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DOCUMENT 003132

GEOTECHNICAL DATA

1.1 SUMMARY
- A. This document includes information pertaining to geotechnical data.

1.2 INVESTIGATION
- A. An investigation of subsurface soil conditions at the building site was authorized by the Owner, and was subsequently performed by ***UES***, project number ***W243611-rev1***, dated ***February 19, 2024***.

1.3 REPORT
- A. The Geotechnical Investigation Report is for information only and is not a warranty of subsurface conditions.
- B. The Report is made available for information only.
- C. The information contained in the Report represents design criteria, recommendations, and guidelines that were utilized as the basis of design for the engineering of the earthwork operations, paving design, and foundation design indicated in the Contract Documents. No changes in these design criteria will be considered or permitted.

1.4 RESPONSIBILITY
- A. Bidders are expected to examine the site and subsurface investigation reports.
- B. The Design Professional and Owner assume no responsibility for variations in subsoil conditions, quality, or stability, or for the presence, level, and extent of underground water.
- C. The Design Professional and Owner assume no responsibility for Bidder's interpretation of data contained in the Report.

END OF DOCUMENT

GEOTECHNICAL EXPLORATION

STAIR WELL & INTERIOR ADDITION FOUNDATIONS

3940 N. Elm Street
Denton, Texas
UES Report No. W243611-rev1
February 19, 2024

Prepared for:

UNIVERSITY OF NORTH TEXAS – UNION CIRCLE
3940 N. Elm Street
Denton, Texas 76205
Attention: Thanh Kim Nguyen, AIA

Prepared By:

UES™

February 19, 2024

University of North Texas – Union Circle
3940 N. Elm Street
Denton, Texas 76205
Attention: Thanh Kim Nguyen, AIA

Re: Geotechnical Exploration
Stair Well & Interior Addition Foundations
3940 N. Elm Street
Denton, Texas
UES Report No. W243611-rev1

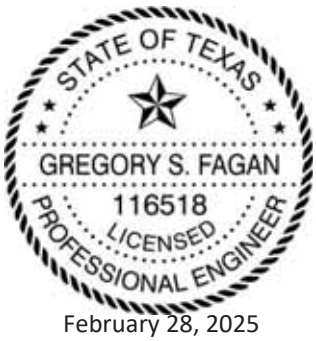
Attached is the report of the geotechnical exploration performed for the project referenced above. This study was authorized using the UNT Purchase Order No. NT100012408 on November 21, 2024 and performed in accordance with UES Professional Solutions 44, LLC (hereinafter UES) Proposal No. 108474-rev1, dated November 13, 2024.

The purpose of this revision is to include subgrade improvement recommendations for the exterior stairwell to reduce potential seasonal movements to about 1 inch.

This report contains results of field explorations and laboratory testing and an engineering interpretation of these with respect to available project characteristics. The results and analyses were used to develop recommendations to aid design and construction of foundations and pavement.

UES Professional Solutions 44, LLC appreciates the opportunity to be of service on this project. If we can be of further assistance, such as providing materials testing services during construction, please contact our office.

Sincerely,
UES PROFESSIONAL SOLUTIONS 44, LLC
TBPE Firm No. 813



February 28, 2025

Karina Cohuo, EIT
Geotechnical Project Manager

Gregory S. Fagan, P.E.
Geotechnical Department Manager

KC/GSF/dt
Copies: (1-PDF) Client

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UES REPORT NO. W243611-REV1

1.0 PURPOSE AND SCOPE

The purpose of this geotechnical exploration is for UES PROFESSIONAL SOLUTIONS 44, LLC (UES) to evaluate for University of North Texas – Union Circle (Client) some of the physical and engineering properties of subsurface materials at selected locations on the subject site with respect to formulation of appropriate geotechnical design parameters for the proposed construction. The field exploration was accomplished by securing subsurface samples from widely spaced test borings performed across the expanse of the site. Engineering analyses were performed from results of the field exploration and results of laboratory tests performed on representative samples.

Also included are general comments pertaining to reasonably anticipated construction problems and recommendations concerning earthwork and quality control testing during construction. This information can be used to evaluate subsurface conditions and to aid in ascertaining construction meets project specifications.

Recommendations provided in this report were developed from information obtained in test borings depicting subsurface conditions only at the specific boring locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from those observed at the boring locations, and subsurface conditions at boring locations may vary at different times of the year. The scope of work may not fully define the variability of subsurface materials and conditions that are present on the site.

The nature and extent of variations between borings may not become evident until construction. If significant variations then appear evident, our office should be contacted to re-evaluate our recommendations after performing on-site observations and possibly other tests.

2.0 PROJECT CHARACTERISTICS

We understand the project will consist of a new exterior stairwell and two new interior column foundations supporting an approximate 3,500 SF second floor in the high bay space. The subject site is located at the existing University of North Texas Discovery Park at 3940 North Elm Street in Denton, Texas. A site plan illustrating the general outline of the property is provided as Figure 1, the Boring Location Plan, in the Appendix

At the time the field exploration was performed, the site consisted of the existing discovery park building with associated parking and drives. A review of images available on Google Earth™ indicates grading and clearing activities occurred at the site prior to our field investigation. No information regarding previous development on the site was provided to us. Cursory visual observation and review of the topographical maps available at www.dfwmaps.com indicate the site is generally level (approximate Elev. 714 ft).

We understand the existing building foundation consists of drilled piers. We further understand

the structures will be design for movements of 1 inch or less and maximum column loads up to 100 kips. No below grade slabs are planned. Grading plans were not provided for this study. We understand existing grades will remain relatively unchanged, requiring maximum cuts and fills of less than 1 ft to achieve final grade.

3.0 FIELD EXPLORATION

Subsurface conditions on the site were explored by drilling a total two (2) test borings. Boring 1 was drilled with truck mounted drilling equipment to a depth of about 35 ft on the exterior of the building in the area of the planned stairwell. Boring 2 was drilled on the interior of the building using trailer mounted drilling equipment. Boring 2 was planned to a depth of about 35 ft but was terminated at 20 ft due to auger refusal on hard limestone. The test borings were drilled in general accordance with ASTM Standard D 420 using standard rotary drilling equipment. The approximate location of each test boring is shown on the Boring Location Plan, Figure 1, enclosed in the Appendix. Details of drilling and sampling operations are briefly summarized in Methods of Field Exploration, Section A-1 of the Appendix.

Subsurface types encountered during the field exploration are presented on Log of Boring sheets included in the Appendix. The boring logs contain our Field Technician's and Engineer's interpretation of conditions believed to exist between actual samples retrieved. Therefore, these boring logs contain both factual and interpretive information. Lines delineating subsurface strata on the boring logs are approximate and the actual transition between strata may be gradual.

4.0 LABORATORY TESTS

Selected samples of the subsurface materials were tested in the laboratory to evaluate their engineering properties as a basis in providing recommendations for foundation design and earthwork construction. A brief description of testing procedures used in the laboratory can be found in Methods of Laboratory Testing, Section B-1 of the Appendix. Individual test results are presented on the Log of Boring sheets enclosed in the Appendix.

5.0 GENERAL SUBSURFACE CONDITIONS

Based on geological atlas maps available from the Bureau of Economic Geology, published by the University of Texas at Austin, the site lies within the Grayson Marl and Main Street Limestone formation, mapped as undivided. This formation generally consists of interbedded marl (limey shale) and limestone. Residual soils associated with this formation generally consist of clay soils with moderate to very high shrink-swell potential.

Subsurface conditions encountered in Boring 1 generally consisted of clay, sandy clay and clayey sand to a depth of about 14 below the existing ground surface underlain by sandstone to a depth of about 18 ft. Limestone was then encountered to a depth of 22 ft underlain by shale extending to the 35 ft termination depth of the boring. Subsurface conditions encountered in Boring 2

generally consisted of clayey sand and sandy clay to a depth of about 11 ft below the ground surface underlain by sandstone to a depth of about 14 ft. Limestone was then encountered extending to the 20 ft termination depth of the boring. Boring 2 was terminated at a depth of 20 ft due to auger refusal on hard limestone. About 8½ inches of concrete was encountered at the surface in Boring 2. Plastic sheeting was encountered at a depth of about 1 ft below the ground surface however, a void or vapor barrier were not encountered in the boring. More detailed stratigraphic information is presented on the attached Log of Boring sheets.

The granular soils (clayey sand) encountered in the borings are considered relatively permeable and are expected to have a relatively rapid response to water movement. However, the clay, sandy clay, sandstone, limestone and shale encountered in the borings are considered relatively impermeable and are expected to have a relatively slow response to water movement. Therefore, several days of observation would be required to evaluate actual groundwater levels within the depths explored. Also, the groundwater level at the site is anticipated to fluctuate seasonally depending on the amount of rainfall, prevailing weather conditions and subsurface drainage characteristics.

Free groundwater was not encountered in the borings. However, it is common to encounter shallower seasonal groundwater in granular materials, from natural fractures within the clayey matrix, at the soil/rock (limestone and/or shale) interface or from fractures in the rock (limestone and/or shale), particularly during or after periods of precipitation. If more detailed groundwater information is required, monitoring wells or piezometers can be installed.

Further details concerning subsurface materials and conditions encountered can be obtained from the Log of Boring sheets provided in the Appendix.

6.0 DESIGN RECOMMENDATIONS

The following design recommendations were developed on the basis of the previously described Project Characteristics (Section 2.0) and General Subsurface Conditions (Section 5.0). Should the project criteria change, including the addition locations on the site, our office should conduct a review to determine if modifications to the recommendations are required. Further, it is recommended our office be provided with a copy of the final plans and specifications for review prior to construction.

The design information provided in this report was developed assuming that final grades are constructed within 1 ft of existing grades. Additional cutting and filling beyond that assumed might require modifications to the recommendations provided herein. It is recommended our office be contacted once final grades are established to determine if modifications to the recommendations in this report are necessary.

6.1 Possible Fill and Differential Movement Considerations

As discussed in Section 2.0, it appears the site was graded prior to our field exploration. Although not encountered in the borings, existing fill material related to previous grading activities could be encountered at this site. We expect the existing fill was placed under compaction control during construction of the building. Our recommendations are based on the assumption that the fill was placed in general conformance with fill compaction recommendations contained in Section 7.3. If it is believed this fill was placed without engineering supervision and that the fill is uncontrolled fill, then the fill could be subject to indeterminate levels of settlement. Uncontrolled fill is generally not suitable for support of foundations or floor slabs. Our office should be contacted for further evaluation if it is believed the existing fill encountered in the borings is uncontrolled fill.

We understand the existing building foundation consists of drilled piers. Differential movements can occur between the existing building and the proposed columns even if the columns are constructed with a similar foundation as the existing building. Methods should be implemented to allow for differential movement between the foundation system of the existing building and the new columns. Further, preventative measures should be taken to avoid damaging or adversely affecting the integrity of the existing foundation system during construction activities.

6.2 Drilled, Straight-Shaft Piers

Our findings indicate the interior columns and exterior stairwell could be supported using a system of drilled, straight-shaft pier bearing at least 2 ft into limestone or shale (the bearing stratum). The bearing stratum was encountered at depths of about 18 ft and 14 ft below the ground surface in Borings 1 and 2, respectively. Deeper penetration will be required to develop sufficient skin friction and/or uplift resistance. Allowable end bearing and skin friction parameters are provided in Table A. Sandstone should be neglected in computing pier capacity due to inconsistent strength characteristics.

TABLE A
Allowable End Bearing and Skin Friction Parameters

Bearing Stratum	Allowable End Bearing (ksf)	Skin Friction in Compression (ksf)[1]	Skin Friction in Uplift Resistance (ksf)
At least 2 ft into Limestone or Shale (the bearing stratum)	30	4.5	3.8

[1] Skin friction should be neglected in the upper 2 ft of the bearing stratum above the bottom of temporary casing.

At least two (2) pier shaft diameters should be provided below the bottom of the pier and the termination depth of our deepest boring (35 ft below existing grade) to use the allowable end

bearing parameter. If the minimum clearance between the bottom of the pier and the deepest boring is not provided, piers should be designed as friction piers, neglecting end bearing. In any case, piers should not bear deeper than the deepest boring (35 ft below the existing ground surface). Deeper borings will be required to verify the bearing stratum below 35 ft if deeper piers are planned.

The minimum clear spacing between piers should be at least two (2) pier shaft diameters, based on the larger pier, to develop the full load carrying capacity from skin friction. The allowable skin friction should be reduced by 50 percent for piers with adjacent touching edges. The allowable skin friction can be interpolated between 100 percent and 50 percent for piers spaced between two (2) pier shaft diameters and piers with adjacent touching edges.

The allowable bearing pressure value in Table A has a factor of safety of at least three (3) and the skin friction values have a factor of safety of at least two (2). Normal elastic settlement of piers under loading is estimated at less than about 1 inch.

Each pier should be sufficiently embedded into the bearing stratum and should be designed with full length reinforcing steel to resist the uplift pressure (soil-to-pier adhesion) due to potential soil swell along the shaft from post construction heave and other uplift forces applied by structural loadings. The magnitude of uplift adhesion due to soil swell along the pier shaft cannot be defined accurately and can vary according to the actual in-place moisture content of the soils during construction. It is estimated this uplift adhesion will not exceed about 1.6 kips per sq ft. This soil adhesion is approximated to act uniformly over the pier shaft in contact with clay soils within 12 ft of final grade or to the top surface of sandstone, whichever is encountered first.

Table B contains L-PILE design parameters for design of lateral resistance of drilled piers. Lateral resistance should be neglected within 6 ft of final grade due to potential soil shrinkage and/or disturbance.

TABLE B
DESIGN PARAMETERS FOR L-PILE

Material	Clay Soils Deeper than 6 ft Below Final Grade	Limestone or Shale
L-Pile p-y Model	Stiff clay	Weak Rock
Effective Unit Weight (γ), pci	0.069	0.078
Undrained Cohesion (c), psi	5.0	-
Rock Uniaxial Compressive Strength (q_u), psi	-	250
Rock Mass Modulus (E_r), psi	-	25,000
Rock Quality Designation (RQD)[1], %	-	60-80

Rock Strain Factor (k_{rm})	-	0.0001
[1]Rock Quality Designation (RQD) is based on our area experience and the results of the field exploration.		

6.3 Helical Piers (Alternative)

Considering possible difficulties due to limited overhead conditions with the existing high-bay space, helical piers could be considered for support of the interior column foundations.

Helical piers are a manufactured foundation element consisting of a centralized steel shaft and one or more helical bearing plates. The helical plates are formed with a uniform-pitch screw thread, and the pier is installed by rotating it into the ground to the desired depth or refusal. The helical plate(s) provides end bearing resistance due to gravity loads and uplift resistance due to swelling of high shrink-swell active clays such as encountered at the boring location.

All helixes should bear on the top surface of sandstone. Sandstone was encountered at a depth of about 11 ft below existing ground surface in Boring 2. Vertical spacing between helixes along the shaft should be least three (3) helix diameters, based on the largest adjacent helix. The minimum helix diameter must be sized to prevent the bearing soils from being over-stressed and to develop sufficient uplift capacity to overcome the potential uplift forces acting on the pier. The helix portion should be at least three (3) times the width of the shaft. The minimum clear spacing between edges of adjacent piers should be at least two (2) helix diameters (based on the larger helix). Normal elastic settlement of helical piers under loading is estimated at less than about 1 inch.

Load capacity of helical piers bearing on the top surface of sandstone can be calculated using an allowable bearing pressure of 10 kips per sq ft acting on the bottom of the single helix.

Each helical pier should be designed to resist the uplift pressure (soil-to-pier adhesion) due to potential soil swell along the shaft from post construction heave and other uplift forces applied by structural loadings. The magnitude of uplift adhesion due to soil swell along the helical pier shaft cannot be defined accurately and can vary according to the actual in-place moisture content of the soils during construction. It is estimated this uplift adhesion will not exceed about 1.6 kips per sq ft to a depth of about 12 ft below the ground surface or to the top surface of sandstone, whichever is encountered first.

From our experience, helical piers are frequently designed and installed by specialty contractors. Helical piers should be designed by a professional engineer and should be installed per the manufacturer's requirements. Helical piers should be load tested to verify the pier is capable of supporting the design load. Load tests can also be utilized to maximize the foundation load, thereby reducing the number of piers. We recommend performing at least one helical pier load test. UES would be pleased to assist in design, implementation, and evaluation of a pier load test if desired.

6.4 Grade Beams and Pier Caps

All grade beams connecting piers should be formed and not cast in earthen trenches. Grade beams should be formed with a nominal 6-inch void at the bottom. Commercially available cardboard box forms (cartons) are made for this purpose. The cardboard cartons should extend the full length and width of the grade beams. Prior to concrete placement, cartons should be inspected to verify they are firm, properly placed, and capable of supporting wet concrete. Some type of permanent soil retainer, such as pre-cast concrete panels, must be provided to prevent soils adjacent to grade beams from sloughing into the void space at the bottom of the grade beams. Additionally, backfill soils placed adjacent to grade beams must be compacted as outlined in Section 7.3.

6.5 Potential Seasonal Movements

Interior Columns

We estimate potential movement of the interior columns due to shrinking and swelling of active clay soils to be about 1 inch based on *current* moisture conditions and swell test results. Based on index properties of the soil (Atterberg limits), potential movement of the addition constructed within 1 ft of existing grade could be about 1½ inches if the soils were allowed to cycle between a wet and a dry condition. The proposed foundation area should be maintained in its current moist condition to maintain current potential movements of about 1 inch.

Exterior Stairwell – Flatwork Considerations

We estimate potential movement of the exterior stairwell due to shrinking and swelling of active clay soils to be about 2½ inches after grading consisting of cuts and fills of less than 1 ft. We understand the stairwell will consist of a prefabricated metal staircase on a shallow foundation.

Potential seasonal movements were estimated in general accordance with methods outlined by Texas Department of Transportation (TxDOT) Test Method Tex-124-E, from results of absorption swell tests and engineering judgment and experience. The estimated movements were calculated assuming the moisture content of the in-situ soil within the normal zone of seasonal moisture content change varies between a "dry" condition and a "wet" condition as defined by methods outlined in Texas Department of Transportation Test Method Tex-124-E. Also, it was assumed a 1 psi surcharge load from the flatwork acts on the subgrade soils. Movements exceeding those predicted herein could occur if the existing soils are exposed to an extended dry period, positive drainage of surface water is not maintained or if soils are subject to an outside water source, such as leakage from a utility line or subsurface migration from off-site locations.

We understand it is desired to reduce the potential seasonal movement of the floor slab to about 1 inch. Movements could be reduced to about 1 inch by placing a minimum 2 ft cap of non-expansive fill between the bottom of the floor slab and the top surface of chemically injected soil extending to a depth of 10 ft below the non-expansive soil. Chemical injection is described in Section 6.5.1. Non-expansive fill could consist of select fill or flexible base material as described

in Section 7.3. In choosing this method of foundation movement reduction, the Owner is accepting some post construction seasonal movement of the foundation (about 1 inch).

6.5.1 Subgrade Improvement Using Chemical Injection – Exterior Stairwell

Movement of the floor slab could be reduced to about 1 inch by placing a minimum 2-ft cap of non-expansive material between the bottom of floor slab and the top surface of 10 ft of chemical injected soil. Non-expansive fill could consist of select fill or flexible base material as described in Section 7.3. Chemical Injection of the on-site soil should extend throughout the entire building pad area, at least 5 ft beyond the perimeter of the building and below any adjacent flatwork for which it is desired to reduce movements. At building entrances and outward swinging doors, chemical injection should extend at least 10 ft beyond the building perimeter. However, non-expansive material should not extend beyond the building limits. If flatwork or paving is not planned adjacent to the structure (i.e. above the chemically injected soils), a moisture barrier consisting of a minimum of 10 mil plastic sheeting with 8 to 12 inches of soil cover should be provided above the chemically injected soils. Chemically injected soils should be maintained in a moist condition prior to placement of the required thickness of non-expansive material or flatwork. The chemical injection contractor should verify if plastic sheeting is required for maintenance of long term performance of chemical injection.

Chemical injection consists of injecting the clayey soils with a proprietary chemical specifically formulated for long-term reduction of shrink-swell capacity in expansive clayey soils. The Client should obtain appropriate documentation from the manufacturer indicating the chemical is environmentally safe and long lasting (effective for 10 years or more). Verification that the chemical solution will not heave adjacent structures as a result of the injection process should also be obtained. All references should be obtained and verified. Chemical injection proposals should only be considered from contractors whose chemicals and processes have been studied and shown to be effective by a major U.S. research university.

Satisfactory completion of the injection process will have been achieved when the desired allowable percent free swell has been achieved in the injected soils. In order to reduce overall building pad movements to about 1 inch, the resulting measured free swell of the injected material should not exceed 1 percent. Multiple passes with chemical injection may be required to meet this design requirement. The performance of post-injection free swell testing by UES should be employed as acceptance criteria in engineering analysis to examine accomplishment of the intended objectives of the injection treatment.

Construction specifications as related to the chemical injection process should be provided by the contractor due to the proprietary nature of the chemicals used during the injection process. This includes acceptance criteria and any warranty.

Maximum benefits of this procedure can best be achieved provided the entire process is carefully observed and monitored by UES.

6.6 Mat Foundations (Exterior Stairwell)

Our findings indicate mat foundations can be used for support of the proposed exterior stairwell. Mat foundations will be subject to movement as discussed in Section 6.5 (up to 2½ inches for slabs constructed within 1 ft of final grade). Subgrade improvement recommended in Section 6.5.1 is required to reduce potential movements of mat foundations to about 1 inch or less.

A net allowable soil bearing pressure of 1.5 kips per sq ft and a modulus of subgrade reaction of 150 pci may be used for design of at-grade mat foundations bearing on chemically injected subgrade placed as recommended in Section 6.5.1.

6.7 Seismic Considerations

The Site Class for seismic design is based on several factors that include soil profile (soil or rock), shear wave velocity, and strength, averaged over a depth of 100 ft. Since our borings did not extend to 100-foot depths, we based our determinations on the assumption that the subsurface materials below the bottom of the borings were similar to those encountered at the termination depth of the borings. Based on Section 1613.2.2 of the 2021 International Building Code and Table 20.3-1 in the ASCE-7-16, we recommend using Site Class C (very dense soil and soft rock) for seismic design at this site.

6.8 Area Pavement

To permit correlation between information from test borings and actual subgrade conditions exposed during construction, a qualified Geotechnical Engineer should be retained to provide subgrade monitoring and testing during construction. If there is any change in project criteria, the recommendations contained in this report should be reviewed by our office.

Calculations used to determine the required pavement thickness are based only on the physical and engineering properties of the materials used and conventional thickness determination procedures. Pavement joining buildings should be constructed with a curb and the joint between the building and curb should be sealed. Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations, reinforcing steel, joint design and environmental factors will significantly affect the service life and must be included in preparation of the construction drawings and specifications, but all were not included in the scope of this study. Normal periodic maintenance will be required for all pavement to achieve the design life of the pavement system.

Please note, the recommended pavement sections are considered the minimum necessary to provide satisfactory performance based on the expected traffic loading. In some cases, City minimum standards for pavement section construction may exceed those recommended.

6.8.1 Pavement Subgrade Preparation

The exposed surface of the pavement subgrade soil should be scarified to a depth of 6 inches and mixed with a minimum 6 percent hydrated lime (by dry soil weight) in conformance with TxDOT Standard Specification Item 260. Assuming an in-place unit weight of 100 pcf for the pavement subgrade soils, this percentage of lime equates to about 27 lbs of lime per sq yard of treated subgrade. The actual amount of lime required should be confirmed by additional laboratory tests (ASTM C 977 Appendix XI) prior to construction. The soil-lime mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above the mixture's optimum moisture content. In all areas where hydrated lime is used to stabilize subgrade soil, routine Atterberg-limit tests should be performed to verify the resulting plasticity index of the soil-lime mixture is at/or below 15.

We recommend subgrade improvement procedures extend at least 1 ft beyond the edge of the pavement to reduce effects of seasonal shrinking and swelling upon the extreme edges of pavement.

Improvement of the pavement subgrade soil will not prevent normal seasonal movement of the underlying untreated materials. Pavement and other flatwork will have the same potential for movement as slabs constructed directly on the existing undisturbed soils. Good perimeter surface drainage with a minimum slope of 2 percent away from the pavement is recommended. Normal maintenance of pavement should be expected over the life of the structures.

6.8.2 Portland Cement Concrete (PCC) Pavement

Following subgrade improvement as recommended in Section 6.8.1, PCC (reinforced) pavement sections are recommended in Table C.

TABLE C Recommended PCC Pavement Sections		
Paving Areas and/or Type	**Subgrade Thickness, Inches**	**PCC Thickness, Inches**
Parking Areas Subjected Exclusively to Passenger Vehicle Traffic,	Scarified and Compacted (native), 6	5
Drive Lanes, Fire Lanes, Areas Subject to Light Volume Truck Traffic	Lime Modified Subgrade, 6	6
Dumpster Traffic Areas, Areas subject to Moderate Volume Truck Traffic,	Lime Modified Subgrade, 6	7

PCC should have a minimum compressive strength of 3,000 psi at 28 days in parking areas subjected exclusively to passenger vehicle traffic. We recommend a minimum compressive strength of 3,500 psi at 28 days for the drive lanes, fire lanes, and truck areas. Concrete should be designed with 4.5+1.5 percent entrained air. Joints in concrete paving should not exceed 15 ft. Reinforcing steel should consist of No. 3 bars placed at 18 inches on-center in two directions.

Improvement of the pavement subgrade is recommended for drive lanes, fire lanes and pavement subject to truck traffic. Improvement of the pavement subgrade is not necessary for pavements subjected exclusively to passenger vehicle traffic, although improvement in these areas would be generally beneficial to the long-term performance of the pavement. Improvement of the subgrade is described in Section 6.8.1.

Alternatively, mechanical improvement of the pavement subgrade could be eliminated by increasing the PCC thickness in the pavement sections presented in Table C by 1 inch and placing on unmodified subgrade. Prior to construction of pavement on unimproved subgrade soil, the exposed subgrade should be scarified to a depth of at least 6 inches and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of -1 to +3 percentage points of the material's optimum moisture content.

6.9 Drainage and Other Considerations

Adequate drainage should be provided to reduce seasonal variations in the moisture content of foundation soils. All pavement and sidewalks within 10 ft of the structure should be sloped away from the structure to prevent ponding of water around the foundation. Final grades within 10 ft of the structure should be adjusted to slope away from the structure at a minimum slope of 2 percent. **Maintaining positive surface drainage throughout the life of the structure is essential.**

In areas with pavement or sidewalks adjacent to the new structure, a positive seal must be maintained between the structure and the pavement or sidewalk to minimize seepage of water into the underlying supporting soils. Post-construction movement of pavement and flatwork is common. Normal maintenance should include inspection of all joints in paving and sidewalks,

etc. as well as resealing where necessary.

Several factors relate to civil and architectural design and/or maintenance, which can significantly affect future movements of the foundation and floor slab system:

- Preferably, a complete system of gutters and downspouts should carry runoff water a minimum of 10 feet from the completed structure.

- Large trees and shrubs should not be allowed closer to the foundation than a horizontal distance equal to roughly one-half of their mature height due to their significant moisture demand upon maturing.

- Moisture conditions should be maintained "constant" around the edge of the slab. Ponding of water in planters, in unpaved areas, and around joints in paving and sidewalks can cause slab movements beyond those predicted in this report.

- Planter box structures placed adjacent to the building should be provided with a means to assure concentrations of water are not available to the subsoil stratigraphy.

Trench backfill for utilities should be properly placed and compacted as outlined in Section 7.4 and in accordance with requirements of local City standards. Since granular bedding backfill is used for most utility lines, the backfilled trench should not become a conduit and allow access for surface or subsurface water to travel toward the new structure. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water from traveling in the trench backfill and entering beneath the structure.

7.0 GENERAL CONSTRUCTION PROCEDURES AND GUIDELINES

Variations in subsurface conditions could be encountered during construction. To permit correlation between test boring data and actual subsurface conditions encountered during construction, it is recommended a registered Professional Engineering firm be retained to observe construction procedures and materials.

Some construction problems, particularly degree or magnitude, cannot be anticipated until the course of construction. The recommendations offered in the following paragraphs are intended not to limit or preclude other conceivable solutions, but rather to provide our observations based on our experience and understanding of the project characteristics and subsurface conditions encountered in the borings.

7.1 Site Preparation and Grading

As discussed in Section 2.0, the site appears to have been graded prior to our field exploration. Existing fill may be encountered in parts of the site that were not explored. Although not

encountered in the borings, existing fill materials could contain organics, boulders and other debris which could be encountered during site grading and general excavation. Test pit excavations performed prior to construction can be used to evaluate the depth, extent and composition of existing fill at this site. UES would be pleased to provide this service if desired.

All areas supporting pavement, flatwork or areas to receive new fill should be properly prepared.

- After completion of the necessary stripping, clearing, and excavating, and prior to placing any required fill, the exposed soil subgrade should be carefully evaluated by probing and testing. Any undesirable material (organic material, wet, soft, or loose soil) still in place should be removed.

- The exposed soil subgrade should be further evaluated by proof-rolling with a heavy pneumatic tired roller, loaded dump truck or similar equipment weighing approximately 20 tons to check for pockets of soft or loose material hidden beneath a thin crust of possibly better soil.

- Proof-rolling procedures should be observed routinely by a Professional Engineer or their designated representative. Any undesirable material (organic material, wet, soft, or loose soil) exposed during the proof-roll should be removed and replaced with well-compacted material as outlined in Section 7.3.

- Prior to placement of any fill, the exposed soil subgrade should then be scarified to a minimum depth of 6 inches and recompacted as outlined in Section 7.3.

If fill is to be placed on existing slopes (natural or constructed) steeper than six horizontal to one vertical (6:1), the fill materials should be benched into the existing slopes in such a manner as to provide a minimum bench width of five (5) feet. This should provide a good contact between the existing soils and new fill materials, reduce potential sliding planes and allow relatively horizontal lift placements.

Even if fill is properly compacted as recommended in Section 7.3, deep fills in excess of about 10 ft are still subject to settlements over time of up to about 1 to 2 percent of the total fill thickness. This should be considered when planning or placing deep fills.

Slope stability analysis of embankments (natural or constructed) and global stability analysis for retaining walls was not within the scope of this study.

The contractor is responsible for designing any excavation slopes, temporary sheeting or shoring. Design of these structures should include any imposed surface surcharges. Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods and sequencing of construction operations. The contractor should also be aware that slope height, slope inclination or excavation depths (including utility trench

excavations) should in no case exceed those specified in local, state and/or federal safety regulations, such as OSHA Health and Safety Standard for Excavations, 29 CFR Part 1926, or successor regulations. Stockpiles should be placed well away from the edge of the excavation and their heights should be controlled so they do not surcharge the sides of the excavation. Surface drainage should be carefully controlled to prevent flow of water over the slopes and/or into the excavations. Construction slopes should be closely observed for signs of mass movement, including tension cracks near the crest or bulging at the toe. If potential stability problems are observed, a geotechnical engineer should be contacted immediately. Shoring, bracing or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Texas.

Due to the nature of the soils found near the surface at some of the borings, traffic of heavy equipment (including heavy compaction equipment) may create pumping and general deterioration of shallow soils. Therefore, some construction difficulties should be anticipated during periods when these soils are saturated.

7.2 Foundation Excavations

All foundation excavations should be properly monitored to verify loose, soft, or otherwise unsuitable material are removed. All foundation excavations should be monitored to verify foundations bear on suitable material. The bearing stratum exposed in the base of all foundation excavations should be protected against any detrimental change in conditions. Surface runoff water should be drained away from excavations and not allowed to collect. All concrete for foundations should be placed as soon as practical after the excavation is made. Piers should be excavated and concrete placed the same day.

Prolonged exposure of the bearing surface to air or water will result in changes in strength and compressibility of the bearing stratum. Therefore, if delays occur, straight shaft piers should be slightly widened and deepened to provide a fresh penetration surface, or a new (deeper) full penetration should be provided.

All pier shafts should have a minimum diameter of 1.5 ft to facilitate clean-out of the base and proper monitoring. Concrete placed in pier holes should be directed through a tremie, hopper, or equivalent. Placement of concrete should be vertical through the center of the shaft without hitting the sides of the pier or reinforcement to reduce the possibility of segregation of aggregates. Concrete placed in piers should have a minimum slump of 5 inches (but not greater than 7 inches) to avoid potential honey-combing.

Observations during pier drilling should include, but not necessarily be limited to, the following items:

- Verification of proper bearing strata and consistency of subsurface stratification with regard to boring logs,

- Confirmation the minimum required penetration into the bearing strata is achieved,
- Complete removal of cuttings from bottom of pier holes,
- Proper handling of any observed water seepage and sloughing of subsurface materials,
- No more than 2 inches of standing water should be permitted in the bottom of pier holes prior to placing concrete, and
- Verification of pier diameter and steel reinforcement.

Groundwater was not encountered in the borings. However, groundwater could be encountered during drilled pier excavations depending on groundwater conditions at that time. Temporary casing could be required control water seepage if encountered during drilling. Casing should be seated in the shale below the depth of seepage and all water and loosened material should be removed from the cased excavation before starting the design penetration. As casing is extracted, care should be taken to maintain a positive head of plastic concrete and minimize the potential for intrusion of water seepage or sloughing of sandy soils. Processing of casing through granular soils could be required.

7.3 Fill Compaction

Select fill used as non-expansive material in the building pad should have a liquid limit less than 35, a plasticity index (PI) not less than about 4 nor greater than 15 and contain no more than 0.5 percent fibrous organic materials, by weight. All select material should contain no deleterious material and should be compacted to a dry density of at least 95 percent standard Proctor maximum dry density (ASTM D 698) and within the range of 1 percentage point below to 3 percentage points above the material's optimum moisture content. The plasticity index and liquid limit of material used as select non-expansive material should be routinely verified during placement using laboratory tests. Visual observation and classification should not be relied upon to confirm the material to be used as select, non-expansive material satisfies the Atterberg-limit criteria.

Flexible base used as non-expansive material in the building pad should consist of material meeting the requirements of TxDOT Standard Specifications Item 247, Type A, B, C, or D, Grade 1-2 or 3. The flexible base should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 2 percentage points below to 2 percentage points above the material's optimum moisture content.

Clayey soils with a plasticity index equal to or greater than 25 should be compacted to a dry density between 93 and 98 percent of standard Proctor maximum dry density (ASTM D 698). The

compacted moisture content of the clays during placement should be within the range of +2 to +6 percentage points of the material's optimum moisture.

Clayey soils used for general fill with a plasticity index less than 25 should be compacted to a dry density of at least 95 percent of standard Proctor maximum dry density (ASTM D 698). The compacted moisture content of the clays during placement should be within the range of -1 to +3 percentage points of the material's optimum moisture.

Clayey material used as fill should be processed such that the largest particle or clod is less than 6 inches prior to compaction.

Where mass fills are deeper than 10 ft, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D 698) and within – 2 to +2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as outlined above.

Compaction should be accomplished by placing fill in about 8-inch thick loose lifts and compacting each lift to at least the specified minimum dry density. Field density and moisture content tests should be performed on each lift.

7.4 Utilities

Where utility lines are deeper than 10 ft, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D 698) and within –2 to +2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as previously outlined. Density tests should be performed on each lift (maximum 12-inch thick) and should be performed as the trench is being backfilled.

Even if fill is properly compacted, fills in excess of about 10 ft are still subject to settlements over time of up to about 1 to 2 percent of the total fill thickness. This should be considered when designing pavement over utility lines.

If utility trenches or other excavations extend to or beyond a depth of 5 ft below construction grade, the contractor or others shall be required to develop an excavation safety plan to protect personnel entering the excavation or excavation vicinity. The collection of specific geotechnical data and the development of such a plan, which could include designs for sloping and benching or various types of temporary shoring, is beyond the scope of this study. Any such designs and safety plans shall be developed in accordance with current OSHA guidelines and other applicable industry standards.

7.5 Groundwater

Groundwater was not encountered in the borings. From our experience, shallower groundwater seepage could be encountered in excavations for foundations, utilities and other general excavations at this site. The risk of seepage increases with depth of excavation and during or after periods of precipitation. Standard sump pits and pumping may be adequate to control seepage on a local basis in clayey soils.

In any areas where cuts made, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. In these areas subsurface drains may be required to intercept seasonal groundwater seepage. The need for these or other dewatering devices should be carefully addressed during construction. Our office could be contacted to visually observe final grades to evaluate the need for such drains.

8.0 LIMITATIONS

Professional services provided in this geotechnical exploration were performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water or groundwater. UES, upon written request, can be retained to provide these services.

UES is not responsible for conclusions, opinions or recommendations made by others based on this data. Information contained in this report is intended for the exclusive use of the Client (and their designated design representatives), and is related solely to design of the specific structures outlined in Section 2.0. No party other than the Client (and their designated design representatives) shall use or rely upon this report in any manner whatsoever unless such party shall have obtained UES's written acceptance of such intended use. Any such third party using this report after obtaining UES's written acceptance shall be bound by the limitations and limitations of liability contained herein, including UES's liability being limited to the fee paid to it for this report. Recommendations presented in this report should not be used for design of any other structures except those specifically described in this report. In all areas of this report in which UES may provide additional services if requested to do so in writing, it is presumed that such requests have not been made if not evidenced by a written document accepted by UES. Further, subsurface conditions can change with passage of time. Recommendations contained herein are not considered applicable for an extended period of time after the completion date of this report. It is recommended our office be contacted for a review of the contents of this report for construction commencing more than one (1) year after completion of this report. Non-compliance with any of these requirements by the Client or anyone else shall release UES from any liability resulting from the use of, or reliance upon, this report.

Recommendations provided in this report are based on our understanding of information provided by the Client about characteristics of the project. If the Client notes any deviation from the facts about project characteristics, our office should be contacted immediately since this may

materially alter the recommendations. Further, UES is not responsible for damages resulting from workmanship of designers or contractors. It is recommended the Owner retain qualified personnel, such as a Geotechnical Engineering firm, to verify construction is performed in accordance with plans and specifications.

APPENDIX

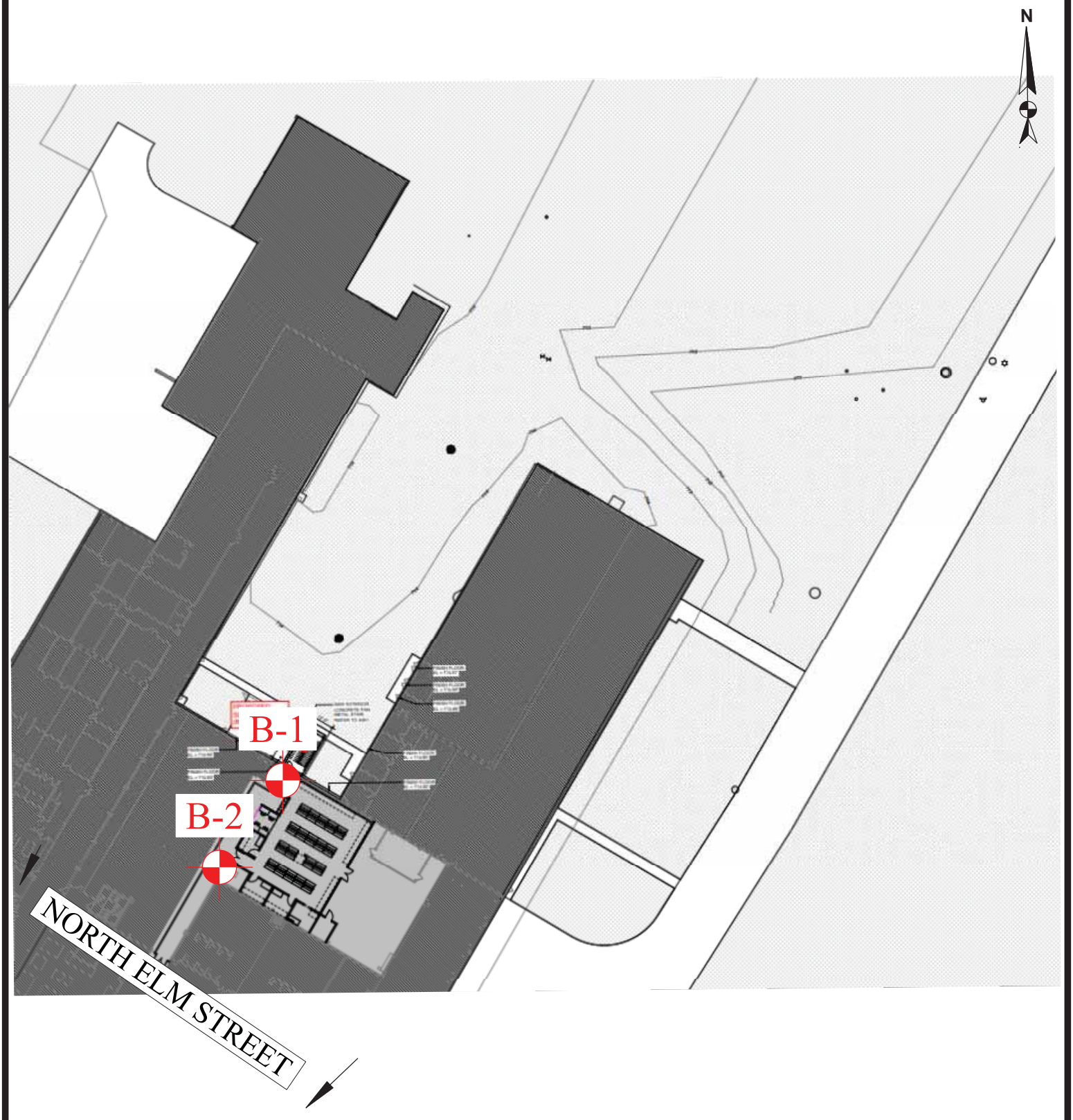
A-1 METHODS OF FIELD EXPLORATION

Using standard rotary drilling equipment, a total of two (2) test borings were performed for this geotechnical exploration. The approximate locations of the borings are shown on the Boring Location Plan, Figure 1. The test boring locations were staked by either pacing or taping and estimating right angles from landmarks which could be identified in the field and as shown on the site plan provided during this study. The locations of test borings shown on the Boring Location Plan are considered accurate only to the degree implied by the methods used to define them.

Relatively undisturbed samples of the cohesive subsurface materials were obtained by hydraulically pressing 3-inch O.D. thin-wall sampling tubes into the underlying soils at selected depths (ASTM D 1587). These samples were removed from the sampling tubes in the field and evaluated visually. One representative portion of each sample was sealed in a plastic bag for use in future visual evaluation and possible testing in the laboratory.

A modified version of the Texas Cone Penetration (TCP) test was completed in the field to determine the apparent in-place strength characteristics of the rock type materials. A 3-inch diameter steel cone driven by a 170-pound hammer dropped 24 inches is the basis for TxDOT strength correlations. In this case, UES has modified the procedure by using a 140-pound hammer dropping 30-inches for completion of the field test. Depending on the resistance (strength) of the materials, either the number of blows of the hammer required to provide 12 inches of penetration, or the inches of penetration of the cone due to 100 blows of the hammer are recorded on the field log and are shown on the Log of Boring sheets as “TX Cone” (reference TxDOT Test Method TEX 132-E, as modified).

Logs of the borings are included in the Appendix. The logs show visual descriptions of subsurface strata encountered using the Unified Soil Classification System. Sampling information, pertinent field data, and field observations are also included. Samples not consumed by testing will be retained in our laboratory for at least 14 days and then discarded unless the Client requests otherwise.



GEOTECHNICAL EXPLORATION
STAIR WELL & INTERIOR ADDITION
FOUNDATIONS
3940 N ELM STREET
DENTON, TEXAS
UES PROJECT NO. W243611

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Formerly Alpha Testing

FIGURE 1

BORING LOCATION PLAN

APPROXIMATE BORING LOCATION

B-1 METHODS OF LABORATORY TESTING

Representative samples were evaluated and classified by a qualified member of the Geotechnical Division and the boring logs were edited as necessary. To aid in classifying the subsurface materials and to determine the general engineering characteristics, natural moisture content tests (ASTM D 2216), Atterberg-limit tests (ASTM D 4318), percent material finer than the No. 200 sieve tests (ASTM D 1140), and dry unit weight determinations were conducted on selected samples. In addition, unconfined compressive strength tests (ASMT D 2166) and pocket-penetrometer tests were conducted on selected soil samples to evaluate the soil shear strength. Results of these laboratory tests are provided on the Log of Boring sheets.

In addition to the Atterberg-limit tests, the expansive properties of the clayey soils were further analyzed by absorption swell tests. The swell test is performed by placing a selected sample in a consolidation machine and applying either the approximate current or expected overburden pressure and then allowing the sample to absorb water. When the sample exhibits very little tendency for further expansion, the height increase is recorded and the percent free swell and total moisture gain calculated. Results of the absorption swell tests are provided on the attached Log of Boring sheets.

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5058 Brush Creek Rd.
Fort Worth, Texas 76119
Phone: 817-496-5600
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BORING NO.: 1
Sheet 1 of 1

PROJECT NO.: W243611

Client: University of North Texas - Union Circle
Project: Stair Well & Interior Addition Fouundations
Start Date: 12/13/2024 **End Date:** 12/13/2024
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Denton, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
On Rods (ft): DRY
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Brown CLAY				2.5					18	42	18	24	
		2.0													
		Orange, Tan and Gray CLAYEY SAND				4.5+			43		16				0.0
5						4.5+					15	43	17	26	0.1
		6.0													
		Orange, Tan and Gray SANDY CLAY				4.5+	2.0		57	115	14				
10						4.0					15	48	17	31	
		14.0													
15		Tan SANDSTONE			100/ 1"										
		18.0													
		Gray LIMESTONE													
20					100/ 0.50"										
		22.0													
		Gray SHALE													
25					100/ 1"										
30					100/ 1"										
35		35.0			100/ 0.50"										
		TEST BORING TERMINATED AT 35 FT													
40															

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BORING NO.: 2
Sheet 1 of 1

PROJECT NO.: W243611

Client: University of North Texas - Union Circle
Project: Stair Well & Interior Addition Fouundations
Start Date: 12/9/2024 **End Date:** 12/9/2024
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Denton, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
On Rods (ft): DRY
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		8.5" CONCRETE, vapor barrier, no void 1.0													
		Orange and Brown CLAYEY SAND				4.25			49		13	41	17	24	0.0
5		6.0				4.5+					14	40	18	22	0.0
		Brown CLAYEY SAND 8.0				2.0			29		16	35	16	19	0.0
		Brown SANDY CLAY							53		19				
10		10.0													
		Tan SANDY CLAY 11.0													
		Red and Tan SANDSTONE with clay seams and layers 14.0													
15		Tan LIMESTONE with clay seams and layers			100/ 1.50"										
20		20.0			100/ 0.50"										
		TEST BORING TERMINATED AT 20 FT DUE TO AUGER REFUSAL ON HARD LIMESTONE													
25															
30															
35															
40															

KEY TO SOIL SYMBOLS AND CLASSIFICATIONS

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SOIL & ROCK SYMBOLS

(CH), High Plasticity CLAY
(CL), Low Plasticity CLAY
(SC), CLAYEY SAND
(SP), Poorly Graded SAND
(SW), Well Graded SAND
(SM), SILTY SAND
(ML), SILT
(MH), Elastic SILT
LIMESTONE
SHALE / MARL
SANDSTONE
(GP), Poorly Graded GRAVEL
(GW), Well Graded GRAVEL
(GC), CLAYEY GRAVEL
(GM), SILTY GRAVEL
(OL), ORGANIC SILT
(OH), ORGANIC CLAY
FILL

SAMPLING SYMBOLS

SHELBY TUBE (3" OD except where noted otherwise)
SPLIT SPOON (2" OD except where noted otherwise)
AUGER SAMPLE
TEXAS CONE PENETRATION
ROCK CORE (2" ID except where noted otherwise)

RELATIVE DENSITY OF COHESIONLESS SOILS (blows/ft)

VERY LOOSE	0 TO 4
LOOSE	5 TO 10
MEDIUM	11 TO 30
DENSE	31 TO 50
VERY DENSE	OVER 50

SHEAR STRENGTH OF COHESIVE SOILS (tsf)

VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
FIRM	0.50 TO 1.00
STIFF	1.00 TO 2.00
VERY STIFF	2.00 TO 4.00
HARD	OVER 4.00

RELATIVE DEGREE OF PLASTICITY (PI)

LOW	4 TO 15
MEDIUM	16 TO 25
HIGH	26 TO 35
VERY HIGH	OVER 35

RELATIVE PROPORTIONS (%)

TRACE	1 TO 10
LITTLE	11 TO 20
SOME	21 TO 35
AND	36 TO 50

PARTICLE SIZE IDENTIFICATION (DIAMETER)

BOULDERS	8.0" OR LARGER
COBBLES	3.0" TO 8.0"
COARSE GRAVEL	0.75" TO 3.0"
FINE GRAVEL	5.0 mm TO 3.0"
COURSE SAND	2.0 mm TO 5.0 mm
MEDIUM SAND	0.4 mm TO 5.0 mm
FINE SAND	0.07 mm TO 0.4 mm
SILT	0.002 mm TO 0.07 mm
CLAY	LESS THAN 0.002 mm

SECTION 05 5100
PREFABRICATED MODULAR STAIR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated stairs.

B. Structural steel stair framing and supports.

C. Handrails and guards.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/NFSI B101.3 - Test Method for Measuring the Wet DCOF of Hard Surface Walkways; 2020.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2023.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Shop Drawings: detailed shop drawings including:
   1. Overall layout dimensions
   2. Detailed shop weldment drawings
   3. Footer layout drawings.

B. Warranty Statement

C. Engineering: Professional Engineering sealed drawings..

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Prefabricated Metal Stairs:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Upside Innovations, a SixAxis company: www.upsideinnovations.com or a comparable product.

2.02 METAL STAIRS - GENERAL REQUIREMENTS

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards and Texas Accessibility Standards.
   3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
      a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
      b. Railing Assemblies: Comply with applicable local code.
   4. Aluminum welding will be in accordance with ANSI / AWS D1.2/D1.2M: 2008. Welding shall be performed solely with Pulsed Gas Metal Arc Welding (MIG) processes or Gas Tungsten Arc Welding (TIG) processes by experience operators.
   5. Dimensions: As indicated on drawings.

6. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
7. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
8. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
a. Welded Joints: Continuously welded and ground smooth and flush.
b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
c. Exposed Edges and Corners: Eased to small uniform radius.
d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

E. Finish: Manufacturer's Standard Powder Coat
1. Color and Sheen: Selected from manufacturer's full range.

2.03 PLATFORMS & LANDINGS

A. Walking surfaces are designed to carry a uniform live load of 100 pounds per square foot and a concentrated vertical load of 300 pounds in an area of one square foot.

B. Platform sections are fabricated in typical lengths between 48" and 96" in each 8" increment. Custom lengths can be fabricated as requested.

C. Walking surfaces are designed to have a coefficient of friction no less than 0.50 in all directions of travel.

D. Walking surfaces are designed and constructed to be continuous, without gaps and shall be made using 1-1/2" x 8" extruded decking. The outside legs of each piece of extrusion should be touching the adjacent piece in order to create a hard stop for structural support.

E. All platforms are designed to be wider than the step leading up to them and at least 60" long in the

F. All platforms are designed to allow at least a 60" diameter area of clearance free of obstructions.

G. Platforms shall be fabricated in typical 5'-4" x 5'-4" sections. Larger sizes will be fabricated as required by layout.

H. Platforms shall be designed as a universal design, so that a common platform can be configured as a resting platform, switchback platform, turning platform, walkway platform, or threshold landing platform.

2.04 PLATFORM LEGS

A. All legs are designed to support the steps and platforms / landings.

B. Platform legs shall be designed using a minimum of 3" x 3" x 0.125" aluminum square tube that connects to the platform and a telescoping 2.7" x 2.7" x 0.125" aluminum square tube with a 6" x 6" x .190" welded foot pad. The legs are bolted wall to wall with two 18-8 stainless steel bolts. The telescoping feature allows leg adjustment in order to meet elevation changes.

C. Depending on total height of platforms, legs can increase in size based on structural design.

D. When needed, 2" x 2" x 3/16" aluminum angle is used for cross-bracing platform legs. As heights are increased cross-bracing sizing will be increased in order to provide structural integrity.

2.05 STEPS

A. Step treads and stringers are designed to carry a uniform live load of 100 pounds per square foot

B. Walking surfaces are designed to have a coefficient of friction no less than 0.50 in the normal direction of travel.

C. Steps are designed to allow a clearance of 48” between handrails.

D. All step treads are designed to have a uniform depth of 12” with a 1” nosing for an effective run of 11” minimum per step, INCLUDING THE TOP STEP ONTO THE PLATFORM / LANDING.

E. All step nosings have a uniform radius of ¼” and an underside angle of 60 degrees from the horizontal.

F. Step treads are designed to have a uniform height of either 6”, 6-½”, or 7” depending on the overall height of the step assembly. All step risers are closed between treads.

G. Step treads are designed to allow a clearance of 48” between handrails.

2.06 HANDRAILS AND GUARDRAILS

A. All step rails are designed to withstand a concentrated load of 200 pounds applied in any direction on the top of the rail.

B. Steps over 30”: Step rails for steps with a vertical rise over 30” shall have a 42” guardrail in addition to the 36” handrail.

C. Steps 30” or under: Step rails for steps at 30” or under do not require a 42” guardrail.

D. All baluster panels and other custom rail panels are designed to withstand a load of 50 pounds in the horizontal direction applied in an area of one square foot.

E. All step rails will not allow a 4” diameter sphere to pass though in any area.

F. Step rails are provided on both sides of the step treads.

G. All step handrails are designed to be continuous along step runs and in between the inside corner of 90 degree and 180 degree turns in step direction. Handrails are not interrupted by posts or other obstructions.

H. All handrails have a clearance of 2-1/4” between the handrail and the guardrail. Handrails are to be constructed of 1-1/4” SCH 40 Pipe with an outside diameter of 1.66”.

I. Step handrails are designed to be 36” high measured vertically from the top of the step nosing to the top of the rail.

J. Step handrails extend 12” past the top Step Nosing parallel to the ground surface and return to the closest rail post or wall if needed due to door swing interference at the top of the step. Step handrails also extend one tread width past the bottom step tread (11”) plus an additional 12” parallel to the ground surface and return to the closest rail post.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install Prefabricated Metal Stairs according to manufacturer's written instructions in orientation, sizes, and locations indicated.

3.03 CLEANING AND PROTECTION

A. On completion of stair installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage

from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Basis of Design: Subject to compliance with requirements, provide products by the following:

1. Armstrong World Industries, Inc.

2. Acoustical Panel Ceiling: APC-1, Armstrong OPTIMA HEALTH ZONE, 3114PB
   a. Color: White.
   b. Light Reflectance (LR): Not less than 0.86.
   c. Noise Reduction Coefficient (NRC): Not less than 0.95.

d. Edge/Joint Detail: Square.
e. Thickness: 1 inch.
f. Modular Size: 24 by 24 inches.
g. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft If retaining "Angle Hangers" Paragraph below, insert sizes or indicate on Drawings.

C. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6519
RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2021a.

E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

F. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section Includes:
   1. Rubber floor tile.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.
   1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

C. Samples: Full-size units of each color, texture, and pattern of floor tile required.
   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile (Rubber used in Laboratories) : Furnish one box for every 20 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.10 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.02 RUBBER FLOOR TILE – RF-1

A. Tile Standard: ASTM F1344, Class I-B, Homogeneous Rubber Tile, through mottled with random scattered design..

B. Hardness: Grade 1, minimum hardness of 85, measured using Shore, Type A durometer according to ASTM D2240.

C. Thickness: 2 mm

D. Size: 24” x 24”” nominal.

E. Colors and Patterns: As indicated on Finish Schedule

2.03 LUXURY VINYL TILE – LVT-1, LVT-2

A. Tile Standard: ASTM F1700, Class III, Type B. Embossed

B. Wearing Surface: Textured.

C. Thickness: 5 mm.

D. Size: 9” x 59” nominal.

E. Install Method: Random, per layout plan

F. Colors and Patterns: As indicated on Finish Schedule

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

3.02 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.03 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:
1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 11 5000
LABORATORY EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The laboratory equipment suppliers are to comply with the requirements of this section for laboratory equipment and related components and accessories for “Laboratory Equipment”. This Section includes reference to the following items indicated herein or in the construction documents:
   1. Provide everything necessary for, and incidental to, the complete installation of laboratory equipment as specified herein. Items included are:
      a. Sterilizer
      b. Glassware Washer
   2. Furnish and install laboratory equipment as indicated on the drawings and specified herein to be Contractor Furnished, Contractor Installed (CFCI), unless otherwise specified.
   3. For all pieces of equipment that require water feed, follow manufacturers’ recommendations to optimize equipment performance, reduce maintenance and promote water conservation.

B. Related Requirements:
   1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring laboratory equipment.
   2. Section 09 2216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring laboratory equipment.
   3. Section 26 0000 for electrical connections

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of laboratory equipment.

B. Coordinate installation of laboratory equipment with installation of fume hoods and other laboratory equipment.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Indicate locations of blocking and other supports required for laboratory equipment, where it corresponds.
   2. Indicate locations and types of services, together with associated service requirements and supply connections.
   3. Show adjacent walls, doors, windows, other building components, laboratory casework, fume hoods, environmental rooms and other laboratory equipment. Indicate clearances from above items.
   4. Include coordinated dimensions with laboratory casework specified in other Sections.

B. Shop Drawings: Submit shop drawing that show, in large scale, methods of construction, joining, dimensions, materials, thicknesses, and finish of materials, installation, and relation to adjoining work, and all other details to fully illustrate the scope of work.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Test Reports for Equipment: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory equipment with requirements of specified product standard and system structural performance specified in "Performance Requirements" Article.

1.07 QUALITY ASSURANCE

A. Manufacturers Qualifications: Manufacturers shall have an established organization and production facilities specializing in producing the type of equipment specified, with an experienced engineering department. Each shall have the demonstrated ability and capacity to produce and deliver the specified equipment within the required time limits.

B. Any deviations from the Drawings or Specifications, including requests for approval of proposed equals, must be listed in detail. List of deviations shall be submitted along with the Bidder's proposal.

C. Installer Qualifications:
   1. Experience: Installer is to have a minimum of seven (7) years of experience installing laboratory equipment and who has completed a minimum of ten (10) successful installations of products as specified which are similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance within the past five years.
   2. Supervisor/foreman: Maintain a full-time supervisor/foreman on job site during times that laboratory equipment installation is in progress, who has a minimum of five (5) years of experience with the installation of laboratory equipment systems of which three (3) years as a full-time foreman.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

B. Deliver laboratory equipment after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate equipment has been completed in installation areas. If equipment must be stored in non-installation areas, store only where environmental conditions meet requirements specified in Project Conditions section below.

C. Protect finished surfaces of room and of equipment from soiling and damage during handling and installation.

1.09 FIELD CONDITIONS

A. Locate concealed framing, blocking, and reinforcements that support equipment by field measurements before being enclosed, and indicate measurements on Shop Drawings.

B. Environmental Limitations: Do not deliver or install laboratory equipment until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. All equipment furnished under this section shall be guaranteed with the maximum industry warranty against defective materials, design and workmanship—warranty shall be made to the benefit of the owner.

PART 2 PRODUCTS

2.01 EQUIPMENT ITEMS – GENERAL REQUIREMENTS

A. Furnish and install equipment as indicated and identified on the drawings by the manufacturers and in the models, sizes and with the qualities shown. Provide each with the manufacturer's standard features and accessories as well as any other accessories, options or special configurations shown on the drawings or elsewhere in the specifications. For recessed or freestanding equipment, provide trim panels to close opening between equipment and adjacent walls, floors and ceilings.

B. Refer to “Laboratory Equipment Schedule,” on A812A , for additional information on building supplied services and special requirements. Building services are being provided to support the Basis of Design models indicated. Alternate manufacturers must work properly with the utility services provided. Any changes required to the infrastructure to support alternative equipment will be the responsibility of the Contractor, including but not limited to redesign of utility infrastructure.

2.02 GLASSWARE WASHER UNDERCOUNTER

A. Description: High Performance electric laboratory glassware washer. Free-standing without view window

B. Basis-of-Design Product: Subject to compliance with requirements, provide Steris Reliance 100 Series, or comparable product by one of the following:
   1. Miele Professional
   2. Steris
   3. Or approved equal, if specifically approved by Architect via addendum during bidding.

2.03 SMALL STERILIZER/FRONT LOAD AUTOCLAVE

A. Description: Laboratory Steam Sterilizer is designed for fast and efficient sterilization of heat- and moisture- stable materials used in scientific applications.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Steris Amsco, Model 250LS, or comparable product by one of the following:
   1. BMT USA
   2. Beta Star Life Science Equipment, Inc.
   3. Consolidated
   4. Lancer
   5. Primus
   6. SteelCo
   7. Tuttnauer
   8. Or approved equal, if specifically approved by Architect via addendum during bidding.

C. Construction
   1. Freestanding with enclosure cabinet.
   2. Integrated electric steam generator (stainless steel).
   3. Chamber Size: 20” W x 20” H x 38” D, Gravity.

D. Accessories
   1. Provide with loading rack and two shelves.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.

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

3.02 INSTALLATION OF EQUIPMENT

A. Uncrate all equipment and place in locations shown. Remove all crating materials and packing debris.

B. Install all items in accordance with manufacturer's instructions. Provide all accessories necessary for a complete installation.

C. Verify plumbing, ventilation and electrical connection requirements for all equipment with manufacturer’s specifications and options for Contractor-furnished items and with Owner for Owner-furnished items and coordinate connections with Division-22, 23 and 26 work.

D. Furnish instruction manuals for all Contractor-furnished equipment to the Owner.

3.03 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain laboratory equipment.

3.04 CLEANING AND PROTECTING

A. Repair or remove and replace defective work as directed upon completion of installation.

B. Clean shop-finished surfaces, touch-up as required, and remove or refinish damaged or soiled areas, as acceptable to Architect.

C. Protection: Advise Contractor of procedures and precautions for protection of equipment from damage by work of other trades.

END OF SECTION

SECTION 11 5313
LABORATORY FUME HOODS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

C. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

D. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials; 2017, with Editorial Revision (2019).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SEFA 1 - Laboratory Fume Hoods; 2010.

I. SEFA 2.3 - Installations; 2010.

J. SEFA 8M - Laboratory Grade Metal Casework; 2020.

K. UL 1805 - Standard for Safety Laboratory Fume Hoods and Cabinets; Current Edition, Including All Revisions.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section Includes:
   1. Bench-top laboratory fume hoods.
   2. Floor-mounted laboratory fume hoods
   3. Piping and wiring within fume hoods for service fittings, light fixtures, fan switches, and other electrical devices included with fume hoods.
   4. Work tops within fume hoods.
   5. Laboratory sinks and cup sinks in fume hoods.
   6. Water, laboratory gas, and electrical service fittings in fume hoods.

B. Related Requirements:
   1. Section 06 1000 "Rough Carpentry" for wood blocking for anchoring fume hoods.
   2. Section 09 2216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring fume hoods.
   3. Section 09 6513 "Resilient Base and Accessories" for resilient base applied to fume hood base cabinets.

1.04 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.

B. Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For laboratory fume hoods.

1. Include plans, elevations, sections, and attachment details.
2. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports.
3. Indicate locations and types of service fittings together with associated service supply connection required.
4. Indicate duct connections, electrical connections, and locations of access panels.
5. Include roughing-in information for mechanical, plumbing, and electrical connections.
6. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from the above items.
7. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
8. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples: For fume hood exterior finishes.

1.06 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.

B. Source quality-control reports.

C. Field quality-control reports.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bench Mounted – Restricted-Bypass Fume Hoods with VAV Control and Steel Exterior:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Labconco Corporation – Protector Premier Laboratory Hoods or comparable product by one of the following:
   a. Mott Manufacturing.
   b. Kewaunee

B. Floor Mounted – Restricted-Bypass Fume Hoods with VAV Control and Steel Exterior:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Labconco Corporation – Protector XL Laboratory Hoods or comparable product by one of the following:
   a. Mott Manufacturing.
   b. Kewaunee

C. Source Limitations: Obtain laboratory fume hoods from single manufacturer.
1. Obtain laboratory fume hoods from same source as laboratory casework.

D. Product Designations: Drawings indicate sizes, types, and configurations of fume hoods by referencing designated manufacturer's catalog numbers. Other manufacturers' fume hoods of similar sizes, types, and configurations, and complying with the Specifications, may be considered. See Section 01 6000 "Product Requirements."

2.02 PERFORMANCE REQUIREMENTS

A. Accessibility: Provide fume hoods that comply with ADAAG/TAS Protrusion Limits as defined in Section 307.2 when installed adjacent to 30” deep laboratory benches.

B. Containment: Provide fume hoods that comply with the following when tested according to ASHRAE 110 as modified below:
   1. As-Manufactured (AM) Rating: AM 0.05 (0.05 ppm).
   2. As-Installed (AI) Rating: AI 0.10 (0.10 ppm).
   3. Average Face Velocity: 60 fpm plus or minus 10 percent with sashes fully open.
   4. Face-Velocity Variation: Not more than 10 percent of average face velocity across the face opening with sashes fully open.
   5. Sash Position: Fully open.
      a. Test hoods with horizontal sashes with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
      b. Test hoods with combination sashes fully raised, with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
   6. Release Rate: 4.0 L/min.
   7. Test Setup Modifications: Conduct tests with a minimum of three and a maximum of five people in the test room and with two 1-gal. round paint cans, one 12-by-12-by-12-inch cardboard box, and three 6-by-6-by-12-inch cardboard boxes in the fume hood during the test. Position items from 6 to 10 inches behind the sash, randomly distributed, and supported off the work surface by 2-by-2-inch blocks.
   8. Walk-by Test: At the conclusion of containment test, execute three rapid walk-bys at 30-second intervals, 12 inches behind the mannequin. Test-gas concentration during each walk-by shall not exceed 0.1 ppm and shall return to specified containment value within 15 seconds.

C. Static-Pressure Loss: Not more than 1/2-inch wg at 60-fpm face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

2.03 FUME HOODS

A. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods - Recommended Practices." Provide fume hoods UL listed and labeled for compliance with UL 1805.

B. Restricted-Bypass Fume Hoods: Provide restricted-bypass fume hoods. Partial compensating bypass above the sash opens after sash is closed to less than 20 percent open. Design partial bypass to maintain exhaust capacity of at least 25 cfm per sq. ft. of work surface regardless of sash position.

2.04 MATERIALS

A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.

B. Glass-Fiber-Reinforced Polyester: Polyester laminate with a chemical-resistant gel coat on exposed faces, and having a flame-spread index of 25 or less according to ASTM E84.

C. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.
   1. Physical Properties:
      a. Flexural Strength: Not less than 10,000 psi.
      b. Modulus of Elasticity: Not less than 2, 000,000 psi.
      c. Hardness (Rockwell M): Not less than 100.

d. Water Absorption (24 Hours): Not more than 0.02 percent.
e. Heat Distortion Point: Not less than 260 deg F.
f. Flame-Spread Index: 25 or less according to ASTM E84.

2. Chemical Resistance: As follows when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
   a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
   b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
3. Color: Match color specified in Section 12 5335 Metal Laboratory Casework

D. Polypropylene: Unreinforced polypropylene complying with ASTM D4101, Group 01, Class 1, Grade 2.

E. Glass: Clear, laminated tempered glass complying with ASTM C1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with two plies not less than 0.12 inch thick and with clear, polyvinyl butyral interlayer.
1. Ultraclear Glass: Glass plies each have visible light transmission not less than 91 percent.
2. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201 for Category II materials.
3. Permanently mark safety glass with certification label of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Fasteners: Provide stainless steel fasteners where exposed to fumes.

2.05 FABRICATION

A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 35-by-79-inch door opening.

B. Steel Exterior: Fabricate from steel sheet, 0.048 inch thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil and to allow access to plumbing lines and service fittings. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.
1. Color: Match Laboratory Casework Finish

C. Ends: Fabricate with double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

D. Splay top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.

E. Interior Lining: Provide one of the following unless otherwise indicated:
1. Glass-fiber-reinforced polyester, not less than 3/16 inch thick.

F. Lining Assembly: Unless otherwise indicated, assemble with stainless steel fasteners or epoxy adhesive, concealed where possible. Seal joints by filling them with chemical-resistant sealant during assembly.
1. Fasten lining components together with stainless steel cleats or angles to form a rigid assembly to which exterior panels are attached.
2. Fasten lining components to a rigid frame assembly fabricated from stainless steel and to which exterior panels are attached.
3. Punch fume hood lining side panels to receive service fittings and remote controls. Provide removable plug buttons for holes not used for indicated fittings.

G. Rear Baffle: Unless otherwise indicated, provide baffle, of same material as fume hood lining, at rear of hood with openings at top and bottom. Secure baffle to cleats at rear of hood with stainless steel screws. Fabricate baffle for easy removal for cleaning behind baffle.
   1. Provide preset baffles.
   2. Provide epoxy-coated, stainless-steel screen at bottom baffle opening to prevent paper from being drawn into the exhaust plenum behind baffles.

H. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.
   1. Duct-Stub Material: stainless steel..

I. Bypass Grilles: Provide grilles at bypass openings of fume hoods.

J. Sashes: Provide operable sashes of type indicated.
   1. Fabricate from 0.050-inch-thick stainless steel. Form into four-sided frame with bottom corners welded and finished smooth. Make top member removable for glazing replacement. Set glazing in chemical-resistant, U-shaped gaskets.
   2. Glaze with laminated safety glass.
   3. Counterbalance vertical-sliding sash with sash weight and stainless-steel cable system to hold sash in place regardless of position. Provide ball-bearing sheaves, plastic glides in stainless steel guides, and stainless-steel lift handles. Provide rubber bumpers at top and bottom of each sash unit.

K. Airfoil: Unless otherwise indicated, provide airfoil at bottom of fume hood face opening with 1-inch space between airfoil and work top. Sash closes on top of airfoil, leaving 1-inch opening for air intake. Airfoil directs airflow across work top to remove heavier-than-air gases and to prevent reverse airflow.

L. Light Fixtures: LED.

M. Filler Strips& Closure Panels: Provide as needed to close spaces between fume hoods or fume hoods base cabinets and adjacent building construction. Fabricate from the same material and with same finish as fume hoods or fume hood base cabinets, as applicable. Reinforce as necessary to accept a wall mounted cylinder restraint.

N. Ceiling Extensions: Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to ceiling.
   1. Not required for floor mounted hoods

O. Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.

P. Comply with requirements in other Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods unless otherwise indicated.

2.06 FUME HOOD BASE CABINETS BASE STANDS WORK TOPS SINKS AND SERVICE FITTINGS

A. Comply with Section 12 3553 "Metal Laboratory Casework." Provide metal base cabinets in finish matching fume hood exterior finish.

B. Work Tops: Epoxy.
   1. Work-Top Configuration: Raised (marine) edge with rounded edge and corners.
   2. Where acid storage cabinets are indicated beneath fume hoods, provide holes in work tops as need to accommodate cabinet vents.
   3. Where epoxy sinks occur in epoxy work tops, provide integral sinks bonded to tops with invisible joint line.

C. Fume Hood Base Stands: Welded steel tubing legs, not less than 2 inches square with channel stretchers and aprons. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to aprons. Provide leveling device welded to bottom of each leg.
   1. Structural Performance: Capable of withstanding 50-lb/ft. work top, 75 lb/ft. on work top, plus weight of hood, without permanent deformation or excessive deflection.

2. Leg Shoes: Black vinyl or rubber, open-bottom, slip-on type.

2.07 CHEMICAL-RESISTANT FINISH

A. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.

B. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
   1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
   2. Colors for Fume Hood Finish: As selected by Architect from manufacturer's full range.

2.08 ACCESSORIES

A. Sash Alarm: Provide fume hoods with audible and visual alarm that activates when sash is opened beyond preset position.
   1. Provide with silence and test switches.
   2. Coordinate with VAV Control interface.

B. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 50 percent of sash height. Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood.

2.09 SOURCE QUALITY CONTROL

A. Demonstrate fume hood performance before shipment by testing fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article. Provide testing facility, instruments, equipment, and materials needed for tests.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.

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

3.02 INSTALLATION

A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Comply with requirements in Section 12 3553 "Metal Laboratory Casework" for installing fume hood base cabinets, work tops, and sinks.

C. Comply with requirements for installing water and laboratory gas service fittings and electrical devices.
   1. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work-top material. Securely anchor fittings to fume hoods unless otherwise indicated.

3.03 FIELD QUALITY CONTROL

A. Field test installed fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article to verify compliance with performance requirements.
   1. Adjust fume hoods, hood exhaust fans, and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.
   2. After making corrections, retest fume hoods that failed to perform as specified.

3.04 ADJUSTING AND CLEANING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION

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