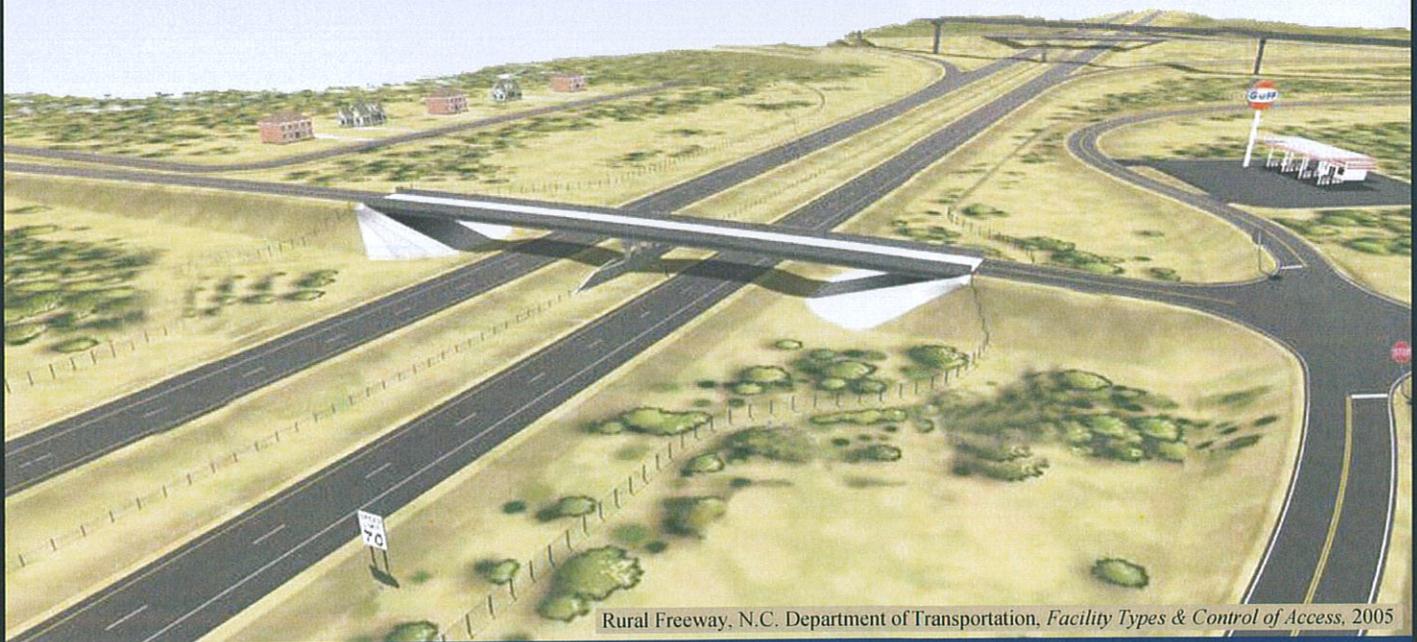


FEASIBILITY STUDY FS-1106B



UPGRADE US 74 TO INTERSTATE STANDARDS
FROM NC 41 IN LUMBERTON
TO SR 1585 (UNION VALLEY ROAD) IN WHITEVILLE
COLUMBUS AND ROBESON COUNTIES
DIVISION 6

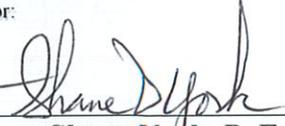


Rural Freeway, N.C. Department of Transportation, *Facility Types & Control of Access*, 2005



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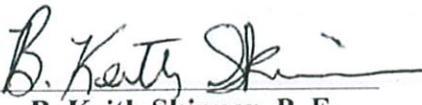

Derrick W. Lewis, P. E.
Feasibility Studies Unit Head
Program Development Branch - N.C. Department of Transportation - Raleigh, NC 27601

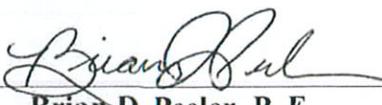

Shane York, P. E.
Feasibility Studies Engineer

5/22/2014
Date

www.ncdot.gov

Prepared By:

 
B. Keith Skinner, P. E.
Director, Transportation


Brian D. Peeler, P. E.
Senior Project Engineer

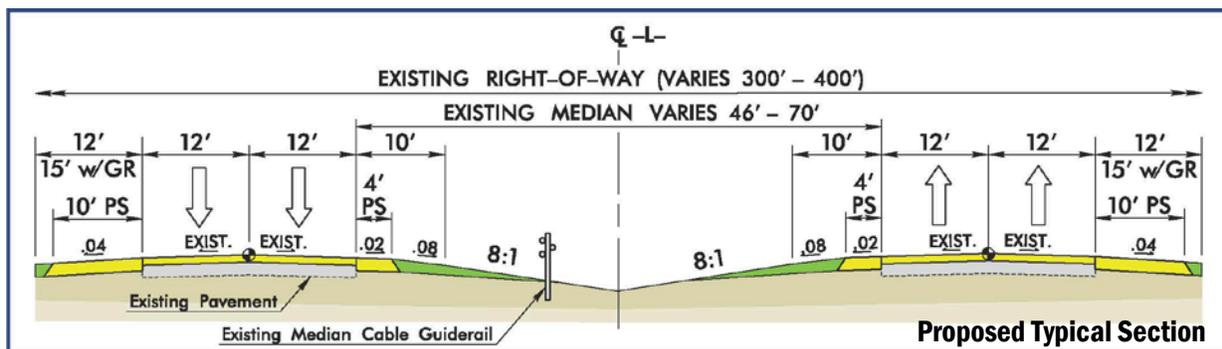
5/22/2014
Date

Rummel, Klepper & Kahl, LLP - Raleigh, NC 27609 www.rkk.com

I - GENERAL DESCRIPTION

This feasibility study addresses upgrading 25 miles of US 74 from NC 41 in Lumberton, Robeson County to SR 1585 (Union Valley Road) just west of Whiteville, Columbus County. This section of US 74 is part of future Interstate 74. It is also a Strategic Highway Corridor throughout Robeson and Columbus Counties. The project is located within the Lumber River RPO^[1] and Cape Fear RPO^[2] areas. The project includes a crossing of the Lumber River at the county line. The planning level Purpose and Need is to upgrade the facility to interstate standards, extend the existing I-74 corridor and improve regional mobility and safety.

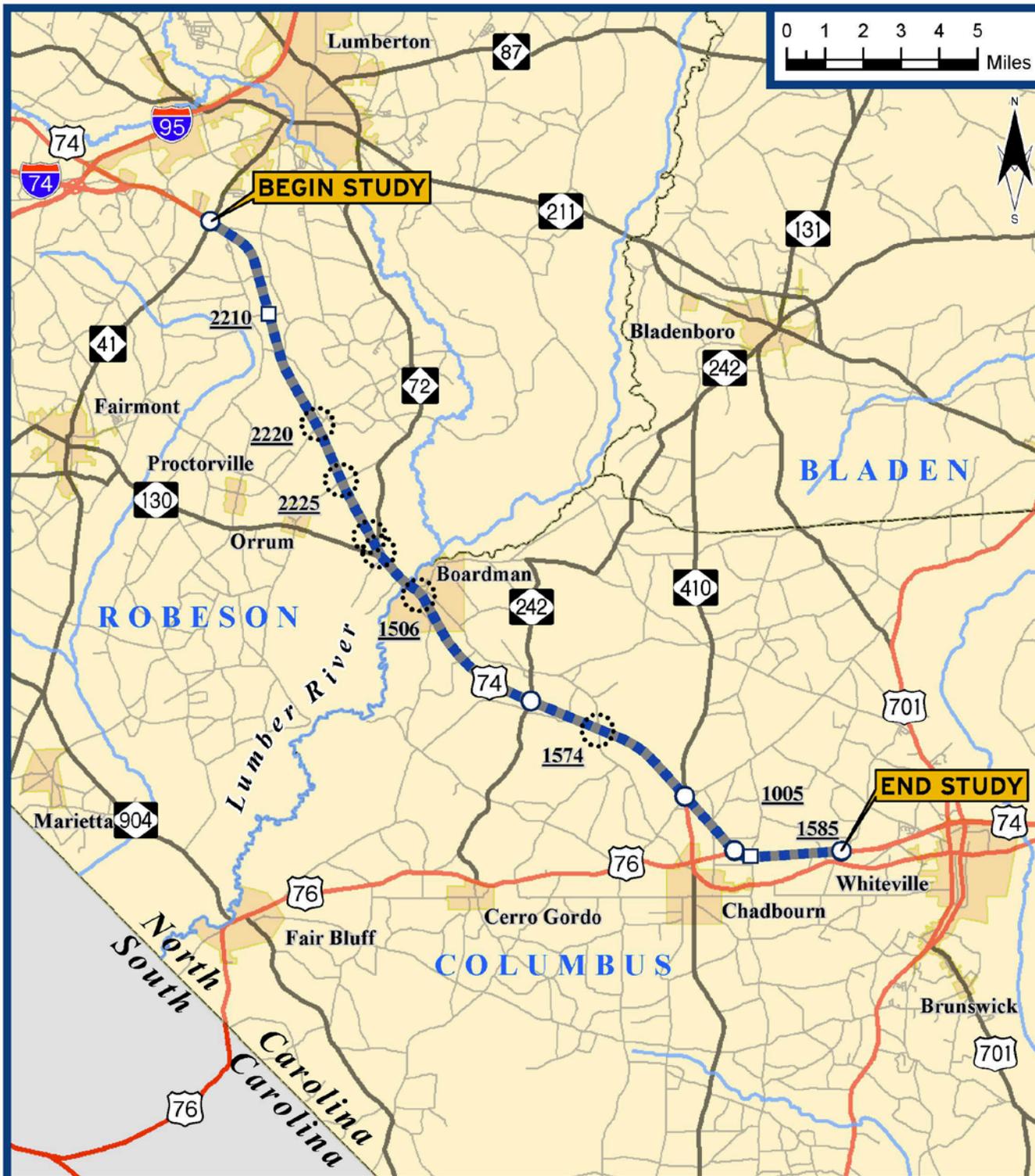
There are three main types of improvements needed to bring this section of US 74 up to interstate standards: 1) Paved Shoulders, 2) Intersections and 3) Service Roads (where needed). Please refer to the **Figure 1 Project Location Map** on page 2. As seen on Figure 1, this section of US 74 includes six major existing at-grade intersections that need full control of access and grade separation. Four of the at-grade intersections are located near the Proctorville and Orrum communities in Robeson County, and are referred to as the “Two-Towns” district in this report. The remaining two existing at-grade intersections are in Columbus County; one on the east side of the Lumber River in the town of Boardman and one at SR 1574 (Old US 74). The existing posted speed limit is 60 mph from SR 2220 (N. Broadridge Rd.) in Robeson County to SR 1574 in Columbus County and is 70 mph elsewhere.



The **Proposed Typical Section** (as seen above) is a four-lane divided freeway with a median varying from 46 to 70 feet, 12-foot travel lanes, 10-foot full-depth outside and 4-foot full-depth inside paved shoulders, and full control-of-access within a minimum state-maintained right-of-way of 300 feet. The required median cable guiderail has been provided by Division hazard elimination projects W-5206R & S.

It should be noted that a Feasibility Study is a preliminary document that is the initial step in the planning and design process for a candidate project and not the product of exhaustive environmental or design investigations. The purpose of the study is to describe the proposed project including cost, and identify potential problems that may require consideration in the planning and design phases.

Once a candidate project is identified for funding in the TIP, the Feasibility Study is followed by a rigorous planning and design process that meets the requirements of the National Environmental Policy Act (NEPA), where either an Environmental Impact Statement (EIS) or an Environmental Assessment (EA) is done.



Legend

- Existing Needs Improvement
- Existing Grade Separation
- Existing Interchange
- Intersection Needs Improvement

PREPARED FOR:
 PROGRAM DEVELOPMENT BRANCH
 N.C. DEPT. OF TRANSPORTATION
 RALEIGH, NORTH CAROLINA
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PREPARED BY:



FIGURE 1

**FS-1106B
 PROJECT LOCATION MAP**

UPGRADE US 74 to INTERSTATE
 NC 41 in LUMBERTON
 to SR 1585 in WHITEVILLE
 COLUMBUS AND ROBESON COUNTIES



II - BACKGROUND

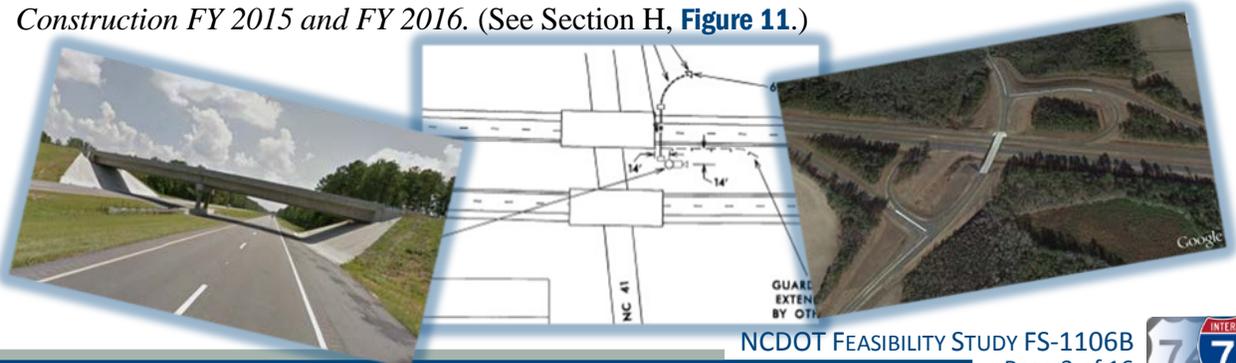
Improvements considered in this study are generated by the need to accommodate future Interstate 74 in Robeson and Columbus Counties. The National Highway System's "High Priority Corridor 5" (also referred to as the "I-73/74 North/South Corridor") is defined by federal law in SEC. 1105. HIGH PRIORITY CORRIDORS ON NATIONAL HIGHWAY SYSTEM as traveling from Georgetown, South Carolina to Sault Ste. Marie, Michigan^[3]. South Carolina and North Carolina have built sections of the corridor and Virginia has plans to build part of the corridor. In North Carolina the corridor is described as generally following US 220 near Randleman to US 74 near Rockingham; US 74 from Rockingham to US 76 near Whiteville; and then east and south to the state line in Brunswick County.

The primary existing routes serving the Lumber River region in Robeson and Columbus Counties are US 74 and US 76. US 74 is part of the Intrastate Highway System and is an east-west corridor that has vital importance to southeastern NC. The highway connects Charlotte and Wilmington and carries a significant volume of commercial truck traffic (17% to 22% on this segment). US 74 also provides a link from I-85 in the southern Piedmont to I-95 in the coastal plain. It is designated as a Strategic Highway Corridor and is shown as future interstate on the Vision Plan^[4]. This route also serves as a Hurricane Evacuation Route for the coastal region. Several freeway segments of the future I-74 have been completed from US 74 west of Rockingham to NC 41 south of Lumberton. Land use within the study area is largely rural and agricultural, with some residential, and a few industrial, commercial and institutional uses.

ADJACENT PROJECTS

Several projects from the State Transportation Improvement Program (STIP) along the study corridor have or will help bring US 74 to interstate standards and are highlighted below^[5]:

- TIP project W-4704: Construct SR 2210 grade separation. *Completed 2009*. See **Figure 2**.
- TIP project R-4900: Construct US 74 interchange at NC 242. *Completed 2009*. See **Figure 10**.
- TIP projects W-5206R & S: Install median cable guiderail from east of NC 41 to the County Line, and from the County Line to US 76 (-L- Sta. 39+00 to 1198+00 +/-). *Completed 2012, 2013*.
- WBS 34601.3.7: ITS installation; i.e. DMS, CCTV. *Completed*. See **Figures 1 & 15**.
- TIP R-5510, R-5511: Resurface US 74, from east of NC 41 to the County Line, and from the County Line to US 76 (-L- Sta. 39+00 to 1198+00 +/-). *Ongoing*.
- TIP project W-5518: US 74 at SR 1574 (Old US 74). Construct grade separation overpass. *R/W and Construction FY 2015 and FY 2016*. (See Section H, **Figure 11**.)



III - TRAFFIC AND SAFETY

These analyses are preliminary and should be examined in greater detail in the subsequent stages of the project. The levels of service (LOS) given below reflect results of future year analyses.

Base year 2012 and future year 2035 traffic forecasts for the annual average daily traffic (AADT) were provided by the NCDOT Transportation Planning Branch and are primarily based on traffic counts taken for the forecast and historic trends. Based on information provided by County Planning Directors, there are currently no specific plans for development that would significantly affect traffic in the project area. As US 74 is upgraded to interstate and the Port of Wilmington continues to generate trips, truck activity will slightly increase as well. Traffic forecast diagrams can be found in [Appendix A](#).

The predicted AADT ranges from 14,500 to 19,400 vehicles per day (vpd) in future year 2035. Trucks are estimated to comprise up to 22% (4% Duals and 18% TTST's) of the total traffic. The highest volumes along the corridor occur near the Lumber River and at the US 76 junction near Whiteville. All freeway segments, AM and PM peak hours, are anticipated to operate at a **LOS A** in future year 2035. All proposed interchanges (ramps and unsignalized intersections) are anticipated to operate at a **LOS A** in future year 2035 as well. Analysis results can be found in [Appendix A](#). After a review of the potential weaving conditions on this project, it does not appear as though any interchanges will be spaced close enough to warrant a continuous auxiliary lane between them.

Traffic analyses in this report are based on the Highway Capacity Manual and NCDOT Analysis Guidelines. Synchro and HCS software were used to analyze traffic components. The selection and use of traffic control devices should be based on an engineering study of traffic conditions and physical characteristics of the location. The engineering study will be required in the subsequent stages of the project.

SAFETY

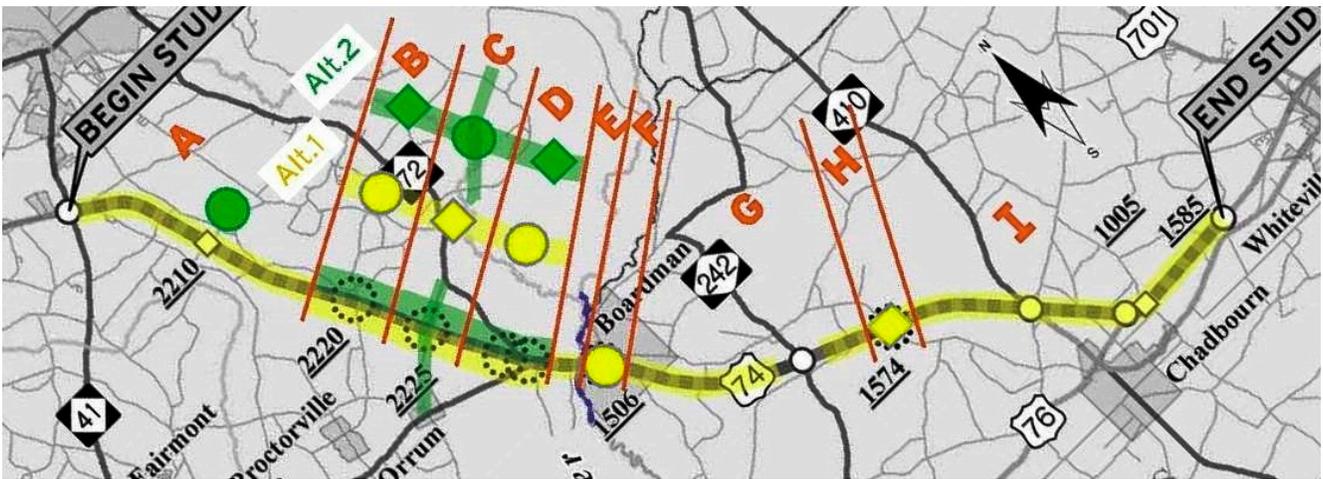
Based on the crash data and analysis provided by the Traffic Safety Unit, the US 74 2010 AADT was estimated at 10,600 vpd and equates to a total vehicle exposure rate of 294.59 million vehicle miles traveled (MVMT). A total of 230 crashes were reported along this section of US 74 between May 1, 2009 to April 30, 2012; resulting in a crash rate of 78.08 crashes per 100 MVMT. The crash rates for the analyzed section were compared with the 2008-2010 statewide crash rates for 4-lane divided Rural US routes with partial control-of-access. Crash Rates exceed the statewide crash rates in the Night and Wet categories only. It is anticipated that removing the at-grade intersections will have a significant effect on the crash rates and could reduce crashes by as much as a 20-25%.



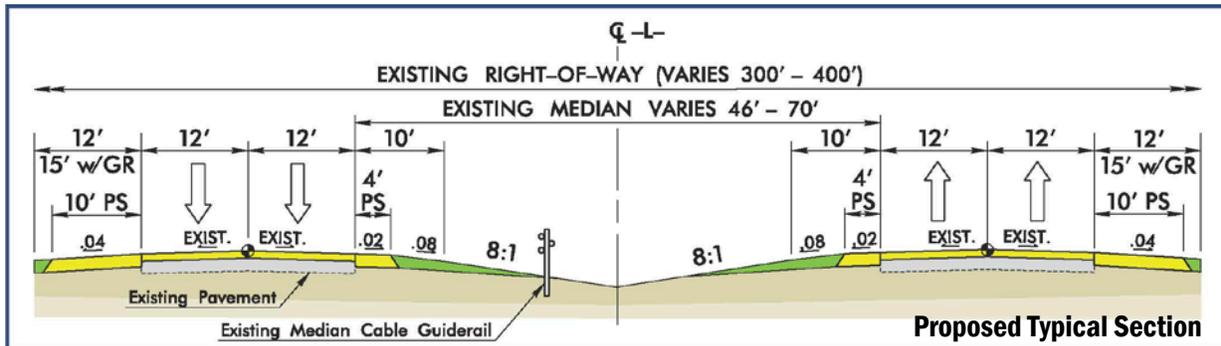
According to the Work Zone Safety and Mobility Policy this will be a non-significant project (Level 3 Activity). Analysis in the subsequent stages of the project is needed to ensure that work zone impacts are identified and traffic management strategies are initiated. The need for bicycle and pedestrian accommodations in the work zone shall be assessed during the subsequent planning stages of the project.

IV - DESCRIPTION OF ALTERNATIVES

The studied alternatives include proposed improvements to upgrade US 74 to interstate standards. The 25-mile project has been divided into sections and alternatives based on the existing at-grade intersection locations and potential project breaks. **Figures 2 thru 15** show the studied alternatives and sections. Section names and breaks can be found along the bottom border of the **Figures**. An overall project section/alternative map key can be seen here:



The proposed typical section for all of the alternatives, as described on page 1, is a four-lane divided freeway with a median varying from 46 to 70 feet, 12-foot travel lanes, 10-foot full-depth outside and 4-foot full-depth inside paved shoulders, and full control-of-access within a minimum state-maintained right-of-way of 300 feet.



Various service roads may be needed for local access with implementation of full control-of-access. Costs for known service road needs in Sections D, E and F (**Figures 5, 7 and 8**) have been included below. Detailed service road studies should be performed in the subsequent phases of the project.

NOTE: The ITS and utility construction costs are included in the construction costs listed below. The estimated human and natural environment impacts are based on available Geographic Information System (GIS) data from Robeson and Columbus Counties. The NC Center for Geographic Information and Analysis (CGIA) provided the USGS Hydrology (2003) and NC OneMap the statewide orthophotography (2010-2013).

SECTION A: US 74 FROM NC 41 TO WEST OF SR 2220 (N. BROADRIDGE RD.)

- SECTION A - ALTERNATIVE 1 -

Section A - Alternative 1 (A1) is 5.23 miles long (-L- Sta. 39+00 to 315+00).

The A1 functional design concept can be seen on **Figures 2, 3 and 4**. It includes improvements to the mainline typical section and maintaining the SR 2210 (Old Kingsdale Rd) grade separation.

It is estimated that the scope of ITS deployment for A1, including Fiber Optic Communications/Conduit and 1 Overhead DMS, will cost \$ 1,003,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 15,300,000.00
Right-of-Way.....	\$ 0
Utility Relocation.....	\$ 0
Total Cost (A1)	\$ 15,300,000.00

It is anticipated that A1 will require 0 relocations and 0 wetland and stream impacts. The total cost is estimated to be \$ 15,300,000.00.

- SECTION A - ALTERNATIVE 2 - SR 2210 INTERCHANGE

Section A - Alternative 2 (A2) is the functional design concept for adding an interchange to the existing overpass at SR 2210 (Old Kingsdale Rd) (-L- Sta. 150+00 to 192+00). It does not include the A1 mainline typical section improvements. Traffic can be maintained on SR 2210 during ramp construction. The A2 functional design concept can be seen on **Figure 3**.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 4,300,000.00
Right-of-Way.....	\$ 800,000.00
Utility Relocation.....	\$ 100,000.00
Total Cost (A2)	\$ 5,200,000.00

It is anticipated that A2 will require 0 relocations, 0 stream impacts and 2.0 acres of wetland impacts. The total cost is estimated to be \$ 5,200,000.00.

SECTIONS B, C AND D: US 74 FROM WEST OF SR 2220 TO EAST OF NC 72-130

Sections B, C, and D (-L- Sta. 315+00 to 545+00) are referred to as the “Two-Towns” area in this study. It includes the four existing intersections along US 74 near Proctorville and Orrum. Two Alternative combinations were considered through the “Two-Towns”: **ALT. 1** with two proposed interchanges at SR 2220 (N. Broadridge Rd.) and NC 72-130 and one grade separation at SR 2225 (N. Creek Rd.); **ALT. 2** with one proposed interchange at SR 2225 (N. Creek Rd.) and two grade separations at SR 2220 (N Broadridge Rd) and NC 72-130. The following describe the estimated costs and impacts for each Section and total “Two-Towns” Alternatives. “Two-Towns” **ALT. 1** can be seen on **Figures 4 and 5**; **ALT. 2** on **Figures 6, 7, 7A and 7B**.



The interchange and grade separation locations in this area of the project were studied closely to consider what would provide safe and cost-effective access and mobility through the “Two-Towns” area. It was noted from prior public involvement that some stakeholders wished to have one interchange location at SR 2225 (N Creek Rd) as a cost savings. However, upon closer investigations, the overall costs for the two options were not that different. For **ALT. 2** (one interchange), the whole 3.2 mile length of SR 2225 would need to be upgraded to accommodate the NC 72 and NC 130 routes which would be relocated to this location. There would be impacts to properties along SR 2225. There would also be an expensive cell tower impact in quadrant “D” of the SR 2225 interchange. For **ALT. 1** (two interchanges), there is already existing Right-of-Way for future interchanges at the SR 2220 and NC 72-130 intersections. The proposed bridge costs would likely be the same for the two options. Some stakeholders were noted as being in favor of having two interchanges at SR 2220 and NC 72-130. The fire department chief expressed support for two interchanges to prevent disruptions in emergency services. Both options have been included in the cost estimates shown below and are shown on **Figures 4 thru 7B**. Further environmental investigations and design details will be developed in the subsequent stages of the project.

- SECTION B – ALTERNATIVE 1 – SR 2220 INTERCHANGE

Section B - Alternative 1 (B1) is 1.23 miles long (-L- Sta. 315+00 to 380+00).

The B1 functional design concept can be seen on **Figure 4**. It includes mainline improvements and construction of a diamond interchange at SR 2220 (N Broadridge Rd). Note that the majority of the land required for the new interchange is within existing Right-of-Way. It is estimated that ITS Fiber Optic Communications/Conduit installation in B1 will cost \$ 195,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 9,900,000.00
Right-of-Way.....	\$ 200,000.00
Utility Relocation.....	\$ 0
Total Cost (B1)	\$ 10,100,000.00

It is anticipated that B1 will require 0 relocations, 3.0 acres of wetland impacts and 110 feet of stream impacts. The total cost is estimated to be \$ 10,100,000.00.

- SECTION B – ALTERNATIVE 2 – SR 2220 GRADE SEPARATION

Section B - Alternative 2 (B2) is 1.23 miles long (-L- Sta. 315+00 to 380+00).

The B2 functional design concept can be seen on **Figure 6**. It includes mainline improvements and construction of a grade separation overpass at SR 2220 (N Broadridge Rd). It is estimated that ITS Fiber Optic Communications/Conduit installation in B2 will cost \$ 195,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 6,600,000.00
Right-of-Way.....	\$ 0
Utility Relocation.....	\$ 100,000.00
Total Cost (B2)	\$ 6,700,000.00



It is anticipated that B2 will require 0 relocations, 0 acres of wetland impacts and 110 feet of stream impacts. The total cost is estimated to be \$ 6,700,000.00.

- SECTION C – ALTERNATIVE 1 – SR 2225 GRADE SEPARATION

Section C - Alternative 1 (C1) is 1.70 miles long (-L- Sta. 380+00 to 470+00).

The C1 functional design concept can be seen on **Figures 4 and 5**. It includes mainline improvements and construction of a grade separation overpass at SR 2225 (N Creek Rd). Note that the land required for the grade separation is within existing Right-of-Way. There is sufficient local road network to provide a feasible off-site detour route during construction.

It is estimated that ITS deployment – one CCTV and Fiber Optic Communications/Conduit installation – in C1 will cost \$ 284,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 7,800,000.00
Right-of-Way.....	\$ 0
Utility Relocation.....	\$ 0
Total Cost (C1)	\$ 7,800,000.00

It is anticipated that C1 will require 0 relocations and 0 wetland and stream impacts. The total cost is estimated to be \$ 7,800,000.00.

- SECTION C – ALTERNATIVE 2 – SR 2225 WIDENING AND INTERCHANGE

Section C - Alternative 1 (C2) is 1.70 miles long (-L- Sta. 380+00 to 470+00).

The C2 functional design concept can be seen on **Figures 6, 7, 7A and 7B**. It includes mainline improvements, construction of a diamond interchange and widening 3.2 miles of SR 2225 (N Creek Rd). There is sufficient local road network to provide a feasible off-site detour route during construction.

It is estimated that ITS deployment – one CCTV and Fiber Optic Communications/Conduit installation – in C2 will cost \$ 284,000.00. It is estimated that utility construction will cost \$1,470,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 15,200,000.00
Right-of-Way.....	\$ 1,200,000.00
Utility Relocation.....	\$ 400,000.00
Total Cost (C2)	\$ 16,800,000.00

It is anticipated that C2 will require 1 residential relocation, 0 wetland impacts, 230 feet of stream impacts and 1 cell tower relocation. The total cost is estimated to be \$ 16,800,000.00.



- SECTION D – ALTERNATIVE 1 – NC 72-130 INTERCHANGE

Section D - Alternative 1 (D1) is 1.42 miles long (-L- Sta. 470+00 to 545+00).

The D1 functional design concept can be seen on **Figure 5**. It includes mainline improvements and a new NC 72 and NC 130 diamond interchange. It also includes two service roads, -SRA- and -SRB-, which connect to the new NC 72 and NC 130. -SRA- continues east parallel to US 74 into Sections E and F, providing river boat ramp access and local (non-interstate) access across the river.

Note that the majority of the land required for the Y-line relocation and interchange is within existing Right-of-Way. Also, most of the estimated stream and wetland impacts are within existing Right-of-Way.

The existing NC 72 and NC 130 routes can be maintained as on-site detours during construction.

It is estimated that ITS Fiber Optic Communications/Conduit installation in D1 will cost \$ 225,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 14,500,000.00
Right-of-Way.....	\$ 300,000.00
Utility Relocation.....	\$ 100,000.00
Total Cost (D1)	\$ 14,900,000.00

It is anticipated that D1 will require 0 relocations, 29.0 acres of wetland impacts and 390 feet of stream impacts. The total cost is estimated to be \$ 14,900,000.00.

- SECTION D – ALTERNATIVE 2 – NC 72-130 GRADE SEPARATION

Section D - Alternative 1 (D2) is 1.42 miles long (-L- Sta. 470+00 to 545+00).

The D2 functional design concept can be seen on **Figure 7**. It includes mainline improvements and a new NC 72 and NC 130 grade separation overpass. It also includes two service roads, -SRA- and -SRB-, which connect to the new NC 72-130 overpass. -SRA- continues east parallel to US 74 into Sections E and F, providing river boat ramp access and local (non-interstate) access across the river.

Note that the majority of the land required for the Y-line relocation and overpass is within existing Right-of-Way. Also, most of the estimated stream and wetland impacts are within existing Right-of-Way.

The existing NC 72 and NC 130 routes can be maintained as on-site detours during construction.

It is estimated that ITS Fiber Optic Communications/Conduit installation in D2 will cost \$ 225,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 10,000,000.00
Right-of-Way.....	\$ 100,000.00
Utility Relocation.....	\$ 200,000.00
Total Cost (D2)	\$ 10,300,000.00



It is anticipated that D2 will require 0 relocations, 0 stream impacts and 27.0 acres of wetland impacts. The total cost is estimated to be \$ 10,300,000.00.

TWO-TOWNS – ALTERNATIVES

-ALTERNATIVE 1 -

Section/ Alternative	Construction	Right-of-Way	Utility Relocation	Relocates	Wetlands (AC)	Streams (LF)	Total
B1	\$ 9,900,000.00	\$ 200,000.00	\$ 0	0	3.0	110	\$ 10,100,000.00
C1	\$ 7,800,000.00	\$ 0	\$ 0	0	0.0	0	\$ 7,800,000.00
D1	\$ 14,500,000.00	\$ 300,000.00	\$ 100,000.00	0	29.0	390	\$ 14,900,000.00
Total	\$ 32,200,000.00	\$ 500,000.00	\$ 100,000.00	0	32.0	500	\$ 32,800,000.00

-ALTERNATIVE 2 -

Section/ Alternative	Construction	Right-of-Way	Utility Relocation	Relocates	Wetlands (AC)	Streams (LF)	Total
B2	\$ 6,600,000.00	\$ 0	\$ 100,000.00	0	0.0	110	\$ 6,700,000.00
C2	\$ 15,200,000.00	\$ 1,200,000.00	\$ 400,000.00	1	0.0	230	\$ 16,800,000.00
D2	\$ 10,000,000.00	\$ 100,000.00	\$ 200,000.00	0	27.0	0	\$ 10,300,000.00
Total	\$ 31,800,000.00	\$ 1,300,000.00	\$ 700,000.00	1	27.0	340	\$ 33,800,000.00

As seen in the tables above, **ALT. 1** has lower Right-of-Way, Utility Relocation and Total Alternative costs. The Construction costs are essentially equal. Although **ALT. 2** has slightly lower wetland and stream impacts, most of the D1 and D2 impacts are within existing R/W. It could also be said that **ALT. 1** has lower human environment impacts – based on relocatees, the C2 SR 2225 widening, the C2 cell tower impact, use of existing R/W for future interchanges, and emergency response times. Further planning and design in the subsequent stages of the project will provide more detailed information for decision making.

SECTION E: US 74 FROM EXISTING NC 130 ACROSS THE LUMBER RIVER

Section E is 1.14 miles long (-L- Sta. 545+00 to 605+00) and includes the crossing of the Lumber River and associated floodway.

The Section E functional design concept can be seen on **Figure 8**. It includes mainline improvements, eastbound US 74 bridge rehabilitations, westbound US 74 bridge replacements, and construction of new parallel service road (-SRA-) and bridges. -SRA- travels east parallel to US 74 through Sections D, E and F, providing river boat ramp/fishing access and local (non-interstate) access across the river.

New westbound bridges are recommended based on NCDOT Bridge Inspection Reports. Bridge lengths over natural systems will be determined in the later planning stages of the project. The new bridges over natural systems in this report are approximately the same length as the existing bridges.

It is estimated that ITS Fiber Optic Communications/Conduit installation will cost \$ 180,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 17,000,000.00
Right-of-Way.....	\$ 100,000.00
Utility Relocation.....	\$ 200,000.00
Total Cost (E).....	\$ 17,300,000.00

It is anticipated that Section E will require 0 relocations, 5.0 acres of wetland impacts and 300 feet of stream impacts. The total cost is estimated to be \$ 17,300,000.00.

SECTION F: US 74 FROM THE LUMBER RIVER TO SR 1506 IN BOARDMAN

Section F is 0.95 miles long (-L- Sta. 605+00 to 655+00) and includes the SR 1506 (Old Boardman Rd/Macedonia Church Rd) intersection.

The Section F functional design concept can be seen on **Figure 8**. It includes mainline improvements, a new parallel service road (-SRA-) and construction of a new half diamond interchange with loops at SR 1506. -SRA- travels east parallel to US 74 through Sections D, E and F, providing river boat ramp access and local (non-interstate) access across the river.

Other diamond interchange configurations were considered and were eliminated from further evaluation in this study based on impacts to existing residential and agricultural properties in the B and C quadrants and potential impacts to the easternmost river bridges. The half-diamond configuration best minimizes human environment impacts in the B and C quadrants and avoids the church and two cemeteries near quadrant A.

The new SR 1506 overpass may be built on new location to the west to avoid Horace Grove church and cemetery and to maintain traffic on existing SR 1506 during construction.

It is estimated that ITS Fiber Optic Communications/Conduit installation will cost \$ 150,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 11,400,000.00
Right-of-Way.....	\$ 1,800,000.00
Utility Relocation.....	\$ 200,000.00
Total Cost (F).....	\$ 13,400,000.00

It is anticipated that Section F will require 1 business relocation, 4 residential relocations, 0 stream impacts and 9.0 acres of wetland impacts. The total cost is estimated to be \$ 13,400,000.00.



SECTION G: US 74 FROM EAST OF SR 1506 TO WEST OF SR 1574

Section G is 5.21 miles long (-L- Sta. 655+00 to 930+00).

The Section G functional design concept can be seen on **Figures 8 thru 11**. It includes constructing new mainline paved shoulders. The recently constructed NC 242 interchange area does not require mainline improvements (-L- Sta. 820+50 to 863+50) (See **Figure 10**).

It is estimated that ITS deployment for G, including Fiber Optic Communications/Conduit, 2 Overhead DMS's, and 1 CCTV, will cost \$ 1,189,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 14,600,000.00
Right-of-Way.....	\$ 100,000.00
Utility Relocation.....	\$ 0
Total Cost (G)	\$ 14,700,000.00

It is anticipated that G will require 0 relocations and 0 wetland and stream impacts. The total cost is estimated to be \$ 14,700,000.00.

SECTION H: US 74 AT SR 1574

Section H is 0.38 miles long (-L- Sta. 930+00 to 950+00) and includes the SR 1574 (Old US 74) intersection.

The Section H functional design concept can be seen on **Figure 11**. It includes mainline improvements and construction of a grade separation overpass at SR 1574 (Old US 74). Note that the land required for the grade separation is mostly within existing Right-of-Way. There is sufficient local road network to provide a feasible off-site detour route during construction.

Future TIP Project W-5518 has recently been programmed and is scheduled for R/W and Construction in FY 2015 and FY 2016, respectively.

It is estimated that ITS Fiber Optic Communications/Conduit installation will cost \$ 60,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 4,400,000.00
Right-of-Way.....	\$ 200,000.00
Utility Relocation.....	\$ 100,000.00
Total Cost (C1)	\$ 4,700,000.00

It is anticipated that H will require 0 relocations and 0 wetland and stream impacts. The total cost is estimated to be \$ 4,700,000.00.

SECTION I: US 74 FROM EAST OF SR 1574 TO SR 1585

Section I is 7.56 miles long (-L- Sta. 950+00 to 1349+00).

The Section I functional design concept can be seen on **Figures 11 thru 15**. It includes constructing new mainline paved shoulders.

It is estimated that ITS deployment for Section I, including Fiber Optic Communications/Conduit, 2 Overhead DMS's, and 1 CCTV, will cost \$ 1,625,000.00.

The following costs have been determined based on the proposed improvements described herein:

Construction.....	\$ 23,900,000.00
Right-of-Way.....	\$ 400,000.00
Utility Relocation.....	\$ 0
Total Cost (G).....	\$ 24,300,000.00

It is anticipated that Section I will require 0 relocations and 0 wetland and stream impacts. The total cost is estimated to be \$ 24,300,000.00.

V - HUMAN AND NATURAL ENVIRONMENT ISSUES

An environmental screening was conducted to identify potential environmental issues; including occurrences of threatened or endangered species, stream and wetland impacts, and human environment issues. The Geographic Information System (GIS) data obtained for the environmental screening are from Robeson and Columbus Counties, the USGS Hydrology from the NC Center for Geographic Information and Analysis (CGIA), and the statewide orthoimagery (2010-2013) from NC OneMap. **Figures 2 through 15** include digital orthoimagery and environmental features.

NATURAL ENVIRONMENT

The study corridor crosses **the Lumber River** and several associated bays, swamps and creeks. The Lumber River is not 303(d) listed but has been reported as polluted for mercury levels found in fish (2010). There are several other water feature crossings: Rough Horn Branch, Cow Branch, Dunn Swamp, Horsepen Branch and Juniper Creek. The NC Division of Water Quality has given all of these waters primary classifications as Class C, with supplemental classifications as Swamp Waters. There are no known critical watersheds that will be affected by this project.

The US Fish and Wildlife Service provided the National Wetlands Inventory (NWI) used in this study. Wetlands and streams may be impacted by the new interchanges and grade separations along this project. State and local buffer rules should be followed. Appropriate permitting and mitigation measures should be taken.



Red-Cockaded Woodpecker



Broadtail Madtom

The NC Department of Environmental and Natural Resources – Natural Heritage Program indicates that there are occurrences of the following threatened or endangered species within the project area: There are two occurrences of the Red-Cockaded Woodpecker (on **Figures 10 and 12**) and one occurrence of the Broadtail Madtom (on **Figure 8** near the Lumber River crossing). More information on these species locations should be acquired in the subsequent planning stages of the project.

There is also a NC Wildlife Resources Commission (WRC) game land located along the corridor. The almost 300 acre Bullard and Branch Hunting Preserve is located along SR 2211 (Elijah Road) west of SR 2220 (N Broadridge Road). See **Figures 4 and 6**.

HUMAN ENVIRONMENT

In addition to the Natural Environment issues listed above, there are human environment features that will be impacted by this project.

The majority of the study area is rural agricultural. However, there are some direct impacts to existing human development; mostly in Section C Alternative 2 (along SR 2225), in Section E near the river, and in Section F at the Boardman interchange.

As stated previously in the Section C Alternative 2 description on pages 8 and 9, and shown on **Figures 7, 7A and 7B**, this C2 alternative includes widening 3.2 miles of SR 2225 to accommodate relocation of NC 72 and 130. This road has many residential, agricultural and some churches and cemeteries. Although only one (1) residential relocation is predicted, and two church/cemetery property impacts have been avoided, many front yards will be impacted by the widening.

In Section E and F of the study (on **Figure 8**), it was determined that a service road would be needed from old NC 130 to SR 1506 to connect local, non-interstate traffic across the river; such as farm tractors or fisherman with boat trailers. The service road will also provide access to SR 2244 (Ann Road), SR 2312, and SR 2245 (V C Britt Road).

And lastly, in Section F, there will be impacts to development at the Boardman interchange. As stated previously in the Section F description on page 11, and shown on **Figure 8**, other diamond interchange configurations were considered and were eliminated from further evaluation based on impacts to existing properties in the B and C quadrants. There are up to four (4) residential relocations included in the estimate. However, at least two of these house-trailers look abandoned. The half-diamond configuration best minimizes human environment impacts in the B and C quadrants and avoids the church and two cemeteries near quadrant A by not requiring any new Right-of-Way on the Horace Grove church and cemetery property.

It is recommended that care be taken to avoid and minimize human and natural environmental impacts in the subsequent planning and design stages of this project.

VI – PROJECT COSTS AND RECOMMENDATIONS

The purpose and need for the project is based on upgrading 25 miles of US 74 to accommodate future Interstate 74. The proposed improvements considered in the study include upgrading the mainline paved shoulders, replacing major at-grade intersections with grade separated overpasses or interchanges, and providing a fully controlled access interstate facility. **Table 1** on page 16 summarizes the section, alternative and project costs based on the functional designs described herein. Based on **Table 1** the estimated cost for the complete project ranges from about \$122.5M to \$128.7M.

Although Section A does not have multiple alternative concepts, it does have an optional interchange at SR 2210 (Old Kingsdale Rd). It may be added to the existing overpass bridge for approximately \$5.2M with little human or natural environment impacts. The additional interchange will provide a desirable interchange spacing of just over 3 miles in each direction and better emergency response times between NC 41 and SR 2220 (N Broadridge Rd). It is the recommendation of this study that the SR 2210 interchange be included in the subsequent stages of the project.

The study considered two alternatives for the “Two-Towns” area of the project, as described previously on pages 6-10. The “Two-Towns” Alt.2 will cost about \$1M more than Alt.1, will have significant R/W impacts to residences along SR 2225, impacts a cell tower, doesn’t make use of existing R/W for future ramps, and likely reduces emergency response times. Based on this, it is recommended to include “Two-Towns” Alternative 1 through Sections B, C and D of the project.

Table 2 on page 17 shows the estimated costs and impacts for the recommended alternative.

TABLE 1 – PROJECT COSTS & IMPACTS

SECTION	FROM / TO	STATION / STATION		DESCRIPTION	LENGTH (Miles)	CONSTRUCTION *	RIGHT-OF-WAY	UTILITY RELOCATION	Relocatees		Environmental **		SUB-TOTAL	
									Business	Residential	Wetlands (AC)	Streams (LF)		
Section A	NC 41 to NW of SR 2220	39+00	315+00	w/o SR 2210 Interchange	5.23	\$15,300,000	\$0	\$0	0	0	0.0	0	\$15,300,000	
Sec A Kingsdale	SR 2210	150+00	192+00	Interch @ SR2210 (add-on)	0.80	\$4,300,000	\$800,000	\$100,000	0	0	2.0	0	\$5,200,000	
Sec B_Alt 1	SR 2220	315+00	380+00	Interch @ SR2220	1.23	\$9,900,000	\$200,000	\$0	0	0	3.0	110	\$10,100,000	
Sec B_Alt 2	SR 2220	315+00	380+00	Grade Sep @ SR 2220	1.23	\$6,600,000	\$0	\$100,000	0	0	0.0	110	\$6,700,000	
Sec C_Alt 1	SR 2225	380+00	470+00	Grade Sep @ SR 2225	1.70	\$7,800,000	\$0	\$0	0	0	0.0	0	\$7,800,000	
Sec C_Alt 2	SR 2225	380+00	470+00	Interch @ SR 2225	1.70	\$15,200,000	\$1,200,000	\$400,000	0	1	0.0	230	\$16,800,000	
Sec D_Alt 1	SE of SR 2225 to Existing NC 130	470+00	545+00	Interch @ NC 72/130	1.42	\$14,500,000	\$300,000	\$100,000	0	0	29.0	390	\$14,900,000	
Sec D_Alt 2	SE of SR 2225 to Existing NC 130	470+00	545+00	Grade Sep @ NC 72/130	1.42	\$10,000,000	\$100,000	\$200,000	0	0	27.0	0	\$10,300,000	
Section E	Existing NC 130 to Lumber River	545+00	605+00	Lumber River Bridges	1.14	\$17,000,000	\$100,000	\$200,000	0	0	5.0	300	\$17,300,000	
Section F	SE of Lumber River, SR 1506	605+00	655+00	½ Diamond w Loops @ SR1506	0.95	\$11,400,000	\$1,800,000	\$200,000	1	4	9.0	0	\$13,400,000	
Section G	SE of SR 1506 to W of SR 1574	655+00	930+00		5.21	\$14,600,000	\$100,000	\$0	0	0	0.0	0	\$14,700,000	
Section H	SR 1574	930+00	950+00	Grade Sep @ SR 1574	0.38	\$4,400,000	\$200,000	\$100,000	0	0	0.0	0	\$4,700,000	
Section I	E of SR 1574 to SR 1585	950+00	1349+00		7.56	\$23,900,000	\$400,000	\$0	0	0	0.0	0	\$24,300,000	
NOTE: The Minimum Sub-Total = Rows 1,3,5,7,9-13 (all the Alt. 1 "Yellow" alternatives). The Maximum Sub-Total = Rows 1,2,4,6,8-13 (includes the Kingsdale Interchange, and the Two-Towns Alt. 2 "Green" alternative).						Minimum Sub-Total:	\$118,800,000	\$3,100,000	\$600,000	1	4	41.0	640	\$122,500,000
						Maximum Sub-Total:	\$122,700,000	\$4,700,000	\$1,300,000	1	5	48.0	800	\$128,700,000

* ITS and Utility Construction are included in Construction Costs.

** Environmental Impacts are based on GIS data and are approximate only.

NOTE: These Plans are preliminary and are subject to change without notice. This study is not the product of extensive design or environmental analysis.

Two-Towns Alternatives

	Constr.*	R/W	Util. Reloc.	Sub-Total
Sec. B, C and D "Two-Towns" Min. = Alt. 1:	\$32,200,000	\$ 500,000	\$ 100,000	\$32,800,000
Sec. B, C and D "Two-Towns" Max. = Alt. 2:	\$31,800,000	\$1,300,000	\$ 700,000	\$33,800,000

NOTE: Do not mix and match Sections B, C and D Alternatives.



TABLE 2 – RECOMMENDED ALTERNATIVE COST & IMPACTS

SECTION	DESCRIPTION	CONSTRUCTION *	RIGHT-OF-WAY **	UTILITY RELOCATION	Relocatees		Environmental ***		SUB-TOTAL
					Business	Residential	Wetlands (AC)	Streams (LF)	
Section A - Kingsdale	Interch @ SR2210 (add-on)	\$4,300,000	\$800,000	\$100,000	0	0	2.0	0	\$5,200,000
Section B_Alt 1	Interch @ SR2220	\$9,900,000	\$200,000	\$0	0	0	3.0	110	\$10,100,000
Section C_Alt 1	Grade Sep @ SR 2225	\$7,800,000	\$0	\$0	0	0	0.0	0	\$7,800,000
Section D_Alt 1	Interch @ NC 72/130	\$14,500,000	\$300,000	\$100,000	0	0	29.0	390	\$14,900,000
Section E	Lumber River Bridges	\$17,000,000	\$100,000	\$200,000	0	0	5.0	300	\$17,300,000
Section F	½ Diamond w Loops @ SR1506	\$11,400,000	\$1,800,000	\$200,000	1	4	9.0	0	\$13,400,000
Section G		\$14,600,000	\$100,000	\$0	0	0	0.0	0	\$14,700,000
Section H	Grade Sep @ SR 1574	\$4,400,000	\$200,000	\$100,000	0	0	0.0	0	\$4,700,000
Section I		\$23,900,000	\$400,000	\$0	0	0	0.0	0	\$24,300,000
Sub-Total:		\$123,100,000	\$3,900,000	\$700,000	1	4	48.0	800	\$127,700,000

* ITS and Utility Construction are included in Construction Costs.

** Environmental Impacts are based on GIS data and are approximate only.

It is anticipated that the recommended alternative shown above will require 1 business relocation, 4 residential relocations, 48 acres of wetland impacts and 800 feet of stream impacts. The total 25-mile project cost is estimated to be **\$127.7M**.

VII – ADDITIONAL RESOURCES

[1] Lumber River RPO, http://lumberrivercog.org/Rural_Transportation_Sub_Page.html

[2] Cape Fear RPO, <http://www.capefearcog.org/Local-Gov-Services>

[3] FHWA, NHS, High Priority Corridor 5, http://www.fhwa.dot.gov/planning/national_highway_system/high_priority_corridors/

[4] NCDOT Strategic Highway Corridors, <https://connect.ncdot.gov/projects/planning/Pages/StrategicHighwayCorridors.aspx>

[5] NCDOT Draft 2012 STIP, <https://connect.ncdot.gov/projects/planning/Pages/default.aspx>

LEGEND

- PROPOSED ROADWAY
- PROPOSED BRIDGES
- EXISTING BRIDGES
- PROPOSED LIMITS OF CONST.
- CITY/TOWN LIMITS
- PROPERTY LINES
- COMMUNITY FEATURES
- STREAMS
- WATER BODIES
- WETLANDS
- FEMA 100 YEAR FLOODWAY
- OVERHEAD POWER LINES
- CELL TOWERS, RADIO TOWERS

NOTE: Robeson and Columbus Counties supplied the GIS data (2012); NC CGIA the USGS Hydrology (2003); and NC OneMap the statewide orthoimagery (2010).

BEGIN STUDY FS-1106B

**END INTERSTATE 74
BEGIN W-5206R
(Med. Guiderail By Others)**

**EXISTING
DMS (WB)**

**PROPOSED
DMS (EB)**

CLIFFWOOD GOLF COURSE

TO LUMBERTON

41

TO 95

74

EXIT 213

74

2208

State Highway 41

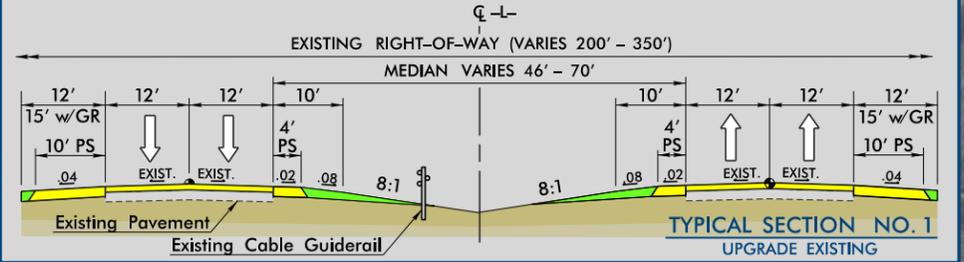
Friendship Dr

END INTERSTATE 74
BEGIN W-5206R
(Med. Guiderail By Others)

3.1 MILES to SR 2210

SMYRNA BAPTIST

State Road 2242



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FIGURE 2

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE
COLUMBUS & ROBESON COUNTIES

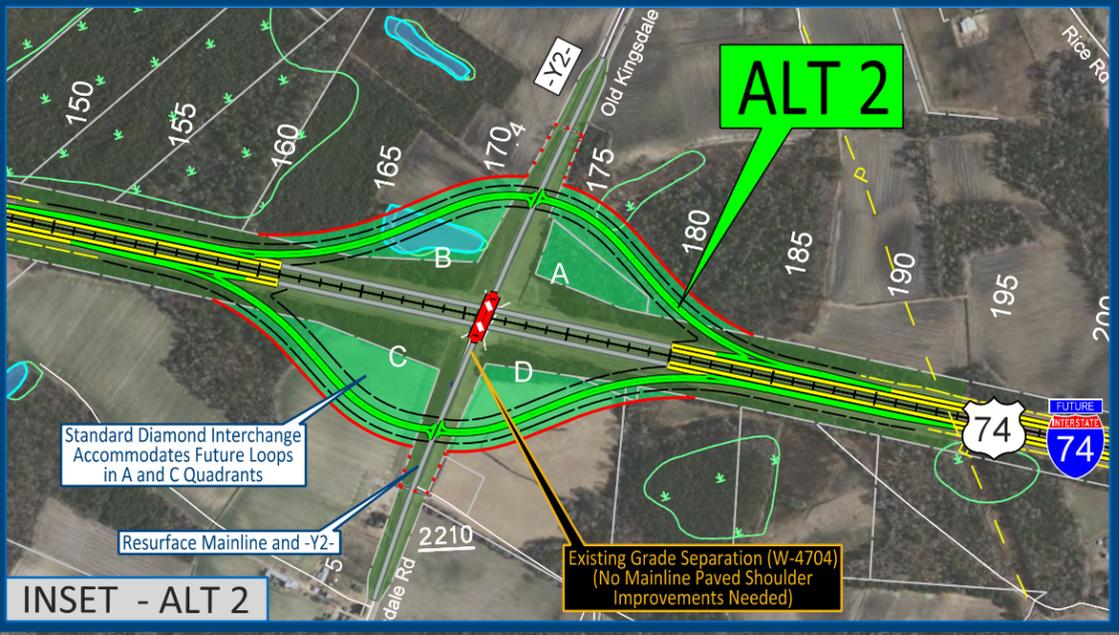
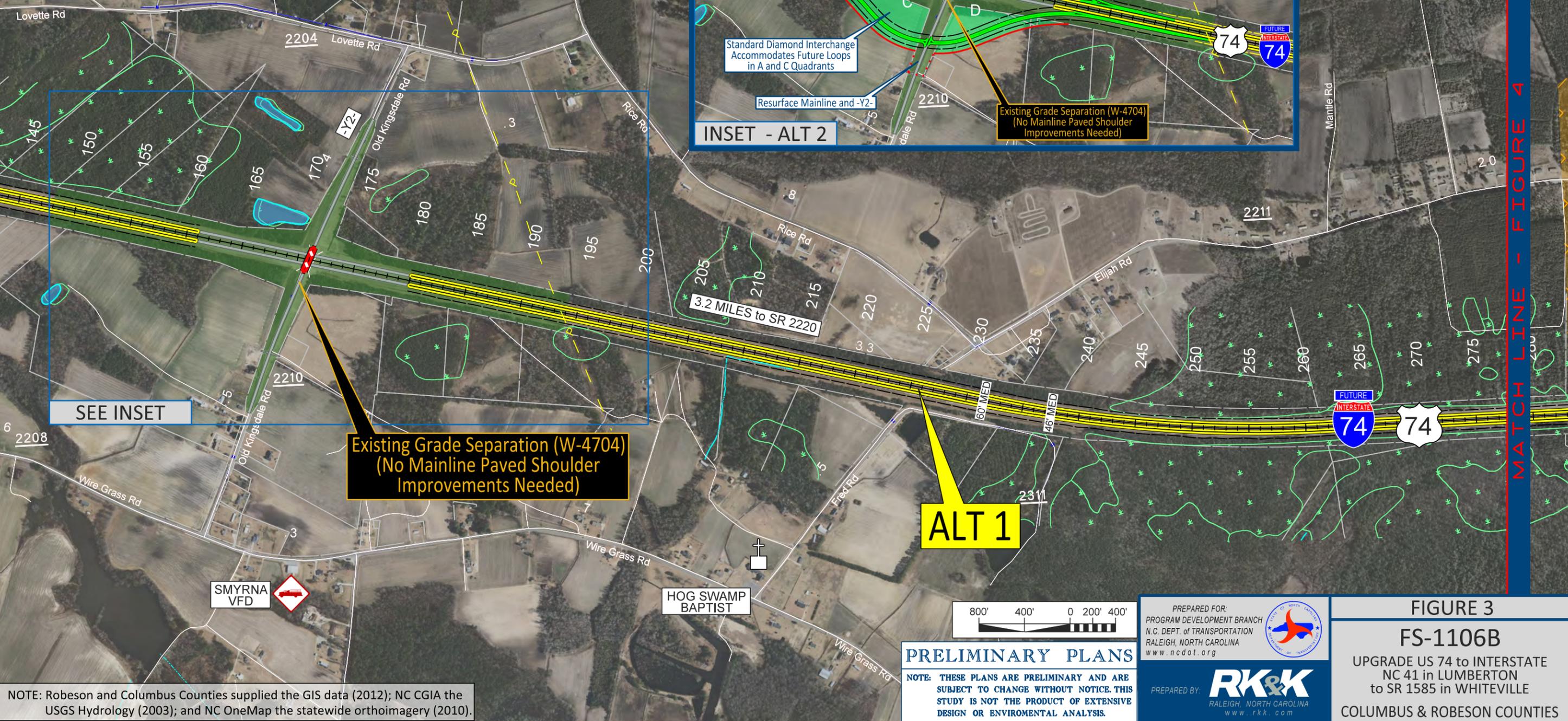
MATCH LINE - FIGURE 3

LEGEND

- ▬ PROPOSED ROADWAYS
- ▬ PROPOSED BRIDGES
- ▬ EXISTING BRIDGES
- PROPOSED LIMITS OF CONST.
- PROPOSED C/A
- PROPOSED C/A LIMITS
- PROPOSED RIGHT-OF-WAY
- EXISTING RIGHT-OF-WAY
- PROPERTY LINES
- CITY/TOWN LIMITS
- GAMELANDS
- ▬ STREAMS
- ▬ WATER BODIES
- ▬ WETLANDS
- FEMA 100 YEAR FLOODWAY
- COMMUNITY FEATURES
- ⊙ CELL TOWERS, RADIO TOWERS

MATCH LINE - FIGURE 2

MATCH LINE - FIGURE 4



SEE INSET

Existing Grade Separation (W-4704)
(No Mainline Paved Shoulder
Improvements Needed)

ALT 1

ALT 2

INSET - ALT 2

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FIGURE 3
FS-1106B
UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE
COLUMBUS & ROBESON COUNTIES

SECTION A

LEGEND

- PROPOSED ROADWAYS
- PROPOSED BRIDGES
- EXISTING BRIDGES
- - - PROPOSED LIMITS OF CONST.
- PROPOSED C/A
- PROPOSED C/A LIMITS
- PROPOSED RIGHT-OF-WAY
- EXISTING RIGHT-OF-WAY
- PROPERTY LINES
- CITY/TOWN LIMITS
- GAMELANDS
- STREAMS
- WATER BODIES
- WETLANDS
- FEMA 100 YEAR FLOODWAY
- COMMUNITY FEATURES
CELL TOWERS, RADIO TOWERS

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Standard Diamond Interchange Accommodates Future Loops in A and C Quadrants



MATCH LINE - FIGURE 3

MATCH LINE - FIGURE 5

NC WRC Bullard and Branch Hunting Preserve

W-5206R (CONT.)
(Med. Guiderail By Others)

ALT 1
TWO-TOWNS
SHELLEY BAY

3.2 MILES to SR 2210

1.6 MILES to SR 2225

TO PROCTORVILLE

ORRUM VFD



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FIGURE 4 - ALT 1

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE
COLUMBUS & ROBESON COUNTIES

SECTION A

SECTION B (TWO-TOWNS)

SECTION C (TWO-TOWNS)



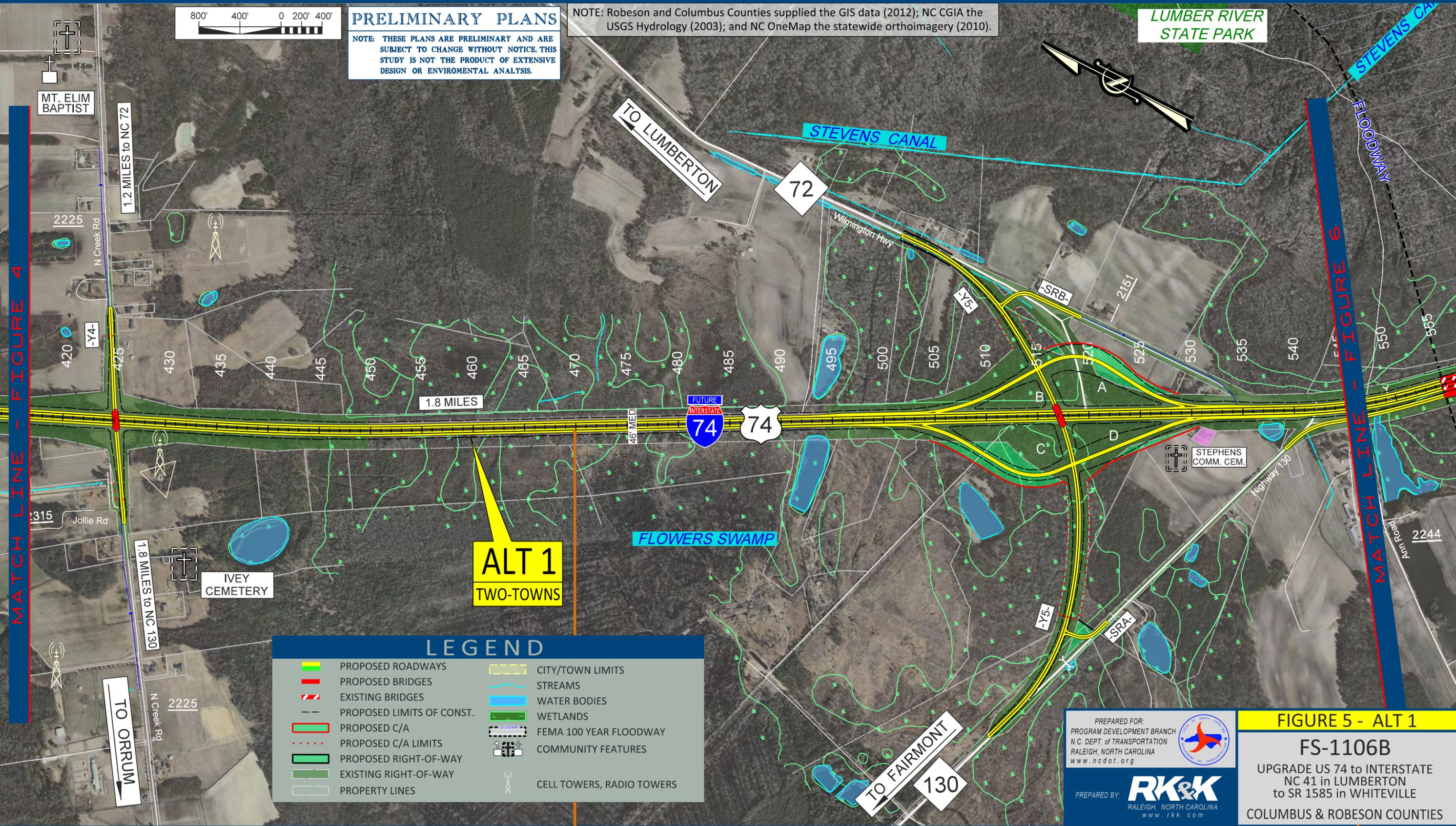
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LUMBER RIVER STATE PARK

MATCH LINE - FIGURE 4

MATCH LINE - FIGURE 6



LEGEND	
	PROPOSED ROADWAYS
	PROPOSED BRIDGES
	EXISTING BRIDGES
	PROPOSED LIMITS OF CONST.
	PROPOSED C/A
	PROPOSED C/A LIMITS
	PROPOSED RIGHT-OF-WAY
	EXISTING RIGHT-OF-WAY
	PROPERTY LINES
	CITY/TOWN LIMITS
	STREAMS
	WATER BODIES
	WETLANDS
	FEMA 100 YEAR FLOODWAY
	COMMUNITY FEATURES
	CELL TOWERS, RADIO TOWERS

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FIGURE 5 - ALT 1
FS-1106B
 UPGRADE US 74 to INTERSTATE
 NC 41 in LUMBERTON
 to SR 1585 in WHITEVILLE
 COLUMBUS & ROBESON COUNTIES

SECTION C (TWO-TOWNS)

SECTION D (TWO-TOWNS)

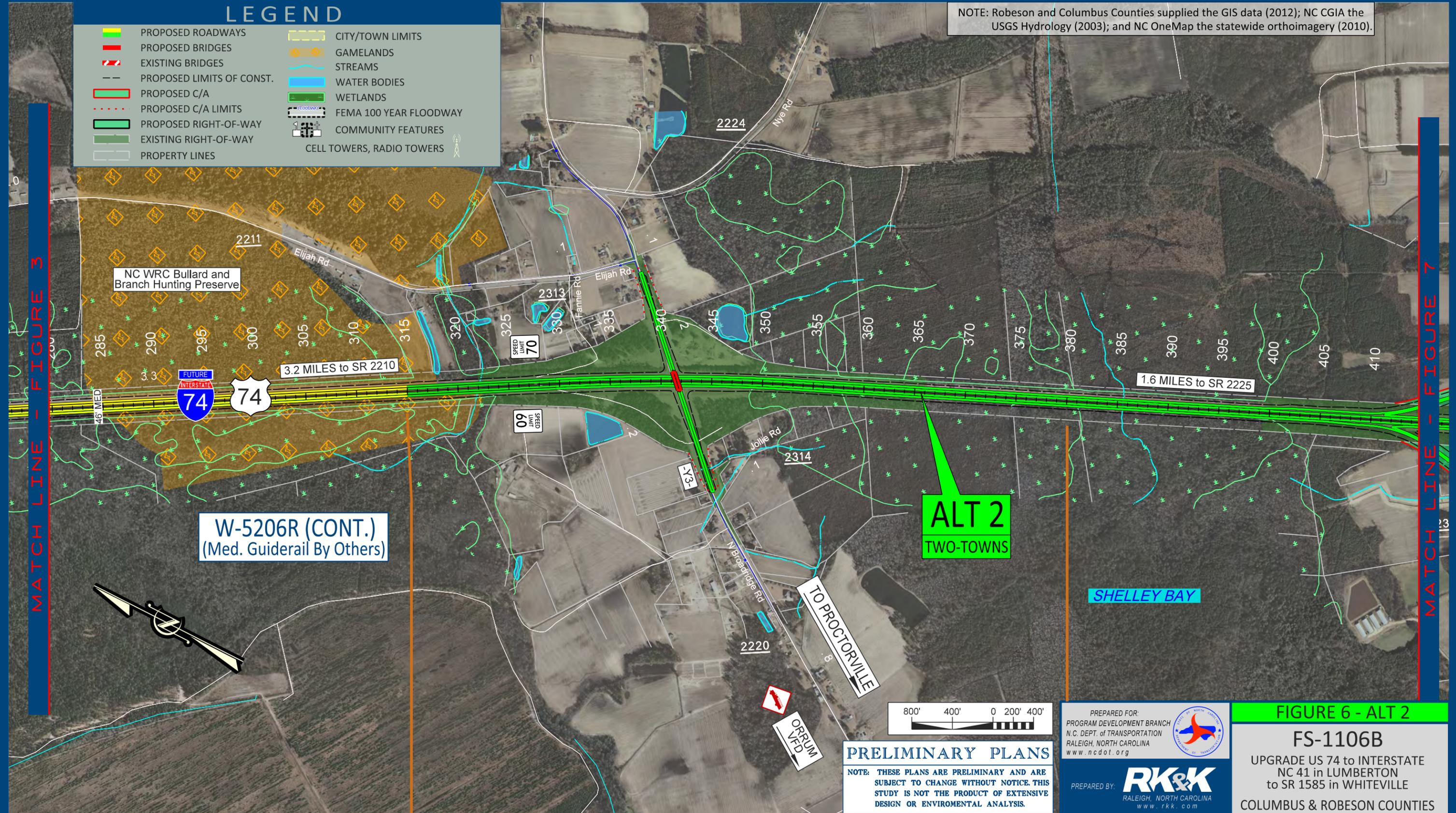
LEGEND

- █ PROPOSED ROADWAYS
- █ PROPOSED BRIDGES
- EXISTING BRIDGES
- PROPOSED LIMITS OF CONST.
- PROPOSED C/A
- PROPOSED C/A LIMITS
- PROPOSED RIGHT-OF-WAY
- EXISTING RIGHT-OF-WAY
- PROPERTY LINES
- CITY/TOWN LIMITS
- GAMLANDS
- STREAMS
- WATER BODIES
- WETLANDS
- FEMA 100 YEAR FLOODWAY
- COMMUNITY FEATURES
- CELL TOWERS, RADIO TOWERS

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MATCH LINE - FIGURE 3

MATCH LINE - FIGURE 7



W-5206R (CONT.)
(Med. Guiderail By Others)

ALT 2
TWO-TOWNS

SHELLEY BAY

TO PROCTORVILLE

ORRUM VFD

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FIGURE 6 - ALT 2

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE

COLUMBUS & ROBESON COUNTIES

MATCH LINE - FIGURE 7B

PRELIMINARY PLANS

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LUMBER RIVER STATE PARK

Upgrade SR 2225 to Accommodate NC 72/130

Standard Diamond Interchange Accommodates Future Loops in A and C Quadrants

1.8 MILES

ALT 2
TWO-TOWNS

LEGEND

- | | | | |
|--|---------------------------|--|---------------------------|
| | PROPOSED ROADWAYS | | CITY/TOWN LIMITS |
| | PROPOSED BRIDGES | | STREAMS |
| | EXISTING BRIDGES | | WATER BODIES |
| | PROPOSED LIMITS OF CONST. | | WETLANDS |
| | PROPOSED C/A | | FEMA 100 YEAR FLOODWAY |
| | PROPOSED C/A LIMITS | | COMMUNITY FEATURES |
| | PROPOSED RIGHT-OF-WAY | | CELL TOWERS, RADIO TOWERS |
| | EXISTING RIGHT-OF-WAY | | |
| | PROPERTY LINES | | |

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FIGURE 7 - ALT 2

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE
COLUMBUS & ROBESON COUNTIES

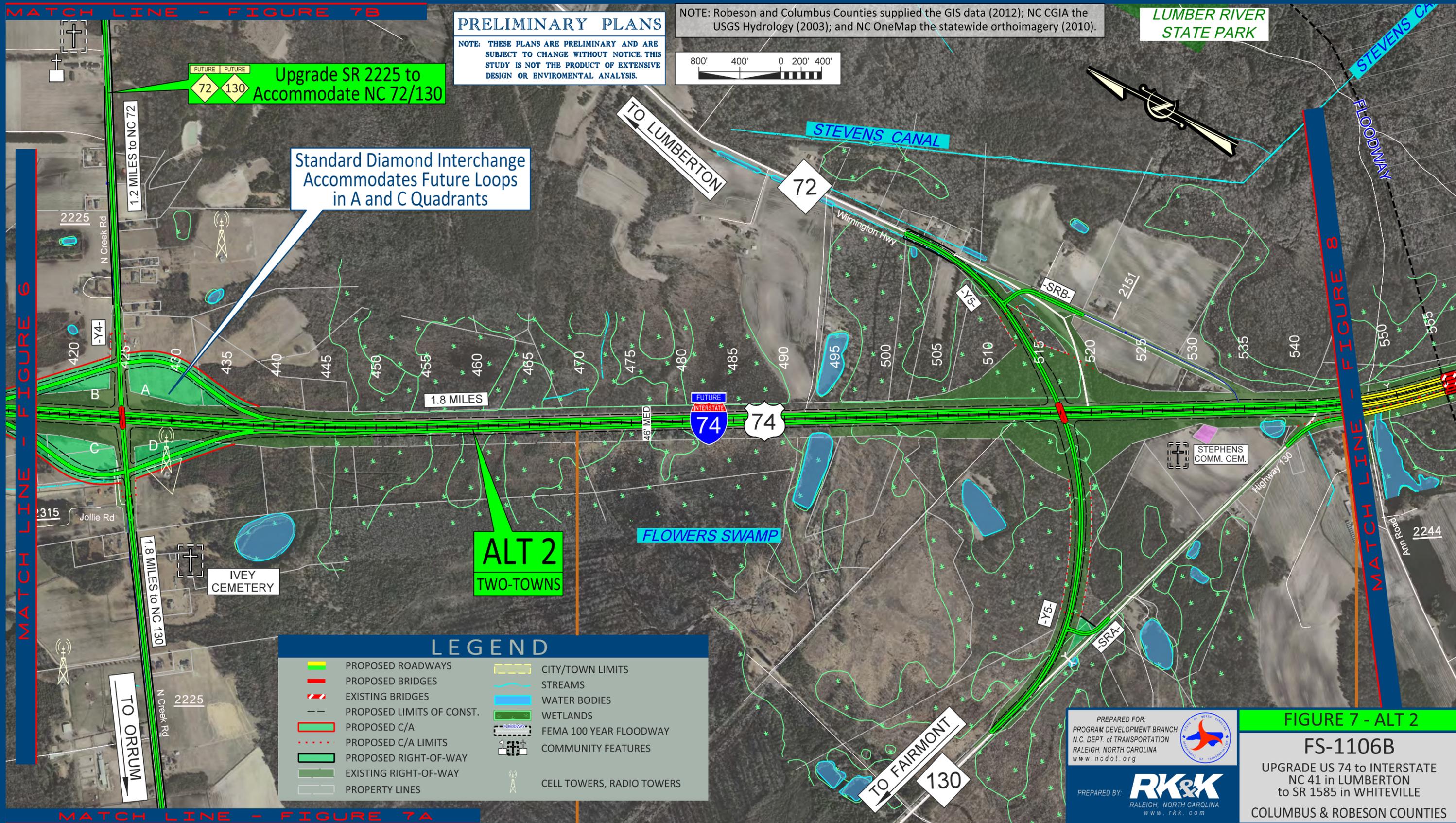
MATCH LINE - FIGURE 6

MATCH LINE - FIGURE 8

MATCH LINE - FIGURE 7A

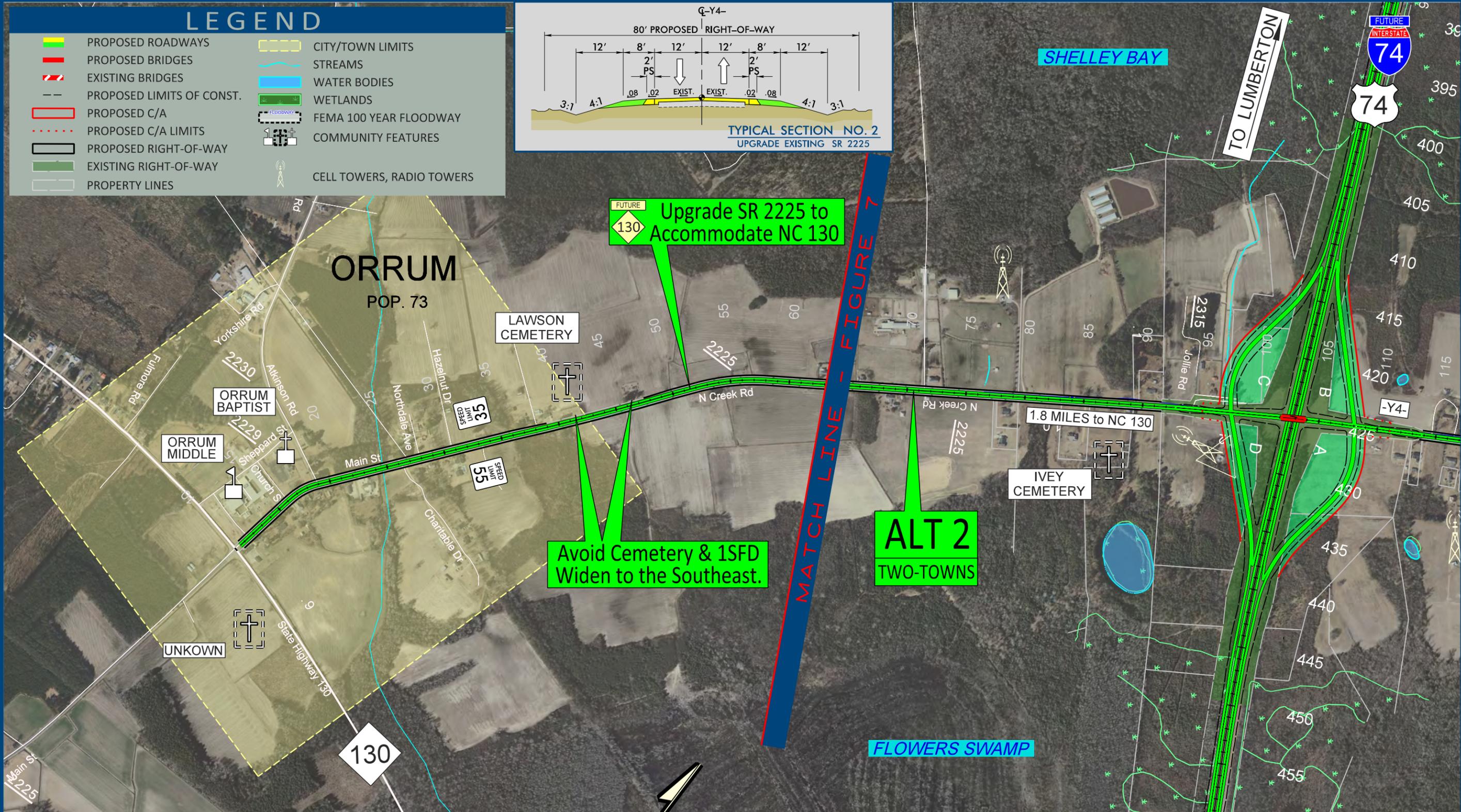
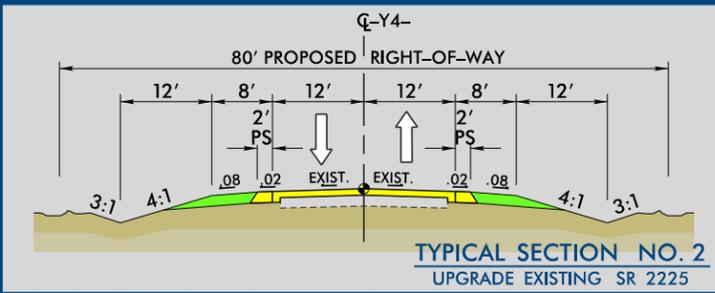
SECTION C (TWO-TOWNS)

SECTION D (TWO-TOWNS)

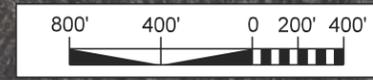


LEGEND

-  PROPOSED ROADWAYS
-  PROPOSED BRIDGES
-  EXISTING BRIDGES
-  PROPOSED LIMITS OF CONST.
-  PROPOSED C/A
-  PROPOSED C/A LIMITS
-  PROPOSED RIGHT-OF-WAY
-  EXISTING RIGHT-OF-WAY
-  PROPERTY LINES
-  CITY/TOWN LIMITS
-  STREAMS
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-  WETLANDS
-  FEMA 100 YEAR FLOODWAY
-  COMMUNITY FEATURES
-  CELL TOWERS, RADIO TOWERS



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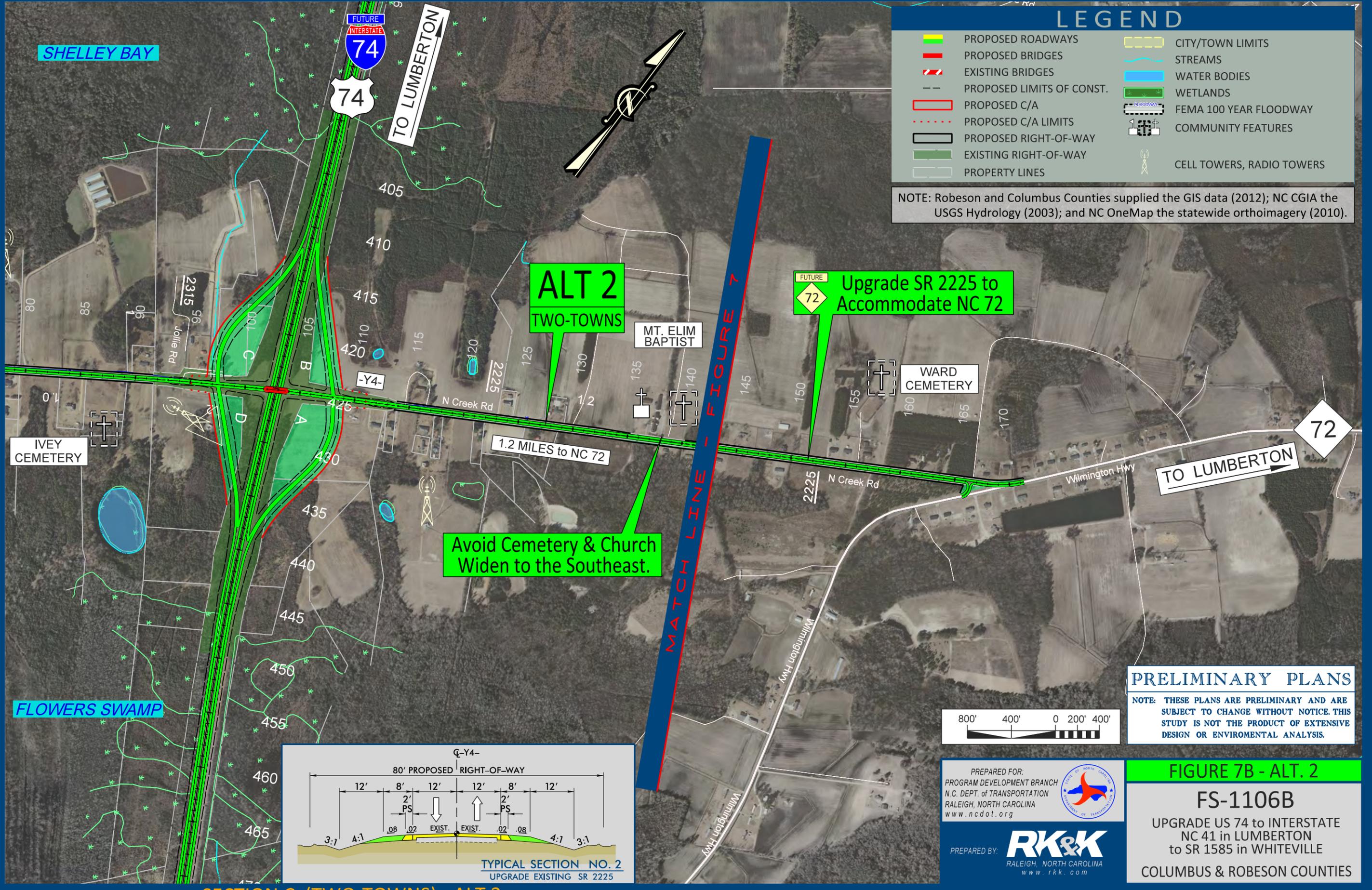


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FIGURE 7A - ALT. 2

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE
COLUMBUS & ROBESON COUNTIES



LEGEND

- PROPOSED ROADWAYS
- PROPOSED BRIDGES
- EXISTING BRIDGES
- PROPOSED LIMITS OF CONST.
- PROPOSED C/A
- PROPOSED C/A LIMITS
- PROPOSED RIGHT-OF-WAY
- EXISTING RIGHT-OF-WAY
- PROPERTY LINES
- CITY/TOWN LIMITS
- STREAMS
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- FEMA 100 YEAR FLOODWAY
- COMMUNITY FEATURES
- ⊕ CELL TOWERS, RADIO TOWERS

NOTE: Robeson and Columbus Counties supplied the GIS data (2012); NC CGIA the USGS Hydrology (2003); and NC OneMap the statewide orthoimagery (2010).

ALT 2
TWO-TOWNS

FUTURE 72
Upgrade SR 2225 to Accommodate NC 72

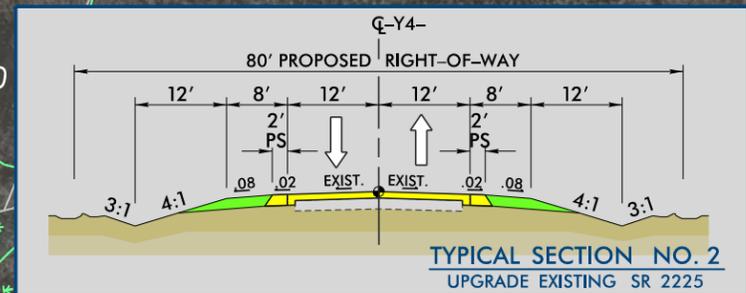
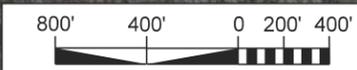
Avoid Cemetery & Church
Widen to the Southeast.

MATCH LINE - FIGURE 7

1.2 MILES to NC 72

PRELIMINARY PLANS

NOTE: THESE PLANS ARE PRELIMINARY AND ARE SUBJECT TO CHANGE WITHOUT NOTICE. THIS STUDY IS NOT THE PRODUCT OF EXTENSIVE DESIGN OR ENVIRONMENTAL ANALYSIS.



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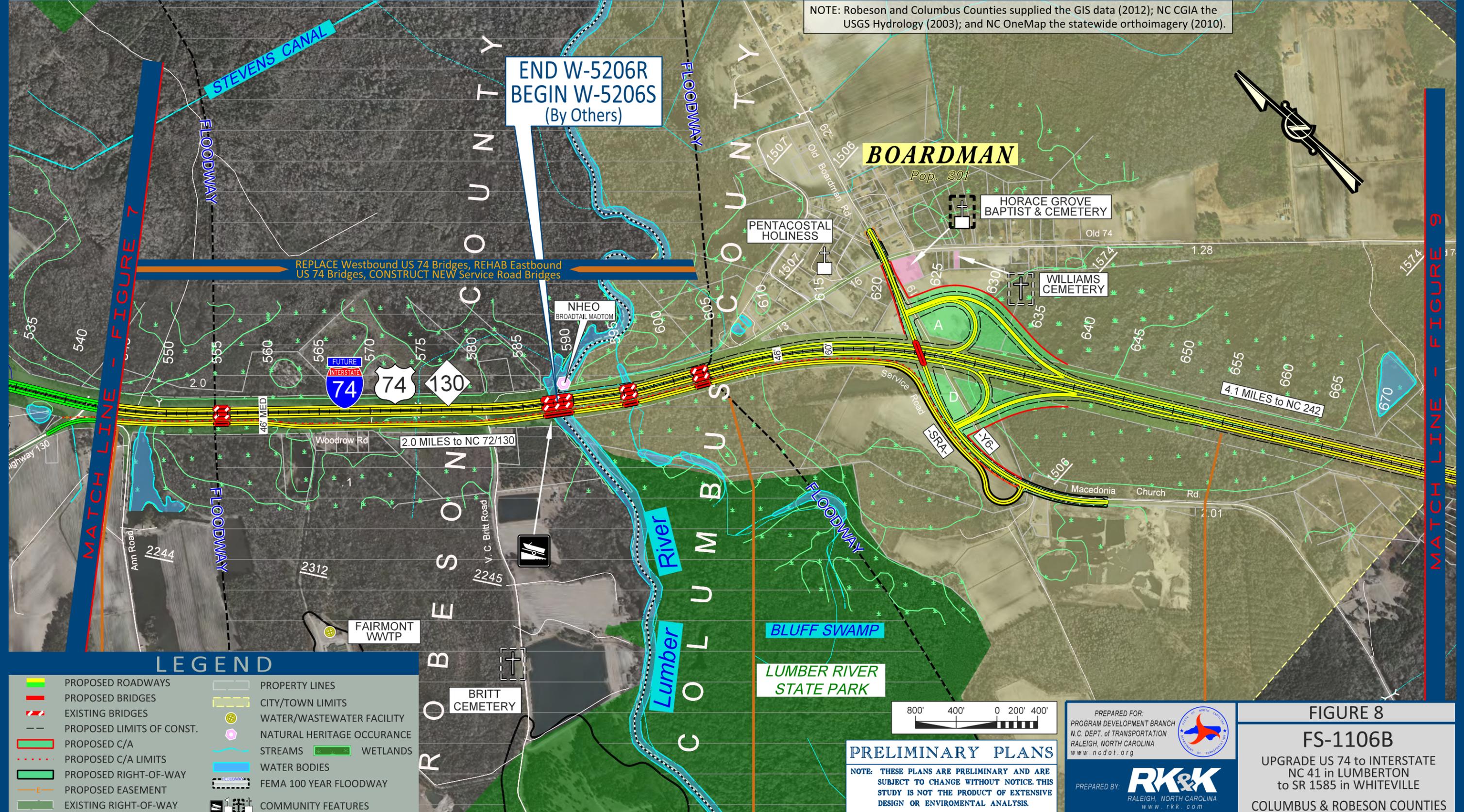
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FIGURE 7B - ALT. 2

FS-1106B
UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE
COLUMBUS & ROBESON COUNTIES

SECTION C (TWO-TOWNS) - ALT 2

NOTE: Robeson and Columbus Counties supplied the GIS data (2012); NC CGIA the USGS Hydrology (2003); and NC OneMap the statewide orthoimagery (2010).



END W-5206R
BEGIN W-5206S
(By Others)

BOARDMAN
Pop. 201

HORACE GROVE
BAPTIST & CEMETERY

WILLIAMS
CEMETERY

NHEO
BROADTAIL MADTOM

PENTACOSTAL
HOLINESS

REPLACE Westbound US 74 Bridges, REHAB Eastbound
US 74 Bridges, CONSTRUCT NEW Service Road Bridges

FUTURE
INTERSTATE
74

74

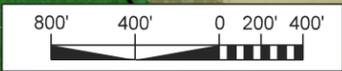
130

2.0 MILES to NC 72/130

4.1 MILES to NC 242

LEGEND

- | | | | |
|--|---------------------------|--|----------------------------|
| | PROPOSED ROADWAYS | | PROPERTY LINES |
| | PROPOSED BRIDGES | | CITY/TOWN LIMITS |
| | EXISTING BRIDGES | | WATER/WASTEWATER FACILITY |
| | PROPOSED LIMITS OF CONST. | | NATURAL HERITAGE OCCURANCE |
| | PROPOSED C/A | | WETLANDS |
| | PROPOSED C/A LIMITS | | STREAMS |
| | PROPOSED RIGHT-OF-WAY | | WATER BODIES |
| | PROPOSED EASEMENT | | FEMA 100 YEAR FLOODWAY |
| | EXISTING RIGHT-OF-WAY | | COMMUNITY FEATURES |



PRELIMINARY PLANS

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FIGURE 8

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE

COLUMBUS & ROBESON COUNTIES

SECTION E

SECTION F

SECTION G

MATCH LINE - FIGURE 7

MATCH LINE - FIGURE 9

LEGEND

	PROPOSED ROADWAYS		PROPERTY LINES
	PROPOSED BRIDGES		CITY/TOWN LIMITS
	EXISTING BRIDGES		STREAMS
	PROPOSED LIMITS OF CONST.		WATER BODIES
	PROPOSED C/A		WETLANDS
	PROPOSED C/A LIMITS		COMMUNITY FEATURES
	PROPOSED RIGHT-OF-WAY		CELL TOWERS, RADIO TOWERS
	EXISTING RIGHT-OF-WAY		

MATCH LINE - FIGURE 8

MATCH LINE - FIGURE 10

BOARDMAN

Pop. 201

PROPOSED DMS (WB)

PROPOSED DMS (EB)

ROUGH HORN BRANCH

COW BRANCH



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PRELIMINARY PLANS

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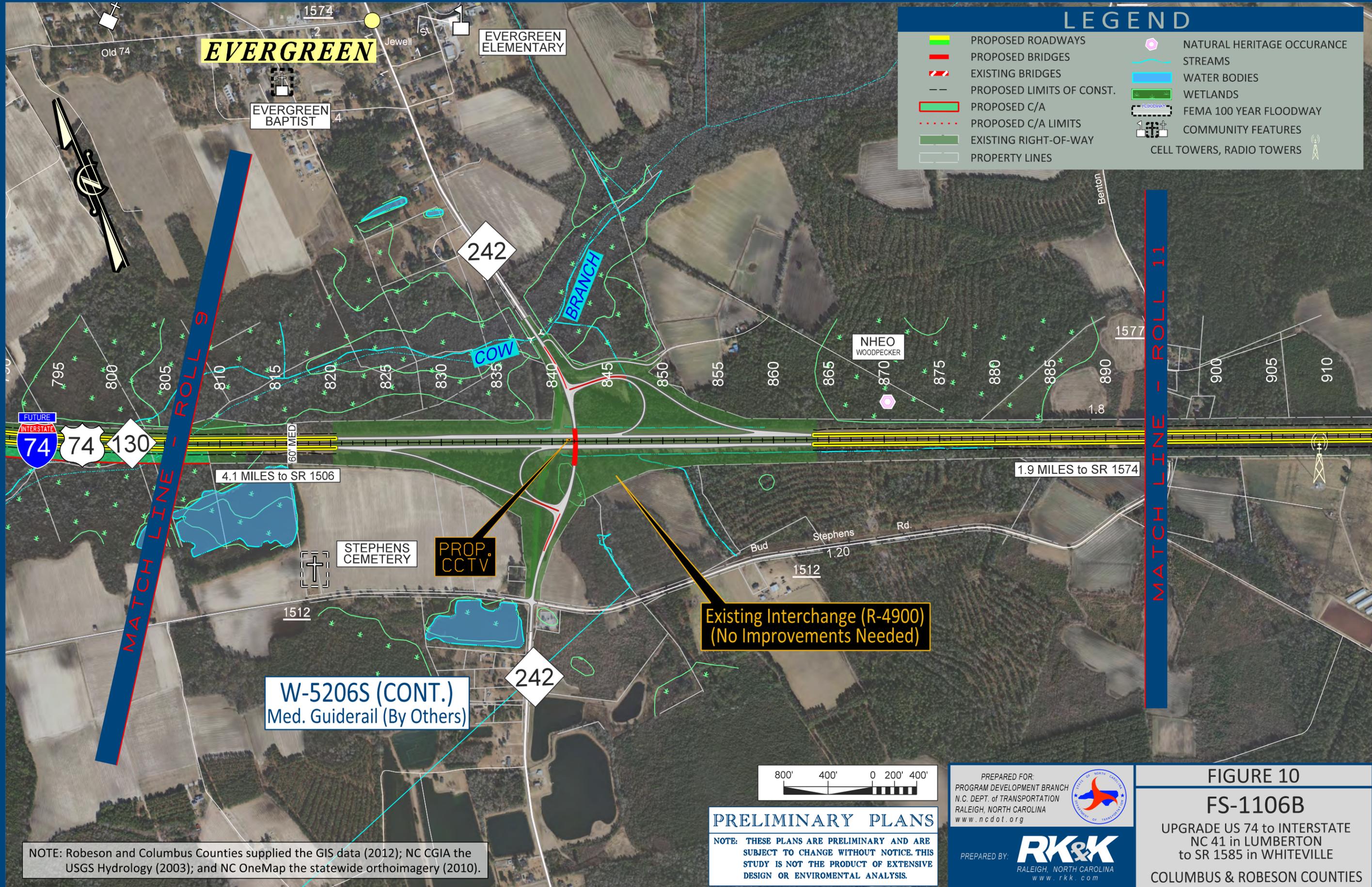
FIGURE 9

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE

COLUMBUS & ROBESON COUNTIES

SECTION G



LEGEND

- PROPOSED ROADWAYS
- PROPOSED BRIDGES
- EXISTING BRIDGES
- PROPOSED LIMITS OF CONST.
- PROPOSED C/A
- PROPOSED C/A LIMITS
- EXISTING RIGHT-OF-WAY
- PROPERTY LINES
- NATURAL HERITAGE OCCURANCE
- STREAMS
- WATER BODIES
- WETLANDS
- FEMA 100 YEAR FLOODWAY
- COMMUNITY FEATURES
- CELL TOWERS, RADIO TOWERS

FUTURE INTERSTATE 74
74 130

MATCH LINE - ROLL 9

MATCH LINE - ROLL 11

EVERGREEN

EVERGREEN ELEMENTARY

EVERGREEN BAPTIST

242

BRANCH

COW

NHEO WOODPECKER

4.1 MILES to SR 1506

1.9 MILES to SR 1574

STEPHENS CEMETERY

PROP CCTV

Existing Interchange (R-4900)
 (No Improvements Needed)

W-5206S (CONT.)
 Med. Guiderail (By Others)

242



PRELIMINARY PLANS

NOTE: THESE PLANS ARE PRELIMINARY AND ARE SUBJECT TO CHANGE WITHOUT NOTICE. THIS STUDY IS NOT THE PRODUCT OF EXTENSIVE DESIGN OR ENVIRONMENTAL ANALYSIS.

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FIGURE 10

FS-1106B

UPGRADE US 74 to INTERSTATE
 NC 41 in LUMBERTON
 to SR 1585 in WHITEVILLE
 COLUMBUS & ROBESON COUNTIES

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PRELIMINARY PLANS

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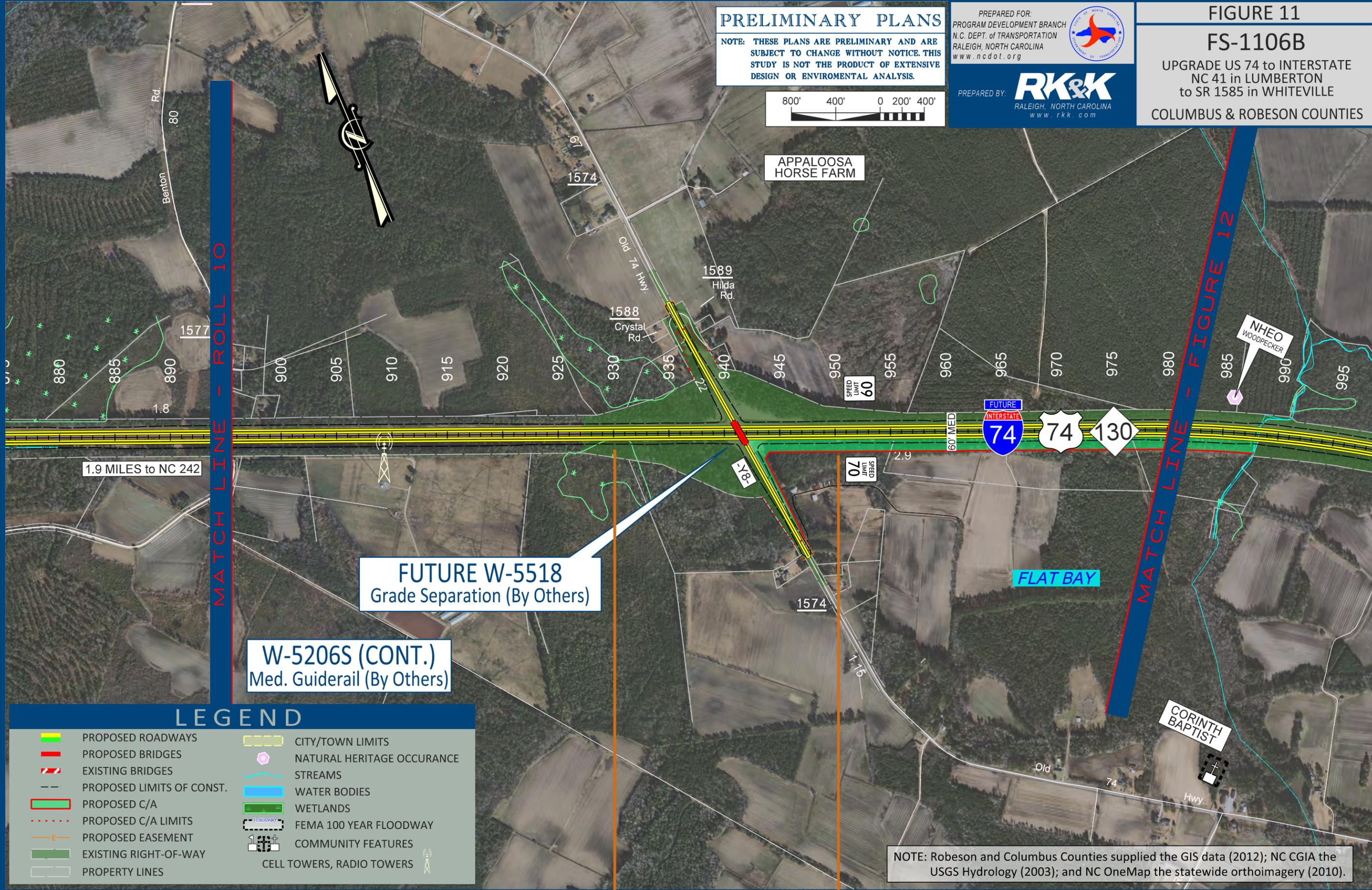
PREPARED BY: **RK&K**
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FIGURE 11

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE

COLUMBUS & ROBESON COUNTIES



FUTURE W-5518
Grade Separation (By Others)

W-5206S (CONT.)
Med. Guiderail (By Others)

LEGEND

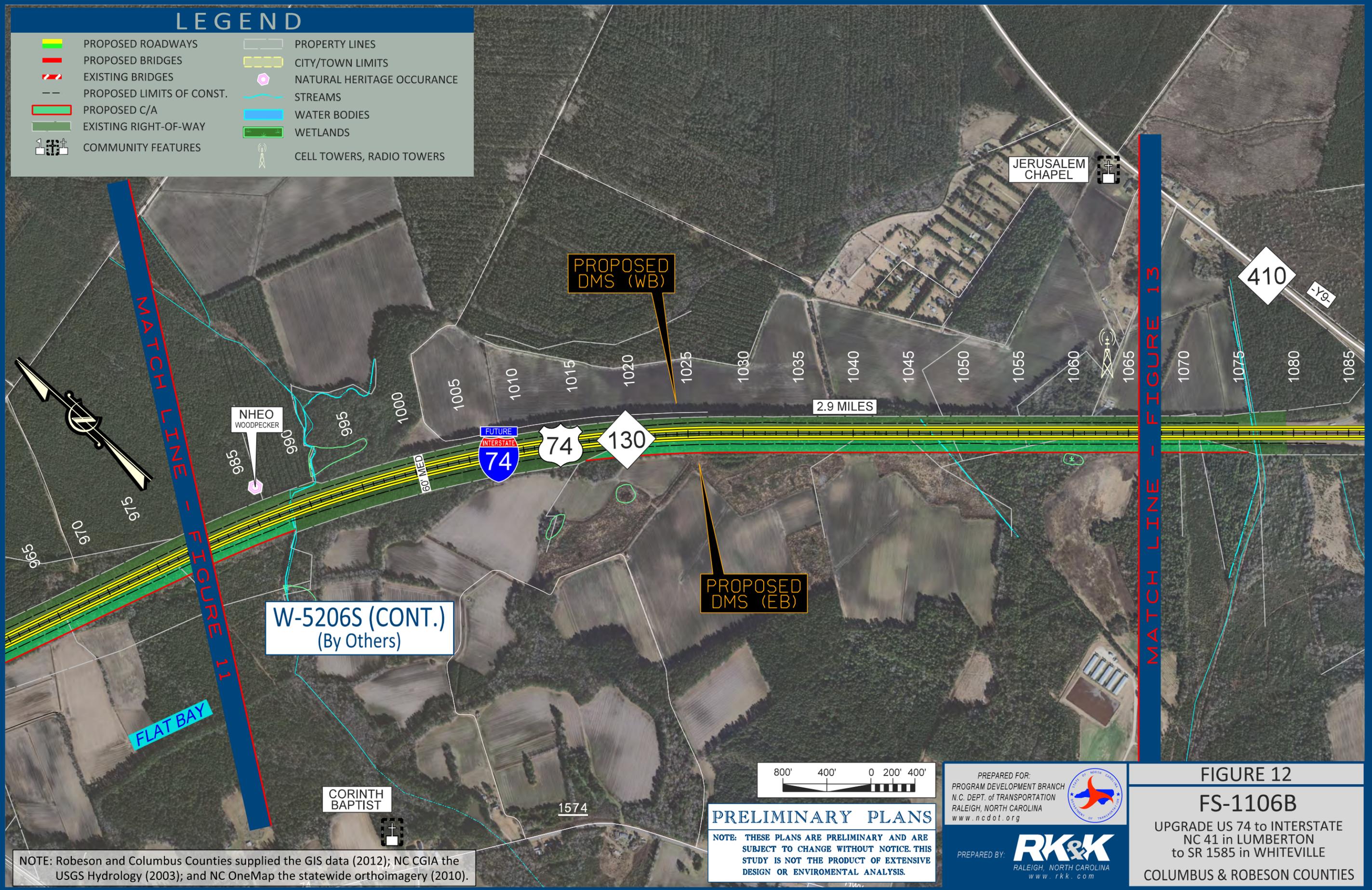
- | | | | |
|--|---------------------------|--|----------------------------|
| | PROPOSED ROADWAYS | | CITY/TOWN LIMITS |
| | PROPOSED BRIDGES | | NATURAL HERITAGE OCCURANCE |
| | EXISTING BRIDGES | | STREAMS |
| | PROPOSED LIMITS OF CONST. | | WATER BODIES |
| | PROPOSED C/A | | WETLANDS |
| | PROPOSED C/A LIMITS | | FEMA 100 YEAR FLOODWAY |
| | PROPOSED EASEMENT | | COMMUNITY FEATURES |
| | EXISTING RIGHT-OF-WAY | | CELL TOWERS, RADIO TOWERS |
| | PROPERTY LINES | | |

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SECTION G **SECTION H** **SECTION I**

LEGEND

- PROPOSED ROADWAYS
- PROPOSED BRIDGES
- EXISTING BRIDGES
- PROPOSED LIMITS OF CONST.
- PROPOSED C/A
- EXISTING RIGHT-OF-WAY
- COMMUNITY FEATURES
- PROPERTY LINES
- CITY/TOWN LIMITS
- NATURAL HERITAGE OCCURANCE
- STREAMS
- WATER BODIES
- WETLANDS
- CELL TOWERS, RADIO TOWERS



PROPOSED DMS (WB)

PROPOSED DMS (EB)

W-5206S (CONT.)
(By Others)

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FIGURE 12

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE
COLUMBUS & ROBESON COUNTIES

SECTION I

NOTE: Robeson and Columbus Counties supplied the GIS data (2012); NC CGIA the USGS Hydrology (2003); and NC OneMap the statewide orthoimagery (2010).

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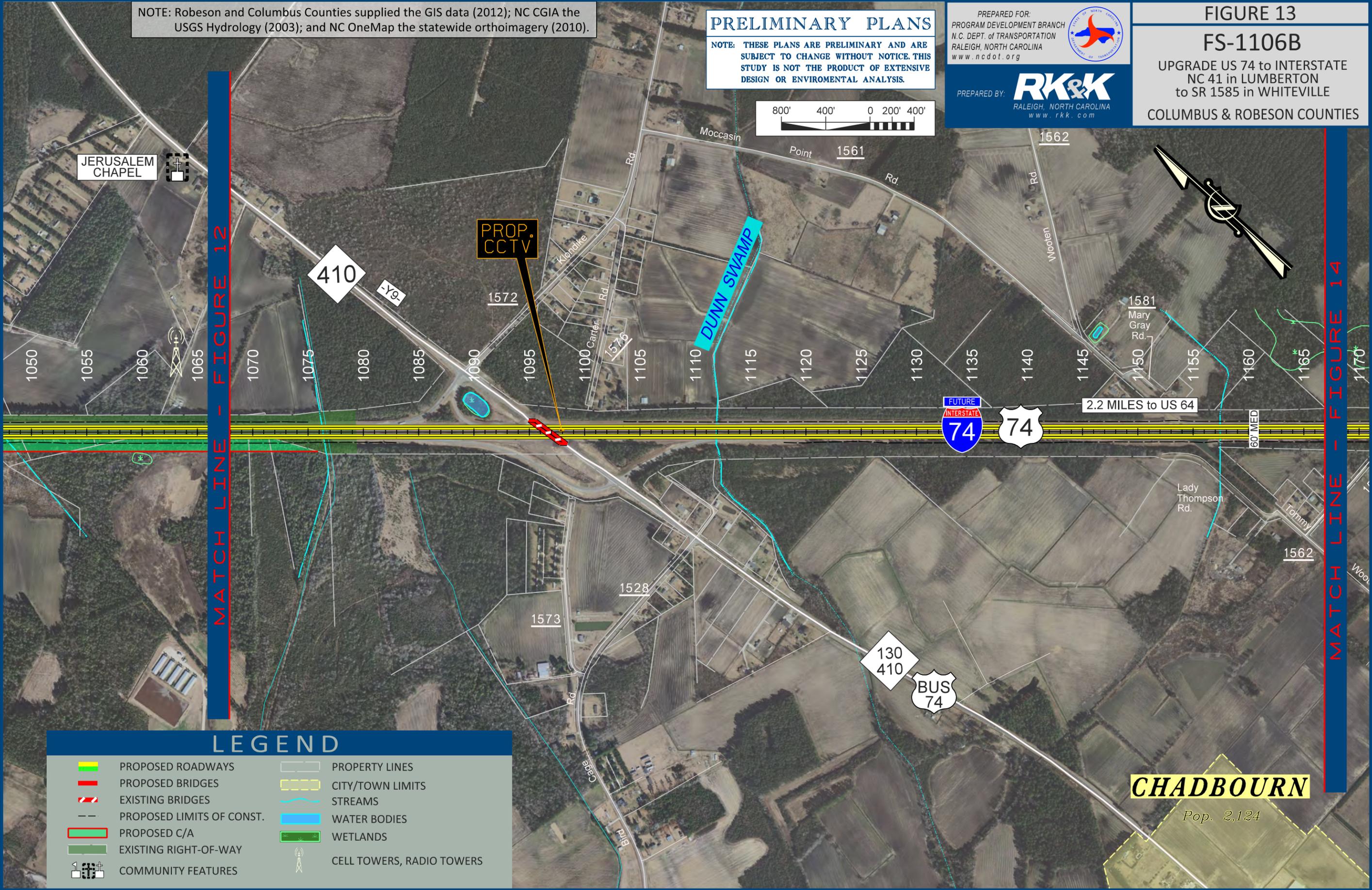
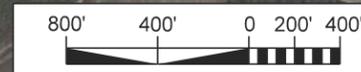
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FIGURE 13

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE

COLUMBUS & ROBESON COUNTIES



MATCH LINE - FIGURE 12

MATCH LINE - FIGURE 14

LEGEND

- | | | | |
|--|---------------------------|--|---------------------------|
| | PROPOSED ROADWAYS | | PROPERTY LINES |
| | PROPOSED BRIDGES | | CITY/TOWN LIMITS |
| | EXISTING BRIDGES | | STREAMS |
| | PROPOSED LIMITS OF CONST. | | WATER BODIES |
| | PROPOSED C/A | | WETLANDS |
| | EXISTING RIGHT-OF-WAY | | CELL TOWERS, RADIO TOWERS |
| | COMMUNITY FEATURES | | |

SECTION I



NOTE: Robeson and Columbus Counties supplied the GIS data (2012); NC CGIA the USGS Hydrology (2003); and NC OneMap the statewide orthoimagery (2010).

LEGEND

- ▬ PROPOSED ROADWAYS
- ▬ PROPOSED BRIDGES
- ▬ EXISTING BRIDGES
- ▬ PROPOSED LIMITS OF CONST.
- ▭ CITY/TOWN LIMITS
- ▭ PROPERTY LINES
- + COMMUNITY FEATURES
- ▬ STREAMS
- ▭ WATER BODIES
- ▭ WETLANDS
- ▭ FEMA 100 YEAR FLOODWAY
- ▬ OVERHEAD POWER LINES
- ⊙ CELL TOWERS, RADIO TOWERS

**End W-5206S Guiderail
Begin Exist. Guiderail**

76
TO S.C.

CHADBOURN

Pop. 2,124

SOUTHEASTERN COMM. COLLEGE

MATCH LINE - FIGURE 15

MATCH LINE - FIGURE 13



PRELIMINARY PLANS

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FIGURE 14

FS-1106B

UPGRADE US 74 to INTERSTATE
NC 41 in LUMBERTON
to SR 1585 in WHITEVILLE

COLUMBUS & ROBESON COUNTIES

SECTION I

LEGEND

- ▬ PROPOSED ROADWAYS
- ▬ PROPOSED BRIDGES
- ▬ EXISTING BRIDGES
- PROPOSED LIMITS OF CONST.
- CITY/TOWN LIMITS
- PROPERTY LINES
- COMMUNITY FEATURES
- ▬ STREAMS
- WATER BODIES
- WETLANDS
- FEMA 100 YEAR FLOODWAY
- ▬ OVERHEAD POWER LINES
- CELL TOWERS, RADIO TOWERS

END STUDY FS-1106B

MATCH LINE - FIGURE 14



NOTE: Robeson and Columbus Counties supplied the GIS data (2012); NC CGIA the USGS Hydrology (2003); and NC OneMap the statewide orthoimagery (2010).

PRELIMINARY PLANS
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FIGURE 15
FS-1106B
 UPGRADE US 74 to INTERSTATE
 NC 41 in LUMBERTON
 to SR 1585 in WHITEVILLE
 COLUMBUS & ROBESON COUNTIES

Appendix A.1

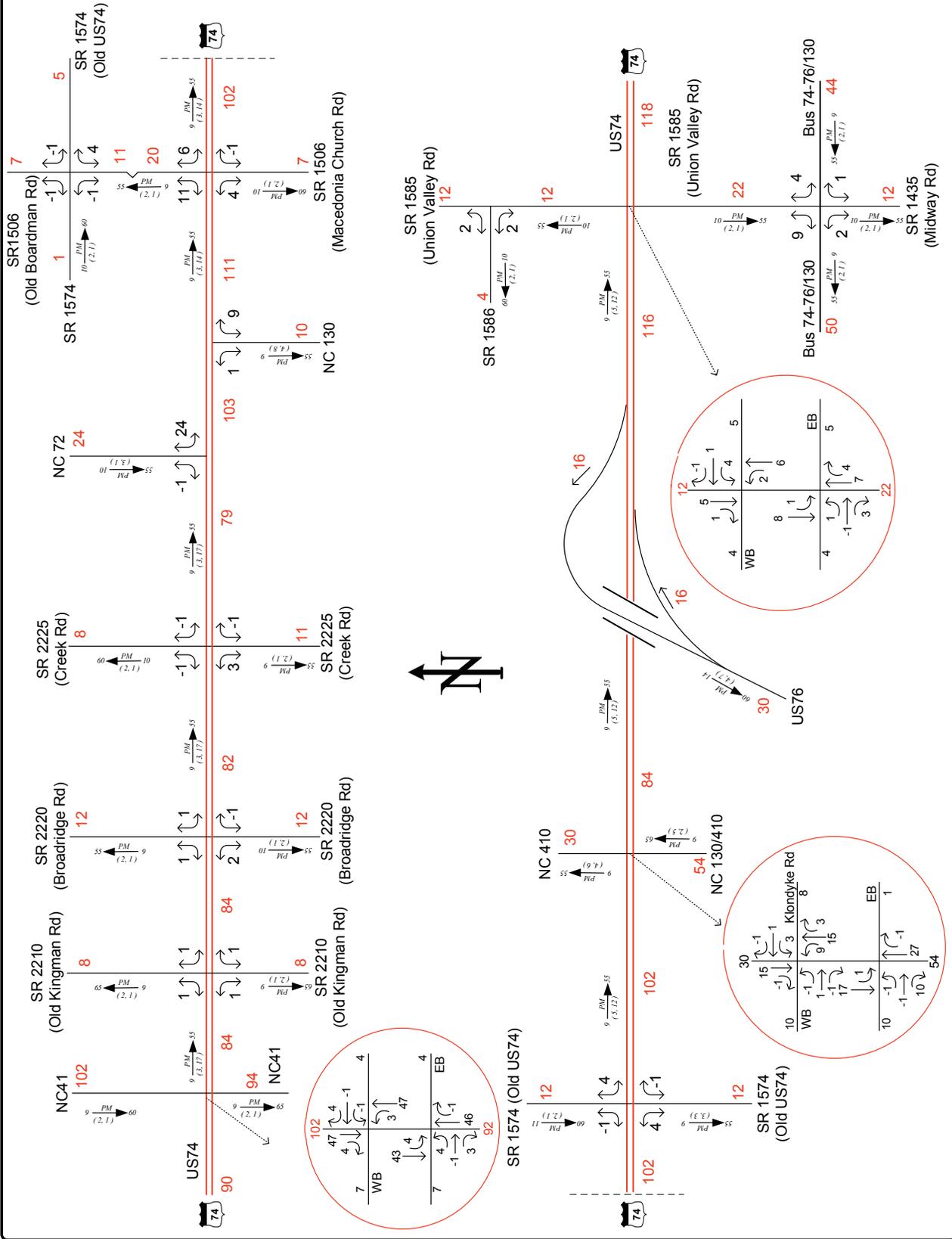


2012 ANNUAL AVERAGE DAILY TRAFFIC NO BUILD SHEET 1 OF 2

LEGEND

- ### No. of Vehicles Per Day (VPD) in 100s
- 1- Less than 50 VPD
- X Movement Prohibited
- K Roadway
- PM Design Hourly Factor
- D Peak Hour Directional Split
- Indicates Direction of D (d,t)
- Duals, TT-STs (%)

TIP: FS1106B	WBS: 34263.1.1
COUNTY: Robeson/Columbus	DIVISION: 6
DATE: 08-2013	
PREPARED BY: Chris McKay	
LOCATION: From NC41 to SR1585 (Union Valley Road)	
PROJECT: Upgrade US74 to Interstate Standards	



Appendix A.2



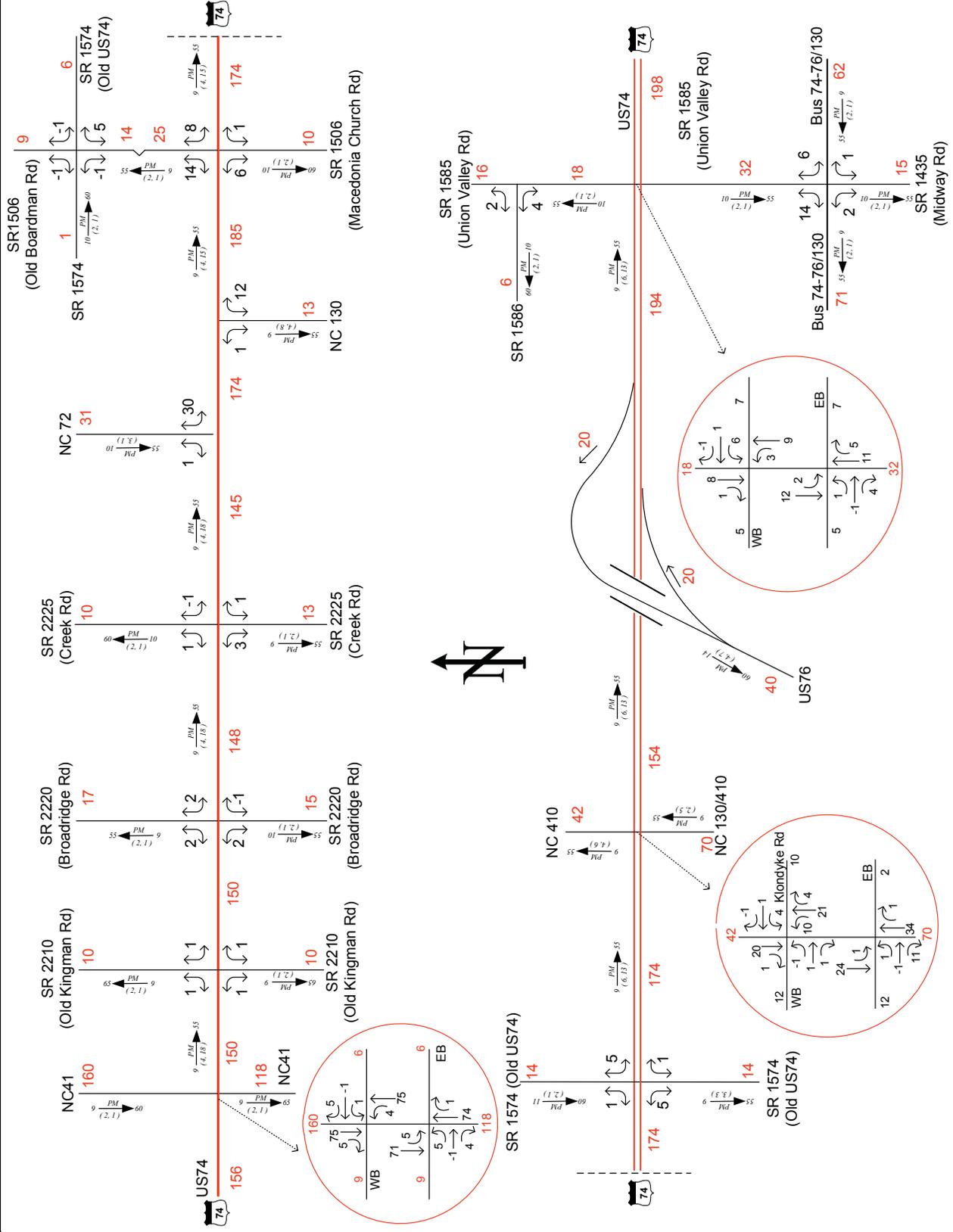
2035

ANNUAL AVERAGE
DAILY TRAFFIC

BUILD LEGEND

- ### No. of Vehicles Per Day (VPD) in 100s
- 1- Less than 50 VPD
- X Movement Prohibited
- K Roadway Design Hourly Factor
- PM PM Peak Period
- D Peak Hour Directional Split
- Indicates Direction of D
- (d,t) Duals, TT-Sts (%)

TIP: FS1106B	WBS: 34263.1.1
COUNTY: Robeson/Columbus	DIVISION: 6
DATE: 08-2013	
PREPARED BY: Chris McKay	
LOCATION: From NC41 to SR1585 (Union Valley Road)	
PROJECT: Upgrade US74 to Interstate Standards	





SUBJECT FS-1106B US 74 Upgrades
Freeway Segments
Based on Chapter 11 of HCM
AM Peak Hour

Cm. No. 11049-A01 SHEET 1 of 2
PREPARED BY SMS DATE 8/8/2012
CHECKED BY BDP DATE 8/15/2013

Location	Direction	Peak Period	V	PHF	N	f _{HV}	f _p	P _T	E _T	P _R	E _R	V _p	S	D	LOS
US 74 West of NC 41	EB	AM	632	0.90	2.00	0.948	1.00	0.11	1.5	0.00	1.2	370	70	5.29	A
US 74 West of NC 41	WB	AM	772	0.90	2.00	0.948	1.00	0.11	1.5	0.00	2.0	452	70	6.46	A
US 74 from NC 41 to SR 2220	EB	AM	607	0.90	2.00	0.948	1.00	0.11	1.5	0.00	2.0	356	70	5.08	A
US 74 from NC 41 to SR 2220	WB	AM	743	0.90	2.00	0.948	1.00	0.11	1.5	0.00	2.0	435	70	6.22	A
US 74 from SR 2220 to SR 2225	EB	AM	599	0.90	2.00	0.948	1.00	0.11	1.5	0.00	2.0	351	70	5.02	A
US 74 from SR 2220 to SR 2225	WB	AM	733	0.90	2.00	0.948	1.00	0.11	1.5	0.00	2.0	430	70	6.14	A
US 74 from SR 2225 to NC 72	EB	AM	587	0.90	2.00	0.948	1.00	0.11	1.5	0.00	2.0	344	70	4.91	A
US 74 from SR 2225 to NC 72	WB	AM	718	0.90	2.00	0.948	1.00	0.11	1.5	0.00	2.0	421	70	6.01	A
US 74 from NC 72 to NC 130	EB	AM	705	0.90	2.00	0.952	1.00	0.10	1.5	0.00	2.0	411	70	5.88	A
US 74 from NC 72 to NC 130	WB	AM	861	0.90	2.00	0.952	1.00	0.10	1.5	0.00	2.0	502	70	7.18	A
US 74 from NC 130 to SR 1506	EB	AM	749	0.90	2.00	0.952	1.00	0.10	1.5	0.00	2.0	437	70	6.24	A
US 74 from NC 130 to SR 1506	WB	AM	916	0.90	2.00	0.952	1.00	0.10	1.5	0.00	2.0	534	70	7.63	A
US 74 from SR 1506 to NC 242	EB	AM	705	0.90	2.00	0.952	1.00	0.10	1.5	0.00	2.0	411	70	5.88	A
US 74 from SR 1506 to NC 242	WB	AM	861	0.90	2.00	0.952	1.00	0.10	1.5	0.00	2.0	502	70	7.18	A
US 74 from NC 242 to SR 1574	EB	AM	705	0.90	2.00	0.952	1.00	0.10	1.5	0.00	2.0	411	70	5.88	A
US 74 from NC 242 to SR 1574	WB	AM	861	0.90	2.00	0.952	1.00	0.10	1.5	0.00	2.0	502	70	7.18	A
US 74 from SR 1574 to NC 410	EB	AM	705	0.90	2.00	0.957	1.00	0.09	1.5	0.00	2.0	409	70	5.85	A
US 74 from SR 1574 to NC 410	WB	AM	861	0.90	2.00	0.957	1.00	0.09	1.5	0.00	2.0	500	70	7.14	A
US 74 from NC 410 to US 76	EB	AM	624	0.90	2.00	0.957	1.00	0.09	1.5	0.00	2.0	362	70	5.18	A
US 74 from NC 410 to US 76	WB	AM	762	0.90	2.00	0.957	1.00	0.09	1.5	0.00	2.0	442	70	6.32	A
US 74 from US 76 to SR 1435/1585	EB	AM	786	0.90	2.00	0.957	1.00	0.09	1.5	0.00	2.0	456	70	6.52	A
US 74 from US 76 to SR 1435/1585	WB	AM	960	0.90	2.00	0.957	1.00	0.09	1.5	0.00	2.0	557	70	7.96	A
US 74 East of SR 1435/1585	EB	AM	802	0.90	2.00	0.957	1.00	0.09	1.5	0.00	2.0	466	70	6.65	A
US 74 East of SR 1435/1585	WB	AM	980	0.90	2.00	0.957	1.00	0.09	1.5	0.00	2.0	569	70	8.13	A

V = Volume (veh/hr)
PHF = Peak-Hour Factor
N = Number of Lanes
f_{HV} = Heavy Vehicle Adjustment Factor (Based on HCM Eq. 11-3)
f_p = Population Adjustment Factor
P_T = Proportions of truck in traffic stream
E_T = Passenger-car equivalent of one truck or bus (Based on HCM Exhibit 11-10)

P_R = Proportions of RVs in traffic stream
E_R = PCE of RVs (Based on HCM Exhibit 11-10)
V_p = Demand Flow Rate (pc/h/ln) based on HCM Eq. 11-2
S = Mean speed of traffic stream
D = Density (pc/mi/ln) based on HCM Eq. 11-4
LOS = Level-of-Service based on HCM Exhibit 11-5

HCM Equation 11-2

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$

HCM Equation 11-3

$$f_{HV} = \frac{1}{1 + P_T (E_T - 1) + P_R (E_R - 1)}$$

HCM Equation 11-4

$$D = \frac{v_p}{S}$$

2010 Highway Capacity Manual - Exhibit 11-5:

LOS Criteria for Basic Freeway Segment s

Level of Service	Density (pc/mi/ln)
A	≤ 11
B	> 11 – 18
C	> 18 – 26
D	> 26 – 35
E	> 35 – 45
F	> 45 (or v/c-ratio > 1.00)

SUBJECT FS-1106B US 74 Upgrades
 Freeway Segments
 Based on Chapter 11 of HCM
 PM Peak Hour

Cm. No. 11049-A01 SHEET 2 of 2
 PREPARED BY SMS DATE 8/8/2012
 CHECKED BY BDP DATE 8/15/2013



Location	Direction	Peak Period	V	PHF	N	f _{HV}	f _p	P _T	E _T	P _R	E _R	V _p	S	D	LOS
US 74 West of NC 41	EB	PM	772	0.90	2.00	0.858	1.00	0.11	2.5	0.00	2.0	500	70	7.14	A
US 74 West of NC 41	WB	PM	632	0.90	2.00	0.858	1.00	0.11	2.5	0.00	2.0	409	70	5.84	A
US 74 from NC 41 to SR 2220	EB	PM	743	0.90	2.00	0.858	1.00	0.11	2.5	0.00	2.0	481	70	6.87	A
US 74 from NC 41 to SR 2220	WB	PM	607	0.90	2.00	0.858	1.00	0.11	2.5	0.00	2.0	393	70	5.61	A
US 74 from SR 2220 to SR 2225	EB	PM	733	0.90	2.00	0.858	1.00	0.11	2.5	0.00	2.0	474	70	6.78	A
US 74 from SR 2220 to SR 2225	WB	PM	599	0.90	2.00	0.858	1.00	0.11	2.5	0.00	2.0	388	70	5.54	A
US 74 from SR 2225 to NC 72	EB	PM	718	0.90	2.00	0.858	1.00	0.11	2.5	0.00	2.0	465	70	6.64	A
US 74 from SR 2225 to NC 72	WB	PM	587	0.90	2.00	0.858	1.00	0.11	2.5	0.00	2.0	380	70	5.43	A
US 74 from NC 72 to NC 130	EB	PM	861	0.90	2.00	0.870	1.00	0.10	2.5	0.00	2.0	550	70	7.86	A
US 74 from NC 72 to NC 130	WB	PM	705	0.90	2.00	0.870	1.00	0.10	2.5	0.00	2.0	450	70	6.43	A
US 74 from NC 130 to SR 1506	EB	PM	916	0.90	2.00	0.870	1.00	0.10	2.5	0.00	2.0	585	70	8.36	A
US 74 from NC 130 to SR 1506	WB	PM	749	0.90	2.00	0.870	1.00	0.10	2.5	0.00	2.0	479	70	6.84	A
US 74 from SR 1506 to NC 242	EB	PM	861	0.90	2.00	0.870	1.00	0.10	2.5	0.00	2.0	550	70	7.86	A
US 74 from SR 1506 to NC 242	WB	PM	705	0.90	2.00	0.870	1.00	0.10	2.5	0.00	2.0	450	70	6.43	A
US 74 from NC 242 to SR 1574	EB	PM	861	0.90	2.00	0.870	1.00	0.10	2.5	0.00	2.0	550	70	7.86	A
US 74 from NC 242 to SR 1574	WB	PM	705	0.90	2.00	0.870	1.00	0.10	2.5	0.00	2.0	450	70	6.43	A
US 74 from SR 1574 to NC 410	EB	PM	861	0.90	2.00	0.881	1.00	0.09	2.5	0.00	2.0	543	70	7.76	A
US 74 from SR 1574 to NC 410	WB	PM	705	0.90	2.00	0.881	1.00	0.09	2.5	0.00	2.0	445	70	6.35	A
US 74 from NC 410 to US 76	EB	PM	762	0.90	2.00	0.881	1.00	0.09	2.5	0.00	2.0	480	70	6.86	A
US 74 from NC 410 to US 76	WB	PM	624	0.90	2.00	0.881	1.00	0.09	2.5	0.00	2.0	393	70	5.62	A
US 74 from US 76 to SR 1435/1585	EB	PM	960	0.90	2.00	0.881	1.00	0.09	2.5	0.00	2.0	605	70	8.65	A
US 74 from US 76 to SR 1435/1585	WB	PM	786	0.90	2.00	0.881	1.00	0.09	2.5	0.00	2.0	496	70	7.08	A
US 74 East of SR 1435/1585	EB	PM	980	0.90	2.00	0.881	1.00	0.09	2.5	0.00	2.0	618	70	8.83	A
US 74 East of SR 1435/1585	WB	PM	802	0.90	2.00	0.881	1.00	0.09	2.5	0.00	2.0	506	70	7.22	A

V = Volume (veh/hr)
 PHF = Peak-Hour Factor
 N = Number of Lanes
 f_{HV} = Heavy Vehicle Adjustment Factor (Based on HCM Eq. 11-3)
 f_p = Population Adjustment Factor
 P_T = Proportions of truck in traffic stream
 E_T = Passenger-car equivalent of one truck or bus (Based on HCM Exhibit 11-10)
 P_R = Proportions of RVs in traffic stream
 E_R = PCE of RVs (Based on HCM Exhibit 11-10)
 V_p = Demand Flow Rate (pc/h/in) based on HCM Eq. 11-2
 S = Mean speed of traffic stream
 D = Density (pc/mi/in) based on HCM Eq. 11-4
 LOS = Level-of-Service based on HCM Exhibit 11-5

HCM Equation 11-2

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$

HCM Equation 11-3

$$f_{HV} = \frac{1}{1 + P_T (E_T - 1) + P_R (E_R - 1)}$$

HCM Equation 11-4

$$D = \frac{v_p}{S}$$

2010 Highway Capacity Manual - Exhibit 11-5:

LOS Criteria for Basic Freeway Segment s

Level of Service	Density (pc/mi/in)
A	≤ 11
B	> 11 – 18
C	> 18 – 26
D	> 26 – 35
E	> 35 – 45
F	> 45 (or v/c-ratio > 1.00)



Cm. No. 11049 SHEET 1 of 2
 PREPARED BY SMS DATE 8/8/2012
 CHECKED BY BDP DATE 8/15/2013

SUBJECT FS-1106B US 74 Upgrades
 Ramp Merge and Diverge
 Based on Chapter 13 of HCM
 AM Peak Hour

Interchange	Ramp Name	Peak Period	Type of Ramp (On/Off)	Volumes		PHF	Fwy N	f _{iw}		f _p	P _T		E _T	P _R	E _R	P _{FD}	P _{FM}	V _f	V _r	L ₀ or L _A	V ₁₂	Speed		D	LOS
				Fwy	Ramp			Fwy	Ramp		Fwy	Ramp										Fwy	Ramp		
NC 41	EB Off-Ramp	AM	Off	632	35	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	1.2	1.0	1.0	370	39	350	370	70	50	4.29	A
	EB On-Ramp	AM	On	597	25	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	350	38	600	350	70	50	4.65	A
	WB Off-Ramp	AM	Off	755	29	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	443	33	350	443	70	50	4.91	A
	WB On-Ramp	AM	On	726	46	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	426	52	600	426	70	50	5.41	A
SR 2220	EB Off-Ramp	AM	Off	603	10	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	353	11	350	353	70	50	4.14	A
	EB On-Ramp	AM	On	593	12	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	348	13	600	348	70	50	4.52	A
	WB Off-Ramp	AM	Off	725	5	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	425	6	350	425	70	50	4.76	A
	WB On-Ramp	AM	On	720	30	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	422	34	600	422	70	50	5.25	A
SR 2225	EB Off-Ramp	AM	Off	594	8	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	348	9	350	348	70	50	4.10	A
	EB On-Ramp	AM	On	586	7	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	343	8	600	343	70	50	4.45	A
	WB Off-Ramp	AM	Off	710	2	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	416	2	350	416	70	50	4.68	A
	WB On-Ramp	AM	On	708	32	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	415	36	600	415	70	50	5.21	A
NC 72 / NC 130	EB Off-Ramp	AM	Off	582	14	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	341	16	350	341	70	50	4.04	A
	EB On-Ramp	AM	On	568	185	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	333	208	600	333	70	50	5.83	A
	WB Off-Ramp	AM	Off	914	210	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	536	236	350	536	70	50	5.71	A
	WB On-Ramp	AM	On	704	17	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	413	19	600	413	70	50	5.07	A
SR 1506	EB Off-Ramp	AM	Off	742	75	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	433	84	350	433	70	50	4.82	A
	EB On-Ramp	AM	On	667	44	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	389	49	600	389	70	50	5.11	A
	WB Off-Ramp	AM	Off	853	38	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	498	43	350	498	70	50	5.38	A
	WB On-Ramp	AM	On	815	109	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	475	122	600	475	70	50	6.32	A
NC 242	EB Off-Ramp	AM	Off	705	23	0.90	2.00	0.952	0.980	1.00	0.10	0.04	1.5	0.00	2.0	1.0	1.0	411	26	350	411	70	50	4.64	A
	EB On-Ramp	AM	On	682	23	0.90	2.00	0.952	0.980	1.00	0.10	0.04	1.5	0.00	2.0	1.0	1.0	398	26	600	398	70	50	5.01	A
	WB Off-Ramp	AM	Off	861	24	0.90	2.00	0.952	0.980	1.00	0.10	0.04	1.5	0.00	2.0	1.0	1.0	502	27	350	502	70	50	5.42	A
	WB On-Ramp	AM	On	837	24	0.90	2.00	0.952	0.980	1.00	0.10	0.04	1.5	0.00	2.0	1.0	1.0	488	27	600	488	70	50	5.72	A
SR 1574	EB Off-Ramp	AM	Off	706	28	0.90	2.00	0.952	0.985	1.00	0.10	0.03	1.5	0.00	2.0	1.0	1.0	412	32	350	412	70	50	4.64	A
	EB On-Ramp	AM	On	678	25	0.90	2.00	0.952	0.985	1.00	0.10	0.03	1.5	0.00	2.0	1.0	1.0	396	28	600	396	70	50	5.00	A
	WB Off-Ramp	AM	Off	868	39	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	506	44	350	506	70	50	5.46	A
	WB On-Ramp	AM	On	829	26	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	484	29	600	484	70	50	5.70	A
NC 410	EB Off-Ramp	AM	Off	705	49	0.90	2.00	0.957	0.980	1.00	0.09	0.04	1.5	0.00	2.0	1.0	1.0	409	56	350	409	70	50	4.62	A
	EB On-Ramp	AM	On	656	8	0.90	2.00	0.957	0.980	1.00	0.09	0.04	1.5	0.00	2.0	1.0	1.0	381	9	600	381	70	50	4.75	A
	WB Off-Ramp	AM	Off	856	58	0.90	2.00	0.957	0.980	1.00	0.09	0.04	1.5	0.00	2.0	1.0	1.0	497	66	350	497	70	50	5.38	A
	WB On-Ramp	AM	On	798	63	0.90	2.00	0.957	0.980	1.00	0.09	0.04	1.5	0.00	2.0	1.0	1.0	463	71	600	463	70	50	5.85	A
SR 1585	EB Off-Ramp	AM	Off	790	20	0.90	2.00	0.957	0.990	1.00	0.09	0.02	1.5	0.00	2.0	1.0	1.0	459	22	350	459	70	50	5.05	A
	EB On-Ramp	AM	On	770	32	0.90	2.00	0.957	0.990	1.00	0.09	0.02	1.5	0.00	2.0	1.0	1.0	447	36	600	447	70	50	5.46	A
	WB Off-Ramp	AM	Off	980	33	0.90	2.00	0.957	0.990	1.00	0.09	0.02	1.5	0.00	2.0	1.0	1.0	569	37	350	569	70	50	5.99	A
	WB On-Ramp	AM	On	947	29	0.90	2.00	0.957	0.990	1.00	0.09	0.02	1.5	0.00	2.0	1.0	1.0	550	33	600	550	70	50	6.24	A

V = Volume (veh/hr)
 PHF = Peak-Hour Factor
 N = Number of Lanes
 f_{iw} = Heavy Vehicle Adjustment Factor (Based on HCM Eq. 11-3)
 f_p = Population Adjustment Factor
 P_T = Proportions of truck in traffic stream
 E_T = Passenger-car equivalent of one truck or bus (Based on HCM Exhibit 11-10)
 P_R = Proportions of RVs in traffic stream
 E_R = PCE of RVs (Based on HCM Exhibit 11-10)
 P_{FD} = Percentage of Traffic in mainline lanes for diverge based on HCM Exhibit 13-7
 P_{FM} = Percentage of Traffic in mainline lanes for merge based on HCM Exhibit 13-6
 V_f = Freeway Demand Flow Rate (pc/h/ln) based on HCM Eq. 11-2
 V_r = Ramp Demand Flow Rate (pc/h/ln) based on HCM Eq. 11-2
 L₀ or L_A = Length of Acceleration or Deceleration Lane
 V₁₂ = Demand Flow Rate of lanes 1 and 2 (pc/h/ln) based on HCM Eq. 13-2 or 13-8
 S = Mean speed of traffic stream
 D = Density (pc/mi/ln) based on HCM Eq. 13-21 or 13-22
 LOS = Level-of-Service based on HCM Exhibit 13-2

Level of Service	Density (pc/mi/ln)
A	≤ 10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	Demand Exceeds Capacity



Cm. No. 11049 SHEET 2 of 2
 PREPARED BY SMS DATE 8/8/2012
 CHECKED BY BDP DATE 8/15/2013

SUBJECT FS-1106B US 74 Upgrades
 Ramp Merge and Diverge
 Based on Chapter 13 of HCM
 PM Peak Hour

Interchange	Ramp Name	Peak Period	Type of Ramp (On/Off)	Volumes		PHF	Fwy N	f _{iw}		f _p	P _t		E _t	P _R	E _R	P _{RD}	P _{FM}	V _f	V _R	L ₀ or L _A	V ₁₂	Speed		D	LOS
				Fwy	Ramp			Fwy	Ramp		Fwy	Ramp										Fwy	Ramp		
NC 41	EB Off-Ramp	PM	Off	772	46	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	1.2	1.0	1.0	452	52	350	452	70	50	4.99	A
	EB On-Ramp	PM	On	726	28	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	426	31	600	426	70	50	5.26	A
	WB Off-Ramp	PM	Off	623	26	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	365	29	350	365	70	50	4.24	A
	WB On-Ramp	PM	On	597	35	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	350	39	600	350	70	50	4.73	A
SR 2220	EB Off-Ramp	PM	Off	751	31	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	440	35	350	440	70	50	4.89	A
	EB On-Ramp	PM	On	720	5	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	422	6	600	422	70	50	5.05	A
	WB Off-Ramp	PM	Off	603	11	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	353	12	350	353	70	50	4.14	A
	WB On-Ramp	PM	On	592	11	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	347	12	600	347	70	50	4.51	A
SR 2225	EB Off-Ramp	PM	Off	741	33	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	434	37	350	434	70	50	4.84	A
	EB On-Ramp	PM	On	708	2	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	415	2	600	415	70	50	4.97	A
	WB Off-Ramp	PM	Off	592	6	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	347	7	350	347	70	50	4.09	A
	WB On-Ramp	PM	On	586	8	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	343	9	600	343	70	50	4.46	A
NC 72 / NC 130	EB Off-Ramp	PM	Off	720	14	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	422	16	350	422	70	50	4.73	A
	EB On-Ramp	PM	On	703	210	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	412	236	600	412	70	50	6.66	A
	WB Off-Ramp	PM	Off	754	185	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	442	208	350	442	70	50	4.90	A
	WB On-Ramp	PM	On	569	14	0.90	2.00	0.948	0.990	1.00	0.11	0.02	1.5	0.00	2.0	1.0	1.0	333	16	600	333	70	50	4.43	A
SR 1506	EB Off-Ramp	PM	Off	924	109	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	539	122	350	539	70	50	5.74	A
	EB On-Ramp	PM	On	815	38	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	475	43	600	475	70	50	5.73	A
	WB Off-Ramp	PM	Off	711	44	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	415	49	350	415	70	50	4.67	A
	WB On-Ramp	PM	On	667	75	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	389	84	600	389	70	50	5.37	A
NC 242	EB Off-Ramp	PM	Off	861	24	0.90	2.00	0.952	0.980	1.00	0.10	0.04	1.5	0.00	2.0	1.0	1.0	502	27	350	502	70	50	5.42	A
	EB On-Ramp	PM	On	837	24	0.90	2.00	0.952	0.980	1.00	0.10	0.04	1.5	0.00	2.0	1.0	1.0	488	27	600	488	70	50	5.72	A
	WB Off-Ramp	PM	Off	705	23	0.90	2.00	0.952	0.980	1.00	0.10	0.04	1.5	0.00	2.0	1.0	1.0	411	26	350	411	70	50	4.64	A
	WB On-Ramp	PM	On	682	23	0.90	2.00	0.952	0.980	1.00	0.10	0.04	1.5	0.00	2.0	1.0	1.0	398	26	600	398	70	50	5.01	A
SR 1574	EB Off-Ramp	PM	Off	855	27	0.90	2.00	0.952	0.985	1.00	0.10	0.03	1.5	0.00	2.0	1.0	1.0	499	30	350	499	70	50	5.39	A
	EB On-Ramp	PM	On	829	39	0.90	2.00	0.952	0.985	1.00	0.10	0.03	1.5	0.00	2.0	1.0	1.0	484	44	600	484	70	50	5.81	A
	WB Off-Ramp	PM	Off	703	24	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	410	27	350	410	70	50	4.63	A
	WB On-Ramp	PM	On	677	29	0.90	2.00	0.952	0.990	1.00	0.10	0.02	1.5	0.00	2.0	1.0	1.0	395	33	600	395	70	50	5.03	A
NC 410	EB Off-Ramp	PM	Off	861	58	0.90	2.00	0.957	0.980	1.00	0.09	0.04	1.5	0.00	2.0	1.0	1.0	500	66	350	500	70	50	5.40	A
	EB On-Ramp	PM	On	803	10	0.90	2.00	0.957	0.980	1.00	0.09	0.04	1.5	0.00	2.0	1.0	1.0	466	11	600	466	70	50	5.43	A
	WB Off-Ramp	PM	Off	718	68	0.90	2.00	0.957	0.980	1.00	0.09	0.04	1.5	0.00	2.0	1.0	1.0	417	77	350	417	70	50	4.69	A
	WB On-Ramp	PM	On	650	55	0.90	2.00	0.957	0.980	1.00	0.09	0.04	1.5	0.00	2.0	1.0	1.0	377	62	600	377	70	50	5.11	A
SR 1585	EB Off-Ramp	PM	Off	976	28	0.90	2.00	0.957	0.990	1.00	0.09	0.02	1.5	0.00	2.0	1.0	1.0	567	31	350	567	70	50	5.97	A
	EB On-Ramp	PM	On	948	32	0.90	2.00	0.957	0.990	1.00	0.09	0.02	1.5	0.00	2.0	1.0	1.0	550	36	600	550	70	50	6.27	A
	WB Off-Ramp	PM	Off	802	33	0.90	2.00	0.957	0.990	1.00	0.09	0.02	1.5	0.00	2.0	1.0	1.0	466	37	350	466	70	50	5.11	A
	WB On-Ramp	PM	On	769	20	0.90	2.00	0.957	0.990	1.00	0.09	0.02	1.5	0.00	2.0	1.0	1.0	446	22	600	446	70	50	5.36	A

V = Volume (veh/hr)
 PHF = Peak-Hour Factor
 N = Number of Lanes
 f_{iw} = Heavy Vehicle Adjustment Factor (Based on HCM Eq. 11-3)
 Population Adjustment Factor
 P_t = Proportions of truck in traffic stream
 E_t = Passenger-car equivalent of one truck or bus (Based on HCM Exhibit 11-10)
 P_R = Proportions of RVs in traffic stream
 E_R = PCE of RVs (Based on HCM Exhibit 11-10)

P_{RD} = Percentage of Traffic in mainline lanes for diverge based on HCM Exhibit 13-7
 P_{FM} = Percentage of Traffic in mainline lanes for merge based on HCM Exhibit 13-6
 V_f = Freeway Demand Flow Rate (pc/h/m) based on HCM Eq. 11-2
 V_R = Ramp Demand Flow Rate (pc/h/m) based on HCM Eq. 11-2
 L₀ or L_A = Length of Acceleration or Deceleration Lane
 V₁₂ = Demand Flow Rate of lanes 1 and 2 (pc/h/m) based on HCM Eq. 13-2 or 13-8
 S = Mean speed of traffic stream
 D = Density (pc/mi/m) based on HCM Eq. 13-21 or 13-22
 LOS = Level-of-Service based on HCM Exhibit 13-2

2010 Highway Capacity Manual - Exhibit 13-2:
 LOS Criteria for Merge and Diverge Segments

Level of Service	Density (pc/mi/m)
A	≤ 10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	Demand Exceeds Capacity

HCM Unsignalized Intersection Capacity Analysis

2: US 74 EB Off-Ramp & NC 72/130

Appendix A.7

8/10/2012

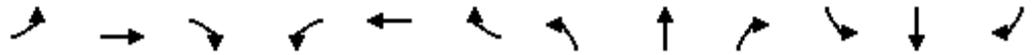


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕						↕			↕	
Volume (veh/h)	8	0	6	0	0	0	0	9	55	130	47	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.92	0.90	0.92	0.92	0.92	0.92	0.85	0.92	0.92	0.89	0.92
Hourly flow rate (vph)	9	0	7	0	0	0	0	11	60	141	53	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											915	
pX, platoon unblocked												
vC, conflicting volume	376	406	53	383	376	40	53			70		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	376	406	53	383	376	40	53			70		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	100	100	100	100			91		
cM capacity (veh/h)	539	485	1012	531	504	1031	1553			1530		

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	16	70	194
Volume Left	9	0	141
Volume Right	7	60	0
cSH	674	1700	1530
Volume to Capacity	0.02	0.04	0.09
Queue Length 95th (ft)	2	0	8
Control Delay (s)	10.5	0.0	5.7
Lane LOS	B		A
Approach Delay (s)	10.5	0.0	5.7
Approach LOS	B		

Intersection Summary		
Average Delay		4.5
Intersection Capacity Utilization	26.3%	ICU Level of Service
Analysis Period (min)		15
		A

HCM Unsignalized Intersection Capacity Analysis
 3: US 74 WB On-Ramp & NC 72



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↔			↔			↔	
Volume (veh/h)	0	0	0	47	0	163	9	8	0	0	130	8
Sign Control		Stop				Stop			Free			Free
Grade		0%				0%			0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.85	0.25	0.86	0.85	0.92	0.92	0.92	0.86	0.88
Hourly flow rate (vph)	0	0	0	55	0	190	11	9	0	0	151	9
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	375	186	156	186	190	9	160			9		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	375	186	156	186	190	9	160			9		
tC, single (s)	7.1	6.5	6.2	7.2	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	93	100	82	99			100		
cM capacity (veh/h)	476	704	890	762	703	1067	1419			1611		
Direction, Lane #	WB 1	NB 1	SB 1									
Volume Total	245	19	160									
Volume Left	55	11	0									
Volume Right	190	0	9									
cSH	979	1419	1700									
Volume to Capacity	0.25	0.01	0.09									
Queue Length 95th (ft)	25	1	0									
Control Delay (s)	9.9	4.2	0.0									
Lane LOS	A	A										
Approach Delay (s)	9.9	4.2	0.0									
Approach LOS	A											
Intersection Summary												
Average Delay			5.9									
Intersection Capacity Utilization			27.8%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 2: US 74 EB Off-Ramp & NC 72/130



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↕						↕			↕		
Volume (veh/h)	8	0	9	0	0	0	0	6	47	163	55	0	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.90	0.92	0.90	0.92	0.92	0.92	0.92	0.85	0.92	0.92	0.89	0.92	
Hourly flow rate (vph)	9	0	10	0	0	0	0	7	51	177	62	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	449	474	62	459	449	33	62				58		
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	449	474	62	459	449	33	62				58		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1		
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2		
p0 queue free %	98	100	99	100	100	100	100				89		
cM capacity (veh/h)	473	433	1000	463	447	1041	1541				1546		
Direction, Lane #													
	EB 1	NB 1	SB 1										
Volume Total	19	58	239										
Volume Left	9	0	177										
Volume Right	10	51	0										
cSH	656	1700	1546										
Volume to Capacity	0.03	0.03	0.11										
Queue Length 95th (ft)	2	0	10										
Control Delay (s)	10.6	0.0	5.9										
Lane LOS	B		A										
Approach Delay (s)	10.6	0.0	5.9										
Approach LOS	B												
Intersection Summary													
Average Delay			5.1										
Intersection Capacity Utilization			28.6%	ICU Level of Service					A				
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis

3: US 74 WB On-Ramp & NC 72

Appendix A.10

8/10/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↔			↔			↔	
Volume (veh/h)	0	0	0	55	0	130	6	8	0	0	163	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.85	0.25	0.86	0.85	0.92	0.92	0.92	0.86	0.88
Hourly flow rate (vph)	0	0	0	65	0	151	7	9	0	0	190	9
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	368	217	194	217	221	9	199				9	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	368	217	194	217	221	9	199				9	
tC, single (s)	7.1	6.5	6.2	7.2	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.6	4.0	3.3	2.2				2.2	
p0 queue free %	100	100	100	91	100	86	99				100	
cM capacity (veh/h)	503	678	847	728	677	1067	1374				1611	
Direction, Lane #	WB 1	NB 1	SB 1									
Volume Total	216	16	199									
Volume Left	65	7	0									
Volume Right	151	0	9									
cSH	937	1374	1700									
Volume to Capacity	0.23	0.01	0.12									
Queue Length 95th (ft)	22	0	0									
Control Delay (s)	10.0	3.4	0.0									
Lane LOS	A	A										
Approach Delay (s)	10.0	3.4	0.0									
Approach LOS	A											
Intersection Summary												
Average Delay			5.1									
Intersection Capacity Utilization			26.8%	ICU Level of Service	A							
Analysis Period (min)			15									