



FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603-2302
T 919.828.3441 | F 919.828.5751
NC Engineering License # F-0266

June 25, 2019

WBS Element No.: 50056.1.1
TIP No.: W-5600
Federal Aid No.: HISP-0070(163)
County: Johnston
Description: US-70 Improvements from US 70 Business to the Neuse River Bridge

SUBJECT: Geotechnical Report – Recommendations

Froehling & Robertson, Inc. has completed the subsurface investigation of the above referenced project based on plans dated 11/2/17 and submits the following recommendations.

(I) Slope/Embankment Stability

A) Slope Design

Slope Recommendations were previously submitted by F&R per “Geotechnical Slope Recommendations” report dated March 5, 2019 and approved by NCDOT on March 6, 2019. Per this previously-submitted report, it was typically recommended that cut and fill slopes be constructed at a ratio of 3:1 (H:V) or flatter with the exception of the areas from -L- station 158+50 to 167+50, -Y7- station 25+00 to 29+00, and -Y7- 28+00 to 29+50, where 1.5:1 slopes with Rock Plating slope protection are proposed. The estimated total area of Rock Plating is 4,400 square yards.

B) Undercut for Embankment Stability

We recommend a contingency item of 2,000 cubic yards be included in the contract to be used at the discretion of the Engineer.

C) Geotextile for Soil Stabilization

We recommend a contingency item of 2,000 square yards be included in the contract to be used at the discretion of the Engineer.



(II) **Subgrade Stability**

A) Subsurface Drainage – Underdrain

Groundwater is present within 6 feet of proposed subgrade at the following areas hence Pipe Underdrain, per Roadway Standard Drawing 815.03, is recommended. The estimated quantity for Pipe Underdrains is approximately 11,000 linear feet which includes additional footage for estimated outfalls.

<u>Alignment</u>	<u>Station (±)</u>
-SR1-	51+50 to 52+50
-SR2-	81+50 to 85+50, right
-SR2-	92+00 to 93+50
-Y7LPC-	12+00 to 19+00
-Y7RPC-	10+00 to 31+77.21
-Y9-	22+50 to 23+50, left
-Y9RPC-	23+50 to 24+50

We also recommend a contingency item of 1,000 linear feet of Subsurface Drain, per Roadway Standard Drawing 815.02, to be used at the discretion of the Engineer.

We also recommend a contingency item of 1,000 linear feet of Pipe Underdrains, per Roadway Standard Drawing 815.03, to be used at the discretion of the Engineer.

B) Grade Point Undercut

We recommend a contingency item of 250 cubic yards of Undercut Excavation be included in the contract to be used at the discretion of the Engineer.

C) Undercut for Subgrade Stability

Soft, wet, and highly plastic soils were encountered at the ground surface at the following areas and have the potential to cause subgrade problems during construction:

<u>Alignment</u>	<u>Station (±)</u>
-SR4-	13+25 to 16+75
-SR7-	15+25 to 18+75
-SR7-	41+25 to 42+75
-SR7-	65+00 to 72+75



-SR8-	10+00 to 11+75
-Y7-	19+25 to 20+75
-Y7LPC-	14+25 to 19+25
-Y7RPC-	12+25 to 26+00

F&R recommends undercutting these areas a minimum of 3 feet below proposed subgrade, placing a geotextile for soil stabilization onto the resulting excavation, and backfilling with Class II or III select granular material. The estimated quantity of Undercut for Subgrade Stability is approximately 11,200 cubic yards. See section II-E for the estimated quantity of Geotextile for Soil stabilization and section III-C for the estimated quantity of Select Granular Materials.

We also recommend a contingency item of 1,000 cubic yards be included in the contract to be used at the discretion of the Engineer.

D) Aggregate Subgrade

Highly plastic soils were encountered at the ground surface at the following area and have the potential to cause subgrade problems during construction:

<u>Alignment</u>	<u>Station (±)</u>
-SR2-	84+50 to 85+75

Due to traffic control concerns in this area, F&R recommends undercutting this area a maximum of 1 foot below proposed subgrade, placing a geotextile for soil stabilization onto the resulting excavation, and backfilling with Class IV select granular material. The estimated quantity of Shallow Undercut is approximately 150 cubic yards.

The estimated quantity of Class IV Select Material (Subgrade Stabilization) is approximately 300 tons.

The estimated quantity of Geotextile for Soil Stabilization is approximately 450 square yards.

We also recommend a contingency item of 1,000 cubic yards of Shallow Undercut be included in the contract to be used at the discretion of the Engineer.

We recommend a contingency item of 2,000 tons of Class IV Select Material (Subgrade Stabilization) be included in the contract to be used at the discretion of the Engineer.



We recommend a contingency item of 3,000 square yards of Geotextile for Soil Stabilization be included in the contract to be used at the discretion of the Engineer.

E) Geotextile for Soil Stabilization

The estimated quantity of Geotextile for Soil Stabilization is approximately 11,200 square yards due to undercut for subgrade stability. See section II-C for complete recommendations.

We recommend a contingency item of 5,000 square yards be included in the contract to be used at the discretion of the Engineer.

(III) Borrow Specifications

A) Borrow Criteria

Common borrow for embankment construction to subgrade shall meet Coastal Plain Borrow Criteria outlined in the Standard Specifications, Article 1018-2 (B).

B) Shrinkage Factor

We recommend a 25% soil Shrinkage Factor be used in Johnston County for earthwork calculations.

C) Select Granular Material

The estimated quantity of Select Granular Material is 11,200 cubic yards. The select granular material should meet the criteria outlined in the Standard Specifications, Article 1016-3, Class II or III. The select material should be placed to a height of three (3) feet above the geotextile-for-soil-stabilization or water level, whichever is greater. Above the select granular material, common borrow may be used. See section II-C for complete recommendations.

We also recommend a contingency item of 7,000 cubic yards of Select Granular Material meeting the criteria outlined in the Standard Specifications, Article 1016-3, Class II or Class III.



(IV) Miscellaneous

A) Reduction of Unclassified Excavation – Clearing and Grubbing

A loss of 2,000 cubic yards is estimated on the project due to Clearing and Grubbing of cut sections.

B) Reduction of Unclassified Excavation - Unsuitable Unclassified Excavation

The following areas of unclassified excavation contain soils with a Plasticity Index more than 20 and are not to be used in the construction of embankments and should be wasted:

<u>Alignment</u>	<u>Station (±)</u>
-SR2-	84+50 to 85+75
-SR4-	13+25 to 16+75
-SR7-	15+25 to 18+75
-SR7-	41+25 to 42+75
-SR7-	65+00 to 72+75
-Y7-	19+25 to 20+75
-Y7LPC-	14+25 to 16+25
-Y7RPC-	12+25 to 26+00

A quantity of approximate 50,000 cubic yards of Unclassified Excavation, which is unsuitable for construction and is recommended to be wasted, has been estimated from the cross sections. The soils are shown by the single hatch pattern on the attached cross sections.

C) Ponds

A pond is located within the proposed construction limits at the following location and will be drained during construction.

<u>Alignment</u>	<u>Station (±)</u>
-Y7RPA-	17+75 to 18+50



We appreciate the opportunity to be of service to you on this project. Please contact us should you have any questions concerning this report or if you need additional information.

Sincerely,

FROEHLING & ROBERTSON, INC.



Cheng Wang, Ph.D., P.E.
Geotechnical Project Manager

W. Patrick Alton, P.E.
Transportation Services Manager

Attachments: 1) Summary of Quantities



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT
 Summary of Quantities

WBS Number: 47802.1.1
 TIP Number: W-5600
 Description: US-70 Improvements from US 70 Business to the Neuse River Bridge

County: Johnston
 Field Office: F&R

Project Engineer: P. Alton
 Project Geologist: S. Woods

Pay Item No.	Pay Item/ Quantity Adjustment	Spec Book Section No. or Special Provision (SP) Reference	Report Section	Alignment	Begin Station	End Station	Quantity	Units / %
003600000-E	Undercut Excavation	225 - Roadway Excavation	I. B	Contingency	N/A	N/A	2,000	CY
003600000-E	Undercut Excavation	225 - Roadway Excavation	II. B	Contingency	N/A	N/A	250	CY
003600000-E	Undercut Excavation	225 - Roadway Excavation	II. C	Contingency	N/A	N/A	1,000	CY
003600000-E	Undercut Excavation	225 - Roadway Excavation	II. C	Varies	N/A	N/A	11,200	CY
Total Quantity of Undercut Excavation =							14,450	CY
019500000-E	Select Granular Material	265 - Select Granular Material	III. C	Varies	N/A	N/A	11,200	CY
019500000-E	Select Granular Material	265 - Select Granular Material	III. C	Contingency	N/A	N/A	7,000	CY
Total Quantity of Select Granular Material =							18,200	CY
019600000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	I. C	Contingency	N/A	N/A	2,000	SY
019600000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. D	Contingency	N/A	N/A	3,000	SY
019600000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. D	-SR2-	84+50.00	85+75.00	450	SY
019600000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. E	Varies	N/A	N/A	11,200	SY
019600000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. E	Contingency	N/A	N/A	5,000	SY
Total Quantity of Geotextile for Soil Stabilization =							21,650	SY
022300000-E	Rock Plating	275 - Rock Plating	I. A	Varies	N/A	N/A	4,400	SY
Total Quantity of Rock Plating =							4,400	SY
109950000-E	Shallow Undercut	505 - Aggregate Subgrade	II. D	Contingency	N/A	N/A	1,000	CY
109950000-E	Shallow Undercut	505 - Aggregate Subgrade	II. D	-SR2-	84+50.00	85+75.00	150	CY
Total Quantity of Shallow Undercut =							1,150	CY
109970000-E	Class IV Subgrade Stabilization	505 - Aggregate Subgrade	II. D	Contingency	N/A	N/A	2,000	TON
109970000-E	Class IV Subgrade Stabilization	505 - Aggregate Subgrade	II. D	-SR2-	84+50.00	85+75.00	300	TON
Total Quantity of Class IV Subgrade Stabilization =							2,300	TON
204400000-E	6" Perforated Subdrain Pipe	815 - Subsurface Drainage	II. A	Varies	N/A	N/A	11,000	LF
204400000-E	6" Perforated Subdrain Pipe	815 - Subsurface Drainage	II. A	Contingency	N/A	N/A	2,000	LF
Total Quantity of 6" Perforated Subdrain Pipe =							13,000	LF

These Items Only Impact Earthwork Totals								
N/A	Loss Due to Clearing & Grubbing	200 - Clearing and Grubbing	IV. A	N/A	N/A	N/A	2,000	CY
N/A	Shrinkage Factor	235 - Embankments	III. B	N/A	N/A	N/A	25	%
N/A	Unclassified Excavation - Unsuitable Waste	225 - Roadway Excavation	IV. B	N/A	N/A	N/A	50,000	CY