

**MOORE PUBLIC SCHOOLS
SOUTHMOORE HIGH SCHOOL**

2026 ATHLETICS PLAZA UPGRADES

**INDEPENDENT DISTRICT NO. 2
CLEVELAND COUNTY, MOORE, OKLAHOMA**

**2901 SOUTH SANTA FE
MOORE, OKLAHOMA 73160**

PROJECT MANUAL
MAY 2026

AGP | the Abila Griffin
Partnership



PROJECT MANUAL

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2026 ATHLETICS PLAZA UPGRADES

INDEPENDENT DISTRICT NO. 2
CLEVELAND COUNTY, MOORE, OKLAHOMA

2901 SOUTH SANTA FE
MOORE, OKLAHOMA 73160

ARCHITECT:



the Abla Griffin Partnership LLC
313 Southeast 5th Street
Moore, Oklahoma 73160
t: 405.735.3477
AGP@theAGP.net

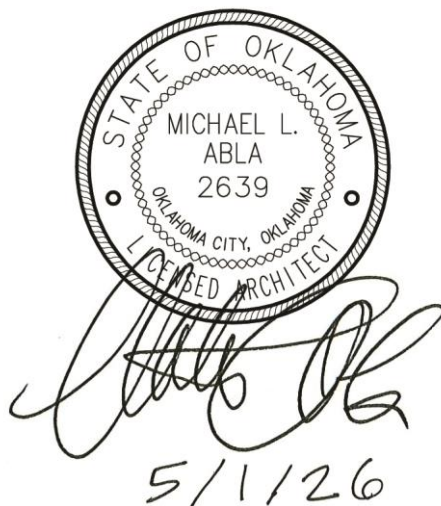


TABLE OF CONTENTS

Title Page	1 page
Table of Contents	2 pages

BIDDING REQUIREMENTS

Special Conditions	8 pages
Geotechnical Engineering Report prepared by Intertek Professional Service Industries, Inc.	61 pages

DIVISION 1 - GENERAL REQUIREMENTS

01010 Summary of the Work	01010-1 - 4
---------------------------	-------------

DIVISION 2 - SITE WORK

02100 Site Preparation	02100-1 - 2
02110 Temporary Construction Fencing	02110-1 - 2
02200 Earthwork	02200-1 - 5
02500 Paving and Surfacing	02500-1 - 4
02741 Hot Mix Asphalt Paving	02741-1 - 10

DIVISION 3 - CONCRETE

03300 Cast-In-Place Concrete	03300-1 - 14
------------------------------	--------------

DIVISION 4 - MASONRY

04720 Cast Stone	04720-1 - 3
04810 Unit Masonry Assemblies	04810-1 - 9

DIVISION 5 - METALS

05120 Structural Steel	05120-1 - 6
05400 Cold Formed Metal Framing	05400-1 - 9
05500 Metal Fabrications	05500-1 - 4

DIVISION 6 - WOOD & PLASTIC

06100 Rough Carpentry	06100-1 - 4
06300 Wood Treatment	06300-1

DIVISION 7 - THERMAL & MOISTURE PROTECTION

07600 Flashing and Sheet Metal	07600-1 - 5
07900 Sealants	07900-1 - 6

DIVISION 8 - DOORS & WINDOWS

Not Used

DIVISION 9 - FINISHES

09900 Painting	09900-1 - 3
----------------	-------------

TABLE OF CONTENTS

DIVISION 10 - SPECIALTIES

Not Used

DIVISION 11 - EQUIPMENT

Not Used

DIVISION 12 - FURNISHINGS

Not Used

DIVISION 13 - SPECIAL CONSTRUCTION

Not Used

DIVISION 14 - CONVEYING SYSTEMS

Not Used

DIVISIONS 21 THRU 26 - MECHANICAL, ELECTRICAL, PLUMBING, & TECHNOLOGY

REFER TO MECHANICAL AND ELECTRICAL DRAWINGS

DIVISION 32 - EXTERIOR IMPROVEMENTS

323119 Fences and Gates

323119-1 - 6

SPECIAL CONDITIONS

TIME FOR COMPLETION AND LIQUIDATED DAMAGES:

- A. Upon execution of the contract agreement between the Owner and the Contractor, it shall become an obligation of the contractor to complete all work to be performed under this agreement for the Construction of the **Southmoore High School 2026 Athletic Plaza Upgrades** to be located at 2901 South Santa Fe, Moore, OK 73160 - **within 180 Calendar Days**.
- B. Penalty for noncompliance by the above date shall be cessation of all further periodical payments until the work is completed and can be fully used for the purpose intended.

PAYMENTS:

- A. The Owner's payment schedule indicating the payment dates established by Moore Public Schools shall be provided to the contractor to establish a monthly payment schedule.
- B. **Certificates of payment shall be submitted to the Architect on or before 7 days prior to Owner's cut-off date.**
- C. Until the Work is 50 percent complete, the Owner will pay 95 percent of the amount due the Contractor on account of progress payments. At the time the Work is 50 percent complete, any **remaining** partial payments shall be paid at 97.5 percent of amount due. The retainage shall be retained until the project is completed.

INSURANCE AND BONDS:

- A. Insurance provided shall be with a company or companies licensed to do business in the state of Oklahoma.
- B. Policies shall be provided in the following types and amounts:
 - 1.
 - a. Workmen's Compensation-Statutory
 - b. Employer's Liability-\$500,000 each accident.
 - 2. Comprehensive General Liability:
 - a. Bodily Injury - \$1,000,000 each occurrence.
 - b. Personal Injury - \$1,000,000
 - c. Property Damage - \$1,000,000 each occurrence

3. Automobile Liability:
 - a. Bodily Injury - \$500,000 each person/\$1,000.000 each occurrence
 - b. Such Comprehensive Automobile Liability Insurance shall include all owned and non-owned hired motor vehicles.
 4. Owner's Protective Liability - Same limits as above.
 5. Products and Completed Operations - Same limits as above.
 6. Contractual Liability - Same limits as above.
- C. Furnish one copy of Certificates herein required for each copy of the Agreement; specifically set forth evidence of all coverage required by Subparagraphs 11.1 and 11.2. Furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits.
- D. **The Contractor shall provide property insurance in the amount of the initial contract sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis without voluntary deductibles. This insurance coverage shall be the "all-risk" form for completed value.**

TEMPORARY SERVICES:

- A. Sanitary Facilities: The Contractor shall provide and maintain necessary sanitary conveniences for the use of those employed on/or about the work. The sanitary facilities shall be properly secluded from public observation and shall be such locations as shall be approved by the Owner, and their use shall be strictly enforced.

SHOP DRAWINGS and SUBMITTALS:

- A. Unless otherwise specified, the shop drawings and product data shall be submitted **electronically**. Physical samples of materials shall be submitted to the Architect as required.
- B. Construction Manager is responsible for obtaining and distributing required prints of shop drawings to his

subcontractors and material suppliers after as well as before final approval.

- C. Shop drawings and samples shall be dated and marked to show the names of the Project, Architect, CM, originating Sub-Contractor, manufacturer or supplier, and separate detailer if pertinent. Shop drawings shall completely identify Specifications section and locations at which materials or equipment are to be installed. Reproduction of Contract Drawings are acceptable as Shop Drawings only when specifically authorized in writing by the Architect.
- D. If materials or specified items other than those specified in these Contract Documents are supplied - and approved by the Architect - it shall be the Construction Manager's responsibility to provide **ALL** additional materials, accessories, substrates, utility connection, etc. for a complete and operational installation at **NO** additional cost to the Owner.

CHANGES IN THE WORK:

- A. Cost shall be limited to the following: cost of materials, including sales tax and cost of delivery; cost of labor, including social security, old age and unemployment insurance, and fringe benefits under collective bargaining agreements; workmen's compensation insurance; bond premiums; and rental value of power tools and equipment. Overhead shall include the following; supervision, superintendence, wages of time keepers, watchmen and clerks, hand tools, incidentals, general office expense, and all other expenses not included in "cost".
- B. Change Order markups shall be limited to 10% overhead and 10% profit. No other markups shall be allowed.

Construction Manager markups shall be limited to 7% profit UNLESS a time extension has been approved by the Owner and the Architect allowing for an increase of G.C.s as per original base agreement times the number of approved additional days. No other markups shall be allowed.

AS BUILT DRAWINGS:

- A. Provide and maintain in proper order and in good, clean

condition in the field office at the project site, one complete full-size set of all working drawings. On this set of drawing prints, in red ink, neatly and accurately inscribe any and all changes in the work.

- B. Upon completion of work, the Contractor shall furnish one set of **"as built"** drawings. These drawings shall be contract drawings corrected in **red ink** to show any differences between contract drawings and actual construction. All changes made during construction shall be noted. Each drawing showing changes in dimensions, details, or containing supplemental information shall be plainly marked **"As Built"** and shall contain the signature of both the Architect and the Contractor.

CLOSEOUT SUBMITTALS:

Prepare project data in the form of an instructional manual supplied electronically on media as requested by Owner (CD or flash drive). The following information shall be included and arranged under a Table of Contents:

1. Directory listing names, addresses, and telephone numbers of the Architect/Engineer(s), Construction Manager, Subcontractors, and major material/equipment suppliers.
2. Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and Suppliers. Include equipment, parts list for each, operating instructions, maintenance instructions for equipment, special finishes, etc.
3. Project documents and certificates, including shop drawings and product data, air and water balance reports, photocopies of warranties.
4. Record As-Built Drawings as described above.
5. Completed Non-Asbestos Affidavit.

DEBRIS DISPOSAL:

Waste disposal shall be the responsibility of the Contractor. The Contractor shall make arrangements with the local authorities having jurisdiction for accommodation of all waste disposal. If local facilities are not available the contractor shall be responsible for all other arrangements for waste disposal.

SUPPLEMENTARY CONDITIONS AND SPECIAL CONDITIONS:

In the following sections where the term "General Conditions" is used, it shall include the "Supplementary Conditions" and/or "Special Conditions" bound in this project manual.

MISCELLANEOUS PROVISIONS:

A. TESTS AND INSPECTIONS

Add the following clarification: **Regardless of how it is described elsewhere in the drawings and specifications, the CM shall engage all testing laboratories / subcontractors as approved by the Architect; and, pay for ALL testing as required by the drawings and specifications.** The CM shall pay for any additional testing due to defective work. The Owner shall pay for any additional testing requested and found to be non-defective.

B. EQUAL OPPORTUNITY

The Contractor shall maintain policies of employment as follows:

The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated fairly during employment without regard to their race, religion, color, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment advertising; layoff or termination; rates of pay or any other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

C. COOPERATION WITH BUILDING OFFICIALS

Cooperate with applicable Federal, State, City or other governmental officials and inspectors at all times. If such officials or inspectors deems special inspection necessary, provide assistance and facilities that will expedite his inspection.

Construction Manager shall be responsible for obtaining and paying for ALL building permits required for this project. This cost shall be included in the Construction Manager's General Conditions.

D. MEASUREMENTS

Before doing any work or ordering any materials, the Contractor shall verify all measurements of existing and new work, and shall be responsible for their correctness.

Quantities obtained during bidding &/or construction shall not be from the scaling of the drawings. Only dimensions obtained from dimensioned documents &/or existing on-site conditions shall be utilized for quantities determination, pricing, and ordering. Any scaling of the Construction Documents will be at the bidder's risk and any discrepancies shall be corrected by and paid for by the bidder.

If differences are found, they shall be submitted to the Architect for consideration and verification before proceeding with the work. No extra compensation will be allowed because of differences between actual dimensions and measurements indicated on the working drawings.

E. CONFLICTS BETWEEN DRAWINGS AND SPECIFICATIONS

Conflicts between the drawings and specifications shall be brought to the immediate attention of the Architect. Failure to bid item(s) noted on the drawings and omitted from the specifications (or vice versa) **does not** remove responsibility from the Construction Manager and applicable Subcontractor(s) to provide and install such with no additional cost to the Owner.

These Contract Documents - including but not limited to the Drawings, Project Manual, and any subsequent Addenda - are issued as a "whole" and shall be bid as such. Each discipline / subcontractor shall review the **entire** set of Contract Documents and include applicable work in their bid **regardless of location within the Contract Documents**. Reviewing only a portion of the Contract Documents shall not absolve the construction manager or subcontractor of the requirements to perform all of the work required for their respective disciplines and/or trade to provide a complete and properly functioning product, system, device, material, etc.

F. MANUFACTURER'S SPECIFICATIONS AND INSTRUCTIONS

Install all manufactured items of materials or equipment in strict accordance with manufacturer's recommended specifications, except that the specifications herein, where more stringent, shall be complied with.

At the completion of the project and prior to final acceptance by the Owner, provide the Owner with three complete sets of operating and maintenance instructions, and demonstrate to them the procedures for proper operation and maintenance of all equipment.

G. JOB MAINTENANCE

During the course of their work, all crafts and trades shall

protect all work which preceded theirs from damage, and they shall make repairs or replacements to any damage caused either directly or indirectly by them.

H. COMPLIANCE WITH STATE AND FEDERAL LAWS

Contractor assumes full responsibility for the payment of all contributions and payroll taxes (state and federal) as to all subcontractors and employees engaged in the performance of work pursuant hereto and further agrees to check and meet all requirements that might be specified under regulations of the administrative officials or board charged with the enforcement of any state or federal act on the subject referenced. CM agrees to furnish Owner, upon request, a certificate or other evidence of compliance therewith.

I. OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (OSHA)

The Construction Manager shall comply with the latest edition and revision of The Federal Occupational Safety and Health Act of 1970 for construction.

J. GUARANTY BONDS

1. Prior to the Owner signing the contract agreement, he will require the Contractor to furnish performance and payment bonds covering the faithful performance of the entire construction contract agreement. The performance bond and the payment bond shall each be made out in one hundred percent (100%) of the contract sum and shall be in a company or companies against which the Owner has no reasonable objection.
2. Bonds shall be signed by an official of the bonding company, and shall be accompanied by the bonding agent's written power-of-attorney in order that one copy may be attached to each copy of the contract agreement.
3. The Construction Manager shall include in his proposal amount the total premiums for all required bonds.
4. Unless noted otherwise, the Construction Manager does hereby warrant and/or guarantee against defects in all workmanship and materials performed or furnished by him directly or by his subcontractors for a period of one (1) year from the date of completion, as evidenced by the date of the Final Certificate or final acceptance of the project. Said warranty and/or guarantee shall be in the form of a good and sufficient bond in a sum equal to one hundred percent

(100%) of the contract price.

End of Special Conditions

GEOTECHNICAL ENGINEERING REPORT

**Proposed Southmoore High School
Additions**

**2901 S Santa Fe Avenue,
Moore, Oklahoma 73160**

PSI Project No. 05462581

PREPARED FOR:

**AGP – The Abila Griffin Partnership, LLC
201 North Broadway, Suite 210
Moore, OK 73160**

August 22, 2022

BY:

**PROFESSIONAL SERVICE INDUSTRIES,
INC.**

**11825 S. Portland Avenue
Oklahoma City, OK 73107
Phone: (405) 735-6052**





Professional Services Industries, Inc.

11825 S. Portland Avenue

Oklahoma City, OK 73107

Phone: (405) 735-6052

August 22, 2022

AGP – The Abla Griffin Partnership, LLC

201 North Broadway, Suite 210

Moore, OK 73160

Attn.: Mr. Michael L. Abla, AIA
mable@theAGP.net
405.735.3477

**Re: Geotechnical Engineering Report
Proposed Southmoore High School Additions**
2901 S Santa Fe Avenue,
Moore, Oklahoma 73160
PSI Project No. 05462581

Dear Mr. Abla,

Professional Service Industries, Inc. (PSI), an Intertek company, is pleased to submit this Geotechnical Engineering Report for the referenced project. This report includes the results from the field exploration and laboratory testing along with recommendations for use in preparation of the appropriate design and construction documents for this project.

PSI appreciates the opportunity to provide this Geotechnical Engineering Report and looks forward to continuing participation during the design and construction phases of this project. PSI also has great interest in providing materials testing and inspection services during the construction of this project and will be glad to meet with you to further discuss how we can be of assistance as the project advances.

If there are questions pertaining to this report, or if PSI may be of further service, please contact us at your convenience.

Respectfully submitted,

Professional Services Industries, Inc.

Certificate of Authorization No. 1111; Expires 06/30/2023

Syed Gous Andrabi
Project Engineer

Thomas M. Vick, P.E., PMP 08/22/22
Senior Engineer | Principal Consultant



TABLE OF CONTENTS

Electronic Navigation: The TOC below and **Keywords** are hyperlinked to sections of relevance. The  Symbol will return the reader to the TOC.

	Page No.
1.0 Project Information.....	1
1.1 Project Authorization.....	1
1.2 Project Description	1
1.3 Purpose and Scope of Services.....	1
1.4 Previous Explorations	2
2.0 SITE AND SUBSURFACE CONDITIONS Regional Geology	3
2.1 Site Geology	3
2.2 Site Description.....	3
2.3 Field Exploration and Laboratory Testing Program	4
2.4 Subsurface Conditions	5
2.5 Water soluble Sulfate	6
2.6 Groundwater Information	6
3.0 Geotechnical Conclusions and Recommendations	7
3.1 Geotechnical Discussion	7
3.2 Site Preparation	8
3.3 Earthwork	9
3.4 Foundations	11
3.5 Floor Slabs.....	15
3.6 Pavement Design	16
3.7 Plan Review and Construction Observation.....	19
4.0 Construction Considerations	20
4.1 Secondary Design Considerations	20
4.2 Construction Materials Testing	21
4.3 Moisture Sensitive Soil / Weather Related Concerns	21
4.4 Drainage and Groundwater Concerns.....	21
5.0 Geotechnical Risk and Report Limitations.....	22

FIGURES	Site Vicinity Map
	Boring Location Plan
APPENDIX A	Field Exploration & Laboratory Testing Program
APPENDIX B	Subsurface Profiles
APPENDIX C	General Notes



INDEX OF TABLES

	Page No.
Table 2.1: Ground Motion Values	3
Table 2.2: Boring Location Information	4
Table 2.3: Generalized Soil Profile.....	5
Table 2.4: Water-Soluble Sulfate Test Result.....	6
Table 3.1: Select Fill Recommendations	8
Table 3.3: Compaction Criteria and Testing Frequency.....	10
Table 3.4: WRI Design Values	12
Table 3.5: Parameters for Axial Design	13
Table 3.6: Geotechnical Recommendations for Straight Shaft Pier Design	14
Table 3.7: Recommended Uplift Loads and Unit Skin Friction Values Due to Swelling	14
Table 3.8: Parameters for Lateral Design using LPILE.....	15
Table 3.9: Minimum Rigid Pavement Section	17



1.0 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Professional Service Industries, Inc. (PSI), an Intertek company, has completed a field exploration and geotechnical evaluation for the Proposed Southmoore High School Additions to be located at 2901 S Santa Fe Avenue in Moore, Oklahoma. Mr. Mike Abila, representing AGP, authorized PSI's services on June 28, 2022 by signing PSI Proposal No. 0546-376797.

1.2 PROJECT DESCRIPTION

Based on information provided by the client, a summary of our understanding of the proposed project is provided below.

- A new single-story indoor practice facility building addition to existing Southmoore High School with an approximate footprint of 53,700 square feet. Building is anticipated to be pre-engineered metal frame structure.
- New Press box, Locker room, Bleachers, and
- Parking and drive-lanes.

Structural loading information was not provided at the time of this report. PSI has prepared this report based on the anticipated loads detailed below:

- Column loads not exceeding 200 kips;
- Wall loads on the order of 3 kips per linear foot or less;
- Maximum floor slab loads not more than 150 pounds per square foot.

Site grading information was not provided at the time of this report. This report has been developed based on finished grades being within two (2) feet of existing site grade.

The geotechnical recommendations presented in this report are based on the available project information, structure locations, and the subsurface materials encountered during the field investigation. Should any of the above information or design basis made by PSI be inconsistent with the planned construction, it is requested that you contact us immediately to allow us to make any necessary modifications to this report. PSI will not be held responsible for changes to the project if not provided the opportunity to review the information and provide modifications to our recommendations.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to evaluate the subsurface conditions at the site and develop geotechnical engineering recommendations and guidelines for use in preparing the design and other related construction documents for the proposed project. The scope of services included drilling borings, performing laboratory testing, and preparing this preliminary geotechnical engineering report.

This report briefly outlines the available project information, describes the site and subsurface conditions, and presents the recommendations regarding the following:

- General site development and subgrade preparation recommendations;
- Estimated potential soil movements associated with collapsing, shrinking and swelling soils and methods to reduce these movements to acceptable levels;



- Recommendations for earthwork, fill compaction, and the use of on-site and imported fill material under pavements and the structures;
- Recommendations for building pad preparation for ground supported slabs having a maximum movement potential, due to heave or settlement;
- Recommendations for the design of foundations for supporting the proposed structures, which may include design criteria for conventional shallow spread footing foundations and/or slab on grade foundations designed for a 1-inch potential vertical movement and/or drilled shaft/pier design criteria.
- Lateral earth pressure design parameters.
- Seismic design site classification per the international building code and ASCE code, if required.
- Recommendations for the design of rigid concrete pavement systems for the proposed parking and drive areas.

The scope of services for this geotechnical exploration did not include an environmental, mold nor detailed seismic/fault assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

1.4 PREVIOUS EXPLORATIONS

PSI previously performed geotechnical services, for the Pre-planning New College & Careers Classroom addition at Southmoore High School, which is located in the southeast corner of the existing school. These services were presented in our report PSI project Number 05462142-7, dated April 24, 2020. Generally, encountered about 16 feet of lean CLAY with various Sand contents, about 9 feet of Shaley CLAY, and rock below 16 feet. Groundwater was not encountered within the borings.



2.0 SITE AND SUBSURFACE CONDITIONS REGIONAL GEOLOGY

2.1 SITE GEOLOGY

As shown on the geologic map database for the State of Oklahoma, the site is located in an area where Terrace Deposits (Qp) overlay Salt Plains formation (Psp), are present at or near the ground surface. Terrace Deposits (Qp) consists of lenticular beds of sand, silt, clay, and gravel. Thickness ranges from a few feet to about 100 feet and probably averages about 50 feet along major streams whereas Salt Plains formation (Psp) consists of red-brown blocky shale orange-brown siltstone, grades southward into Pp "Purcell Sandstone" in Norman area. Thickness of the Salt Plains formation (Psp) is about 200 feet. Division Three publication of the "Engineering Classification of Geologic Materials" manual published by ODOT indicates the project site is underlain by the Hennessey Unit (Phy).

2.2 SITE DESCRIPTION

The project site is located at 2901 S Santa Fe Avenue in Moore, Oklahoma. The latitude and longitude of the proposed construction site are approximately at 35.30967° N and 97.52025° W, respectively. Currently, the project site is an existing recreational facility at the Southmoore High School. The site is bordered by residential area on the north, west and south. The site is bordered by undeveloped land on the east. The truck-mounted drill rig did not experience significant mobility difficulty in accessing the boring at the time of the field work.

2.2.1 SEISMIC DESIGN PARAMETERS

We understand that the project is governed by the International Building Code (IBC), 2018 edition. As part of this code, the design of structures must consider dynamic forces resulting from seismic events. These forces are dependent upon the magnitude of the earthquake event as well as the properties of the soils that underlie the site.

As part of the procedure to evaluate seismic forces, the code requires the evaluation of the Seismic Site Class, which categorizes the site based upon the characteristics of the subsurface profile within the upper 100 feet of the ground surface. Our boring extended to a depth of 24 feet bgs, but to define the Site Class for this project, we have interpreted the results of soil test borings drilled within the project site and estimated appropriate soil properties below the base of the borings to a depth of 100 feet as permitted by the code. The estimated soil properties were based upon the soils encountered at the site, data available in published geologic reports, and our experience with subsurface conditions in the general site area.

Based upon our evaluation, the subsurface conditions at the site are consistent with the characteristics of a **Site Class "C"** as defined in Chapter 20.3-1 of the ASCE 7-16. The associated probabilistic ground acceleration values and site coefficients for the general site area were obtained from the USGS geohazards web page (<https://seismicmaps.org/>) using the **ASCE 7-16** option and are presented in the table below.

TABLE 2.1: GROUND MOTION VALUES

Period (sec)	Mapped MCE Spectral Response Acceleration (g)		Site Coefficients		Adjusted MCE _R Spectral Response Acceleration (g)		Design Spectral Response Acceleration (g)	
0.2	S _s	0.339	F _a	1.3	S _{Ms}	0.441	S _{Ds}	0.294
1.0	S ₁	0.084	F _v	1.5	S _{M1}	0.127	S _{D1}	0.084

2% Probability of Exceedance in 50 years for Latitude, Longitude: 35.30967°, -97.52025°

MCE_R = Maximum Considered Earthquake



2.3 FIELD EXPLORATION AND LABORATORY TESTING PROGRAM

2.3.1 FIELD EXPLORATION

Subsurface conditions at the site were explored by drilling twenty-three (23) borings at the approximate locations shown on the Boring Location Plan included in the Appendix. The boring locations were approximately located in the field by the drilling crew by estimating distances from known site reference points and with the aid of a handheld GPS device. The boring elevations on the boring logs are estimated from Google Earth and should be considered as accurate as the means and methods used to obtain them. The boring location information is included in the table below.

TABLE 2.2: BORING LOCATION INFORMATION

Boring Number*	Boring Location	Depth(ft)
DB-1	New Visitor Restrooms Building	24
DB-2	New Visitor Restrooms Building	24
DB-3	Bleachers	24
DB-4	Restroom/Locker Room Building	24
DB-5	Bleachers/Press Box	24
DB-6	Locker Room	24
DB-7	Bleachers	24
DB-8	Indoor Practice Facility	24
DB-9	Indoor Practice Facility	24
DB-10	Indoor Practice Facility	24
DB-11	Indoor Practice Facility	24
DB-12	Indoor Practice Facility	24
DB-13	Indoor Practice Facility	24
SB-1	Pavement	6
SB-2	Pavement	6
SB-3	Pavement	6
SB-4	Pavement	6
SB-5	Pavement	6
SB-6	Pavement	6
SB-7	Pavement	6
SB-8	Pavement	6
SB-9	Indoor Practice Facility	14½
SB-10	Indoor Practice Facility	14½

*The boring location DB-6 was offset approx. 30 feet southeast due to existing storm drain and DB-7 was offset 33 feet southwest due to the existing fence around the track/football field.

Actual ground elevations should be finalized by others prior to construction. Therefore, the references to depth of the various materials encountered are from the existing grade at the time of drilling.

The borings were drilled and sampled in general accordance with ASTM standards. Drilling equipment utilized for this project included truck-mounted rotary drilling equipment with appropriate support vehicles. The borings were drilled using continuous flight auger drilling techniques.



The borings were sampled relatively continuously to a depth of approximately ten feet and at five-foot intervals thereafter. The borings were advanced utilizing solid flight auger drilling methods from a truck-mounted CME-750 drill rig equipped with an automatic hammer using a weight of 140 pounds dropping 30 inches, and soil samples were routinely obtained during the drilling process. Drilling and sampling techniques were accomplished generally in accordance with ASTM procedures.

Groundwater level measurements were recorded at the boring locations during the field operations and were noted on the boring logs. The borings were backfilled with soil cuttings after the drilling operations were completed as per the local regulatory requirements.

The subsurface conditions during drilling were monitored, logged and visually classified in the field by the drilling crew. Field notes were maintained for soil types and description, water levels, changes in subsurface conditions, and drilling conditions. After completion of field activities, the samples were transported to the laboratory in general accordance with ASTM D4220. The soil samples were sealed in plastic bags and placed in secured containers prior to being transported to the geotechnical laboratory.

Boring logs, which include soil descriptions, water level information, laboratory test data, stratifications, classifications based on the ASTM D 2487 and D2488, and sample types and depths are included in the Appendix. A key to descriptive terms and symbols used on the boring logs is also presented in the Appendix.

2.3.2 GEOTECHNICAL LABORATORY TESTING

Laboratory testing of soils was performed in general accordance with applicable ASTM procedures. The geotechnical laboratory testing program was established so that the engineering design parameters produced from the tests are appropriate for use in the engineering analyses and in support of the conclusions and recommendations.

The geotechnical laboratory program included the following tests:

- Classification (ASTM D 2487 / 2488)
- Moisture Content (ASTM D 2216)
- Atterberg Limits (ASTM D 4318)
- Percent Soil Particles Finer than No. 200 Sieve (ASTM D1140)
- Soluble Sulphate (ODOT's OHD L-49)

The samples not tested in the laboratory will be stored for a period of 60 days subsequent to submittal of this report and will be discarded after this period, unless other arrangements are made prior to the disposal period.

2.4 SUBSURFACE CONDITIONS

The results of the field and laboratory testing have been used to generalize a subsurface profile at the project site. The following subsurface descriptions provide a highlighted generalization of the major subsurface stratification features and material characteristics.

TABLE 2.3: GENERALIZED SOIL PROFILE

Stratum	Top (ft)	Bottom (ft)	Description
I	0	14 to 14½	Lean CLAY (CL), medium stiff to hard, brown, light gray inclusions, red, trace sand; Sandy Lean CLAY (CL), stiff to hard, brown to reddish brown, light gray inclusions, red; SILT (ML), stiff to very stiff, brown and light gray, with sand.
II	Below 14 or 14½		SHALE, soft, red



The boring logs included in Appendix A should be reviewed for specific information at individual boring locations. The boring logs include soil descriptions, stratifications, locations of the samples, and field and laboratory test data. The descriptions provided on the logs only represent the conditions at that actual boring location; the stratifications represent the approximate boundaries between subsurface materials. The actual transitions between strata may be more gradual and less distinct. Variations will occur and should be expected across the site.

2.5 WATER SOLUBLE SULFATE

PSI performed water-soluble sulfate testing of a select sample collected from select boring locations DB-2, DB-5 and SB-9. The testing was performed in general accordance with OHD L-49. The table below summarizes the results of the testing.

TABLE 2.4: WATER-SOLUBLE SULFATE TEST RESULT

Boring	Depth (ft)	Water-Soluble Sulfate Content	
		ppm (mg/kg)	Percent by Weight
DB-2	2	< 100	-
DB-5	6	< 100	-
SB-9	3½	< 100	-

2.6 GROUNDWATER INFORMATION

The initial water levels were monitored in the open boreholes during drilling and attempts were made to measure final water levels. Groundwater was not observed to collect in the borings during nor upon completion of drilling, indicating measurable groundwater may be below the maximum depths of the borings or groundwater will require additional time to stabilize in the open holes.

Groundwater levels fluctuate seasonally as a function of rainfall, proximity to creeks, rivers and lakes, the infiltration rate of the soil, seasonal and climatic variations and land usage. In relatively pervious soils, such as sandy soils, the indicated depths are a relatively reliable indicator of groundwater levels. In relatively impervious soils, water levels observed in the borings may not provide a reliable indication of groundwater elevations, even after several days. If a detailed water level evaluation is required, observation wells or piezometers can be installed at the site to monitor water levels.

The groundwater levels presented in this report were measured at the time of PSI field activities. The contractor should determine the actual groundwater levels at the site before construction activities.



3.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

3.1 GEOTECHNICAL DISCUSSION

The primary geotechnical consideration at this site is the presence of low to medium plasticity soils. These conditions will govern the site preparation and earthwork activities and the project foundation designs. Should changes in the project criteria occur, a review must be made by PSI to determine if modifications to our recommendations will be required.

The following geotechnical design recommendations have been developed based on the previously described project characteristics and subsurface conditions encountered. The proposed construction should be performed in accordance with these recommendations and the applicable building code, and local governmental standards which have jurisdiction over this project. If there are changes in the project criteria, PSI should be retained to determine if modifications in the recommendations will be required. The findings of such a review would be presented in a supplemental report. Once final design plans and specifications are available, a general review by PSI is recommended to confirm that the conditions anticipated in preparing this geotechnical report are consistent with the earthwork and foundation recommendations contained within the construction documents.

3.1.1 SOIL SHRINK-SWELL POTENTIAL

The results of laboratory plasticity tests indicate that low to medium plasticity clay soils are present on site. The materials generally have a low to moderate potential for shrinking and swelling. The amount of potential soil movement due to shrinking and swelling with soil moisture variations for this site could be on the order of 1½ inches or less for these soils, assuming that the subgrade materials are allowed to increase in moisture content from a relatively dry condition to a relatively wet condition over a depth of approximately 8 feet. The relatively dry condition can occur with severe dry weather situations, thereby resulting in a significant degree of shrinkage and eventual potential swell in the foundation material. Differential movements are expected to be about ½ of the PVR. However, it should be noted that for extreme conditions (i.e., soils dry and shrink in one area with soils in another area being exposed to water and swelling) differential movement can be equal to or even double the PVR.

A reduction in potential vertical movement can be achieved by supporting the floor slab on the properly compacted low plasticity structural fill or modified existing soils as recommended in the [SITE PREPARATION](#) section of this report to reduce the estimated PVR to 1 inch or less. The greater the select/structural fill or modified existing soil (used as structural fill) thickness beneath the slab, the less the probability of structural distress due to shrinkage and swelling of the clay soils. The structural fill should extend a minimum of 5 feet beyond the edges of the structure. The desired thickness of fill can be provided by raising the site grade with the properly compacted recommended materials or undercutting and replacing with the recommended materials. If modification of the site soil is desired, it can be performed as recommended below.

Poor drainage and water infiltration into the foundation soils may result in reduction of soil strength, thereby causing adverse and damaging movements. It is recommended that the moisture-related problems be corrected immediately as they can be detrimental to the ground supported structures.

It is important to control the possibility of moisture changes by following the precautions shown below:

- Direct surface runoff away from structures by sloping the subgrade away from the structure.
- Extend paving or other impervious coverings, such as sidewalks, to the structure's edge.
- Extend roof drain downspouts so that the discharge is at least 5 feet from the structure.
- Avoid placing trees or shrubs adjacent to structure.



- Avoid excessive drying of soil around the structure.

3.2 SITE PREPARATION

The proposed building pad and parking areas should be stripped and grubbed of any construction debris, trash, vegetation, organic laden materials, and other structures in conflict with the proposed construction a minimum 10 feet outside the structural and pavement limits. Depressions or low areas resulting from stripping and grubbing should be backfilled with approved soil and compacted in accordance with [EARTHWORK](#) section herein.

3.2.1 BUILDING PAD PREPARATION

For a structurally supported slab above the grade, no significant site preparation is required other than general site grading. All fill placements should be placed in accordance with the [EARTHWORK](#) section of this report.

A ground supported slab can be constructed provided the movements associated with shrinking and swelling soils are reduced to a tolerable level and the owner understands the risk associated with such movements. Typically, it is the industry practice to consider one-inch soil movement as the tolerable level. In order to reduce the soil movements, it has been the industry practice to provide an engineered soil layers below the ground supported slab system. The following option for subgrade preparation is provided to reduce the soil movements depending on the amount of risk that the owner is willing to take for this project.

3.2.1.1 OPTION 1: SELECT FILL/STRUCTURAL FILL

This option is applicable for a conventional shallow foundation system such as shallow spread/continuous footings; or, monolithic, steel reinforced stiffened slab-on-grade foundation system (i.e., a waffle type grade beam configuration designed using PTI or WRI). This option is also applicable for drilled shafts.

In order to provide uniform support to the floor slab-on-grade and to reduce the potential movements associated with shrink/swell soils to about 1 inch, the recommended soil layers to be placed below the floor slab are given in the table below.

TABLE 3.1: SELECT FILL RECOMMENDATIONS

PVR	Material Type	Layer Thickness (ft)	Elevation ^a (ft)
1-inch	Select Fill	1	+0 to -1

Notes: a) Existing grade is anticipated to be finished grade at +0 feet

The select/structural fill should be placed within the plan area of the structure and to a distance of at least 5 feet beyond the perimeter of the structure and include building entrances and flatwork sensitive to movements. Plasticity and compaction requirements for the select fill are provided later in this section. On-site materials are mostly marginal to unsuitable for use as structural fill without modification (lime or cement, or fly ash or CKD treated) as described later in this report, but the material may be stockpiled for use in non-load bearing areas such as landscaping.



3.3 EARTHWORK

Following site preparation and any excavation to proposed grades, the newly exposed subgrades in site improvement areas intended for structures and pavements must be approved by the Geotechnical Engineer prior to fill placement. These exposed subgrades should be proof rolled with a loaded tandem axle dump truck or similar piece of rubber-tired equipment (20 tons or greater) in the presence of the Geotechnical Engineer's representative. The purpose of the proof rolling is to detect the existence of marginal or loose near-surface materials or unsuitable soils that may require undercutting. Areas which deflect, rut or pump excessively during proof rolling, and which cannot be densified in-place, should be undercut to suitable soils and backfilled and/or as directed by the geotechnical engineer. Proof rolling should not be performed on saturated, frozen or during wet weather conditions. Once approved, the soils exposed at the base of all excavations should be scarified to a depth of at least 12 inches, moisture conditioned and then compacted as described below prior to placing Engineered Fill above.

3.3.1 FILL MATERIALS

The resulting engineered fill must produce a stable, uniform, and consistent compacted fill body. Fill materials should be free of organic or other deleterious materials and should be placed in maximum lifts of 8 inches of loose material and should be compacted in accordance with the below table. Compaction of the fill material should be performed with appropriate types of power, pneumatic or tamping equipment. Monitoring of the backfilling should include sufficient compaction testing by the Geotechnical Engineering representative to document that each lift of fill has been compacted to the required density. Each lift of compacted engineered fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts. If any lift or portion of a lift does not conform to the density requirements, the lift should be thoroughly scarified and re-compacted until the required density is obtained. If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Care should be taken to apply compactive effort throughout the fill and fill slope areas. The moisture content and the degree of compaction of the engineered fill soils should be maintained until the construction of the structures within the area.

All proposed fill materials should be tested and approved by the geotechnical engineer prior to placement in the field, in accordance the *Compaction Criteria and Testing Frequency* table below. The following types of fill can be used as recommended in this report.

Common Fill: Common fill may consist of on-site or imported materials. Common fill should be free of organics or other deleterious materials and have a particle size of 3 inches or less. Common fill materials shall be classified in accordance with ASTM D2487. Satisfactory soils will be Clayey SAND (SC), Sandy lean CLAY or lean clay (CL) soils. Common fill shall have a plasticity index of less than 30.

Select Fill: Select fill should be free of organic or other deleterious materials, should have a maximum particle size less than 3 inches, and at least 35% fines (passing #200 sieve). Select fill materials shall be classified in accordance with ASTM D2487. Satisfactory soils will be Sandy lean CLAY or lean CLAY (CL) soils. Select fill shall have a liquid limit not greater than 35 and a plasticity index between 8 and 20.

On-site soils: The onsite soils can be stockpiled and tested in bulk for compliance with the fill specifications prior to their reuse.



Lime, Cement, Fly Ash, and CKD Treated Soils: The lime and Portland cement treated soils are soils that are treated with 4 to 6% of lime or cement expressed as percent of the dry weight of the soil to be treated. The fly ash and cement kiln dust (CKD) treated soils are soils that are treated with 12 to 14% of fly ash or CKD expressed as percent of the dry weight of the soil to be treated. Lime, cement, fly ash, and CKD treated soils can also be used as Select Fill materials and also to strengthen the subgrade supporting pavements. These treated/modified soils, if used, should be placed and compacted to the specifications as shown in the below table.

- **Lime Treatment** should be performed when the wet subgrade soils are classified as CL or CH or SC in accordance with ASTM D 2487.
- **Lime-Flyash Treatment** should be performed when the wet subgrade soils are classified as SC, SC-SM, CL-ML, ML, SM in accordance with ASTM D 2487.
- **Cement Treatment** should be performed when the wet subgrade soils are classified as SM with less than 20% fines, SP-SC, SP-SM, SW-SC, SW-SM, SP, SW in accordance with ASTM D 2487.

Flexible Base: Flexible base materials should meet ODOT Type A Aggregate Base. Recycled concrete can be used. Flexible base should be placed and compacted to the specifications as mentioned in table below.

TABLE 3.2: COMPACTION CRITERIA AND TESTING FREQUENCY

Material Type (Location)	Per Standard Proctor Test (ASTM D698)			
	Minimum Compaction (%)	Moisture Content Range (ref. to optimum moisture content)		Testing Frequency (min. 3 per lift)
		Minimum	Maximum	
Common Fill or On-Site Soils	95	-2%	+3%	1 per 2,500 sf
Select Fill	95	-1%	+3%	1 per 2,500 sf
Modified/Treated Soil	95	0%	+4%	1 per 2,500 sf
Flexible Base	95	-2%	+2%	1 per 5,000 sf
Utility Backfill	95	-1%	+4%	1 per 1,000 lf

3.3.2 EXCAVATIONS

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or other parties' compliance with local, state, and federal safety or other regulations.



3.3.3 SLOPES

Any permanent cut or fill slopes should not exceed 2 Horizontal to 1 Vertical (2H:1V). Excavations extending below a 1H:1V plane extending down from any adjacent footings should be shored for safety. All excavations should be inspected by a representative of the geotechnical engineer during construction to allow any modifications to be made due to variation in the soil types. All work should be performed in accordance with Department of Labor Occupational Safety and Health Administration (OSHA) guidelines as described in the previous section.

3.3.4 UTILITIES

Utility trenches may be backfilled with suitable onsite native soils or imported soil above the pipe zone. In pavement areas, the top 12-inches of soil subgrade should reach a minimum of 95 percent of this Proctor. If rocks larger than 3-inches in maximum size are encountered, they should be removed from the backfill material prior to placement in the utility trenches. Pipe zone backfill requirements should be in conformance with the requirements of the local agencies having jurisdiction. Jetting or flooding of utility backfill is not recommended. If smaller compaction equipment such as jumping jacks or plate compactors are used, thinner lifts will be required to achieve compaction. Where utilities cross building perimeters, concrete or concrete slurry should be used for backfilling around the utility to prevent moisture from migrating along the utility trench and entering the building envelope.

3.3.5 FLATWORK

For sidewalks or other flatwork located adjacent to grade-supported foundations, the undercutting and select fill placement operations for the building should extend beyond the perimeter of the building and pavements to at least the width of the adjacent sidewalk or flatwork.

Any other sidewalks or flatwork not adjacent to buildings should be placed on an improved subgrade meeting or exceeding the pavement subgrade improvement methods previously recommended. If the sidewalk subgrade consists of material with a plasticity index of 20 or greater, a 12-inch-thick layer of material satisfying the requirements of select fill provided in the [FILL MATERIALS](#) section must be placed below the sidewalk.

Proper drainage around grade-supported sidewalks and flatwork is also very important to reduce potential movements. Elevating the sidewalks where possible and providing rapid, positive drainage away from them will reduce moisture variations within the underlying soils and will therefore provide valuable benefit in reducing the full magnitude of potential movements from being realized.

3.4 FOUNDATIONS

In our opinion, the structural loads of the proposed development can be supported on shallow foundations or deep foundations constructed in accordance with the following design criteria. Alternatively, the structurally supported foundation can be used in lieu of the building pad preparation or removal and replacement activity. Additionally, PSI recommends that foundation type and bearing strata be consistent throughout a structure.

3.4.1 CONVENTIONAL SPREAD FOOTING RECOMMENDATIONS

The proposed building can be supported on shallow spread footings/grade beams or monolithic, steel reinforced stiffened slab-on-grade foundation system (i.e., a waffle type grade beam configuration), provided that some differential movement can be tolerated, and the recommended subgrade preparation activities are performed as per the [BUILDING PAD PREPARATION](#) section of this report.



Shallow foundations should be placed at least two feet below the finished grade on properly compacted structural fill soils and can be designed for a net allowable bearing pressure of 3,000 psf for dead load plus live loads, and 2,300 psf for dead plus sustained live loads, whichever results in a larger bearing area.

To allow the structure to move as a unit, a monolithic, steel reinforced slab-on-grade foundation may be designed using an allowable bearing capacity of 1,600 psf based on dead load plus design live load. A modulus of subgrade, k , value of 120 pci is also applicable, if required in the slab-on-grade foundation design. For frost protection, it is recommended at least the external grade supported beam for the slab-on-grade foundation be founded a minimum depth of 2 feet below final grade.

Alternatively, a monolithic, steel reinforced slab-on-grade foundation may be designed using the Design of Slab-On-Grade Foundations published by the Wire Reinforcement Institute, Inc. (TF 700-R-07). Utilizing the Wire Reinforcement Institute (WRI) as a guideline, the following design criteria are provided for this site considering the site preparation presented is as described in the [SITE PREPARATION](#) Section.

TABLE 3.3: WRI DESIGN VALUES

Waffle Slab Design Method	WRI
Climatic Rating (C_w) – Moore, OK	19
Effective Plasticity Index	20
Soil/Climatic Rating Factor (1-C)	0.05
Min. Depth of Perimeter Grade Beams Below Final Exterior Grade	24-inches

The grade beams of a monolithic steel reinforced slab should have a minimum width of 10 inches even if the actual bearing pressure is less than the design value. The perimeter grade beams should bear at least 24 inches below adjacent surface grades (i.e. bottoms of beams and pads should bear at least 24 inches below the adjacent ground surface). If soft or loose soils are encountered at the design bearing level, they should be undercut to stiff or dense soils and the excavation backfilled with concrete.

Single isolated footing, with width no larger than eight feet, designed as discussed above, should experience a settlement of less than one inch. If a cluster of closely spaced footings (i.e., if the center to center spacing of the footings is less than two times the width of the footing) are planned, PSI should be contacted to calculate the amount of settlement.

The base adhesion/frictional resistance and the passive soil resistance will resist the horizontal loads on shallow foundations. For a footing cast against compacted soil, the adhesion/frictional resistance and the passive soil resistance values for both transient and sustained loading conditions are given herein. For transient loading conditions, an ultimate base adhesion resistance of 650 psf and an ultimate passive resistance of 2,000 psf can be used. For sustained loading conditions, a frictional co-efficient of 0.36 and an ultimate passive resistance of 240 psf per foot depth is recommended. A factor of safety of 2.0 is recommended to arrive at the allowable values. Passive resistance from the upper two feet of soil should be neglected. Also, the passive resistance of any un-compacted fill material should be neglected.

The uplift resistance of a shallow foundation formed in an open excavation will be limited to the weight of the foundation concrete and the soil above it. For design purposes, the ultimate uplift resistance should be based on effective unit weights of 120 and 150 pcf for soil and concrete, respectively. This value should then be reduced by an appropriate factor of safety to arrive at the allowable uplift load. If there is a chance of submergence, the buoyant unit weights should be used.



The foundation excavations should be observed by a representative of PSI prior to steel or concrete placement to assess that the foundation materials can support the design loads and are consistent with the materials discussed in this report. Soft or loose soil zones encountered at the bottom of the footing or grade beam excavations should be removed and replaced with properly compacted fill as directed by the geotechnical engineer.

After opening, footing or grade beam excavations should be observed, and concrete placed as quickly as possible to avoid exposure of the footing or grade beam bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, the foundation concrete should be placed during the same day the excavation is made. If it is required that footing or grade beam excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture.

3.4.2 DEEP FOUNDATIONS

3.4.3 DRILLED PIER RECOMMENDATIONS

The column loads of the proposed building, can be supported on straight drilled shafts/piers bearing in shale. The axial load carrying capacity of a drilled shaft can be computed using the static method of analysis. According to this method, axial capacity, Q , at a given penetration is taken as the sum of the skin friction on the side of the shaft, Q_{sf} , and the end bearing at the shaft tip, Q_{eb} , so that:

$$Q = Q_{sf} + Q_{eb} = f \cdot A_{sf} + q \cdot A_{eb}$$

where A_{sf} and A_{eb} represent, respectively, the embedded surface area and the end area of the shaft; f and q_{eb} represent, respectively, the unit skin friction and the unit end bearing.

The total allowable axial capacity in compression will be the summation of the allowable frictional capacity and the allowable end bearing capacity. The total allowable axial capacity in tension will be the allowable frictional capacity alone neglecting end bearing component, plus the weight of the pier.

3.4.3.1 STRAIGHT SHAFT DRILLED PIERS

PSI recommends that the building may be supported on deep straight shaft drilled piers based at least 12 feet below final grade to minimize the potential for undesirable settlement and to reduce potential foundation movements as the structure support will be based below the seasonal active zone. The following tables outline the requirements for drilled shaft design and construction considerations for support of these structures.

TABLE 3.4: PARAMETERS FOR AXIAL DESIGN

Material	Depth, feet	Allowable Skin Friction, f , psf (F.S. = 2)	Allowable End Bearing, q , psf (F.S. = 3)
Clay	0 to 8	—	—
Clay	8 to 13	2,000	13,000
Clay	13 to 16½	4,500	30,000



TABLE 3.5: GEOTECHNICAL RECOMMENDATIONS FOR STRAIGHT SHAFT PIER DESIGN

Neglect Skin Friction from Top of Shaft	8 feet
Minimum Embedment Depth Below Original Grade	12 feet
Minimum Penetration Depth	$L/D \geq 3$
Minimum Shaft Diameter, d	18 inches
Thickness to Neglect Skin Friction at Base of Shaft	1 Shaft Diameter

Notes: Detailed Settlement Analysis is outside project scope

The minimum embedment depth was selected to locate the pier base below the depth of seasonal moisture change and within a specified desired stratum. Actual pier depths may need to be deeper depending upon the actual compressive loads on the pier.

Where pier groups may be required, the spacing should be a minimum of three times the selected diameter center-to-center. Drilled shaft elements with center-to-center spacing less than 10 feet should not be installed within 24 hours following placement of adjacent elements.

An isolated single drilled shaft having a diameter of less than 60 inches when designed as discussed, is not anticipated to settle greater than approximately $\frac{1}{2}$ inch. A detailed group settlement analysis was not performed, as the actual configurations are not known at this time. If a group settlement analysis is desired, PSI should be contacted to perform such a settlement analysis.

As stated previously PSI has not been provided loading information. The settlement estimate is based on the capacity of a single drilled shaft pier supporting approximately 200 kips. The settlement should be considered an estimate and a more refined analysis should be made based on actual loading conditions.

3.4.3.2 EXPANSIVE SOIL CONSIDERATIONS

Piers extending through expansive soils are potentially subjected to vertical uplift loads should the soils become moist and swell. For this reason, each pier should be designed with enough steel reinforcement to resist the tensile stresses caused by the expansive soil uplift. The reinforcement of the pier should be checked for the appropriate tension load alone neglecting any dead loads on the pier. The uplift load values as well as the unit friction due to swelling soils are provided in the table below. The uplift load values shown in the table are computed using the unit friction due to swelling along the embedded shaft surface area to a depth of 8 feet.

TABLE 3.6: RECOMMENDED UPLIFT LOADS AND UNIT SKIN FRICTION VALUES DUE TO SWELLING

Subgrade Type	Unit Skin Friction Due to swelling, f_{swell} , (psf)	Expansive Soil Uplift Load (kips)
Existing Natural Clay Soils	1,700	43d
Site prepared as per Site Preparation and Earthwork sections	750	18d



3.4.3.3 LPILE DESIGN CRITERIA

Piers having lateral loads should be designed utilizing the following LPILE input parameters for this project.

TABLE 3.7: PARAMETERS FOR LATERAL DESIGN USING LPILE

Soil Type	Depth, feet	γ_e , pcf	c, psf	ϕ , Deg.	k_s or k_c , pci	k_c , pci	ϵ_{50} or k_{rm}
Clay	0 to 8	110	1,000	0	100	---	0.01
Clay	8 to 13	120	2,000	0	500	200	0.005
Clay	13 to 24	115	6,000	0	2000	800	0.004

Note: γ_e : Effective Soil Unit Weight
 c: Undrained Cohesion for Clay
 ϕ : Friction Angle for Sand ($\phi = (12N)^{0.5} + 15 \leq 32$; Dunham (1954))
 k_s : Clay Static Loading Modulus of Subgrade Reaction (LPILE Manual Table 3-3)
 k_c : Clay Cyclic Loading Modulus of Subgrade Reaction (LPILE Manual Table 3-3)
 ϵ_{50} : Axial Strain Factor for Soil (LPILE Manual Table 3-2 and 3-4)

3.4.3.4 GENERAL PIER CONSTRUCTION RECOMMENDATIONS

The performance of the foundation system is highly dependent on the quality of the installation. PSI recommends the installation procedure in accordance with FHWA-NHI-10-016, May 2010.

PSI recommends that the drilling contractor review the field exploration logs of this report before starting excavations for the drilled piers. If used, temporary casing must be removed during concrete placement, keeping a concrete head of at least 2 feet above the bottom of the casing as it is being removed. A representative of the Geotechnical Engineer should be on site to observe and document the entire drilling and installation of the deep foundation system, if used.

When the drilling processes are completed for the pier, the reinforcing steel and the concrete should be placed immediately after the final cleanout pass is conducted on the base. The tremie method of concrete placement should be adopted when placing concrete below the groundwater table (if present) to prevent segregation of the concrete materials. If concrete is placed by the free-fall method into a dry excavation, it should be placed to avoid contact with the excavation sidewalls to prevent segregation and be limited to a drop of less than 4 feet.

Concrete placed in the pier excavations should have a slump in the range of 7 to 9 inches to reduce the potential for the formation of voids as the temporary pier casing is extracted. The concrete mix should be designed to attain the required 28-day design strength when placed at this slump. PSI should be retained to observe and document the drilled pier construction and to evaluate whether the subsurface and pier bearing conditions are as anticipated in this report. The contractor should submit their procedures for drilled pier installation to the Geotechnical Engineer for approval prior to the start of the drilled pier construction.

3.5 FLOOR SLABS

The grade supported floor slab used in conjunction with a conventional shallow foundation or drilled pier and grade beam foundation system should be grade supported on a properly compacted and moisture conditioned select fill material as per the [BUILDING PAD PREPARATION](#) section. Proof-rolling should be accomplished to identify any soft or unstable soils which should be removed from the floor slab area prior to fill placement and/or floor slab construction.



An allowable net bearing pressure of 600 psf can be used for slab-on-grade bearing on compacted fill. If the site is prepared as recommended below, total settlement of the ground supported slab should not exceed one inch. A vapor retarder such as polyethylene sheeting should be provided beneath the ground supported slab in accordance with ACI procedures. Adequate construction joints and reinforcement should be provided to reduce the potential for cracking of the floor slab due to differential movement.

For the properly constructed grade supported floor slab, a modulus of subgrade, k , value of 120 pci is applicable in the grade supported floor slab design based on a typical 1 ft. x 1 ft. plate load test. However, depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the following expression for cohesive and cohesionless soils:

Modulus of Subgrade Reaction:

$$k_s = \frac{k}{B} \text{ for cohesive soil, and}$$

$$k_s = k \left(\frac{B+1}{2B} \right)^2 \text{ for cohesionless soil (not recommended in undercut)}$$

where:

- k_s = coefficient of vertical subgrade reaction for loaded area,
- k = coefficient of vertical subgrade reaction for 1x1 square foot area,
- B = width of area loaded, in feet (or effective width, B' , for grade beam, continuous footing, or mat/raft foundation)

PSI recommends that a minimum four-inch-thick free draining granular mat be placed beneath the building floor slabs to enhance drainage. Prior to placing drainage layer, the subgrade should be graded to drain and not provide pockets to trap water. In moisture sensitive areas for equipment and flooring, vapor retarder should be installed with the grade supported slab construction according to ACI criteria. The floor slabs should have an adequate number of joints to reduce cracking resulting from differential movement and shrinkage.

3.6 PAVEMENT DESIGN

Pavement design recommendations for several levels of traffic loading were developed based on assumptions of potential traffic, drive paths or patterns and anticipated soil support characteristics of pavement subgrades. PSI utilized the "AASHTO Guide for Design of Pavement Structures" published by the American Association of State Highway and Transportation Officials to evaluate the pavement thickness recommendations in this report. This method of design considers pavement performance, traffic, roadbed soil, pavement materials, environment, drainage and reliability. Each of these items is incorporated into the design methodology. *PSI is available to provide site specific laboratory testing and engineering evaluation to refine the estimated design parameters and sections, upon request.*

3.6.1 SUBGRADE SOIL PREPARATION

Based on subsurface soil information, PSI recommends that at least the upper 8 inches of the pavement subgrade soils be lime treated. Lime treatment should extend at least one foot outside the perimeter of the pavement. Lime treatment of subgrade soils is described in [SITE PREPARATION](#) section. In lieu of 8 inches of lime treatment, 12 inches of select fill or 6 inches of flexible can be provided below the pavement materials. Lime treatment and select fill subgrade or flexible base should be compacted as provided in [SITE PREPARATION](#) section of this report.



As an alternative to preparing the subgrade, the design pavement thickness of rigid pavement can be increased by one inch in addition to the recommended pavement thickness provided in the [PAVEMENT SECTION](#) below. The thicker pavement section will be constructed over 6 inches of scarified and re-compacted subgrade instead of lime-stabilized subgrade or select fill subgrade.

Structurally, both designs (i.e., pavement over lime-treated subgrade and pavement with greater thickness over natural soils) are more or less equal. However, it is our opinion that the pavement with lime-treated subgrade will perform better than the pavement with 1-inch additional thickness on natural soil. This is primarily due to environmental and drainage factors affecting the performance life of this pavement. Non-treated soils are susceptible to movements or softening thus resulting in a loss of support to the concrete pavement structure. The purpose of lime treatment is to minimize the loss of support and bridge the subgrade from moisture infiltration thereby reducing soil softening and enhancing the performance and life of the pavement. Both pavements would require periodic maintenance.

3.6.2 PAVEMENT SECTION

According to AASHTO design methodology, the pavement design thickness primarily depends on strength of the subgrade soils and type of traffic. Traffic includes several types of vehicles with various magnitudes of axle loads that may be subjected to the pavement during its service life. The design involves a traffic analysis that converts various types of vehicles with various magnitudes axle loads to a number of 18-kip equivalent single axle load (ESAL) repetitions. The design engineer should perform the traffic analyses to compute the number of ESALs repetitions that would be subjected to the pavement during its service life or design life. Based on the computed ESALs, an economical and appropriate pavement can be designed accordingly.

AASHTO low volume design methodology can also be used to design pavements. The low volume design methodology depends on typical subgrade conditions for 6 different U.S climatic zones and provides minimum thickness for 3 different levels of traffic.

Based on AASHTO low volume design and previous experience, pavement thickness for both a rigid and a flexible pavement system are provided in the tables below. The tables below include thickness design corresponding to 3 levels of traffic (low, medium and high). It is recommended that the pavement design thicknesses correspond to following:

- **Low traffic condition:** Parking areas expected to receive only passenger vehicles and light pickup truck traffic. (30,000 ESALs)
- **Medium traffic condition:** Secondary drive areas and/or parking areas expected to receive delivery vans or light trucks or fire lanes. (45,000 ESALs)
- **High traffic condition:** Parking and drive areas with heavy traffic, trash pickup areas, main access driveways, and 18-wheeler loading/unloading. (60,000 ESALs)

PSI has based its recommendation on subgrade soils prepared to achieve a minimum CBR value of 3, with proper proof-rolling and the site not being wet at the time of construction. Based on the above, it is possible to design a locally typical "standard" pavement section consisting of the following:

TABLE 3.8: MINIMUM RIGID PAVEMENT SECTION

Component	Low	Medium	High
Portland Cement Concrete	5-inches	5½-inches	6-inches
ODOT Type A Aggregate Base (Optional)	4-inches		
Pavement Subgrade	As Discussed in SUBGRADE SOIL PREPARATION SECTION		



Large front-loading garbage trucks frequently impose concentrated front-wheel loads on pavements during loading. This type of loading typically results in rutting of the pavement and ultimately, pavement failures. Therefore, it is recommended that the pavement in trash pickup areas consist of a minimum 7-inch thick, reinforced concrete slab.

During the construction phase of this project, site grading should be kept in such a way that the water drains freely off the site.

Proper finishing of concrete pavements requires the use of sawed and sealed joints. Construction joints should be designed in accordance with current Portland Cement Association guidelines. Joints should be sealed to reduce the potential for water infiltration into pavement joints and subsequent infiltration into the supporting soils. Joint spacing is recommended at 15-foot intervals for plain concrete. Dowel bars should be used to transfer loads at the transverse joints. Normal periodic maintenance will be required.

The design of steel reinforcement should be in accordance with accepted codes. The concrete should have a minimum compressive strength of 3,500 psi at 28 days. The concrete should also be designed with 5 ± 1 percent entrained air to improve workability and durability. Pavement materials and construction procedures should conform to ODOT or appropriate city and county requirements.

Surface water infiltration to the pavement subgrade layers may soften the subgrade soils. Considering several factors in the pavement design can reduce surface infiltration. The following are some of the factors that need to be emphasized in order to maintain proper drainage.

- Appropriate slopes should be provided to drain the water freely from the pavement surface.
- Joints should be properly sealed and maintained.
- Side drains or sub drains along a pavement section may be provided.
- Proper pavement maintenance programs such as sealing surface cracks, and immediate repair of distressed pavement areas should be adopted.
- During and after the construction, site grading should be kept in such a way that the water drains freely off the site and off any prepared or unprepared subgrade soils. Excavations should not be kept open for a long period of time.

Pavements can be expected to crack due to environmental factors and require periodic maintenance to reduce damage to the pavement structure should be planned throughout the life of the pavement. During the paving life, maintenance to seal surface cracks within concrete or asphalt paving and to reseal joints within concrete pavement should be undertaken to achieve the desired paving life. Perimeter drainage should be controlled to prevent or retard influx of surface water from areas surrounding the paving. Water penetration leads to paving degradation. Water penetration into base or subgrade materials, sometimes due to irrigation or surface water infiltration leads to pre-mature paving degradation. Curbs should be used in conjunction with asphalt paving to reduce potential for infiltration of moisture into the base course. Curbs should extend the full depth of the base course and should extend at least 3 inches into the underlying subgrade. The base layer should be tied into the area inlets to drain water that may collect in the base.



3.7 PLAN REVIEW AND CONSTRUCTION OBSERVATION

After final plans and specifications are complete, PSI should review the final design and specifications so that the earthwork and foundation recommendations are properly interpreted and implemented. It is considered imperative that the Geotechnical Engineer and/or their representative be present during earthwork operations and foundation installations to observe the field conditions with respect to the design documents and specifications. PSI will not be responsible for changes in the project design or project information it was not provided, or interpretations and field quality control observations made by others. PSI would be pleased to provide these services for this project.



4.0 CONSTRUCTION CONSIDERATIONS

4.1 SECONDARY DESIGN CONSIDERATIONS

The following information has been developed after review of numerous problems concerning foundations throughout the area. It is presented here for your convenience. If these features are incorporated in the overall design and specifications for the project, performance of the project will be improved.

Prior to construction, the area to be covered by building should be prepared so that water will not pond beneath or around the building after periods of rainfall. In addition, water should not be allowed to pond on or around pavements.

Roof drainage should be collected and transmitted by pipe to a storm drainage system or to an area where the water can drain away from buildings and pavements without entering the soils supporting buildings and pavements.

Sidewalks should not be structurally connected to buildings. They should be sloped away from buildings so that water will be drained away from structures.

Paved areas and the general ground surface should be sloped away from buildings on all sides so that water will always drain away from the structures. Water should not be allowed to pond near buildings after the floor slabs and foundations have been constructed.

Backfill for utility lines that are located in pavement, sidewalk and building areas should consist of on-site fill. The backfill should be compacted as described in the [EARTHWORK](#) sections of this report. Lesser lift thicknesses may be required to obtain adequate compaction.

Care should be exercised to make sure that ditches for utility lines do not serve as conduits that transmit water beneath structures or pavements. The top of the ditch should be sealed to inhibit the inflow of surface water during periods of rainfall.

Flower beds and planting areas should not be constructed along building perimeters. Constructing sidewalks or pavements adjacent to buildings would be preferable. If required, flower beds and planting areas could be constructed beyond the sidewalks away from the buildings. If it is desired to have flower beds and planting areas adjacent to a building, the use of above grade concrete box planters, or other methods that reduce the likelihood of large changes in moisture content of soils adjacent to or below structures should be considered.

Water sprinkling systems should not be located where water will be sprayed onto building walls and subsequently drain downward and flow into the soils beneath foundations.

Trees in general should not be planted closer to a structure than the mature height of the tree. A tree planted closer to a structure than the recommended distance may extend its roots beneath the structure, allowing removal of subgrade moisture and/or causing structural distress.

Utilities that project through the floor slab should be designed with some degree of flexibility and/or with a sleeve to reduce the potential for damage to the utilities should movement occur.

Soil supported floor slabs are subject to vertical movements. This often causes distress to interior wall partitions supported on soil supported floor slabs. This should be considered in the design of soil supported floor slabs.



4.2 CONSTRUCTION MATERIALS TESTING

It is recommended that PSI be retained to provide observation and testing of construction activities involved in the foundations, earthwork, and related activities of this project. PSI cannot accept any responsibility for any conditions that deviates from those described in this report, nor for the performance of the foundations if not engaged to also provide construction observation and testing for this project.

Observation of all foundation bearing materials, pier construction activities, structural steel and subgrade treatment operations should be performed by a representative of PSI.

4.3 MOISTURE SENSITIVE SOIL / WEATHER RELATED CONCERNS

The upper fine-grained soils discovered at this site could be sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. Construction schedules should account for these conditions during wetter times of the year.

4.4 DRAINAGE AND GROUNDWATER CONCERNS

Water should not be allowed to collect in the foundation excavation, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, ground water, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

PSI recommends that the contractor determine the actual ground water levels at the site at the time of the construction activities. It may be expedient to drill auger holes or excavate test pits adjacent to the building area immediately prior to construction to determine the prevailing water level elevation. Any water accumulation should be removed from excavations by pumping. Should excessive and uncontrolled amounts of seepage occur, the geotechnical engineer should be consulted.



5.0 GEOTECHNICAL RISK AND REPORT LIMITATIONS

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding sections constitute PSI's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

Services performed by PSI for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area. No warranty, expressed or implied, is made.

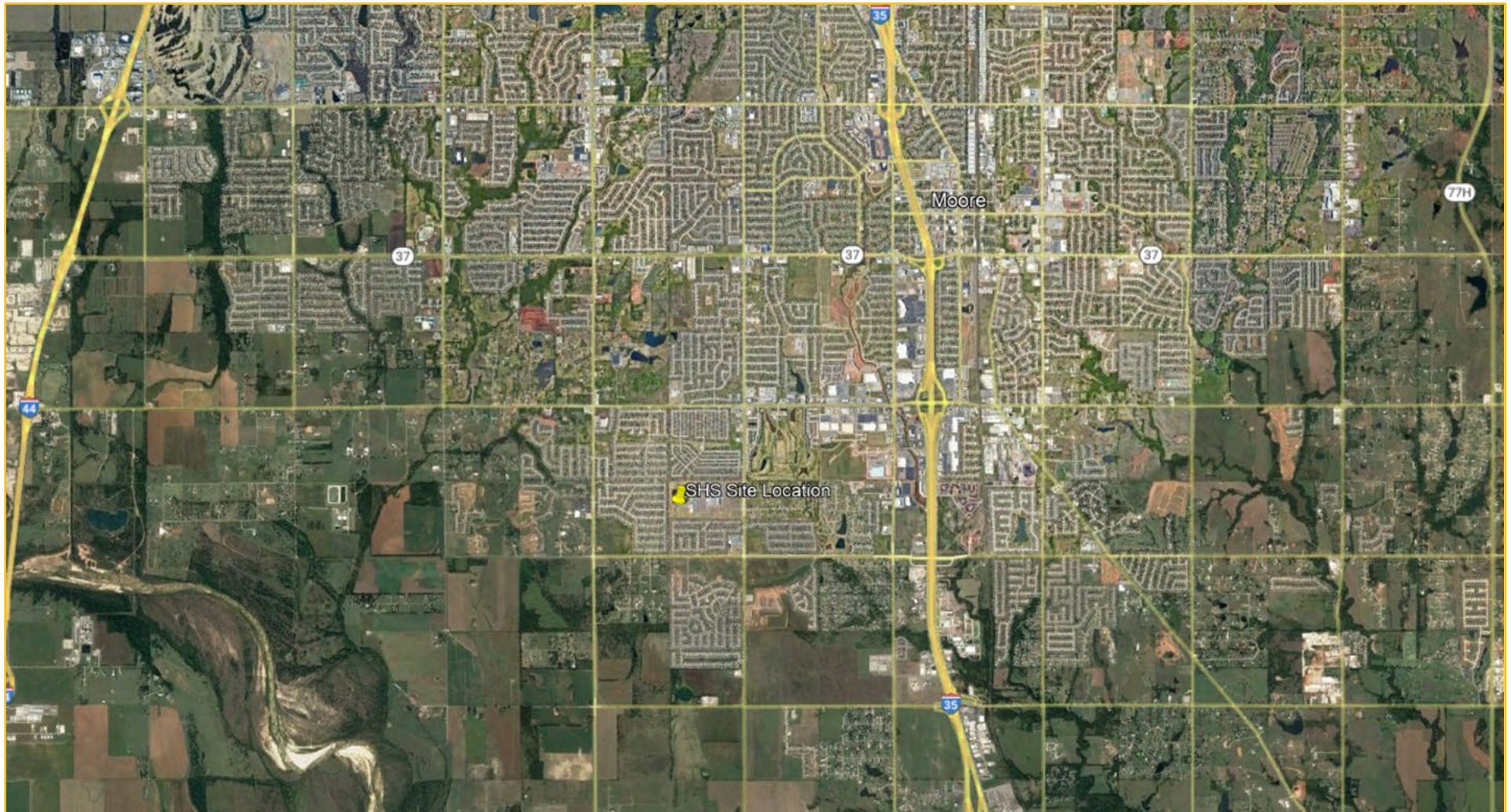
The recommendations submitted are based on the available subsurface information obtained by PSI, and information provided by the client, client's representative and client's design consultants. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation and/or other recommendations are required. If PSI is not retained to perform these functions, PSI cannot be responsible for the impact of those conditions on the performance of the project.

The Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations.

This report has been prepared for the exclusive use of Client and their design consultants, for the aforementioned project parameters.



FIGURES





APPENDIX A

Field Exploration & Laboratory Testing Program



DATE STARTED: 7/14/22 DATE COMPLETED: 7/14/22 COMPLETION DEPTH: 24.0 ft BENCHMARK: N/A ELEVATION: 1218 ft LATITUDE: 35.31181° LONGITUDE: -97.51967° STATION: N/A OFFSET: N/A REMARKS:		DRILL COMPANY: DSO DRILLER: DH LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS/TC HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA		BORING DB-1 Water While Drilling Upon Completion Delay BORING LOCATION: 	
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Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @ × Moisture ▣ PL ▣ LL ▲ Qu * Qp	Additional Remarks
0		[Graphic Log: Yellow hatched pattern]		1		Lean CLAY, very stiff to hard, brown, with sand, trace roots		8-17-14 N=31	7		LL = 40 PL = 16 Fines=82.1%
1215			2		... 2 to 6 feet, brown and light gray, with sand and occasional ferrous nodules	CL	12-7-7 N=14	14			
			3				4-6-7 N=13	16			
5			4		... 6 to 8.5 feet, orange brown, brown and light gray inclusions		3-8-8 N=16	16			
1210			5		Lean CLAY, very stiff, red, trace sand	CL	5-10-10 N=20	18	LL = 35 PL = 17 Fines=95.1%		
10			6				27-50 (5")	15	>>⊙		
1205		[Graphic Log: Green hatched pattern]		7		SHALE, soft, red		50/6.0" 50/2.5"		>>⊙	
1200			8				50/4.0" 50/1.25"		>>⊙		
1195					End of boring						



Professional Service Industries, Inc.
 11825 S. Portland Avenue
 Oklahoma City, OK 73170
 Telephone: (405) 735-6052

PROJECT NO.: 05462581
PROJECT: Southmoore HS Additions
LOCATION: 2901 S Santa Fe Avenue
 Moore, OK

DATE STARTED: 7/14/22 DATE COMPLETED: 7/14/22 COMPLETION DEPTH: 24.0 ft BENCHMARK: N/A ELEVATION: 1217 ft LATITUDE: 35.31181° LONGITUDE: -97.51991° STATION: N/A OFFSET: N/A REMARKS:		DRILL COMPANY: DSO DRILLER: DH LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS/TC HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA		BORING DB-2 Water While Drilling Upon Completion Delay BORING LOCATION: 	
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Elevation (feet)	Depth, (feet)	Graphic Log	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @ Moisture PL LL	Additional Remarks
0			1		Lean CLAY , very stiff, brown to reddish brown, with sand, trace roots		9-7-7 N=14			
1215			2		... 2 to 6 feet, brown, reddish brown and light gray inclusions, with occasional ferrous nodules	CL	5-10-12 N=22			
			3				4-7-11 N=18			
5										
1210			4		Lean CLAY , very stiff to hard, red with light gray inclusions, trace sand		7-10-15 N=25			
			5				10-12-18 N=30			
1205										
			6				23-50/4.0"			
15					SHALE , soft, red					
1200			7				50/4.0" 50/2.0"			
20										
1195			8				50/4.0" 50/2.25"			
					End of boring					

	Professional Service Industries, Inc. 11825 S. Portland Avenue Oklahoma City, OK 73170 Telephone: (405) 735-6052	PROJECT NO.: 05462581 PROJECT: Southmoore HS Additions LOCATION: 2901 S Santa Fe Avenue Moore, OK
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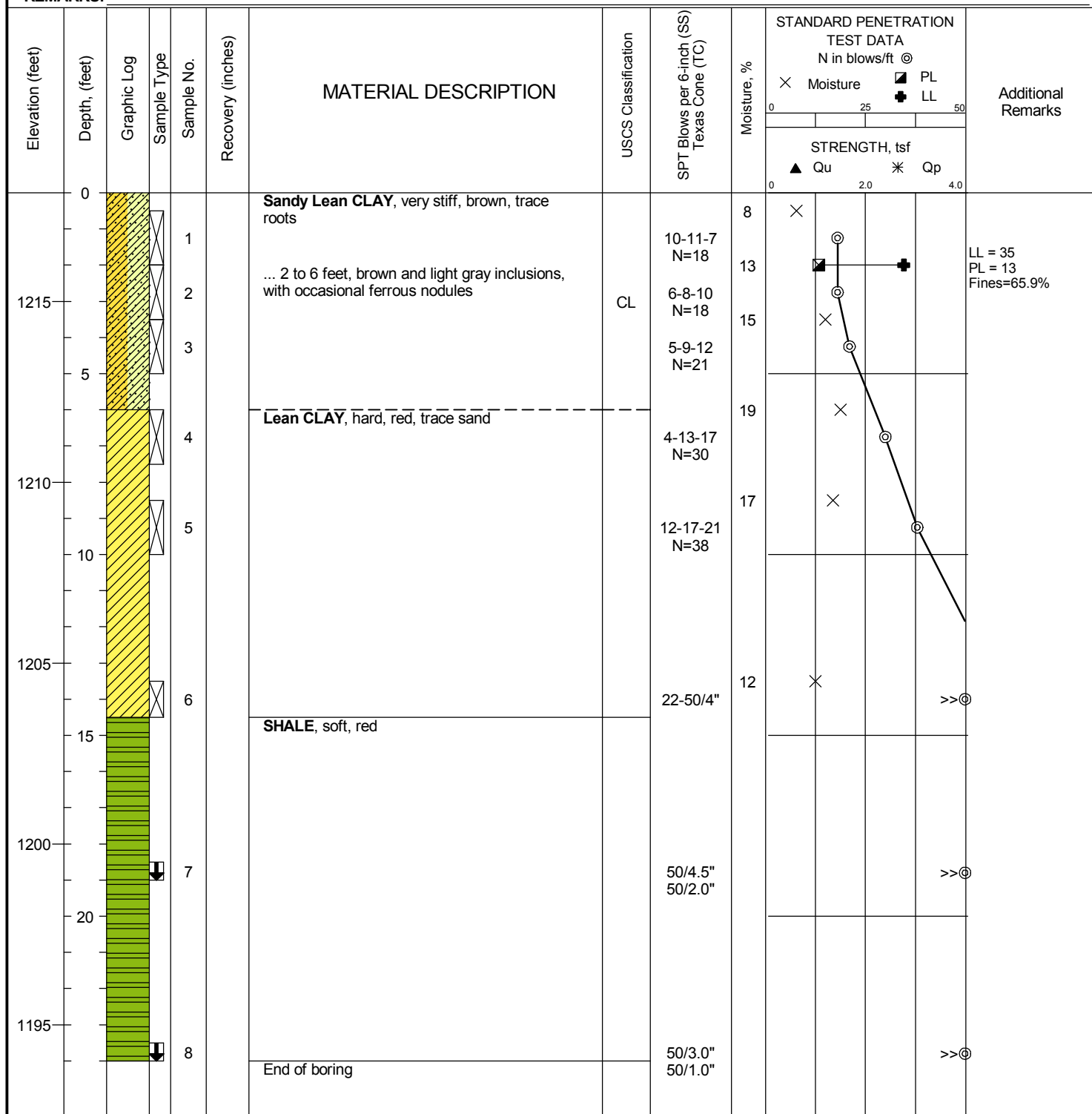
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Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @ Moisture PL LL STRENGTH, tsf ▲ Qu * Qp	Additional Remarks
0				1		Sandy Lean CLAY , very stiff, brown, reddish brown and light gray inclusions, trace roots	CL	7-12-13 N=25	6		LL = 35 PL = 14 Fines=63.5%
1215			2				5-8-10 N=18	10			
			3				6-10-11 N=21	13			
5			4			Lean CLAY , hard, red with light gray inclusions, trace sand	CL	7-10-16 N=26	14		LL = 31 PL = 17 Fines=93.0%
1210			5				9-12-14 N=26	14			
10			6			SHALE , soft, red		22-50/2.0"	12		>>⊙
1205		7					50/3.5" 50/1.0"		>>⊙		
1200		8					50/2.0" 50/0.75"		>>⊙		
1195						End of boring					

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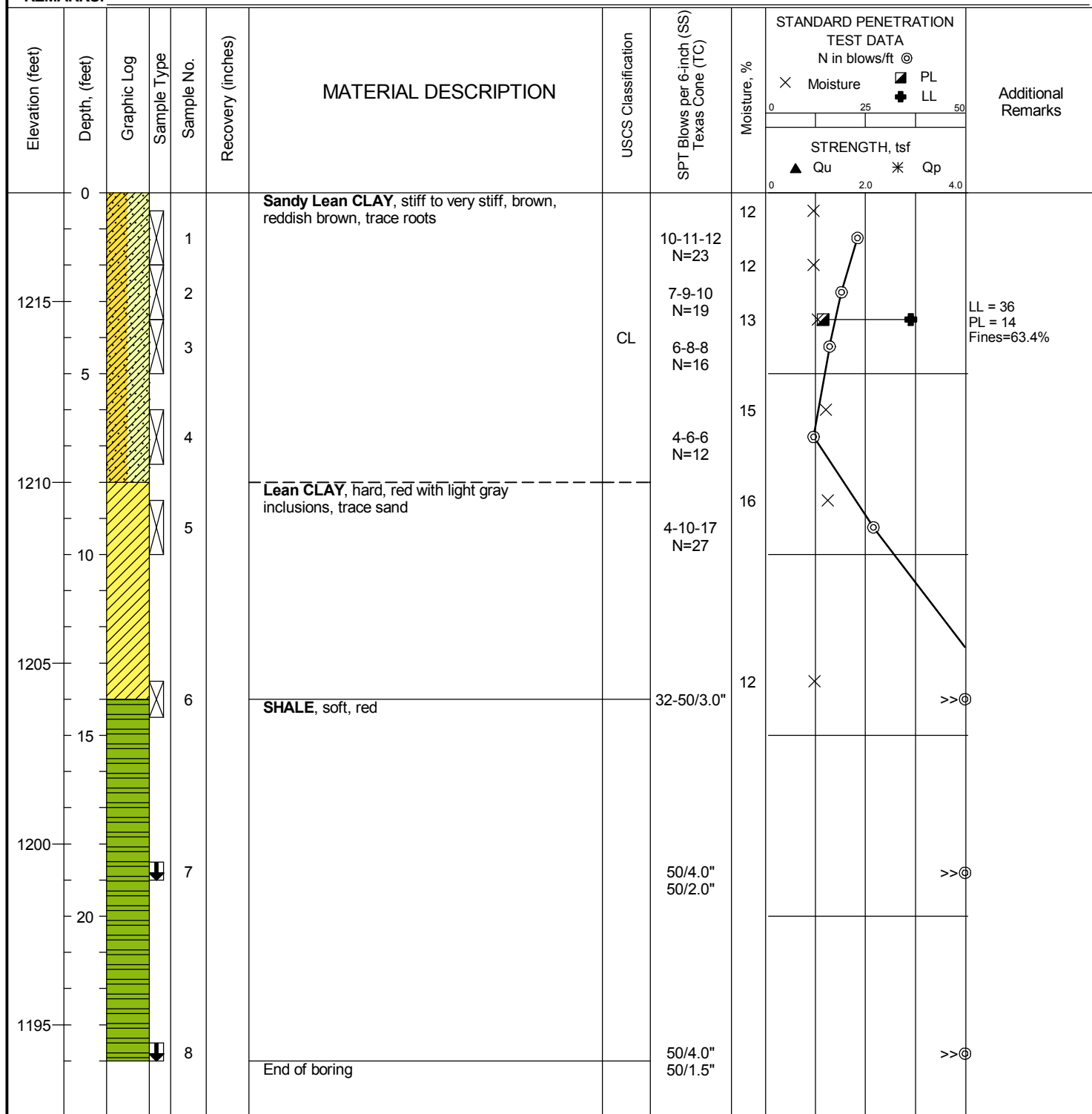
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DATE COMPLETED: 7/14/22		DRILLER: DH LOGGED BY: BL		
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BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger		
ELEVATION: 1218 ft		SAMPLING METHOD: SS/TC		
LATITUDE: 35.31122°		HAMMER TYPE: Automatic		
LONGITUDE: -97.52087°		EFFICIENCY: N/A		
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA		
REMARKS:				



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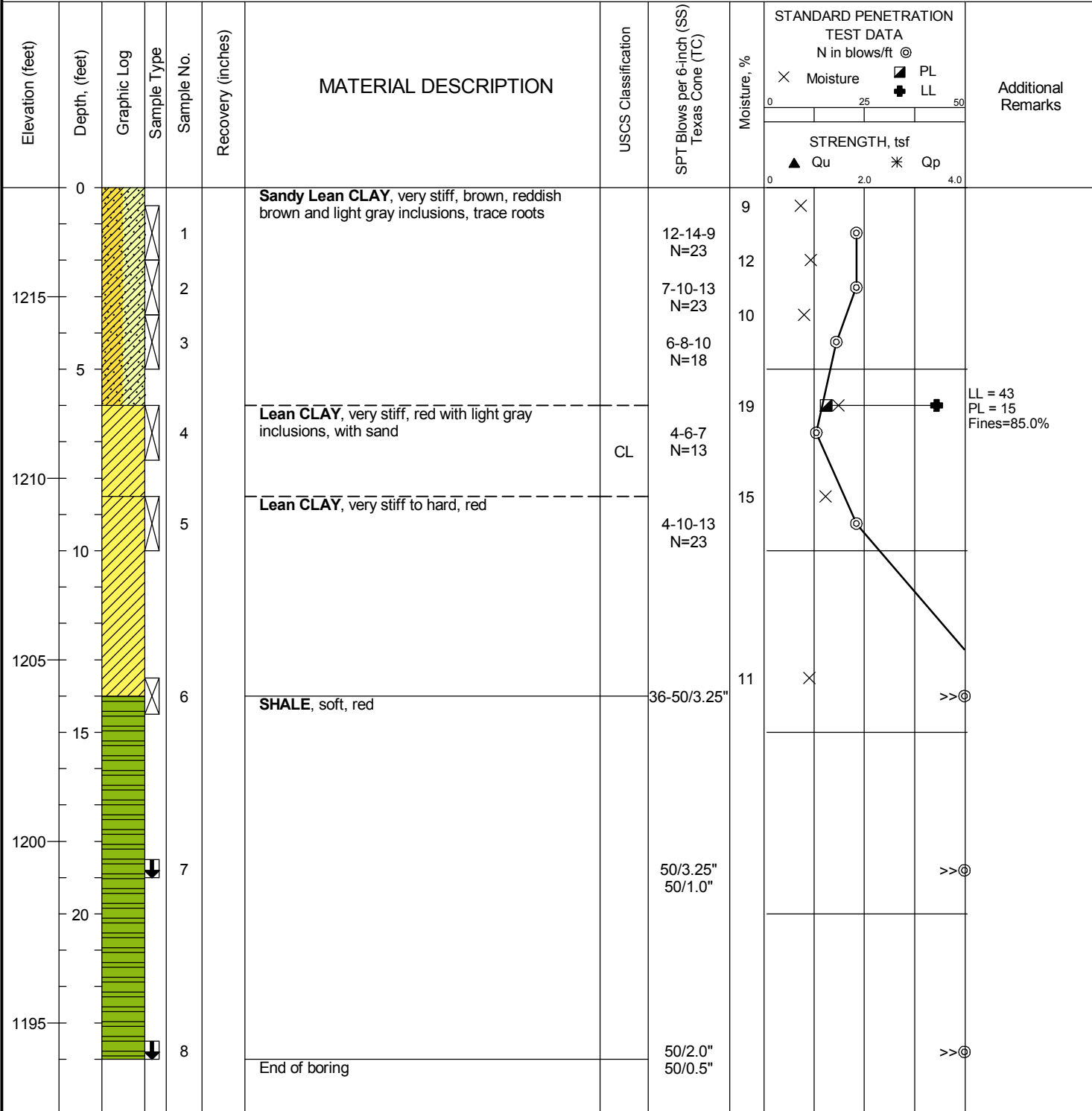
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DATE COMPLETED: 7/14/22		DRILLER: DH LOGGED BY: BL			
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BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger			
ELEVATION: 1218 ft		SAMPLING METHOD: SS/TC		BORING LOCATION:	
LATITUDE: 35.31099°		HAMMER TYPE: Automatic			
LONGITUDE: -97.5208°		EFFICIENCY: N/A			
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA			
REMARKS:					



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BORING LOCATION: _____



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 Moore, OK

DATE STARTED: 7/15/22 DATE COMPLETED: 7/15/22 COMPLETION DEPTH: 24.0 ft BENCHMARK: N/A ELEVATION: 1218 ft LATITUDE: 35.31048° LONGITUDE: -97.52085° STATION: N/A OFFSET: N/A REMARKS:		DRILL COMPANY: DSO DRILLER: DH LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS/TC HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA		BORING DB-7 Water ▽ While Drilling N/A ▼ Upon Completion N/A ▽ Delay N/A BORING LOCATION:	
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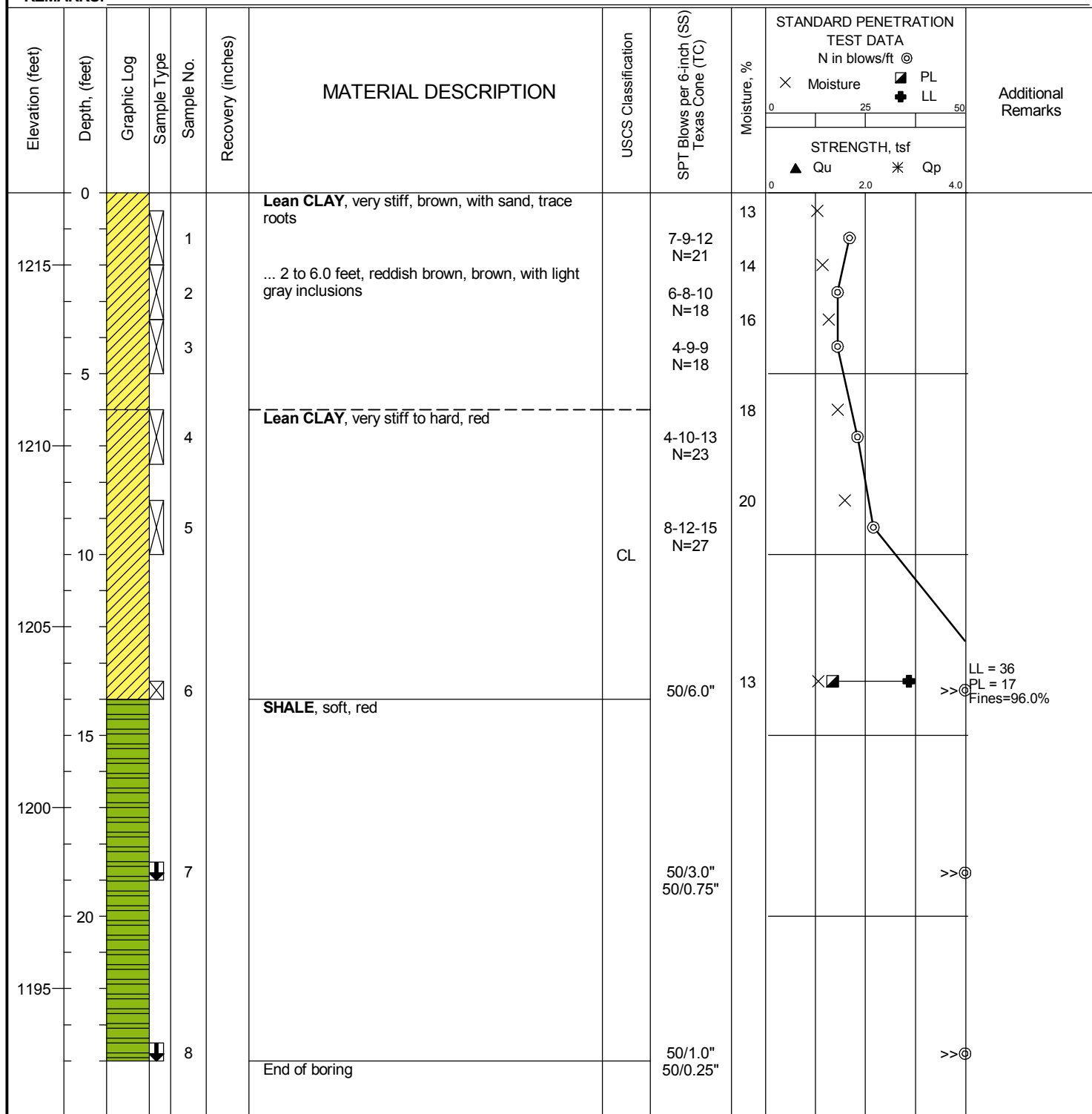
Elevation (feet)	Depth, (feet)	Graphic Log	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @ × Moisture ▣ PL ▣ LL ▲ Qu * Qp	Additional Remarks
0			1		Lean CLAY , very stiff, brown, with sand, trace roots		9-10-13 N=23	11	LL = 42 PL = 19 Fines=96.9%	
1215	2		... 2 to 8.5 feet, reddish brown to brown, with light gray inclusions		7-10-12 N=22	15				
5	3				4-6-8 N=14	15				
	4				4-7-11 N=18	14				
1210	5		Lean CLAY , hard, red	CL	7-16-22 N=38	18				
10	6		SHALE , soft, red		31-50/3.0"	10				
1205	7				50/3.25" 50/1.5"					
1200	8				50/2.5" 50/1.0"					
1195				End of boring						



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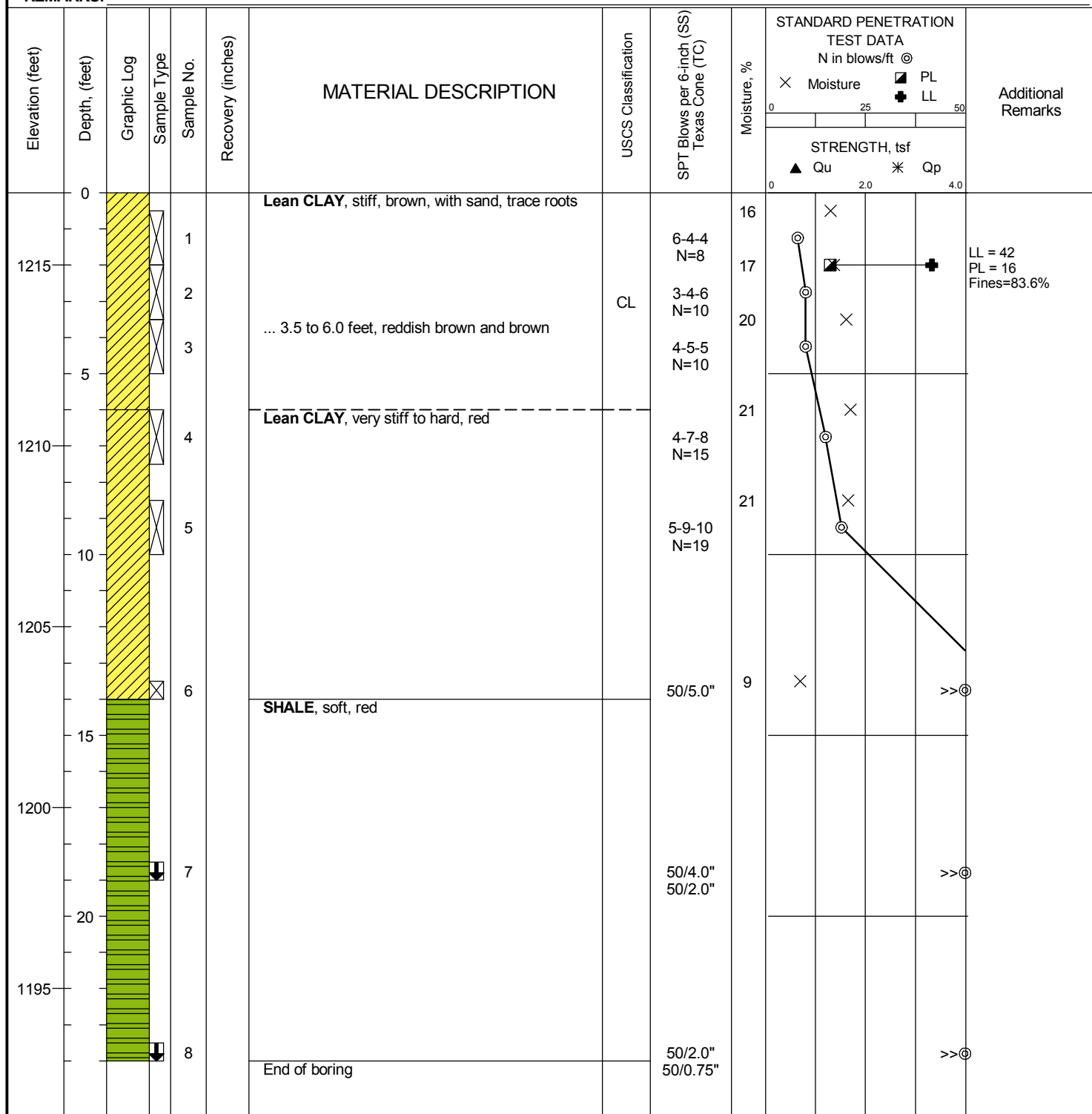
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DATE COMPLETED: 7/15/22		DRILLER: DH LOGGED BY: BL			
COMPLETION DEPTH: 24.0 ft		DRILL RIG: CME750		Water ▽ While Drilling ▼ Upon Completion ▽ Delay N/A N/A N/A	
BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger			
ELEVATION: 1217 ft		SAMPLING METHOD: SS/TC		BORING LOCATION:	
LATITUDE: 35.30993°		HAMMER TYPE: Automatic			
LONGITUDE: -97.52044°		EFFICIENCY: N/A			
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA			
REMARKS:					



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DATE STARTED: 7/15/22		DRILL COMPANY: DSO		BORING DB-9
DATE COMPLETED: 7/15/22		DRILLER: DH LOGGED BY: BL		
COMPLETION DEPTH: 24.0 ft		DRILL RIG: CME750		
BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger		
ELEVATION: 1217 ft		SAMPLING METHOD: SS/TC		
LATITUDE: 35.30992°		HAMMER TYPE: Automatic		
LONGITUDE: -97.51983°		EFFICIENCY: N/A		
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA		
REMARKS:				



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The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 7/15/22 DATE COMPLETED: 7/15/22 COMPLETION DEPTH: 24.0 ft BENCHMARK: N/A ELEVATION: 1218 ft LATITUDE: 35.30949° LONGITUDE: -97.52045° STATION: N/A OFFSET: N/A REMARKS:		DRILL COMPANY: DSO DRILLER: DH LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS/TC HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA		BORING DB-10 Water ▽ While Drilling ▼ Upon Completion ▽ Delay N/A N/A N/A BORING LOCATION:	
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Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STRENGTH, tsf	Additional Remarks
0						Lean CLAY , very stiff, brown, with sand, trace roots					
1215				1		... 2 to 6.0 feet, reddish brown and brown, with light gray inclusions	CL	9-10-12 N=22			
				2				7-7-9 N=16			
5				3				5-6-8 N=14			LL = 37 PL = 14 Fines=70.8%
				4		Lean CLAY , very stiff to hard, red		4-9-12 N=21			
1210				5				8-10-13 N=23			
10											
1205				6				21-50/4.5"	16		>>⊙
15						SHALE , soft, red					
1200				7				50/4.0" 50/2.0"			>>⊙
20											
1195				8				50/2.5" 50/1.0"			>>⊙
						End of boring					



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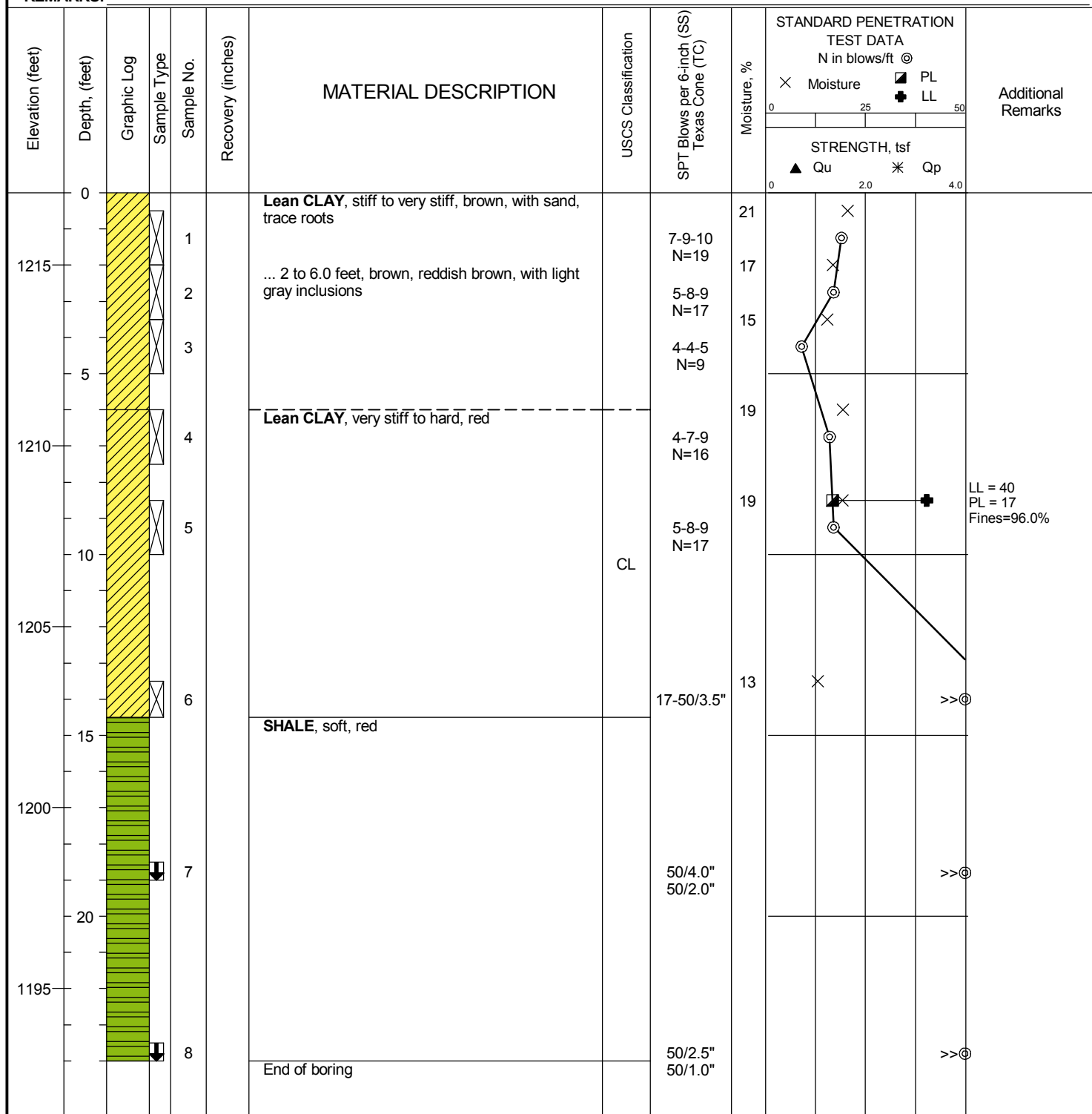
Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STRENGTH, tsf	Additional Remarks
0				1		Lean CLAY , medium stiff to stiff, brown, with sand, trace roots		4-3-3 N=6	14		
1215			2		... 2 to 6.0 feet, brown, with light gray inclusions and occasional ferrous nodules		3-4-3 N=7	21			
5			3				3-3-4 N=7	18			
				4		Lean CLAY , stiff to hard, red		4-5-6 N=11	19		LL = 42 PL = 15 Fines=89.0%
1210			5				4-7-9 N=16	21			
10			6								
1205				7		SHALE , soft, red		50/6.0"	12		>>⊙
15											
1200											>>⊙
1195				8		End of boring		50/2.0" 50/0.5"			>>⊙



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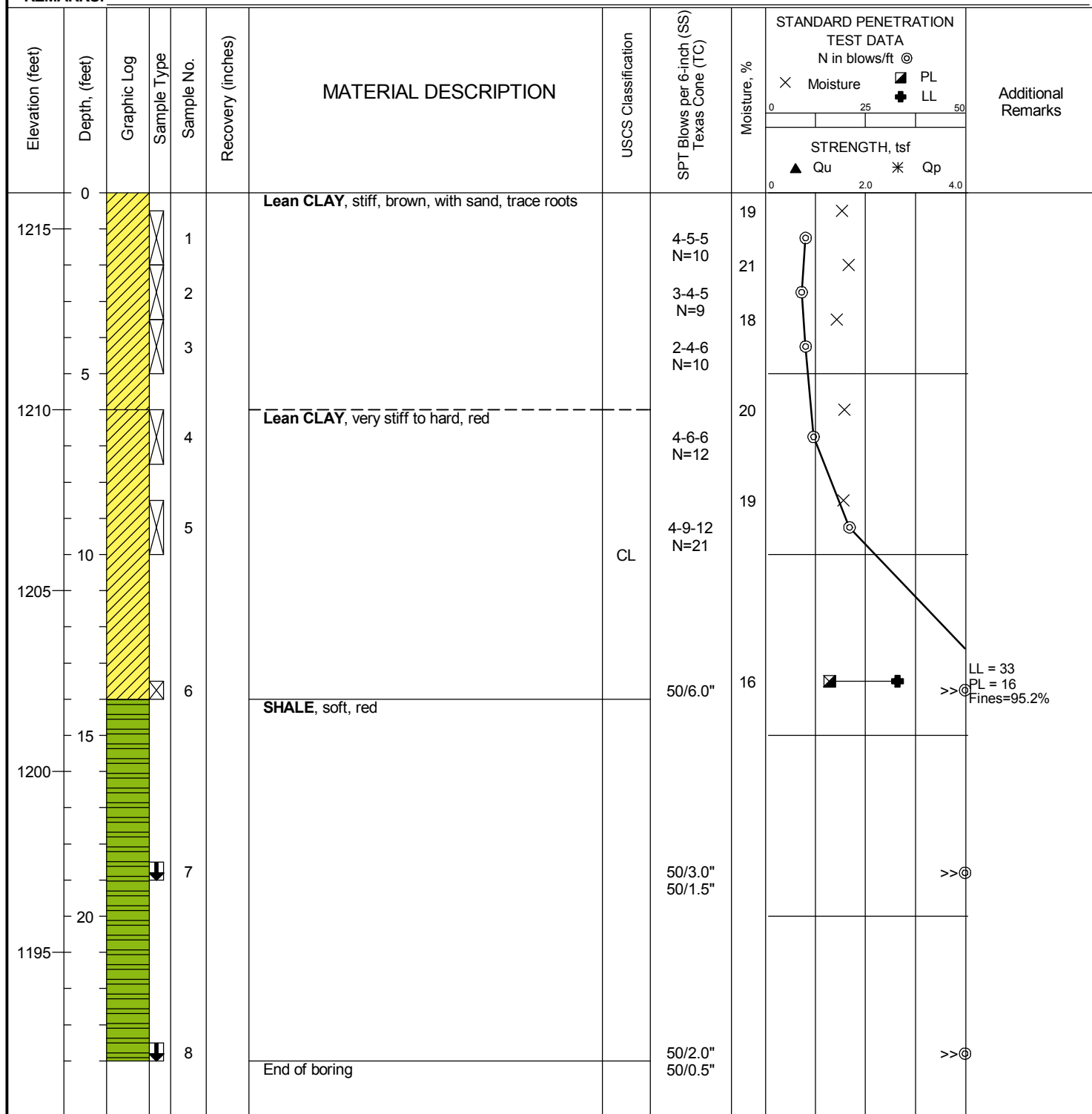
PROJECT NO.: 05462581
PROJECT: Southmoore HS Additions
LOCATION: 2901 S Santa Fe Avenue
 Moore, OK

DATE STARTED: 7/15/22 DATE COMPLETED: 7/15/22 COMPLETION DEPTH: 24.0 ft BENCHMARK: N/A ELEVATION: 1217 ft LATITUDE: 35.30912° LONGITUDE: -97.52044° STATION: N/A OFFSET: N/A REMARKS:	DRILL COMPANY: DSO DRILLER: DH LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS/TC HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA	BORING DB-12 <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%; text-align: center;">Water</td> <td style="width:80%;"> ▽ While Drilling N/A ▼ Upon Completion N/A ▽ Delay N/A </td> <td style="width:10%;"></td> </tr> </table> BORING LOCATION:	Water	▽ While Drilling N/A ▼ Upon Completion N/A ▽ Delay N/A	
Water	▽ While Drilling N/A ▼ Upon Completion N/A ▽ Delay N/A				



	Professional Service Industries, Inc. 11825 S. Portland Avenue Oklahoma City, OK 73170 Telephone: (405) 735-6052	PROJECT NO.: 05462581 PROJECT: Southmoore HS Additions LOCATION: 2901 S Santa Fe Avenue Moore, OK
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DATE STARTED: 7/15/22		DRILL COMPANY: DSO		BORING DB-13
DATE COMPLETED: 7/15/22		DRILLER: DH LOGGED BY: BL		
COMPLETION DEPTH: 24.0 ft		DRILL RIG: CME750		
BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger		
ELEVATION: 1216 ft		SAMPLING METHOD: SS/TC		
LATITUDE: 35.30912°		HAMMER TYPE: Automatic		
LONGITUDE: -97.51983°		EFFICIENCY: N/A		
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA		
REMARKS:				



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PROJECT NO.: 05462581
PROJECT: Southmoore HS Additions
LOCATION: 2901 S Santa Fe Avenue
Moore, OK

DATE STARTED: 7/18/22 DATE COMPLETED: 7/18/22 COMPLETION DEPTH: 6.0 ft BENCHMARK: N/A ELEVATION: 1215 ft LATITUDE: 35.31244° LONGITUDE: -97.51881° STATION: N/A OFFSET: N/A REMARKS:		DRILL COMPANY: DSO DRILLER: JS LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA		BORING SB-1 Water ☐ While Drilling ☐ Upon Completion ☐ Delay N/A N/A N/A BORING LOCATION:	
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Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
0				1		Lean CLAY, stiff, brown, with sand, trace roots	CL	4-5-5 N=10	15	X Moisture ☒ PL ☒ LL STRENGTH, tsf ▲ Qu * Qp	LL = 42 PL = 15 Fines=78.6%
	2					3-4-5 N=9		17			
1210	5		3			Lean CLAY, stiff, red		3-5-7 N=12	19		
						End of boring					



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PROJECT NO.: 05462581
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 Moore, OK

DATE STARTED: 7/18/22		DRILL COMPANY: DSO		BORING SB-2	
DATE COMPLETED: 7/18/22		DRILLER: JS LOGGED BY: BL			
COMPLETION DEPTH: 6.0 ft		DRILL RIG: CME750		Water ▽ While Drilling ▼ Upon Completion ▽ Delay N/A N/A N/A	
BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger			
ELEVATION: 1217 ft		SAMPLING METHOD: SS			
LATITUDE: 35.31245°		HAMMER TYPE: Automatic		BORING LOCATION:	
LONGITUDE: -97.51967°		EFFICIENCY: N/A			
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA			
REMARKS:					

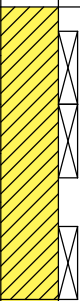
Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
										X Moisture	
1215	0			1		Lean CLAY, stiff, brown, trace roots		5-6-5 N=11	20		
				2			CL	3-5-5 N=10	20		
	5			3		... below 4.5 feet, very stiff, brown and red		4-6-8 N=14	17		
						End of boring					



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LOCATION: 2901 S Santa Fe Avenue
Moore, OK

DATE STARTED: 7/18/22	DRILL COMPANY: DSO	BORING SB-3
DATE COMPLETED: 7/18/22	DRILLER: JS LOGGED BY: BL	
COMPLETION DEPTH: 6.0 ft	DRILL RIG: CME750	
BENCHMARK: N/A	DRILLING METHOD: Hollow Stem Auger	
ELEVATION: 1218 ft	SAMPLING METHOD: SS	
LATITUDE: 35.31246°	HAMMER TYPE: Automatic	
LONGITUDE: -97.52076°	EFFICIENCY: N/A	
STATION: N/A OFFSET: N/A	REVIEWED BY: SGA	

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎			Additional Remarks
										02550			
										STRENGTH, tsf			
										▲ Qu * Qp			
										02.04.0			
1215	0			1		Lean CLAY , stiff to very stiff, brown, trace sand and roots	CL	4-4-5 N=9	19				LL = 34 PL = 17 Fines=89.4%
			2	... below 2 feet, brown and light gray		3-5-5 N=10		18					
	5		3	End of boring		4-7-8 N=15	17						



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PROJECT NO.: 05462581
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LOCATION: 2901 S Santa Fe Avenue
Moore, OK

Water		While Drilling	N/A
		Upon Completion	N/A
		Delay	N/A

STANDARD PENETRATION TEST DATA		Additional Remarks
N in blows/ft @		
×	Moisture	PL LL
+		
0	25	50
STRENGTH, tsf		
▲	Qu	* Qp
0	2.0	4.0



DATE STARTED: 7/18/22		DRILL COMPANY: DSO		BORING SB-5	
DATE COMPLETED: 7/18/22		DRILLER: JS LOGGED BY: BL			
COMPLETION DEPTH: 6.0 ft		DRILL RIG: CME750		Water ▽ While Drilling ▼ Upon Completion ▽ Delay N/A N/A N/A	
BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger			
ELEVATION: 1217 ft		SAMPLING METHOD: SS			
LATITUDE: 35.31017°		HAMMER TYPE: Automatic		BORING LOCATION:	
LONGITUDE: -97.52069°		EFFICIENCY: N/A			
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA			
REMARKS:					

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @		Additional Remarks
										× Moisture ▣ PL 0		



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PROJECT NO.: 05462581
PROJECT: Southmoore HS Additions
LOCATION: 2901 S Santa Fe Avenue
 Moore, OK

DATE STARTED: 7/18/22 DATE COMPLETED: 7/18/22 COMPLETION DEPTH: 6.0 ft BENCHMARK: N/A ELEVATION: 1218 ft LATITUDE: 35.3096° LONGITUDE: -97.52064° STATION: N/A OFFSET: N/A REMARKS:		DRILL COMPANY: DSO DRILLER: JS LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA		BORING SB-6 Water ☐ While Drilling ☐ Upon Completion ☐ Delay N/A N/A N/A BORING LOCATION:	
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Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
1215	0			1		FILL Lean CLAY , brown, with sand, trace roots, concrete pieces and wood	CL	4-7-7 N=14	13	Moisture X (X) (X) X PL (X) (X) (X) LL (X) (X) (X)	LL = 37 PL = 15 Fines=74.6%
	2				Lean CLAY , very stiff, brown, red and light gray inclusions, with sand		5-7-9 N=16	15			
	5			3		End of boring		6-8-10 N=18	14		



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PROJECT NO.: 05462581
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LOCATION: 2901 S Santa Fe Avenue
 Moore, OK

DATE STARTED: 7/18/22		DRILL COMPANY: DSO		BORING SB-7											
DATE COMPLETED: 7/18/22		DRILLER: JS LOGGED BY: BL													
COMPLETION DEPTH: 6.0 ft		DRILL RIG: CME750		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td rowspan="3" style="width: 30px; text-align: center; vertical-align: middle;">Water</td> <td style="text-align: center;">▽</td> <td>While Drilling</td> <td style="text-align: center;">N/A</td> </tr> <tr> <td style="text-align: center;">▼</td> <td>Upon Completion</td> <td style="text-align: center;">N/A</td> </tr> <tr> <td style="text-align: center;">▽</td> <td>Delay</td> <td style="text-align: center;">N/A</td> </tr> </table>		Water	▽	While Drilling	N/A	▼	Upon Completion	N/A	▽	Delay	N/A
Water	▽	While Drilling	N/A												
	▼	Upon Completion	N/A												
	▽	Delay	N/A												
BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger		BORING LOCATION:											
ELEVATION: 1215 ft		SAMPLING METHOD: SS													
LATITUDE: 35.30908°		HAMMER TYPE: Automatic													
LONGITUDE: -97.51954°		EFFICIENCY: N/A													
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA													
REMARKS:															

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
										X Moisture	
	0			1		Lean CLAY, stiff, brown and reddish brown, trace sand and roots		4-5-6 N=11	14		
				2		... below 2 feet, brown and red	CL	3-4-4 N=8	19		
1210	5			3				4-5-5 N=10	19		LL = 42 PL = 15 Fines=85.4%
						End of boring					



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Moore, OK

DATE STARTED: 7/18/22		DRILL COMPANY: DSO		BORING SB-8											
DATE COMPLETED: 7/18/22		DRILLER: JS LOGGED BY: BL													
COMPLETION DEPTH: 6.0 ft		DRILL RIG: CME750		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td rowspan="3" style="width: 30px; text-align: center; vertical-align: middle;">Water</td> <td style="text-align: center;">▽</td> <td>While Drilling</td> <td style="text-align: center;">N/A</td> </tr> <tr> <td style="text-align: center;">▼</td> <td>Upon Completion</td> <td style="text-align: center;">N/A</td> </tr> <tr> <td style="text-align: center;">▽</td> <td>Delay</td> <td style="text-align: center;">N/A</td> </tr> </table>		Water	▽	While Drilling	N/A	▼	Upon Completion	N/A	▽	Delay	N/A
Water	▽	While Drilling	N/A												
	▼	Upon Completion	N/A												
	▽	Delay	N/A												
BENCHMARK: N/A		DRILLING METHOD: Hollow Stem Auger		BORING LOCATION:											
ELEVATION: 1215 ft		SAMPLING METHOD: SS													
LATITUDE: 35.30909°		HAMMER TYPE: Automatic													
LONGITUDE: -97.51877°		EFFICIENCY: N/A													
STATION: N/A OFFSET: N/A		REVIEWED BY: SGA													
REMARKS:															

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @		Additional Remarks
										× Moisture ▣ PL + LL 0 25 50 STRENGTH, tsf ▲ Qu ✱ Qp 0 2.0 4.0		
1210	0			1		Lean CLAY, stiff to very stiff, brown and reddish brown, with sand, trace roots	CL	4-6-6 N=12	13		LL = 40 PL = 17 Fines=82.0%	
			2	... 2 to 4.5 feet, brown		3-5-7 N=12		19				
			3	... below 4.5 feet, red		4-7-7 N=14		18				
			5	End of boring								

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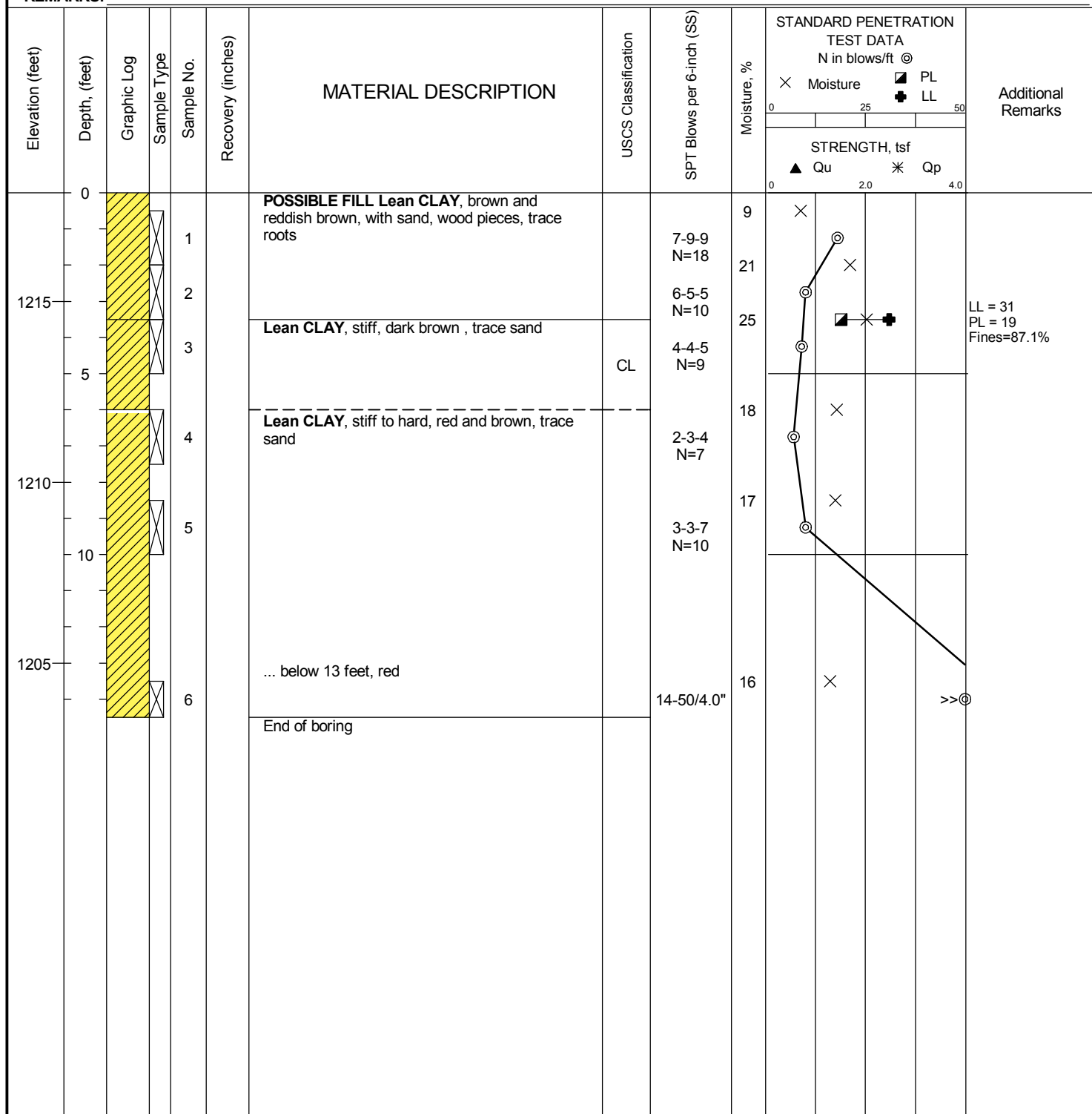
DATE STARTED: 7/18/22 DATE COMPLETED: 7/18/22 COMPLETION DEPTH: 14.5 ft BENCHMARK: N/A ELEVATION: 1220 ft LATITUDE: 35.30967° LONGITUDE: -97.52015° STATION: N/A OFFSET: N/A REMARKS:		DRILL COMPANY: DSO DRILLER: JS LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA		BORING SB-9 Water ▽ While Drilling N/A ▼ Upon Completion N/A ▽ Delay N/A BORING LOCATION: 	
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Elevation (feet)	Depth, (feet)	Graphic Log	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STRENGTH, tsf	Additional Remarks
0			1		Lean CLAY, stiff to very stiff, brown, trace sand		7-9-10 N=19			LL = 26 PL = 15 Fines=87.9%
			2				4-5-4 N=9			
			3				3-5-5 N=10			
1215	5		4		... below 6 feet, red	CL	4-5-5 N=10			
			5				4-5-9 N=14			
1210	10		6		... below 13 feet, hard		13-50/4.0"			
					End of boring					

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 Moore, OK

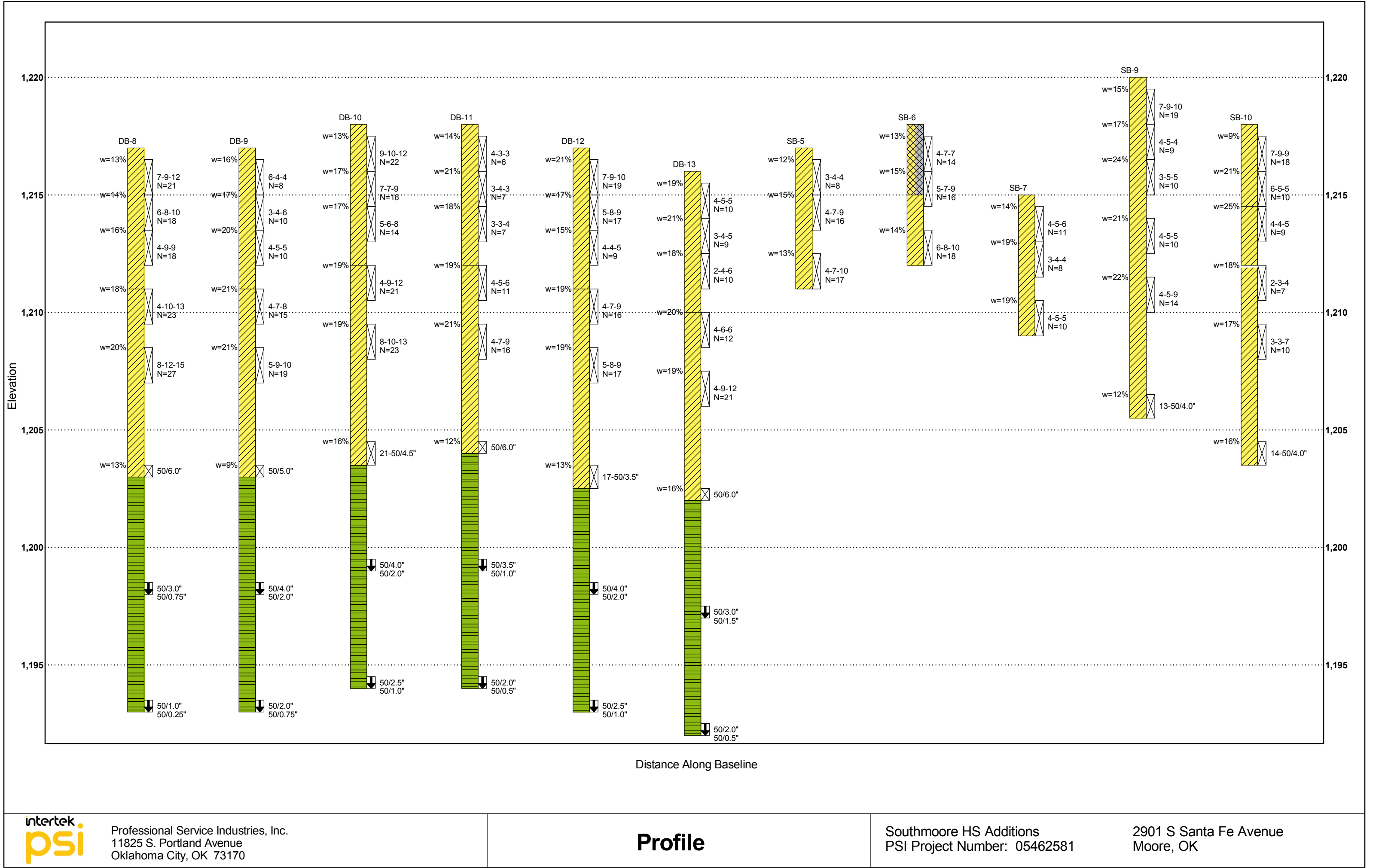
DATE STARTED: 7/18/22 DATE COMPLETED: 7/18/22 COMPLETION DEPTH: 14.5 ft BENCHMARK: N/A ELEVATION: 1218 ft LATITUDE: 35.30935° LONGITUDE: -97.52014° STATION: N/A OFFSET: N/A REMARKS:	DRILL COMPANY: DSO DRILLER: JS LOGGED BY: BL DRILL RIG: CME750 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: SS HAMMER TYPE: Automatic EFFICIENCY: N/A REVIEWED BY: SGA	BORING SB-10 <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%; text-align: center;">Water</td> <td style="width:80%;"> ▽ While Drilling ▼ Upon Completion ▽ Delay </td> <td style="width:10%; text-align: center;"> N/A N/A N/A </td> </tr> </table> BORING LOCATION:	Water	▽ While Drilling ▼ Upon Completion ▽ Delay	N/A N/A N/A
Water	▽ While Drilling ▼ Upon Completion ▽ Delay	N/A N/A N/A			

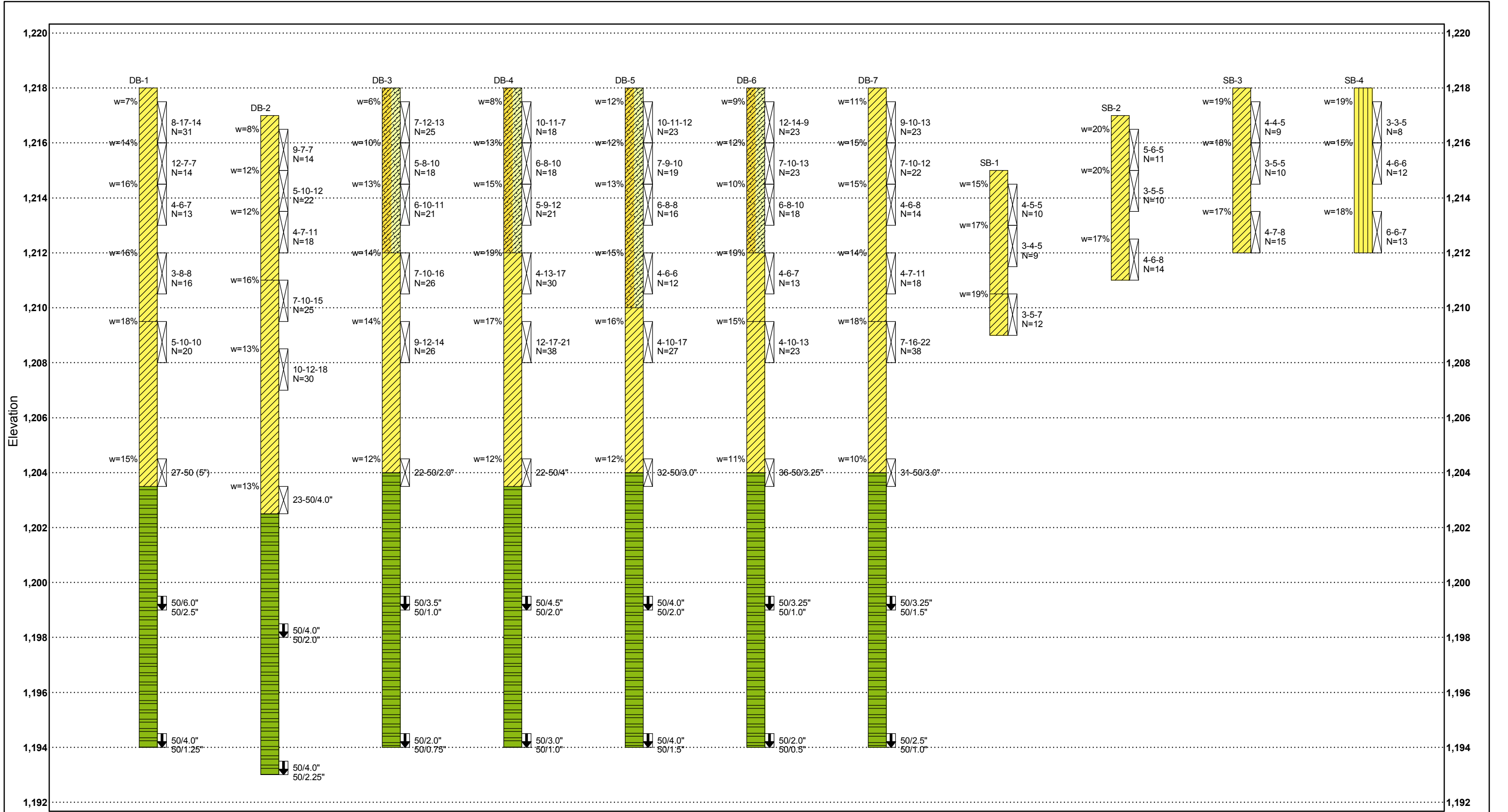


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APPENDIX B

Subsurface Profiles





Distance Along Baseline

APPENDIX C

General Notes

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.	☒ SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
HSA: Hollow Stem Auger - typically 3 1/4" or 4 1/4" I.D. openings, except where noted.	■ ST: Shelby Tube - 3" O.D., except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry	▮ RC: Rock Core
R.C.: Diamond Bit Core Sampler	↓ TC: Texas Cone
H.A.: Hand Auger	☞ BS: Bulk Sample
P.A.: Power Auger - Handheld motorized auger	☒ PM: Pressuremeter
	CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N ₆₀ : A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q _u : Unconfined compressive strength, TSF
Q _p : Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL), %
DD: Dry unit weight, pcf
▼, ▽, ▾ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	50+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (3/4 in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to 3/4 in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.005 mm to 0.075 mm
Clay:	<0.005 mm

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

<u>Q_u - TSF</u>	<u>N - Blows/foot</u>	<u>Consistency</u>
0 - 0.25	0 - 1	Very Soft
0.25 - 0.50	2 - 3	Soft
0.50 - 1.00	4 - 6	Medium Stiff
1.00 - 2.00	7 - 12	Stiff
2.00 - 4.00	13 - 26	Very Stiff
4.00 +	26+	Hard

MOISTURE CONDITION DESCRIPTION

<u>Description</u>	<u>Criteria</u>
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term</u>	<u>% Dry Weight</u>
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

<u>Description</u>	<u>Criteria</u>	<u>Description</u>	<u>Criteria</u>
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick	Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick	Lensed:	Inclusion of small pockets of different soils
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing	Layer:	Inclusion greater than 3 inches thick (75 mm)
Slickensided:	Fracture planes appear polished or glossy, sometimes striated	Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
		Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

<u>Q_u - TSF</u>	<u>Consistency</u>
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

<u>Description</u>	<u>Criteria</u>
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

<u>Voids</u>	<u>Void Diameter</u>
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

<u>(Typically Sedimentary Rock)</u>	
<u>Component</u>	<u>Size Range</u>
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

<u>Rock Mass Description</u>	<u>RQD Value</u>
Excellent	90 - 100
Good	75 - 90
Fair	50 - 75
Poor	25 - 50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered:	Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered:	Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered:	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

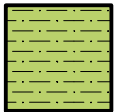
Graphic Symbols for Materials and Rock Deposits



CONCRETE
Portland Cement Concrete



BITUMINOUS CONCRETE



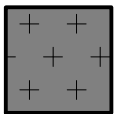
CLAYSTONE



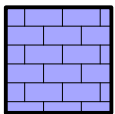
COAL
Coal, Anthracite Coal



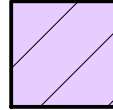
CONGLOMERATE/BRECCIA
Conglomerate, Breccia



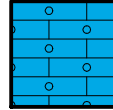
IGNEOUS ROCK
Anorthosite, Basalt, Metabasalt, Diabase (Gabbro), Gabbro, Granite/Granodiorite, Hornfels, Pegmatite, Rhyolite/Metarhyolite



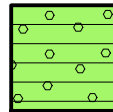
LIMESTONE
Limestone, Dolomite



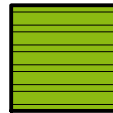
METAMORPHIC ROCK
Amphibolite, Gneiss, Marble, Phyllite, Quartzite, Schist, Serpentine, Slate



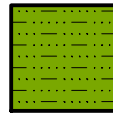
CHERT



SANDSTONE
Sandstone, Orthoquartzite (Sandstone)



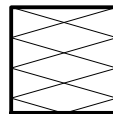
SHALE



SILTSTONE



NO RECOVERY



VOID

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010-SUMMARY OF THE WORK

Part 1 - General

1.01 Work Included:

- A. The General Conditions, Bidding Requirements, and Division I are hereby made a part of each of the technical sections that follow and shall be understood to apply and shall apply in full to all individuals or corporations who contract or subcontract to perform any part or all of the project work.
- B. Indications on the working drawings or in any section of the specifications of an article or material, operation, or method, requires that the Contractor shall provide each item or service or quality or is subject to qualifications noted; and, the Contractor shall perform each operation prescribed according to the conditions stated providing, therefore, all necessary labor, equipment and incidentals to complete the project work.
- C. The project:
 - 1. Name: **2026 Athletic Plaza Upgrades**
Southmoore High School - Moore Public Schools.
 - 2. Location: 2901 South Santa Fe, Moore, Oklahoma 73160.

1.02 Summary of Work:

- A. **Base Bid:** Provide and pay for all materials, labor, services, equipment, licenses, taxes, permits, and other items necessary for the complete construction of the New Upgrades to be performed at the existing sports plaza entry and concourse area. Except as noted otherwise, the work consists of a new arch, sidewalks, fencing, upgrades to outfield fencing at baseball and softball fields, bleacher addition(s), and site lighting. Contractor shall maintain all barriers, guards and other environmental items required at the site during construction.
- B. Owner: Moore Public Schools
 - 1. Owner's Representative:
Jeff Horn, Bond Issue Consultant
Moore Public Schools
1500 SE 4th Street
Moore, OK 73160
405-735-4221
- C. Design Team:
 - 1. Architect:
AGP
313 S.E. 5th Street
Moore, OK 73160
405-735-3477
 - 2. Structural Engineer:
KFC Engineering, Inc.
1300 N. Walker, Suite 200
Oklahoma City, OK 73103
405-528-4596

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010-SUMMARY OF THE WORK

- 3. Electrical Engineers:
Salas O'Brien LLC
2900 S. Telephone Rd., Suite 120
Moore, OK 73160
405-364-9926
- 4. Civil Engineer:
No applicable.
- D. Construction Management Team:
 - 1. Construction Manager's Representative:
Joe Sherga, Project Manager
Omni Construction LLC
1909 S. Eastern Ave.
Moore, OK 73160
405-735-3992
- 1.04 Work to be Provided and Installed By Others:
 - A. No applicable.
- 1.05 Use of the Site:
 - A. Confine operations at the site to the areas permitted under the contract. Portions of the site beyond areas on which work is indicated are not to be disturbed.
 - B. Keep facility free from accumulation of waste material, rubbish or construction debris.
- 1.06 Safety of Persons and property:
 - A. Contractor shall at all times protect the building from damage from rainwater.
 - B. Contractor shall provide barricades and clearly mark work zone areas.
 - C. Refer to Special Conditions "Temporary Services" for additional information.
 - D. During the period of construction, the OSHA Standards shall be followed as applicable by law.
 - E. The Contractor shall post emergency telephone numbers.
 - F. **EXISTING TRACK AROUND EXISTING SPORTS FIELD SHALL BE PROTECTED FROM NEW BLEACHER RELATED DAMAGE AT ALL TIMES.**
- 1.07 Preconstruction Conference:
 - A. A preconstruction meeting will be held at a time and place designated by the Architect or Owner's Representative, for the purpose of identifying responsibilities of the Owner's and the Architect's personnel and explanation of administrative procedures.
 - B. The Contractor shall use this meeting for the following minimum agenda:
 - 1. Construction Schedule/Project Phasing.
 - 2. Use of areas of the site.
 - 3. Delivery and storage.
 - 4. Safety.
 - 5. Security.
 - 6. Cleaning up.
 - 7. Subcontractor procedures relating to:
 - a. Submittals.
 - b. Change orders.
 - c. Applications for payment.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010-SUMMARY OF THE WORK

- d. Record documents.
- C. The attendees shall include:
 - 1. The Owner's Representatives.
 - 2. The Architect.
 - 3. The Contractor and its superintendent.
- 1.08 Project Scheduling:
 - A. The Contractor is responsible for the scheduling of construction and must prepare a schedule and charting system described below. This schedule is to ensure adequate planning and execution of the work by the contractor and to assist the Architect in appraising the schedule and evaluating the progress of the work.
 - B. The project schedule shall be presented within ten (10) days after receipt of the Notice to Proceed. Three (3) copies of the schedule shall be submitted to the Architect for review and approval.
 - C. The schedule logic must be in the form of a "fenced" bar chart or Critical Path Method network indicating the planned start and completion dates of the activity, logical constraints between activities, and total float of each activity.
 - D. An updated project schedule shall be provided when requested by the Architect.
- 1.09 Environmental Controls:
 - A. Water Resources:
 - 1. Oily substances: prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water.
 - 2. Mosquito abatement: prevent ponding of stagnant water conducive to mosquito breeding habitat.
 - B. Land Resources:
 - 1. Erodible soils: plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use the areas developed. Immediately protect side slopes and back slopes upon completion of rough grading.
 - C. Air resources:
 - 1. Prevent creation of dust, air pollution, and odors.
 - 2. Use water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to locate practical level.
 - 3. Store volatile liquids, including fuels and solvents, in closed containers.
 - 4. Properly maintain equipment to reduce gaseous pollutant emissions.
 - D. Comply with all applicable environmental control guidelines as required by the City of Moore.
- 1.10 Temporary Utilities:
 - A. The Contractor shall provide and pay for all temporary utilities required for the complete construction of the project including, but not limited to, electricity,

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010-SUMMARY OF THE WORK

lighting, heating, cooling, ventilating, telephone, water, sanitary facilities, exterior and interior enclosures, access roads and parking areas, cleaning and waste removal, project identification and signs, etc.

1.11 Cleaning:

- A. Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.
- B. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's published instructions.
- C. Complete cleaning operations prior to requesting a Final / Substantial Completion Inspection.

1.12 Project Sign:

Not applicable.

End of Section

DIVISION 2 - SITE WORK

SECTION 02100 - SITE PREPARATION

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services, and incidentals necessary for the completion of this section of the work.
- B. Erection and maintenance of a temporary construction fence, as noted on the Drawings, shall be provided by the Contractor.

1.02 Protection of Trees and Shrubs:

- A. All existing trees and shrubs in or near the construction area that are not indicated to be removed shall be protected. Should damage occur, the Contractor shall replace the tree or shrub with a similar size and species.
- B. Periodically water as required to limit dust and dirt during construction.
- C. Protect any adjacent property and improvements from damage, and replace any portions damaged through this operation.

Part 2 - Products

2.01 Materials:

- A. Temporary Fencing: **Refer to Section 02110.**

Part 3 - Execution

3.01 Clearing and Grubbing:

- A. Limits of clearing shall be all areas within contract limit lines.
- B. Remove all organic or undesirable materials from areas where concrete is to be placed.
- C. Within building lines and exterior concrete slabs remove roots, debris, rubbish, etc., and cut roots of adjacent trees and shrubs to remain, not less than 12" from concrete work.
- D. From building lines and exterior concrete walks and slabs out to the limits of earth cut and fill, remove all exposed stumps and roots, brush, rubbish, etc.
- E. Remove completely all existing trees designated on Drawings.
- F. Remove top soil to depth of organic matter and stockpile on site for use in grading.

3.02 Removal of Improvements:

- A. Remove all above-grade and below-grade improvements indicated on the Drawings or as necessary for the installation of new work.

DIVISION 2 - SITE WORK

SECTION 02100 - SITE PREPARATION

3.03 Disposal of Debris:

- A. Burning of combustible materials on the site will not be permitted. Completely remove from site and legally dispose of all materials and debris.

End of Section

DIVISION 2 - SITE WORK

SECTION 02110 - TEMPORARY CONSTRUCTION FENCING

Part 1 - General

1.01 Summary

- A. Section includes: Erection, maintenance and dismantling of temporary fencing around construction site and materials storage areas. This section does not apply where security fencing is required.
- B. Refer to Drawings for temporary fencing layout and location of gates.

1.02 Submittals

- A. Submit the following:
 - 1. Shop drawing indicating layout of temporary fencing, location and size of gates, existing pavement and roads, access to fire hydrants and hose connections, and other site specific conditions. Prepare drawing after site observation and verification of existing conditions.

Part 2 - Products

2.01 Temporary Chain Link fencing:

- A. Unless otherwise indicated, type of temporary chain link fencing shall be Contractor's option. Following types are acceptable:
 - 1. New materials or previously used salvaged chain link fencing in good condition.
 - 2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with base plates, or inserting in precast concrete blocks.
 - 3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.
 - 4. Height: Minimum Height shall be 8'-0".
- B. Gates: Provide personnel and vehicle gates of the quantity and size indicated on the Drawings or required for functional access to site.
 - 1. Fabricate of same material as used for fencing.
 - 2. Vehicle gates:
 - a. Minimum width: 20 feet to allow access for emergency vehicles.
 - b. Capable of manual operation by one person.

Part 3 - Execution:

3.01 Layout:

- A. Installation of temporary fencing shall not deter or hinder

DIVISION 2 - SITE WORK

SECTION 02110 - TEMPORARY CONSTRUCTION FENCING

access to existing and new hose connections and fire hydrants.

1. Maintain 3 feet diameter clear space around fire hydrants.
 2. Where fire hydrant or hose connection is blocked by fencing, provide access gate.
- B. Access: Provide gates for personnel, delivery of materials, and access by emergency vehicles.

3.02 Installation:

- A. Chain link posts:
1. Space at 10'-0" maximum.
 2. Drive posts, set in holes and backfill, or anchor in precast concrete blocks.
 3. For soft and unstable ground conditions, cast concrete plug around post.
 4. Posts over pavement: Use steel post plates or precast concrete blocks.
 5. Gate posts: Use bracing or concrete footings to provide rigidity for accommodating size of gate.
- B. Fabric: Securely attach to posts.
- C. Gates: Install with required hardware.
- D. Plastic mesh fencing: Space steel support posts to ensure mesh remains vertical and at proper height. Securely tie mesh to posts.

3.03 Maintenance and Removal:

- A. Maintain fencing in good condition. If damaged, immediately repair.
- B. Remove temporary fencing upon completion of Work or when no longer required for security or control. Backfill holes and compact. Holes in pavement shall be surfaced to match existing paving. Repair damage caused by installation of temporary fencing.

End of Section

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Site Preparation - Section 02100
- B. Paving and Surfacing - Section 02500
- C. Cast-In-Place Concrete - Section 03300

1.03 Quality Assurance:

- A. Standards:
 - 1. American Society for Testing and Materials
 - a. ASTM D-1556, Density of soil in place
- B. **Testing: All required tests, and their fees, shall be the responsibility of the Contractor. The Contractor shall engage and pay for the services of an independent testing laboratory approved by the Architect.**
 - 1. Qualified according to ASTM E-329 and ASTM D-3740 for testing.
- C. Comply with 29 CFR 1926, Subpart P - Excavations (OSHA Regulations).

1.04 Submittals:

- A. Product data for each type of manufactured products required.
- B. Qualification data for testing agency.
- C. Material Test Reports for each borrow soil material proposed for engineered fill and backfill as follows:
 - 1. Classification according to ASTM D-2487.
 - 2. Laboratory compaction curve according to ASTM D-698.

1.05 Project Conditions:

- A. Traffic: minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Authority Having Jurisdiction. Provide alternate routes around obstructions as required by authorities.

Part 2 - Products

2.01 Materials:

- A. Backfill Material: Approved low volume change material. If additional material required, it shall be low plasticity cohesive material (plasticity index between 5 and 18 and a maximum liquid limit of 35 percent). The moisture content of the low volume change soil should be adjusted to its optimum value, or above, before compaction. The suitability of materials, including off-site soils, shall be approved by the Geotechnical Engineer hired by the Contractor. Frozen material shall not be acceptable for backfilling.
- B. Top Soil: Material shall be native, fertile, neutral top soil of loamy character, free from heavy clay, coarse sand, stones,

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

- lumps, plants, roots, or other foreign matter.
- C. Gravel: Course gravel - 100% passing a 2" screen, 90% retained on a 1/4" screen.
- D. Aggregate Base Course: Aggregate base - meet ASTM D448 size 57, 100 percent passing the 12" sieve, less than 5 percent passing the #8 sieve, plasticity index less than or equal to 6.
- E. Hydrated Lime: meet requirements of ASTM C977.

Part 3 - Execution

3.01 Excavations:

- A. General:
 - 1. Excavations shall be made to the elevations and dimensions shown on Drawings.
 - 2. If excavations are made deeper than called for on plans, no backfilling is permitted. Any additional depth or size shall be made up by additional concrete at no increase in contract price.
 - 3. Foundations shall be plumb, bottoms level and of type indicated on Drawings with allowance for erection of any required forms or shoring, and inspection of footings, etc.
 - 4. Shore and brace excavations where necessary to prevent cave-ins, and in accordance with all safety laws and codes, including all OSHA requirements.
 - 5. If an excavation must remain empty through a shutdown period, cover hole with suitable protection materials and clean out immediately prior to placing concrete.
 - 6. Keep excavations free of water by use of pumps.
 - 7. Keep area around excavations and concrete work clean for a distance of 3 feet all directions until concrete is placed and has set.
- B. Footings / Grade Beams:
 - 1. Footing bottoms shall be level, clean, clear of loose and objectionable material, and true to size.
 - 2. Concrete for footings shall be poured as soon as possible after excavation has been completed. Excavations shall be protected until concrete has been poured.
- C. Exterior and Pavement Sections:
 - 1. Excavate to underside of walks, curb, gutter, and miscellaneous items.
 - 2. Excavation shall be away from sides of grade beams and retaining walls below grade to a sufficient distance for erecting and removing forms with assured safety for workmen.
 - 3. Bottoms of excavated areas shall be level and kept clean of loose and objectionable materials at all times.
- D. All excavations for concrete footings, foundations or slabs shall be kept dry at all times, and shall be completely dry

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

at the time of any concrete pour. The Geotechnical Engineer, **hired by the Contractor**, shall make final approval of all excavations prior to the start of any concrete placement.

3.02 Classification of Excavation:

- A. All excavation shall be unclassified and the term "unclassified excavation" shall be understood to mean all and any materials encountered during excavation - including old floors, pavement, foundations, rock, earth, piping and debris. No adjustment in the contract price will be made on account of the presence or absence of rock, hard or soft sandstone, shale, masonry, or other materials.

3.03 Unknown Utilities:

A. Unknown Utilities:

1. If any unknown and uncharted utilities are encountered during excavation, promptly notify the Architect and wait for his instructions before proceeding.
2. If it is ascertained by the Architect that such utility line has been abandoned, the Contractor shall properly cap the line at depth of 12" or more below finish grade.
3. If such unknown utilities are encountered and work is continued without contacting the Architect for instruction, and damage is caused to said utilities, the Contractor shall repair, at his own expense, such damage to the satisfaction of the utility company concerned.

B. Unknown Obstacles:

1. If any unknown obstacles such as house or small building foundations or such as residential size basements, cisterns, etc., are encountered, the Contractor at his own expense shall remove the foundations, fill basements or cisterns or perform any work necessary to complete the work of this contract.
2. Should the Contractor encounter any unforeseen major obstacle in excavation, such as an abandoned water-well, subsurface streams, or "cave-ins" etc., which prove to be unduly expensive to overcome, it is the intention to cause a survey to be made to determine a course of action that will relieve the Contractor of undue expense.

3.04 Fill and Backfill:

A. Preparation for Concrete slab item on Fill:

1. Site preparation shall include removing existing vegetation, and any other unsuitable materials encountered. Refer to Soils Report and Structural Drawings concerning additional preparation procedures. The prepared area shall extend beyond the building footprint a minimum of 5 feet laterally. After performing the required cuts, proofroll existing site with a loaded, tandem-axle dump truck weighing at least 25 tons. Proofrolling shall involve overlapping passes in mutually perpendicular directions. After proofrolling, unstable soil should be overexcavated and replaced with a low volume change soil. Scarify existing soil at base of fill to

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

a minimum depth of 8"; moisture content of scarified soil shall be adjusted to a minimum of 2% above the material=s optimum content, as determined by the standard Proctor method ASTM D-698, and be compacted to at least 95 percent of its maximum dry density.

2. Provide fill material to bring site to required grade. Refer to 2.01A.
3. Compaction: Compact fill in lifts not exceeding 8" in loose thickness. Compact soil according to table below. Tests shall be required and paid for by the Contractor. Any additional moisture required to achieve compaction in a layer should be added and the entire lift mixed to obtain the uniform moisture content.
4. Compaction shall not be attempted using water settling.
5. **Care shall be taken to maintain the minimum recommended moisture content in the subgrade until floor slabs are constructed. Positive drainage shall also be developed away from building to prevent water from ponding along the perimeter and affecting future floor slab performance.**

B. Preparation for Paving items on fill:

1. Before compaction, the top 8" of the stabilized soil zone shall be modified with a minimum of 7% hydrated lime. The lime shall be thoroughly blended into the subgrade and allowed to cure for 48 to 72 hours before being remixed and compacted. Before compaction, the treated soil zone shall be adjusted to within 2 percentage points of optimum moisture as determined by the standard Proctor method (ASTM D-698); then compacted to at least 98 percent of the material=s maximum standard Proctor dry density.

C. Backfill at Walls (including footing and foundation walls):

1. Fill material shall be approved backfill material except as noted on Drawings.
2. Backfill around footing and foundation walls must be compacted.

3.05 Exterior Fill and Grading:

A. Fill:

1. Subgrade fill as shown on plot plan, placed in 4" to 8" layers, to within 6" of finish. Compact according to table below.
2. Top 6" of graded surface shall be approved top soil.

B. Lines and Grades:

1. Work shall conform to lines and grades shown on the Drawings. Ruts holes and depressions shall be filled with approved material.
2. The slopes between contours or between spot elevations shall be smooth, uniform slopes and the surface shall be finished to a tolerance of 2" in 10' under a straight edge.

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

3.06 Compaction (fills less than 8'-0" thick):

Soil Compaction Criteria

Minimum Compaction (%) per ASTM D698

Use	Exposed in-situ subgrade soil	Fill	Base Course
Beneath foundation components	95	95	95
Beneath pavements, curbs and sidewalks (Stabilized on-site soil)	98	98	95
Aggregate base (at slab) Aggregate base (at pavements)			98
Beneath exterior slabs and utility trench backfill (stabilized on-site soil)	95	95	95
Miscellaneous backfill (non-load bearing)		90	

3.08 Testing:

- A. Make at least one density test of subgrade for every 2500 square feet of paved area or building slab, but in no case less than 5 tests.
- B. In each compacted fill layer, make one density test for every 2500 square feet of overlaying building slab or paved area, but in no case less than 8 tests.

3.09 Trenching and Backfilling of Utilities:

- A. The Contractor shall do all excavation and backfilling necessary for the installation of all utilities, including shoring, bailing, and pumping required to maintain the excavations in a safe and dry condition.
- B. All excavations shall be backfilled in 4" to 6" layers and thoroughly compacted one layer at a time with a mechanical tamper. Backfill material under areas where walks, drives, slab, parking areas, etc., are to be constructed shall be fill sand (free of all dirt). Backfill material in other areas shall be excavated material. Where excavation is not to be built over, replace the top 12" with existing top soil. Remove superfluous materials from job site.

End of Section

DIVISION 2 - SITE WORK

SECTION 02500 - PAVING AND SURFACING

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services, and incidentals necessary to complete all Paving Work as shown on the Drawings, and specified herein.

1.02 Related Work Specified Elsewhere:

- A. Site Preparation - Section 02100
- B. Earthwork for Buildings - Section 02200
- C. Hot Mix Asphalt Paving - Section 02741
- C. Cast-In-Place Concrete - Section 03300

1.03 Quality Assurance:

- A. Standards:
 - 1. American Society for Testing and Materials (ASTM).
 - 2. American Association of State Highway and Transportation Officials (AASHTO).
 - 3. Oklahoma Department of Transportation (ODOT) Standard Specifications for Highway Construction.
- B. **Testing: All required tests, and their fees, shall be the responsibility of the Contractor. The Contractor shall engage and pay for the services of an independent testing laboratory approved by the Architect.**

1.04 Paving Quality Requirements:

- A. General: In addition to other specified conditions, comply with the following minimum requirements:
 - 1. Test concrete as required under Section 03300 - Cast-In-Place Concrete.
 - 2. Test subgrade preparation as required under Section 02200 - Earthwork for Buildings.
- B. Provide final surfaces of uniform texture, conforming to required grades and cross-sections. Finished surface tolerance - 1/2" in 10'-0" under a straightedge.
- C. Thickness: In-place compacted thickness shall not be acceptable if not meeting the minimum thickness indicated on the Drawings.

1.05 Coordination:

- A. Coordinate work and cooperate with any other trades whose work relates to paving in any way.

1.06 Personnel:

- A. All work shall be directed by trained and experienced applicators, thoroughly adept at the procedures and equipment required by this section.

1.07 Weather Limitations:

- A. Do not install paving when the subgrade is frozen or show any evidence of excessive moisture.
- B. Do not install paving when the air temperature is less than

DIVISION 2 - SITE WORK

SECTION 02500 - PAVING AND SURFACING

40 degrees Farenheit nor when temperature of the surface on which mixture is to be placed is below 40 degrees Farenheit unless directed otherwise by Architect.

Part 2 - Products

2.01 Material Applications:

- A. Subgrade Preparation:
 - 1. Description: Refer to Section 02200 - Earthwork, Part 3, 3.01 and 3.04.
- B. Concrete Paving:
 - 1. Description: A minimum 4,000 p.s.i. 28 day concrete slab with a minimum cement content of six (6) sacks per cubic yard on prepared base and subgrade course. Provide steel dowels at all expansion and construction joints. The concrete shall be reinforced with #3 bars at 24" o.c. Provide expansion and saw joints as shown on the Drawings.
- C. Concrete Curbs:
 - 1. Description: Concrete curbs and/or gutters constructed of a minimum 4,000 p.s.i., 28 day concrete with a minimum cement content of six (6) sacks per cubic yard on prepared base and subgrade course. Provide steel dowels at all expansion and construction joints.
- D. Concrete Walks:
 - 1. Description: A 4,000 p.s.i. reinforced concrete slab on a sand base. Provide expansion and saw cuts as shown on the Drawings.
- E. Paint:
 - 1. Parking lot paint shall be Pittsburg Paints Speedhide High Performance Test Drying Safety Paint:
 - a. Colors:
 - 1. Parking stall striping, directional arrows, and miscellaneous markings - white.
 - 2. All handicapped markings shall be blue field with white symbol and border.
 - 3. Fire lane striping and curbs - red with white letters indicating "FIRE LANE - NO PARKING".
 - 4. Light Pole Base (where applicable) - yellow.
 - 5. Lane Striping Separation of Traffic in Opposite Directions - double line yellow.
- F. Asphalt Paving: refer to Section 02741 - Hot Mix Asphalt Paving.

2.02 Expansion Control:

- A. Construction Joint Form: Tongue and groove keyway, premolded asphaltic or wood form, designed to provide 1 1/2" keyway.
- B. Joint Filler: Resilient, non-extruding

DIVISION 2 - SITE WORK

SECTION 02500 - PAVING AND SURFACING

- bituminous-impregnated fiberboard expansion joint material by thickness shown on the Drawings, ASTM D-1751.
- C. Joint Sealers: Hot applied, non-tracking asphalt-rubber compound, ASTM D-1190.
 - D. Anchorage Inserts: Malleable cast iron adjustable wedge, or threaded, type with 3/4" bolt size unless indicated otherwise on the Drawings.
 - E. Embedded Items: Provide materials as sized and/or indicated on the Drawings, or as required.

Part 3 - Execution

3.01 General:

- A. Make careful inspection of excavated surface on which paving is to be placed, and check on bottom and top grades of paving throughout the area to be paved, prior to starting work under this section. Notify the Contractor of any unsatisfactory conditions. Do not begin paving work until such conditions have been corrected and area is ready to receive paving.

3.02 Workmanship:

- A. Apply paving in true planes to eliminate depressions or "fat" spots. Carefully warp changes in slope. Carefully hand compact and roll around building projections so that texture and compaction matches machine compaction. Mask building before placing concrete primer to prevent staining exposed building surfaces, and concrete curbs.
- B. All concrete curb and gutter shall be constructed to the alignment and grades shown on the plans.
- C. Backfill shall be placed behind the sidewalks in a manner that will not cause displacement of the section nor damage to the exposed edges. All damaged sidewalks shall be replaced at the direction of the Architect at the Contractor's expense.
- D. Adjoining Paving: where new work adjoins existing, warp carefully to flush surface, with seal over joint.
- E. Construction Joints: As noted on the Drawings or as directed by the Architect:
 - 1. At joints, thoroughly clean surfaces and remove all laitance.
 - 2. In addition, vertical surfaces shall be thoroughly wetted and coated with cement grout before placing new concrete.
- F. Expansion Joints: As noted on the Drawings, or as directed by the Architect:
 - 1. Provide 1/2" expansion joints where sidewalks join structural concrete.
 - 2. Hold filler material down 1/2", fill top with sealant.
- G. Control Joints: Provide scored lines and weak plane joints

DIVISION 2 - SITE WORK

SECTION 02500 - PAVING AND SURFACING

on exterior and interior concrete slabs as indicated on the Drawings, and as approved by the Architect. Fill with sealant.

- H. Finishes:
 - 1. Concrete Walks and Pavement:
 - a. Provide trowel and medium broom finish. Refer to drawings.
 - b. Broom after concrete is hard enough to retain scoring, using a stiff fiber, or wire, broom. Broom perpendicular to direction of traffic.
- I. Repair any damage to finished pavement surfaces that may result from subsequent construction to a smooth, true, and uniform surface.
- J. Clean-up: After completion of paving operations, remove all excess materials, equipment and debris (dispose of away from the site). Leave all work in clean condition.
- K. Protection:
 - 1. Provide barricades and warning devices as required to protect pavement and the general public.
 - 2. Cover any openings of structures in area of paving until permanent coverings are installed.
 - 3. Prohibit all traffic on paving until it has reached atmospheric temperature.
- L. Pavement Markings:
 - 1. Surface shall be dry, free of oil, and grease, and cleaned of all loose dirt.
 - 2. Paint shall be spray applied to a wet film thickness of 12-15 mils.
 - 3. The paint shall be spray applied in accordance with manufacturer's recommendations.
 - 4. Do not apply paint markings on surfaces that are not dry or if rain is expected within 24 hours.
 - 5. Do not apply paint markings when surface temperature is below 50 degrees F.
 - 6. At sidewalks, and where applicable, use straightedge to provide uniform, clean, and straight stripe.

End of Section

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt patching.
 - 3. Pavement-marking paint.
 - 4. Subgrade modification.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork".

1.3 QUALITY ASSURANCE

- A. STATE OF OKLAHOMA, DEPARTMENT OF TRANSPORTATION, Standard Specifications for Construction and Materials, Current standards, as amended to date.
- B. Current ODOT Standards are available at the following website address:
[http://www.odot.org/c_manuals/specbook/oe ss 2009.pdf](http://www.odot.org/c_manuals/specbook/oe_ss_2009.pdf)
- C. 36 CFR 1191 American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines.

1.4 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications.

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties (all test results must be current - within the last 12 months).
- B. Job-Mix Designs: Certification of approval of job mix proposed for the Work (mix must be current - within the last 12 months).
- C. In place material testing procedures - refer to Section 3.11 for testing requirements.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer shall be Oklahoma Department of Transportation (ODOT) approved paving-mix manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 40 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse and Fine Aggregate: shall be in accordance with the requirements of ODOT Standards for Construction, as amended to date, for hot-mixed asphalt.

2.2 ASPHALT MATERIALS

- A. Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30 or MC-70.
- B. Tack Coat: AASHTO M 140, emulsified asphalt slow setting, diluted in water, of suitable grade and consistency for application - ASHTO MP1.
- C. Water: Potable.

2.3 STABILIZED SUBGRADE MATERIAL

- A. Hydrated Lime Material: Shall meet the requirements of ASTM C 977. Top 8" of substrate shall be amended at a rate of 5 - 7% hydrated lime.
- B. At the time of hydrated lime stabilization placement, the contractor shall coordinate with the testing agency to observe and provide on-site testing during application. This is required to ensure the proper amount of hydrated lime is mixed and the recommended subgrade modification is achieved.
- C. Compact to a minimum 95 percent optimum density in accordance with ASTM D 698, or 92 percent optimum density in accordance with ASTM D 1557, unless otherwise required by the Geotechnical Report which is a part of these Contract Documents.

2.4 AUXILIARY MATERIALS

- A. Joint Sealant: ASTM D 3405 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant as manufactured by:

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

- a. Crafcro Inc
 - b. W.R. Meadows, Inc.
 - c. Or approved equal
- B. Color: Joint color shall match pavement color. Contractor shall submit color sample to Owner for approval
- C. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

2.5 MIX

- A. Hot-Mix - Hot Lay Asphalt:
- 1. Oklahoma Department of Transportation (ODOT) Type "A" Asphalt Concrete:

Sieve Size (inch) Passing (%)

1-1/2"	100
1	90-100
3/4	-
1/2	70-90
3/8	-
No. 4	40-65
No. 10	25-45
No. 40	10-26
No. 200	-

Asphalt Cement

% of mix mass 3.8 - 6.5

- 2. Oklahoma Department of Transportation (ODOT) Type "B" Asphalt Concrete:

Sieve Size (inch) Passing (%)

1-1/2"	-
1	-
3/4	100
1/2	90-100
3/8	70-90
No. 4	45-70
No. 10	25-50
No. 40	12-30

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

No. 200

7-20

Asphalt Cement

% of mix mass 4.7 - 7.5

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads. Contractor shall verify proper moisture.
- B. Proof-roll subbase using a loaded, tandem-axle dump truck weighing at least 25 tons to locate areas that are unstable or that require further compaction. Amend substrate below all paving with lime stabilization as per Geotechnical Report which is a part of this Project Manual, and as described above.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

3.3 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place Type "A" hot-mix asphalt base course in number of lifts (maximum 3-inch lift) and thicknesses required for a total thickness of 5".
 - 2. Place Type "B" hot-mix asphalt surface course in single lift (maximum lift height: 3-inches) for a total thickness of 3".
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 1. Asphalt material behind the laydown machine shall be a minimum of 250°F and complete compaction before mix temperature cools to below 180° F.
 2. Minimum surface temperatures for compacted lift thickness:
 - a. Less than 1-1/2 inch - minimum 50°F
 - b. 1-1/2 inch to 3 inches - minimum 45°F
 3. Steel wheeled compactors shall weigh at least 10 tons (maximum speed 2.50mph)
 4. Pneumatic tired compactors (maximum speed 3mph) shall have at least seven pneumatic tires of equal size and diameter. They shall be constructed so that their total weights shall be varied to produce an operating weight of at least 3,500 pounds per tire.
 5. Use Pneumatic tired rollers on all lifts following the initial roller with a steel roller and before finishing with a steel wheel roller. A minimum of two coverages with the pneumatic tired roller is required on each lift.
 6. Compaction requirements shall be in accordance with the current ODOT standards.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports. Testing agency shall be certified in all ASTM and AASHTO test required for this project.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
2. Testing frequency as listed below:

Asphalt Extraction and Gradation	1,000 tons Asphalt Pavement
Roadway Density of Asphalt Mix	4 Per 2,000 Tons Asphalt Pavement (not less than 1 per day of laydown)
Hveem Stability Test and Density of Molded Specimen	1 Per 2,000 Tons Asphalt Pavement
Maximum Theoretical Specific Gravity of Asphalt Mix	1 Per 2,000 Tons Asphalt Pavement

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

1. Tolerance: 1/8 inch in 10 feet
2. All pavement will be subject to straightedge inspection during construction operations. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall at no point exceed the tolerance listed above.

DIVISION 2 - SITE WORK

SECTION 02741 - HOT MIX ASPHALT PAVING

E. In-Place Density: Testing agency will take samples of un-compacted paving mixtures and compacted pavement according to specifications.

1. The target density of each lot shall be 94% of the Maximum Theoretical Specific Gravity at the job mix formula asphalt content determined by the most recent specific gravity of the bituminous paving mixture in accordance with AASHTO T209.
2. The roadway density for each lot will be the average of tests of three separate specimens taken randomly within the limits of the area represented by the lot.
3. Average lot density tolerance: 91% to 97% of Maximum Theoretical Density.

F. Remove and replace hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

G. Coring of pavement: If core drilling is determined necessary, the following will be followed:

1. Minimum of three cores for each section of questionable pavement.
2. Obtain 3-1/2 inch diameter cores.
3. Obtain a length of 1.50 times the diameter.
4. Condition cores based on current version of ACI 318 and ASTM C 42.

3.8 DISPOSAL

A. Except for material indicated to be recycled, excessive asphalt shall be removed from Project site and legally disposed of.

END OF SECTION

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 Section Includes

- A. Concrete formwork.
- B. Slabs on grade.
- C. Concrete foundation walls and retaining walls.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Miscellaneous concrete elements, including equipment pads and equipment pits.
- G. Concrete curing.

1.02 Related Requirements

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints, construction joints and isolation joints in slabs.

1.03 Reference Standards

- A. For all reference standards listed below, comply with the version year in the governing building code adopted by the Authority Having Jurisdiction. For those reference standards that are not directly referenced by the building code, use the latest edition unless noted otherwise.
- B. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
- C. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- D. ACI 301 - Specifications for Structural Concrete.
- E. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
- F. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- G. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- H. ACI 305R - Guide to Hot Weather Concreting.
- I. ACI 305.1 - Specification for Hot Weather Concreting.
- J. ACI 306R - Guide to Cold Weather Concreting.
- K. ACI 308R - Guide to External Curing of Concrete.
- L. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- M. ACI 347R - Guide to Formwork for Concrete.
- N. ACI SP-66 - ACI Detailing Manual.
- O. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- P. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- Q. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- R. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- S. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- T. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- U. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- V. ASTM C150/C150M - Standard Specification for Portland Cement.
- W. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
- X. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- Y. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
- Z. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- AA. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- AB. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
- AC. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- AD. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- AE. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- AF. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.
- AG. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- AH. CRSI (DA4) - Manual of Standard Practice.
- AI. ICC (IBC)-2015 - International Building Code.

1.04 Definitions

- A. Cold Weather: A period when for more than three successive days the average daily outdoor temperature drops below 40 F. The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50 F occur during more than half of any 24 hr duration, the period shall no longer be regarded as cold weather.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- B. Hot Weather: Hot weather is any combination of the following conditions that tends to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration, or otherwise causing detrimental results:
 - 1. High ambient temperature
 - 2. High concrete temperature
 - 3. Low relative humidity
 - 4. Wind speed
 - 5. Solar radiation

1.05 Submittals

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 26 - Concrete Documents and Inspection.
- D. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- E. Test Reports: Submit report for each test or series of tests specified.
- F. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- G. Formwork Design Submittal: As required by authorities having jurisdiction.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 Quality Assurance

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- D. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for placement as required by the manufacturer's warranty.

1.07 Warranty

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- C. Slabs with Moisture Vapor Reducing Admixture (MVRA):
Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of the concrete.
 - 1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
 - 2. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.

PART 2 PRODUCTS

2.01 Formwork

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
 - 2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces of trenched footings unless expressly allowed in the General Notes in the structural drawings. Natural rock formations that maintain a stable vertical edge may be used as side forms for below-grade concrete.
 - 3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
 - 4. Form Ties: Cone snap type that will leave no metal within the clear cover zone of the concrete surface as specified in the Minimum Concrete Cover for Cast-in-Place Non-Prestressed Members table included in the General Notes of the structural drawings.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

2.02 Reinforcement Materials

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars, weldable.
 - 1. Unfinished.
- C. Reinforcement Accessories:
 - 1. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (60,000 psi) plain-steel bars, cut true to length with ends square and free of burrs.
 - 2. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 - 3. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - a. Continuous slab bolsters shall be used to support the bottom reinforcing bars of all reinforced slabs-on-grade.
 - 4. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement of reinforcing steel within 1-1/2 inches of weathering surfaces and for concrete surfaces that will be exposed to view.
- D. Fabrication of Reinforcing:
 - 1. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
 - 2. Welding of reinforcement is permitted only with the specific approval of Architect/Engineer. Perform welding in accordance with AWS D1.4/D1.4M.
 - 3. Locate reinforcing splices not indicated on drawings at point of minimum stress.

2.03 Concrete Materials

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
 - 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 - 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 Admixtures

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- D. Water Reducing Admixture: ASTM C494/C494M Type A.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- E. Moisture Vapor Reducing Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.
 - 1. Provide admixture in slabs to receive adhesively applied flooring.
 - 2. Manufacturers:
 - a. Barrier One, Inc; Barrier One Moisture Vapor Reduction Admixture: www.barrierone.com/#sle.
 - b. Substitutions: Substitutions shall comply with the use of concrete staining/dye products. See Section 01 6000 - Product Requirements.
- 2.05 Accessory Materials
 - A. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107/C1107M.
- 2.06 Bonding And Jointing Products
 - A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
 - B. Epoxy Bonding System:
 - 1. Complying with ASTM C881/C881M and of Type required for specific application.
 - C. Waterstops: Bentonite and butyl rubber, complying with NSF 61 and NSF 372.
 - D. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness.
 - 1. Material: ASTM D1751, cellulose fiber.
- 2.07 Evaporation Retarders
 - A. Evaporation Retarder: Liquid thin film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement. These products provide a protective film shield over plastic concrete, dissipate as soon as the concrete is no longer plastic, and are not curing products.
 - 1. Manufacturers:
 - a. Euclid Chemical Company ; EUCOBAR: www.euclidchemical.com/#sle.
 - b. SpecChem, LLC; SpecFilm Concentrate or SpecFilm: www.specchemllc.com/#sle.
 - c. W. R. Meadows, Inc ; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

2.08 Liquid Floor Treatments

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ChemMasters; Chemisil Plus.
 - b. ChemTec Int'l; ChemTec One.
 - c. Conspec by Dayton Superior; Intraseal.
 - d. Curecrete Distribution Inc.; Ashford Formula.
 - e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
 - f. Edoco by Dayton Superior; Titan Hard.
 - g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - h. Kaufman Products, Inc.; SureHard.
 - i. L&M Construction Chemicals, Inc.; Seal Hard.
 - j. Meadows, W. R., Inc.; LIQUI-HARD.
 - k. Metalcrete Industries; Floorsaver.
 - l. Nox-Crete Products Group; Duro-Nox.
 - m. Symons by Dayton Superior; Buff Hard.
 - n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
 - o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

2.09 Curing Materials

- A. Moisture-Retaining Sheet: ASTM C171.
 - 1. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
 - 2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.
- B. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.
- C. Water: Potable, not detrimental to concrete.

2.10 Concrete Mix Design

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete: Refer Structural General Notes for mix requirements for various classes of concrete.

2.11 Mixing

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 Examination

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 Preparation

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- E. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- F. In locations where new concrete is doweled to existing work, drill holes in existing concrete, clean out drilled holes, inject the adhesive indicated on drawings and/or General Notes, and insert steel dowels, all in accordance with adhesive manufacturer's installation instructions.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- G. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade in accordance with manufacturer's instructions, ASTM E1643, ASTM F710 and ACI 302.2R.
 - 1. Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
 - 2. Lap vapor retarder sheet over footings and seal to previously placed concrete foundations.
 - 3. Lap joints minimum 6 inches (150 mm).
 - 4. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
 - 5. No penetration of vapor retarder is allowed except for reinforcing steel and permanent utilities.
 - 6. Repair damaged vapor retarder before covering with other materials.
 - 7. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
- 3.03 Installing Reinforcement And Other Embedded Items
 - A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
 - B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
 - C. Verify that anchors, seats, plates, reinforcement, waterstops and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.
- 3.04 Placing Concrete
 - A. Place concrete in accordance with ACI 304R.
 - B. Place concrete for floor slabs in accordance with ACI 302.1R.
 - C. Notify Architect not less than 48 hours prior to commencement of placement operations.
 - D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
 - E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
 - F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- G. Finish slab-on-grade and shored elevated floors level and flat, unless otherwise indicated, within the tolerances specified below.
- 3.05 Slab Jointing
- A. Locate and install joints as indicated on drawings and Slab-On-Grade Schedule or as submitted by Contractor and approved by structural engineer.
 - B. Anchor joint fillers and devices to prevent movement during concrete placement.
 - C. Isolation Joints: Use preformed joint filler, total height equal to thickness of slab, set flush with top of slab.
 - 1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
 - D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
 - E. Saw Cut Contraction Joints: Saw cut joints shall be installed with early-entry dry-cut saw before concrete begins to cool, within 1 to 4 hours after completing the slab finishing operations; commence in approximately 1 hour in hot weather or approximately 4 hours in cold weather. Use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab. Refer to Slab-On-Grade Schedule in drawings for additional requirements.
- 3.06 Floor Flatness And Levelness Tolerances
- A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for compliance with specified tolerances.
 - B. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
 - 2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
 - 3. Under Carpeting: 1/4 inch in 10 feet.
 - C. Correct the slab surface if surface variations exceed specified tolerances.
 - D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.
- 3.07 Concrete Finishing
- A. Repair surface defects, including tie holes, immediately after removing formwork.
 - B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 - D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
 - 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 - 3. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.
 - 4. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
 - E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal (approximately 1/8 inch per foot).
- 3.08 Curing And Protection
- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
 - B. Uniformly apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss due to evaporation approaching 0.2 lb/sq.ft./h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing. A methodology for calculating the moisture loss due to evaporation is provided in ACI 305.1.
 - C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven (7) days.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- D. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- E. Surfaces Not in Contact with Forms:
 - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than seven (7) days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for seven (7) days.
 - b. Spraying: Spray water over floor slab areas and maintain wet.
 - c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
 - 2. Final Curing: The surface shall be protected against rapid moisture loss upon the termination of initial curing by replacing wet burlap or similar coverings with plastic sheets until the surface has dried under the sheets.
 - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

3.09 Liquid Floor Treatments

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 28 days old.
 - a. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.10 Field Quality Control

- A. An independent testing agency will perform Special Inspections and field quality control tests as required by

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

Chapter 17 of ICC (IBC)-2015. The testing outlined below includes some, but not all, of the testing and observations required to meet the Special Inspection provisions of the building code. Refer to the following parts of the structural drawings for additional Special Inspection requirements:

1. Statement of Special Inspection Notes
 2. Table 1705.3 titled "Required Special Inspections and Tests of Concrete Construction"
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit approved mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure four concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed each day.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. Air Content: ASTM C173/C173M, one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- I. Concrete Temperature: ASTM C1064/C1064M, one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
- J. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.11 Defective Concrete

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.12 Protection

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

DIVISION 4 - MASONRY

SECTION 04720 - Architectural Cast Stone

Part 1 - General

1.01 Scope:

- A. All labor, materials, and equipment to provide the Cast Stone shown on architectural drawings and as described in this specification.
- B. Manufacturer shall furnish and deliver Cast Stone covered by this specification.
- C. Setting contractor shall unload, store, furnish all anchors and set Cast Stone.

1.02 Quality Assurance:

- A. Shall be producer member of the Architectural Precast Association.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. ASTM C150 - Specification for Portland Cement
 - 2. ASTM C33 - Specification for Concrete Aggregates
 - 3. ASTM C979 - Specification for Coloring Pigments for Integrally Pigmented Concrete
 - 4. ASTM C494 - Specification for Concrete Admixtures
 - 5. ASTM A615 - Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
 - 6. ASTM C1194 - Tested Method for Compressive Strength of Architectural Cast Stone.
 - 7. ASTM C1195 - Test Method for Absorption of Architectural Cast Stone.
 - 8. ASTM C642 - Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.
 - 9. ASTM C39 - Test Method for Compressive Strength of Concrete Cylinders.
 - 10. ASTM D2244 - Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.
 - 11. ASTM C1364-97 - Standard specification for Architectural Cast Stone.
- C. Testing: Test three specimens per 500 cubic feet at random from plant production in accordance with referenced standards.

1.03 Submittals:

- A. Submit for approval the following:
 - 1. Samples of the Cast Stone specified which will be representative of the general range of color and finish to be furnished.
 - 2. Test results of Cast Stone previously made by the manufacturer.
- B. Shop Drawings: Submit for approval the following:
 - 1. Copies of shop drawings showing details of the stone to be provided including: profiles, cross-sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, annotation of stone types and their location.
 - 2. Unless otherwise shown on contract drawings:

DIVISION 4 - MASONRY

SECTION 04720 - Architectural Cast Stone

- a. Provide suitable wash on all exterior sills, coping, projecting courses and pieces with exposed top surfaces.
- b. Provide drips as needed.

Part 2 - Products

2.01 Materials:

- A. Architectural Cast Stone:
 1. Physical properties: Provide the following:
 - a. Compressive Strength, ASTM C1194: 6500 psi min. for products at 28 days.
 - b. Absorption, ASTM C1195: less than 6% max. for products at 28 days.
 2. Raw Materials:
 - a. Portland cement - Type I or III, white and/or gray, ASTM C150
 - b. Coarse aggregates - Granite, quartz, or limestone, ASTM C33
 - c. Fine aggregates - Manufactured or natural sands, ASTM C33
 - d. Colors - Inorganic iron oxide pigments, ASTM C979
 - e. Admixtures - ASTM C494
 - f. Water - potable

2.02 Color and Finish:

- A. Color: Refer to color schedule.
- B. Exposed surfaces, unless otherwise specified, shall exhibit a fine grained texture similar to natural stone. No bug holes or air voids shall be permitted.
- C. Variation:
 1. ASTM color variation allowed - 2%, hue: 6% lightness, chroma and hue combined.

2.03 Curing and Finishing:

- A. Cure units in a warm, moist curing chamber at 95% relative humidity for 24 hours, or yard cure for 350°-days (i.e. 7 days @ 50°F or 5 days @ 70°F) prior to packaging for shipment.

2.04 Reinforcing:

- A. New billet steel reinforcing bars - ASTM A615.
 1. Reinforce units when necessary for safe handling and structural stress.
 2. Reinforcement shall be galvanized or epoxy coated when covered with less than 1-1/2" of material.
 3. Area of reinforcement in panels shall be not less than 1/4 percent of the cross section area.

2.05 Related Materials:

- A. Anchors - non-corrosive: galvanized, brass or stainless steel type 304.
- B. Mortar - Type N, ASTM C270.

DIVISION 4 - MASONRY

SECTION 04720 - Architectural Cast Stone

Part 3 - Execution

3.01 Tolerances:

- A. Comply with Cast Stone Institute Technical Manual (current edition).
- B. Set stones 1/8" or less, within plane of adjacent unit.
- C. Joints, +1/16", -1/8".

3.02 Jointing:

- A. Joint Size:
 - 1. At stone/brick joints - 3/8".
 - 2. At stone/stone joints in vertical position - 1/4" (3/8" optional).
 - 3. Stone/stone joints exposed on top side - 3/8".
- B. Joint Material:
 - 1. Use a full bed of mortar at all bed joints.
 - 2. Flush vertical joints full with mortar.
 - 3. Leave all joints with exposed tops or under relieving angles open for sealant.
- C. Location of joints:
 - 1. As shown on approved shop drawings.
 - 2. Unless otherwise shown: at control and expansion joints refer to Drawings for locations.

3.03 Setting:

- A. Drench stones with clear, running water just prior to setting.
- B. Fill all dowel holes and anchor slots completely with mortar or non-shrink grout.
- C. Set all stones in a full bed of mortar. Leave head joints in coping and similar stones open for sealant.
- D. Rake mortar joints 3/4" for pointing. Sponge the face of each stone to remove excess mortar.
- E. Tuck point stone joints to a slight concave.
- F. Sealant joints - Prime the ends of stones, insert properly sized foam backup rod and gun-in sealant.
- G. Protect stone while on ground (and after setting) from splashing, mortar, and damage from other trades.

3.04 Cleaning and Repair:

- A. Clean stone by wetting with clear running water and applying a solution of acidic detergent recommended by the manufacturer.
- B. Repair obvious chips with touchup material furnished by the manufacturer.

3.05 Inspection and Acceptance:

- A. Inspect according to Cast Stone Institute Technical Manual.

End of Section

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.01 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 Summary

- A. Section Includes:
 - 1. Clay facing brick.
 - 2. Mortar and grout.
 - 3. Reinforcement and anchorage.
 - 4. Lintels.
 - 5. Accessories.

1.03 Related Sections:

- A. Section 05500 - Metal Fabrications: Loose steel lintels and fabricated steel items.
- B. Section 07900 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.04 References:

- A. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar; 2004.
- B. ASTM C 150 - Standard Specification for Portland Cement; 2005.
- C. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.
ASTM C 270 - Standard Specification for Mortar for Unit Masonry; 2007.
- D. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout; 2006.
- E. ASTM C 476 - Standard Specification for Grout for Masonry; 2002.

1.05 Submittals:

- A. Product Data: Provide data for masonry units, mortar, and masonry accessories.
- B. Samples: Submit 10 samples of facing brick units to illustrate color, texture, and extremes of color range.

1.06 Quality Assurance:

- A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents

1.07 Delivery, Storage, and Handling:

- A. Deliver, handle, and store masonry materials by means that will prevent mechanical damage and contamination by other materials.

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

1.08 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. 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.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.01 Face Brick (Veneer):

- A. Type and Finish: Velour Modular Brick - match existing adjacent ticket booth - coordinate with Architect.
- B. Quality: ASTM C-216, Type FBS.
- C. Size: match existing.
- D. Units shall be uniform in all dimensions and texture, straight and free from cracks, spalls and other defects.
- E. Color: refer to Color Schedule - match existing.

2.02 Mortar and Grout Materials:

- A. Portland Cement: ASTM C 150, Type I.
 - 1. Hydrated Lime: ASTM C 207, Type S.
 - 2. Mortar Aggregate: ASTM C 144.
 - 3. Grout Aggregate: ASTM C 404.
- B. Water: Clean and potable.

2.03 Reinforcement and Anchorage:

- A. Manufacturers of Joint Reinforcement and Anchors:
 - 1. Dur-O-Wal: www.dur-o-wal.com.
 - 2. Hohmann & Barnard, Inc: www.h-b.com.
 - 3. Masonry Reinforcing Corporation of America: www.wirebond.com.
 - 4. Substitutions: as approved by Architect / Engineer.
- B. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
2. Wire ties: Triangular shape, 0.1875 inch thick.
3. Vertical adjustment: Not less than 3-1/2 inches.

2.04 Flashings (where applicable):

- A. Metal Flashing Materials: Galvanized Steel as specified in Section 07600.

2.05 Accessories (where applicable):

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35%; formulated from neoprene, urethane or PVC.
- C. Bond Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type 1 (No. 15 asphalt felt).
- D. Weeps: Free-draining mesh made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe.
 1. Manufacturers:
 - a. Mortar Net USA, Ltd; Product - Mortar Net Weep Vents: www.martarnet.com
 - b. Substitutions: as approved by Architect / Engineer.

Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 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: ASTM C 270, using the Proportion Specification.
 1. All masonry: Type S.
 - a. Portland Cement Mixture: One part Grey Portland Cement; 1/4 to 1/2 part lime; sand, not less than 2-1/4 and not more than three times the sum of

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

the volumes of cement and lime used, measured in damp, loose conditions.

b. Colors at exterior face brick veneer and mortar to be selected by Architect to match existing.

- C. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout 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 measure according to ASTM C 143/C 143M.
- D. Mortar Mixing
 - 1. All mortars shall be machine mixed in equipment that is free of dirt, oil or grease and which is thoroughly cleaned and rinsed after each day's use. Mix no more mortar than can be used before setting takes place.
 - 2. Mortars shall be mixed placing all dry ingredients in the mixer first and mixing until uniform in color. Then mixed for 3 to 5 minutes with the maximum amount of water to provide workable consistency.
 - 3. No add-mixtures shall be used at any time in the mortar on this project, unless approved in writing by the Engineer.
 - 4. A waterproofing additive will be used in the mortar for brick.
 - 5. Construct one or two wooden boxes 12"x12"x6" deep and use them to measure the sand required in a batch. Add the cement or lime by the bag. Then add water, measuring by pail. When the desired consistency of mix is determined, mark the level of the mortar in the mixing drum. Use that as the mark for later batches when sand will be added by the shovel full. Repeat the measuring process halfway through the day or whenever the inspector requests it.
 - 6. Testing: General Contractor will observe a minimum of three (3) observed mixing sessions to verify that the quantities are being mixed as described in the proportions paragraph for Type "S" mortar.

PART 3 - EXECUTION

3.01 Examination:

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

properly sized and located.

- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 Erection:

- A. Construction Requirements (Masonry Being Worked On)
 - 1. Air Temperature 40 F to 32 F: Heat sand or mixing water to minimum of 70 F and maximum of 160 F.
 - 2. Air Temperature 32 F to 25 F: Heat sand and mixing water to minimum of 70 F and maximum of 160 F.
 - 3. Air Temperature 25 F to 20 F: Heat sand and mixing water to minimum of 70 F and maximum of 160 F. Use salamanders or other sources of heat on both sides of walls under construction. Employ windbreaks when wind is in excess of 15 mph.
 - 4. Air Temperature 20 F and Below: Heat sand and mixing water to minimum of 70 F and maximum of 160 F. Provide enclosure and auxiliary heat to maintain air temperature above 32 F. Temperature of units when laid shall be not less than 20 F.
- B. Protection Requirements (Completed Masonry or Sections Not Being Worked On)
 - 1. Mean Daily Air Temperature 40 F to 32 F: Protect masonry from rain or snow for 24 hrs.
 - 2. Mean Daily Air Temperature 32 F to 25 F: Completely cover masonry for 24 hrs.
 - 3. Mean Daily Air Temperature 25 F to 20 F: Completely cover masonry with insulating blankets for 24 hrs.
 - 4. Mean Daily Air Temperature 20 F and Below: Maintain masonry temperature above 32 F for 24 hrs. by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps or other approved method.
- C. No masonry shall be laid when the ambient temperature is below 40 degrees F. All masonry shall be laid plumb, true to line and level, with accurately spaced courses, with each course breaking joints with the course below, unless noted otherwise on the drawings. A story pole and template shall be used and work checked with a surveying instrument to maintain level coursing.
- D. Work required to be built into masonry, including anchors, frames, bolts, sleeves, inserts, compressible fillers, expansion joints and flashing shall be built in as erection progresses.
- E. Lintels shall be provided where shown and for all openings

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

in masonry work where other types of lintels have not been provided. Lintels shall bear not less than six inches (6") on each jamb.

- F. Brick: Provide a 3/8" mortar bed with concave tooled horizontal and vertical joints. Refer to drawings for vertical coursing as related to openings and other features. Brickwork is to be brushed down daily to remove large pieces of mortar slag. At completion of brick masonry work, all exposed masonry surfaces shall be thoroughly cleaned and washed down with clean water and a stiff bristled brush or as recommended by the brick manufacturer and as approved by the Design/Builder. The brick masonry work shall be left in a state exhibiting properly and fully pointed joints and completely clean surfaces. Subcontractor shall build-in all features of brickwork as shown or indicated on the drawings including weeps, special coursing and or patterned elements.
- G. The Subcontractor shall be responsible for furnishing all required labor, tools, and equipment as required to complete all areas of masonry work on the project. This shall be inclusive of all scaffolding, walk-boards and bracing as required to support the work until fully incorporated into the structure.
- H. Subcontractor shall also furnish all materials save for the brick units as called out above. These materials include concrete block, mortar, reinforcing, ties and other accessories necessary for the execution of the masonry work.

3.03 Preparation:

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.04 Coursing:

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

3.05 Placing and Bonding:

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Masonry work shall be laid true to dimensions, plumb, square and in bond and properly anchored with vertical joints in line, plumb and true.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- D. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- E. Remove excess mortar and mortar smears as work progresses.
- F. Interlock intersections and external corners.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Provide a 3/8" joint around hollow metal door jambs and window frames to allow for sealant and expansion.

3.06 Weeps/Cavity Vents:

Install weeps in veneer walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.07 Reinforcement and Anchorage - General:

- A. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.
- B. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches around perimeter.
- C. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

3.08 Reinforcement And Anchorage - Masonry Veneer:

- A. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.09 Masonry Flashings:

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 4 inches into adjacent masonry or turn up at least 4 inches to form watertight pan at non-masonry construction.
 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.
- C. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.
- 3.10 Lintels:
- A. Install loose steel lintels over openings.
- 3.11 Control Joints:
- A. Do not continue horizontal joint reinforcement through control joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joint in accordance with Section 07900 for sealant performance.
- 3.12 Built-In Work:
- A. As work progresses, install items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Do not build into masonry construction organic materials that are subject to deterioration.
- 3.13 Tolerances:
- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.
- 3.14 Cutting And Fitting:
- A. Cut and fit for pipes and conduit. Coordinate with other

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

sections of work to provide correct size, shape, and location.

- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 Cleaning:

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.

3.16 Protection Of Finished Work:

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

End of Section

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 Section Includes

- A. Structural steel framing members.
- B. Base plates, shear stud connectors and anchor rods.
- C. Grouting under base plates.

1.02 Related Requirements

- A. Section 05 2100 - Steel Joist Framing.
- B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.
- C. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 Reference Standards

- A. For all reference standards listed below, comply with the version year in the governing building code adopted by the Authority Having Jurisdiction. For those reference standards that are not directly referenced by the building code, use the latest edition unless noted otherwise.
- B. AISC (MAN) - Steel Construction Manual.
- C. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
- D. AISC 360 - Specification for Structural Steel Buildings.
- E. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
- F. ASTM A29/A29M - Standard Specification for Steel Bars, Carbon Alloy, Hot-Wrought, General Requirements.
- G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- J. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- K. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- L. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- M. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- N. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
- O. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric).

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

- P. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 - Q. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
 - R. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - S. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
 - T. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film.
 - U. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.
 - V. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry.
 - W. ASTM E709 - Standard Guide for Magnetic Particle Testing.
 - X. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
 - Y. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 - Z. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - AA. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - AB. AWS D1.1/D1.1M - Structural Welding Code - Steel.
 - AC. ICC (IBC)-2015 - International Building Code.
 - AD. MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.
 - AE. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.
 - AF. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
 - AG. SSPC-SP 3 - Power Tool Cleaning.
 - AH. SSPC-SP 6 - Commercial Blast Cleaning.
- 1.04 Submittals
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
 - B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections.
 - 3. Indicate cambers and loads.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Product Data: For shop primers, include manufacturer's technical information including basic materials analysis and application instructions.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- F. Delegated Connection Design Submittal: Provide delegated connection design submittals as required by the General Notes included in the Project Drawings.
- G. Erection Sequence: Provide erection sequence submittal as required by the General Notes included in the Project Drawings.

1.05 Quality Assurance

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Fabricator Qualifications:
 - 1. A steel fabricator specializing in performing the work of this section with minimum 10 years of experience.
- C. Erector Qualifications:
 - 1. An erector specializing in performing the work of this section with minimum 5 years of experience.
- D. Delegated Connection Designer Qualifications: Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of steel connections and licensed in the State in which the Project is located.

1.06 Delivery, Storage And Handling

- A. Comply with the requirements of the General Conditions and of ASTM A6/A6M, including the following.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.01 Materials

- A. Steel Angles, Plates, and Channels: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.
- D. Pipe: ASTM A53/A53M, Grade B, Finish black.
- E. Headed Stud Anchors: AWS D1.1 Type B, ASTM A29 Grades 1010 through 1020.
- F. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M, Class C.
- G. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade C heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- H. Tension Control Bolts: Twist-off type: ASTM F1852.
- I. Unheaded Anchor Rods: ASTM F1554, Grade 55, Supplementary Requirement S1, Weldable, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436/F436M Type 1 washers.
- J. Deformed Bar Anchors: AWS D1.1/D1.1M Type C, ASTM A1064 Grade 70.
- K. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- L. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 1. Minimum Compressive Strength at 48 Hours: 3000 pounds per square inch.
 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
 3. Height Change, Plastic State; when tested according to ASTM C827/C827M:
 - a. Maximum: Plus 4 percent.
 - b. Minimum: Plus 1 percent.
- M. Shop and Touch-Up Primers: As required below, complying with VOC limitations of authorities having jurisdiction.
 1. Steel Exposed to Exterior Weather or an Uncontrolled Environment: Two-component, high performance, zinc-rich, aromatic urethane, compatible with topcoat and complying with SSPC-Paint 20.

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

- 2. Interior Steel: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI #79 and compatible with topcoat.
- N. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
- 2.02 Fabrication
 - A. Shop fabricate to greatest extent possible. Fabricate according to AISC 303 and to AISC 360.
 - B. Fabricate connections for bolt, nut, and washer connectors.
 - C. Develop required camber for members.
 - D. Fabricated uncambered beams with rolling camber up.
- 2.03 Finish
 - A. Prepare structural component surfaces in accordance with SSPC-SP3 for interior steel or SSPC-SP6 for all steel exposed to exterior weather or an uncontrolled environment.
 - B. Shop prime structural steel members:
 - 1. Do not prime surfaces that will be galvanized, fireproofed, field welded, in contact with concrete, or [in slip surfaces of slip-critical connections].
 - 2. All steel exposed to exterior weather or an uncontrolled environment shall be blast cleaned and primed with a submitted and approved zinc-rich primer.
 - 3. Interior steel shall be shop primed with the fabricators standard shop primer.
 - C. Galvanize structural steel members to comply with ASTM A123/A123M.
- 2.04 Source Quality Control & Quality Assurance
 - A. Unless the fabricator is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel, an independent testing agency will perform Special Inspections and field quality control and quality assurance tests in the fabricator's shop as required by Chapter 17 of ICC (IBC)-2015 and Chapter N of AISC 360. Refer to the following parts of the structural drawings for additional Special Inspection requirements.
 - 1. Statement of Special Inspection Notes
 - 2. Two tables titled "Required Verification and Inspection of Steel Construction"

PART 3 - EXECUTION

- 3.01 Examination
 - A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

3.02 Erection

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing. Refer to the "Construction Loads and Stability" section of the General Notes in the Project Drawings for additional information and requirements.
- C. Field weld components, deformed bar anchors and shear studs indicated on shop drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
- E. Do not field cut or alter structural members without approval of Structural Engineer.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for non-shrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 Field Quality Control & Quality Assurance

- A. An independent testing agency will perform Special Inspections and field quality control and quality assurance tests as required by Chapter 17 of ICC (IBC)-2015 and Chapter N of AISC 360. Refer to the following parts of the structural drawings for additional Special Inspection requirements:
 - 1. Statement of Special Inspection Notes
 - 2. Two tables titled "Required Verification and Inspection of Steel Construction"

END OF SECTION

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 Summary

- A. This Section includes the following:
 - 1. Exterior non-load-bearing wall framing.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.

1.03 Performance Requirements

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: Design loads shall be calculated components and cladding load per ASCE/SEI 7 edition indicated on the drawings.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of wall height at areas backing up brick veneer, and 1/240 of wall height at areas backing up other materials.
 - 3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.04 Submittals

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging,

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

splices, accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Research/Evaluation Reports: For cold-formed metal framing.

1.05 Quality Assurance

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.06 Delivery, Storage, And Handling

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.02 Materials

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: ST33H (ST230H).
 2. Coating: G60 (Z180).
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: 50 (340), Class 1 or 2.
 2. Coating: G90 (Z275).

2.03 Exterior Non-Load-Bearing Wall Framing

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0428 inches (1.09 mm).
 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inches (1.37 mm)
 2. Flange Width: 1-1/2 inches.
- C. Vertical Deflection Clip Option: Manufacturer's standard head clips, capable of accommodating upward and downward

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
 - D. Single Deflection Track Option: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 2. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
 - E. Double Deflection Track Option: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 - b. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 - b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.
- 2.04 Framing Accessories
- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
 - B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.05 Anchors, Clips, And Fasteners

- A. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C or mechanically deposition according to ASTM B 695, Class 50.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.06 Miscellaneous Materials

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.07 Fabrication

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.01 Examination

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Installation, General

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

3.03 Exterior Non-Load-Bearing Wall Installation

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Fast both flanges to top track if required by deflection option selected. Space studs as follows:
 - 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Single Deflection Track Option: Install single-leg deflection tracks and anchor to building structure.
 - 2. Double Deflection Track Option: Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Deflection Clip Option: Connect vertical deflection clips to infill studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track Option: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at maximum 96-inch (2440-mm) centers and as shown on approved Shop Drawings.
 - 2. Bridging Options:
 - a. Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - b. Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - c. Proprietary bridging bars installed according to manufacturer's written instructions.

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.04 Field Quality Control

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 Repairs And Protection

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures the cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

DIVISION 5 - STRUCTURAL STEEL

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 Section Includes

- A. Shop fabricated steel items.

1.02 Related Requirements

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
- D. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
- ~~E. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.~~
- ~~F. Section 05 5100 - Metal Stairs.~~

1.03 Reference Standards

- A. For all reference standards listed below, comply with the version year in the governing building code adopted by the Authority Having Jurisdiction. For those reference standards that are not directly referenced by the building code, use the latest edition unless noted otherwise.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- K. MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.
- L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

DIVISION 5 - STRUCTURAL STEEL

SECTION 05500 - METAL FABRICATIONS

1.04 Submittals **SPECIAL CONDITIONS**

- A. See ~~Section 01 3000~~ - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
 - a. Include the following, as applicable:
 - 1) Design criteria.
 - 2) Engineering analysis depicting stresses and deflections.
 - 3) Member sizes and gauges.
 - 4) Details of connections.
 - 5) Support reactions.
 - 6) Bracing requirements.

PART 2 - PRODUCTS

2.01 Materials - Steel

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- G. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: As required below, complying with VOC limitations of authorities having jurisdiction.
 - 1. Steel Exposed to Exterior Weather or an Uncontrolled Environment: Two-component, high performance, zinc-rich, aromatic urethane, compatible with topcoat and complying with SSPC-Paint 20.
 - 2. Interior Steel: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI #79 and compatible with topcoat.

DIVISION 5 - STRUCTURAL STEEL

SECTION 05500 - METAL FABRICATIONS

- J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

2.02 Fabrication

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 Fabricated Items

- A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and joists; prime paint finish.
- B. Lintels: As detailed; prime paint finish.
- C. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.
- D. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.
- E. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

2.04 Finishes - Steel

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP3 for interior steel or SSPC-SP6 for all steel exposed to exterior weather or an uncontrolled environment.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 Fabrication Tolerances

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.

DIVISION 5 - STRUCTURAL STEEL

SECTION 05500 - METAL FABRICATIONS

- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 - EXECUTION

3.01 Examination

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 Preparation

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 Installation

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 Tolerances

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

DIVISION 6 - WOOD & PLASTIC

SECTION 06100 - ROUGH CARPENTRY

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Wood Treatment - Section 06300

1.03 Quality Assurance:

- A. Grades specified shall conform to the most recent grading rules as established by the following bureaus and associations.
 - 1. PS 20 - American Softwood Lumber Standard.
 - 2. Western Wood Products Association
 - 3. Southern Pine Inspection Bureau
- B. Grade and trade mark each piece of lumber or bundle on bundled stock. Use only the recognized official marks of association under whose rules it is graded. Grade and trade marks will not be required if each shipment is accompanied by certificate of inspection issued by grading association.

1.04 Submittals:

- A. Product Data: for each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing and finishing treated material.
 - 2. As requested by authorities having jurisdiction include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials both before and after exposure to elevated temperatures when tested according to ASTM D5516 and ASTM D 5664.
 - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

DIVISION 6 - WOOD & PLASTIC

SECTION 06100 - ROUGH CARPENTRY

4. Research / evaluation reports - for the following, showing compliance with building code in effect for Project:
 - a. Fire-retardant treated wood.
 - b. Power-driven fasteners.
 - c. Power-actuated fasteners.
 - d. Expansion anchors.
 - e. Metal framing anchors.

1.05 Delivery, Storage and Handling:

- A. Stack lumber, plywood, sheathing, and other materials: provide spacers between each bundle to provide air circulation around bundled material. Provide proper air circulation between stacks and under coverings.

Part 2 - Products

2.01 General:

- A. Provide best quality of respective grades and kinds. Lumber and plywood shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship". Factory mark each piece of lumber with grade stamp of grading agency.
- B. Maximum moisture content of lumber 19%.
- C. Provide dressed lumber (S4S) unless otherwise indicated.
- D. Where nominal sizes are indicated, provide actual sized required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

2.02 Grades and Applications of Lumber:

- A. Framing lumber for the following shall be "Standard" grade Douglas Fir (WCLIB or WWP).
 1. Concealed blocking/nailers, cants, grounds, and miscellaneous wood items used in conjunction with the roofing work and as indicated on the Drawings.
 2. Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the Grading Agency indicated.

2.03 Fire-retardant Treated Materials:

- A. General - where fire-retardant treated materials are required by authorities having jurisdiction, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant treated wood with appropriate classification

DIVISION 6 - WOOD & PLASTIC

SECTION 06100 - ROUGH CARPENTRY

marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

2.04 Panel Products:

- A. Miscellaneous Concealed Plywood: shear wall sheathing, span rating to suit framing in each location, and thickness indicated. Refer to Structural Drawings.
- B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, C-D Plugged, fire-retardant treated, in thickness indicated, or if not indicated, not less than ½ inch thick.

2.05 Fasteners:

- A. All nails, spikes, bolts, connectors and other fasteners used in connections with this work shall be galvanized.
 - 1. Nails, wire, brads and staples - FS-FF-N-105.
 - 2. Power-driven Fasteners - CABO NER-272.
 - 3. Wood screws - ASME B18.6.1.
 - 4. Screws for fastening to cold formed metal framing: ASTM C954 length as recommended by screw manufacturer for material to be fastened.
 - 5. Lag bolts - ASME B18.2.1.
 - 6. Bolts - steel bolts complying with ASTM A 307, Grade A with ASTM C563 hex nuts and, where indicated, flat washers.
 - 7. Expansion anchors - anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material for interior applications: carbon steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - b. Material for exterior applications: stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, alloy group 1 or 2.

2.06 Metal Framing Anchors:

- A. General: provide galvanized steel framing anchors of structural capacity, type, and size indicated and acceptable to authorities having jurisdiction.
- B. Galvanized Steel Sheet: hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

DIVISION 6 - WOOD & PLASTIC

SECTION 06100 - ROUGH CARPENTRY

Part 3 - Execution

3.01 Sizes and Applications (General Framing):

- A. Members shall be accurately cut and fitted, true to line and level, avoiding shims and wedges as much as possible. Discard material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Where applicable, apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- C. At wood ground, blocking and nailer installation: install where indicated and required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- D. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless noted otherwise.

3.02 Rough Hardware:

- A. Provide all sufficient nails, screws, etc. to insure rigidity and structural soundness. Provide hot-dipped galvanized fasteners at all weather exposed locations.
- B. Spiking and nailing shall be done using largest size spikes and nails practicable and as indicated on the drawings. Securely attach carpentry according to applicable codes and recognized standards.
- C. Bolt nailers and blocking to steel or concrete members with bolts of proportionate strength of members attached, length required, spaced 4'-0" o.c. maximum and 4" from each end, except as otherwise indicated. Countersink fastener heads on exposed carpentry work and fill holes with wood fiber.
- D. Predrill members when necessary to avoid splitting of wood.

3.03 Panel Product Installation:

- A. Wood structural panels: comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential and Commercial", for types of structural-use panels and applications indicated. Comply with "Code Plus" provisions in above referenced guide.

End of Section

DIVISION 6 - WOOD & PLASTIC

SECTION 06300 - WOOD TREATMENT

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. American Wood Preservers Association:
 - a. AWPA Standard P-5 (Preservative)
 - b. AWPA Standard Commodity Standards (Treating Process).
 - 2. Federal Specifications:
 - a. TT-W-550 (Preservative).
 - b. TT-W-571 (Treating Process).
- B. All lumber and plywood receiving wood treatment shall bear the trademark of the process used.
- C. Submit certificate and guarantee of the lumber treated.

Part 2 - Products

2.01 Materials:

- A. Description: Waterborne chemical salts intended for pressure impregnation as a wood preservative. Preservatives with a petroleum vehicle are not permitted.

Part 3 - Execution

3.01 Installation:

- A. Location of treated lumber:
 - 1. All blocking, plates, nailers and curbs used in conjunction with gravel guards, roof edges and all other wood components used in the roofing project.
- B. Materials shall be pressure treated in accordance with the standards of the American Wood Preservers Institute and the chemical manufacturer's specifications.
- C. Treated material shall conform to AWPB LD-2 and treated to a maximum retention of 0.23 pound of oxide per cubic foot.
- D. Moisture content of finish products shall not exceed 19%.

End of Section

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07600 - FLASHING AND SHEET METAL

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Modified Bitumen Membrane Roofing System - Section 07550
- B. Sealants - Section 07900

1.03 Quality Assurance:

- A. Standards:
 - 1. American Society of Testing and Materials
 - a. ASTM A-526, Steel Sheet, Zinc-Coated (Galvanized), Commercial Quality.
 - b. ASTM B-32, Solder Metal
 - 2. Federal Specifications:
 - a. SS-C-153B, Cement, Bituminous, Plastics
 - 3. Sheet Metal and Air Conditioning Contractors National Association:
 - a. Architectural Sheet Metal Manual

1.04 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

- A. Prefinished Sheet Metal Gutters and Downspouts, and Prefinished Metal Edge Trim/Flashing:
 - 1. Galvanized iron, prefinished one side.
 - 2. Gauge: 24 gauge, of design and width as detailed.
 - 3. Acceptable manufacturer: Color Klad - Vincent Brass and Aluminum Co.
 - 4. Finish: Kynar 500 - match prefinished composite wall panel system at adjacent ticket booth as selected by Architect.
- B. Sheet Metal:
 - 1. Galvanized Sheet Steel: ASTM A-526, Commercial Quality.
 - 2. Gauge: 22 Gauge minimum or as required by Drawings or Specifications.
- C. Fasteners: Nails, screws, and other fasteners used in conjunction with this work shall be galvanized or cadmium plated and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07600 - FLASHING AND SHEET METAL

sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- D. Solder: ASTM B-32, alloy grade 58, 50% tin, 50% lead.
- E. Flux: Muriatic acid with zinc.
- F. Sealants: Rubber based compound - refer to Section 07900.
- G. Bituminous Plastic Cement: FS SS-C-153B.
- H. Accessories: Provide accessories as recommended by manufacturer or as indicated on Drawings.
- I. Underlayment Materials: Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
- J. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, non-staining tape 112 inch wide and 118 inch thick.

Part 3 - Execution

3.01 Fabrication:

- A. Shape and install sheet metal as indicated on Drawings. Comply with recommendations of SMACNA "Architectural Sheet Metal Manual."
- B. Form exposed faces flat and free of buckles, excessive wave and tool marks. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07600 - FLASHING AND SHEET METAL

- C. Hem all exposed edges.
- D. Make waterproof corner joints by soldering solidly. Joints shall be full-lapped.
- E. Soldering: Shall be done slowly with well heated coppers to thoroughly heat the sheet and completely sweat the solder through the full width of the seam. Ample solder shall be used and the seam shall show a least one full inch of evenly flowed solder. Soldering coppers: Shall be heavy and blunt design, properly tinned before using. Neutralize all excess flux.
- F. Provide for thermal expansion of running trim, flashing and other items exposed for more than 15'-0" continuous length. Locate expansion seams at 10'-0" intervals and 2'-0" each side of corners and intersections.
- G. Angle bottom edges of exposed vertical surfaces to form drips.
- H. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- I. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.
- J. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- K. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

3.02 Installation and Application:

- A. General:
 - 1. Furnish those items to be installed by other trades to proper grade for installation.
 - 2. Cooperate with and coordinate installation of sheet metal with wall panel masonry work.
 - 3. Install work watertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07600 - FLASHING AND SHEET METAL

complete sheet metal flashing and trim system.

- a. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - b. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - c. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - d. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - e. Install sealant tape where indicated.
 - f. Torch cutting of sheet metal flashing and trim is not permitted.
4. Embed all flashing in plastic cement. Coat dissimilar metals from contact with bituminous coating.
- B. Metal Protection: Embed all flashing in plastic cement. Coat dissimilar metals from contact with bituminous coating. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Coat back side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07600 - FLASHING AND SHEET METAL

- E. Seal joints as shown and as required for watertight construction.
 - F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel sheet.
 - 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - 4. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.
 - G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.
- 3.03 Cleaning and Protection:
- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
 - B. Clean and neutralize flux materials. Clean off excess solder and sealants.
 - C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in the manufacturer's written installation instructions.

End of Section

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07900 - SEALANTS

Part 1 - General

1.01 Work Included:

- A. All materials, labor services, and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. TT-S-00230C, Sealing Compound, One Component.
 - 2. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.03 Submittals:

- A. Submit manufacturer's specifications and color chart for each type of sealant.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- D. Product test reports.
- E. Preconstruction compatibility and adhesion test reports.
- F. Preconstruction field-adhesion test reports.
- G. Field-adhesion test reports.

1.04 Warranty:

- A. All work done under this section of the work shall be guaranteed for a period of two years from date of final acceptance of the building. Guarantee shall include materials and workmanship required to repair any leaks or the repairs thereof.
- B. Special Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section for a period of 10 years from date of final acceptance.

1.05 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

- A. Building Sealant: One part high performance polyurethane waterproofing sealant, FS-TT-S-00230C.
 - 1. Acceptable Manufacturer: Sonneborn NP1 Building Sealant.
 - 2. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07900 - SEALANTS

comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- a. Architectural Sealants: 250 gIL.
- b. Sealant Primers for Nonporous Substrates: 250 gIL.
- c. Sealant Primers for Porous Substrates: 775 gIL.
3. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - a. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
4. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
5. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- B. Silicone Joint Sealants:
 1. Mildew-Resistant Neutral-Curing Silicone Joint Sealant: ASTM C 920.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. BASF Building Systems.
 2. Dow Corning Corporation.
 3. GE Advanced Materials - Silicones.
 4. Pecora Corporation.
 5. Sika Corporation; Construction Products Division.
 6. Tremco Incorporated.
- C. Urethane Joint Sealants: Urethane Joint Sealant: ASTM C 920.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07900 - SEALANTS

- include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Lymtal, International, Inc.
 - d. Pecora Corporation.
 - e. Sika Corporation; Construction Products Division.
 - f. Tremco Incorporated.
- D. Latex Joint Sealants: Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Pecora Corporation.
 - d. Tremco Incorporated.
- E. Preformed Joint Sealants: Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior Specialty Chemicals.
 - b. EM SEAL Joint Systems, Ltd.
 - c. Sandell Manufacturing Co.
 - d. Schul International, Inc.
 - e. Willseal USA, LLC.
- F. Acoustical Joint Sealants: Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation.

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07900 - SEALANTS

- b. USG Corporation.
- G. Joint Sealant Backing: cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type 0 (open-cell material) or any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.
- H. Miscellaneous Materials: as recommended by sealant manufacturer.
 - 1. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
 - 2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
 - 3. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
 - 4. Joint Cleaner
 - 5. Joint Primer/Sealer
 - 6. Bond Breaker Tape
 - 7. Joint Backer-Rod: Closed-cell compressible rod stock, size and shape as required by application.
- I. Caulking compound: Watertight, gun consistency, conforming to FS-TT-C-598, Type 1.
- J. Accessories: As recommended by sealant manufacturer.
- K. Color: to be selected from manufacturer's standard colors.

Part 3 - Execution

- 3.01 Preparation:
 - A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07900 - SEALANTS

manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.02 Installation: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

- A. Do not leave gaps between ends of sealant backings.
- B. Do not stretch, twist, puncture, or tear sealant backings.
- C. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- G. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.
- H. Clean off excess sealant or sealant smears adjacent to

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07900 - SEALANTS

joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.03 Joint Sealant Schedule:

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non traffic surfaces.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal non-traffic surfaces.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal non traffic surfaces.

3.04 Additional Information:

- A. Application: All sight exposed caulking, and all exterior applications.
- B. Comply with sealant manufacturer's printed instructions.
- C. Any surfaces requiring priming, shall be prepared according to manufacturer's recommendations.
- D. Install sealants to depths as shown or as recommended by sealant manufacturer. Smooth uneven surfaces.
- F. Do not disturb compound by touching, washing, or otherwise until it has cured tack free.
- G. Excess compound shall be removed from surfaces after curing.
- H. Follow manufacturer's recommendations for painting over sealant.

End of Section

DIVISION 9 - FINISHES

SECTION 09900 - PAINTING

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this entire section of the work.
- B. Consult Drawings, finish schedules, details and specification section.

1.02 Quality Assurance:

- A. All painted surfaces shall be uniform in color, texture and finish to the satisfaction of the Architect.

1.03 Submittals:

- A. Submit manufacturer's specifications, including paint label analysis and application instructions for each material specified.
- B. Submit color samples for review of color and texture.
- C. Provide samples of all natural and stained wood finishes.
- D. Final samples: Prepare samples of finishes on the job to the satisfaction of the Architect. If required, a 4' x 8' portion of wall surface finished as final sample.

1.04 Product Deliver, Storage and Handling:

- A. Materials shall be delivered to the project site in strong, undamaged, waterproof containers with manufacturer's label intact. Materials in previously opened or unsealed containers, are not acceptable.
- B. Include on label of container: Manufacturer's name, type of paint, number and application instructions.
- C. Immediately upon delivery to the project site, all painter materials shall be stored and locked in a watertight shed with floor well off the ground. The shed shall remain locked at all times except for adding or removing materials.
- D. No materials of any manufacturer will be allowed on the project site any time during construction except those of the manufacturers specified or approved by the Architect.

1.05 Job Conditions:

- A. Comply with manufacturer's recommendations as to environmental conditions under which coating and coating systems can be applied.
- B. Do not apply finishes in areas where dust is being generated or where work in progress may affect finish quality.
- C. Protect finished work of other trades, and all surfaces not being painted concurrently, or not to be painted.

Part 2 - Products

2.01 General:

- A. The following specifications for Finishes is not intended to mention every particular item which will receive painter finish, but is intended to establish type and quality of finish which shall be required on various materials.
- B. **Products of Sherwin-Williams are specified herein to simplify descriptions of types and qualities of finishes required only.**

DIVISION 9 - FINISHES

SECTION 09900 - PAINTING

Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.

- C. Wherever the abbreviation "SW" appears in the following detailed specification, it shall be understood to mean Sherwin-Williams.
- D. Primers shall be as specified by manufacturers of finish paint used and as approved by the Architect.
- 2.02 Acceptable Manufacturers:
 - A. Sherwin-Williams.
 - B. PPG Industries.
 - C. Cook Paint and Varnish Co.
 - D. Pratt and Lambert.
 - E. Kelly-Moore.
- 2.02 Exterior Finishes:
 - A. Enamel on Ferrous Metals:
 - 1. One coat SW Kem Kromik Primer, (Alkyd primer).
 - 2. Two coats SW Industrial Enamel, (Alkyd gloss enamel).
 - B. Enamel on Galvanized Metal:
 - 1. One Coat SW Galvite primer.
 - 2. 2 Coats SW Industrial Enamel, (Alkyd gloss enamel).
- 2.03 Interior Finishes:

Not applicable.

Part 3 - Execution

- 3.01 Inspection:
 - A. Notify Contractor of any surface not in proper condition to be finished before proceeding with the work. Starting work will constitute the painter's acceptance of preceding work, and conditions under which finish will be applied and his assumption of responsibility for results to be obtained.
- 3.02 Preparation of Surfaces:
 - A. Wood:
 - 1. Sand to a smooth even surface, then dust off.
 - 2. Touch-up knots, resinous spots, etc., on all surfaces with shellac 18 hours before applying prime coat.
 - 3. Fill nail holes, cracks and blemishes flush after priming coat has dried.
 - B. Ferrous Metal Surfaces:
 - 1. Remove rust and scale, clean grease or oil surfaces with turpentine or benzine before painting.
- 3.03 Application:
 - A. Number of coats and quality of finish shall be in accordance with these specifications, which requires the use of material which will product first quality finish if properly applied.
 - B. Apply coats of material in strict accordance with manufacturer's currently published specifications, except where requirements of these specifications are in excess or manufacturer's requirements.
 - C. Except as otherwise approved by the Architect, the first two

DIVISION 9 - FINISHES

SECTION 09900 - PAINTING

- coats of painter's finish shall be applied by roller or brush application. Finish coats may be applied by spray application.
- D. Comply with recommendation of product manufacturer for drying time between succeeding coats allow additional as required until finish is dry.
 - E. All work where a coat of material has been applied must be inspected and approved before application of succeeding coat, otherwise, no credit for the coat will be given. Notify Architect when a particular coat has been completed for inspection and approval.
 - F. Shellacs, oils, turpentine, etc., shall be of the highest quality and subject to approval of Architect. Materials shall be mixed in and applied directly from containers which they are purchased except when use of other containers is approved.
 - G. First Coat of all finishes, except of varnish and stains, shall be white.
 - H. Sand lightly between coats where shellac, varnish or enamel is used.
 - I. Remove all hardware, accessories, machined surfaces, and similar items in place and not to be finish-painted or provide surface-applied protection prior to surface preparation and painting operations.
- 3.04 Clean-up:
- A. Clean and paint spots from work and touch-up or otherwise repair any defective or damaged work.
 - B. Remove all surplus materials and equipment after work is completed.
 - C. Leave entire job clean and acceptable to the Architect.

End of Section

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 323119 - FENCES AND GATES

PART 1 - GENERAL

1.01 WORK INCLUDED

The contractor shall provide all labor, materials and appurtenances necessary for installation of the welded ornamental steel fence system.

1.02 RELATED WORK

Section 02200 - Earthwork

Section 03300 - Concrete

1.03 SYSTEM DESCRIPTION

The manufacturer shall supply a total fence system of Montage II® *Welded and Rackable* (ATF - All Terrain Flexibility) Ornamental Steel (*Invincible™*) design. The system shall include all components (i.e., panels, posts, gates and hardware) required.

CLARIFICATION - fencing system shall be as specified - Montage II Industrial Ornamental Steel Fence with Invincible style, refer Drawings. Color of fencing and gates to be Black. At gates, provide manufacturer's hardware as noted below. Verify with Owner and Architect.

1.04 QUALITY ASSURANCE

The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.05 REFERENCES

- ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- ASTM D523 - Test Method for Specular Gloss.
- ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 323119 - FENCES AND GATES

- ASTM F2408 - Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.06 SUBMITTAL

The manufacturer's literature shall be submitted prior to installation.

1.07 PRODUCT HANDLING AND STORAGE

Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.08 PRODUCT WARRANTY

A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufacturer's warranty shall be guaranteed for five (5) years from date of original purchase.

PART 2 - MATERIALS

2.01 MANUFACTURER

The fence system shall conform to Montage II® *Welded and Rackable* (ATF - All Terrain Flexibility) Ornamental Steel, (*Invincible™*) design, bottom rail treatment, (4-Rail) style manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma.

2.02 MATERIAL

A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi and a minimum zinc (hot-dip galvanized) coating weight of 0.90 oz/ft², Coating Designation G-90.

B. Material for pickets shall be 1" square x 14 Ga. tubing. The rails shall be steel channel, 1.75" x 1.75" x .105". Picket holes in the rail shall be spaced 4.715" o.c. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 323119 - FENCES AND GATES

2.03 FABRICATION

- A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.
- B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly (Note: The process produces a virtually seamless, spatter-free good-neighbor appearance, equally attractive from either side of the panel).
- C. The manufactured panels and posts shall be subjected to an inline electrodeposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash, followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils. The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 (Note: The requirements in Table 2 meet or exceed the coating performance criteria of ASTM F2408).
- D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.
- E. Swing gates shall be fabricated using 1.75" x 14ga Forerunner double channel rail, 2" sq. x 12ga. gate ends, and 1" sq. x 14ga. pickets. Gates that exceed 6' in width will have a 1.75" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Cable kits will be provided for additional trussing for all gates leaves over 6'.
- All swing gates shall be Double Gate Arrangement - Montage II Invincible 4-rail style as manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma. Refer to drawings.
- F. Pedestrian swing gates shall be self-closing, having a gate leaf no larger than 48" width. Integrated hinge-closer set (2 qty) shall be ADA compliant that shall include a variable speed and final snap adjustment with compact design (no greater than 5" x 6" footprint). Hinge-closer set (2 qty) shall be tested to a minimum of 500,000 cycles and capable of self-closing gates up to a maximum gate weight of 260 lbs. and maximum weight load capacity of 1,500 lbs. Hinge-

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 323119 - FENCES AND GATES

closer device shall be externally mounted with tamper-resistant security fasteners, with full range of adjustability, horizontal (.5" - 1.375") and vertical (0 - .5"). Maintenance free hinge-closer set shall be tested to operate in temperatures of negative 20 F to 200 F degrees, and swings to negative 2 degrees to ensure reliable final lock engagement.

PART 3 - EXECUTION

3.01 PREPARATION

All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 FENCE INSTALLATION

Fence post shall be spaced according to Table 3, plus or minus ½". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 FENCE INSTALLATION MAINTENANCE

When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 GATE INSTALLATION

Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 323119 - FENCES AND GATES

provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations.

3.05 CLEANING

The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

Table 1 - Minimum Sizes for Montage II Posts

<u>Fence Posts</u>	<u>Panel Height</u>		
3" x 12 Ga.	Over 6' Up to & Including 8' Height		
<u>Gate Leaf</u>	<u>Gate Height</u>		
			<u>Over 6' Up to & Including 8'</u>
6'1" to 8'	3" x 12 Ga.	4" x 11 Ga.	6" x 3/16"
8'1" to 10'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
10'1" to 12'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
12'1" to 14'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
14'1" to 16'	6" x 3/16"	6" x 3/16"	6" x 3/16"

Table 2 - Coating Performance Requirements

<u>Quality Characteristics</u>	<u>ASTM Test Method</u>	<u>Performance Requirements</u>
Adhesion	D3359 - Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 - Montage II - Post Spacing By Bracket Type

Span	For INVINCIBLE®	Not applicable
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DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 323119 - FENCES AND GATES

	8' Nominal (91-1/2" Rail)				8' Nominal (92-5/8" Rail)					
Post Size	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Industrial Flat Mount (BB301) *		Industrial Line 2-1/2" (BB319) 3" (BB320)		Industrial Universal 2.5" (BB302) 3" (BB303)		Industrial Flat Mount (BB301)		Industrial Swivel (BB304) *	
Post Settings ± 1/2" O.C.	94-1/2"	95"	94-1/2"	95"	96"	96-1/2"	96"	96-1/2"	*96"	*96-1/2"
*Note: When using BB304 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel. When using the BB301 flat mount bracket for Invincible style, rail may need to be drilled to accommodate rail to bracket attachment.										