INTEC TERRADYNE
Engineers, Geologists & Environmental Scientists

# Subsurface Exploration and Foundation Analysis
# Proposed Day Care at 3808 South 1st Street
# Austin, Texas

## InTEC Project No.: A121366

Mr. Rahul Singh
Sun Moon and Stars
3808 South 1st Street
Austin, Texas 78704

December 20, 2012

INTEC OF AUSTIN, INC.
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**Proposed Day Care at 3808 South 1st Street**
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**Mr. Rahul Singh**
**Sun Moon and Stars**
**3808 South 1st Street**
**Austin, Texas 78704**

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Zack J. Munstermann, E.I.T.
Geotechnical Project Manager

STATE OF TEXAS
JOHN A. GUNTER
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REGISTERED
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John A. Gunter, M.S., P.E
Chief Engineer

Locations in Southern and Western United States

February 7, 2022

**Sun Moon and Stars**
3810 South 1st Street
Austin, Texas 78704

Attn: **Mr. Rahul Singh**

Re: **Supplementary Letter**
Proposed Day Care at:
3810 South 1st Street
Austin, Travis County, Texas 78704
**Terradyne Project No.: A121366**

Dear Mr. Singh:

As requested, by Mr. Steve Hampton, PE, Architect, Partner of N-VIZION design, LLC, on January 24, 2022, Terradyne has reviewed our geotechnical report (Terradyne Project No.: A121366 and dated on December 20, 2012) for the above referenced project. The purpose of our review was to provide the recommendations of drilled pier foundation.

In our geotechnical report dated on December 20, 2012, we estimated the swell potential on the order of two and one-quarter ($2^1/_4$) inches. We recommended a stiffened grid type beam and slab foundation, either conventionally reinforced or post tensioned for the proposed structure. It is understood, via the Mr. Steve Hampton, a drilled pier foundation system will be considered for the proposed structure.

<u>Terradyne should be notified prior to the pier holes drilling operation and piers installation. The depths of limestone should be observed and verified by the representatives of Terradyne on the site during the pier holes drilling operation.</u>

**Drilled Piers**
Drilled piers are used in areas where relatively soft or expansive soil strata overlie a firm foundation soil. The soil conditions at the site and the magnitude of the loads of the proposed structures indicate that straight shaft piers will be a suitable foundation system for the structures.

The piers will utilize a combination of end bearing and skin friction to develop load carrying capacity. Straight shaft piers founded at a minimum depth of 3-feet[1] into limestone may be sized

[1] This pier depth is a guideline and should not be construed as the final pier depth. Please refer to the structural engineers' foundation plans for the actual required pier depth for the site.

for allowable end bearing capacity 15,000 psf. Drilled straight shaft piers will need to extend to a deeper depth to provide resistance to the uplift force from swelling soils.

Allowable skin friction can be used on the portion of the straight shaft piers that is below a depth of five (5) feet. Skin friction values are presented in Table No. 1.

**Table No. 1 – Allowable Skin Friction Values**

| Depth, Ft. | Allowable Skin Friction Value, PSF |
|---|---|
| 5-10 | 1,200 |

*Uplift Forces:* Moisture variation in the expansive soils at this site can cause vertical movements of the subsurface soils. This potential vertical movement can mobilize an uplift force along the shaft of a drilled pier. The uplift force acting on the shaft may be estimated by using Equation No. 1.

$$\mathbf{F_u = 11d} \text{ - - - - - } \mathbf{(1)}$$

where $F_u$ = uplift force in kips
$d$ = Diameter of the shaft in feet

If resistance to the uplift force is not provided, the pier will move vertically as the clay soils shrink and swell. For straight shaft piers resistance can be provided by skin friction along the shaft as it is extended below a depth of five (5) feet plus the load that is carried by the pier. Therefore, straight shaft piers will need to extend to a deeper depth based on the uplift force.

Tension steel will be required in each pier shaft to withstand a net force equal to the uplift force, minus the sustained compressive load carried by that footing. We recommend that each pier be reinforced with tension steel to withstand this net force or one percent of the cross-sectional area of the shaft, whichever is greater.

It is recommended that the design and construction of drilled piers should generally follow methods outlined in the manual titled Drilled Shafts: Construction Procedures and Design Methods (Publication No: FHWA-IF-99-025, August 1999).

*Pier Spacing:* The minimum clear spacing between any two piers should not be less than 3*d,* where *d* is the pier diameter. If the spacing between the piers is closer than 3*d*, stress concentrations will occur between the two piers. The concentrated stress may be higher than the allowable bearing capacity. Hence, these piers should be designed for a lower bearing capacity than the maximum allowable. For construction purposes, the minimum pier spacing may be as close as three (3) feet, provided the first pier has been drilled and concreted and the concrete has achieved its final set prior to drilling the adjacent pier.

*Grade Beams:* A minimum 6-inch void space should be provided beneath the grade beams to prevent uplift should the underlying soils expand.

*Floor Slabs:* Two alternatives are available for constructing floor slabs with a drilled pier foundation. The owner may select the alternative best satisfying the required performance criteria.

*Alternative No. 1:* Floor slabs, or portions of the floor slab, which have high performance criteria and are movement sensitive in nature, should be structurally suspended above grade because of the anticipated ground movements. A positive void space of at least six (6) inches should be provided beneath the floor slab. The crawl space should be designed with a positive drainage flow so that water will not accumulate in the crawl space. Excavated on-site material may be used to raise the grade in the crawl space area. This material should be compacted to 95 percent of the ASTM D-698 maximum density and tested. Select fill need not be used to raise the grade in the crawl space area.

*Alternative No. 2:* Floor Slabs within the superstructure may be ground supported provided the potential vertical movements will not impair performance of the floor system. Ground supported floor slabs could be doweled to the perimeter grade beams. Doweled slabs that are subjected to heaving will typically crack and develop a plastic hinge along a parallel line located approximately five (5) to 10 feet inside the grade beams.

The floor slab may be cast independent of the grade beams, interior columns and partitions. These slabs should experience cracking of lower magnitude, but may create difficulties at critical entry points, such as doors. A "trip hazard" could result due to resulting differential movements at entryways and difficulty in opening and closing doors could develop.

We recommend placement of a polyethylene moisture barrier underground supported floor slabs to reduce the possibility of moisture migration through the slab.

All other recommendations in the original report, Terradyne Project No.: A121366 and dated on December 20, 2012, will remain in effect.

We appreciate and wish to thank you for the opportunity to service you on this project. If you have any questions regarding these design values, please contact our office.

*Supplementary Letter: Sun Moon and Stars*
*Proposed Day Care at:*
*3810 South 1st Street*
*Austin, Travis County, Texas 78704*

Respectfully submitted,

**Terradyne Residential, Inc.**
*Texas Firm Registration No. F-22173*


Aaron (Haicheng) Mao, MCE, P.E.
*Project Engineer*

Derek Stout, P.E.
*Regional Vice President*

*2/7/2022*

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December 20, 2012

Sun Moon and Stars
3808 South 1st Street
Austin, Texas 78704

Attention: Rahul Singh

Re: **Subsurface Exploration and Foundation Analysis**
Proposed Day Care at 3808 South 1st Street
Austin, Texas
**InTEC Project No.: A121366**

Dear Mr. Singh:

Integrated Testing and Engineering Company of Austin, Inc. (InTEC) has completed a soil and foundation engineering report at the above referenced project site. The results of the exploration are presented in this report.

We appreciate and wish to thank you for the opportunity to service you on this project. Please do not hesitate to contact us if we can be of additional assistance during the Construction Materials Testing and Quality Control phases of construction.

Respectfully Submitted,

Very Truly Yours,
Integrated Testing and Engineering Company of Austin, Inc.

Zack J. Munstermann, E.I.T.
Geotechnical Project Manager

Copies Submitted: Above (1)

# TABLE OF CONTENTS

Page

## EXECUTIVE SUMMARY

The soil conditions at the site of the proposed day care structure at 3808 South 1st Street in Austin, Texas were explored by drilling 2 borings to a maximum depth of 10 feet below the existing ground surface elevation. Laboratory tests were performed on selected soil samples to evaluate the engineering characteristics of the soil strata encountered in our test holes.

The results of our exploration, laboratory testing and engineering evaluation indicate that the underlain shallow soils at this site are of moderate expansion potential. Potential vertical movement on the order of 2 ¼ inches was estimated for dry soil moisture conditions on the subject lot.

If it is desirable to design the foundation systems utilizing the simplifying assumption that the loads are carried by the beams, an allowable bearing pressure value of 1,700 pounds per square foot should be used for beams founded at a minimum depth of 12 inches below the existing grade. If structure existing grade has to be raised to achieve design grade, select structural fill should be placed, compacted and tested. An allowable bearing pressure value of 2,300 pounds per square foot should be used for beams bearing on a minimum of 12 inches of compacted select structural fill. The depth of the beams should be at least 12 inches and also should be 10 inches wide to prevent local shear failure of the bearing soils. A design plasticity index value of 20 is recommended for slabs bearing on compacted natural subgrade soils for the lot.

Groundwater was not encountered in our borings at the time of our drilling.

Detailed descriptions of subsurface conditions, engineering analysis and design recommendations are included in this report.

## 1.0 INTRODUCTION

This report presents the results of our subsurface exploration and foundation analysis for the proposed day care structure at 3808 South 1st Street in Austin, Texas. This project was authorized by Rahul Singh of Sun Moon and Stars.

## 2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of our geotechnical investigation was to evaluate the subsurface materials and groundwater conditions of the site and provide geotechnical-engineering recommendations for the design and construction of a new structure. Our scope of services includes the following:

1) Drilling and sampling of two (2) borings to a maximum depth of 10 feet;
2) Observation of the groundwater conditions during drilling operations;
3) Performing laboratory tests such as Atterberg limits and moisture content tests;
4) Review and evaluation of the field and laboratory test programs during their execution with modifications of these programs, when necessary, to adjust to subsurface conditions revealed by them;
5) Compilation, generalization and analysis of the field and laboratory data in relation to the project requirements;
6) Estimation of potential vertical movement;
7) Development of recommendations for the design, construction, and earthwork phases of project; and
8) Consultations with the Prime Professional and members of the design team on findings and recommendations; and preparation of a written geotechnical

engineering report for use by the members of the design team in their preparation of design, contract documents, and specifications.

The Scope of Services did not include any environmental assessment for the presence or absence of wetlands and/or hazardous or toxic materials in the soil, surface water, groundwater, or air, in the proximity of this site. Any statements in this report or on the boring log regarding odors, colors or unusual or suspicious items or conditions are strictly for the information of the client.

## 3.0 GEOTECHNICAL INVESTIGATION

The field exploration to determine the engineering characteristics of the subsurface materials included a reconnaissance of the project site, drilling the boring, and recovering split spoon samples. Due to site access limitations two (2) borings were drilled to a maximum depth of 10 feet below the presently existing ground surface elevation.

The soil borings were performed with a drilling rig equipped with a rotary head. Conventional solid stem continuous augers were used to advance the holes and samples of the subsurface materials were sampled using a two-inch O.D. split barrel sampler (ASTM D 1586).

### 3.1 Field Tests and Measurements

*Penetration Tests*: During the sampling procedures, standard penetration tests were performed in the borings in conjunction with split-barrel sampling (ASTM 1586). The standard penetration value (N) is defined as the number of blows of a 140-pound hammer, falling thirty inches, required to advance the split-spoon sampler one foot into the soil. The sampler is lowered to the bottom of the drill hole and the number of blows recorded for each of the three successive increments of six inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration tests indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

*Water Level Measurements:* Water level observations were made during the boring operations and the results are noted on the boring logs. In relatively pervious soils, such as sandy soils, the indicated elevations are considered reliable groundwater levels. In relatively impervious soils, an accurate determination of the groundwater elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the level of the groundwater table and the volume of water encountered will depend on the permeability of the soils.

### 3.2 Field Logs

A field log was prepared for each boring. The logs include information concerning the samples attempted and recovered, indications of the presence of material (such as calcareous clays, sandy clay, etc.) and groundwater observations. It also includes an interpretation of the subsurface conditions between samples. Therefore, the logs include both factual and interpretive information.

### 3.3 Presentation of the Data

The final log represents our interpretation of the contents of the field log for the purpose delineated by our client. The final logs are included on Plates 2 and 3 in the Illustration Section. A key to classification terms and symbols used on the logs is presented on Plate 4.

### 3.4 Laboratory Testing Program

In addition to field exploration, a supplemental laboratory-testing program was conducted to determine additional pertinent engineering characteristics of the subsurface materials necessary in evaluating the design parameters of the soil. All phases of the laboratory testing program were conducted in general accordance with the indicated applicable ASTM Specifications as presented in Table No. 1.

**TableNo.1**

| Laboratory Test | Applicable Test Standard |
|---|---|
| Liquid Limit, Plastic Limit, & Plasticity Index of Soil | ASTMD-4318 |
| Moisture Content | ASTMD-2216 |

In the laboratory, each sample was examined and classified by a geotechnical engineer. As a part of this classification procedure, the natural water content of the soil samples were determined. Atterberg limit tests were performed on representative soil samples to determine the plasticity characteristics of the soil strata encountered. The following tests, presented in Table No. 2, were performed in the laboratory to evaluate the engineering characteristics of the subsurface materials. The results of these tests are presented on the boring logs.

**Table No. 2**

| Type of Test | Number Conducted |
|---|---|
| Natural Moisture Content | 4 |
| Atterberg Limits | 2 |

### 3.5 General Subsurface Conditions

The soils underlying these sites may be grouped into generalized strata. The soil stratigraphy information is presented on the Boring Logs, Plates 2 and 3. The soil stratigraphy and the engineering properties of the underlying soils based on our laboratory test results on selected soil samples are presented in Table No. 3 below:

**Table No. 3**

| Stratum Description | Depth Range, Feet | Liquid Limit | Plasticity Index | SPT, Blows per Foot |
|---|---|---|---|---|
| 1. Brown Sandy Fat Clay with Gravel (CH) | 0–4*<br>0–3** | 56–62 | 32–43 | 8–12 |
| 2. Limestone Rock | 4–10*<br>3 – 10** | -- | -- | 89/8" – 95/8" |

*Boring B-1
**Boring B-2

During the field investigation, subsurface water was not encountered in the borings. In addition, the soil samples were considered dry. Based upon this information and past projects in the surrounding areas of the site, groundwater is not anticipated to be major concern during construction activities. However, groundwater conditions can fluctuate due to seasonal and climatic variations, and may be encountered at shallow depths during high precipitation seasons.

## 4.0 FOUNDATION DESIGN CONSIDERATIONS

*Lot Drainage:* How a lot is graded affects the accumulation of surface water around the slab. Most builders are aware of the importance of grading the soil away from structures so that rainwater does not collect and pond adjacent to the foundation. If allowed to accumulate next to the foundation, water may infiltrate the expansive soils underlying the foundation, which could cause the foundation to settle. Similarly, runoff from surface water drainage patterns and swales must not collect adjacent to foundation.

*Topography:* As it swells, soil heaves perpendicularly to the ground surface or slope, but as it shrinks, it recedes in the direction of gravity and gradually moves downslope in a sawtooth fashion over a number of shrink-swell cycles. In addition to this shrink-swell influence, soil will exhibit viscoelastic properties and creep downhill under the steady influence of the weight of the soil. Therefore, to avoid a structure constructed on a slope from moving downhill with the soil, it must be designed to compensate for this lateral soil influence.

*Pre-Construction Vegetation:* A large amount of vegetation, especially large trees, on a site prior to construction may have desiccation effect at the site. Constructing over a desiccated soil can produce some dramatic instances of heave and associated structural distress and damage as it becomes wet.

*Post-Construction Vegetation:* The type, amount, and location of vegetation that has grown since construction can cause localized desiccation. Planting trees or large shrubs near a building can result in the loss of foundation support as the vegetation robs moisture from the foundation soil.

Conversely, the opposite effect can occur if flowerbeds or shrubs are planted next to foundations and these beds are kept well watered or flooded. This practice can result in swelling of the soil around the perimeter where the soil remains wet.

*Summation:* It is beyond the scope of this investigation to do more than point out the factors that may influence the amount and type of swell a slab-on-grade foundation may be subjected to during its lifetime. The design engineer must be aware of these factors in developing his design, using his engineering experience and judgment as a guide.

## 5.0 DESIGN ENGINEERING ANALYSIS

*Foundation Design Considerations:* Review of the boring and test data indicates that the following factors will affect the foundation designs and construction at this site:

1) The site at shallow depths is underlain by subsurface soils of moderate expansiveness in character. Structures supported at shallow depths will be subjected to potential vertical movement on the order of 2 ¼ inches.
2) The strengths of the underlying soils are adequate to support the proposed structure.
3) Groundwater seepage was not encountered in our borings during the subsurface exploration phase.

*Vertical Movements:* The potential vertical movement (PVR) for slab-on grade construction at this site has been estimated using the general guidelines presented in a) the Texas Department of Transportation Test Method TXDOT-124-E and b) based on our experience with the swelling characteristics of the clays that are similar to those at the project site. The Texas Department of

Transportation method utilizes the liquid limits and plasticity indices for soils in the seasonally active zone, estimated to be about twelve (12) to fifteen (15) feet in the project area.

The estimated PVR value provided is based on the proposed floor system applying a sustained surcharge load of approximately one pound per square inch on the subgrade materials. Potential vertical movement on the order of 2 ¼ inches was estimated for dry soil moisture conditions at the finish grade elevation. The PVR value is based on the current site grades. Higher PVR values than the above mentioned value will occur in areas where water is allowed to pond for extended periods.

If it is desired to reduce the PVR then existing clay soils can be removed and replaced with select fill. If 2 feet of surface clay is removed and replaced with select fill the Potential Vertical Rise would be reduced to approximately one inch. If this option is chosen the bottom of the excavation should be shaped so that it is well drained against any water entering the select fill. The excavation and select fill should not be allowed to become a "bathtub", holding water in the fill. Any surface of the select fill outside of the house should be covered in a fashion to prevent surface water from entering the fill.

***If the existing grade of the structures has to be raised to attain finish grade elevation, select structural fill should be used, placed in lifts and compacted as recommended under the section titled Select Structural Fill provided in this report.***

## 6.0 FOUNDATION RECOMMENDATIONS

### 6.1 Stiffened Grid Type Beam and Slab Foundations

A stiffened grid type beam and slab foundation may be considered to support the proposed buildings provided the anticipated vertical movement will not impair the performance of the structures.

It is desirable to design the foundation systems using an assumption that the beams carry the loads. An allowable bearing pressure of 1,700 pounds per square foot should be used for beams founded at a minimum depth of 12 inches below the existing undisturbed soils. If the existing grade of the structure has to be raised to achieve design grade, select structural fill should be placed, compacted and tested. An allowable bearing pressure of 2,300 pounds per square foot should be used for beams bearing on a minimum of 12 inches of compacted select structural fill. Beams should be at least 12 inches deep and 10 inches wide to prevent local shear failure of the bearing soils. A design plasticity index value of 20 is recommended for slabs bearing on compacted natural subgrade soils.

### 6.2 Post-Tensioned Beam and Slab Foundation

A post-tensioned slab-on-grade foundation may also be considered to support the structure provided the anticipated movement will not impair the performance of the structure. Pertinent design parameters were evaluated and are presented in the following paragraphs.

Differential vertical movements should be expected for a shallow type foundation at this site due to the expansive soil conditions that were encountered. Differential vertical movements have been estimated for both the center lift and edge lift conditions for post-tensioned slab-on grade construction at this site. These movements were estimated using the procedures and criteria discussed in the Post-Tensioning Institute Manual entitled "Design and Construction of Post-Tensioned Slabs-on-Ground", 3rd Edition. This procedure uses the soils data obtained from both the field and laboratory tests performed on the soil samples.

Differential vertical movements have been estimated for the center lift and edge lift conditions. The PTI Design Parameters are presented in Table No. 4. Refer to the Stiffened Grid Type Beam and Slab Foundation section for allowable bearing capacities.

**Table No. 4**
**PTI 3rd Edition**

| Design Plasticity Index/PVR (inches) | Differential Vertical Movement, $y_m$ Inches | | Edge Moisture Variation Distance, $e_m$ Feet | |
|---|---|---|---|---|
| | Center Lift | Edge Lift | Center Lift | Edge Lift |
| 20/2 ¼ | 1.53 | 2.22 | 6.4 | 3.6 |
| 18/1 * | 0.95 | 1.30 | 8.3 | 4.3 |

*These values apply if the upper 2 feet of soil is removed and replaced with select fill.

### 6.3 Utilities

Utilities, that project through slab-on-grade floors, should be designed with either some degree of flexibility or with sleeves in order to prevent damage to these lines should vertical movement occur.

### 6.4 Contraction, Control or Expansion Joints

Contraction, control and/or expansion joints should be designed and placed in various portions of the structure. Properly planned placement of these joints will assist in controlling the degree and location of material cracking that normally occurs due to soil movements, material shrinkage, thermal affects, and other related structural conditions.

### 6.5 Lateral Earth Pressure

Some retaining walls may be needed at the site. The equivalent fluid density values were evaluated for various backfill materials. These values are presented in Table No. 5.

**Table No. 5**

| Backfill Material | Equivalent Fluid Density PCF | | |
|---|---|---|---|
| | Active Condition | At Rest Condition | Passive Condition |
| a. Crushed Limestone | 40 | 60 | 530 |
| b. Clean Sand | 40 | 60 | 360 |
| c. Select Fill (PI $\leq$ 15) | 65 | 85 | 265 |

These equivalent fluid densities do not include the effect of seepage pressures, surcharge loads such as construction equipment, vehicular loads or future storage near the walls.

If the basement wall or cantilever retaining wall can tilt forward to generate "active earth pressure" condition, the values under active condition should be used. For rigid non-yielding walls which are part of the buildings, the values "at rest condition" should be used. The compactive effort should be controlled during backfill operations. Over compaction can produce lateral earth pressures in excess of at rest magnitudes. Compaction levels adjacent to below-grade walls should be maintained between 95 and 98 percent of standard Proctor (ASTM D698) maximum dry density.

The backfill behind the wall should be drained properly. The simplest drainage system consists of a drain located near the bottom of the wall. The drain collects the water that enters the backfill and this may be disposed of through outlets along the base of the wall. To insure that the drains are not clogged by fine particles, they should be surrounded by a granular filter. In spite of a well-constructed toe drain, substantial water pressure may develop behind the wall if the backfill consists of clays or silts. A more satisfactory drainage system, consisting of a back drain of 12 inches to 24 inches width gravel may be provided behind the wall to facilitate to drainage.

The maximum toe pressure for wall footings founded a minimum depth of 12 inches into the clay soils should not exceed 1,200 pounds per square foot. An adhesion value of 290 pounds per square foot should be used to check against sliding for wall footings bearing on clay.

## 7.0 CONSTRUCTION CONSIDERATIONS

### 7.1 Site Drainage

We recommend that an effective site drainage plan be devised by others prior to commencement of construction to provide positive drainage away from the foundation perimeter and off the site, both during and after construction.

## 7.2 Site Preparation

In any areas where soil-supported floor slabs are to be constructed, vegetation and all loose or organic material should be stripped and removed from the site. Subsequent to stripping operations, the subgrade should be proof-rolled to identify soft zones. Any soft zone detected should be removed and replaced with compacted suitable soils to reach subgrade level.

## 7.3 Select Structural Fill

Select fill material used at this site should be clayey sand (SC), lean clay with gravel (CL) or clayey gravel (GC) with maximum liquid limit of 35 percent and plasticity index (PI) between 5 and 20. The fill should be compacted to at least 95 percent of the maximum dry density as determined by TxDOT-113-E, within± 2 percentage points of optimum moisture content.

## 7.4 Groundwater

In any areas where significant cuts (one foot or more) are made to establish final grades for building pads, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. Subsurface drains may be required to intercept seasonal groundwater seepage. The need for these, or other dewatering devices, on building pads should be carefully addressed during construction. Our office could be contacted to visually inspect final pads to evaluate the need for such drains.

Groundwater seepage may occur several years after construction if the rainfall rate or drainage changes in the vicinity of the project site. If seepage runoff occurs towards the residence, an engineer should be notified to evaluate its' effect and determine whether French Drains are required at the location.

### 7.5 Earthwork and Foundation Acceptance

Exposure to environment may weaken the soils at the foundation bearing level if the excavation remains open for long periods of time. Therefore, it is recommended that all foundation excavations are extended to final grade and the footings constructed as soon as possible to minimize potential damage to bearing soils or rock. The foundation bearing level should be free of loose soil; ponded water or debris and should be inspected and approved by the geotechnical engineer or his representative prior to concreting.

Foundation concrete should not be placed on soils that have been disturbed by rainfall or seepage. If the bearing soils are softened by surface water intrusion during exposure or by desiccation, the unsuitable soils must be removed from the foundation excavation and replaced prior to placement of concrete.

Subgrade preparation and fill placement operations should be monitored by the soils engineer or his representative. As a guideline, at least one in-place density test should be performed for each 2,500 square feet of compacted surface per lift. Any areas not meeting the required compaction should be re-compacted and retested until compliance is met.

## 8.0 DRAINAGE AND MAINTENANCE

Final drainage is very important for the performance of the structures. Landscaping, plumbing, and downspout drainage is also very important. It is vital that all roof drainage be transported away from the building so that no water ponds around the building which can result in soil volume change under the building. Plumbing leaks should be repaired as soon as possible in order to minimize the magnitude of moisture change under the slab. **Large trees and shrubs should not be planted in the immediate vicinity of the structures, since root systems can cause a substantial reduction in soil volume in the vicinity of the trees during dry periods.**

Adequate drainage should be provided to reduce seasonal variations in moisture content of foundation soils. All pavement and sidewalks within 10-feet of the structure should be sloped away from the structures to prevent ponding of water around the foundation. Final grades within 10-feet of the structure should be adjusted to slope away from structures preferably at a minimum slope of 3 percent. Maintaining positive surface drainage throughout the life of the structure is essential.

In areas with pavement or sidewalks adjacent to the new structure, a positive seal must be provided and maintained between the structure and the pavement or sidewalk to minimize seepage of water into the underlain supporting soils. Post-construction movement of pavement and flat-work is not uncommon. Maximum grades practical should be used for paving and flatwork to prevent areas where water can pond. In addition, allowances in final grades should take into consideration post construction movement of flatwork particularly if such movement would be critical. Nonnal maintenance should include inspection of all joints in paving and sidewalks, etc. as well as re-sealing where necessary.

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

1. Where positive surface drainage cannot be achieved by sloping the ground surface adjacent to the building, a complete system of gutters and downspouts should carry runoff water a minimum of 10-feet from the completed structure.
2. Planters located adjacent to the structure should preferably be self contained. Sprinkler mains should be located a minimum of 5-feet from the building line.
3. Planter box structures placed adjacent to buildings should be provided with a means to assure concentrations of water are not available to the subsoil stratigraphy.
4. Large trees and shrubs should not be allowed closer to the foundation than a horizontal distance equal to roughly their mature height due to their significant moisture demand upon maturing.
5. Moisture conditions should be maintained "constant" around the edge of the slab. Ponding of water in planters, in unpaved areas, and around joints in paving and sidewalks can cause slab movements beyond those predicted in this report.
6. Roof drains should discharge on pavement or be extended away from the structures. Ideally, roof drains should discharge to storm sewers by closed pipe.

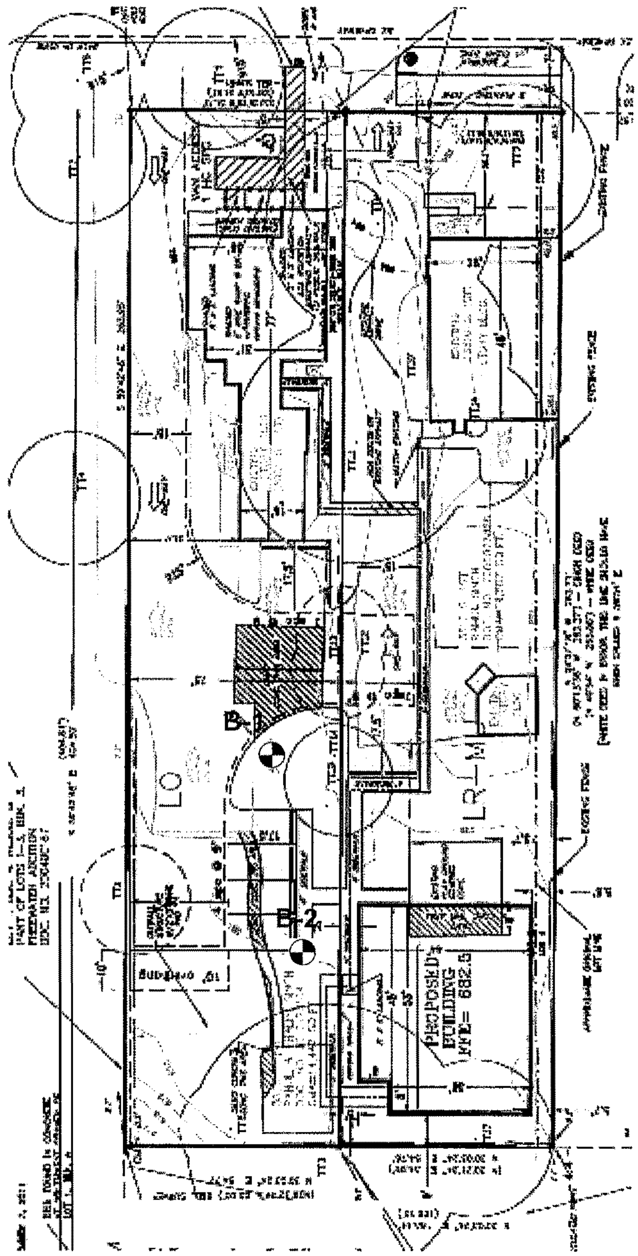
Trench backfill for utilities should be properly places and compacted as outlined in this report and in accordance with requirements of local City Standards. Since granular bedding backfill is used for most utility lines, the backfilled trench should be prevented from becoming a conduit and allowing an access for surface or subsurface water to travel toward the new structures. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water traveling in the trench backfill and entering beneath the structures.

The PVR values estimated and stated under "Vertical Movements" are based on the provision that positive drainage shall be maintained to divert water away from the building. If the this drainage is not maintained, the wetted front may occur below the assumed fifteen feet depth, and the resulting PVR may be 2 to 3 times greater than the stated values shown in this report. Utility leaks may also cause similar high movements to occur.

## 9.0 LIMITATIONS

The exploration and analysis of the subsurface conditions reported herein are considered sufficient to form a reasonable basis for the foundation design. The recommendations submitted are based upon the data obtained from our borings drilled at the project site. If deviations from the noted subsurface conditions are encountered during construction, they should be brought to the attention of the geotechnical engineer. The geotechnical engineer declares that the findings, recommendations, specifications or professional advise contained herein, have been made after being prepared in accordance with generally accepted professional engineering practice, in the fields of geotechnical engineering, soil mechanics and engineering geology. No other warranties are implied or expressed. This report has been prepared for the specific application to the proposed day care structure at 3808 South 1st Street in Austin, Texas.

# ILLUSTRATIONS




**Approximate Location of Exploratory Borings**

3808 South 1st Street
Austin
Travis County, Texas

InTEC

INTEGRATED TESTING & ENGINEERING CO.
AUSTIN, TEXAS

| | | |
|---|---|---|
| Prepared By: ZJM | Scale: Not to Scale | Project# A121366 |
| Base Plan By: A.C.E. | Date: Dec. 2012 | Figure# 1 |

InTEC

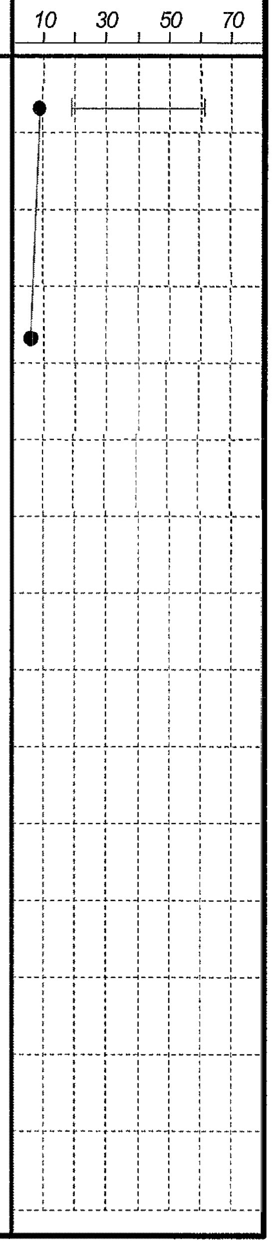
# LOG OF BORING # B-1

**PROJECT:** 3808 South 1st Street, Austin **DATE:** Decemer 9, 2012

**LOCATION:** See Figure 1 **PROJECT#:** A121366

| DEPTH | SYMBOL | SAMPLES | SUBSURFACE PROFILE – SOIL DESCRIPTION Surf. Elev. | PP (tsf) | % Fines | Moisture Content (%) | SPT (blows per ft) | Vertical Swell (%) | Liquid Limit (LL) | Plasticity Index (PI) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | SS | SANDY FAT CLAY WITH GRAVEL, stiff, dry, brown, (CH) | | | 09 | 12 | | 62 | 43 |
| | | SS | | | | 06 | 89/8" | | | |
| 5 | | A | LIMESTONE, hard | | | | | | | |
| | | A | | | | | | | | |
| 10 | | | End of Borehole | | | | | | | |
| 15 | | | | | | | | | | |

Water Content %




Completion Depth: Refusal at 10' Ground Water Observed: None Date:

THD - TxDOT Cone Penetrometer Test
PP=Pocket Penetrometer
SS- Split Spoon Sample
ST- Shelby Tube Sample
A- Auger Sample
LL- Liquid Limit
PL- Plastic Limit
RC- Rock Core
NP- Non Plastic

Figure 2

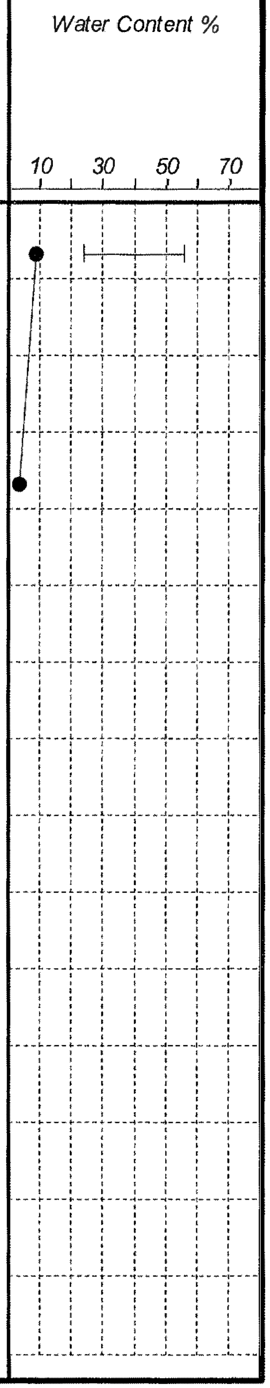
InTEC

# LOG OF BORING # B-2

**PROJECT:** 3808 South 1st Street, Austin　　**DATE:** Decemer 9, 2012

**LOCATION:** See Figure 1　　**PROJECT#:** A121366

| Depth (ft) | Samples | Soil Description (Surf. Elev.) | PP (tsf) | % Fines | Moisture Content (%) | SPT (blows per ft) | Vertical Swell (%) | Liquid Limit (LL) | Plasticity Index (PI) |
|---|---|---|---|---|---|---|---|---|---|
| 0–3 | SS | SANDY FAT CLAY WITH GRAVEL, stiff, dry, brown, (CH) | | | 09 | 08 | | 56 | 32 |
| 3–10 | SS | LIMESTONE, hard | | | 04 | 95/8" | | | |
| | A | | | | | | | | |
| | A | | | | | | | | |
| 10 | | End of Borehole | | | | | | | |




Completion Depth: Refusal at 10'　　Ground Water Observed: None　　Date:

THD - TxDOT Cone Penetrometer Test
PP=Pocket Penetrometer
SS- Split Spoon Sample
ST- Shelby Tube Sample
A- Auger Sample
LL- Liquid Limit
PL- Plastic Limit
RC- Rock Core
NP- Non Plastic

Figure 3

**InTEC**

# STANDARD REFERENCE NOTES FOR BORING LOGS

## I. Sampling & Testing Symbols or Abbreviations:

| ST | SS | RC | TC | A | SPT | PT |
|---|---|---|---|---|---|---|
| Shelby Tube | Split-Spoon Sampler | Rock core | Texas Cone | Auger | Standard Penetration Test | Percussion Tube |

## II. Correlations of Penetration Resistance to Soil Properties:

| Relative Density of Sand and Sandy Silt | | Consistency of Clay and Clayey Silt | | |
|---|---|---|---|---|
| Relative Density | SPT N-value | Stiffness | SPT N-value (qualitative measure) | Unconfined Compressive Strength (tsf) |
| Very loose | 0 to 4 | Very soft | 0 to 3 | Under 0.25 |
| Loose | 5 to 10 | Soft | 4 or 5 | 0.25–0.5 |
| Medium dense | 11 to 30 | Medium stiff | 6 to 10 | 0.5–1.0 |
| Dense | 31 to 50 | Stiff | 11 to 15 | 1.0–2.0 |
| Very Dense | > 50 | Very stiff | 16 to 30 | 2.0–4.0 |
| | | Hard | > 30 | 4.0– 8.0 |

## III. Unified Soil Classification Symbols:

GP - Poorly Graded Gravel
GW - Well Graded Gravel
GM - Silty Gravel
GC - Clayey Gravel
OH - High Plasticity Organics

SP - Poorly Graded Sand
SW - Well Graded Sand
SM - Silty Sand
SC - Clayey Sand
OL - Low Plasticity Organics

ML - Low Plasticity Silt
MH - High Plasticity Silt
CL - Low to Medium Plasticity Clay
CH - High Plasticity Clay

## IV. Rock Quality Designation index (RQD):

| RQD: | Description of Rock Quality: (if all natural fractures) |
|---|---|
| 0-25 % | Very poor |
| 25-50 % | Poor |
| 50-75 % | Fair |
| 75-90 % | Good |
| 90-100% | Excellent |

## V. Natural moisture content:

"Dry" No apparent moisture, crumbles easily
"Moist" Damp but no visible water
"Wet" Visible water

## VI. Grain size terminology:

Cobble: 3-inches to 12-inches
Gravel: #4 sieve size (4.75 mm) to 3-inches
Coarse sand: #10 to #4 sieve size
Medium sand: #40 to #10 sieve size
Fine sand: #200 to #40 sieve size
Silt or clay: smaller than #200 sieve size

## VII. Descriptive terms for soil composition:

"Trace" . . . . . . . . . . . . . . . . . . . 1 to 9%
"Some" . . . . . . . . . . . . . . . . . . . 10 to 29%
(with suffix–y, e.g. sandy, clayey ...) . . . . 30 to 49%

## VIII. Descriptive terms or symbols:

"Mottled": occasional/spotted presence of that color
"-[...]":identifies change in soil characteristics
LL: Liquid Limit (moisture content as% of dry weight)
PL: Plastic Limit (moisture content as% of dry weight)
WOH: Weight of hammer
"with [...]": item identified within that sample only
"REC": Rock core recovery %

## IX. Plasticity of cohesive soil:

(function of PI and clay mineral types)

| *Plasticity Index (PI):* | *Plasticity:* |
|---|---|
| 0 to 20 | Low |
| 20 to 30 | Medium |
| 30 + | High |

2301 Denton Drive, Suite B, Austin, Texas 78758 * (512)252-1218 * Fax: (512)252-1219

Fig. 4

| Site Photographs<br>3808 South 1st Street<br>Austin<br>Travis County, Texas | InTEC INTEGRATED TESTING & ENGINEERING CO.<br>AUSTIN, TEXAS | |
|---|---|---|
| Prepared By: ZJM | Scale: Not to Scale | Project# A121366 |
| Base Plan By: | Date: Dec. 2012 | Figure# 5 |