KARNES CITY INDEPENDENT SCHOOL DISTRICT
REQUEST FOR COMPETITIVE SEALED PROPOSALS
CTE BUILDING PROJECT

ADDENDUM NO. 1

The following additions/clarifications are made to the CSP for **KARNES CITY INDEPENDENT SCHOOL DISTRICT CTE BUILDING PROJECT**

1. Proposal submission date is amended to read as follows:

   PROPOSALS MUST BE RECEIVED NO LATER THAN 2:00 P.M., May 22, 2024.

   This change will be applicable as of the date of this Addendum No. 1.

Except with regard to the items set out above, the RFP remains unchanged.

Date of Addendum: May 3, 2024

Notice to Respondents –Please remember to submit your acknowledgement of Addendum to acknowledge receipt of Addendum No. 1 and any other subsequent addenda with your submission.

Addendum Number 01

(May 3, 2024)

To Drawings and Specifications dated 01/17/2023

(Career and Technical Education Building)
(Karnes City ISD)

Prepared By: PBK Architects, Inc.
601 NW Loop 410, Suite 400
San Antonio, Texas 78216

PBK Project No.: P2104400AR

Notice to Proposers:

A. Receipt of this Addendum shall be acknowledged on the Proposal Form.

B. This Addendum forms part of the Contract documents for the above referenced project and shall be incorporated integrally therewith.

C. Each proposer shall make necessary adjustments and submit his proposal with full knowledge of all modifications, clarifications, and supplemental data included therein. Where provisions of the following supplemental data differ from those of the original Contract Documents, this Addendum shall govern.

GENERAL ITEMS

Item No. 01: RFI Response

Item No. 02: LEAF Narrative

Item No. 03: Geotechnical Report

SPECIFICATIONS

Item No. 04: MEP Specification:

1. 23 35 16 –Welding Fume Removal Systems

END OF ADDENDUM NO. 01

Addendum Number 01

May 3, 2024

(Career and Technical Education Building)
(Karnes City ISD)

Prepared by: PBK Architects, Inc.
601 NW Loop 410, Suite 400
San Antonio, Texas 78216

PBK Project No.: P2104400AR

Notice to Bidders:

A. The following answers are in response to RFI #1 that was submitted.

B. There is a forthcoming Addendum 2 that will give additional information.

C. Each proposer shall make necessary adjustments and submit his bid with full knowledge of all modifications, clarifications, and supplemental data included therein. Where provisions of the following supplemental data differ from those of the original Contract Documents, the forthcoming Addendum shall govern.

RFI 1

Question No. 1: **Page 1 of the RFCSP lists that bid date as May 22nd at 2:00 and page 5 lists May 21st at 2:00. What is the correct bid date?**
May 22nd at 2:00 PM

Question No. 2: **A prebid meeting is scheduled for May 8th, what is the location of this meeting?**
TBD, A location will be provided prior to May 8, 2024.

Question No. 3: **Section 00 31 00 says the Geotechnical Report is available upon request. Please provide the Geotech & boring logs.**
Geotechnical Report will be included in Addendum 1.

Question No. 4: **The bidding requirements listed in the RFCSP are contradictory to those listed in 00 11 19 Request for Proposal & 00 21 16 Instructions to Proposers. Please advise.**
The RFCSP takes precedence.

Question No. 5: **See attached AIA A305 from Singer H&R. Please indicate if they are an approved Kitchen Equipment Contractor.**
The District has no objection to Singer H&R based upon the referenced A305.

END OF RESPONSE

601 N.W. Loop 410, Suite 400 \\ San Antonio, Texas 78216 \\ P 210-829-0123 \\ F 210-829-0578 \\ PBK.com

Addendum Number 01

05/03/2024

To Drawings and Specifications dated 02/09/2024

Career and Technical Education Building
Karnes City ISD

Prepared by: LEAF Engineers, Inc.
601 NW Loop 410, Suite 400
San Antonio, Texas 78216

LEAF Project No.: P2104400AR

Notice to Proposers:

A. Receipt of this Addendum shall be acknowledged on the Proposal Form.

B. This Addendum forms part of the Contract documents for the above referenced project and shall be incorporated integrally therewith.

C. Each proposer shall make necessary adjustments and submit his proposal with full knowledge of all modifications, clarifications, and supplemental data included therein. Where provisions of the following supplemental data differ from those of the original Contract Documents, this Addendum shall govern.

SPECIFICATIONS

Item No. 01: Added as an acceptable Manufacturers for Welding Fume Removal Systems – 3. Maxair

SECTION 23 35 16 - WELDING FUME REMOVAL SYSTEMS

2.1 WELDING FUME REMOVAL FANS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. National System of Garage Ventilation (NSGV)
2. Monoxivent
3. Maxair

DRAWINGS

Item No. 01: Re: **Sheet NUMBER:** Description

I

END OF ADDENDUM NO. 01

601 N.W. Loop 410, Suite 460 \\ San Antonio, Texas 78216 \\ P 210-638-7200 \\ F 210-829-0578 \\ LEAFengineers.com

Geotechnical Engineering Report

Karnes City ISD - CTE Building
Karnes City, Texas
March 30, 2021
Terracon Project No. 90215043

Prepared for:
PBK Architects Inc.
San Antonio, Texas

Prepared by:
Terracon Consultants, Inc.
San Antonio, Texas

March 30, 2021

Terracon GeoReport

PBK Architects Inc.
601 NW Loop 410, Ste. 400
San Antonio, Texas 78216-5527

Attn: Mr. Cliff Whittingstall, AIA

Re: Geotechnical Engineering Report
Karnes City ISD - CTE Building
400 TX-123
Karnes City, Texas
Terracon Project No. 90215043

Dear Mr. Whittingstall:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P90215043 dated January 25, 2021. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and pavements for the proposed project.

We appreciate the opportunity to work with you on this project and look forward to contributing to the ongoing success of this project by providing Materials Testing services during construction. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.
(Firm Registration No. F3272)

Carlos Cotilla
Staff Engineer

Mike T. Ghazawi, P.E.
Senior Principal

STATE OF TEXAS
M. GHAZAWI
90130
LICENSED
PROFESSIONAL ENGINEER
3/31/2021

Enclosures
Copies To: Addressee: (1) Electronic

REPORT TOPICS

Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

REPORT SUMMARY

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **General Comments** should be read for an understanding of the report limitations.

Based on the information obtained from our subsurface exploration, pertinent geotechnical considerations include the following:

- The subsurface soils consist of FILL – Clayey Sand (SC) in the upper 2 feet (encountered in CB-2 and CB-4 only), Sandy Lean Clay (CL), Clayey Sand (SC), Poorly Graded Sand (SP), and Fat Clay (CH)
- Groundwater was observed in boring CB-4 only, at a depth of 20 feet below existing grade surface.
- The Potential Vertical Rise (PVR) at this site is about 1 to 1½ inches in its present condition.
- A shallow slab-on-grade foundation may be considered to support the new building, provided the building pad is prepared as recommended in this report. However, a drilled pier foundation system may also be considered. Recommendations for both shallow and deep foundation systems are provided in this report.
- The 2018 International Building Code IBC seismic site classification for this site is D.
- Both asphalt and concrete pavements can be considered for this site.

Geotechnical Engineering Report
Karnes City ISD - CTE Building
400 TX-123
Karnes City, Texas
Terracon Project No. 90215043
March 30, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed building to be located at 400 TX-123 in Karnes City, Texas. The purposes of these services are to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- earthwork
- seismic considerations
- groundwater conditions
- foundation design and construction
- pavement recommendations

The geotechnical engineering Scope of Services for this project included the advancement of nine test borings to depths of 6 and 40 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 400 TX-123 in Karnes City, Texas. GPS coordinates of the site are: 28.88937°N, 97.88999°W. See **Site Location**
Existing Improvements	Undeveloped. There is an existing parking lot south of the proposed building.
Current Ground Cover	Bare soil, grass, and asphalt pavement.
Existing Topography	The site is relatively level.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions are as follows:

Item	Description
Information Provided	Mr. Cliff Whittingstall, AIA with PBK Architects and Mr. Justice Edge, P.E. with Intelligent Engineering Services have provided Terracon with the relevant information.
Proposed Structures	The new CTE building will be located in the northeast corner of the existing high school campus and will be a one story building with an approximate 14,150 sq. ft. area. The roofs are anticipated to be open web steel joists supported on steel wide flange beams and the beams supported by steel tube columns. Both shallow and deep foundation systems will be considered.
Floor Slabs	Both ground supported and suspended floor systems will be considered.
Pavements	Both asphalt and concrete pavement would be considered.

GEOTECHNICAL CHARACTERIZATION

Subsurface Conditions

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. As part of our analyses, we identified the following model layers within the subsurface profile.

Model Layer #	Name	General Description
---	PAVEMENT SECTION: 2” Asphalt over 6” Base Material (encountered in CP-4 only)	----
1	FILL - CLAYEY SAND (SC) [1] (encountered in CB-2 and CB-4 only)	Brownish Gray, Medium Dense
2	SANDY LEAN CLAY (CL) [2]	Dark Brown, Tan, Light Gray, Very Stiff to Hard

3	CLAYEY SAND (SC) [1]	Dark Brown, Tan, Brownish Gray, Medium Dense to Very Dense
4	FAT CLAY (CH) [3]	Brownish Gray, Light Gray, Gray, Very Stiff to Hard
5	POORLY GRADED SAND (SP) [1]	Tan, Tan to Gray, Medium Dense to Very Dense

1/ The CLAYEY SAND (SC) and POORLY GRADED SAND (SP) materials could undergo low volumetric changes (shrink/swell) should they experience changes in their in-place moisture content. These materials are considered volumetrically stable with regards to change in moisture content due to their granular nature.

2/ The SANDY LEAN CLAY (CL) materials could undergo moderate volumetric changes (shrink/swell) should they experience changes in their in-place moisture content.

3/ The FAT CLAY (CH) materials could undergo moderate to very high volumetric changes (shrink/swell) should they experience changes in their in-place moisture content.

This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs and GeoModel can be found in the **Exploration Results** section of this report. It can be emphasized that the stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Groundwater Conditions

Groundwater generally appears as either a permanent or temporary water source. Permanent groundwater is generally present year-round, which may or may not be influenced by seasonal and climatic changes. Temporary groundwater water is also referred to as a “perched” water source, which generally develops because of seasonal and climatic conditions.

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was observed in boring CB-4 only, at a depth of about 20 feet below existing grade surface. The borings were backfilled with soil cuttings after the drilling operations were completed.

Seasonal variations such as amount of rainfall and runoff, climatic conditions and other factors generally result in fluctuations of the groundwater level over time. Additionally, the sand may become water bearing after a precipitation event and can readily transmit water. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The foundation contractor should check the groundwater conditions just before foundation excavation activities.

GEOTECHNICAL OVERVIEW

We understand that the proposed building will be supported by a shallow foundation system. The desired foundation system may be used at this site provided the building pad and foundations are designed and constructed as recommended in this report. However, drilled piers with both flat and suspended floor slab may be considered.

The foundations being considered must satisfy two independent engineering criteria with respect to the subsurface conditions encountered at this site. One criterion is the foundation system must be designed with an appropriate factor of safety to reduce the possibility of a bearing capacity failure of the soils underlying the foundation when subjected to axial and lateral load conditions. The other criterion is that the movement of the foundation system due to compression (consolidation or shrinkage) or expansion (swell) of the underlying soils must be within tolerable limits for the structures.

Expansive Soil Considerations

Based on our findings, the subsurface soils at this site generally exhibit low expansion potential. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of about 1 to 1½ inches in its present condition. The actual movements could be greater if inadequate drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structures after construction. In order to reduce soil movement beneath the floor slab, subgrade grade and building pad modifications will be required as discussed in this report. The desired slab foundation system may be used at this site provided the building pad and foundations are designed and constructed as recommended in this report. If movement can not be tolerated, then the building should be supported by a drilled pier foundation with a suspended floor slab.

DEEP FOUNDATIONS

Drilled Piers Foundation

The building may be supported on a straight-sided drilled pier foundation system bearing at a depth no shallower than 20 feet below existing grade.

Drilled piers may be designed for net allowable bearing pressure of 9,000 psf. This bearing pressure include factor of safety against a bearing capacity failure of approximately 3. An allowable side shear value of 550 psf, with an assumed factor of safety of at least 2, may be used to aid in resisting axial compressive loads on the piers. The side shear should be neglected for the upper 4 feet of soil in contact with the pier shaft. Piers should not extend deeper than 35 feet below the existing grades at the time of our geotechnical field activities without contacting our office. Piers should be designed with a shaft diameter at least 18 inches to facilitate inspection.

The allowable end bearing and skin friction values presented in this report are based on center-to-center spacing of the pier foundations no closer than a horizontal distance of three shaft diameters (using the larger bearing diameter). A closer spacing may be considered but may effect (reduce) the axial capacity of the foundation depending on the spacing pattern of the foundations. Terracon can assist in evaluating the possibility of a closer spacing once a foundation layout has been determined.

In addition to the axial compressive loads on the piers, these piers will also be subjected to axial tension loads due to the expansive soil conditions and possibly due to other induced structural loading conditions. To compute the axial tension force due to the swelling soils along the pier shaft, the following equation may be used.

$$Q_u = 20 \cdot d$$

Where: Q_u = Uplift force due to expansive soil conditions in kips (k)
d = Diameter of pier shaft in feet (ft)

This calculated force may be used to compute the longitudinal reinforcing steel required in the pier to resist the uplift force induced by the swelling clays. However, the cross-sectional area of the reinforcing steel should not be less than 1 percent of the gross cross-sectional area of the drilled pier shaft. The reinforcing steel should extend from the top to the bottom of the shaft to resist this potential uplift force.

The allowable uplift resistance of the straight sided drilled piers can be evaluated using the following equation:

$$Q_{ar} = 2.0 \cdot d \cdot D_p + 0.9\, W_p + P_{DL}$$

Where: Q_{ar} = Allowable uplift resistance of pier in kips (k)
d = Diameter of pier shaft in feet (ft)
D_p = Founding depth of pier in natural soils minus the upper 4 feet of shaft in contact with the soil in feet (ft)
W_p = Weight of the drilled pier in kips (k)
P_{DL} = Dead Load acting on the drilled pier in kips (k)

<u>Settlement</u> – For piers, total settlements, based on the indicated bearing pressures, should be about 1 inch or less for properly designed and constructed drilled piers. Settlement beneath

individual piers will be primarily elastic with most of the settlement occurring during construction. Differential settlement may also occur between adjacent piers. The amount of differential settlement could approach 50 to 75 percent of the total pier settlement. For properly designed and constructed piers, differential settlement between adjacent piers is estimated to be less than ¾ of an inch. Settlement response of drilled piers is impacted more by the quality of construction than by soil-structure interaction.

Drilled Pier Construction Considerations

The pier excavations should be augered and constructed in a continuous manner. Steel and concrete should be placed in the pier excavations immediately following drilling and evaluation for proper bearing stratum, embedment, and cleanliness. Under no circumstances should the pier excavations remain open overnight.

Subsurface water was encountered in the boring CB-4 only at a depth of 20 feet below existing grade. However, water may be encountered during construction due to weather conditions and local geology. **In addition, due to the presence of sand, caving and sloughing of the pier walls should be anticipated**. Therefore, the contractor should be prepared to use temporary casing or slurry to reduce the water flow into the excavation and/or sloughing of the excavation sidewalls should this occur. Casing may not achieve a tight seal due to the presence of sand, should water be encountered. **Therefore, the slurry method will become the only feasible option in wet conditions**. The casing and slurry methods are discussed in the following paragraphs.

<u>Casing Method-</u> Casing will provide stability of the excavation walls but may not completely eliminate subsurface water influx potential or stability of the pier excavation bottom unless the casing penetrates below any pervious soils. Casing that terminates in pervious soils may generate "boils" due to the head differential between the inside and outside of the casing and require that the casing be extended until the excess seepage or boils are eliminated. The drilling subcontractor should determine casing depths and casing procedures. Water that accumulates in excess of six (6) inches in the bottom of the pier excavation should be pumped out prior to steel and concrete placement. If the water is not pumped out, a long closed-end tremie should be used to place the concrete completely to the bottom of the pier excavation in a controlled manner to effectively displace the water during concrete placement. If this operation is not successful or to the satisfaction of the foundation contractor and engineer, the pier excavation should be flooded with fresh water to offset the differential water pressure caused by the unbalanced water levels inside and outside of the casing. If water is not a factor, concrete should be placed with a short tremie so that the concrete is directed to the bottom of the pier excavation. The concrete should not be allowed to ricochet off the walls of the pier excavation nor off reinforcing steel. When the pier excavation depth

is achieved, and the bearing area has been cleaned, steel and concrete should then be placed immediately in the excavation.

Removal of casing should be performed with extreme care and under proper supervision to reduce mixing of the surrounding soil and water with the fresh concrete. Rapid withdrawal of casing or the auger may develop suction that could cause the soil to intrude into the excavation. An insufficient head of concrete in the casing during its withdrawal could also allow the soils to intrude into the wet concrete. Both of these conditions may induce “necking”, a section of reduced diameter, in the pier.

Slurry Method- As an alternate to the use of casing to install the pier foundations, water or a weighted drilling fluid may be considered. Slurry displacement drilling can only prevent sloughing and water influx but cannot control sloughing once it has occurred. Therefore, slurry displacement drilling techniques must begin at the ground surface, not after sloughing materials are encountered.

Typical drilling fluids include those which contain polymers or bentonite. If a polymer is used with “hard” mixing water, a water softening agent may be required to achieve intimate mixing and the appropriate viscosity. The polymer manufacturer should be consulted concerning proper use of the polymer. If bentonite slurry is used, the bentonite should be mixed with water several hours before placing in the pier excavation. Prior mixing gives the bentonite sufficient time to hydrate properly. The drilling fluid should only be of sufficient viscosity to control sloughing of the excavation walls and subsurface water flow into the excavation. Care should be exercised while extracting the auger so that suction does not develop and cause disturbance or create “necking” in the excavation walls as described above. Casing should not be employed in conjunction with the slurry drilling technique due to possible trapping of loose soils and slurry between the concrete and natural soil.

The use of weighted drilling fluid when installing drilled pier foundations requires extra effort to ensure an adequate bearing surface is obtained. A clean-out bucket should be used just prior to pier completion in order to remove any cuttings and loose soils which may have accumulated in the bottom of the excavation. Steel and concrete should be placed in the excavation immediately after pier completion. A closed-end tremie should be used to place the concrete completely to the bottom of the excavation in a controlled manner to effectively displace the slurry during concrete placement. The concrete should be placed completely to the bottom of the excavation with a closed-end tremie in the pier excavation if more than six (6) inches of water is ponded on the bearing surface or the water should be pumped from the excavation. A short tremie may be used if the excavation has less than 6 inches of ponded water. The fluid concrete should not be allowed to strike the pier reinforcement, temporary casing (if required) or excavation sidewalls during concrete placement.

All aspects of concrete design and placement should comply with the American Concrete Institute (ACI) 318 Code Building Code Requirements for Structural Concrete, ACI 336.1 Standard Specification for the Construction of Drilled Piers, and ACI 336.3R entitled Suggested Design and Construction Procedures for Pier Foundations. Concrete should be designed to achieve the specified minimum 28-day compressive strength when placed at a 7 inch slump with a ±1 inch tolerance. Adding water to a mix designed for a lower slump does not meet the intent of this recommendation. If a high range water reducer is used to achieve this slump, the span of slump retention for the specific admixture under consideration should be thoroughly investigated. Compatibility with other concrete admixtures should also be considered. A technical representative of the admixture supplier should be consulted on these matters.

Successful installation of drilled piers is a coordinated effort involving the general contractor, design consultants, subcontractors and suppliers. Each must be properly equipped and prepared to provide their services in a timely fashion. Several key items are:

- Proper drilling rig with proper equipment (including casing).
- Reinforcing steel cages tied to meet project specifications;
- Proper scheduling and ordering of concrete for the piers; and
- Monitoring of installation by design professionals.

Pier construction should be carefully monitored to assure compliance of construction activities with the appropriate specifications. A number of items recommended for monitoring during pier installation include those listed below.

- Pier locations
- Vertical alignment
- Competent bearing
- Steel placement
- Concrete properties and placement
- Casing removal (if required)
- Proper casing seal for subsurface water control

If the contractor has to deviate from the recommended foundations, Terracon should be notified immediately so additional engineering recommendations can be provided for an appropriate foundation type.

FLOOR SLABS

Suspended Floor Slab System

A structurally suspended floor slab may also be considered for this project.

For a structurally suspended floor slab system at this site, Terracon recommends a void space of at least 12-inches beneath the floor slabs, structural beams and subfloor plumbing systems. The thickness of the void space may be increased to several feet to facilitate maintenance activities in the crawl space. **With the structurally suspended floor slab system, remedial earthwork measures will not be required other than general site grading.**

Drainage beneath the structure must be designed to remove and/or reduce the possibility of water accumulation in these areas. The subgrade below the floor slab should be sloped to appropriate drainage outlets. Surface and subsurface drainage of water away from the building will enhance the performance of the foundation.

In addition, proper ventilation should be provided to reduce the possibility that a high humidity environment could develop in the void space areas. Measures should be taken to maintain voids beneath the perimeter beams.

Ground-Supported Slab System

For a ground-supported floor slab, subgrade soil within pad area should be prepared as described in the **Building Pad Preparation** section of this report.

Several design methods use the modulus of subgrade reaction, k, to account for soil properties in design of flat, floor slabs. The modulus of subgrade reaction is a spring constant that depends on the kind of soil, the degree of compaction, and the moisture content. Based on our recommendations provided in **Building Pad Preparation**, a k-value of about 90 pci can be used for design of a stiffened, grade-supported floor slab.

The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slabs will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 for procedures and cautions about the use and placement of a vapor retarder.

EARTHWORK

The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations.

Site Preparation

Construction operations may encounter difficulties due to the wet or soft surface soils becoming a general hindrance to equipment due to rutting and pumping of the soil surface, especially during and soon after periods of wet weather. If the subgrade cannot be adequately compacted to minimum densities as described in the **Fill Compaction Requirements** section of this report, one of the following measures may be required:

- removal and replacement with select fill.
- chemical treatment of the soil to dry and increase the stability of the subgrade.
- drying by natural means if the schedule allows

Prior to construction, all vegetation, loose topsoil, and any otherwise unsuitable materials should be removed from the construction area. The stripped materials consisting of vegetation and organic materials should be wasted from the site or used to revegetate landscaped areas or exposed slopes after completion of grading operations. Wet or dry material should either be removed, or moisture conditioned and recompacted. After stripping and grubbing, the subgrade should be proof-rolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with a 15-ton roller or fully loaded dump truck. Soils that are observed to rut or deflect excessively (typically greater than 1-inch) under the moving load should be undercut and replaced with properly compacted on-site soils. The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather.

Building Pad Preparation

The following building pad preparation recommendations should be performed for the proposed building prior to foundation construction. As previously mentioned, the existing PVR at this site is about 1 to 1½ inches. The upper soil at the site appears to be in a dry condition. The moisture contents are below the corresponding plastic limits. Therefore, soil modification to increase moisture and compaction will be required. Recommendations for at-grade pad preparation to reduce the PVR to about 1 inch and provide uniform support to the grade supported slabs and flatwork for this project site are provided in the following sections.

- After completing stripping operations as discussed in the Site Preparation section, excavate and stockpile about 4 feet of the onsite soil from the building pad area for later use. The building pad area is defined as the area that extends at least 5 feet (horizontal) beyond the perimeter of the proposed building and to the outside edge of any movement sensitive flatwork. The limits of the building pad should be indicated on the drawings for the project.

- After excavating to the depth specified above, the exposed subgrade should be proof rolled with a fully loaded dump or water truck to evidence any weak yielding zones. A Terracon geotechnical engineer or their representative should be present to observe proof rolling operations.

- Over-excavate any confirmed weak yielding zones, both vertically and horizontally, to expose competent soil. The upper 6 inches of the exposed subgrade should be moisture conditioned between -2 and +3 percentage points of the optimum moisture content and then compact to at least 95 percent of the maximum dry density determined in accordance with ASTM D 698.

- After proof-rolling and the replacement of weak yielding zones, place back the 3 feet stockpiled onsite soil to achieve the Finished Building Pad Elevation (FBPE). The onsite soil should be placed in loose lifts of about 8 inches and compacted thickness not exceeding 6 inches. The onsite soil should be moisture conditioned between -2 and +3 percentage points of the optimum moisture content and then compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM D 698.

This method should result in 4 feet of onsite reworked soils beneath the grade supported floor slab. If grades are to be raised, select fill should then be used to achieve the Finished Building Pad Elevation (FBPE).

Details regarding select fill materials, placement and compaction are presented in the following sections **Fill Material Types** and **Fill Compaction Requirements**.

Fill Material Types

Earthen materials used for structural and general fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location of Placement
Imported Select fill	CL or SC ■ LL≤40 and 7<PI≤20 ■ % passing #200 sieve ≥35% ■ Maximum particle size 1½”	All locations and elevations.
On-Site Soil	CL, SC, CH	The CL and SC soils meeting the select fill criteria can be used as select fill. The CH soils should not be used as select fill.
Free Draining Granular Fill	Open graded gravel (ASTM C33, Grade 57)	Can be used as clean granular fill as a drainage material for any retaining walls or below grade walls.

Fill Type [1]	USCS Classification	Acceptable Location of Placement

1/ *Prior to any filling operations, samples of the proposed borrow and on-site materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction, including dry unit weight and moisture content, are being attained.*

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Description
Fill Lift Thickness	All fill should be placed in thin, loose lifts of about 8 inches, with compacted thickness not exceeding 6 inches.
Compaction of On-Site Soil, Select Fill and Granular Select Fill	95 percent of the material's Standard Proctor maximum dry density (ASTM D 698).
Moisture Content of On-Site soil, Select Fill and Granular Select Fill	The materials should be moisture conditioned between -2 and +3 percentage points of the optimum moisture content.

Grading and Drainage

Effective drainage should be provided during construction and maintained throughout the life of the new improvements. After pad construction, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary, as part of the structure's maintenance program.

Flatwork and pavements will be subjected to post-construction movement. Maximum grades that are feasible should be used for paving and flatwork to prevent water from ponding. Allowances in final grades should also consider post-construction movement of flatwork, particularly if such movements are deemed critical. Where paving or flatwork abuts the structure, joints should be effectively sealed and maintained to prevent surface water infiltration. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a grade of at least five percent for at least 10 feet from perimeter walls (except in areas where ADA ramps are required; these should comply with state and local regulations). Backfill against grade beams, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of construction debris to reduce the possibility of moisture infiltration.

Planters and other surface features which could retain water in areas adjacent to the structures should be properly drained, designed, sealed or eliminated. Landscaped irrigation adjacent to the foundation systems should be properly designed and controlled to help maintain a relatively constant moisture content within 5 feet of the structure.

Utility trenches are a common source of water infiltration and migration. Infiltration of water into utility trenches or foundation excavations should be prevented during construction. Utility trenches that penetrate beneath the structure should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the pad. We recommend constructing an effective clay "trench plug" that extends at least 5 feet out from the face of the building exterior. The plug material should consist of clay compacted at a water content at or above the soil's optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report. The combination of 10 mil poly and flowable fill backfill can be used in place of a clay plug.

Consideration should be given to the use of proposed utility trenches outside of the building area and along the high sides of the site as interceptor drains. For instance, these excavations can be backfilled near full depth with granular material and sloped to drain into storm sewers or similar outflow areas. In addition, 20 mil PVC vapor barrier (ASTM E 1745 Class A) may be placed on the downhill side (building pad side of the trench). As a result, some additional "protection" from the negative effects of subsurface water flow may be gained with little extra cost. Proper perimeter positive drainage should be provided so infiltration of surface water at the project site is minimized

Earthwork Construction Considerations

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively stable. However, the stability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unstable conditions develop, workability may be improved by scarifying and drying. Over excavation of wet zones and replacement with granular materials may be necessary. Lightweight excavation equipment may be required to reduce subgrade pumping. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance.

All temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

SHALLOW FOUNDATIONS

A stiffened slab on grade beam foundation or a spread footing may be considered to support the structures at the project site.

Design Parameters – Slab on Grade Foundation

A slab on grade beam foundation may be considered to support the structures at this site. Parameters commonly used to design this type of foundation are provided on the table below. The slab foundation design parameters presented are based on the conventional method and the criteria published by the Wire Reinforcement Institute (WRI). These are essentially empirical design methods and the recommended design parameters are based on our understanding of the proposed project, our interpretation of the information and data collected as a part of this study, our area experience, and the criteria published in the WRI design manual.

Conventional Method	Prepared Subgrade [1]
Net allowable bearing pressure [2]	2,000 psf
Subgrade Modulus (k)	90 pci
Potential Vertical Rise (PVR)	about 1 inch
WRI Method	
Design Plasticity Index (PI) [3]	20
Climatic Rating (C_w)	17
Soil-Climate Support Index (1-C)	0.05

1/ Based on preparing the pad preparation as discussed in this report.

2/ The net allowable bearing pressure provided above includes a Factor of Safety (FS) of at least 3.

3/ The WRI effective PI is equal to the near surface PI if that PI is greater than all of the PI values in the upper 15 feet.

We recommend that perimeter grade beams be at least 36 inches below final exterior grade. These recommendations are for a proper development of bearing capacity for the continuous beam sections of the foundation system and to reduce the potential for water to migrate beneath the slab foundation. These recommendations are not based on structural considerations. Grade beam depths may need to be greater than recommended herein for structural considerations and should be properly evaluated and designed by the Structural Engineer. Interior grade beams (if any) should be sized by the structural engineer to provide adequate stiffness to the slab and should be used under load-bearing walls. The grade beams or slab portions may be thickened and widened to serve as spread footings at concentrated load areas.

For a slab foundation system designed and constructed as recommended in this report, post construction settlements should be less than 1 inch. Settlement response of a select fill supported slab is influenced more by the quality of construction than by soil-structure interaction. Therefore, it is essential that the recommendations for foundation construction be strictly followed during the construction phases of the pad and foundation.

Design Parameters – Spread Foundation

Design recommendations for spread foundations for the proposed structures are presented in the table below.

The spread footings can provide some uplift resistance for those structures subjected to wind or other induced structural loading. The uplift resistance of a spread footing may be computed using the effective weight of the soil above the spread footing along with the weight of the spread footing and structure. A soil unit weight of 120 pcf may be assumed for the soils placed above the footing, provided the fill is properly compacted.

Description	Parameters
Net allowable bearing pressure [1]	3,000 psf
Minimum dimensions	30 inches
Minimum embedment below finished grade for bearing	36 inches
Approximate heave or total settlement from foundation loads	<1 inch
Allowable Net passive pressure [2]	200 pcf, equivalent fluid density
Allowable coefficient of sliding friction	0.25

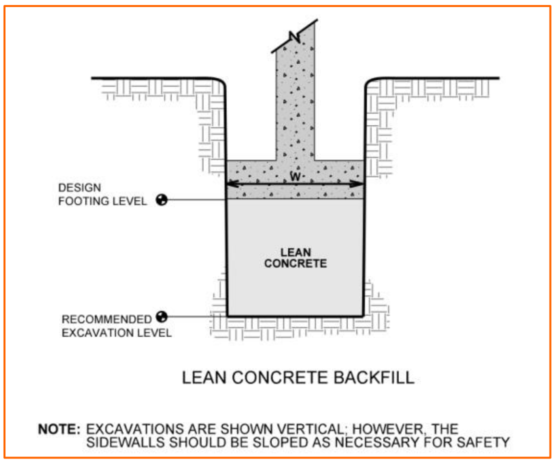
[1] The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any soft soils, if encountered, will be undercut and replaced with compacted select fill or footing bears in competent native soils. Based upon a minimum Factor of Safety of 3.

[2] The spread footing foundation excavation sides must be nearly vertical and the concrete should be placed neat against these vertical faces for the passive earth pressure values to be valid. If the loaded side is sloped or benched, and then backfilled, the allowable passive pressure will be significantly reduced. Passive resistance in the upper 12 inches of the soil profile should be neglected.

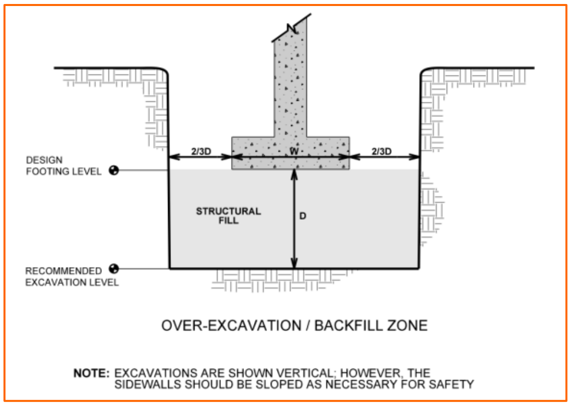
Foundation Construction Considerations

As noted in **Earthwork**, the grade beam footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed. **Due to the presence of sand, the contractor should be prepared to use forms should grade beam excavations experience caving or sloughing.**

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with select fill placed, as recommended in the **Earthwork** section.



SEISMIC CONSIDERATIONS

Description	Value
2018 International Building Code Site Classification (IBC) [1]	D [2]

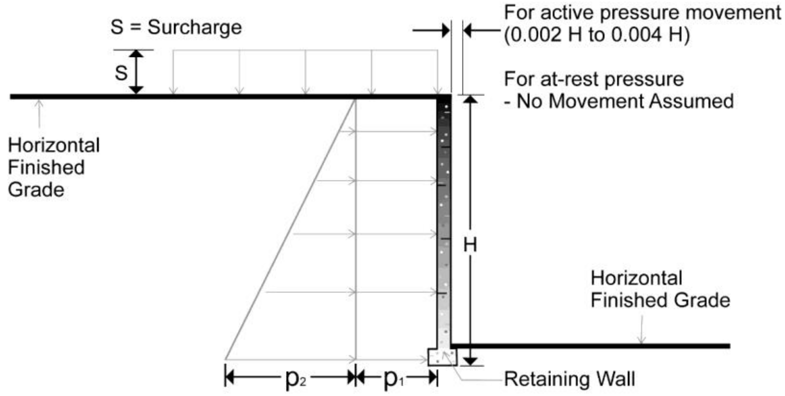
1/ The site class definition was determined using SPT N-values in conjunction with section 1613.3.2 in the 2018 IBC and Table 20.3-1 in the 2010 ASCE-7.

2/ Borings extended to a maximum depth of 40 feet, and this seismic site class definition considers that similar conditions continue below the maximum depth of the subsurface exploration.

LATERAL EARTH PRESSURES

Retaining Walls

New retaining walls may be constructed at the site. Walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls. Presented below are earth pressure coefficients that may be used to design the wall.



Earth Pressure Conditions	Backfill Type[1]	Coefficient of Earth Pressure	Equivalent Fluid Density (pcf)	Lateral Pressure due to Surcharge (psf)	Earth Pressure (psf)
Active (K_a)	Granular Select Fill	0.33	40	0.33S	40H
	On Site Soil	0.42	50	0.42S	50H
	Free Draining Granular Fill	0.26	30	0.26S	30H
At-Rest (K_o)	Granular Select Fill	0.46	55	0.46S	55H
	On Site Soil	0.58	70	0.58S	70H
	Free Draining Granular Fill	0.41	47	0.41S	47H
Passive (K_p)	Granular Select Fill	3.0	360	---	---
	On Site Soil	2.4	288	---	----
	Free Draining Granular Fill	3.85	442	---	---

1/ Refer to ***Fill Material Types*** *section of this report*

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 H to 0.004 H, where H is wall height.
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance.
- Uniform surcharge, where S is surcharge pressure.

- In-situ soil backfill weight a maximum of 120 pcf.
- Horizontal backfill, compacted to 95 percent of standard Proctor maximum dry density.
- Loading from heavy compaction equipment not included.
- No hydrostatic pressures acting on wall.
- No dynamic loading.
- No safety factor included in soil parameters.
- Ignore passive pressure in upper 1 feet.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 30 and 60 degrees from vertical for the active and passive cases, respectively. If it is not possible to construct a wedge of granular backfill, then a minimum of 12 inches of free draining granular fill should be placed behind the wall and the lean clay values presented in the table should be used.

To control hydrostatic pressure behind the wall we recommend that a drain be installed at the foundation wall with a collection pipe leading to a reliable discharge. If this is not possible, then combined hydrostatic and lateral earth pressures should be calculated for lean clay backfill using an equivalent fluid weighing 95 pcf. For granular backfill, an equivalent fluid weighing 90 pcf should be used. These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

To calculate the resistance to sliding, a value of 0.25 should be used as the allowable coefficient of friction between the footing and the underlying soil or select fill. The "active" earth pressures need to be resisted by the passive earth pressures on the face of the retaining wall base or a key (if applicable), and by the friction that will develop along the base of the wall. An allowable (FOS = 2) passive fluid density of 120 pcf may be used on the vertical face of the retaining wall base and key. Allowable bearing pressure along the base of the wall should be 2,000 psf. This bearing pressure includes a factor of safety against a bearing capacity failure of at least 3. Allowable bearing pressures are also based on the bearing surface being comprised of compacted soil that is free and clean of all debris and loose material.

A drainage system is recommended regardless of the backfill used. Weep holes along the front of, and a drain system located behind the wall will provide an outlet for water which may collect in the wall backfill. The wall backfill should drain much more effectively if a granular material is used behind the wall. The free-draining backfill should be protected from clogging by surrounding finer-grained soils through use of a geotextile filter fabric. The filter fabric should prevent the finer-grained materials from infiltration into the interstitial space between the individual grains of the free-draining backfill.

It is critical that surface water infiltration be reduced behind the wall. The upper 1 to 2 feet of backfill should be a clay soil having a Plasticity Index in the range of 20 to 40; or, the backfill material should be covered with pavement. This clay soil cap or pavement coupled with sloping the ground surface away from the wall will help to reduce infiltration of surface water into the backfill. The clay soil should be at least 12 inches in thickness and compacted to at least 95 percent of the maximum dry density as evaluated by the ASTM D 698 test method. The clay should be moisture conditioned between 0 and +4 percentage points of the optimum moisture content. The onsite soil may be used in the upper 1 to 2 feet of the backfill material.

PAVEMENTS

Both flexible and rigid pavement systems may be considered for the project. Based on our knowledge of the project, we anticipate that traffic loads will be produced primarily by automobile traffic, delivery trucks, trash removal trucks, and maybe school buses.

Subgrade Preparation

Prior to construction, any vegetation, loose topsoil and any otherwise unsuitable materials should be removed from the new pavement areas. After stripping, the subgrade should be proof-rolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with a fully loaded dump truck. Wet, soft, low-density or dry material should either be removed or moisture conditioned and recompacted to the moisture contents and densities described in section **Fill Compaction Requirements** prior to placing fill.

Design Recommendations

For this project Light and Heavy pavement section alternatives have been provided. Light is for areas expected to receive only car traffic. Heavy assumes areas with heavy traffic, such as trash pickup areas, delivery areas, main access drive and drive-through areas.

The flexible pavement section was designed in general accordance with the National Asphalt Pavement Association (NAPA) Information Series (IS-109) method (Class 1 for Light and Class 2 for Heavy). The rigid pavement section was designed using the American Concrete Institute (ACI 330R-01) method (Traffic Category A (ADTT=0) for Light and A-1 (ADTT=10) for Heavy). If heavier traffic loading is expected, Terracon should be provided with the information and allowed to review these pavement sections.

	FLEXIBLE PAVEMENT SYSTEM (inches)	
	Raw Subgrade	
	Light Duty	**Heavy Duty**
Hot Mix Asphaltic Concrete	2.0	3.0
Granular Base Material [1]	10.0	14.0
Moisture Conditioned Raw Subgrade	6.0	6.0

1/ Asphaltic base material may be used in place of crushed limestone base material. Every 2.5 inches of crushed limestone base material may be replaced with 1 inch of asphaltic base material. However, the minimum thickness of the asphaltic base material is 4 inches.

	RIGID PAVEMENT SYSTEM (inches)	
	Raw Subgrade	
	Light Duty	**Heavy Duty**
Reinforced Concrete	5.5	6.5
Moisture Conditioned Raw Subgrade	6.0	6.0

1/ Dumpster pad should be constructed as heavy duty concrete.

Pavement areas that will be subjected to heavy wheel and traffic volumes, such as waste bin or "dumpster" areas, entrance/exit ramps, and delivery areas, should be a heavy duty rigid pavement section constructed of reinforced concrete. The concrete pavement areas should be large enough to properly accommodate the vehicular traffic and loads. For example:

- The dumpster pad should be large enough so that the wheels of the collection truck are entirely supported on the concrete pavement during lifting of the waste bin; and
- The concrete pavement should extend beyond any areas that require extensive turning, stopping, and maneuvering.
- The pavement design engineer should consider these and other similar situations when planning and designing pavement areas. Waste bin and other areas that are not designed to accommodate these situations often result in localized pavement failures.

The pavement section has been designed using generally recognized structural coefficients for the pavement materials. These structural coefficients reflect the relative strength of the pavement materials and their contribution to the structural integrity of the pavement. If the pavement does not drain properly, it is likely that ponded water will infiltrate the pavement materials resulting in a weakening of the materials. As a result, the structural coefficients of the pavement materials will be reduced and the life and performance of the pavement will be shortened. The Asphalt Institute recommends a minimum of 2 percent slope for asphalt pavements. The importance of proper drainage cannot be overemphasized and should be thoroughly considered by the project team.

Pavement Section Materials

Presented below are selection and preparation guidelines for various materials that may be used to construct the pavement sections. Submittals should be made for each pavement material. The submittals should be reviewed by the Geotechnical Engineer and appropriate members of the design team and should provide test information necessary to verify full compliance with the recommended or specified material properties.

- **Hot Mix Asphaltic Concrete Surface Course** - The asphaltic concrete surface course should be plant mixed, hot laid Type C or D Surface. Each mix should meet the master specifications requirements of 2014 TXDOT Standard Specifications Item 341, Item SS 3224 (2011) and specific criteria for the job mix formula. The mix should be compacted between 91 and 95 percent of the maximum theoretical density as measured by TEX-227-F. The asphalt cement content by percent of total mixture weight should fall within a tolerance of ±0.3 percent asphalt cement from the specific mix. In addition, the mix should be designed so 75 to 85 percent of the voids in the mineral aggregate (VMA) are filled with asphalt cement. The grade of the asphalt cement should be PG 70-22 or higher performance grade. Aggregates known to be prone to stripping should not be used in the hot mix. If such aggregates are used measures should be taken to mitigate this concern. The mix should have at least 70 percent strength retention when tested in accordance with TEX-531-C.

  Pavement specimens, which shall be either cores or sections of asphaltic pavement, will be tested according to Test Method TEX-207-F. The nuclear-density gauge or other methods which correlate satisfactorily with results obtained from project pavement specimens may be used when approved by the Engineer. Unless otherwise shown on the plans, the Contractor shall be responsible for obtaining the required pavement specimens at their expense and in a manner and at locations selected by the Engineer.

- **Concrete** - Concrete should have a minimum 28-day design compressive strength of 4,000 psi.

- **Granular Base Material** - Base material may be composed of crushed limestone base meeting all of the requirements of 2014 TxDOT Item 247, Type A, Grade 1-2; including triaxial strength. The material should be compacted to at least 95 percent of the maximum dry density as determined in accordance with ASTM D 1557 at moisture contents ranging from -2 and +3 percentage points of the optimum moisture content.

- **Moisture Conditioned Subgrade** - The subgrade should be scarified to a depth of 6 inches and then moisture conditioned and compacted as recommended in the Compaction Requirements section of this report.

Details regarding subgrade preparation, fill materials, placement and compaction are presented in **Earthwork** section under subsections **Fill Material Types** and **Fill Compaction Requirements**.

Pavement Joints and Reinforcement

The following is recommended for all concrete pavement sections in this report. Refer to ACI 330 "Guide for Design and Construction of Concrete Parking Lots" for additional information.

Item	Description
Distributed Reinforcing Steel	No. 3 reinforcing steel bars at 18 inches on-center-each-way, Grade 60. It is imperative that the distributed steel be positioned accurately in the pavement cross section, namely 2 inches from the top of the pavement.
Contraction Joint Spacing	12.5 feet each way for pavement thickness of 5 to 5.5 inches. 15 feet each way for pavement thickness of 6 inches or greater. Saw cut control joints should be cut within 6 to 12 hours of concrete placement.
Contraction Joint Depth	At least ¼ of pavement thickness.
Contraction Joint Width	One-fourth inch or as required by joint sealant manufacturer.
Construction Joint Spacing	To attempt to limit the quantity of joints in the pavement, consideration can be given to installing construction joints at contraction joint locations, where it is applicable.
Construction Joint Depth/Width	Full depth of pavement thickness. Construct sealant reservoir along one edge of the joint. Width of reservoir to be ¼ inch or as required by joint sealant manufacturer. Depth of reservoir to be at least ¼ of pavement thickness.
Isolation Joint Spacing	As required to isolate pavement from structures, etc.
Isolation Joint Depth	Full depth of pavement thickness.

Item	Description
Isolation Joint Width	½ to 1 inch or as required by the joint sealant manufacturer.
Expansion Joint	In this locale, drying shrinkage of concrete typically significantly exceeds anticipated expansion due to thermal affects. As a result, the need for expansion joints is eliminated provided all joints (including saw cuts) are sealed. Construction of an unnecessary joint may be also become a maintenance problem. All joints should be sealed. If all joints, including sawcuts, are not sealed then expansion joints should be installed.

All construction joints have dowels. Dowel information varies with pavement thickness as presented as follows:

Parameter	5 to 5½ inches	6 to 6½ inches
Dowels	⅝ inch diameter	¾ inch diameter
Dowel Spacing	12 inches on center	12 inches on center
Dowel Length	12 inches long	14 inches long
Dowel Embedment	5 inches	6 inches

Pavement Drainage and Maintenance

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventative maintenance. The following recommendations should be implemented to help promote long-term pavement performance:

- The subgrade and the pavement surface should be designed to promote proper surface drainage, preferably at a minimum grade of 2 percent.
- Install joint sealant and seal cracks immediately.
- Extend curbs into the treated subgrade for a depth of at least 4 inches to help reduce moisture migration into the subgrade soils beneath the pavement section.
- Place compacted, low permeability clayey backfill against the exterior side of the curb and gutter.

- Slope subgrade in landscape islands to low points should drain to an appropriate outlet.
- Edge drains are recommended along pavement/ landscape borders.

Sulfate Considerations

A sulfate test was performed on a selected sample collected from the borings to check for possible adverse reactions with concrete. Testing was not performed on all borings nor at all depths. Sulfate content concentrations for a boring along with its approximate depth and nearest boring number is as follows:

Boring No.	Approximate Depth, feet	Sulfate Content, mg/Kg
CB-4	4.5-6	72

The test results indicate a sulfate value of about 72 mg/Kg. Based on the test results, the sulfate effect at this site is considered to be low.

The test results indicate that the sulfate concentrations in the soils are within levels deemed to be of a low risk for adverse reactions when mixed with a calcium-based additive TxDOT (>8,000 mg/Kg), the National Lime Association (>3,000 mg/Kg) and AASHTO (>5,000 mg/Kg). The American Concrete Institute (ACI) and the Texas Department of Transportation (TxDOT) provide guidance and specifications regarding sulfates in soil and groundwater. Concrete exposed to these materials is also subject to sulfate attack which can result in the deterioration of the concrete over time.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made. Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

FIGURES

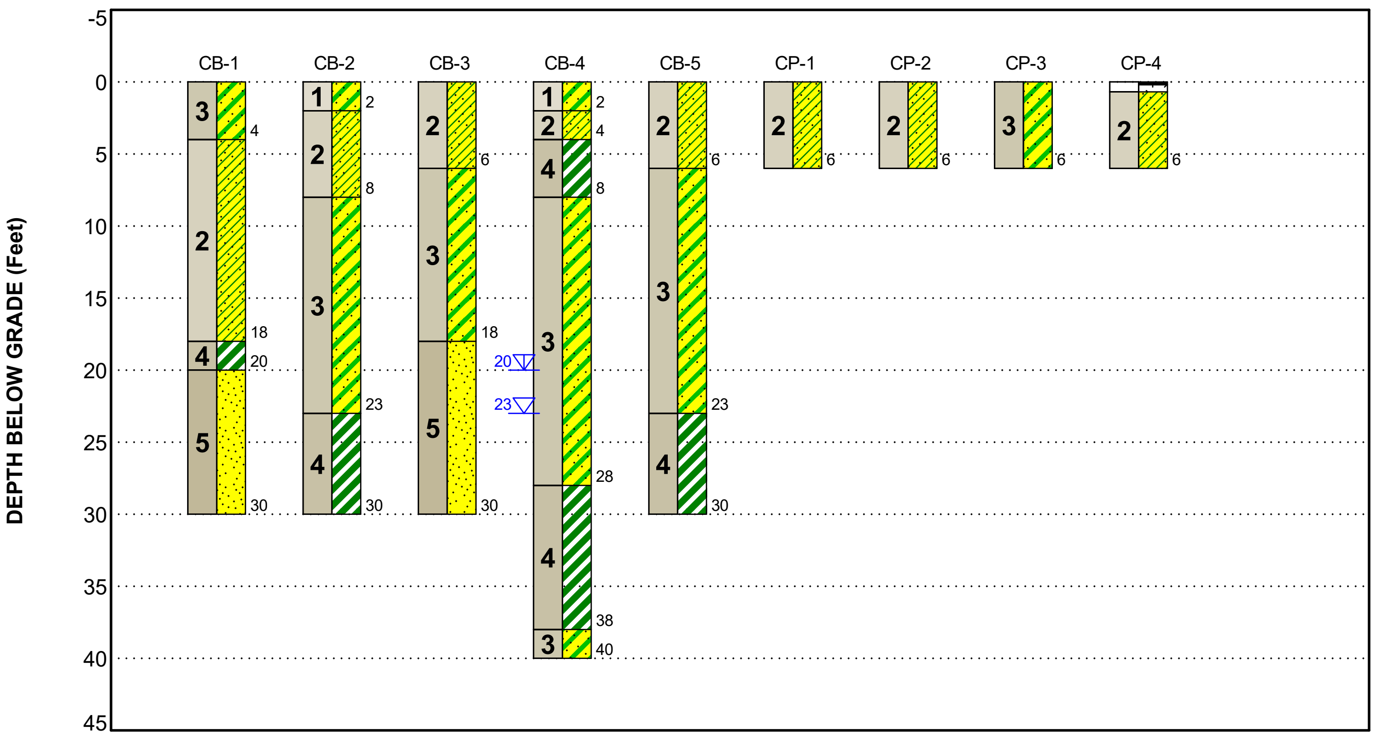
Contents:

GeoModel

GEOMODEL

Karnes City ISD CTE Building ■ Karnes CIty, TX
Terracon Project No. 90215043

Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	FILL - CLAYEY SAND (SC)	Brownish Gray, Medium Dense
2	SANDY LEAN CLAY (CL)	Dark Brown, Tan, Light Gray, Very Stiff to Hard
3	CLAYEY SAND (SC)	Dark Brown, Tan, Brownish Gray, Medium Dense to Very Dense
4	FAT CLAY (CH)	Brownish Gray, Light Gray, Gray, Very Stiff to Hard
5	POORLY GRADED SAND (SP)	Tan, Tan to Gray, Medium Dense to Very Dense

LEGEND

- Clayey Sand
- Sandy Lean Clay
- Fat Clay
- Poorly-graded Sand
- Asphalt
- Base

- First Water Observation
- Second Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
CB-1, CB-2, CB-3, CB-5	30	Building Location
CB-4	40	
CP-1 through CP-4	6	Pavement

Boring Layout and Elevations: We use handheld GPS equipment to locate borings with an estimated horizontal accuracy of +/-20 feet.

Subsurface Exploration Procedures: We advanced the soil borings with a truck-mounted drill rig using continuous flight augers (solid stem and/or hollow stem, as necessary, depending on soil conditions). Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was performed using thin-wall tube and/or split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split barrel sampling procedure, a standard 2-inch outer diameter split barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples.

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in this Appendix. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Moisture Content
- Atterberg Limits
- Soil Finer than No. 200 Mesh Sieve
- Sulfate Tests (ASTM C1580)

Final boring logs that were prepared represented the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

SITE LOCATION AND EXPLORATION PLANS

SITE LOCATION

Karnes City ISD - CTE Building ■ Karnes City, Texas

March 30, 2021 ■ Terracon Project No. 90215043

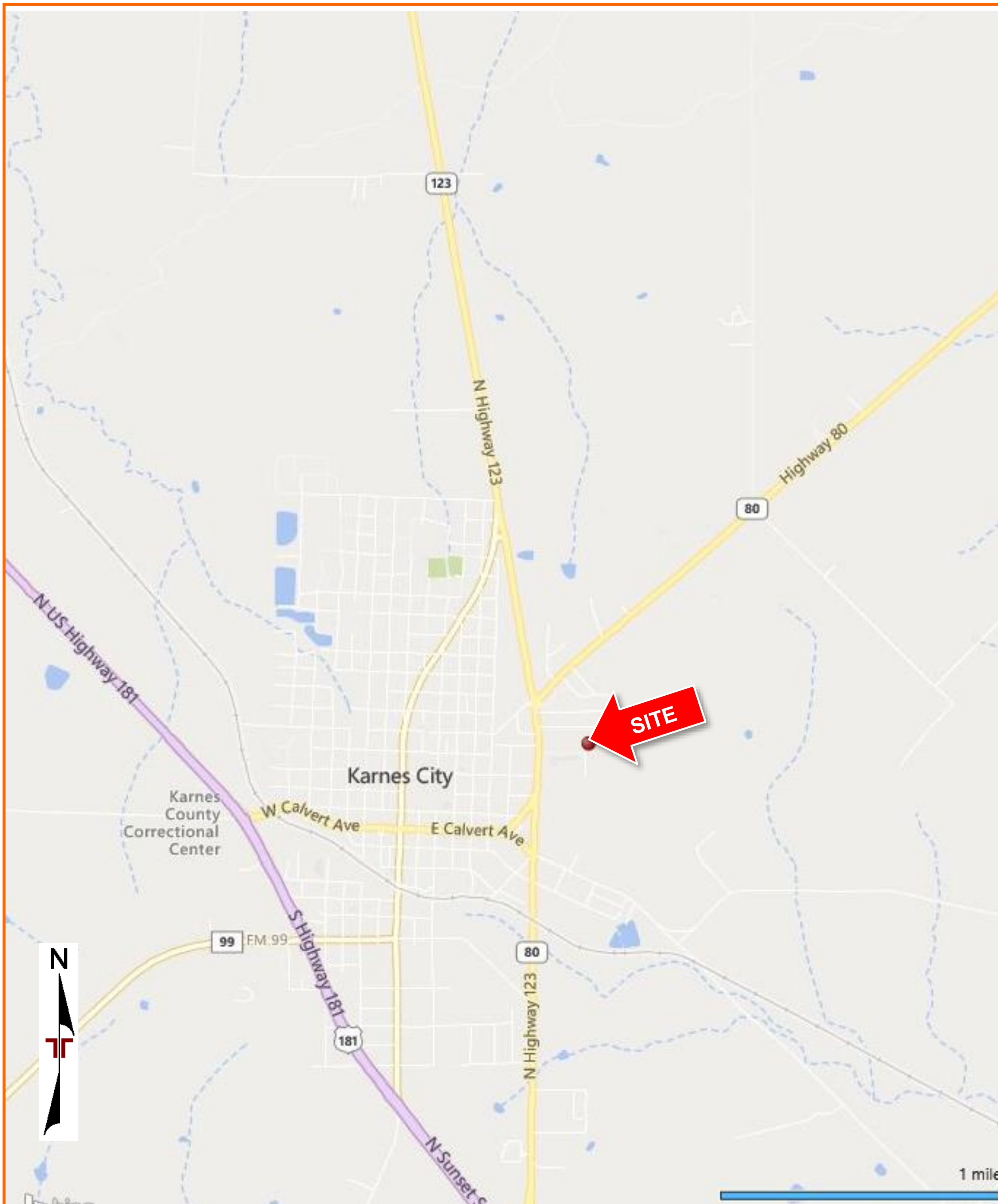


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Karnes City ISD - CTE Building ■ Karnes City, Texas

March 30, 2021 ■ Terracon Project No. 90215043

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS
NOT INTENDED FOR CONSTRUCTION PURPOSES

EXPLORATION RESULTS

Contents:

Boring Logs (CB-1 through CB-5 & CP-1 through CP-4)

BORING LOG NO. CB-1

PROJECT: Karnes City ISD CTE Building

SITE: 400 TX-123 Karnes CIty, TX

CLIENT: PBK Architects Inc San Antonio, TX

LOCATION See Exploration Plan

Latitude: 28.8894° Longitude: -97.8902°

MODEL LAYER	DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
3	4.0	**CLAYEY SAND (CL)**, dark brown, medium dense				4.5 (HP)	10.4		
						4.0 (HP)	13.9	39-18-21	40
2	18.0	**SANDY LEAN CLAY (CL)**, dark brown, hard	5			4.5+ (HP)	14.4		53
		- tan below 6 feet				16-21-23 N=44	15.5	32-16-16	61
			10			13-15-17 N=32	10.9		
		- Clayey Sand (SC) layer at 13 feet	15			16-22-50/4"	5.1		
4	20.0	**FAT CLAY (CH)**, brownish gray, hard				18-25-50/3"	10.3	71-28-43	72
5	30.0	**POORLY GRADED SAND (SP)**, tan to gray, dense to very dense	20						
			25			16-25-32 N=57	2.6		
			30			18-23-21 N=44	5.4		
		Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-30 ft

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021 | Boring Completed: 03-05-2021

Drill Rig: Track Rig | Driller: Ramco

Project No.: 90215043

BORING LOG NO. CB-2

PROJECT: Karnes City ISD CTE Building

CLIENT: PBK Architects Inc
San Antonio, TX

SITE: 400 TX-123
Karnes CIty, TX

LOCATION See Exploration Plan

Latitude: 28.8895° Longitude: -97.8898°

MODEL LAYER	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1	2.0	**FILL - CLAYEY SAND (SC)**, brownish gray, medium dense				4.5+ (HP)	15.0	38-20-18	40
2	8.0	**SANDY LEAN CLAY (CL)**, dark brown, very stiff to hard - light gray and with calcareous deposits below 4 feet				6-9-12 N=21	13.3		
			5			5-8-9 N=17	8.1	45-21-24	
						7-12-19 N=31	15.0		
3	23.0	**CLAYEY SAND (SC)**, tan, medium dense to very dense				10-13-12 N=25	9.8		
			10						
						20-22-50/3"	5.0		33
			15						
						15-16-21 N=37	4.9		
			20						
4	30.0	**FAT CLAY (CH)**, gray, hard				7-23-21 N=44	31.7		74
			25						
						9-12-23 N=35	31.3		
			30						
		Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-30 ft

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021	Boring Completed: 03-05-2021
Drill Rig: Track Rig	Driller: Ramco
Project No.: 90215043	

BORING LOG NO. CB-3

PROJECT: Karnes City ISD CTE Building

CLIENT: PBK Architects Inc
San Antonio, TX

SITE: 400 TX-123
Karnes CIty, TX

LOCATION See Exploration Plan

Latitude: 28.8893° Longitude: -97.8902°

MODEL LAYER	DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
2		**SANDY LEAN CLAY (CL)**, dark brown, very stiff to hard				4.5+ (HP)	13.4	37-16-21	
						7-10-11 N=21	10.4	42-19-23	
	6.0	- light gray and with calcareous deposits below 4 feet	5			9-12-8 N=20	10.0		
3		**CLAYEY SAND (SC)**, tan, dense				17-21-19 N=40	8.3		37
			10			15-17-23 N=40	7.5		
	18.0		15			16-19-22 N=41	2.5		
5		**POORLY GRADED SAND (SP)**, tan, medium dense to dense	20			12-10-11 N=21	0.8		9
			25			17-15-18 N=33	2.5		
	30.0		30			14-12-12 N=24	3.6		
		Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-30 ft

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS
No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021 | Boring Completed: 03-05-2021

Drill Rig: Track Rig | Driller: Ramco

Project No.: 90215043

BORING LOG NO. CB-4

PROJECT: Karnes City ISD CTE Building

CLIENT: PBK Architects Inc
San Antonio, TX

SITE: 400 TX-123
Karnes CIty, TX

LOCATION See Exploration Plan

Latitude: 28.8894° Longitude: -97.8900°

MODEL LAYER	DEPTH	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
1	2.0	**FILL - CLAYEY SAND (SC)**, brownish gray, medium dense, with gravel				4.5+ (HP)	13.4	37-24-13	37
2	4.0	**SANDY LEAN CLAY (CL)**, dark brown, very stiff				9-11-13 N=24	12.6		
4	8.0	**FAT CLAY (CH)**, light gray, very stiff, with calcareous deposits	5			11-13-15 N=28	18.5		
						7-9-11 N=20	18.3	75-30-45	
3	28.0	**CLAYEY SAND (SC)**, tan, very dense				25-50/4"	5.7		
			10						
			15			26-50/5"	2.1		27
			20	▽		21-32-50/4"	9.2		
				▽					
			25			22-27-39 N=66	12.9		
4	38.0	**FAT CLAY (CH)**, brownish gray, hard, sandy	30			17-25-36 N=61	27.9		65
			35			9-14-31 N=45	21.1		
3	40.0	**CLAYEY SAND (SC)**, brownish gray, very dense	40			17-29-36 N=65	13.7		27
		Boring Terminated at 40 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-40 ft

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS

▽ *23 feet while drilling*

▽ *20 feet after boring completion*

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021	Boring Completed: 03-05-2021
Drill Rig: Track Rig	Driller: Ramco
Project No.: 90215043	

BORING LOG NO. CB-5

PROJECT: Karnes City ISD CTE Building

CLIENT: PBK Architects Inc
San Antonio, TX

SITE: 400 TX-123
Karnes CIty, TX

LOCATION See Exploration Plan

Latitude: 28.8893° Longitude: -97.8898°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
2		**SANDY LEAN CLAY (CL)**, dark brown, very stiff				3.5 (HP)	14.1		
						7-9-9 N=18	18.4	42-20-22	
		6.0	5			8-8-12 N=20	15.5		
3		**CLAYEY SAND (SC)**, tan, medium dense to dense				4-5-6 N=11	8.8	19-16-3	20
			10			5-5-7 N=12	7.9		
			15			11-21-27 N=48	8.5		43
			20			12-15-21 N=36	4.7		
		23.0							
4		**FAT CLAY (CH)**, gray, very stiff, with sand	25			6-9-12 N=21	31.9		73
		30.0	30			7-10-15 N=25	28.7		
		Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-30 ft

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021	Boring Completed: 03-05-2021
Drill Rig: Track Rig	Driller: Ramco
Project No.: 90215043	

BORING LOG NO. CP-1

PROJECT: Karnes City ISD CTE Building

CLIENT: PBK Architects Inc
San Antonio, TX

SITE: 400 TX-123
Karnes CIty, TX

LOCATION See Exploration Plan

Latitude: 28.8896° Longitude: -97.8900°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
2		**SANDY LEAN CLAY (CL)**, dark brown, very stiff				4.0 (HP)	12.5		
						3.0 (HP)	15.6		
		6.0	5			3.0 (HP)	15.8	46-23-23	
		Boring Terminated at 6 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-5 ft

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021	Boring Completed: 03-05-2021
Drill Rig: Track Rig	Driller: Ramco
Project No.: 90215043	

BORING LOG NO. CP-2

PROJECT: Karnes City ISD CTE Building

CLIENT: PBK Architects Inc
San Antonio, TX

SITE: 400 TX-123
Karnes CIty, TX

LOCATION See Exploration Plan

Latitude: 28.8894° Longitude: -97.8904°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
2		**SANDY LEAN CLAY (CL)**, dark brown, very stiff to hard				4.5+ (HP)	13.1		
						3.0 (HP)	12.7	38-15-23	
		6.0	5			15-18-17 N=35	11.8		
		Boring Terminated at 6 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-5 ft

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021	Boring Completed: 03-05-2021
Drill Rig: Track Rig	Driller: Ramco
Project No.: 90215043	

BORING LOG NO. CP-3

PROJECT: Karnes City ISD CTE Building

CLIENT: PBK Architects Inc
San Antonio, TX

SITE: 400 TX-123
Karnes CIty, TX

LOCATION See Exploration Plan

Latitude: 28.8894° Longitude: -97.8896°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
3		**CLAYEY SAND (SC)**, dark brown, medium dense				4.5+ (HP)	13.9		
						7-9-11 N=20	10.4		34
		6.0	5			9-13-15 N=28	9.5		
		Boring Terminated at 6 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-5 ft

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021	Boring Completed: 03-05-2021
Drill Rig: Track Rig	Driller: Ramco
Project No.: 90215043	

BORING LOG NO. CP-4

PROJECT: Karnes City ISD CTE Building

CLIENT: PBK Architects Inc
San Antonio, TX

SITE: 400 TX-123
Karnes CIty, TX

LOCATION See Exploration Plan

Latitude: 28.8891° Longitude: -97.8900°

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		0.2	**Asphalt thickness: 2 inches**							
		0.7	**Base material thickness: 6 inches**							
2			**SANDY LEAN CLAY (CL)**, dark brown, very stiff to hard				4.5+ (HP)	15.3	45-21-24	
							5-8-10 N=18	16.3		
		6.0	- light gray below 4 feet	5			9-9-12 N=21	16.5		
			Boring Terminated at 6 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger: 0-5 ft

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 03-05-2021	Boring Completed: 03-05-2021
Drill Rig: Track Rig	Driller: Ramco
Project No.: 90215043	

SUPPORTING INFORMATION

Contents:

GENERAL NOTES
DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Shelby Tube Split Spoon	▽ Water Initially Encountered ▽ Water Level After a Specified Period of Time ▼ Water Level After a Specified Period of Time Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

Terracon GeoReport

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification: Group Symbol	Soil Classification: Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above “A” line		CL	Lean clay [K, L, M]
			$PI < 4$ or plots below “A” line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line		CH	Fat clay [K, L, M]
			PI plots below “A” line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains $\geq$ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add “sandy” to group name.

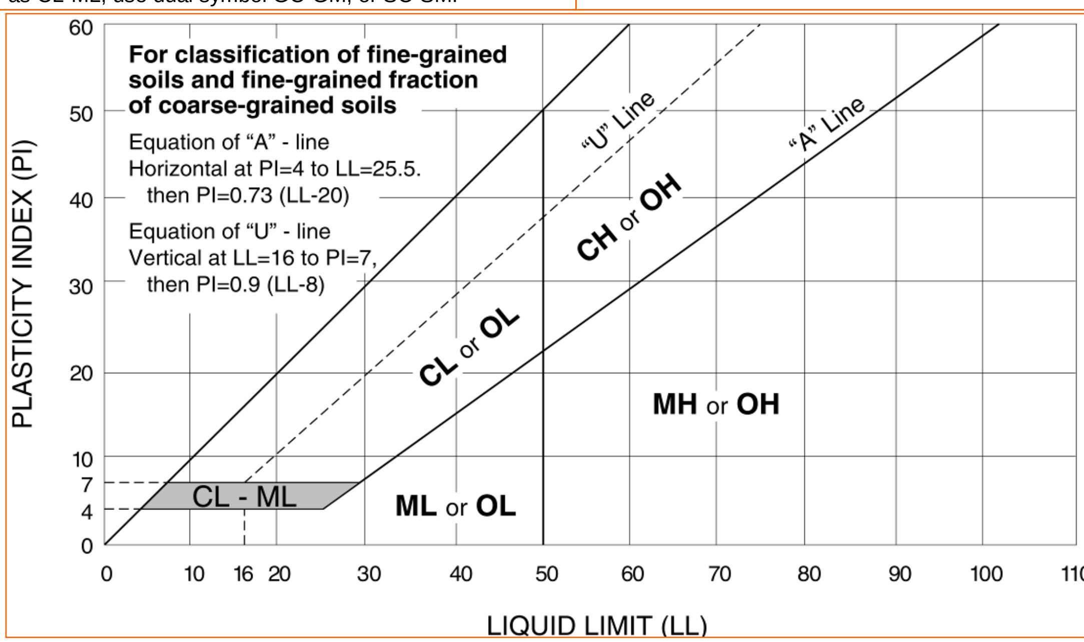
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] $PI \geq 4$ and plots on or above “A” line.

[O] $PI < 4$ or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.



SECTION 23 35 16 - WELDING FUME REMOVAL SYSTEMS

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. Provide complete, fully operational system where indicated on Drawings.

B. Section Includes:

1. Welding Fume Removal Fan.
2. Fume Removal Weld Arm with Flexible Tube and Removal Hood.
3. Bench Welding Hood with Flexible Tube.
4. Welding Fume Removal Hood with Flexible Tube for Tube Drop Application.

C. Related Sections:

1. Section 23 31 13 – Metal Ducts: Product requirements for hangers for placement by this section.
2. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.
3. Coordinate work in this Section with Division 7.

1.3 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork, and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics, and connection requirements.

D. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

1.6 WARRANTY

A. Furnish one (1) year manufacturer’s warranty for fans and hose system. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start up will not be acceptable.

1.7 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading: Deliver vehicle exhaust fans and hose storage system as a factory assembled unit with protective crating and covering. Store equipment in original protective crating and covering and in a dry location.

B. All equipment shall remain in manufacturer’s protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver Equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

E. Handle and lift fans in accordance with the manufacturer’s instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.

1.8 COORDINATION

A. Coordinate layout and installation with other work, including but not limited to: light fixture, HVAC equipment, overhead cranes, structural members, and fire suppression system components.

B. Coordinate location and requirements of service-utility connections.

C. Confirm product locations with owner’s representative prior to installing equipment.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Spare materials shall be provided by equipment manufacturer and not by the installing mechanical contractor.

1. Fan Belts: Two (2) sets for each belt-driven fan.

PART 2 - PRODUCTS

2.1 WELDING FUME REMOVAL FANS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. National System of Garage Ventilation (NSGV)
2. Monoxivent
3. Maxair

B. The fan shall be class 1, single inlet, single width, and non-overloading belt drive blower built in accordance with AMCA 210 guidelines as well as OSHA 1910 general sound requirements. The blower housing shall be constructed of not less than 16-gauge carbon steel. The blower impellers shall be welded steel construction backward curve type, and accurately balanced both statically and dynamically. The blower shall be designed for not less than 150 percent of the connected driving capacity, and the motor sheaves adjustable to provide not less than an overall 20 percent speed variation. Sheaves shall be selected to drive the blower as such speed to produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for v-belt drives shall be provided with adjustable base plate assemblies. Delivered air volume, static pressure and motor horsepower shall be as indicated on equipment schedule.

The drive assembly shall include a singular hot rolled solid steel shaft, which is precision, turned, ground, and polished with keyway at each end. Belts provided are to be oil resistant, and sheaves are machined cast iron type. Ball bearings are to be self-aligning, re-greaseable pillow block type.

Standard AMCA arrangements shall be provided. Blower rotation and discharge shall be indicated. Fans shall be totally free of vibration and objectionable noise.

Individual fan will be controlled via the on/off switch mounted on wall in space. Wiring, conduit, and switch will be provided by Div. 26 Electrical.

C. Required Accessories:

1. Back-draft damper.
2. Vibration isolators.
3. Mounting Platform.
4. AMCA Type B spark-proof construction.
5. Open Drip Proof.
6. Flexible connections for inlet and outlet duct connections.
7. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
8. Weather guard cover
9. Control starter box – coordinate with electrical contractor to provide pedestal mounting and electrical connection from control box to fan.

2.2 FUME REMOVAL WELD ARM WITH FLEXIBLE TUBE AND REMOVAL HOOD

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:
1. National System of Garage Ventilation (NSGV).
2. Monoxivent

B. Weld Arm: (Monoxivent Series 15320)

1. Weld arm shall be articulating and capable of 360° swivel. The 6” and 8” diameter telescopic arm shall have an internal three-piece aluminum tube to allow for telescopic movement. The 4” diameter telescopic arm shall have an external three-piece aluminum tube. The duct mount swivel flange connection shall be provided to attach weld arm directly to ductwork. The connection flange shall be fixed to duct and shall be the support for the arm. The connecting duct shall be adequately braced to support the arm. Arm is mounted with wall bracket.

a. Required Accessories:

1) Hand Damper.

C. Flexible Tubing:

1. Flexible tubing shall be constructed of a single ply, double overlap PVC bonded fabric. The material shall be .021 Mil thickness and be reinforced with a spring steel wire helix that is enclosed in the making of the tubing. The fabric will be black in color. The temperature rating shall be -20°F to 275°F continuous.

D. Welding Removal Hood for weld arm application:

1. The weld hood shall be constructed of polycarbonate. The weld hood shall be mounted directly to the weld arm assembly and pivot separately of the arm. As an additional safety feature, a screen constructed of minimum 16-gauge steel mesh shall be incorporated into the weld hood preventing large debris and other foreign materials from being introduced into the system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with installer present, for compliance with requirements for installation tolerances, service-utility connections, and other conditions affecting installation and performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 TEST REQUIREMENTS

A. The assembled fan shall be test run before shipment. Any fan having an average reading of over 3 mils deflection is not acceptable.

3.3 INSTALLATION

A. Fans and hose reels must be mounted securely from the building steel or suitable structure.

B. Install system level and plumb, and in accord with manufacturer’s written instructions, original design and referenced standards.

C. Provide sheaves required for final air balance.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.4 ADJUSTING

A. Adjust system for proper operation. Replace any parts that prevent the system from operating properly.

3.5 CLEANING

A. Remove all debris caused by installation of the system. Clean all exposed surfaces to as fabricated condition and appearance.

3.6 DEMONSTRATION

A. Furnish services of factory trained representative for minimum of one (1) day to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.7 PROTECTION OF FINISHED WORK

A. Do not operate fans until clean, bearings are lubricated, and fan has been test run under observation.

END OF SECTION 23 35 16