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March 24, 2016

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Attention: Josh Sepkowitz

PHASE 2: DESIGN GEOTECHNICAL REPORT
BLOCK 287
THE HOUSTON VENUE
POLK AVE. & HAMILTON ST.
HOUSTON, TEXAS

Ulrich Engineers, Inc. (UEI) submits this design geotechnical report for The Houston Venue at Block 287 S.S.B.B. between Polk Ave. and Hamilton St. in Houston, Texas. The assignment was performed in general accordance with our Proposal No. 2016-008-01, dated February 26, 2016, and authorized by Mr. Herb Goodman on February 29, 2016.

This report presents the findings of the field investigation along with results of laboratory testing to confirm the preliminary foundation design and construction recommendations submitted in UEI Report No. 2016-013-01, dated March 09, 2016.

The sample borings drilled did not disclose evidence of site disturbance and only one of the eight borings attempted encountered refusal. The cause of refusal is unknown and may or may not be extensive. Although the likelihood of there being filled-in basements at the site has been decreased by the findings of the borings, other buried obstructions related historical developments such as foundations, cisterns, and/ or wells may still exist.

INTRODUCTION

PROJECT DESCRIPTION

The boundaries of the Houston Venue site are Polk Ave. on the north, Hamilton St. on the east, Clay Ave. on the south, and Chenevert St. on the east as shown in Plate 1. The George R. Brown (GRB) Convention Center is located across Polk Ave. on the north and the GRB Convention Center/Hilton Parking Garage is located across Chenevert St. on the west. The GRB service drive ramp traverses the site along the south border. We have no information on the ramp right of way or property boundaries.

The Houston Venue will be a one-story steel frame structure. The floor slab will have about four different elevations, the lowest being 2 ft below top of curb and the highest 4 ft above grade. The edge of the structure will remain about 25 ft away from the GRB service drive ramp as shown in the overall site plan we have reviewed, Plate 1. The portion of the site east of the structure will be have an entrance drive and parking.

PURPOSE AND SCOPE

The purpose of this assignment was to develop recommendations to guide the design and construction of foundations for the Houston Venue. We accomplished this objective with the following multi-phase program:

- Analyses of subsurface data from our experience working in design and construction on contiguous blocks to predict the subsurface conditions at the site
- Examination of Sanborn Maps and aerial photographs to assess the presence of old foundations and filled-in basements at the site
- Sample borings to explore subsurface conditions at the site and obtain samples for laboratory testing
- Laboratory testing of selected samples to determine pertinent soil properties
- Engineering analyses of the assembled information to develop recommendations for design and construction of foundations

The assignment did not include investigations of geologic faulting, subsidence, wetlands, or environmental considerations. Each of these elements is important and may have a major impact on foundation design. For example, active geologic faults move vertically and horizontally but irregularly and rates of movement can be in the order of 0.2 in. per year. We are prepared to investigate these hazards as an expansion of our scope of work.

HISTORICAL SITE ASSESSMENT

We examined available historical site information in an attempt to identify potential major buried obstructions and fill areas. The information we reviewed is listed in Table 1.

TABLE 1
REVIEWED HISTORICAL SITE INFORMATION

DESCRIPTION	DATE
Sanborn Map	1896
Sanborn Map	1907
Sanborn Map	1924
Sanborn Map	1950
Sanborn Map	1969
Aerial Photograph	1972
Google Earth Historical Imagery	1978 to Present

FIELD INVESTIGATION

Subsurface conditions at the site were explored by eight sample borings drilled at the approximate locations shown in Plate 1. The boring locations were optimized to detect the presence of filled-in basements by coordinating the proposed building layout with historical site information. One boring, B-1, encountered an unknown obstruction at 1-ft depth and was abandoned. The remaining borings were all drilled to their respective target depths, three to 30-ft depth and four to 10-ft depth.

The soil borings were drilled using truck-mounted equipment. Soil samples were obtained semi-continuously to 10-ft depth and at 5-ft intervals thereafter using auger and rotary methods. Detailed descriptions of the soils encountered in each boring and the depths at which samples were obtained are presented in the individual boring logs in Plates 2 thru 9. A key to understanding the terms and symbols used in the boring logs is presented in Plate 10.

A 3-in. thin-walled tube sampler was used to obtain clay samples and a 2-in. split-barrel sampler was used in silt and sand. The samples recovered were removed from the sampler in the field and then examined and visually classified by a specialist from our staff. Representative portions of each sample were then packaged for transportation to our laboratory for testing and to again be visually classified, this time by an Engineer.

The unconfined compressive strength of each cohesive sample was estimated in the field using a calibrated hand penetrometer. Results of these estimates are plotted on the boring logs as circles enclosing an “x” (⊗).

The split-barrel sampler was driven by a 140-lb weight falling 30 in. The number of blows required to advance the sampler 18 in. was recorded in 6-in. increments. The total number of blows needed for the last 12 in. of penetration is called the Standard Penetration Resistance, N-Value, and is given on the boring logs. A relationship between N-Value and soil condition is also given in Plate 10.

LABORATORY TESTING

The laboratory testing program was directed primarily toward evaluation of the shear strength, shrink-swell, and classification characteristics of the foundation soil. The following tests were performed: unconfined compression, Atterberg limits, and natural water content. Natural water content was determined as a routine portion of each compression and Atterberg limit test. The unit dry weight was also determined as part of each compression test. The results of the laboratory tests are either plotted or tabulated in the individual boring logs. Table 3 gives the symbols used in the boring logs to present the laboratory test results.

TABLE 2
BORING LOG SYMBOLS

Type of Test	Identifying Symbol
Unconfined Compression	○
Natural Water Content	•
Hand Penetrometer	⊗
Dry Density	(Listed under “Unit Dry Wt”)

<u>GENERAL SITE CONDITIONS</u>

HISTORICAL SITE INFORMATION

The site occupies Block 287 of the Houston Central Business District (CBD). Salient interpretations from our historical research of the block are given below.

- The block was primarily occupied by one to two-story dwellings and flats from 1896 to 1924.
- Dwellings in the northwest quadrant of the block are replaced by a three-story steel frame and brick face store in the 1950 Sanborn Map, Figure 1. We expect that foundations were excavated and probably still remain on the Block.
- Only one flat from 1896 to 1924 remains in the 1969 Sanborn Map. The other dwellings and flats are replaced with parking lots and two one-story structures in the southeast quadrant. These structures are likely of concrete block construction.
- A multi-story building may have occupied the northeast quadrant of the site after 1969 based on aerial photographs from 1972 and 1978.
- Historical imagery from Google Earth shows the site has been cleared since 1989.

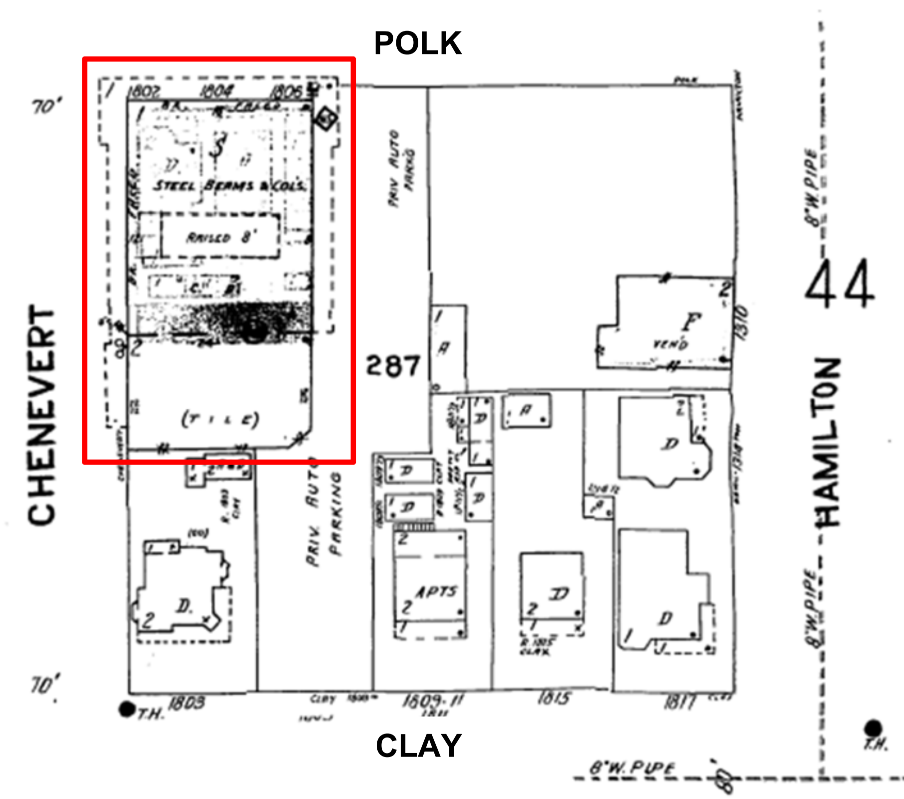


Figure 1 - 1950 Sanborn Map

Although the findings of the soil borings make it less likely that the historical developments included basements, their foundations may still remain along with cisterns and/ or wells consistent with our experience.

A Houston CBD Block, 250 ft sq, contains from 8 to 12 lots. Each lot has the potential to have a cistern that could extend to 20 ft. The cistern diameter can reach 10 to 12 ft, may be empty or filled with debris, and may be brick lined. At the Hilton Hotel site, we found three shallow wells each connected to each other by a brick lined tunnel. At another site, the soil borings and environmental exploration missed two basements and three buried tanks.

Surface Characteristics

The site is located between Polk, Hamilton, Clay, and Chenevert, Plate 1, and is currently occupied by a parking lot with asphalt pavement. Surface elevation varies from about 43 to 44 ft

The asphalt thickness varies from 1 to 6 in. as disclosed by the borings. We expect the asphalt pavement to overly floor slabs in some areas. An aluminum fence surrounds the parking lot on all sides.

Subsurface Soil Conditions

Soil Stratigraphy. The subsurface soil conditions disclosed by the soil borings consist of highly plastic clay fill underlain by highly plastic clay and interlayered sand, silt, and clay to a depth of 30 ft. These interpretations are consistent with our experience.

The subsurface soil conditions to a depth of 75 ft may be divided into four generalized strata given in Table 3. Although the subsurface soil conditions are presented generalized in this report, localized variations in thickness, position, and textural characteristics should be expected over very short distances.

Table 3
Generalized Subsurface Soil Conditions

Stratum	Depth (ft)		Description
	From	To	
I	0	1 to 2	Fill: stiff clay (CH)
II	1 to 2	22	Stiff to very stiff clay (CH)
III	22	55	Interlayered sand (SM), silt (ML), and clay (CL-CH)
IV	55	75	Very stiff to hard clay (CH) with occasional silt (SM) and silty clay (CL) layers

Fill. The thickness of fill at the site as disclosed by the soil borings is 1 to 2 ft. The fill thickness may potentially be greater locally and old foundations, cisterns, and wells may also be onsite. Proof rolling by a loaded dump truck is not adequate to locate these.

Natural Soil. The natural soil deposits at the site are considered typical of the Pleistocene deposits that underlie the downtown Houston area. Both the fill and the natural soil have a moderate to high potential for volume changes. The Stratum II clay is moderately to highly plastic and natural water contents are near the plastic limit. The clay contains a secondary structure, slickensides, which cause the clay to behave like a loose fractured mass.

The Stratum III sand and silt are generally in a dense condition based on driving resistances. Measured undrained shear strengths of the Stratum III silty to sandy clay can be misleadingly low due to sample disturbance and the presence of sand and/ or silt inclusions. Our experience has shown that these deposits are relatively strong.

Groundwater Conditions

Only one of the three borings extending below 10-ft depth encountered groundwater and the depth to water measured in the open borehole was 26 to 27 ft. Our experience adjacent to Block 287 has shown the depth to water can be only 20 ft below the ground surface. Fluctuations of ± 5 ft should be expected with seasonal variations and changes in weather conditions.

Foundation Analyses and Recommendations

General Design Criteria

All foundations must satisfy two basic independent design criteria. First, the maximum bearing pressure transmitted to the foundation soil should not exceed the allowable bearing pressure based on an adequate factor of safety with respect to soil shear strength. Second, the foundation movements resulting either from expansion and/ or consolidation of the supporting soils under sustained loads should be within tolerable limits for the structure.

On previous downtown developments we have removed all old fill and basement debris beneath the floor slab areas, but allowed those materials to remain for parking and driveways with the understanding that repair work will be needed on the subsiding pavements. Variations in fill depth are common and site stripping often discloses the presence or absence of site fill between boring locations.

Given this facility is lightly loaded and there will be no basement, the initial site work should be oriented to stripping the existing pavement and assessing the conditions within the building footprint and hardscape. We recommend removing all old fill, debris, and historical development remnants within the building footprint and hardscape areas. Parking and traffic areas can be built to design grade.

FOUNDATION TYPES AND DEPTH

The Houston Venue may be supported on open-cut shallow spread footings resting on the strong natural soil at a target depth of 5 ft below existing ground. As an alternative to open-cut shallow spread footings, drilled-and-underreamed piers at a target depth of 10 ft may be used. The drilled-and-underreamed foundation is a locally popular foundation system for lightly loaded facilities. In the event there has to be fill to restore grade or raise grade above the top of curb, the foundations should rest in natural soil or at a target depth of 10 ft below top of curb, whichever is deeper.

The drilled pier foundations are considered shallow foundations in the Houston area. The recommended depths are target depths and may need to be adjusted in the field by the Construction Geotechnical Engineer due to the presence of fill or buried obstructions.

The tops of the underreams should be sloped at an angle of 45° from the horizontal and underream-to-shaft ratios should be 3 to 1. Underream diameters should be limited to 8 ft to accommodate truck-mounted equipment limitations. The 8 ft diameter bell should be feasible if applied loads are 250 kips or less.

ALLOWABLE BEARING PRESSURE

Open-cut spread footings and drilled-and-underreamed piers resting on the strong natural soil at the recommended target depths may be designed for an allowable net service load bearing pressure of 5500 psf. This value includes a factor of safety of at least 2.0 with respect to ultimate bearing capacity of the foundation soil. The foundations should be designed to maintain the resultant under total loads within the middle third for each direction of total loading. Also, foundations must be proportioned so that the maximum net contact pressure under dead, live, and transient loads does not exceed the allowable net bearing pressure. Net bearing pressure is defined on Plate 11.

DRILLED-AND-UNDERREAMED PIERS

Drilled-and-underreamed piers are very economical but contain inherent risks related to construction that cannot be quantified during design. Such risks include:

- Early collapse of underreams may occur even if soil borings results do not disclose collapsing soils.
- If underreams collapse before the piers are concreted, then a supplemental foundation is needed to replace the collapsed pier, at a cost several times larger than the original pier.
- Underream cleanliness can be a problem and may cause excessive foundation movement.
- Since inspection is performed at the ground surface, the inspection process has inherent limitations which do not allow detection of all defects before installation is complete.
- Ground conditions will vary between underream locations.

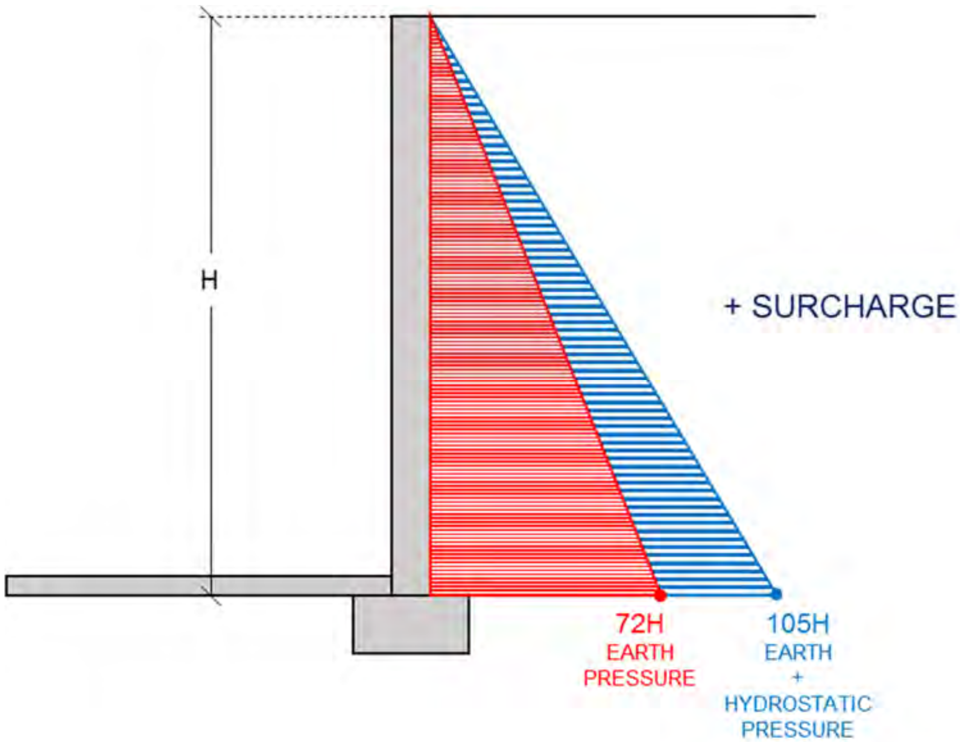
We believe it is reasonable to expect some of the planned piers to experience underream collapse even under conditions considered ideal during design. In the event an underreamed pier collapses prematurely, the typical option is to install a straight shaft with a diameter equal to the bell diameter. This option or others cause the costs to become severe if the underreams collapse early.

BELOW GRADE WALLS

Below grade walls will be acted upon by lateral earth pressures. Permanent restraint of the lateral pressures should be derived from the floor system.

The design earth pressure for below grade walls under long-term conditions should be an equivalent fluid of 72 pcf assuming drainage occurs through an outside perimeter drainage system. In the event drainage is not provided, the design earth pressure should include hydrostatic pressure for a total equivalent fluid of 105 pcf. The design earth pressures are shown in Figure 2.

The earth pressure value we have given for no drainage is designable, but leakage through the wall will be noticeable even if a waterproofing application is part of the design. Most designers wrongly believe that a waterproofing application solves the below ground seepage potential, but an examination of the basic physics applied will explain the futility of such an approach. **Hence drainage with collector pipes below the floor slab level is essential. We prefer to design the subsurface drainage systems.**



Notes:

1. Design Earth Pressure is Service Load Application
2. Analyze stability using Service Loads and design section using Factored Loads. Do not analyze stability with Factored Loads.

Fig. 2 - Design Earth Pressure

FLOOR SLABS

SLAB SEPARATED FROM SUBGRADE

Since shrinking and swelling of the soils should be expected from varying weather conditions and/ or leaking buried utilities, we believe the most positive means of assuring that vertical distress does not occur is by the use of a structural system which completely removes the floor slabs and grade beams from contact with the surface soils. This system of construction is very expensive ($15 per sq ft more than a slab-on-grade plus other sandwich elements) and may not be appropriate for the facility planned at the site unless the Owner is not willing to accept the risk of unsuitable floor slab behavior. A typical 5-in. thick floor slab often becomes an 8-in. thick doubly reinforced section with two levels of reinforcing and foundations on a 15-ft sq grid.

The floor slab separated from the subgrade offers more challenges that exacerbate costs. These challenges included the application of floor slab damp proofing by the "blind-side method" and the implementation of internal surface drainage.

Both the floor slab and grade beams should be separated from the subgrade. The subgrade below the slab should be sloped to drain to perimeter or internal drains, and the subgrade should be a seal slab reinforced with fiber mesh. Moisture will likely accumulate, hence a moisture proof membrane on top of the slab along with a topping slab will likely be needed. Combinations of this sandwich are appropriate and we would be glad to sit down with the Design Team to discuss the most appropriate one for this project if a slab separated from the subgrade is engaged. Engaging a slab separated from the subgrade often results in severe project challenges.

Moreover, the method of separation is important in that cardboard void boxes have been known to collapse during concreting to ruin the design or the void boxes can allow concrete from the floor slab to reach the subgrade. Manufactured adapters should be affixed to the carton forms at penetrations to minimize the risk of concrete spreading to the subgrade. The use of hollow core precast elements is preferred in some areas of the country to properly confine the floor slab concrete.

SLAB-ON-GRADE

For economy, and with the understanding that movement and interior floor slab cracking will occur, we recommend that a modified structural system be employed. In this system, grade beams support block walls and masonry walls. The floor slab is tied to the grade beams with reinforcing steel and the grade beams are connected to the foundations. The grade beams are then designed as beams that span between foundations and do not rely on the earth for support.

This floor slab design approach is not a design to resist potential upward soil pressures, but instead to delay the effects in the event upward soil pressures become significant. The floor slab and grade beams are not designed to resist upward swell pressures.

Design recommendations for the potential upward swell pressures in drilled pier foundations are not part of this report because our local experience has shown that the minimum amount of reinforcing steel of 0.5% has been adequate to resist the effects of uplift locally.

Movement and interior floor slab cracking is often accompanied by dry wall cracking, door jamming, and cracking of architectural finishes. If movements reach values to cause cracking, we know of no simple economical methods to arrest the movement.

With the grade beams constructed as recommended, a conventional concrete "slab-on-fill" of the required structural thickness to carry the ground floor loads may be used for the interior portion of the structure. We recommend that the concrete slab be placed on a minimum of 4 ft of low plasticity select fill after the subgrade is lime-treated with a minimum concentration of 6% by dry weight (about 55 lbs per sq yd) to 10 ft beyond the building perimeter. Please refer to the Earthwork section of this report for additional discussion on select fill and lime treatment.

Grade Beams. The floor slab should be structurally connected to grade beams and individual foundations to delay the effects of upward slab movement. The minimum reinforcement should be No. 4, Grade 60 bars on 16-in. centers. The exterior grade beams should penetrate to the subgrade by 30 in. along the perimeter and be earth formed.

Utilities and Lime Barrier. We recommend that the sub slab utilities be located within the select fill above the lime-treated natural subgrade, and be bedded in cement stabilized sand and backfilled with select fill. Proposed deep utilities should be shallow and within the select fill thickness before turning down outside of the structure or the utilities should be bedded and backfiled with flowable fill or controlled low-strength material (CLSM) until the top of the lime-treated zone is reached. Conduits entering and egressing the building should be bedded and backfilled with CLSM from 5 ft outside of the building until the conduits turn up through the floor slab.

CLSM Barrier. A CLSM barrier should be used for all sub slab utilities entering and egressing the building. The CLSM barrier should extend from 5 ft outside to 5 ft inside the building.

Sand Leveling Course. A sand fill leveling course beneath the floor slab and sidewalks should be avoided because the sand provides a seepage path for surface water and often that water remains trapped beneath the concrete. The trapped water will accelerate soil swelling and cracking even on relatively inactive soil subgrades.

Internal Walls. Block, brick, masonry, and tile walls should rest on grade beams in accordance with our previous recommendations. The walls should not be attached to the ceilings or ceiling beams. Instead, the walls should be allowed to move independent of the ceiling structure. Ground floor walls that extend to walls supported by the second or third floor levels should be designed to accommodate vertical movement of at least 1 1/2 in. between the two independent supported walls.

Internal Dry Walls. Dry walls should be designed so that the metal studs can move vertically through a slip joint mechanism. None of the studs should be fixed to the ceiling structure. Expansion joints should be included above each door corner and as part of the dry walls every 15 ft.

Mechanical Supports | Unistruts. Mechanical supports that extend from floor to ceiling should be adjustable to accommodate vertical movement. Supports extending from the ceilings to hold piping will have to be adjusted to accept movements of ground supported elements.

Floor Slab Position | Depressed Floor Slab

The top of the floor slab should be at least 12 in. above surrounding grade and depressed floor slab areas should not extend below the adjacent grade outside. Hence depressed floors will govern the overall position of the building slab.

The recommendation of floor slab position is given because we have seen seepage enter depressed floor slab areas with as little as 6 in. in depression below adjacent ground outside. Our intent is to furnish a floor slab system that is consistent with other slabs-on-grade and if indeed a depressed slab is the preferred option, there should be perimeter and underfloor drainage provided.

Hence we recommend that any depressed slab area include a subsurface drainage system. We will design such a system for you.

Building Entrance

The building entrances should be treated like a structurally loaded portion of the building and be supported on individual foundations. Walkways are otherwise likely to move enough to jam doors and form trip hazards.

Permanent Drainage

We have seen seepage into depressed slab areas located as little as 6 in. below the adjacent grade outside, hence we recommend that a permanent drainage system be installed along the outside perimeter of any below grade walls if depressed slabs cannot be avoided. The drainage system should be a column of filter sand extending to the base of the interior floor slab. Below the base of the filter sand should be a slotted pipe encapsulated in filter gravel and sloped to discharge into a sump. The design of the permanent drainage system should be performed by the Geotechnical Engineer.

Landscaping, Drainage, and Utilities

Landscaping and site drainage can adversely influence slab performance even if the ground floor slabs are designed as structural units elevated above the ground. Fast-growing, deciduous trees should not be placed near the building. Slow-growing trees, such as oaks, should be located at a distance of at least the ultimate untrimmed drip line radius the trees are expected to grow plus 15 ft.

Mow Strips

Mow strips, if used, should be concrete instead of loose granular material such as gravel. Granular material even with drain systems should be avoided.

Slopes

The grassed ground outside the building should be sloped steeply (5% or more) to provide good drainage away from the building.

Planters

Planters within and adjacent to the building should be concrete and impervious to prevent irrigation water from entering the subgrade. Exterior flower beds should be raised and contain only shallow rooted plants. The bed subgrade should be sloped away from the building or wall and contain drains to carry off excess water from the structure.

Water Sprinklers

Water sprinkler lines should be located at least 10 ft from the building walls because experience has shown that underground sprinkler lines often leak and saturate the subgrade.

Utility Lines

Utility lines adjacent to the building or entering the building should be bedded and backfilled with CLSM in accordance with our previous recommendations. The CLSM should extend from 5 ft inside to 5 ft outside the building.

Hardscape

Hardscape will move noticeable much sooner than floor slabs because the combined effects of landscape and water sprinklers contribute to accelerate bad performance. If frequent maintenance cannot be tolerated, then the design should follow the recommendations of this report including placing low walls on grade beams.

Pavement Design

Subgrade Preparation for Pavements

Subgrade preparation for pavements should follow the recommendations under Earthwork in this report. In the event the risk of pavement performance that will potentially be worse than placing pavement on natural soil can be tolerated and the subsidence and increased maintenance is accepted, then the pavement can be placed on the existing fill after cutting to the desired subgrade, proof rolling to detect weak zones, and removing and replacing those areas which fail the proof roll with compacted select fill. The proof roll can miss buried debris and long-term pavement subsidence can result.

PAVEMENT SECTIONS

Pavement sections at the site should satisfy City and County design criteria and the recommendations of this report. We recommend a minimum concrete pavement thickness of 6 in. for normal traffic and 7 in. for heavy traffic. For dumpster traffic we continue to recommend 8-in. thick pavement sections. Reinforcing of No. 4, Grade 60 bars on 16-in. centers is preferred. Concrete should have a minimum modulus of rupture of 550 psi or minimum 28-day strength of 4000 psi.

CONSTRUCTION RECOMMENDATIONS

SHALLOW EXCAVATIONS

The side slopes of shallow excavations in the strong natural clay soil will probably stand near vertical for limited periods. We recommend, however, that vertical-sided excavations be limited to a depth of 5 ft. Sides of temporary excavations deeper than about 5 ft should be braced or sloped back to at least 1-vertical on 1/2-horizontal. Bracing requirements for excavations deeper than 5 ft should conform to applicable federal, state, and local regulations.

Positive drainage away from excavations should be established to avoid surface water from ponding within the excavations and around the completed foundations. Foundation soils should be protected against disturbance from construction activities. We recommend that individual foundations be poured the same day the excavation is made to grade. If this is impractical, then a thin seal slab of lean concrete should be poured over the base of the excavation.

EARTHWORK

Subgrade Preparation. Subgrade preparation for placement of fill, floor slabs, or pavements should consist of stripping organic matter, existing fill, and unsuitable areas of soft or wet materials as assessed by the Construction Geotechnical Engineer. Exposed subgrade soil should be compacted to at least 95% of the maximum dry density determined by ASTM D 698 with passes of a roller weighing at least 25 tons unless the Construction Geotechnical Engineer waives the density requirements. All subgrade preparation should be under the continuous review of the Construction Geotechnical Engineer.

Lime Treatment. We recommend that the floor slab subgrade be lime-treated to a depth of 8 in. and to a horizontal distance of 10 ft beyond the building line before select fill is placed. A lime concentration of 6% by dry weight (55 lbs per sq yd) should be used.

Select Fill. Fill that will be used onsite is termed select fill in this report. Select fill should consist of low plasticity clay (CL) with a liquid limit less than 42 and a plasticity index between 8 and 22. The soil at this site may be suitable for use as select fill but must be checked for conformance to these requirements. Select fill should be placed in 6 to 8-inch thick loose lifts at a moisture content between ± 2% of optimum, and be compacted to between 95 and 100% of the maximum dry density determined by ASTM D 698. Select fill placement should be under the continuous review of the Construction Geotechnical Engineer.

CONCLUSIONS

FOUNDATION COSTS

Experience has shown that risks are inherent in foundation construction. Not even the most comprehensive geotechnical investigation can guide the design and construction of foundations flawlessly. Hence, foundation budgeting should allow a contingency to cope with the unexpected.

LIMITATIONS

This report is limited to the subsurface conditions interpreted by the results of the field and laboratory phases. Regardless of the thoroughness of a geotechnical investigation, there is always a possibility that conditions between borings will be different from those at boring locations and that conditions will not be as anticipated by the designers and contractors. Subtle changes in the design or development concept may occur before construction begins. In addition, the construction process may change the soil conditions.

In the event that a testing laboratory is selected for construction services, or the design geotechnical engineer is not selected for construction engineering of earthwork and foundation installation, then the group selected shall accept this design geotechnical report as their own and become the design geotechnical engineer, holding UEI harmless from actions resulting from this report or the interpretations made by others.

A Design Geotechnical Report is a “for information only” document regardless if the document is included with the Project Documents or is set aside as a separate reference item because the report is not written in the terse mandatory language of Project Drawings or Specifications. Accordingly, a Design Geotechnical Report gives options, interpretations, conclusions, and recommendations wherein the reader has the option of accepting or rejecting.

CRANES AND MOBILE EQUIPMENT ACCESS

This report does not address mobile equipment access and egress, or crane foundation design.

PROJECT DOCUMENTS AND CONSTRUCTION ENGINEERING

The Geotechnical Engineer should participate in the [1] foundation construction planning, [2] development and review of the final design and construction documents for geotechnical considerations, as well as [3] engineer, inspect and document the construction procedures used and the conditions encountered. Unanticipated conditions and inadequate procedures should be reported to the design team along with recommendations to solve observed problems. Construction engineering should be continuous to be effective and responsible.

We recommend that Ulrich Engineers, Inc. provide this service based on our familiarity with the project, the subsurface conditions, and the intent of the recommendations for design.

We appreciate the opportunity to assist you on this project. Please call us to review the construction documents and observe the foundation installation.

* * *

The following Illustrations and appendices are attached and complete this report.

Plate	**Description**
Plate 1	Plan of Borings
Plate 2 thru 9	Individual Boring Logs
Plate 10	Key to Terms and Symbols
Plate 11	Computation of Bearing Pressures

Sincerely,
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