June 5, 1998

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Re: Subsurface Exploration
Proposed Mainstay Suites
Addison Road
Addison, Texas
Job No. 17985274

INTRODUCTION

The subsurface exploration for the proposed Mainstay Suites in Addison, Texas has been completed. As requested, two borings were drilled to depths of approximately 17 to 25 feet below the existing ground surface in the proposed building area. Laboratory tests were then performed on selected samples obtained from the borings and this engineering report was prepared based on the results of this data.

This exploration was performed to explore the subsurface conditions at the site, evaluate the pertinent engineering properties of the subsurface materials and provide soil parameters for the design and construction of monolithic slab foundations for the proposed hotel. Recommendations for building pad preparation for grade supported slabs, general site grading and pavement sections are also provided.

PROJECT INFORMATION

The proposed project site is located on the east side of Addison Road, south of Arapaho Road, in Addison, Texas. It is our understanding the proposed construction will consist of a three-story wood frame structure. We also understand the structure will be supported on a monolithic slab foundation, and that any required building pad preparation will be performed to reduce potential movements in the building area to about 1 inch.

SUBSURFACE EXPLORATION PROCEDURES

The borings were drilled on May 11, 1998 with a truck-mounted auger drilling rig using continuous flight augers to advance the boreholes. The boring were located on the site by the drill crew at the approximate locations shown on the Boring Location Diagram. The locations of the borings indicated on the attached diagram are approximate and were measured with a tape from existing structures and landmarks. The location of the borings should be considered accurate only to the degree implied by the means and method used to define them.
Representative samples were obtained using thin-walled tube procedures in general accordance with ASTM Specification D-1587. In the thin-walled tube sampling procedure, a thin-walled seamless steel tube with a sharp cutting edge is pushed hydraulically into the ground to obtain relatively undisturbed samples of cohesive or moderately cohesive soils. These sample depths are indicated on the boring logs. The samples were sealed and returned to the laboratory for testing and classification.

Texas Cone Penetrometer Tests were performed to evaluate the load carrying capacity of the limestones encountered. These tests were performed in general accordance with test method Tex-132-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures. The results of these tests are shown on the attached boring logs at the depths of occurrence.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples. Individual boring logs and a Boring Location Diagram are included with this report.

TESTING PROGRAM

The soil samples obtained from the borings were tested in the laboratory to determine their natural water contents. A hand penetrometer was used to measure the approximate unconfined compressive strength of the thin-walled tube samples. The hand penetrometer test has been correlated with the unconfined compression test and provides a more reliable estimate of the consistency and strength than visual observation alone. The test data are provided on the attached boring logs.

Atterberg limits tests and swell tests were performed on representative soil samples obtained from the borings. The Atterberg limits tests were used to help classify the soils, and were also used in conjunction with the swell test result in evaluating the swell potential of the near surface soils. The results of these tests are provided on the attached boring logs and swell test result sheet.

As part of the testing program, the samples were examined in the laboratory and classified in general accordance with the attached General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbols for the Unified Soil Classification System are shown on the boring logs, and a brief description of the Unified Soil Classification System is attached.

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the borings were generally similar. Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

Approximately 8 inches of asphalt was present at the ground surface in Boring 1. Based on visual examination of the soils samples, limestone fill containing dark brown clay was present at the ground surface in Boring 2, and extended to a depth of about 3 feet. Native dark gray and dark brown clay was present beneath the asphalt and fill materials, and extended to depths of about 7 to 8 feet. The clay soils were underlain by grayish brown and tan silty clay in Boring 1 that extended to a depth of about 11 feet. Tan limestone containing clay layers was present at a depth of about 11 feet in Boring 1, and at about 7 feet in Boring 2. The tan limestone extended to the top of gray shaley limestone that was encountered at depths of about 19 and 12 feet in Borings 1 and 2, respectively. The shaley limestone continued to the termination of the borings at depths of 17 to 25 feet.

The Atterberg limits and swell test results indicate the clay soils encountered at this site are highly active. Active clays are subject to swelling with increases in moisture content and shrinking as they become dry. These clays can subject structures bearing in/or adjacent to the clays to uplift pressures with the normal moisture increases that occur beneath a structure after construction.

WATER LEVEL OBSERVATIONS

The borings were monitored while drilling and after completion for the presence and level of groundwater. Groundwater seepage was not observed while advancing the borings, or at the completion of drilling. Although seepage was not encountered during our drilling, water can be present in and above the tan limestone stratum, particularly during or after wet periods of the year. Fluctuations of the groundwater level can occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

ANALYSIS AND RECOMMENDATIONS

General

The active clays soils encountered at this site will subject shallow foundation systems to moisture-induced soil movements. We understand a monolithic slab foundation will be used to support the proposed structure, and the slab foundation will be designed to resist potential moisture induced movements on the order of 1 inch. Geotechnical design parameters for design of a monolithic slab foundation system, including recommendations for preparing of the building pad to reduce potential movements to on the order of 1 inch are provided in the following sections. Recommendations for general site grading and pavement sections are also provided.

Monolithic Slab Foundation

Monolithic slab foundations will need to be designed to tolerate some potential differential soil movements and provide satisfactory support of the proposed structure. All monolithic slab foundations should be designed to tolerate the anticipated differential movements and result in slab deflections considered tolerable to the structure. If a monolithic slab is used at this site, we understand the slab will be designed for potential movements to about 1 inch. Special building pad preparation will be required to meet these requirements.

The clay soils on the site can subject lightly loaded interior slabs to movements (due to shrinking and swelling) with fluctuations in their moisture content, and possible settlements due to consolidation of the existing fills. Potential movements will vary across the building area and depend on the thickness of the clays and existing fills that overly the limestone. Based on test method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures and our experience with similar soils, moisture-induced slab movements on the order of 4 inches could occur. These movements are based on dry conditions that could occur prior to construction. The actual movement could be greater if poor drainage, ponded water and/or other unusual sources of moisture are allowed to saturate the clays beneath the structure. Potential settlements associated with the fills are difficult to estimate due to possible variation in the in-situ fill compaction.

Various methods can be considered to reduce potential slab movements (due to moisture-induced volume changes and fill consolidation) to the desired 1 inch of soil movement required for monolithic slab design. The measures most appropriate to reduce potential slab movements at this site include installation of non-expansive select fill, or a combination of select fill over a layer properly water-injected clays.

The methods described below for reduction in moisture-induced active clay movements will involve removal and/or recompaction of some of the existing fills, and therefore will provide some benefit in reducing possible settlements associated with consolidation of the fills. If the existing fills extend below the recommended depth of select fill, additional removal and recompaction below these depths will further reduce potential settlements.

Installing approximately 5 feet of select fill beneath the monolithic slab foundation could reduce potential active clay soil movements to about 1 inch or less. Installing approximately 2 1/2 feet of select fill beneath the monolithic slab foundation in conjunction with a 7 foot deep water injection of the underlying active clays could also reduce potential active clay soil movements to about 1 inch.

Select material (such as clayey sand or very sandy clay which is free of debris and organic matter) should have a liquid limit less than 35 and a plasticity index between 5 and 15. The non-expansive replacement soil should be placed in loose lifts of 9 inches or less and compacted to at least 95% of its standard Proctor dry density at a moisture content ranging from -1 to +3% above its optimum value. Before placing the select fill, the subgrade should be scarified to a depth of at least 9 inches, moisture conditioned to at least 2% above the optimum value (at a workable moisture level) and compacted to at least 95% of the maximum standard Proctor dry density.

Select fill materials should be installed as shown on the attached detail. The select fill material installed beneath a monolithic slab foundation should extend outward from the perimeter grade beam 8 inches for every 12 inches the select fill extends below the grade beam. A minimum thickness of 2 feet of compacted clay fill should be placed above any select fill that extends outward beyond the exterior grade beam to reduce the likelihood of surface water to pond in the select fill above the deeper active clays.

We have attached a set of General Specifications for the water injection process. Compliance with these specifications is essential to achieving maximum benefits from the injection(s). Multiple injections are typically required to obtain the desired moisture levels, and the time and expense for these injections will need to be included in the project schedule and budget. Very stiff to hard clays may be encountered during dry periods of the year. These clays can be difficult to penetrate, and may require heavy duty injection equipment and/or a reduction in injection rods to achieve the recommended injection depth. In some cases the desired moisture levels and/or injection depths cannot be achieved, and this can result in an increase in potential movements. Shallow limestone may be encountered at depths shallower than the recommended injection depth, and care should be taken to assure that injection rod refusal is due to the presence of shallow limestone, not stiff clays. We recommend paving/sidewalks be placed adjacent the structure perimeter to reduce seasonal drying of the water injected clays near the perimeter of the structure.

If the above methods of building pad preparation (a combination of select fill and water injection) are used, the monolithic slab foundation can be designed for potential movements on the order of 1 inch. An effective plasticity index of 30 is recommended for use in slab design at this site. The following design parameters are provided for the Post-Tensioning Institute's slab-on-grade design method:

EDGE MOISTURE VARIATION	
Center Lift	5.2 feet
Edge Lift	4.2 feet
DIFFERENTIAL SWELL	
Center Lift	3/4 inches
Edge Lift	1/2 inch

These design parameters assume that positive drainage will be provided away from the structure and moderate irrigation of surrounding lawn and planter areas with no excessive wetting or drying of soils adjacent to the foundation. Greater potential movements could occur due to extreme wetting or drying of the soils due to ponding of water, plumbing leaks or lack of irrigation.

A net allowable soil bearing pressure of 2,000 psf can be used to design grade beams founded on the existing soils or on properly compacted fill extending down to suitable soils. Grade beams should extend at least 18 inches below final adjacent grade to utilize this bearing pressure. Fills should extend a minimum of 3 feet beyond the edge of the foundation and be sloped to grade at as flat a slope as practical.

If floor treatments which are sensitive to moisture will be used, a vapor barrier of polyethylene sheeting or similar material should be placed beneath the slabs to retard moisture migration through the slabs.

Grading and Compaction

In preparing the site for construction, all vegetation, existing pavement, and any loose, soft or otherwise unsuitable material should be removed from the entire construction area. After stripping, proofrolling with heavy construction equipment such as a loaded scraper or tandem axle dump truck is recommended in fill areas to aid in locating unsuitable subgrade materials. Proofrolling is also recommended in cut areas, and areas left near existing grade after rough grading is completed. Unsuitable materials located by proofrolling should be removed and replaced with suitable engineered fill material.

Imported fill materials used for general site grading should be similar to the on-site soils and preferably have a liquid limit less than 50. Fill placed in areas to be paved should consist of approved on-site or similar imported materials which are free of organic matter and debris. The fill should be placed and compacted in lifts of 9 inches or less in loose thickness. Fill placed in areas to be paved should be compacted to at least 95% of the materials maximum standard Proctor dry density. All clay fill should be compacted at a workable moisture content within in the range of 0 to 3% above optimum moisture as determined by the standard Proctor test.

Drainage

Positive drainage should be developed around the building area and paving areas to minimize any increase in moisture content of the clay soils underlying structures and on-grade slabs. All adjacent flatwork and the ground surface surrounding the structure should be sloped to prevent ponding of water around the building. Roof drains should be extended to discharge rainwater away from the structure. Pavements or sidewalks are preferable to open areas immediately adjacent to the structure. Joints between the paving and the structure should be sealed, periodically inspected and resealed to prevent the infiltration of surface water.

Some movement in grade supported flatwork is expected due to the active nature of the soils at this site. Provisions should be made to allow for this movement where it may affect the proposed structure (i.e. outward swinging doors, porches adjacent to the structure, etc.).

All landscaped beds should be designed to prevent migration of irrigation water into the clay soils beneath the structure, and other flatwork sensitive to movement. Irrigation of lawn and landscaped area should be moderate, with no excessive saturation or drying of soils around the foundation allowed to occur.

Pavement Subgrades

The surficial clays are subject to strength loss with the increases in moisture content that normally occur beneath paving. These soils are generally considered to provide poor subgrade support. Mixing hydrated lime with these soils typically improves their subgrade support value, even at the higher moisture levels that occur beneath area paving. An application rate of 8% hydrated lime by dry soil weight is recommended for treatment of the on-site clay soils.

The hydrated lime should meet the requirements of Item 264 (Type A) in the TxDOT Standard Specifications for Construction of Highways, Streets and Bridges. This lime should be thoroughly mixed and blended with the top 6 inches of subgrade and compacted to at least 95% of its maximum standard Proctor dry density. The moisture content of the lime modified material at the time of compaction should be within a range of -2% to +4% of its optimum value. Mixing, curing and compaction of the lime modified layer is described in Item 260 of the previously mentioned Standard Specifications.

Lime treatment is recommended for subgrade areas to support asphaltic concrete paving. Lime treatment will also improve the performance of portland cement concrete pavement sections, although it is not considered essential if the subgrade is properly compacted in a uniform manner. Untreated pavement subgrades beneath concrete pavement sections should be scarified to a depth of 6 inches and uniformly compacted to a minimum of 95% of standard Proctor maximum dry density (ASTM D-698) at ±2 percent of optimum moisture.

Pavement Sections

If asphaltic concrete pavement is used, we recommend a full depth asphaltic concrete section having a minimum total thickness of 5.0 inches for automobile parking areas and 6.5 inches for drive lanes receiving light to medium size trucks. A minimum surface course thickness of 2 inches is recommended for asphaltic concrete pavements. The asphaltic concrete surface course should conform to Type D and the base course should conform to Type A or B in Item 340 of the TxDOT Standard Specifications. The coarse aggregate in the surface course should be crushed limestone rather than gravel.
If portland cement concrete pavement is used, a minimum thickness of 5 inches of concrete is recommended for parking areas for automobiles and light trucks, and 6 inches for drive lanes and light to medium heavy truck traffic. A minimum 7 inch section is recommended in areas receiving occasional heavy trucks and dumpsters. Concrete with a minimum 28 day compressive strength of 3,500 psi should be used.

The above sections should be considered minimum pavement thicknesses and higher traffic volumes and heavy trucks may require thicker pavement sections. Additional recommendations can be provided after traffic volumes and loads are known. Periodic maintenance should be anticipated for minimum pavement thickness. This maintenance should consist of sealing cracks and timely repair of isolated distressed areas.

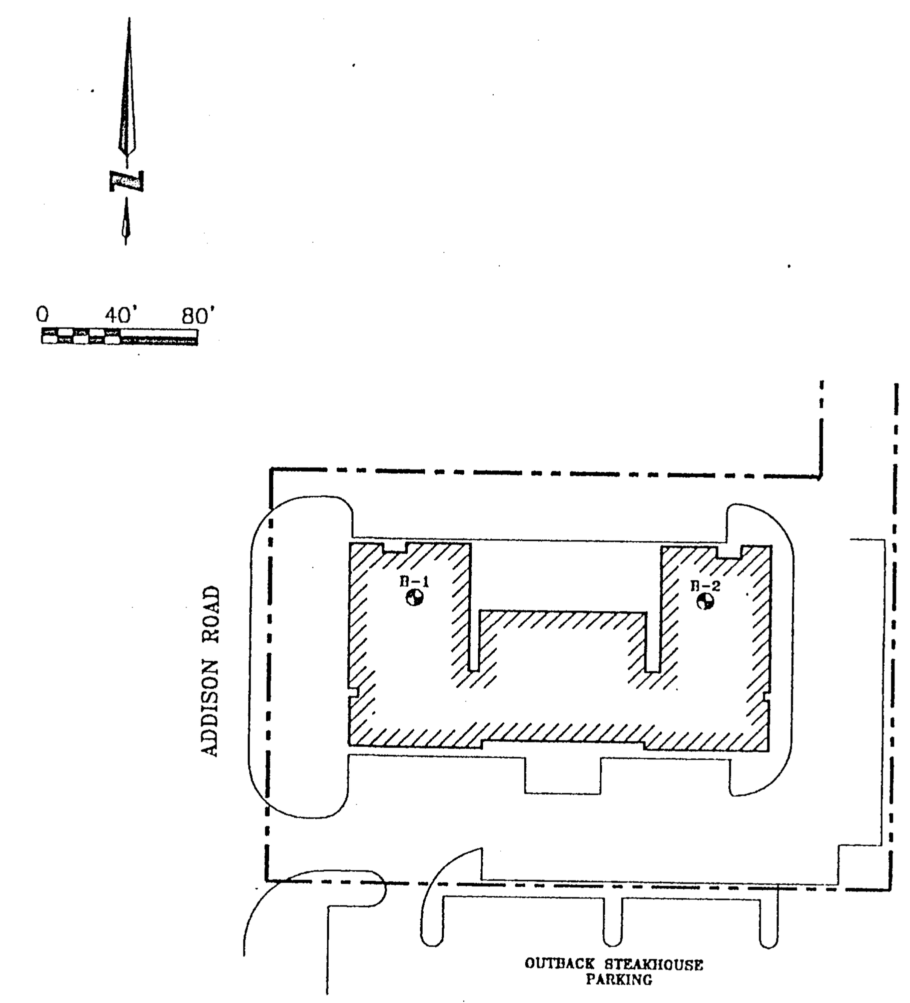
Grades should be adjusted to provide positive drainage away from paving and prevent ponding of water behind curbs and pavement edges. Joints and cracks in paving should be sealed and periodically inspected and resealed to prevent surface water infiltration into the underlying subgrade.

GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide testing and observation during excavation, grading, foundation and construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations which may occur between borings or across the site. The nature and extent of such variations may not become evident until construction. If variations appear, it will be necessary to reevaluate the recommendations of this report.

The scope of services for this project does not include either specifically or by implication any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken.
This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. In the event that changes in the nature, design, or location of the project as outlined in this report, are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes, and either verifies or modifies the conclusions of this report in writing.



PROJ.# 17985274	CHECKED BY: CHRIS
SCALE: 1"=80'	DRAWN BY: ROMAN
FN: 7985274.DWG	
DATE: MAY 13, 1998	

BORING LOCATION DIAGRAM
PROPOSED MAINSTAY SUITES
ADDISON ROAD
ADDISON, TEXAS
Terracon
F1

GENERAL SPECIFICATION
WATER PRESSURE INJECTION

1. A surfactant (wetting agent) shall be added to the water for injection. Surfactant should be added in accordance with the manufacturer's recommendations.

2. Hole patterns on the lower portion of the injection rods shall be orientated to uniformly disperse the water throughout the injected zone.

3. Injection pressures should be between 50 and 200 pounds per square inch and should be adjusted to disperse as large a volume as possible of water.

4. The injection process shall be observed on a full time basis by a qualified technician. This technician shall be under the direction of the owners designated geotechnical engineer.

5. The injection pipe shall be forced downward in 12 to 18 inch intervals to the specified depth (7 or 10 feet). The pipes should not be jetted or washed to achieve each penetration. A minimum of 4 intervals should be used.

6. Injection should continue to refusal at each interval to the total depth specified in geotechnical report. Refusal should be determined by an on site inspector.

7. Injection spacing should not exceed 5 feet on center in each direction. Injections shall extend at least 5 feet beyond the building perimeter. Subsequent injections shall be offset from initial locations in a pattern that maximizes distribution of the slurry.

8. Evaluations of the moisture content in the injected zone shall be performed after each injection. Continuous tube samples (not cuttings) shall be performed in shallow borings following a 24 hour curing period after each injection pass. This engineer will develop recommendations on the need for additional injections based on the results of laboratory tests.

9. If more than 3 injection passes are required, the surface of the injected area should be scarified to a minimum depth of 8 inches and recompacted prior to the next injection.

10. At completion of the injection process, the surface should be scarified to a depth of 8 inches and recompacted to a minimum of 90 percent of standard Proctor maximum dry density as determined by ASTM D-698.

11. Completion of the building pad and construction of the slab shall proceed in a continuous manner after injection and recompaction is complete.

MAINSTAY SUITES
ADDISON, TEXAS

REGISTERED ARCHITECT
ART WILLIAMS JR
1786
STATE OF TEXAS

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SOIL
INVESTIGATION

JOB: 811
DRAWN: FEC
DATE: 10/2/98
REVISIONS:

SHEET NO.
SI-1
OF: