Mason Farm Road under the No-Build scenario ranges from 2,200 at US 15-501 to 15,300 at NC 86 (South Columbia Street). The projected 2035 ADT along NC 86 (South Columbia Street) ranges from 28,400 to 33,300 and the ADT along US 15-501 is projected to be 77,800 in the vicinity of Mason Farm Road.

The traffic operations for Mason Farm Road under the No-Build scenario show that the roadway is projected to operate at LOS D near NC 86 (South Columbia Street) and at LOS B for the section near US 15-501. The signalized intersection with NC 86 (South Columbia Street) is projected to operate at LOS F while the intersection at US 15-501 would operate at LOS F as either a signalized or unsignalized intersection.

2035 Build Alternatives

The projected 2035 ADT for Mason Farm Road for the Build Alternatives ranges from 15,400 at US 15-501 to 15,800 at NC 86 (South Columbia Street). The projected 2035 ADT along NC 86 (South Columbia Street) ranges from 28,800 to 33,300 and the ADT along US 15-501 is projected to range from 77,500 to 87,100 in the vicinity of Mason Farm Road. Additionally, for the Build Alternatives, the projected ADT on Manning Drive will be reduced from 34,600 under the No-Build scenario to 21,400 if Mason Farm is upgraded, providing relief to the already congested roadway.

The traffic operations for Mason Farm Road under Alternative 1 show that the roadway is projected to operate at LOS B for all portions of the roadway in the design year 2035.

The signalized intersection between Mason Farm Road and East Drive is projected to operate at LOS C in the design year. The signalized intersection between Mason Farm Road and NC 86 (South Columbia Street) is projected to operate at LOS F in the design year. The failing operations at this location are due to the projected traffic volumes along NC 86 (South Columbia Street) and the three-lane typical section that is proposed to be constructed under TIP Project U-0624. The traffic operations for the signalized intersections between Mason Farm Road and US 15-501 as well as the new U-turn intersections are projected to operate at LOS F in the design year. The failing operations at this location are due to projected traffic volumes along US 15-501 exceeding the capacity of the existing four-lane divided typical section. In order to provide adequate traffic operations, US 15-501 would require widening to an eight-lane divided typical section. This type of improvement is considered beyond the scope of this project and would require a future study to determine the feasibility of widening US 15-501.

The traffic operations for Mason Farm Road under Alternative 2 show that the roadway is projected to operate at LOS B for all portions of the roadway in the design year 2035. The signalized intersection between Mason Farm Road and East Drive is projected to operate at LOS C in the design year. The signalized intersection between Mason Farm Road and NC 86 (South Columbia Street) is projected to operate at LOS F in the design year. The failing operations at this location are due to the projected traffic volumes along NC 86 (South Columbia Street) and the three-lane typical section that is proposed to be constructed under TIP Project U-0624. The traffic operations for the signalized intersections between Mason Farm Road and the partial interchange ramps in the northeast and southwest quadrant are projected to operate at LOS C and LOS B, respectively. The signalized intersections between the partial interchange ramps and US 15-501 are projected to operate at LOS F in the design year. The failing operations at this location are due to projected traffic volumes along US 15-501 exceeding the capacity of the existing four-lane divided typical section. In order to provide adequate traffic operations US 15-501 would require widening to an eight-lane divided typical section. This type of improvement is considered beyond the scope of this project and would require a future study to determine the feasibility of widening US 15-501.

Table 1 - Summary of Traffic Operations

2006 Existing Conditions

Two-lane Roadways	2006 AM Peak	2006 PM Peak
Mason Farm Road - S. Columbia to East Drive	D	D
Mason Farm Road - East Drive to US 15-501	A	A
Unsignalized Intersections		
Mason Farm Road Southbound Right	C	F
Signalized Intersections		
Mason Farm Road at South Columbia Street	D	D

2035 No-Build Scenario

Two-lane Roadways	2035 AM Peak	2035 PM Peak
Mason Farm Road - S. Columbia to East Drive	D	D
Mason Farm Road - East Drive to US 15-501	B	B
Signalized Intersections		
Mason Farm Road at South Columbia Street	F	F
Mason Farm Road at US 15-501	F	F

2035 Build Alternatives

Multi-lane Roadways	2035 AM Peak	2035 PM Peak
East Drive - S. Columbia to Mason Farm Road	B	B
Mason Farm Road - East Drive to US 15-501	B	B
Signalized Intersections		
Common to All Alternatives		
East Drive at South Columbia Street	F	F
East Drive at Mason Farm Road	C	C

US 15-501 Alternative 1 - Partial Interchange

4/6/8-Lane US 15/501*

	2035 AM Peak	2035 PM Peak
US 15/501 at Loop C	F/F/C	F/E/B
US 15/501 at Loop A	F/C/A	F/E/C
Loop A at Mason Farm Road	B/B/B	C/C/C
Loop C at Mason Farm Road	A/A/A	B/B/B

US 15-501 Alternative 2 - Superstreet Design

4/6/8-Lane US 15/501*

	2035 AM Peak	2035 PM Peak
US 15/501 at Westbound U-turn	F/F/B	F/D/B
US 15/501 at Mason Farm Road	F/E/B	F/F/E
US 15/501 at Westbound U-turn	F/C/A	F/D/A

* Analysis with a four, six or eight-lane typical section on US 15/501

IV. Description of Alternatives

Alternative 1

Alternative 1, shown in Figure 2, is a 4-lane divided typical section on 110 feet of right of way with a grade separated partial interchange at US 15-501. The proposed design includes the relocation and widening to four-lanes of existing Mason Farm Road to the south in the vicinity of the NC 86 (South Columbia Street) intersection. The relocated roadway ties to existing East Drive to form a loop roadway and Mason Farm Road turns to the southeast at a three leg intersection. From the intersection of East Drive, Mason Farm Road will be widened from the existing two-lane typical section to a four-lane divided typical section and will utilize a best-fit alignment to minimize impacts along the roadway. One major Y-line relocation will be required to accommodate Baity Hill Drive due to the location of the proposed ramp for the partial interchange.

Alternative 1 includes a grade separated partial interchange at US 15-501 that takes Mason Farm Road over US 15/501. The alignment of the crossing of US 15-501 is located approximately 600 feet west of the existing intersection location. The partial interchange consists of two-way ramps in the northeast and southwest quadrants that provide right-in/right-out movements at US 15-501. The proposed design will require the closing of two intersections along US 15-501. The Oteys Road intersection will become a cul-de-sac near US 15-501 to eliminate through traffic within the residential area along Oteys Road, and the intersection of Kings Mill Road will be eliminated due to the location of the ramp in the southwest quadrant and the difference in elevation between the grade separation over US 15-501 and the existing roadway. This elimination of access will force vehicles to use the existing intersection at Manning Drive to access US 15-501.

There are three (3) residences and no (0) businesses expected to be relocated under this alternative.

The total cost of this alternative, including construction and right-of-way, is estimated to be \$34,400,000.

Construction.....	\$ 12,000,000
Right-of-Way.....	\$ 22,400,000

Total Project Cost (Alternative 1).....	\$ 34,400,000
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Alternative 1 will also include both pedestrian and bicycle improvements along the entire length of Mason Farm Road. The pedestrian and bicycle improvements would connect to an existing sidewalk at NC 86 (South Columbia Street) and to an off-road path proposed in the *Chapel Hill Bicycle and Pedestrian Action Plan* along the north side of US 15-501. Pedestrian facilities will be provided with a five-foot wide sidewalk along both sides of the roadway. Bicycle access will be provided with a five-foot wide striped bike lane along both directions of the roadway. It is possible that the bicycle lane may be reduced

to only include a wider (14-foot) outside lane in later planning and design stages. The cost savings for the reduced bicycle lane would be approximately \$210,000.

Alternative 2

Alternative 2, shown in Figure 3, is a 4-lane divided typical section on 110 feet of right of way with a superstreet design along US 15-501. The proposed design for Alternative 2 is identical to Alternative 1 west of Oteys Road.

Alternative 2 includes an at-grade signalized intersection between US 15-501 and Mason Farm Road. The intersection location requires a relocation of Mason Farm Road approximately 600 feet to the west of the existing location and will tie to US 15-501 opposite the existing intersection of Kings Mill Road. To accommodate the superstreet design the intersection includes right-in/right-out movements from Mason Farm Road and Kings Mill Road to US 15-501 with directional left-turn movements from US 15-501 to Mason Farm Road and Kings Mill Road. Two new signalized intersections would be constructed along US 15-501 to accommodate the U-turn movements and would be located approximately 900 feet to the east and west of the Mason Farm Road intersection. The U-turn movements will require the construction of U-turn bulbs along US 15-501 to accommodate U-turn for tractor trailers. The proposed design will require the closing of the Oteys Road intersection with US 15-501, which will become a cul-de-sac as it approaches US 15-501 to eliminate through traffic within the residential area.

There is one (1) residence and no (0) businesses expected to be relocated under this alternative.

The total cost of this alternative, including construction and right-of-way, is estimated to be \$23,100,000.

Construction.....	\$ 9,200,000
Right-of-Way.....	\$ 13,900,000
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Total Project Cost (Alternative 2).....	\$ 23,100,000

Identical to Alternative 1, Alternative 2 will include both pedestrian and bicycle improvements along the entire length of Mason Farm Road. The pedestrian and bicycle improvements would connect to an existing sidewalk at NC 86 (South Columbia Street) and to an off-road path proposed in the *Chapel Hill Bicycle and Pedestrian Action Plan* along the north side of US 15-501. Pedestrian facilities will be provided with a five-foot wide sidewalk along both sides of the roadway. Bicycle access will be provided with a five-foot wide striped bike lane along both directions of the roadway. It is possible that the bicycle lane may be reduced to only include a wider (14-foot) outside lane in later planning and design stages. The cost savings for the reduced bicycle lane would be approximately \$210,000.

V. Community Issues

Existing Land Use

The existing land use throughout the study area is predominantly institutional with pockets of low density residential (1-4 units/acre) and open space designated areas. There are no state, county or municipal parks located directly in the study area.

Schools and Facilities

University of North Carolina – Chapel Hill

Mason Farm Road lies south of the central campus and immediately adjacent to the University of North Carolina at Chapel Hill (UNC). The current system enrollment at UNC totals approximately 24,000 students. In general, Central Campus is 730 acres in size and is located southeast of the Town of Chapel Hill. The proposed project lies adjacent to the UNC Medical Complex which is known as the Nation's most complete academic medical center.

Various residence dormitories also lie adjacent to existing Mason Farm Road including a recent construction project near the intersection of Mason Farm Road and NC 15/501. Baity Hill and Mason Farm student family communities were constructed for student families.

The Chapel Hill Kehillah

Located immediately adjacent and to the south of Mason Farm Road at Purfefoy Road is the Chapel Hill Kehillah. The Kehillah was established in 1989 as a center for Jewish life in Chapel Hill.

Historic Resources

There are a number of mid twentieth-century historic resources inventoried as part of a preliminary study completed by the State Historic Preservation Office (SHPO). A full study to determine eligibility was never funded. The resources that fall within the proposed study area for FS-0307A are as follows:

Mason Farm Road (OR-1656) – This multiple-property survey form summarily records four houses on Mason Farm Road and one on White Circle.

- 1301 Mason Farm Road (c. 1940)
- 1303 Mason Farm Road (c. 1940)
- 1306 Mason Farm Road (c. 1955)
- 1506 Mason Farm Road (c. 1965)
- 400 Whitehead Circle (c. 1955)

Whitehead Circle (No survey number) – This multiple-property survey form includes summary information on five potentially significant Modernist residences.

- 407 Whitehead Circle – Joseph L. and Pearl Morrison House (c. 1952 Jim Webb architect)

- 410 Whitehead Circle – Kai and Mary J. Jurgenson House (c. 1956 – Don Stewart architect)
- 412 Whitehead Circle – William C. and Ida H. Friday House (c. 1953 – Jim Webb and Don Stewart architects)
- 418 Whitehead Circle – Walter and Mary D. Spearman House (c. 1948 – Jim Webb and Don Stewart architects)
- 419 Whitehead Circle – Alex and Betty W. McMahan House (c. 1953 – Jim Webb architect)

Miscellaneous potentially significant homes

- 408 Morgan Creek Road – Dr. C. G. Thomas House (c. 1953 Terry Waugh architect)
- 613 Morgan Creek Road – Dean Smith House (c. 1950s)
- 618 Morgan Creek Road – Dr. Isaac and Gertrude Taylor House (c. 1955 – John Lattimer architect)
- 640 Morgan Creek Road – Ellis Rollett House (c. 1950s)
- 700 Morgan Creek Road – John and Nina Sessions House (c. 1956 Don Stewart architect)
- 903 Coker Drive – Bowers-Nelson House (c. 1960 Jim Webb and Don Stewart architects)
- 1503 Baity Hill Drive – Herman and Elizabeth Baity House (c. 1930)
- 106 Purefoy Road – Community Church of Chapel Hill (c. 1957 George Matsumoto architect)

Archaeological Resources

Several study sites within the proposed project study area have been investigated and documented by the Office of State Archaeology (OSA).

- CH 03-2499 (04-E-6020-0062) – Project to replace Odum Village with student family housing, cleared by OSA 10/14/03.
- ER-91-7119 – UNC Ambulatory Care Facility Borrow Pit., project cancelled 03/04/92 (No further study).
- 90-E-6020-0715 – Project to construct UNC Ambulatory Care Facility, project cancelled 03/04/92 (No further study).
- 31-OR-3 – Miscellaneous collection site near intersection of US 15-501 and Mason Farm Road contained projectile points, axes, crude blades and scrapers.

These issues will need to be further investigated and addressed in later planning and design stages.

VI. Natural Environment Issues

A detailed environmental study was not conducted for this feasibility study. Geographic Information System (GIS) level research and a preliminary site review were completed. Figure 4 shows the location of documented natural resources within and near the project study area.

Water Resources

Intermittent headwaters to Morgan Creek occur south of US 15/501 within the project study area. Morgan Creek is a tributary to Jordan Lake and is considered a “sensitive” resource. Morgan Creek Bluffs, located south of the project study area, is noted as a significant natural heritage areas by the NC Natural Heritage Program (NHP).

No jurisdictional “Waters of the US,” mapped floodplains, or mapped floodway areas are documented within the study area.

Protected Species

The NHP lists one protected species occurrence in the proposed project study area. A historic occurrence of a Federal Species of Concern (FSC), *Monotropsis odorata* (Sweet pinesap), a perennial flowering species of plant, was recorded east of existing Mason Farm Road at Hibbard Drive.

Permits

Permits from the US Army Corps of Engineers (USACE) Regulatory Division, the North Carolina Department of Natural Resources; Division of Water Quality (DWQ) and Division of Land Resources (DLR) may be required. Final determinations regarding permit applicability will be made after detailed studies are complete.

In addition, coordination with the US Fish and Wildlife Service (USFWS) and the North Carolina Wildlife Resources Commission (WRC) may also be required if natural resources warranting additional coordination are located within the project study area after further field review.

VII. Recommendations

Alternative 1

The analysis of Alternative 1 showed that it would require additional relocations and would have a higher construction cost. Additionally, the traffic operations were only slightly better than for Alternative 2. Based on the limited benefit of providing a partial interchange and the higher costs and number of relocations, this alternative is not recommended as the preferred option.

Alternative 2

The analysis of Alternative 2 showed that it would lower impacts to the human environment and would be a less expensive option than Alternative 1. The traffic operations for Alternative 2 showed that the operations would be similar to Alternative 1.

Thus with similar improvements and traffic operations and safety, Alternative 2 would be the preferred option for the relocation and widening of Mason farm Road.

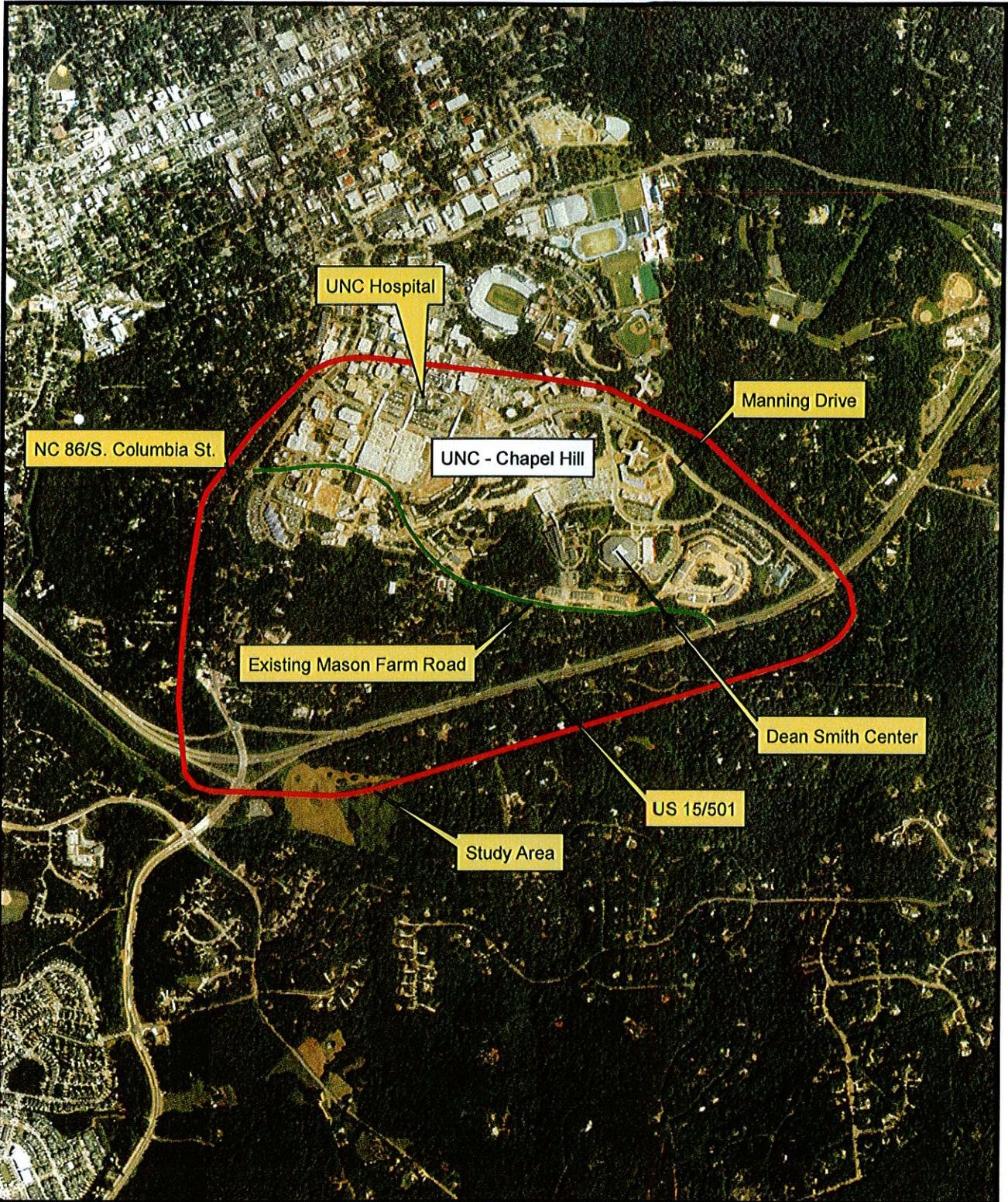
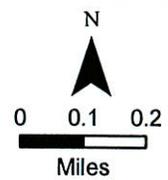
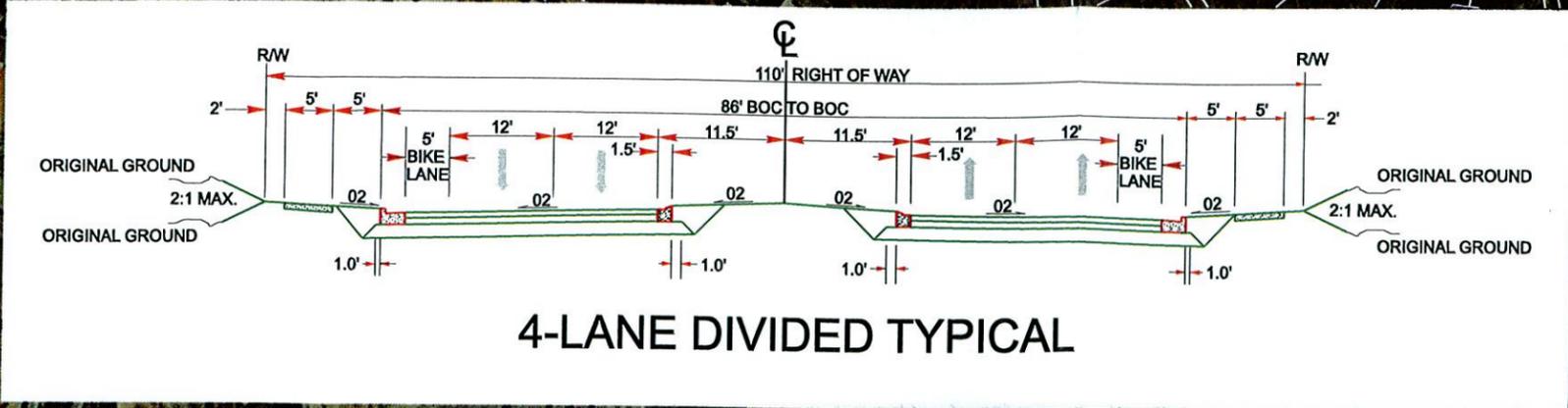
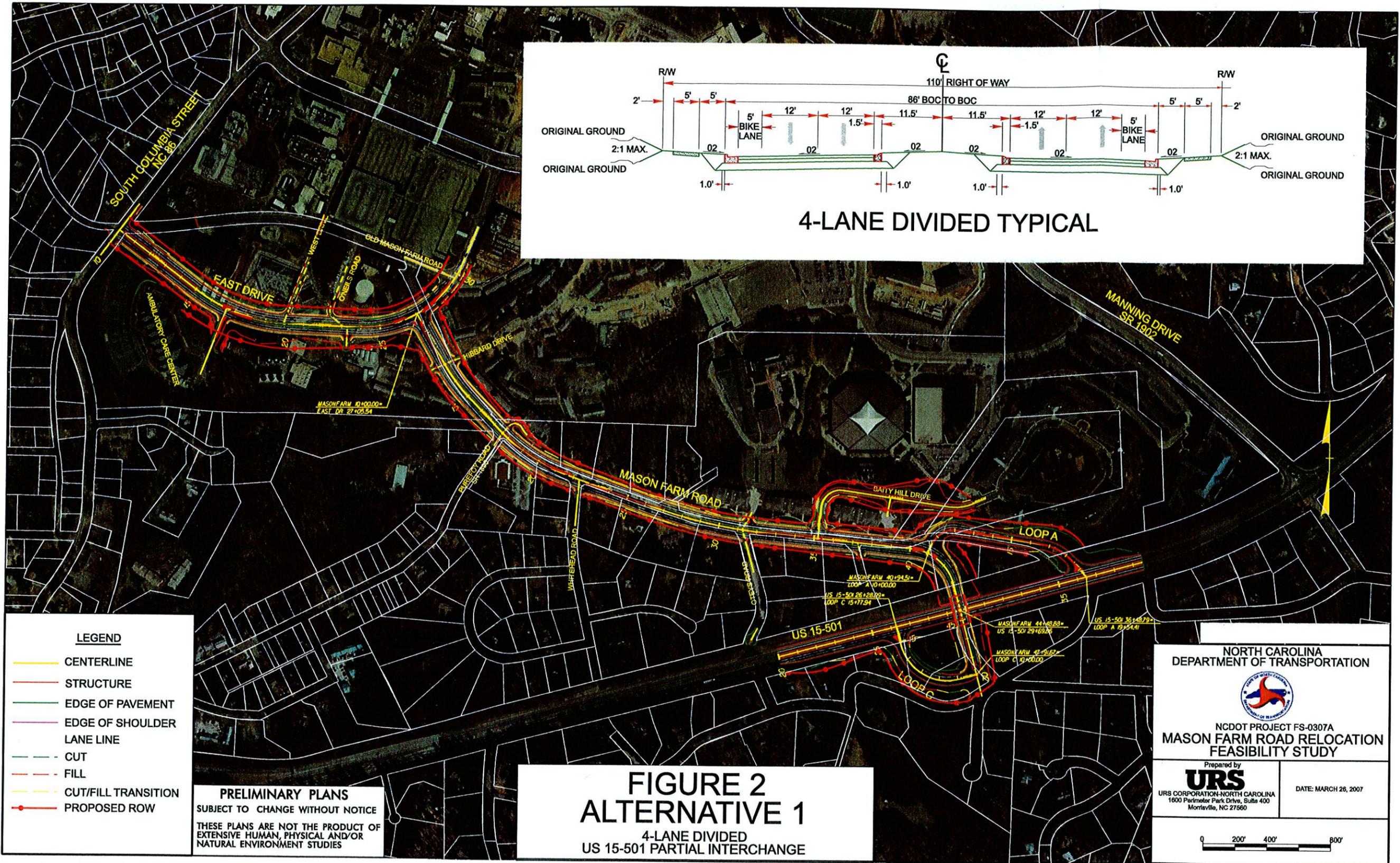


Figure 1. Location Map for FS-0307A, Relocation of Mason Farm Road Between NC 86 (South Columbia Street) and US 15-501 in Chapel Hill, Orange County, North Carolina





- LEGEND**
- CENTERLINE
 - STRUCTURE
 - EDGE OF PAVEMENT
 - EDGE OF SHOULDER
 - LANE LINE
 - - - CUT
 - - - FILL
 - - - CUT/FILL TRANSITION
 - PROPOSED ROW

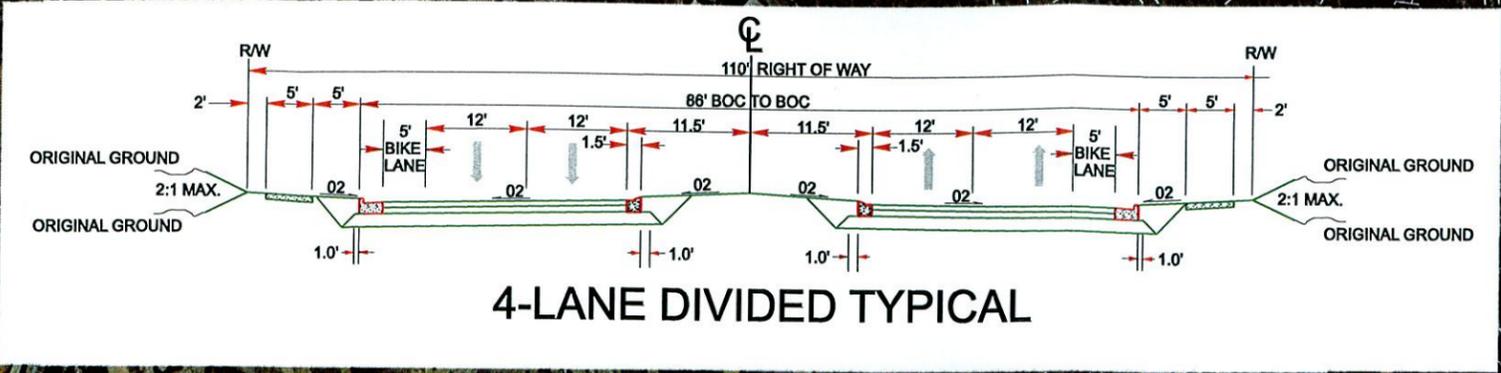
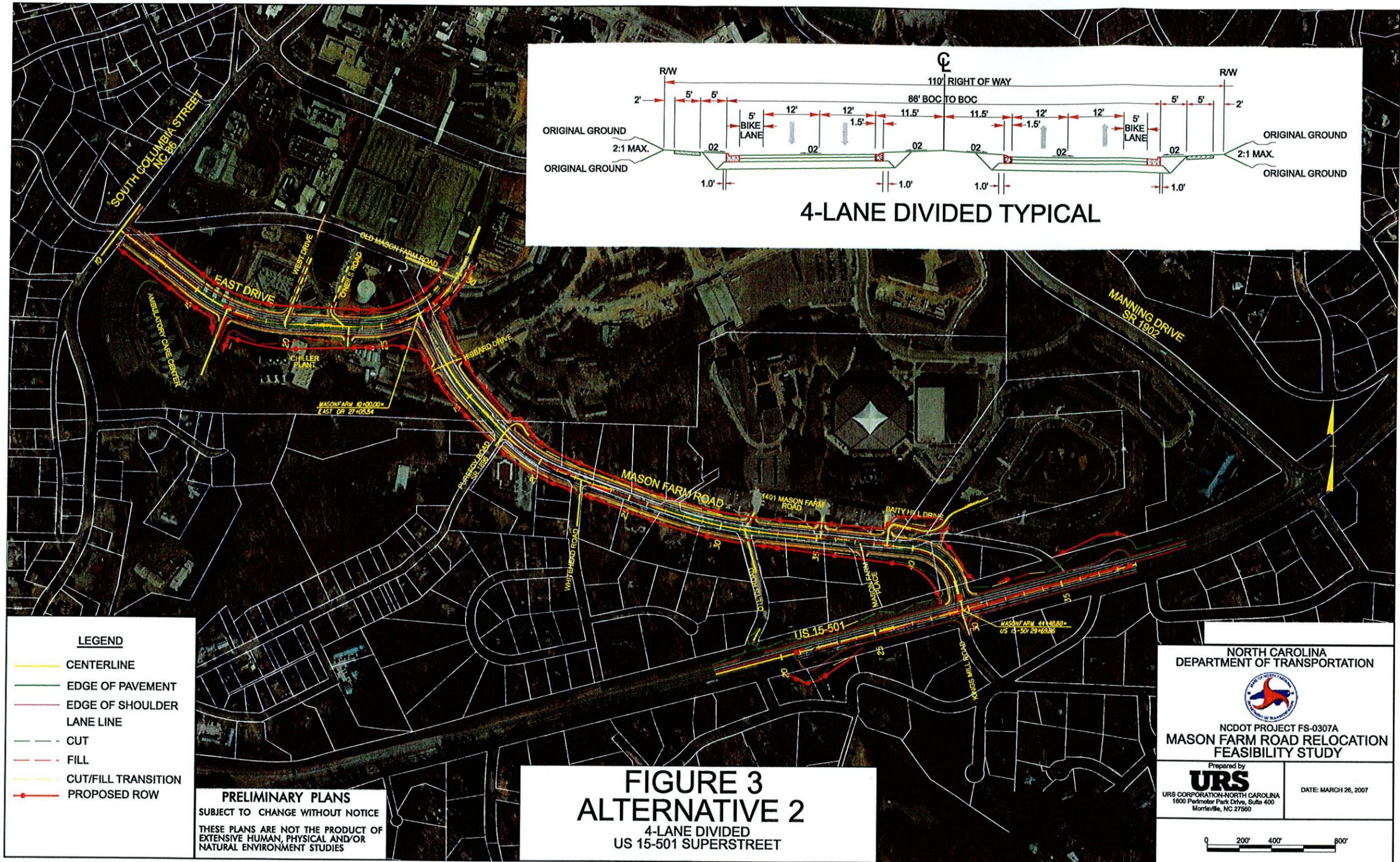
PRELIMINARY PLANS
 SUBJECT TO CHANGE WITHOUT NOTICE
 THESE PLANS ARE NOT THE PRODUCT OF
 EXTENSIVE HUMAN, PHYSICAL AND/OR
 NATURAL ENVIRONMENT STUDIES

FIGURE 2
ALTERNATIVE 1
 4-LANE DIVIDED
 US 15-501 PARTIAL INTERCHANGE

NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION

 NCDOT PROJECT FS-0307A
**MASON FARM ROAD RELOCATION
 FEASIBILITY STUDY**
 Prepared by
URS
 URS CORPORATION-NORTH CAROLINA
 1800 Perimeter Park Drive, Suite 400
 Morrisville, NC 27560
 DATE: MARCH 26, 2007





- LEGEND**
- CENTERLINE
 - EDGE OF PAVEMENT
 - EDGE OF SHOULDER
 - LANE LINE
 - - - CUT
 - - - FILL
 - - - CUT/FILL TRANSITION
 - PROPOSED ROW

PRELIMINARY PLANS
 SUBJECT TO CHANGE WITHOUT NOTICE
 THESE PLANS ARE NOT THE PRODUCT OF
 EXTENSIVE HUMAN, PHYSICAL AND/OR
 NATURAL ENVIRONMENT STUDIES

FIGURE 3
ALTERNATIVE 2
 4-LANE DIVIDED
 US 15-501 SUPERSTREET

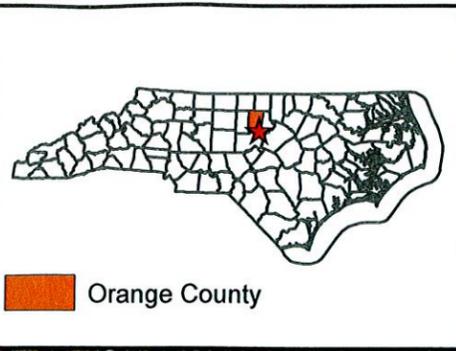
NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION

NCDOT PROJECT FS-0307A
**MASON FARM ROAD RELOCATION
 FEASIBILITY STUDY**

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DATE: MARCH 26, 2007





Orange County

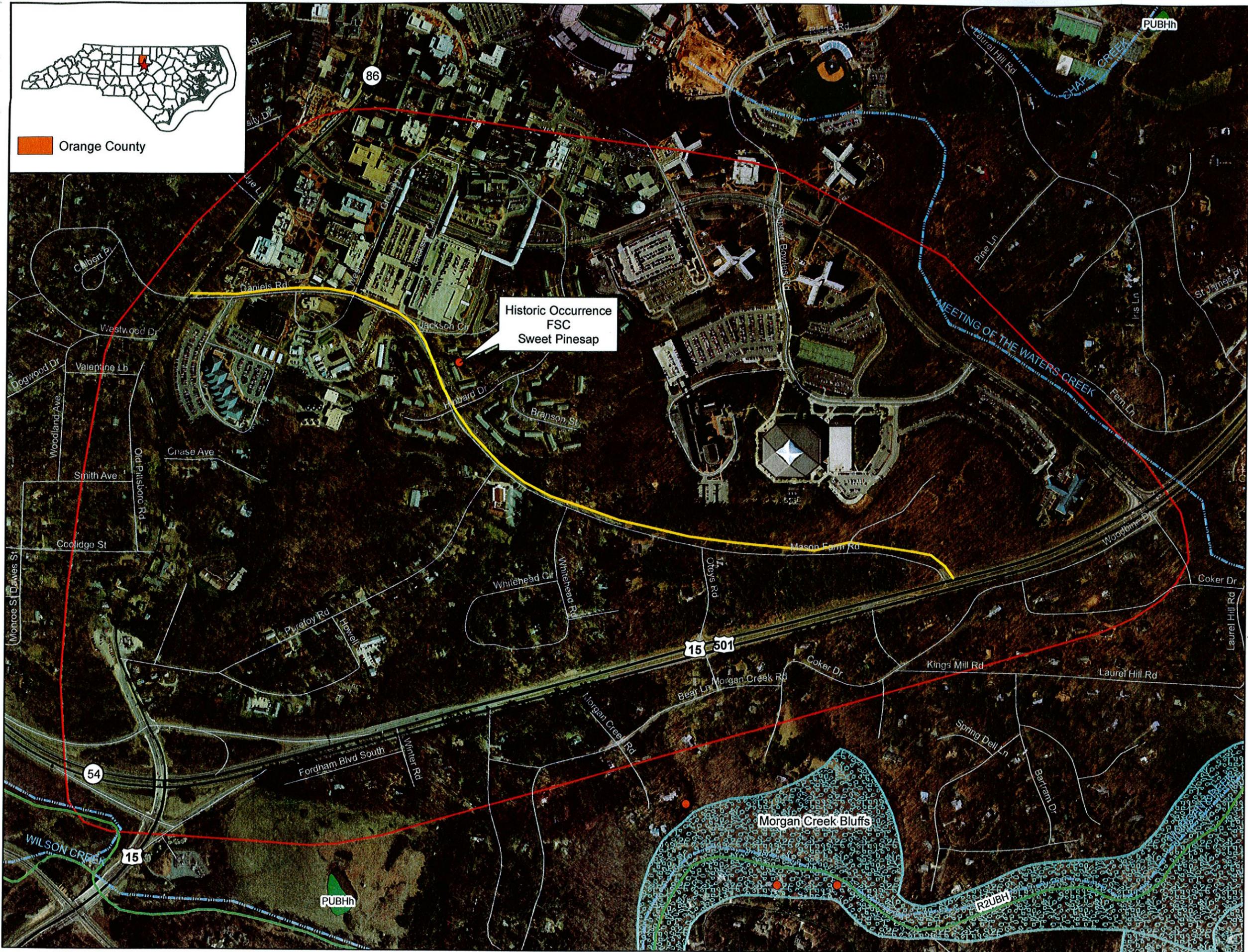


North Carolina
Department of
Transportation

Figure 4
Relocated Mason Farm
Road Feasibility Study
between NC 86 (South
Columbia Street) and
US 15-501
Orange County
FS-0307A

Legend

- Study Area
- Mason Farm Road
- US Route
- State Route
- NC Route
- Local Route
- Streams
- NWI Wetlands
- NHP Element Occurrence
- Significant Natural Heritage Area



0 250 500 1,000
Feet