# STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

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STATE PROJECT: FEDERAL PROJECT:

GOVERNOR

NHF-18-4(19)

6.469002T R-0513A

COUNTY: Robeson
DESCRIPTION: US 74 fro

US 74 from Maxton Bypass to 1.87 km East of SR 1166

SECRETARY

(Cabinet Shop Road)

SUBJECT: Geotechnical Report - Inventory

The project consists of upgrading dual lane US 74 to a relocated four lane divided facility with a typical median width of 21 meters. The majority of the project generally lies parallel to and south of existing US 74. Length of the project is 7.7 km. The eastern terminus will tie into a future US 74 roadway project. The geotechnical investigation of subsurface conditions was confined to the corridor of proposed new construction.

The following survey lines were investigated for this project:

<u>Line</u>	<u>Station</u>
-L-	10+00 to 86+00
-Y1-	10+60 to 25+20
-RPAY1-	10+00 to 14+65
-RPBY1-	10+00 to 19+22
-RPCY1-	10+00 to 14+04
-RPDY1-	10+00 to 19+55
-LPAY1-	10+00 to 13+15
-LPDY1-	10+00 to 16+30
-Y2-	11+00 to 22+00
-RPAY2-	10+00 to 16+44
-RPBY2-	10+00 to 15+14
-RPCY2-	10+00 to 16+28
-RPDY2-	10+00 to 15+10
-Y3-	10+00 to 11+50

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Soils occurring along the project are derived from marine, eolian and fluvial sediments deposited in the geologic past.

The predominant soil type along the project consists of fine to coarse sand (A-2-4, A-3, A-1-b, A-2-6). Sand occurs as surficial deposits, low ridges or rims associated with probable Carolina Bays and as thick beds underlying the surficial soils. Engineering properties of the granular soils are generally good to excellent but the material is highly susceptible to erosion.

Cohesive soils typically consisting of clayey sandy silt (A-4) and silty to fine sandy clay (A-6, A-7-6) occur as 1 to 2 meter thick surficial beds and discontinuous beds of variable thickness underlying the surficial soil veneer. Silt and clay soils occurring at depth are typically interbedded with granular material. Engineering properties of the silt and clay soils generally range from fair to poor. The sandy silt (A-4) and sandy clay (A-6) soils with a maximum Plasticity Index of 15 and 50 percent or less passing the 75µm sieve generally exhibit fair engineering properties and may be suitable for use in subgrade if moisture contents are low. However, the majority of the surficial cohesive soils consist of soft to medium stiff fine sandy clay (A-6, A-7-6) with poor engineering properties as shown by plasticity indices of 16 to 25, above optimum moisture contents and an excess of 50 percent passing the 75µm sieve. These surficial clay soils have the potential to cause subgrade failure. Beds of fine sandy or silty clay (A-6, A-7-6) with very soft to soft consistency occur at depth primarily in the -Y2- interchange area. These compressible clay soils typically exhibit low shear strengths and have the potential to cause long term settlement and/or stability problems.

Organic soils occurring along the project typically consist of muck, slightly to highly organic sands (A-2-4, A-2-5), silts (A-4, A-5) and clays (A-6, A-7-6). Tested organic contents range from 6.5 to 42.8 percent. Typically, surficial organic soils occur in the flood plain of a minor tributary of the Lumber River near the beginning of the project along segments of -L-, -RPBY1-, -RPCY1-, -SR1-, -X2- and -X3-. A Carolina Bay containing surficial organic soils is crossed by segments of -RPDY1- and -LPDY1-. Buried deposits of organic soil occur along segments of -L- (station 26+00±), -RPAY1- (station 11+00±) and portions of the -Y2- interchange area.

The organic soils are generally highly compressible and exhibit low shear strengths. A potential for subgrade failure or embankment stability/long term settlement problems exists in areas containing organic soils.

### <u>Culverts</u>

Based on the Culvert Survey and Hydraulic Design Report of 1/8/01, a dual 2.4m x 2.1m RCBC is proposed for -Y2- over Double Branch at station 12+42.5. A Standard Penetration Test (SPT) boring made adjacent to the proposed culvert site shows that very loose to loose fine to coarse sand (A-1-b, A-2-4) underlies the culvert site. However, an interbed of soft sandy silty clay (A-6) occurs between elevation 45.6 and 46.6± meters. Ground water was measured at an elevation of 49 meters.

-SR1-	12+60 to 25+59
-SR2-	10+03 to 39+60
-SR3-	10+03 to 26+37
-X1-	21+93 to 26+32
-X2-	9+66 to 13+87
-X3-	8+73 to 13+90

-2-

Areas of Special Geotechnical Interest

1) A high water table, seasonal high ground water or the potential for ground water related construction problems occurs along the majority of the project.

2) The following sections contain surficial cohesive soils which have the potential to cause subgrade problems during construction. Typically the cohesive soils exhibit medium to high plasticity indices, relatively high moisture contents and 50 percent or more passing the 75 µm sieve

3) The following sections		3) The following sections contain organic soils:
<u>Line</u>	<u>Station</u>	
		<u>Line</u>
-L-	22+90 to 38+20±	-L-
-L-	42+00 to 43+50	<b>-</b> L-
-L-	44+40 to 48+90	-L-
-L-	51+40 to 52+60	-L-
-L-	53+40 to 53+80	
-L-	54+10 to 58+70	-RPAY1-
-L-	64+70 to 68+20	-RPBY1-
-L-	69+80 to 73+40	-RPCY1-
-L-	80+40 to 82+80	-RPDY1-
-L-	83+70 to 85+80	-LPDY1-
-Y1-	14+90 to 16+30±	<b>-</b> Y2-
-RPAY1-	10+00 to 14+65	-RPBY2-
-RPCY1-	13+10 to 13+90	-RPCY2-
-RPDY1-	10+00 to 11+30	-RPCY2-
-LPAY1-	10+60 to 12+00	-RPDY2-
-Y2-	17+30 to 19+20±	-SR1-
-RPAY2-	10+00 to 12+20	-SR2-
-RPCY2-	15+60 to 16+28	-SR3-
-RPDY2-	12+00 to 15+10	-X2-
		-X3-

12+60 to 13+20±

20+80 to  $21+30\pm$ 

22+40 to 23+60

Approximate limits of surficial organic soils are shown on the accompanying plan view sheets.

-SR2-

-SR2-

-SR2-

-SR2-

-SR2-

-SR2-

-SR3-

-SR3-

-X1-

-X2-

-X3-

10+10 to  $10+70\pm$ 

21+20 to 22+80

23+85 to 26+40

27+50 to 29+30

29+80 to 31+20

37+40 to 38+60

39+20 to 39+60

20+00 to 24+40±

25+20 to 26+37

23+60 to  $24+70\pm$ 

11+40.to 12+10

12+00 to 12+90

Station 11+00 to 13+20±

14+40 to 16+20±

25+45 to  $27+00\pm$ 

 $81+10 \text{ to } 86+00\pm$ 

10+60 to 12+00±

12+50 to 12+90±

12+15 to  $12+70\pm$ 

11+60 to 16+30±

11+35 to  $13+30\pm$ 

 $15+80 \text{ to } 18+50\pm$ 

12+20 to 14+40±

14+00 to  $14+40\pm$ 

16+20 to 16+28±

15+00 to  $15+10\pm$ 

16+40 to 17+40±

12+00 to 15+10±

20+70 to 25+70± 10+90 to 12+10±

11+00 to  $12+15\pm$ 

4) The following sections contain beds of very soft to soft clay and/or organic soils which have the potential to cause embankment stability and/or long term settlement problems:

Line	Station
<b>-</b> L-	25+45 to 27+00±
<b>-</b> Y1-	$18+00 \text{ to } 20+00\pm$
-RPAY1-	10+60 to 12+00±
-RPBY1-	12+50 to 12+90±
-RPCY1-	$12+20$ to $12+70\pm$
-LPDY1-	11+35 to 13+30±
-Y2-	$15+30$ to $18+50\pm$
-RPAY2-	$15+80$ to $16+44\pm$
-RPBY2-	12+20 to 15+14±
-RPCY2-	13+00 to 16+28±
-RPDY2-	$13+80 \text{ to } 15+10\pm$
-SR1-	16+40 to 17+45±
-SR1-	$19+60 \text{ to } 21+40\pm$

#### **Physiography and Geology**

The project is located within the Inner Coastal Plain Physiographic Province. Geology basically consists of mixed fluvial, marine and eolian sediments of Pliocene to Recent age overlying deltaic sediments of the Upper Cretaceous age Black Creek Formation. The project corridor traverses gently sloping to nearly level topography generally ranging from 55 to 49± meters in elevation. Elevations are highest near the beginning of the project and gradually decrease towards the project's eastern terminus.

The project is primarily located on upland topography which generally forms the interstream divide between Big Shoe Heel Creek to the south and the Lumber River to the north. Carolina Bay or bay like features which have been drained occur along portions of the project. Drainage is provided by a minor tributary of the Lumber River near the beginning of the project and primarily by canals or farm ditches along the remainder of the project. The canals and ditches flow into the Big Shoe Heel Creek and Lumber River drainage systems. Drainage conditions are generally fair to poor along the project corridor due to the nearly level topography and lack of sufficient natural outfall.

#### **Ground Water Properties**

Ground water data was collected primarily from summer of 2000 through the winter of 2000/2001 during average rainfall conditions. Typically ground water levels were measured at depths of 1.0 to 1.5 meters or less along the majority of the project.

## **Undisturbed Samples**

Undisturbed (Shelby Tube) samples were taken at the following locations and submitted for testing:

-SR1-

-SR1-

-SR1-

Sample No.	Station	Depth (m)	Test
ST-1	15+45, -Y2-	3.04 - 3.64	Triaxial CU
ST-2	15+45, -Y2-	3.04 - 3.64	Consolidation
ST-3	14+60, -RPDY2-	4.56 - 5.16	Triaxial CU
ST-4	11+00, -RPAY1-	0.45 - 1.06	Consolidation
ST-5	11+00, -RPAY1-	2.59 - 3.20	Consolidation
ST-6	12+20, -L-	0.45 - 1.05	Triaxial CU & Consolidation
ST-7	14+65, -L-	1.83 - 2.43	Consolidation
ST-8	14+00, RPBY2-, 10 m Rt.	3.20 - 3.80	Triaxial CU & Consolidation
ST-9	16+00, -RPCY2-	3.6 - 4.2	Triaxial CU & Consolidation
ST-10	21+06, -SR1-	5.5 – 6.1	Triaxial CU & Consolidation

### California Bearing Ratio (CBR) Samples

Bulk samples were taken at the following locations and submitted for CBR testing:

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Sample No.	<u>Station</u>	Depth (m)
CBR-1	-SR1- 19+40	0.3 - 1.0
CBR-2	-L- 38+60	0.3 - 1.0
CBR-3	-L- 78+00	0.3 - 1.0

Respectfully submitted,

EaWitst

E. A. Witort, Project Geologist