City of Laurinburg North Fire Station — City of Luarinburg, Owner
Project No.: 2021-062 — Contract Document Date: September 15, 2021
Issue to: Bidders — Addendum Date: December 7, 2021

A. NOTICE TO BIDDER

1.1 This Addendum is issued pursuant to the Conditions of the Contract and is hereby made part of the Contract Documents. The addendum serves to clarify, revise, and supersede information in the Project Manual, the Drawings, and previously issued Addenda. The Bidder shall acknowledge receipt of this Addendum in the appropriate space on the Bid Form. Failure to do so may subject the Bidder to disqualification. A list of attachments, if any, is part of this document.

1.2 The date for receipt of bids for this project **is unchanged by this Addendum.**

1.3 Pre-Bid Conference: A **mandatory** Pre-Bid Conference was held at City of Laurinburg City Hall and then followed by a project site visit on December 2, 2021 at 10:00 am. Any clarifications issued as a result of the meeting are addressed by Addendum; verbal information provided does not alter the content of the bidding documents. A copy of the sign-in sheet is included in the Attachments to this Addendum.

B. MODIFICATIONS TO PREVIOUS ADDENDA **(None)**

C. APPROVED SUBSTITUTION REQUESTS **(None)**

D. MODIFICATIONS TO PROJECT MANUAL

1.4 SECTION 00 01 10 – Table of Contents: Revised per added sections.

1.5 SECTION 00 09 00 – Addenda 1 Form: revised to add Unit Cost

1.6 SECTION 00 11 16 – Invitation to Bid: revised to add Bid Bond to be attached in an envelop to the Bid Document package

1.7 SECTION 00 41 13 – Bid Form: revised to add Unit Cost

1.8 SECTION 00 52 00 – Agreement Forms: Add to the documents

1.9 SECTION 00 72 00 – General Conditions: added to the documents

1.10 SECTION 00 22 00 – Unit Prices: added to the documents

1.11 SECTION 02 41 19 – Sellective Demolition: added to the documents

1.12 SECTION 04 20 00 – Unit Masonry Assemblies: added to the documents

1.13 SECTION 13 34 19 – Metal Building Systems: added to the documents

E. MODIFICATIONS TO DRAWINGS (None)

F. ATTACHMENTS

1.14 This Addendum includes the attached documents and specification sections:

a) Section 00 01 10 – Table of Contents, (reissued).
b) Section 00 09 00 – Addenda 1 Form, (new).
c) Section 00 11 16 – Invitation to Bid, (reissued).
d) Section 00 41 13 – Bid Form, (reissued).
e) Section 00 52 00 – Agreement Forms, (new).
f) Section 00 72 00 – General Conditions, (new).

g) Section 00 22 00 – Unit Prices, (new).
h) Section 02 41 19 – Sellective Demolition, (new).
i) Section 04 20 00 – Unit Masonry Assemblies, (new).
j) Section 13 34 19 – Metal Building Systems, (new).
k) Section 13 34 19 – Metal Building Systems, (new).
l) SME Getech Report, (new).
m) Pre-Bid Sign-in Sheet, (new).

1.15 This Addendum includes the following attached drawings:
a) None.

1.16 This Addendum includes the following Questions and Answers:
a) What is the overhang on the roof?
A: The overhang is 12" on all overhangs

b) Is there a door hardware specification?
A: a door hardware specification will be provided in the next addendum.

c) What is the retainage for the project?
A: The retainage will be 10% through the entire length of the project.

d) Will HUB documents and affidavit forms be provided?
A: yes, they wil be provided in the next addendum.

END OF ADDENDUM 1

PROJECT MANUAL – 100% CONSTRUCTION DOCUMENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS
00 01 01 Project Title Page
00 01 10 Table of Contents
00 11 16 Invitation to Bidders
00 21 13 Instruction to Bidders
00 41 13 Bid Form
Geotechnical Engineering Report
00 52 00 Agreement Forms
00 72 00 General Conditions

DIVISION 01 – GENERAL REQUIREMENTS
01 10 00 Summary
01 22 00 Unit Prices
01 23 00 Alternates
01 26 00 Contract Modifications Procedures
01 29 00 Payment Procedures
01 31 00 Project Management and Coordination
01 32 00 Construction Progress Documentation
01 33 00 Submittal Procedures
01 40 00 Quality Requirements
01 41 00 Special Inspections
01 42 00 References
01 50 00 Temporary Facilities and Controls
01 60 00 Product Requirements
01 73 00 Execution
01 73 29 Cutting and Patching
01 74 19 Construction Waste Management and Disposal
01 77 00 Closeout Procedures
01 78 23 Operation and Maintenance Data
01 78 39 Project Record Documents
01 79 00 Demonstration and Training

DIVISION 02 – EXISTING CONDITIONS
02 41 19 Selective Demolition

DIVISION 03 - CONCRETE
03 10 00 Concrete Formwork

DIVISION 04 - MASONRY
04 20 00 Unit Masonry Assemblies

DIVISION 05 - METALS
05 12 00 Structural Steel
05 31 00 Steel Decking
05 40 00 Cold-Formed Metal Framing
05 73 00 Decorative Metal Railings

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES
06 10 53 Miscellaneous Rough Carpentry

DIVISION 07 – THERMAL AND MOISTURE PROTECTION
07 11 13 Bituminous Dampproofing
07 18 00 Traffic Coatings
07 21 00 Thermal Insulation
07 41 13 Standing-Seam Metal Roof Panels
07 62 00 Sheet Metal Flashing and Trim
07 71 00 Roof Specialties
07 72 00 Roof Accessories
07 84 13 Penetration Firestopping
07 84 46 Fire-Resistive Joint Systems
07 92 00 Joint Sealants

DIVISION 08 - OPENINGS
08 11 13 Hollow Metal Doors and Frames
08 14 16 Flush Wood Doors
08 31 13 Access Doors and Frames
08 36 13 Vision Panel Sectional Doors
08 41 13 Aluminum-Framed Entrances and Storefronts
08 71 00 Door Hardware
08 80 00 Glazing
08 83 00 Mirrors
08 90 00 Louvers and Vents

DIVISION 09 - FINISHES
09 29 00 Gypsum Board Assemblies
09 30 00 Tiling
09 51 13 Acoustical Panel Ceilings
09 65 13 Resilient Base and Accessories
09 65 19 Resilient Tile Flooring
09 67 23 Resinous Flooring
09 68 13 Tile Carpeting
09 91 00 Painting
09 96 00 High-Performance Coatings

DIVISION 10 - SPECIALTIES
10 11 00 Visual Display Surfaces
10 14 00 Signage
10 21 13 Toilet Compartments
10 28 00 Toilet, Bath, and Laundry Accessories
10 44 00 Fire-Protection Specialties
10 51 13 Metal Lockers
10 56 13 Metal Storage Shelving
10 73 18 Pre-Fabricated Steel Canopies
10 75 16 Ground-Set Flagpoles

DIVISION 11 – EQUIPMENT
NOT APPLICABLE

DIVISION 12 - FURNISHINGS
12 24 13 Roller Window Shades
12 36 00 Countertops

DIVISION 13 - SPECIAL CONSTRUCTION
13 34 19 Metal Building Systems

DIVISION 14 – CONVEYING EQUIPMENT
NOT APPLICABLE

DIVISION 21 - FIRE SUPPRESSION
NOT APPLICABLE – SEE DRAWINGS

DIVISION 22 – PLUMBING
NOT APPLICABLE – SEE DRAWINGS

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING
NOT APPLICABLE – SEE DRAWINGS

DIVISION 26 - ELECTRICAL
NOT APPLICABLE – SEE DRAWINGS

DIVISION 27 – COMMUNICATIONS
NOT APPLICABLE – SEE DRAWINGS

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
NOT APPLICABLE – SEE DRAWINGS

DIVISION 32 – EXTERIOR IMPROVEMENTS
NOT APPLICABLE – SEE DRAWINGS

END OF TABLE OF CONTENTS

1.1 PROJECT INFORMATION

A. Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.

B. Project Identification: Laurinburg North Fire Station

1. Project Location: 17501 Aberdeen Road, Laurinburg, NC 28352.

C. Owner: City of Laurinburg, 303 W. Church Street, Laurinburg, NC 28352

1. Owner's Representative: Mr. Harold Haywood, General Services Director

D. Architect: Creech & Associates, 1000 W. Morehead St., Suite 120, Charlotte, NC 28208.

E. Project Description: The Project consists of building a new fire station for the City of Laurinburg. This is to replace the existing North Fire Station that has been damaged by flooding. The new fire station will be a pre-engineered building with metal siding and a metal roof. The building will have 3 apparatus bays, a kitchen, bathrooms, a day room, a tool room and a training room. There are several alternatives that takes the apparatus bays from 3 to 5 and finishes some of the interior space into separate spaces verses a large common space.

F. Construction Contract: Bids will be received for the following Work:

1. General Contract (all trades).

1.2 BID SUBMITTAL AND OPENING

A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

1. Last Day for Bid Questions: Wednesday, December 8, 2021
2. Last Addendum: Monday, December 13, 2021
3. Bid Opening Date: Tuesday, December 21, 2021
4. Bid Time: 2:00 p.m., local time.
5. Location: Hard copies of complete bids are to be delivered to the City of Laurinburg Attn: Mr. Harold Haywood, General Services Director, 303 W. Church Street (Room 242), Laurinburg, NC 28352.

B. Bids will be thereafter **publicly opened in the Council Chambers of City Hall (Room 221), 303 W Church Street, Laurinburg, NC 28352.** Precautions for COVID-19 will be in place and based upon the current direction from state officials at the time of bid openings.

C. The City of Laurinburg reserves the right to reject any and all bids and to waive irregularities and informalities in any bids submitted.

1.3 PREBID CONFERENCE

A. A **mandatory** Pre-Bid Conference for all bidders will be held at the Laurinburg City Hall on Thursday, December 2, 2021, at 10:00 AM, local time. Prospective bidders are **required** to attend. Please adhere to current COVID-19 protocols at time of conference. After the pre-bid meeting, the owner and architect will drive to the project site where bidders can review the site conditions. The project site is at 17501 Aberdeen Rd., Laurinburg, NC

1.4 DOCUMENTS

A. ELECTRONIC Procurement and Contracting Documents: Obtain on/after November 18, 2021, by downloadable link on the City of Laurinburg website at -
https://www.laurinburg.org/business/#purchasing-rfps
Bid questions should be directed to Creech & Associates,
Attn: John Crawford, AIA – jcrawford@creech-design.com
Any verbal questions will not be considered as part of this bid. All questions need to be sent in written form and the response will be part of the addendum process.

1.5 TIME OF COMPLETION AND LIQUIDATED DAMAGES

A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time. Work that is not completed by the established completion date, plus approved extensions, is subject to liquidated damages as follows:

- 1st week = $0/day.
- Weeks 2 & 3 = $300/day (based on 5 days per week).
- Weeks 4 & above = $1,000/day (based on 5 days per week).

1.6 BIDDER'S QUALIFICATIONS

A. Bidders shall meet all North Carolina state and federal requirements for MWBE (HUB) participation.

B. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A 5% bid bond is required with the submittal of bids. A Performance Bond, Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder. **Provide the bid bond clearly marked as "BID BOND" in a separate envelop and attached to the outside of the envelop of the bid forms/documents.**

END OF DOCUMENT 00 11 16

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: Laurinburg North Fire Station

C. Project Location: 17501 Aberdeen Rd, Laurinburg, NC 28352.

D. Owner: City of Laurinburg

E. Architect: Creech & Associates.

F. Architect Project Number: 2020-062.

1.2 CERTIFICATIONS AND BASE BID

A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Creech & Associates and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

_____ Dollars ($_____).

1.3 BID GUARANTEE

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____ Dollars ($_____).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 ALTERNATE BID PRICES:

A. The following Alternate Prices, representing the total cost to the Owner when the scope of the work is changed and when approved by the Architect, are hereby submitted, and are guaranteed to remain valid and in force for the duration of the construction period. Refer to Division 01 Section "Alternates" for descriptions of Alternates and conditions for submittal of Alternate pricing. Indicate whether alternates are additions or deductions from Bid Sum.

B. Alternate No. 1: $_____(Add/Deduct)

Provide the work identified as alternate #1 on sheet A21.01 & other applicable sheets for two (2) additional apparatus bays beyond Apparatus Bay - 100. This would include all trades associated with this alternate.

Alternate No. 2: $_____(Add/Deduct)

Provide the work identified as alternate #2 on sheet A21.01 & other applicable sheets for the converting the Office/Lobby - 104 into 3 individual offices, Office/Lobby - 104, Office 2 – 105 and Office 3 - 106. This would include all trades associated with this alternate.

Alternate No. 3: $_____(Add/Deduct)

Provide the work identified as alternate #3 on sheet A21.01 & other applicable sheets for converting Sleeping - 112 into 3 individual sleeping rooms, Sleeping – 112, Sleeping – 113 and Sleeping 114.This would include all trades associated with this alternate.

Alternate No. 4: $_____(Add/Deduct)

Provide the work identified as alternate #4 on sheet A21.01 & other applicable sheets for updating the finishes and adding a ceiling in the Training Room - 107. This would include all trades associated with this alternate.

Alternate No. 5: $_____(Add/Deduct)

Provide the work identified as alternate #5 on sheet A21.01 & other applicable sheets for converting Laundry / Ice / Tool / Deconstruction – 103 into 2 individual rooms, Tool / Deconstruction – 102 and Laundry / Ice - 103. This would include all trades associated with this alternate.

1.5 UNIT PRICES:

A. Unit prices conform to applicable project specification section. Refer to the specifications for a complete description of the following Unit Prices:

B. Unit Price No. 1:

Unsatisfactory Soil Mass : Add $_____ Deduct $_____

Unit Price No. 2:

Unsatisfactory Soil Trench: Add $_____ Deduct $_____

Unit Price No. 3:

Earth Import from Surrounding Site: Add $_____ Deduct $_____

Unit Price No. 4:

Earth Import from Off Site: Add $_____ Deduct $_____

1.6 SUBCONTRACTORS AND SUPPLIERS

A. The following companies shall execute subcontracts for the portions of the Work indicated:

1. Procurement & Contracting Requirements: _____.
2. General Conditions: _____.
3. Concrete: _____.
4. Masonry: _____.
5. Metals: _____.
6. Wood, Plastic and Composites: _____.
7. Thermal and Moisture Protection: _____.
8. Openings: _____.
9. Finishes: _____.
10. Specialty: _____.
11. Equipment: _____.
12. Furnishings: _____.
13. Special Construction: _____.
14. Conveying Equipment: _____.
15. Fire Suppression: _____.
16. Plumbing: _____.
17. Heating, Ventilation, and Air Conditioning (HVAC): _____.
18. Integrated Automation: _____.

19. Electrical: _____.

20. Communications: _____.

21. Electronic Safety and Security: _____.

22. Earthwork: _____.

23. Exterior Improvements: _____.

Subtotal – Cost Summary: _____.

Sales Tax: _____.

Building Permits: _____.

Bonds: _____.

Sub Bond: _____.

Payment & Performance Bonds: _____.

Cost Total: _____.

General Conditions: _____.

Builders Risk Insurance: _____.

General Liability Insurance: _____.

General Contractor Fee: _____.

Total Construction Cost: _____.

1.7 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect and shall fully complete the Work within _____ calendar days.

1.8 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.

3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.
5. None _____.

1.9 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.
   1. Bid Form Supplement - Bid Bond Form (AIA Document A310).

1.10 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in North Carolina, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.11 HUB PARTICIPATION ACKNOWLEDGEMENT

A. The undersigned further states that they have satisfied all state requirements for HUB participation.

B. Required documents & affidavits attached at the end of bidding form. No bids will be accepted with missing or incomplete HUB forms.

1.12 SUBMISSION OF BID

A. Respectfully submitted this _____ day of _____, 2021.

B. Submitted By_____(Name of bidding firm or corporation).

C. Authorized Signature:_____(Handwritten signature).

D. Signed By:_____(Type or print name).

E. Title:_____(Owner/Partner/President/Vice President).

F. Witness By:_____(Handwritten signature).

G. Attest:_____(Handwritten signature).

H. By:_____(Type or print name).

I. Title:_____(Corporate Secretary or Assistant Secretary).

J. Street Address:_____.

K. City, State, Zip_____.

L. Phone:_____.

M. License No.:_____.

N. Federal ID No.:_____(Affix Corporate Seal Here).

END OF DOCUMENT 00 41 13

1.1 FORM OF AGREEMENT

A. The following form of Owner/Contractor Agreement shall be utilized for the Project:

1. AIA Document A101, Owner-Contractor Agreement Form, 2017 Edition.

END OF DOCUMENT 00 52 00

1.1 GENERAL CONDITIONS

A. General Conditions for the Project are AIA Document A201-1997 General Conditions of the Contract for Construction.

B. The above document is hereby incorporated by reference.

C. Copies of AIA standard forms may be obtained from:

1. American Institute of Architects, Charlotte, NC: (704) 369-2302.

END OF DOCUMENT 00 72 00

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Related Sections include the following:

1. Division 01, Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Supplement Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A list of unit prices is included at the end of this Section. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. Unit Price No. 1: Unsatisfactory Soil Excavation and Replacement (Mass).

1. Description: Unsatisfactory soil excavation and [disposal offsite] and replacement with compacted engineered fill provided from offsite, in accordance with Section 31 00 00 "Earthwork."
2. Unit of Measurement: Cubic yard of earth excavated, based upon survey of volume removed measured in place by geotechnical engineer.

B. Unit Price No. 2: Unsatisfactory Soil Excavation and Replacement (Trench).

1. Description: Unsatisfactory soil excavation and [disposal offsite] and replacement with compacted engineered fill provided from offsite, in accordance with Section 31 00 00 "Earthwork."
2. Unit of Measurement: Cubic yard of earth excavated, based upon survey of volume removed measured in place by geotechnical engineer.

C. Unit Price No. 3: Earth Import from Surrounding Site

1. Description: Importing compacted engineered fill or satisfactory soil, as required, provided from surrounding site, in accordance with Section 31 00 00 "Earthwork."
2. Unit of Measurement: Cubic yard of rock excavated, based upon survey of volume removed measured in place by geotechnical engineer.

D. Unit Price No. 4: Earth Import from Off Site

1. Description: Importing compacted engineered fill or satisfactory soil, as required, provided from offsite, in accordance with Section 31 00 00 "Earthwork."
2. Unit of Measurement: Cubic yard of rock excavated, based upon survey of volume removed measured in place by geotechnical engineer.

END OF SECTION 01 22 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Demolition and removal of selected portions of building or structure.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Predemolition Photographs or Video: Submit before Work begins.

1.6 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 QUALITY ASSURANCE

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
   1. Comply with requirements specified in Division 01 Section "Photographic Documentation."

3.2 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.3 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated on Drawings. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   5. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.5 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.6 DEMOLITION LEGEND

A. Refer to Drawings for General Demolition Notes and Demolition Legend.

END OF SECTION 02 41 19

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units.
   2. Mortar and grout.
   3. Masonry joint reinforcement.
   4. Ties and anchors.
   5. Miscellaneous masonry accessories.

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.

B. Determine net-area compressive strength (f'_m) of masonry by testing masonry prisms according to ASTM C 1314.

1.5 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Shop Drawings: Show fabrication and installation details for the following:
   1. Masonry Units: Show sizes, profiles, and coursing.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
   3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection: For the following:
   1. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project.

D. Samples for Verification: For each type and color of the following:
   1. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project**.**

E. Qualification Data: For testing agency.

F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
   2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for each type of exposed unit masonry construction showing typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
      a. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
      b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
      c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
      d. Include metal studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.
   2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
   3. Protect accepted mockups from the elements with weather-resistant membrane.
   4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
      a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners, unless indicated as bullnose.

B. Concrete Masonry Units: ASTM C 90 and as follows:
   1. Minimum Net Area Average Compressive Strength: Average of three units 1900 psi, individual unit 1700 PSI. Meets ASTM C 90 standard average of three units 1900 psi, individual unit 1700 psi.
   2. Maximum Absorption: Absorption is less than 18 lbs/CF. Meets ASTM C 90 standard of 18/lbs/CF absorption rate.
   3. Weight Classification: Units shall be lightweight, blended with expanded shale, clay or slate, produced by the rotary kiln process and shall conform to ASTM C331 and ASTM C33 shall be graded to assure consistent texture with total mix weight not more than 105 lbs/CF and not less than 90 lbs/CF. Meets ASTM C 90 standard for lightweight not more than 105 lbs/CF.
   4. All units shall be free of organic impurities that will cause rusting, staining, or pop outs and shall contain no combustible material. All lightweight material to be manufactured by rotary

kiln process. The use of coal cinder aggregate/bottom ash or similar waste products will not be allowed.

5. The producer of the lightweight concrete masonry units shall furnish a letter of certification stating that all lightweight aggregate used in the manufacturer of the units was expanded shale, clay or slate produced by the rotary kiln process conforming to ASTM C331 and ASTM C330.
6. Size (Width): Manufactured to the following dimensions:
   a. 4 inches nominal; 3-5/8 inches actual.
   b. 8 inches nominal; 7-5/8 inches actual.
7. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color to match mortar in existing building.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Masonry Cement: Not Permitted.

E. Mortar Cement: ASTM C 1329.

F. Colored Cement Product: Packaged blend made from portland cement and lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
   2. Pigments shall not exceed 10 percent of portland cement by weight.
   3. Pigments shall not exceed 5 percent of mortar cement by weight.
   4. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Colored Portland Cement-Lime Mix:
         1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
         2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
         3) Lafarge North America Inc.; Eaglebond.
         4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
      b. Colored Mortar Cement:
         1) Lafarge North America Inc.; Magnolia Superbond Mortar Cement.

G. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. Natural Color.
   4. White-Mortar Aggregates: Natural white sand or crushed white stone.

H. Aggregate for Grout: ASTM C 404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Addiment Incorporated; Mortar Kick.
      b. Euclid Chemical Company (The); Accelguard 80.
      c. GCP Technologies, Inc. (formerly Grace); Morset.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

K. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: W2.8 or 0.188-inch diameter.
4. Wire Size for Cross Rods: W2.8 or 0.188-inch diameter.
5. Wire Size for Veneer Ties: W2.8 or 0.188-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- diameter, hot-dip galvanized, carbon-steel continuous wire.

2.5 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, stainless-steel wire.
2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch- diameter, hot-dip galvanized steel wire.

C. Partition Top anchors: 0.097-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.6 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.

B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

C. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.7 EMBEDDED FLASHING MATERIALS

A. Provide prefabricated corners and end dams of same material and thickness as primary material and from the same flashing manufacturer.

B. Provide minimum 10-inch wide strips of same material under joints.

C. Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:

1. Copper-Laminated Flashing – Thru-Wall Flashing: 5-oz./sq. ft. copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Advanced Building Products Inc.; Copper Fabric Flashing.
      2) AFCO Products Inc.; Copper Fabric.
      3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
      4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
      5) Polytite Manufacturing Corp.; Copper Fabric Flashing.
      6) York Manufacturing, Inc.; York Copper Fabric Flashing.
2. Rubberized-Asphalt Flashing – Self-Adhered Flashing, where indicated: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Advanced Building Products Inc.; Peel-N-Seal.
      2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      3) GCP Applied Technologies, Inc. (formerly Grace); Perm-A-Barrier Wall Flashing.
      4) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
      5) Hohmann & Barnard, Inc., Dur-O-Wal Division; Dur-O-Barrier-44.
      6) Hohmann & Barnard, Inc.; Textroflash.
      7) Polyguard Products, Inc.; Polyguard 300.
      8) Polytite Manufacturing Corp.; Poly-Barrier Self-Adhering Wall Flashing.
      9) Williams Products, Inc.; Everlastic MF-40.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.
2. PVC: ASTM D 2287, Type PVC-65406

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.9 MASONRY-CELL INSULATION

A. Insulation Fill (Foam Insulation): Two-component foamed insulation consisting of aqueous resin and foaming agent; containing no polyurethane, polystyrene, polyisocyanurate or petrochemicals;

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Core-Fill 500 Foam Insulation by Tailored Foam, Inc., Hickory, NC 28603;

b. Tripolymer Insulation by C.P. Chemical Co.
c. Polymaster Foam Insulation by Polymaster, Inc., Knoxville, TN.

B. Masonry Cell Foam Insulation: Injected, expansive foam, UL approved as component of fire-resistance-rated concrete masonry unit wall assembly, Class A rated per ASTM E-84. Products: Core-fill 500 by Tailored Chemical Products, Inc.

2.10 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide one of the following:
Diedrich Technologies, Inc.
a. EaCo Chem, Inc.
b. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to portland cement and lime.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

C. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Match mortar in existing building.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Match mortar in existing building.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

2.12 SOURCE QUALITY CONTROL

A. Owner may choose to engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

E. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
   7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONARY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.5 MASONRY-CELL INSULATION

A. Install acoustical masonry foam by drilling and injecting concrete masonry assembly and completely filling all cores in wall. Comply with manufacturer’s installation recommendations. Patch wall to original condition.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
    a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
   1. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing, concrete, and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Embed connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
   3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   4. Space anchors as indicated.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
   1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick made from clay or shale as follows:
   1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows, unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe.
3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep products specified in Part 2 to deter insects from entering weep holes.
2. Space weep holes 24 inches o.c., unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

E. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

F. Prism Test: For each type of construction provided, per ASTM C 1314 at 7 days and at 28 days.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
   1. Point mortar joints of existing building as required for a neat, uniform appearance.
C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 "Earthwork."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

END OF SECTION 04 20 00

SECTION 13 34 19

METAL BUILDING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal Building System:
   1. Structural steel framing system.
   2. Metal roof system.
   3. Metal wall system.
   4. Roof and wall insulation systems.

1.2 RELATED REQUIREMENTS

A. Section 03 10 00 Concrete Formwork

1.3 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC):
   1. AISC 360 - Specification for Structural Steel Buildings.
   2. AISC Design Guide 3 – Serviceability for Steel Buildings

B. ASTM International (ASTM):
   1. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   2. ASTM A 653 / A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A 792 / A 792M – Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. ASTM C 1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
   5. ASTM D 1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
   6. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
   7. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
   8. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
   9. ASTM E 96 / E 96M – Standard Test Methods for Water Vapor Transmission of Materials.
   10. ASTM E 1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

11. ASTM G 87 – Standard Practice for Conducting Moist SO2 Tests.

C. Metal Building Manufacturers Association (MBMA):
   1. MBMA Metal Building Systems Manual.
   2. Seismic Design Guide for Metal Building Systems.

D. North American Insulation Manufacturers Association (NAIMA):
   1. NAIMA 202 – Standard For Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.

E. The Society for Protective Coatings (SSPC):
   1. SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards.
   2. SSPC-SP2 – Hand Tool Cleaning.

F. Underwriters Laboratories (UL):
   1. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies.
   2. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 PREINSTALLATION MEETINGS

A. Convene preinstallation meeting 2 weeks before start of installation of metal building system.

B. Require attendance of parties directly affecting work of this section, including Contractor, Architect, Engineer, installer, and metal building system manufacturer's representative.

C. Review materials, installation, protection, and coordination with other work.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.

C. Erection Drawings: Submit metal building system manufacturer's erection drawings, including plans, elevations, sections, and details, indicating roof framing, transverse cross-sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.

D. Certification: Submit written "Certificate of design and manufacturing conformance" prepared and signed by a Professional Engineer, registered to practice in North Carolina verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
   1. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.

2. Submit certification 1 week before bid date on the metal building system manufacturer's letterhead.

E. Submit certification verifying that the metal roof system has been tested and approved by Underwriter's Laboratory as Class 90.

F. Submit certification verifying that the metal standing seam roof system has been tested in accordance with ASTM E 1592 test protocols.

G. Warranty Documentation: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
1. Manufacturer regularly engaged, for past 10 years, in manufacture of metal building systems of similar type to that specified.
2. Accredited based on IAS Accreditation Criteria AC472 and requirements in International Building Code (IBC), Chapter 17.

B. Installer's Qualifications:
1. Installer regularly engaged, for past 5 years, in installation of metal building systems of similar type to that specified.
2. Employ persons trained for installation of metal building systems.

C. Certificate of design and manufacturing conformance:
1. Metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered to practice in North Carolina verifying that building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
2. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
3. Certificate shall be on metal building system manufacturer's letterhead.
4. Refer to Submittals article of this specification section.

D. Material Testing:
1. In addition to material certifications of structural steel, metal building system manufacturer shall provide, upon request at time of order, evidence of compliance with specifications through testing.
2. This quality assurance testing shall include testing of structural bolts, nuts, screw fasteners, mastics, and metal coatings (primers, metallic coated products, and painted coil products).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer's instructions.
   2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
   3. Do not store materials directly on ground.
   4. Store materials on flat, level surface, raised above ground, with adequate support to prevent sagging.
   5. Protect materials and finish during storage, handling, and installation to prevent damage.

1.8 WARRANTY

Specifier Notes: Specify any one of the **three** paragraphs below for generic structural standing-seam roof systems. Specify the **third** paragraph when specifying through-fastened roof systems.

A. Metal building system manufacturer shall provide a written weathertightness warranty for a maximum of 20 years against leaks in standing roof panels, arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions.
   1. Warranty shall be signed by both the metal roof system manufacturer and the metal roof system installer.

B. Metal building system manufacturer shall provide a written warranty for 25 years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions.
   1. Warranty shall be signed by metal roof system manufacturer.

C. Metal building system manufacturer shall provide a paint film written warranty for 25 years against cracking, peeling, chalking, and fading of exterior coating on painted roof and wall panels.
   1. Warranty shall be signed by metal building system or roof system manufacturer and state that the coating contains 70 percent "Kynar 500" or "Hylar 5000" resin.
   2. Metal building system manufacturer shall warrant that the coating shall not peel, crack, or chip for 25 years.
   3. For a period of 25 years, chalking shall not exceed ASTM D 4214, #8 rating and shall not fade more than 5 color difference units in accordance with ASTM D 2244.

PART 2 PRODUCTS

2.1 BUILDING DESCRIPTION

A. Building Dimensions: Indicated on the Drawings.
   1. Horizontal Dimensions: Measure to inside face of wall sheets.
   2. Eave Height: Measure from top of finished floor to intersection of insides of roof and sidewall sheets.
   3. Clear Height Between Finished Floor and Bottom of Roof Beams: Indicated on the Drawings.

B. Primary Structural Members:
   1. As shown and described on the structural drawings.

C. Metal Roof System: Standing seam roof as described and shown on the architectural drawings

D. Metal Wall System: Metal wall panels are as shown with material and direction of installation on the architectural drawings.

2.2 METAL ROOF SYSTEM

A. Metal Roof System: Standing seam roof system.

B. Roof System Design:
   1. Design roof panels and liner panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. Design roof paneling system to support design live, snow, and wind loads.
   3. Endwall Trim and Roof Transition Flashings: Allow roof panels to move relative to wall panels and/or parapets as roof expands and contracts with temperature changes.

C. Roof System Performance Testing:
   1. UL Wind Uplift Classification Rating, UL 580: Class 90.
   2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.

D. Roof Panels:
   1. Factory roll-formed, 24 inches wide, with 2 major corrugations, 2 inches high (2-3/4 inches including seam), 24 inches on center.
   2. Flat of the Panel: Cross flutes 6 inches on center, perpendicular to major corrugations in entire length of panel to reduce wind noise.
   3. Variable Width Panels:
      a. For roof lengths not evenly divisible by the 2'-0" panel width, factory-manufactured variable-width (9-inch, 12-inch, 15-inch, 18-inch, and 21-inch-wide) panels shall be used to ensure modular, weathertight roof installation.
      b. Minimum Length: 15 feet.
      c. Supply maximum possible panel lengths.

Specifier Notes: Specify **one** of the following **three** Panel Material and Finish paragraphs. Delete Panel Material and Finish paragraphs not specified.

4. Panel Material and Finish:
    a. 24-gauge galvanized steel, G90 coating; ASTM A 653, G90.
    b. Paint with exterior colors of finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
    c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
        1) Not to peel, crack, or chip.
        2) Chalking: Not to exceed ASTM D 4214, #8 rating.
        3) Fading: Not more than 5 color-difference units, ASTM D 2244.
5. Use panels of maximum possible lengths to minimize end laps.
6. Extend eave panels beyond structural line of sidewalls.
7. Factory punch panels at panel end to match factory-punched holes in eave structural member.
8. Panel End Splices: Factory punched and factory notched.
9. Panel End Laps: Locate directly over, but not fastened to, a supporting secondary roof structural member and be staggered, to avoid 4-panel lap-splice condition.
10. End Laps: Floating. Allows roof panels to expand and contract with roof panel temperature changes.
11. Self-Drilling Fasteners: Not permitted in weathering membrane of roof system.
12. Ridge Assembly:
    a. Design ridge assembly to allow roof panels to move lengthwise with expansion and contraction as roof panel temperature changes.
    b. Factory punch parts for correct field assembly.
    c. Install panel closures and interior reinforcing straps to seal panel ends at ridge.
    d. Do not expose attachment fasteners on weather side.
    e. Use lock seam plug to seal lock seam portion of panel.
    f. High-Tensile Steel Ridge Cover: Span from panel closure to panel closure and flex as roof system expands and contracts.

E. Insulation Board:
1. Rigid Metal Building Board glass-fiber-reinforced, polyisocyanurate foam plastic core.
2. Width: 4 feet.
3. Maintain Class A fire rating.
4. Approved for use without thermal barrier.
5. Maximum Thickness: 4 inches.
6. Covered with embossed aluminum facing - Metal Building Board.

F. Vapor Retarder:
1. WMP-50, 0.0015-inch minimum thickness, UV-stabilized, white polypropylene, laminated to 30-pound Kraft paper / metalized polyester and reinforced with glass fiber and polyester scrim.
2. Perm Rating: 0.02.

G. Interior Liner Panels:
   1. Form panels from 0.0149 - inch minimum total coated thickness coated steel with minimum yield strength of 80,000 psi.
   2. Painted Panel Finish:
      a. Exposed Side: 0.15-mil min primer and 0.70-mil minimum interior white polyester paint.
      b. Unexposed Side: 0.1-mil minimum primer and 0.40 minimum polyester backer
      c. Panel Dimensions: Nominal 36 inches wide with corrugations 1/2 inches high, 3 inches on center.
   3. Factory cut panels to lengths required.

H. Provision for Expansion and Contraction:
   1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
      a. Stainless Steel Tabs: Factory centered on roof clip to ensure full movement in either direction.
      b. Maximum Force of 8 Pounds: Required to initiate tab movement.
      c. Each Clip: Accommodates a minimum of 1.25-inch movement in either direction.
   2. Roof: Provide for thermal expansion and contraction without detrimental effects on roof panels, with plus or minus 100-degree F temperature difference between interior structural framework of building and of roof panels.

I. Fasteners:
   1. Make connections of roof panels to structural members, except at eaves, with clips with movable stainless steel tabs, seamed into standing seam side lap.
   2. Fasten insulation board, bearing plates, and panel clips to structural members with fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched or field-drilled holes in structural members.
      a. Fasteners: Metal-backed rubber washer to serve as torque indicator.
   3. Fasteners penetrating metal membrane at the following locations do not exceed the frequency listed:
      a. Basic Panel System: 0 per square foot.
      b. High Eave Trim, No Parapet: 2 per linear foot.
      c. Exterior Eave Gutter: 2 per linear foot.
      d. Panel Splices: 2 per linear foot.
      e. Gable Trim: 0 per linear foot.
      f. High Eave with Parapet: 0 per linear foot.
      g. Ridge: 0 per linear foot.
      h. Low Eave Structural: 1.5 per linear foot.

J. Accessories:
   1. Accessories (i.e., ventilators, skylights, gutters, fascia): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
   2. Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
   3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

4. Material used in flashing and transition parts and furnished as standard by metal building system manufacturer may or may not match roof panel material.
    a. Parts: Compatible and not cause corrosive condition.
    b. Copper and Lead Materials: Do not use with Galvalume or optional aluminum-coated panels.

K. Thermal Performance:
1. Determine thermal performance in accordance with ASTM C 1363 and test U-factors for composite roof section.
2. Insulation Thicknesses: Maximum 4 inches.
3. Metal Building Board Insulation:
    a. Class I Factory Mutual Approval and UL Fire Hazard Classification Ratings, UL 723:
        1) Flame Spread: 25 or less.

2.3 METAL WALL SYSTEM

A. Exterior Metal Wall System: Per the architectural drawings.

B. Wall System Design: Design wall panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
1. One piece from base to building eave.
2. Upper End of Panels: Fabricate with mitered cut to match corrugations of roof panels of 1/2 inch to 12 inches and square cut for all other roof panels and slopes.
3. Factory punch or field drill wall panels at panel ends and match factory-punched or field-drilled holes in structural members for proper alignment.
4. Panel Material and Finish:
    a. 26-gauge or 24-gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A 792.
    b. Paint with exterior colors of finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
    c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
        1) Not to peel, crack, or chip.
        2) Chalking: Not to exceed ASTM D 4214, #8 rating.
        3) Fading: Not more than 5 color-difference units, ASTM D 2244.
5. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.

D. Fasteners:
1. Fastener Locations: Indicated on erection drawings furnished by metal building system manufacturer.
2. Exposed Fasteners: Factory painted to match wall color.

E. Accessories:
1. Accessories (i.e., doors, windows, louvers): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.

2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.4 INSULATION

A. Laminated Fiberglass: Owens-Corning Fiberglas, NAIMA 202, "Certified R" metal building insulation.
   1. TIMA Insignia and Insulation Thickness: Ink-jet printed on fiberglass.

B. Back-Fill Insulation: Owens-Corning Fiberglas unfaced "Pink Metal Building Insulation Plus".

C. Roof and Wall Insulation Facing: R-3035 HD (FSK-HD) (Silver).
   1. 0.0003-inch-thick, aluminum foil laminated to 30-pound Kraft paper, reinforced with glass-fiber scrim, in unpainted (Aluminum Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket
   2. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Facing Perm Rating: 0.02.

D. Roof and Wall Insulation Facing: PSK Light Duty (WMP-VR).
   1. 0.0015-inch-thick, UV-stabilized, white polypropylene laminated to 11-pound Kraft paper, reinforced with glass-fiber scrim, in white.
   2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
   3. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.09.
   4. 0.0015-inch-thick, UV-stabilized, white polypropylene laminated to metalized polyester film, reinforced with glass-fiber scrim.
   5. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
   6. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.02.

E. Roof and Wall Insulation Facing:
   1. 0.0015-inch-thick, UV-stabilized, white polypropylene film laminated to 30-pound Kraft paper/metalized polyester, reinforced with glass-fiber and polyester scrim.
   2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
   3. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.02.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine area to receive metal building system.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 ERECTION – STRUCTURAL STEEL FRAMING SYSTEM

A. Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer's erection drawings.

B. Field Modifications:
   1. Require approval of metal building system manufacturer.
   2. Responsibility of building erector.
   3. Field Modifications to Truss Purlins: Not allowed, unless indicated on erection drawings furnished by metal building system manufacturer.

C. Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.

3.3 PROTECTION

A. Protect installed metal building system to ensure that, except for normal weathering, metal building system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 13 34 19

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City of Laurinburg – North Fire Department

Prebid Sign-in Sheet

Meeting Date: December 2, 2021
Meeting Time: 10:00 AM
Meeting Place: Laurinburg City Hall

Name	Company	Email Address
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Geotechnical Exploration Report
Laurinburg Fire Station
Laurinburg North Carolina
S&ME Project No. 4305-20-096 CO-1

PREPARED FOR:

City of Laurinburg
503 Hall Street
Laurinburg, North Carolina 28352

PREPARED BY:

S&ME, Inc.
3201 Spring Forest Road
Raleigh, North Carolina 27616

June 18, 2021

June 18, 2021

City of Laurinburg
503 Hall Street
Laurinburg, North Carolina 28352

Attention: Mr. Harold W. Haywood, MPA, CLGPO
General Service Director

Care of: John Crawford, Creech & Associates

Reference: **Geotechnical Exploration Report**
Laurinburg Fire Station
Aberdeen Road, Laurinburg, North Carolina
S&ME Project No. 4305-20-096 CO-1
NC PE Firm License No. F-0176

S&ME, Inc. (S&ME) is pleased to submit this geotechnical exploration report for the referenced project site. The work was completed in general accordance with our change order number 4305-20-096 CO-1, dated May 13, 2021. The purpose of our geotechnical services is to explore the subsurface conditions at the site, evaluate those conditions, and provide recommendations for site preparation and foundation support of the proposed structure. This report presents a summary of pertinent project information, results of field testing, and our geotechnical engineering conclusions and recommendations. A Test Location Plan, CPT sounding logs, a Shear Wave Velocity plot, and laboratory results are included in the appendix.

S&ME appreciates the opportunity to provide our services on this project. Please contact us if you have any questions regarding this report or if we may be of further assistance.

Sincerely,

S&ME, Inc.

Alyson K. Aarons, P.E.
Project Engineer

J. Adam Browning, P.E.
Jun 18 2021 9:58 AM

DocuSign

J. Adam Browning, P.E.
Area Manger/Senior Geotechnical Engineer
NC Registration No. 034984

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1.0 Project and Site Information

We understand the Town of Laurinburg plans to construct a fire station along the east side of Aberdeen Road, within the Laurinburg Scotland Industrial Park. The proposed location for the new fire station is the northwest corner of a 69-acre parcel, identified by Scotland County GIS PIN 02030501036. Based on the architectural site plan, the building will have a plan footprint of approximately 12,500 square feet with associated parking and drive lanes. The concept plan shows a storm pond on the south side of the building.

Structural loading information was not provided at the time of this report; however, we anticipate maximum column, wall, and floor loads will be on the order of 200 kips, 3 kips/ft, and 300 pounds per square foot, respectively.

We anticipate pavements will consist of a combination of concrete and asphalt pavement suitable for emergency vehicle traffic.

A site grading plan was not provided at the time of this report. Based on Google Earth topographic data, existing site elevations range from about 234 to 236 feet. We understand there is consideration for raising site grades by approximately 2 to 3 feet.

2.0 Methods of Exploration

Our exploration included a site reconnaissance by a geotechnical professional which included shallow hand auger borings to measure topsoil depths within the planned development area. After site reconnaissance, our exploration continued with the performance of six (6) cone penetrometer test (CPT) soundings (B-1, B-2, and P-1 through P-4) including one (1) seismic cone penetrometer test (SCPT) sounding (B-2). Within the building footprint, the soundings went to depths of 25 and 50 feet, and within pavement areas, soundings went to depths of 10 feet. One bulk sample of near-surface soils was collected near sounding location P-2 for laboratory testing. Sounding locations were selected and established in the field by S&ME by using a hand-held GPS device. Approximate test locations are shown on Figure 2 in the Appendix.

2.1 Cone Penetration Test Soundings

S&ME advanced the soundings as approximately shown on the Field Test Location Plan (Figure 2) in the Appendix. In a CPT sounding (ASTM D5778), an electronically instrumented cone penetrometer is hydraulically pushed through the soil to measure point stress, pore water pressure, and sleeve friction. The CPT data is used to determine soil stratigraphy and to estimate soil parameters such as, friction angle, and undrained shear strength. Soil types presented on CPT sounding logs are derived from Robertson's (1990) Soil Behavior Type (SBT) Index. The soil type determined from the SBT index is more representative of soil behavior characteristics than traditional soil classification that is based on grain size and plasticity. Sounding logs are included in the Appendix.

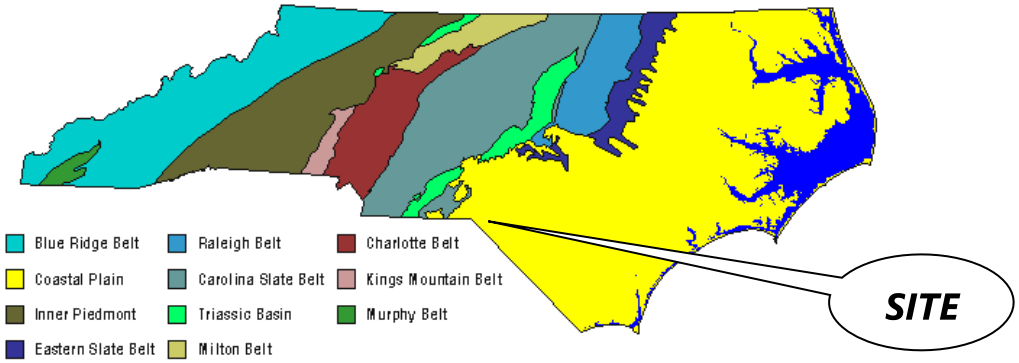
In a SCPT sounding the travel times of shear waves generated by an impulsive force applied to the ground surface are measured by geophones mounted within the cone penetrometer. For each measurement, the distance traveled and travel time of the first shear wave arrival was determined. Interval velocities were calculated by

dividing the distance between adjacent depths by the difference in travel times. Measurements are collected every 3 feet.

3.0 Surface and Subsurface Conditions

3.1 Physiography

Figure 1 - Physiography



The site is located within the Coastal Plain Physiographic Province of North Carolina as shown in Figure 1. The Coastal Plain Province is typically characterized by marine, alluvial, and aeolian sediments that were deposited during periods of fluctuating sea levels and moving shorelines. The soils and basal formations in the North Carolina Coastal Plain Physiographic Province are typical of those laid down in a shallow sloping sea bottom; interbedded sands and clays with irregular deposits of shells and layers of limestone and cemented sands. Alluvial sands, silts, and clays are typically present near rivers and creeks.

The site more specifically lies within the Middendorf formation. Middendorf deposits of the Cretaceous Age were laid down in a fluvial, deltaic environment close to shore, which gradually became a shallow basin under near shore conditions eastward. The source for the sediments was the westward lying, nearby Carolina Slate Belt and Triassic Basin. The complexity of the sediments was developed by a regular depositional cycle brought about by climatic changes. That is, the depositing streams would bring in sediments ranging in size from clay to gravel during flood stage, which results in varying consistencies throughout the area. The beds are laterally discontinuous with cross bedding common.

3.2 Subsurface Conditions

Details of the subsurface conditions encountered by the soundings are shown on the logs in the Appendix. These logs represent our interpretation of the subsurface conditions based upon field data. Stratification lines on the

logs represent approximate boundaries between soil types[1]; however, the actual transition may be gradual. The general subsurface conditions and their pertinent characteristics are discussed in the following paragraphs.

The exploration initially encountered 6 to 8 inches of organic laden topsoil underlain by very loose to loose clayey sand and soft to firm sandy clay in the upper 4 to 8 feet below the existing ground surface. Below the loose and soft surface soils, sounding B-1 encountered medium dense to dense clean to silty sand to a depth of 13 feet. Sounding B-2 encountered sands to a depth of 10 feet underlain by a 6-foot soft clay layer before returning to very dense sand to a depth of approximately 21 feet. Intermittent stiff clay layers and dense to very dense sand layers were encountered to a depth of 40 feet, underlain by very stiff silt and clay until the termination of the deepest sounding at 50 feet below the existing ground surface.

Shear wave velocity measurements in sounding B-2 ranged from approximately 500 to 820 feet per second.

In the CPT soundings, water was encountered at a depth of approximately 5 feet below the existing ground surface after completion of the sounding. Water levels tend to fluctuate with seasonal and climatic variations. Therefore, groundwater may be encountered during construction at depths not indicated by the soundings. In addition, perched water could be present within sands overlying less permeable soils between our test locations.

4.0 Laboratory Test Results

A summary of laboratory test results is presented in the following table. Individual laboratory test results are included in Appendix III.

Boring No.	Sample Depth (ft)	Natural Moisture Content (%)	Percent Passing No. 200 Sieve (%)	Atterberg Limits		Standard Proctor		CBR[1] (%)	USCS
				Liquid Limit	Plasticity Index	Opt. Moisture Content (%)	Max. Dry Unit Weight (pcf)		
P-2*	0 – 5	15.8	47.6	33	17	13.7	118.0	27.2	SC

[1] Corrected CBR value at 0.1 inches of penetration. The sample was compacted to approximately 98% of its standard Proctor maximum dry density, near its optimum moisture content. The sample was soaked for approximately 96 hours under a surcharge of approximately 100 pounds per square foot. Percent Swell of 1.0%.
** Bulk Sample*

5.0 Conclusions and Recommendations

The following conclusions and recommendations are based on our field exploration, our understanding of the proposed construction, our engineering analyses, experience with similar projects and subsurface conditions, and

[1] Soil Behavior Type is calculated based on empirical correlations with tip resistance, sleeve friction, and pore pressure. A CPT may define a soil based on its behavior as one type while its grain size and plasticity, the traditional basis for soil classification (USCS), may define it as a different type.

our correspondence with you. If structural loads and/or proposed site grades are different from those assumed or indicated, we should be provided the opportunity to review and comment upon the recommendations of this report so that they may be confirmed, extended, or modified as necessary. If subsurface conditions adverse to those indicated by this report are encountered during construction, those differences should be reported to us for review and comment.

5.1 General Discussion

Based on our review of the provided project information and geotechnical analyses of field-testing data, this site is suitable for the planned construction provided that site preparation recommendations presented herein are implemented during construction.

The following sections present our geotechnical conclusions and recommendations regarding site development.

5.2 Earthwork

5.2.1 Site Preparation

Initial site preparation should begin by clearing vegetation and stripping of organics and topsoil, and any other deleterious materials for a lateral distance of at least 5 feet beyond the limits of new construction. We anticipate topsoil thicknesses will typically range from 6 to 8 inches based on conditions encountered in the shallow hand auger borings during site reconnaissance. We recommend the site be stripped with light, tracked equipment to avoid mixing the topsoil into the low-consistency near surface soils and creating thicker stripping depths. Any voids created from stripping should be cleaned and filled with well-compacted structural fill.

After the required initial site work has been completed, we recommend that the exposed subgrade soils be proofrolled with a 10-ton smooth-drum self-propelled roller operating in the static mode or a loaded dump truck to locate any areas of soft, very loose, or otherwise unsuitable surface conditions. Any area that ruts or pumps should be disced, moisture conditioned to near the soil's optimum moisture content by drying or wetting, and recompacted. If recompaction is unsuccessful, undercutting and replacement may be required. The CPT soundings indicate loose near surface soils that may require repair at time of construction.

5.2.2 Excavations

Based on subsurface conditions encountered and assumed site grading, low to moderate consistency soils will be encountered within anticipated excavation depths at the site. Past experience indicates that these materials can be excavated by routine earth moving equipment. Local excavations for shallow utility trenches and foundations can be accomplished by a conventional backhoe or track-mounted backhoe.

Groundwater was encountered at an approximate depth of 5 feet within the CPT soundings at time of exploration. However, groundwater may be shallower at different times of year or in unexplored areas. If shallow water is encountered during construction the contractor should be prepared to dewater where utility or foundation excavations are required that go below the groundwater table and control any water that collects in excavations. The contractor should be responsible for determining water control measures. If subsurface water is encountered

during excavation, the water level should be maintained at least 2 feet below excavations to help maintain bottom stability.

Excavations should be sloped or shored in accordance with local, state and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is usually responsible for site safety. This information is provided only as a service and under no circumstances should we be assumed responsible for construction site safety.

5.2.3 *Structural Fill*

We recommend that soils used as structural fill meet the following requirements:

- Contain less than 5 percent organics.
- Be free of debris or other deleterious materials.
- Have a maximum particle size of 2 inches or less.
- Have a minimum standard Proctor maximum dry density of 100 pounds per cubic foot.
- Have a plasticity index of less than 25 percent.

Based on the near-surface soils encountered in the CPT soundings, a portion of the on-site soils should be suitable for use as structural fill and backfill. On-site clays (CL, CH) will likely be difficult to grade with, especially during wet conditions. On-site sands (SP, SC, SM) such as those encountered in the bulk sample tested, should be suitable for use as structural fill. If off-site borrow is required, we recommend that the borrow meet the requirements presented above and be a sand material with less than 25 percent fines (silt/clay).

If groundwater is encountered during construction excavation, soils excavated below the groundwater level will require discing and drying prior to reuse as compacted structural fill.

5.2.4 *Fill Placement and Compaction*

All new structural fill soil should be placed in 8 to 10-inch loose lifts and compacted to at least 95 percent of the standard Proctor maximum dry density (MDD) (ASTM D 698). The top 12 inches should be compacted to at least 98 percent of the materials standard Proctor MDD. The moisture content of structural fill should be maintained at +/- 3 percent of optimum moisture content during compaction. A qualified S&ME soil technician working under the supervision of the geotechnical engineer should observe fill placement and compaction. An appropriate number of soil density tests should be conducted to confirm that adequate fill compaction is achieved.

5.3 Foundation Recommendations

We were provided maximum column, wall and floor loads of 200 kips, 3 kips per linear foot, and 300 pounds per square foot, respectively. Please let us know if assumed structural loads are different than our assumptions.

For column loads of up to 125 kips, foundations can be supported on shallow spread footings designed for a net allowable bearing pressure of 2,000 psf. This bearing pressure assumes that footings will bear in compacted structural fill or natural soils, and that the site is prepared as recommended above. For column loads higher than 125 kips up to 300 kips, shallow spread footings will require a neatline overexcavation and replacement with No.

57 stone to a depth of 2 feet below the footing bottom to achieve the net allowable bearing pressure of 2,000 psf. No design overexcavation is required for wall loads of 3 kips per linear foot or less (may be required for bearing capacity based on foundation subgrade conditions encountered at time of construction).

Footings should bear at least 18 inches below exterior grade to avoid frost penetration and develop the design bearing capacity. Continuous wall footings should be at least 18 inches wide, and isolated column footing should be at least 24 inches wide. This recommendation is made to prevent a localized or "punching" shear failure condition which can occur with very narrow footings.

Based on encountered subsurface conditions and assumed structural loads, we estimate that total settlement of building foundations will be 1 inch or less. These estimates assume that all structural fill is properly placed and compacted and overexcavation and replacement is performed as described above. A detailed foundation layout with structural loads is required to estimate differential settlement; however, based on the maximum column load and subsurface conditions encountered, we would estimate differential settlements of one half of the total settlement between adjacent columns.

5.3.1 Footing Evaluations

The bottom of all footing excavations for the structure should be evaluated by the project geotechnical engineer or a S&ME soils technician working under the direction of the geotechnical engineer using a hand auger and dynamic cone penetrometer (DCP) to gauge the consistency of subgrade soils. It is anticipated that densification of all the footing excavations will be required during construction due to the loose sand conditions of the near surface soils. Footing subgrades that are unstable or require bearing repairs should be either densified, over-excavated and replaced with NCDOT #57 stone or lean concrete as recommended by the S&ME representative at the time of foundation excavation.

5.4 Floor Slabs

The ground floor slab may be constructed above suitable compacted fill or stable natural soils provided that the recommendations described above are implemented. The slab should be separated from footings to allow for relative displacement.

A properly prepared subgrade should be suitable for slab-on-grade support. We recommend a 6-inch thickness of compacted dense graded aggregate (NCDOT ABC gradation) beneath the slab to enhance uniform slab support. The slab subgrade should be evaluated for stability immediately prior to placement of concrete. Provided subgrade materials are stable under proofrolling and 6-inches of compacted ABC stone is placed on the subgrade soil below the slab, a modulus of subgrade reaction value (k-value) of 125 psi/inch may be used for slab-on-grade design.

Exposure to the environment and construction activities will weaken the floor slab subgrade soils. Therefore, we recommend that subgrade soils in slab areas be evaluated prior to placement of the select granular fill. If near surface deterioration of the soils has occurred, densification of existing soils, undercutting, or reworking of the fill may be necessary.

Based on the results of our exploration and the assumed finish floor elevation, the floor slab will not be below the exterior grade and will not be subjected to hydrostatic pressure from groundwater. However, water vapor transmission through the slab is still a design consideration. Evaluating the need for and design of a vapor retarder or vapor barrier for moisture control is outside our scope of services and should be determined by the project architect/structural engineer based on the planned floor coverings and the corresponding design constraints, as outlined in ACI 302.1R-04 Guide for Concrete Floor and Slab Construction. Further, health and environmental considerations with respect to any potentially harmful vapor transmission are also outside of our scope.

5.5 Seismic Design Considerations

5.5.1 General

There are no known, mapped faults in the area of the site. Five minor earthquakes with epicenters in the Wilmington area with magnitudes of 3.0 to 3.9 occurred between 1871 and 1968[2]. The historic earthquake event which influences the design seismicity of the site the most is the 1886 Charleston, South Carolina earthquake with a magnitude of approximately 7.3.

5.5.2 Seismic Site Class

Seismic site classification is based on the top 100 feet of a site's subsurface profile. Based on the Shear Wave velocity values in the Seismic CPT soundings recorded during the field exploration and S&ME's knowledge of the local geology, per Section 1613 of the *2018 North Carolina State Building Code* the site is considered as Seismic Site Class D.

5.6 Pavement Recommendations

Pavement design procedures are based on AASHTO "Guide for Design of Pavement Structures" (1993) and associated literature. At the time of this report, traffic loading information was not available. For the purpose of our analysis, we have considered the following traffic loading.

Vehicle Type	Volume & Frequency
Emergency Vehicles	30 per day
Trash and Service Trucks	2 per week
Automobiles	20 per day

The pavement analysis was based on an initial serviceability index of 4.2 (4.5 for concrete), a terminal serviceability index of 2.0, and a 20-year design life.

[2] Map of Earthquake Epicenters in North Carolina and Portions of Adjacent States (1698-2006), North Carolina Geologic Survey.

5.6.1 *Asphalt Pavement*

The laboratory testing indicates a CBR value of greater than 10 percent; however, based on our experience, pavement design is based on a CBR value of 8 percent assuming a majority of the pavement subgrades will likely consist of imported sandy structural fill. This CBR value is based on the subgrade soils consisting of sandy soils and the top 12 inches being uniformly compacted to at least 98 percent of the soil's standard Proctor MDD. For the light-duty pavement areas (i.e. parking stalls) an 18-kip equivalent single axle loads (ESAL) value of 30,000 was used. For heavy-duty pavement area (i.e. access drives and route to vehicular bay and dumpster pad) an ESAL value of 500,000 was used. The thickness of the pavement is directly dependent on this assumption and should be reviewed by the owner and project designer.

Recommendations for the standard and heavy-duty asphalt pavements are provided in the table below.

Material Type	Light Duty	Heavy Duty
Asphalt Surface Course	2.0 inches (S-9.5B)	1.5 inches (S-9.5C)
Asphalt Intermediate Course	--	2.5 inches (I-19.0C)
Aggregate Base Course	6 inches	8 inches

All materials and construction methods should conform to the 2018 edition of the NCDOT "Standard Specifications for Roads and Structures." The aggregate base course (ABC) stone should consist of stone meeting the requirements under Section 520. ABC stone should be compacted to at least 98 percent of the maximum dry density as determined by the modified Proctor compaction test, AASHTO T-180M as modified by NCDOT. To confirm that the base course stone has been uniformly compacted, in place density tests should be performed by a qualified S&ME soils technician and the area should be thoroughly proofrolled under his observation.

Asphaltic concrete should conform to Section 610 in the 2018 edition of the NCDOT "Standard Specifications for Roads and Structures." Sufficient testing and observation should be performed during pavement construction to confirm that the required thickness, density, and quality requirements of the specifications are achieved.

Although our analysis was based on traffic loading for a 20-year design life, our experience indicates that pavement maintenance is necessary due to normal weathering of the asphaltic concrete. Normal weathering (i.e., oxidation) causes asphalt to become more brittle resulting in loss of tensional strength. This loss in strength can cause minor cracking which provides access for water infiltration into the stone base and subgrade. As the degree of saturation of the subgrade increases, the strength of the subgrade decreases leading to pavement failure. Routine maintenance in the form of sealing, patching, and maintaining proper drainage is required to increase pavement life. It is not uncommon for overlays to be required after 10 to 12 years.

5.6.2 *Concrete Pavement*

The concrete pavement design was performed using an assumed value for design traffic of 500,000 ESALs. The compressive strength of the concrete was assumed to be 4,000 psi. A modulus of subgrade reaction of 125 pci

was used for design assuming 6 inches of compacted ABC stone is placed beneath the concrete pavement. We have assumed that load transfer across contraction (saw) joints will be handled by aggregate interlock (i.e. load transfer dowels are not required). ABC should meet the material and compaction requirements stated in the "Flexible (Asphalt) Pavement" section above.

Concrete pavement is recommended for heavily loaded traffic and dumpster pad areas. The table below presents our recommended concrete pavement section thicknesses.

Material Type	Concrete Pavement Design
Air Entrained Concrete (4000 psi)	7.0 inches
Aggregate Base Course (ABC) stone	6.0 inches
Maximum Joint Spacing	15 feet in all directions

Saw joints should be cut to a depth of at least ¼ of the thickness of the concrete pavement to promote shrinkage cracking along the joint. The ABC stone should be compacted to at least 98 percent of its modified Proctor maximum dry density and be proofrolled with a loaded dump truck prior to concrete placement.

6.0 Qualifications of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

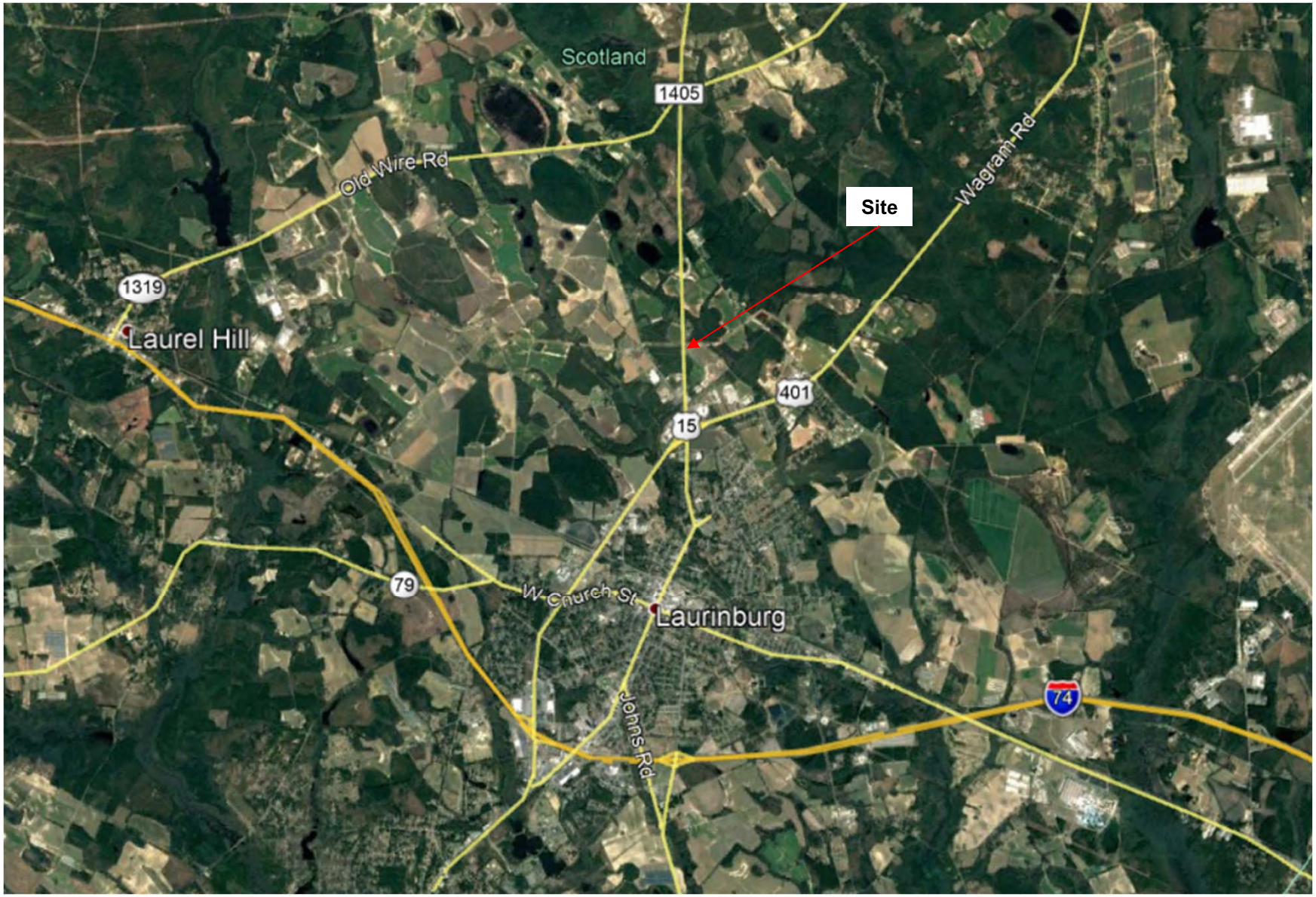
Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

Appendices

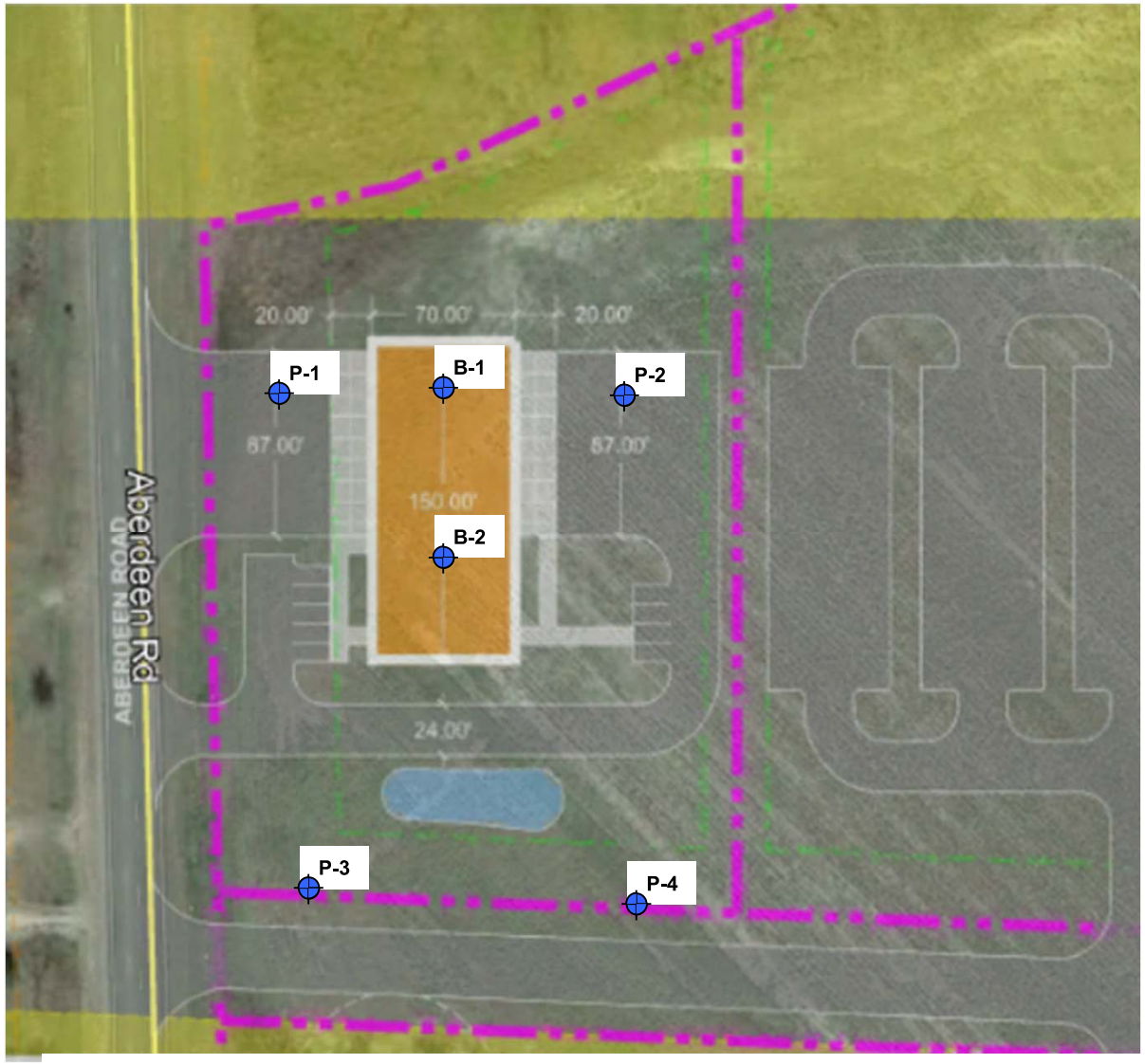
Appendix I – Figures



SITE VICINITY MAP

LAURINBURG FIRE STATION
ABERDEEN ROAD
LAURINBURG, NORTH CAROLINA

SCALE:	FIGURE NO.
NOT TO SCALE	1
DATE:	
6/11/2021	
PROJECT NUMBER	
4305-20-096 CO-1	



LEGEND

CPT Sounding Location

NOTE:
THE DRAWING PROVIDED BY THE CLIENT AND THE AERIAL PHOTOGRAPH FROM GOOGLE EARTH WAS MODIFIED BY S&ME. GRAPHIC IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

TEST LOCATION PLAN

LAURINBURG FIRE STATION
ABERDEEN ROAD
LAURINBURG, NORTH CAROLINA

SCALE:	FIGURE NO.
NOT TO SCALE	2
DATE: 6/11/2021	
PROJECT NUMBER 4305-20-096 CO-1	

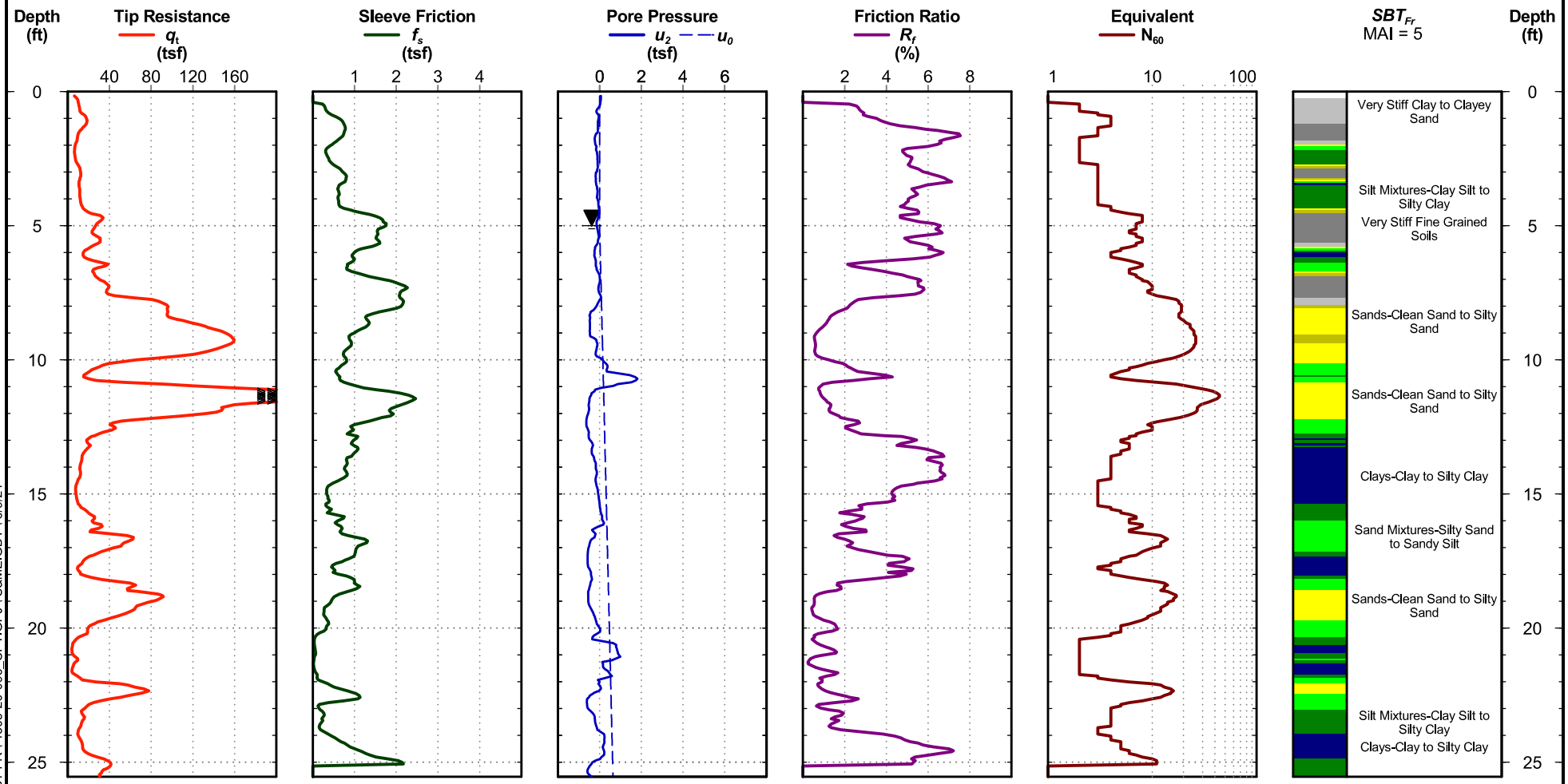
Appendix II – CPT Sounding Logs and Shear Wave Velocity Plots

Sounding ID: B-1

Laurinburg Fire Station
Laurinburg, North Carolina
S&ME Project No: 4305-20-096

Date: Jun. 8, 2021
Estimated Water Depth: 5 ft
Rig/Operator: ATV/T. Chew

Total Depth: 25.5 ft
Termination Criteria: Target Depth
Cone Size: 1.75



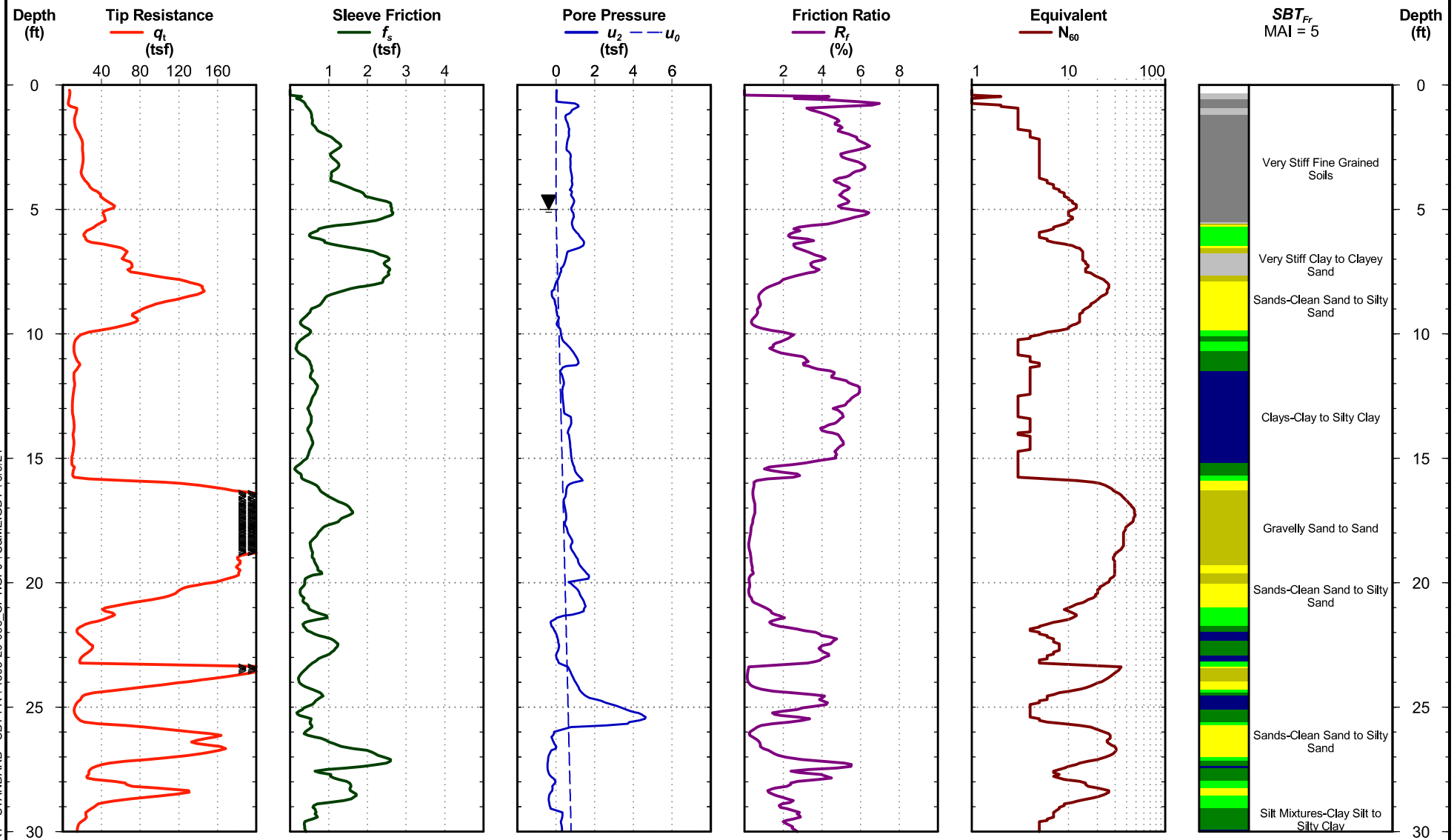
Cone Penetration Test

Electronic Filename: B-1.DAT

Sounding ID: B-2

Laurinburg Fire Station
Laurinburg, North Carolina
S&ME Project No: 4305-20-096

Date:	Jun. 8, 2021	**Total Depth:**	50.1 ft
Estimated Water Depth:	5 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	ATV/T. Chew	**Cone Size:**	1.75



Cone Penetration Test

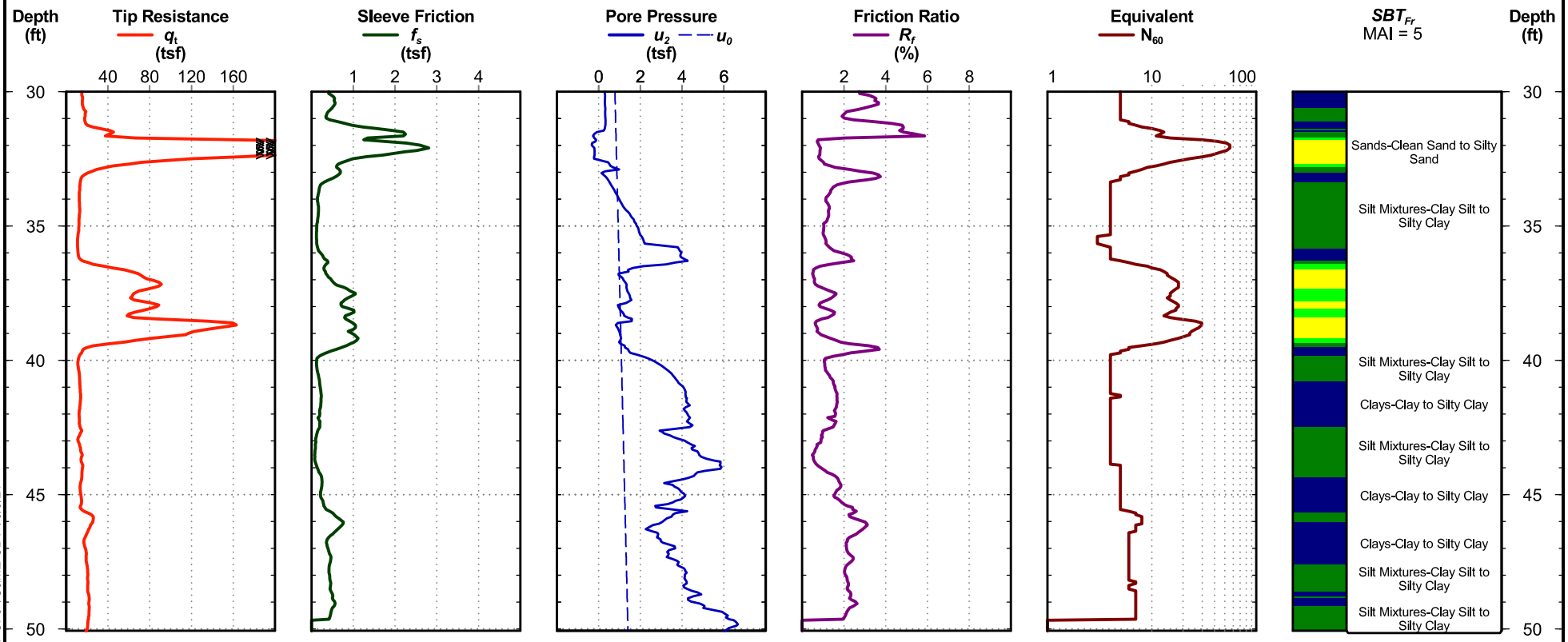
Electronic Filename: B-2.DAT

Sounding ID: B-2

Laurinburg Fire Station
Laurinburg, North Carolina
S&ME Project No: 4305-20-096

Date: Jun. 8, 2021
Estimated Water Depth: 5 ft
Rig/Operator: ATV/T. Chew

Total Depth: 50.1 ft
Termination Criteria: Target Depth
Cone Size: 1.75



Cone Penetration Test

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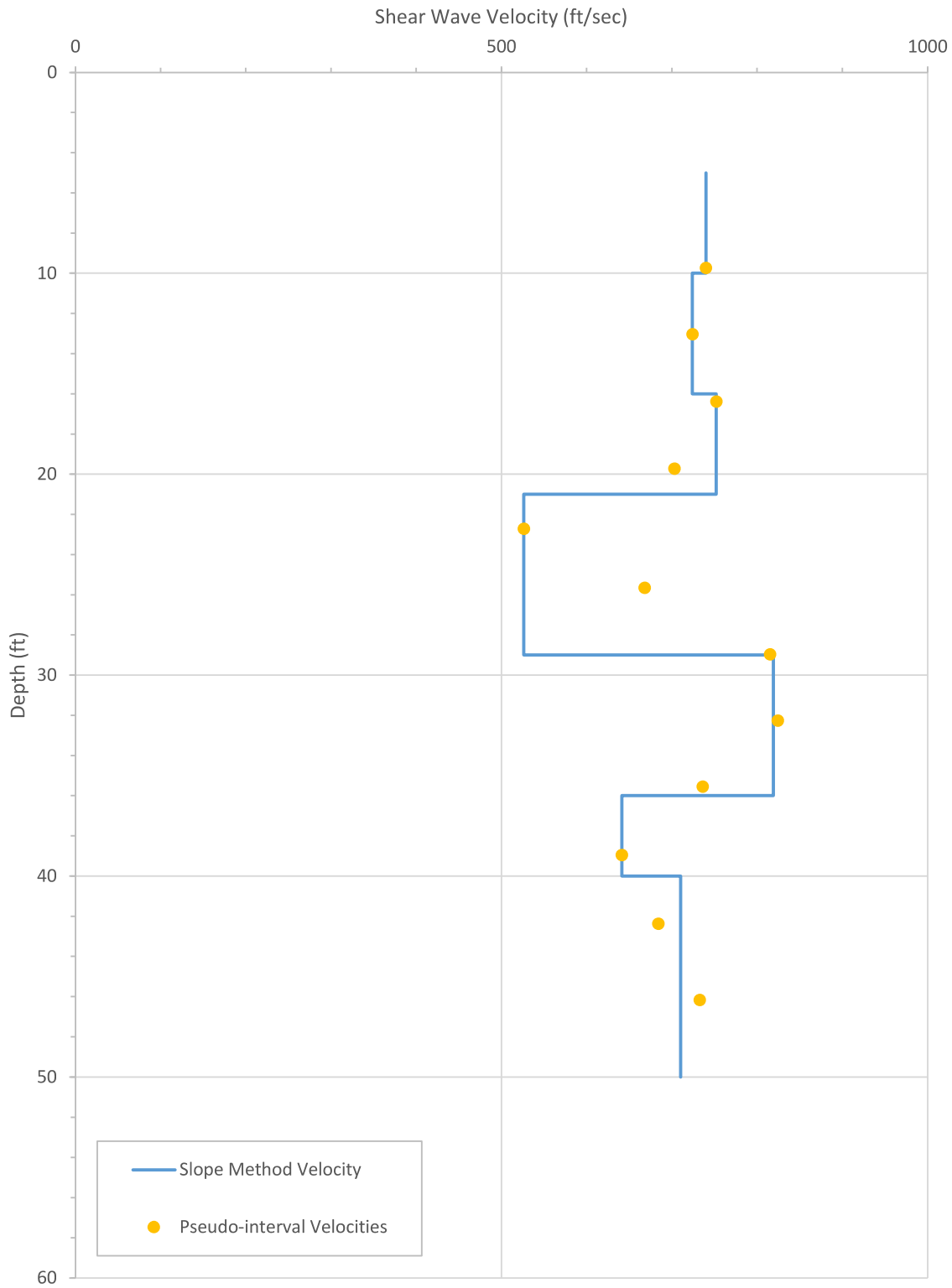


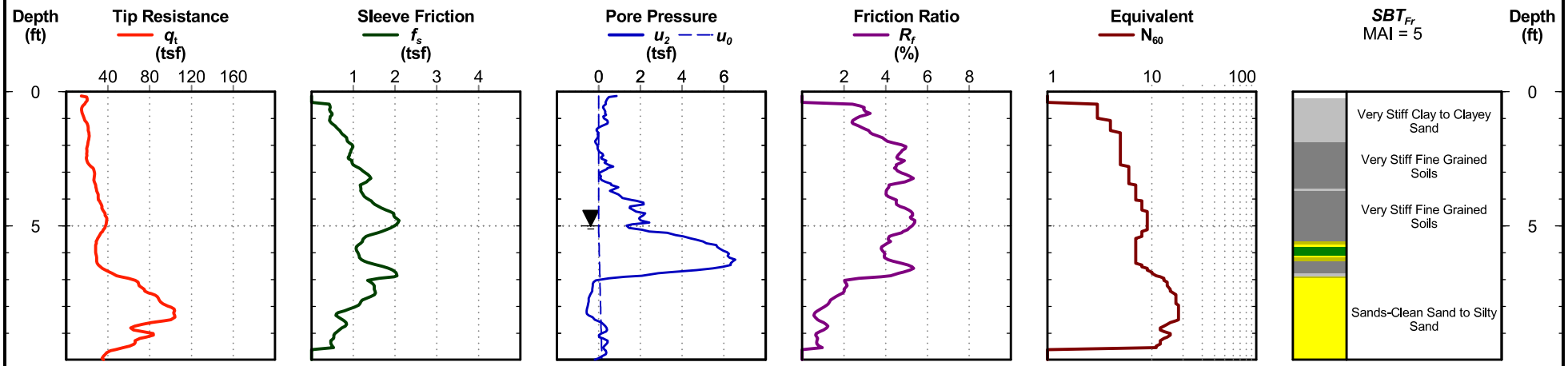
Drawn by: A. Aarons		**Shear Wave Velocity Profile**	Fig. No.
Checked by: A. Browning		Laurinburg Fire Station Laurinburg, NC	3
Date: 6/8/2021		Proj. No. 4305-20-096 B-2	

Sounding ID: P-1

Laurinburg Fire Station
Laurinburg, North Carolina
S&ME Project No: 4305-20-096

Date: Jun. 8, 2021
Estimated Water Depth: 5 ft
Rig/Operator: ATV/T. Chew

Total Depth: 10.0 ft
Termination Criteria: Target Depth
Cone Size: 1.75



Cone Penetration Test

Electronic Filename: P-1.DAT

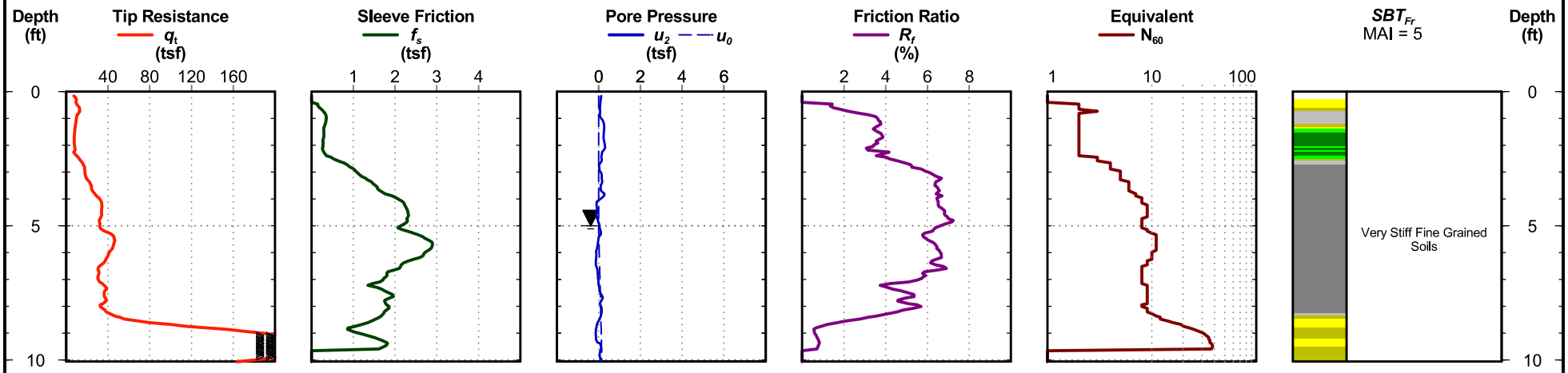
CPT REPORT - STANDARD - SBT FR \ 4305-20-096_CPT.GPJ \ S&ME.GDT \ 6/9/21

Sounding ID: P-2

Laurinburg Fire Station
Laurinburg, North Carolina
S&ME Project No: 4305-20-096

Date: Jun. 8, 2021
Estimated Water Depth: 5 ft
Rig/Operator: ATV/T. Chew

Total Depth: 10.1 ft
Termination Criteria: Target Depth
Cone Size: 1.75



Cone Penetration Test

Electronic Filename: P-2.DAT

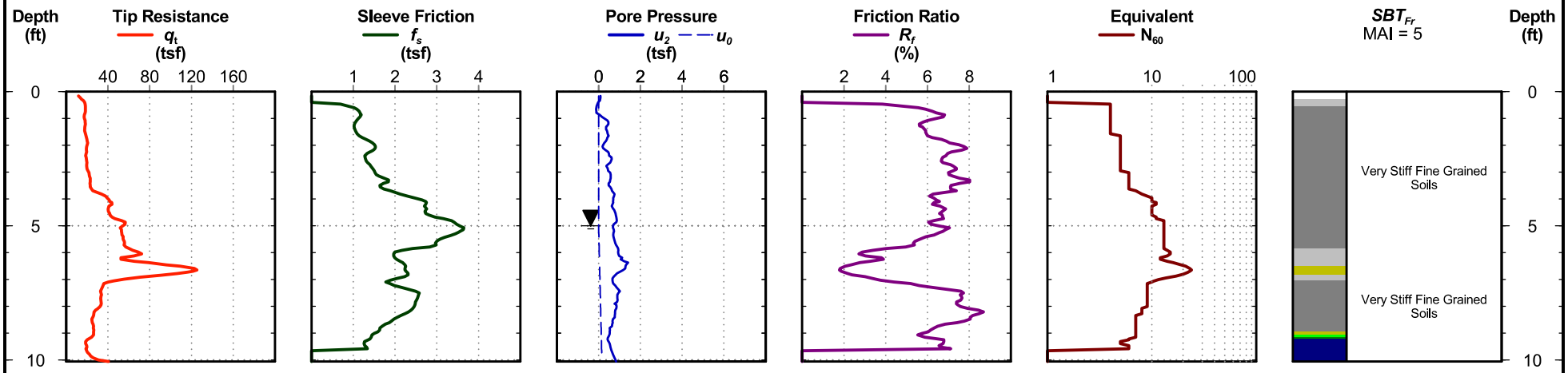
CPT REPORT - STANDARD - SBT FR \ 4305-20-096_CPT.GPJ \ S&ME.GDT \ 6/9/21

Sounding ID: P-3

Laurinburg Fire Station
Laurinburg, North Carolina
S&ME Project No: 4305-20-096

Date: Jun. 8, 2021
Estimated Water Depth: 5 ft
Rig/Operator: ATV/T. Chew

Total Depth: 10.1 ft
Termination Criteria: Target Depth
Cone Size: 1.75



Cone Penetration Test

Electronic Filename: P-3.DAT

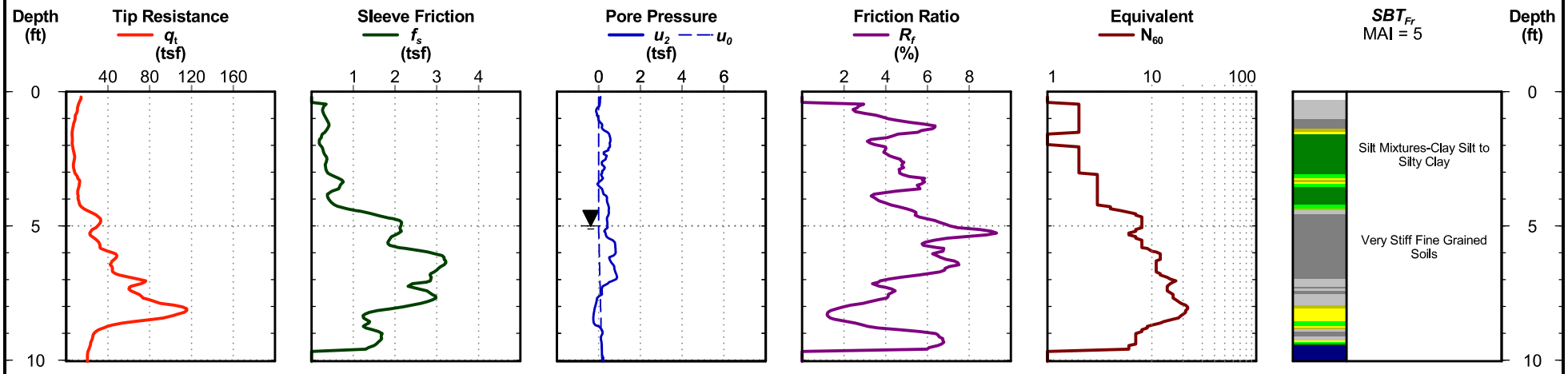
CPT REPORT - STANDARD - SBT FR \ 4305-20-096_CPT.GPJ \ S&ME.GDT \ 6/9/21

Sounding ID: P-4

Laurinburg Fire Station
Laurinburg, North Carolina
S&ME Project No: 4305-20-096

Date: Jun. 8, 2021
Estimated Water Depth: 5 ft
Rig/Operator: ATV/T. Chew

Total Depth: 10.0 ft
Termination Criteria: Target Depth
Cone Size: 1.75



Cone Penetration Test

Electronic Filename: P-4.DAT

FIELD TESTING PROCEDURES

Seismic Cone Penetrometer Test (SCPT) and Cone Penetrometer Test (CPT) Sounding

The cone and seismic cone penetrometer test soundings (ASTM D 5778) were performed by hydraulically pushing an electronically instrumented cone penetrometer through the soil at a constant rate. As the cone penetrometer tip was advanced through the soil, nearly continuous readings of point stress, sleeve friction and pore water pressure were recorded and stored in the on-site computers. Using theoretical and empirical relationships, CPT data can be used to determine soil stratigraphy and estimate soil properties and parameters such as effective stress, friction angle, Young's Modulus and undrained shear strength.

During the SCPT sounding, the cone penetrometer was halted at pre-specified depth increments to measure shear waves. As the probe was stopped, a shear wave was then generated at the ground surface. As the shear waves propagate through the soil, the response of geophones mounted inside the cone penetrometer is recorded with time to create a shear wave record. Several of these records were taken at different depth intervals in the sounding and arrival times for each record were compared to calculate the shear wave velocity of the soil for the given depth interval.

The consistency and relative density designations, which are based on the cone tip resistance, q_t for sands and cohesive soils (silts and clays) are as follows:

SANDS		SILTS AND CLAYS	
Cone Tip Resistance, q_t (tsf)	**Relative Density**	**Cone Tip Resistance, q_t (tsf)**	**Consistency**
<20	Very Loose	<5	Very Soft
20 – 40	Loose	5 – 10	Soft
40 – 120	Medium Dense	10 – 15	Firm
		15 – 30	Stiff
120 – 200	Dense	30 –60	Very Stiff
>200	Very Dense	>60	Hard

CPT Correlations

References are in parenthesis next to the appropriate equation.

General

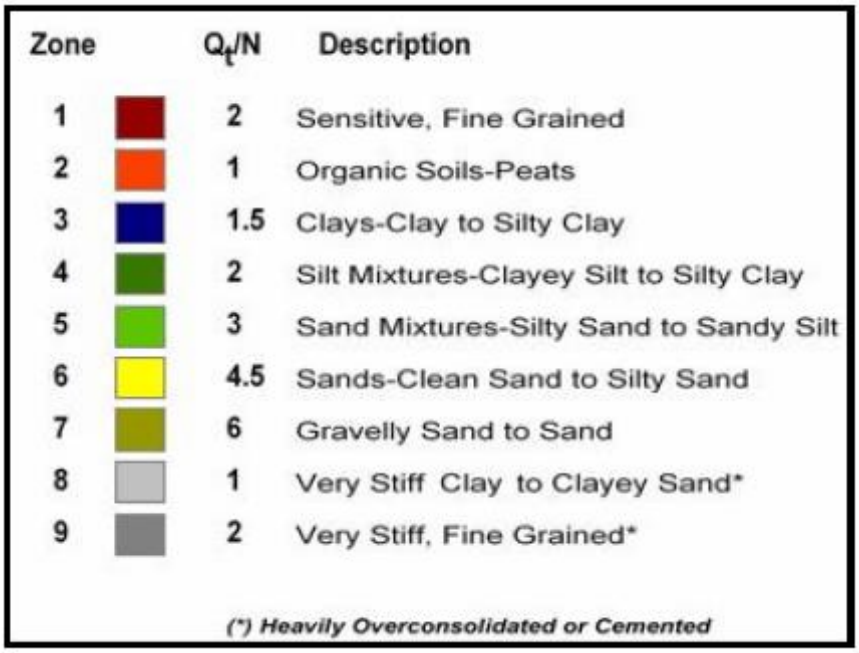
p_a = atmospheric pressure (for unit normalization)
q_t = corrected cone tip resistance (tsf)
f_s = friction sleeve resistance (tsf)
$R_f = 100\% * (f_s/q_t)$
u_2 = pore pressure behind cone tip (tsf)
u_0 = hydrostatic pressure
$B_q = (u_2-u_0)/(q_t-\sigma_{v0})$
$Q_t = (q_t-\sigma_{v0})/ \sigma'_{v0}$
$F_r = 100\% * fs/(q_t-\sigma_{v0})$
$I_c = ((3.47-\log Q_t)^2+(\log F_r+1.22)^2)^{0.5}$

N-Value

$N_{60} = (q_t/p_a)/[8.5(1-I_c/4.6)]$ (6)

(6) Jefferies, M.G. and Davies, M.P., (1993), "Use of CPTu to estimate equivalent SPT N60", ASTM Geotechnical Testing Journal, Vol. 16, No. 4

CPT Soil Classification Legend



Robertson's Soil Behavior Type (SBT), 1990			
Group #	Description	I_c	
		Min	Max
1	Sensitive, fine grained	N/A	
2	Organic soils - peats	3.60	N/A
3	Clays - silty clay to clay	2.95	3.60
4	Silt mixtures - clayey silt to silty clay	2.60	2.95
5	Sand mixtures - silty sand to sandy silt	2.05	2.60
6	Sands - clean sand to silty sand	1.31	2.05
7	Gravelly sand to dense sand	N/A	1.31
8	Very stiff sand to clayey sand (High OCR or cemented)	N/A	
9	Very stiff, fine grained (High OCR or cemented)	N/A	

Soil behavior type is based on empirical data and may not be representative of soil classification based on plasticity and grain size distribution.

Appendix III – Laboratory Results

Form No: TR-D2216-T265-2
Revision No. 1
Revision Date: 08/16/17

LABORATORY DETERMINATION OF WATER CONTENT

ASTM D 2216 ☑ *AASHTO T 265* ☐

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	4305-20-096 Ph. 110	Report Date:	6/11/2021
Project Name:	North Fire Station - Laurinburg, NC	Test Date(s)	6/10 - 6/11/2021
Client Name:	City of Laurinburg		
Client Address:			
Sample by:	S&ME	Sample Date(s):	6/8/21
Sampling Method:	Bulk	Drill Rig :	0-5 ft.

Method: **A (1%)** ☐ **B (0.1%)** ☑ Balance ID. 20977 Calibration Date: 4/5/2021 Oven ID. 1454 Calibration Date: 11/29/2019

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture
		ft.		grams	grams	grams	grams	%
P-2	Bulk	0-5		8.97	276.54	240.09	36.45	15.8%

Notes / Deviations / References

AASHTO T 265: Laboratory Determination of Moisture Content of Soils

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

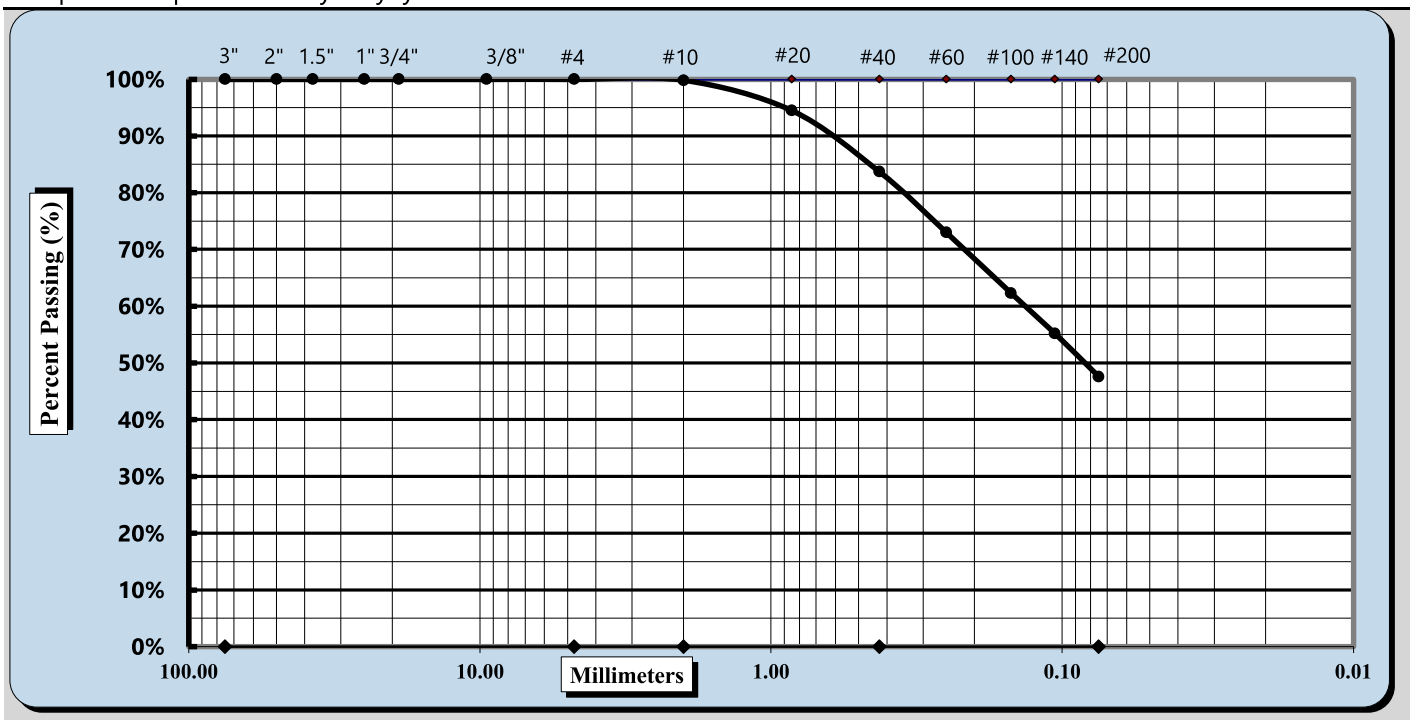
Mal Krajan, ET		Laboratory Manager	6/11/2021
Technical Responsibility	*Signature*	*Position*	*Date*

SIEVE ANALYSIS OF SOIL

Single sieve set ASTM D6913

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	4305-20-096 Ph. 110	Record Date:	6/9/2021
Project Name:	North Fire Station - Laurinburg, NC	Lab Report #:	1
Client Name:	City of Laurinburg	Date Received:	6/8/2021
Received By:	Lab Tech	Sampled by: S&ME, Inc.	Date Sampled: 6/8/2021
Location:	Site-Borehole	Boring #: P-2	Sample #: Bulk
Log/Sample Id.	164	Type: Bulk	Elev/Depth (ft): 0-5
Sample Description:	Gray Clayey SAND		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B Procedure for obtaining Specimen: Moist

Maximum Particle Size	#4	Coarse Sand	0.2%	Fine Sand	36.1%
Gravel	0.0%	Medium Sand	16.1%	Silt & Clay	47.6%
Liquid Limit	33	Plastic Limit	16	Plastic Index	17
Maximum Dry Density	118.0 pcf	Bulk Gravity (C127)	N/A	% Absorption	N/A
Optimum Moisture	13.7%	Natural Moisture	15.8%		

Notes / Deviations / References:

Mal Krajan, ET		Laboratory Manager	6/17/2021
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No.
Revision Date: 8/28/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

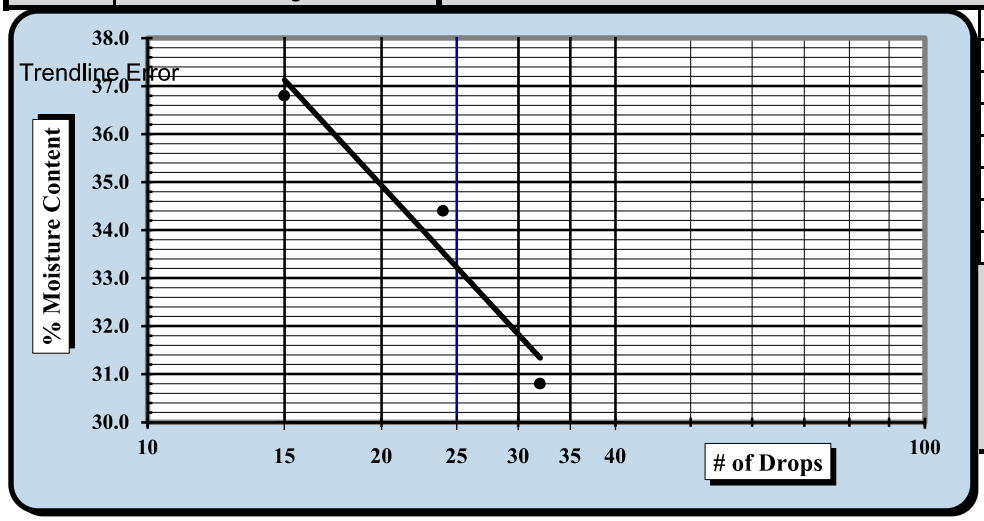
S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	4305-20-096 Ph. 110	Report Date:	6/17/2021
Project Name:	North Fire Station - Laurinburg, NC	Test Date(s)	6/10 - 6/15/2021
Client Name:	City of Laurinburg		
Client Address:			

Boring #:	P-2	Sample #: Bulk	Sample Date: 6/8/2021
Location:	Site-Borehole	Offset: N/A	Depth (ft): 0-5
Sample Description:	Gray Clayey SAND		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	20977	4/5/2021	Grooving tool	1801	5/21/2021
LL Apparatus	1803	8/2/2020			
Oven	1454	11/29/2020			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:									
A	Tare Weight	20.99	20.92	13.60				13.31	20.98	
B	Wet Soil Weight + A	34.89	33.84	30.03				23.99	33.10	
C	Dry Soil Weight + A	31.62	30.53	25.61				22.55	31.45	
D	Water Weight (B-C)	3.27	3.31	4.42				1.44	1.65	
E	Dry Soil Weight (C-A)	10.63	9.61	12.01				9.24	10.47	
F	% Moisture (D/E)*100	30.8%	34.4%	36.8%				15.6%	15.8%	
N	# OF DROPS	32	24	15				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.7%**		



One Point Liquid Limit			
N	**Factor**	**N**	**Factor**
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit	**33**
Plastic Limit	**16**
Plastic Index	**17**
Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☐ Air Dried ☑ *Estimate the % Retained on the #40 Sieve:* 16.3%

Notes / Deviations / References: Group symbol based on percent of sample passing #40 sieve.

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET		Laboratory Manager	6/17/2021
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

MOISTURE - DENSITY REPORT

Quality Assurance

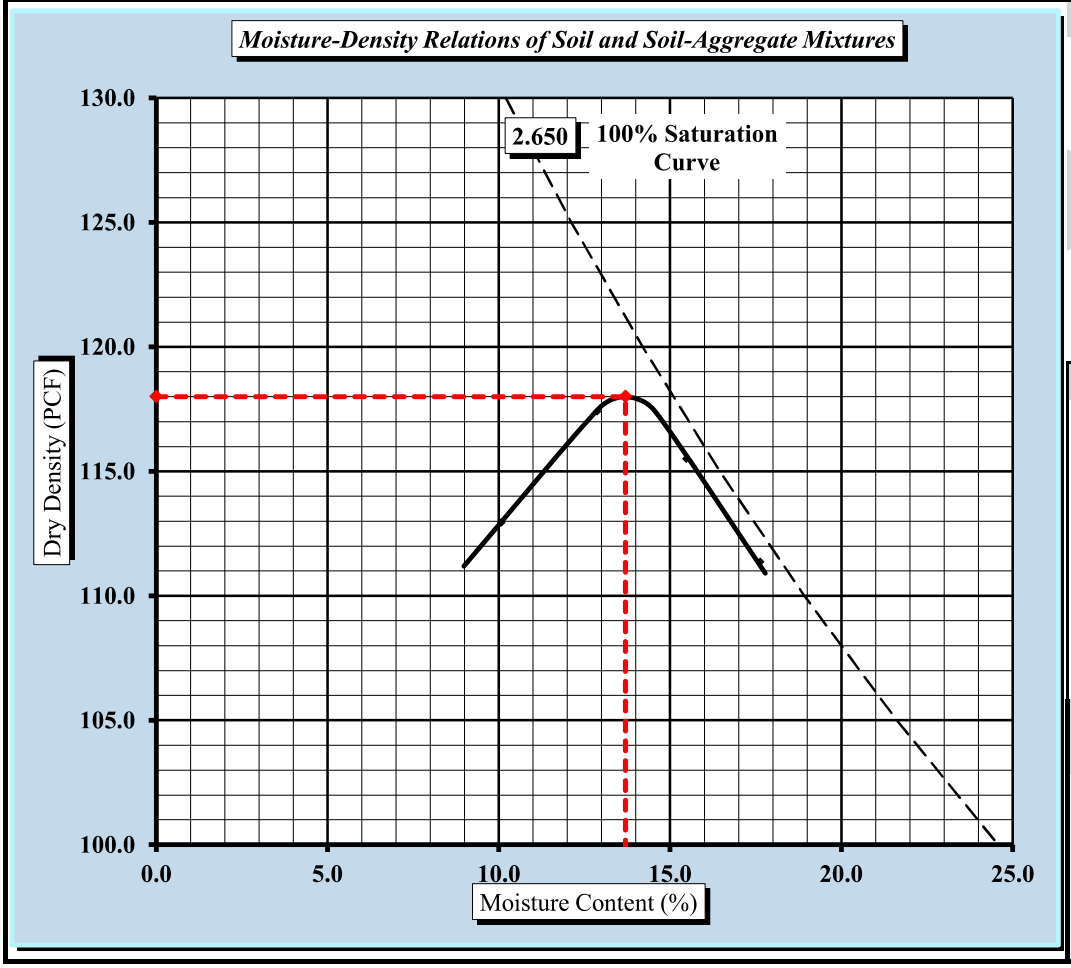
S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

S&ME Project #:	4305-20-096 Ph. 110	Report Date:	6/11/2021
Project Name:	North Fire Station - Laurinburg, NC	Test Date(s):	6/09 - 6/11/2021
Client Name:	City of Laurinburg		
Client Address:			

Boring #:	P-2	Sample #:	Bulk	Sample Date:	6/8/2021
Location:	Site-Borehole	Offset:	N/A	Depth (ft):	0-5 ft.
Sample Description:	Gray Clayey SAND				

Maximum Dry Density 118.0 PCF. Optimum Moisture Content 13.7%

ASTM D 698 - - Method A



Soil Properties	
Natural Moisture Content	15.8%
Assumed Specific Gravity	2.650
Liquid Limit	33
Plastic Limit	16
Plastic Index	17
% Passing	
3/4"	100.0%
3/8"	100.0%
#4	100.0%
#10	99.8%
#40	83.7%
#60	73.0%
#200	47.6%
Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☐ Manual Rammer ☒ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations:

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Mal Krajan, ET		Laboratory Manager	6/11/2021
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

ASTM D 1883

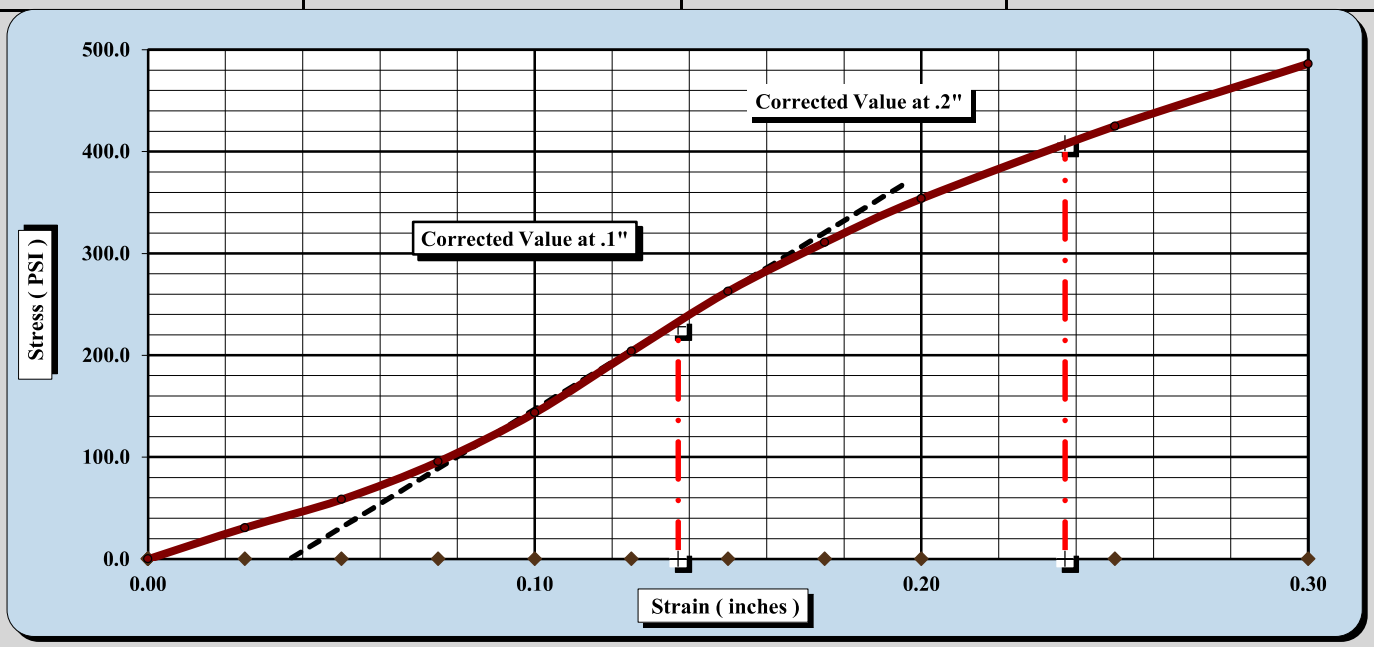
S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	4305-20-096 PH 110	Report Date:	6/17/2021
Project Name:	North Fire Station - Laurinburg, NC	Test Date(s)	6/11 - 6/17/2021
Client Name:	City of Laurinburg		
Client Address:			
Boring #:	P-2	Sample #: Bulk	Sample Date:
Location:	Site-Borehole	Offset: N/A	Depth (ft): 0-5
Sample Description:	Gray Clayey SAND		

ASTM D 698 *Method A* Maximum Dry Density: 118.0 PCF Optimum Moisture Content: 13.7%

Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 14.4	CBR at 0.2 in. 23.6	CBR at 0.1 in. 22.8	CBR at 0.2 in. 27.2



CBR Sample Preparation:

The entire gradation was used and compacted in a 6" CBR mold in accordance with ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	42	Final Dry Density (PCF)	115.2
Initial Dry Density (PCF)	115.0	Average Final Moisture Content	13.8%
Moisture Content of the Compacted Specimen	13.2%	Moisture Content (top 1" after soaking)	14.5%
Percent Compaction	97.5%	Percent Swell	0.1%

Soak Time: 96 hrs. Surcharge Weight 20.0 Surcharge Wt. per sq. Ft. 101.9

Liquid Limit 33 Plastic Index 17

Notes/Deviations/References:

Test specimen compacted to 98% at optimum moisture.

Mal Krajan, ET		Laboratory Manager	6/17/2021
Technical Responsibility	*Signature*	*Position*	*Date*