above ground storage tank
air quality
asbestos/lead-based paint
baseline environmental assessment
brownfield redevelopment
building/infrastructure restoration
caisson/piles
coatings
concrete
construction materials services
corrosion
dewatering
drilling
due care analysis
earth retention system
environmental site assessment
facility asset management
failure analyses
forensic engineering
foundation engineering
geodynamic/vibration
geophysical survey
geosynthetic
greyfield redevelopment
ground modification
hydrogeologic evaluation
industrial hygiene
indoor air quality/mold
instrumentation
ISO14001 EMS
masonry/stone
metals
nondestructive testing
pavement evaluation/design
property condition assessment
regulatory compliance
remediation
risk assessment
roof system management
sealants/waterproofing
settlement analysis
slope stability
storm water management
structural steel/welding
underground storage tank

PRELIMINARY GEOTECHNICAL EVALUATION REPORT

BEAUMONT COMMERCE TOWNSHIP MEDICAL CENTER
COMMERCE TOWNSHIP, MICHIGAN

SME Project No. PG52339
May 15, 2006

Soil and Materials Engineers, Inc.

Soil and Materials Engineers, Inc.
The Kramer Building
43980 Plymouth Oaks Blvd.
Plymouth, MI 48170-2584
tel (734) 454-9900
fax (734) 454-0629
www.sme-usa.com

May 15, 2006

Mr. Edward A. Pocock, AIA
Hobbs + Black Architects
100 N. State Street
Ann Arbor, Michigan 48104

RE: Preliminary Geotechnical Evaluation
Beaumont Commerce Township Medical Center
Commerce Township, Michigan
SME Project No. PG52339

Dear Mr. Pocock:

We have completed our preliminary geotechnical evaluation for the proposed Beaumont Commerce Township Medical Center in Commerce Township, Michigan. This report presents the results of our observations and analyses, and our preliminary recommendations for subgrade preparation and earthwork, foundations and feasibility of basement construction. Additionally, our report contains a short discussion regarding construction considerations related to the geotechnical conditions disclosed by the borings and test pits.

We appreciate this opportunity to be of service. If you have questions or require additional information regarding our preliminary evaluation, please contact me.

Very truly yours,

SOIL AND MATERIALS ENGINEERS, INC.

Larry P. Jedele, PE
Principal Consultant

Enclosed: One original

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SUMMARY

The report conclusions and recommendations are summarized as follows:

1. The soil conditions encountered at the site generally indicate surficial topsoil overlying interbedded natural sands and clays to the explored depths of the borings. However, sand fill was encountered at two borings and two stockpiles. Rubble and debris were also observed at the ground surface at several locations throughout the site. Groundwater was encountered between about elevations 935 to 951 feet.

   Although subsurface exploration was not performed within existing wetlands on site, we anticipate organic soil deposits (peat and/or organic silts/clays) are present.

2. The inorganic soils exposed after site stripping are generally expected to consist of natural sands and clays. However, existing fill will be encountered in some areas within the site. The natural sands and clays (excluding the topsoil) and some of the existing fill are generally considered suitable for grade-slab and pavement support, provided the subgrade soils are properly prepared during construction. Below-grade structures associated with existing developments on-site, topsoil stockpiles, organic soils, and any unsuitable fill should be removed to expose suitable subgrade.

3. Shallow spread and/or continuous foundations bearing on natural inorganic sands or clays, or engineered fill over suitable natural soils are feasible for support of the Phase I structures within the non-wetland areas of the site. Maximum net allowable soil bearing pressures in the range of 3,000 to 5,000 psf can be preliminarily used for design.

   Deep foundations may be considered for structures located within existing wetlands, if such areas are developed. However, additional subsurface information is required to determine if deep foundations are practical within the wetlands.

4. Basement construction is feasible at this site, provided the basements are constructed above the long-term groundwater levels. Basements should be constructed at least 2 feet above the long-term high groundwater levels to allow for seasonal variations. If basements are situated below the long-term groundwater levels, consideration may be given to constructing an engineered basement system.

5. We anticipate standard sump pit and pump methods should generally be adequate to control groundwater seepage for most shallow excavations. However, more aggressive dewatering techniques may be required for deeper excavations that extend below the groundwater level. In excavation areas where groundwater accumulates, a working surface of either crushed aggregate or crushed concrete may be required to protect the exposed surface from disturbance.

6. The earthwork operations may generate significant amounts of excess soils or "spoils" along with any dewatering activities required during construction. Since impacted soil and/or groundwater were previously identified by SME, earthwork and other subsurface contractors should implement special handling and disposal practices. In addition, there may be a health risk to persons working in or near soil excavations or with the excavated soils and groundwater. Therefore, we recommend the excavation, earth-moving and dewatering activities be conducted in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120), which includes provisions for preparing a site specific health and safety plans, worker and supervisor training, medical surveillance, personal protective equipment, site work zones, health and safety monitoring, decontamination, and emergency plans, as necessary. In addition, the State of Michigan requires owners and operators of known impacted sites to evaluate and document Section 20107a "due care" obligations such as preventing potential exposure and exacerbation of existing impact. ***Therefore, the generalized Due Care Plans referenced in Section 1.3 of this report outline soil and groundwater handling precautions. A more comprehensive Due Care Plan will be developed in the future and should be reviewed by prospective contractors and other service providers to implement during construction.***

The summary presented above includes selected elements of our preliminary findings and recommendations and is provided solely for purposes of overview. It does not present crucial details needed for the proper application of our preliminary findings and recommendations. It should therefore not be considered apart from the entire text of this report and appendices, with all of the qualifications and considerations mentioned therein which are best evaluated with the active participation of SME.

REPORT PREPARED BY:

Matthew S. Moyneur, EIT
Senior Engineer

REPORT REVIEWED BY:

Larry P. Jedele, PE
Principal Consultant

1. INTRODUCTION

This report presents the results of the preliminary geotechnical evaluation performed by Soil and Materials Engineers, Inc. (SME) for the proposed Beaumont Commerce Township Medical Center located in Commerce Township, Michigan. Our evaluation was conducted in general conformance with the scope of services outlined in SME Proposal No. P06-0231 (SME Alternate), dated March 14, 2006, and the letter titled Final Addendum to Proposal for Preliminary Geotechnical Evaluation Services, dated March 28, 2006. However, boring B7 was not performed for this evaluation due to its location within the existing Northpointe Cabinet property and the agreed upon Access Agreement (Revised 4/6/06). This evaluation was authorized by Mr. Edward Pocock of Hobbs + Black Associates, Inc.

1.1 Site Conditions

The subject site covers about 35 acres and is located on the north side of Maple Road, between M-5 and Welch Road in Commerce Township, Michigan. The site is bounded to the north by a C.O.E. Railroad line. In addition, a series of four-legged towers supporting an overhead electrical line is aligned along the south side of the railroad. Also, an asphalt concrete paved drive extends about 400 feet from Maple Road north into the center of the site. Overhead utilities were also observed along the east side of the drive. At the north end of the drive, the overhead utilities extended northwest toward the Northpointe Cabinet buildings at the northwest corner of the site.

Generally, the site is unoccupied, except for two existing buildings at 1080 Welch Road. The larger building is a Northpointe Cabinet store and covers about 33,100 square feet and is an L-shaped, 14-foot high, single-story, metal sided building with a concrete and block foundation. A smaller masonry block building is present at the southeast corner of that parcel and covers about 2,940 square feet. An access drive from Welch Road and a parking lot south of the larger building consist of asphalt concrete pavement. Concrete pavements are present at the main entrance to the larger building along with truck docks or loading ramps at both buildings.

Based on our observations during the field exploration, the site is primarily wooded. However, the east end of the site is relatively open and covered in tall weeds and brush. In addition, three wetlands, denoted Wetland A/B, Wetland C, and Wetland D on a Boundary/Topographic/Wetland Survey (dated April 17, 2006) prepared by Nowak & Fraus, PLLC, are located within the site. Wetland A/B is a regulated wetland covering a total of about 3.84 acres and is located just south of the C.O.E. Railroad. Wetland A/B extends southeast from the C.O.E Railroad and into the central portion of the site. Wetlands C and D are not regulated wetlands and cover about 0.07 and 0.03 acres, respectively, near the east end of the site. Standing water was observed in Wetlands A/B and C during the field exploration.

Overall, topographic conditions appear to relatively flat to slightly undulating with ground surface levels varying about 10 feet across the site. There are several areas where the ground surface is steeper, such as at existing stockpiles or areas formerly filled or excavated. Based on our review of the referenced Boundary/Topographic/Wetland Survey, ground surface elevations generally vary from about 940 to 950 feet across most of the site. However, ground surface elevations within the southwest and southeast corners of the site vary from about 950 to 955 feet.

During the field exploration, debris, including relatively large concrete blocks (e.g. concrete road barriers), large diameter (about 2 feet) concrete pipe and wood, concrete, brick, and asphalt concrete fragments and reinforcing steel (construction debris) were observed at several locations throughout the site. Specifically, the concrete blocks and concrete pipe were observed near the southeast end of the site. Based on our review of an aerial photograph taken in 1999, the southeast corner of the site appears to have been used as a staging area for construction equipment and materials for the construction of M-5. Therefore, there may be areas where existing fill was placed during the construction operations for M-5 on this site. A relatively large area of construction debris was observed near the center of the site, just west of a portion of Wetland A/B. The approximate locations where construction debris was observed at the existing ground surface is indicated on the Boring Location Diagram included in the Appendix.

1.2 Project Description

The project will consist of the design and construction of a new Medical Center development for Beaumont Hospital. In addition, based on our review of an undated Phase I site plan (Option B) provided by Hobbs + Black Architects via electronic mail (e-mail) on May 2, 2006, a fire station is planned southwest of the proposed Medical Center. Based on our review of the referenced Phase I site plan, the Phase I development will consist of two structures (a POB structure and an ACC structure) near the center of the site, a fire station southwest of those proposed structures, and a helipad west of the two structures. Access drives and parking areas will also be provided.

The POB structure will consist of a two-story structure with a below-grade level covering a footprint of about 30,000 square feet. An ACC structure will be located west of the POB structure and cover a total of 47,749 square feet. These structures will be connected with a lobby at the main entry. The fire station will cover about 11,566 square feet and we anticipate the fire station will be a one- to two-story, slab-on-grade structure. We anticipate the helipad will be a slab-on-grade structure.

Associated parking and service drives will also be provided around the new structures. Three service drives are planned with two from Maple Road (Main Campus Entrance and the fire truck exit) and an entrance from Welch Road. Paved parking areas are planned northwest, south and east of the two Phase I medical buildings.

In addition, based on our review of an undated composite site plan (Option B) provided by Hobbs + Black Architects via electronic mail (e-mail) on May 2, 2006, a five-story hospital and a parking deck are planned north and east of the Phase I structures. The hospital will cover about 300,000 square feet and the parking deck will provide about 700 parking spaces. The proposed hospital building will generally be located within a large portion of Wetland A/B. Additional information regarding the proposed hospital and parking deck were not available when this report was prepared.

Column loads are anticipated to typically range from about 300 to 800 kips in the buildings and could be as high as about 1,500 kips if integrated with parking structures. In addition, we understand basements could extend as deep as about 20 feet below the "Main Level", to be set at or near existing ground surface levels. Based on the existing site topography and assuming the "Main Level" of the Phase I portion of the medical center will be at or near the existing ground surface levels (about elevations 945 to 950 feet), we anticipate relatively minor cuts and fills (about 5 feet) will be required to reach the subgrade levels for the Phase I structures at the site. However, we anticipate more significant cuts and fills will be required to establish final subgrade elevations within the existing wetlands due to the potential for encountering relatively deep organic soil deposits.

1.3 Previous Site Evaluations

SME has performed several environmental evaluations at the subject site. Specifically, SME has completed the following environmental evaluations under separate cover:

- Phase I Environmental Site Assessment (ESA) titled, "*31-Acre Site, Commerce Twp, MI,*" dated October 8, 2004 (SME Project No. PE47886)
- Baseline Environmental Assessment (BEA) report titled, "*31-Acre Site, Site, Commerce Twp, MI,*" dated October 14, 2004 (SME Project No. PE47886A)
- Due Care Plan titled, "*31-Acre Site, Site, Commerce Twp, MI,*" dated January 17, 2005 (SME Project No. PE47886A)
- Phase I ESA titled, "*5-Acre Site, Commerce Twp, MI,*" dated February 2, 2005 (SME Project No. PE48916)

- BEA report titled, "*5-Acre Site, Site, Commerce Twp, MI,*" dated March 31, 2005 (SME Project No. PE48916A)
- Due Care Plan titled, "*5-Acre Site, Site, Commerce Twp, MI,*" dated July 7, 2005 (SME Project No. PE48916A)
- Phase I ESA titled, "*1080 Welch Road, Commerce Twp, MI,*" dated November 30, 2005 (SME Project No. PE51025)
- Asbestos Assessment Report, "*1080 Welch Road, Commerce Twp, MI*, dated December 9, 2005 (SME Project No. PE51025A)
- BEA report titled, "*1080 Welch Road, Commerce Twp, MI*, dated February 10, 2006 (SME Project No. PE51025A)
- Due Care Plan titled, "*1080 Welch Road, Commerce Twp, MI,*" dated February 10, 2006 (SME Project No. PE51025A)

Previous SME environmental assessments identified concentrations of contaminants in soil and groundwater exceeding MDEQ Part 201 generic residential cleanup criteria. Therefore, Section 20107a "due care" obligations shall be evaluated for future earthwork and groundwater activities at the site." Please refer to the referenced SME environmental reports for additional recommendations and environmental concerns regarding the subject site.

2. EVALUATION PROCEDURES

2.1 Field Exploration

Twenty-two (22) borings (B1 through B6 and B8 through B23) were drilled at the project site between April 10 through 14, 2006. Nine borings extended 25 feet below the existing ground surface; seven borings extended 30 feet below the existing ground surface; one boring extended 35 feet below the existing ground surface; and the remaining five borings extended 40 feet below the existing ground surface. In total, 670 lineal feet of drilling was performed for this evaluation.

In addition, four borings (HA1 through HA4) were performed with hand auger probing equipment by SME on May 9, 2006. Borings HA1 through HA4 extended about 2 to 6.5 feet below the existing ground surface for a total of about 19.5 feet of probing.

The approximate locations of the borings are shown on the Boring Location Diagram included in the Appendix.

The planned number, depths, and locations of the borings were determined by SME. Prior to drilling, the planned boring locations for borings B1 through B6 and B8 through B23 were staked in the field by Giffels-Webster Engineers, Inc (Giffels-Webster). The locations of borings HA1 through HA4 were determined by SME at the time of the field exploration, using existing site features and the referenced Boundary/Topographic/Wetland Survey for reference.

The existing ground surface elevations at borings B1 through B6 and B8 through B23 were provided by Giffels-Webster. However, borings B10 and B17 were offset from the staked locations so as not to perform the borings within the regulated wetlands on site, per the referenced Access Agreement. In addition, boring B9 was offset due to overhead utilities, boring B13 was offset due to soft subgrade conditions and standing water, boring B15 was offset from its staked location near the top of a slope adjacent to the Northpointe Cabinet building, and boring B22 was offset from its staked location at the top of a relatively steep slope. Therefore, the existing ground surface elevations at those borings (B9, B10, B13, B15, B17, and B22) were estimated by SME to the nearest 1-foot based on existing site topography provided on the referenced Boundary/Topographic/Wetland Survey. The existing ground surface elevations at borings HA1 through HA4 were estimated by SME to the nearest 1-foot based on existing site topography provided on the referenced Boundary/Topographic/Wetland Survey.

Borings B1 through B6 and B8 through B23 were drilled using a drill rig mounted on an all-terrain vehicle (ATV). The borings included soil sampling based upon the split-barrel sampling procedure. Soil samples collected from the borings were sealed in glass jars by the driller.

Borings HA1 through HA4 were performed by an SME representative using a 3 ¼-inch diameter auger bucket attached to a steel rod and T-handle assembly. Soil samples representative of the soils encountered at those locations were sealed in glass jars in the field by the SME representative.

Groundwater level measurements were recorded during drilling/probing and immediately after completion of the drilling/probing operations at each of the borings. Since the boreholes were backfilled with auger cuttings shortly after drilling/probing, long-term groundwater level information is not available from the borings.

The recovered soil samples were sent to the SME laboratory for further observation and testing.

2.2 Laboratory Testing

The general laboratory testing program consisted of performing visual soil classification on the recovered samples from the borings. In addition, moisture content and hand penetrometer and Torvane shear tests were performed on portions of cohesive soil samples obtained from the borings.

The soil samples were visually classified in general accordance with the Unified Soil Classification System (USCS). The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs in the Appendix. The appended General Notes sheet includes a brief summary of the general method of describing the soil and assigning an appropriate USCS group symbol.

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to penetration of a small, calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). The shear strength reported on the boring logs is one-half of the unconfined compressive strength and is reported in units of kips per square-foot (ksf).

In the Torvane test, the shear strength of a cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The shear strength of a cohesive sample is determined directly from the maximum torque required to shear the sample and is reported on the logs in units of ksf.

The boring logs included in the Appendix include the drilling method(s), materials encountered, penetration resistances, and pertinent field observations made during the drilling/probing operations, along with the results of the laboratory testing.

Soil samples retained over a long time, even in sealed jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, soil samples are normally retained in our laboratory for 60 days and then disposed, unless instructed otherwise.

3. SUBSURFACE CONDITIONS

3.1 Soil Conditions

The soil conditions encountered at the boring locations generally consisted of surficial topsoil overlying interbedded natural sands and clays extending to the explored depths of the borings. However, sand fill was encountered at two borings, stockpiled topsoil was observed at two borings, and fill containing debris and rubble was observed at the ground surface several locations throughout the site. A generalized summary of the soils encountered in the borings is given below, beginning at the existing ground surface and proceeding downward:

Stratum 1: Topsoil. The driller reported about 1 to 18 inches of surficial topsoil at 22 borings. Two inches of stone was encountered overlying the topsoil at boring B15.

At borings HA3 and HA4, the SME representative encountered 6 and 6.5 feet of topsoil, respectively. The borings were terminated within topsoil due to encountering obstructions. These borings were performed on top of two existing stockpiles on the site.

Clayey sand fill with some silt and trace gravel content along with trace amounts of wood fragments was encountered underlying the topsoil at boring B12. The fill extended about 4 feet below the existing ground surface. A single Standard Penetration Test (SPT) resistance (N-value) of 6 blows per foot (bpf) was obtained within the sand fill, indicating a loose condition.

Also, fill with varying amounts of construction debris and rubble (e.g. bricks, concrete and wood fragments, reinforcing steel, etc.) was encountered at boring HA1. In addition, the construction debris and rubble was observed at the ground surface near boring HA1, west of Wetland A/B, approximately between borings B13 and B16. Boring HA1 extended about 2 feet into the fill and was terminated within the fill due to encountering obstructions.

Stratum 2: Interbedded Natural Sands and Clays. Natural sands containing varying amounts of clay, silt and gravel were encountered at the borings, excluding borings HA1, HA3, and HA4. The natural sands extended about 27 to 38 below the existing ground surface at six borings and were penetrated about 4 to 28 feet to the explored depths of 17 borings. Standard Penetration Test (SPT) resistances (N-values) obtained within the natural sands varied from about 2 blows per foot (bpf) to 50 blows per 4 inches, indicating a very loose to extremely dense condition. However, most of the sands were in a medium dense to dense condition.

Natural clays with varying silt, sand, and gravel contents were encountered below the Stratum 1 soils and above, below, and within the natural sands at 21 borings. The clay strata was penetrated about 1 to 11 feet to the explored depth of five borings and varied from about 2 to 18 feet thick in 20 borings. Shear strengths within the natural clays ranged from 0.8 to greater than 4.5 ksf, indicating a soft to hard consistency. Moisture contents within the natural clays ranged from about 9 to 31 percent.

Natural cohesionless silts with varying clay, sand, and gravel contents were encountered below and within the natural sands and clays at five borings. The silt strata was penetrated about 3 feet to the explored depth of one boring and varied from about 1.5 to 5 feet thick in four borings. N-values within the natural silts varied from about 11 to 30 bpf, indicating a medium dense to dense condition.

The soil descriptions and properties, in addition to groundwater conditions observed by the driller are graphically presented on the boring logs included in the Appendix. Please refer to the boring logs for the soil conditions at the specific test locations. Stratification lines on the logs indicate a general transition between soil types. They are not intended to show an area of exact geological change. The soil descriptions on the logs are based on visual classification of the soils encountered.

3.2 Groundwater Conditions

During drilling, groundwater was encountered within the borings from about 0.5 to 22 feet below the existing ground surface (between about elevations 932.5 to 950.7 feet). Just after completion of drilling, groundwater was observed in the borings from about 2 to 22 feet below the existing ground surface (between about elevations 935 to 950.7 feet). Groundwater was not encountered at borings HA1 through HA4.

Hydrostatic groundwater levels and the elevations and volumes of groundwater should be expected to fluctuate throughout the year, based on variations in precipitation, evaporation, surface runoff, and other factors. The groundwater levels indicated by the borings and presented in this section represent conditions at the time the borings were performed. The groundwater levels at the time of construction may vary.

3.3 Preliminary Seismic Site Class

The project site is located at the northwest corner of M-5 and Maple Road in Commerce Township, Michigan. Based on our review of the referenced Boundary/Topographic/Wetland Survey, ground surface elevations generally vary from about 940 to 950 feet across most of the site. However, ground surface elevations within the southwest and southeast corners of the site vary from about 950 to 955 feet. Based on Plate 13 (Topography of the Bedrock Surface) in the Hydrogeologic Atlas of Michigan, the estimated level of the top of rock at the site is between about elevation 635 to 655 feet (from linear interpolation of contours plotted at 50-foot intervals). From this information, the glacial drift at the site is roughly 285- to 320-feet thick.

The known N-values and shear strengths for drift at this site are limited to the explored depths of 25 to 40 feet below the existing ground surface at the borings performed for this evaluation. According to the limited information obtained from the borings and considering the penetration resistances and shear strengths below the explored depths of the borings either increase or are at least similar to the penetration resistances and shear strengths encountered in the borings, the subgrade soils at this site can preliminarily be designated as seismic site Class D in determining seismic design forces for this project in accordance with the 2003 MBC Code (Table 1615.1.1). However, the soil conditions may meet a better seismic site class, but deeper soil borings and/or actual shear wave velocities are needed to identify whether or not the preliminary site class provided in this report can be upgraded.

4. PRELIMINARY ANALYSIS AND RECOMMENDATIONS

Based on our observations of the site and our understanding of the project, we anticipate construction of the proposed Beaumont Medical Center will be performed in two phases. Phase I will consist of the design and construction of several structures outside the limits of existing wetland areas and Phase II will consist of the design and construction of several structures within the limits of the existing wetland areas. Therefore, the following sections include preliminary information on site preparation and earthwork and foundations outside and inside wetland areas. However, subsurface exploration was not performed within existing wetland areas. Therefore, the preliminary recommendations provided within existing wetland areas are based on our experience with similar sites and are subject to revision after additional subsurface exploration is performed. Further evaluation of the existing wetland areas should be performed to evaluate the general nature and extent of the subgrade soils within existing wetland areas.

4.1 Site Preparation and Earthwork Outside Wetland Areas

After demolition of the existing buildings, proposed building and pavement areas should be cleared of asphalt concrete, topsoil, trees, root mats, vegetation, debris, unsuitable fill and other deleterious materials to expose the existing natural soils or suitable fill. The amount of surface organics and topsoil will vary across the site, especially near and within existing wetland areas. We recommend stripping surficial soils containing more than 4 percent organic matter by weight.

Below-grade construction/debris associated with the existing structures on-site (e.g. foundations, buried slabs, septic fields, etc.) and any existing utilities should be completely removed from proposed building areas. Existing utilities that are to remain active after the new development is constructed (if any) should be rerouted around the proposed structures. In proposed pavement areas, below-grade obstructions and/or abandoned utilities could be left in place, provided the obstructions/utilities are situated at least 2.5 feet below the final subgrade level to reduce the potential for developing "hard spots" in the subgrade. Abandon utilities to be left in-place should be fully grouted. Due to the unknown condition of the backfill in and around below-grade obstructions/utilities to remain in-place, the existing backfill should be evaluated to confirm these soils are adequate for support of engineered fill and/or pavements. Unsuitable existing trench backfill (where encountered) should be undercut and replaced with a suitable granular engineered fill.

Existing fill was encountered at borings HA1 and B12 and construction debris was observed at the ground surface at several locations throughout the site. At boring HA1, the boring was terminated within the fill due to encountering obstructions. Therefore, the thickness of the fill could not be determined at the time of the field exploration. Based on our observations of the site and the subgrade conditions encountered adjacent to boring HA1 (borings B13, B14, and B16), we anticipate the fill will be relatively shallow (less than 3 feet below the ground surface) and relatively isolated throughout the site. Also, based on our review of an aerial photograph taken in 1999, the southeast corner of the site appears to have been used as a staging area for construction equipment and materials for the construction of M-5. Therefore, there may be areas where existing fill was placed during the construction operations for M-5 on this site. However, the nature and extent of the fill was not fully determined for this evaluation. Therefore, we recommend additional subsurface information (e.g. test pits) be obtained to further evaluate the condition and extent of the existing fill. The approximate locations of where construction debris and rubble were observed at the site are indicated on the Boring Location Diagram included in the Appendix.

Based on the our observations of the site and the fill encountered at boring HA1, the existing fill was likely placed in an uncontrolled manner, and therefore, there is some risk for poor performance (e.g. cracking, settlements) of structures supported on uncontrolled fill. Proper subgrade preparation during construction (e.g. compaction, moisture conditioning, partial undercutting, etc.), and obtaining additional subsurface information (e.g. test pits) to further evaluate the condition of the existing fill, can reduce the risk for poor structural performance. However, if even a small degree of risk is not acceptable, then the existing fill will need to be completely removed and replaced with engineered fill. Generally, the more uncontrolled fill removed, the less the risk becomes.

In addition to the existing fill encountered at the site, two topsoil stockpiles were located near the center of the site, just east of Wetland A/B. The depth of the topsoil stockpiles could not be determined at the boring locations due to encountering obstructions within the stockpiles. However, based on the existing site topography, we anticipate about 7 feet of topsoil will be encountered at the topsoil stockpile where boring HA3 was performed (west stockpile) and about 12 feet of topsoil will be encountered at the topsoil stockpile where boring HA4 was performed (east stockpile). The topsoil encountered is not suitable for reuse as engineered fill and should be used in non-structural areas of the site or hauled off-site. The approximate locations of the topsoil stockpiles are indicated on the Boring Location Diagram included in the Appendix.

Following stripping, the exposed subgrade soils outside of the wetland area are generally anticipated to consist of natural sands and/or clays, or existing fill. Based on the boring information, most of the on-site inorganic soils are generally suitable for use as general site engineered fill and are generally considered suitable for support of grade slabs and pavements. As noted previously, we recommend the existing fill be further evaluated to determine its suitability for support of grade slabs and pavements. Areas to receive engineered fill should be compacted and proofrolled prior to placement of engineered fill. The purpose of the proofroll is to locate areas of unsuitably loose or soft subgrade and to uniformly compact the surface. Areas of unsuitable subgrade revealed during proofrolling should be mechanically improved (compacted) in place. If it is not possible to compact the unsuitable subgrade, it may be necessary to remove (undercut) the unsuitable soils and backfill the undercut excavation with engineered fill. Proofrolling should be performed with a fully loaded, tandem-axle truck or equivalent pneumatic-tired construction equipment.

The natural sands and clays, and some of the existing fill, are generally considered suitable for reuse as engineered fill, provided the organics content of the soils is less than 4 percent and the soils are relatively free of debris/obstructions. Existing fill containing significant amounts of debris (such as encountered at boring HA1), topsoil (such as encountered at borings HA3 and HA4), and organic soil deposits (peat, organic silt/clay) are not considered suitable for reuse as engineered fill and should be either placed in non-structural areas on-site or hauled off-site.

The natural sands (above the groundwater level) and sand fill determined to be suitable for reuse as engineered fill are generally expected to require little or no moisture conditioning to allow for proper compaction. However, some drying/aeration of the natural clays and clay fill (if encountered/used to raise site grades) will likely be required. The successful reuse of the on-site soils for engineered fill will be dependent on the time of year and the care the earthwork contractor uses during construction. During cold and wet periods of the year, the subgrade soils can become saturated and disturbed. Based on our experience, sites where silty sand or clay subgrades are encountered are most often successfully graded during the warmer and drier months since the likelihood of subgrade disturbance is reduced during this time and these soils are more easily moisture conditioned. If drying of the existing sands and clays cannot be accomplished due to weather or schedule considerations, we recommend imported fill meet the requirements of MDOT Class II sand.

Relatively clean granular material (such as MDOT Class II sand) should be used as backfill in confined areas (such as in utility trenches) and where drainage is required (such as behind basement walls). Some of the on-site granular soils visually classified as SP or SP-SM type soils (refer to the boring logs) may be suitable for reuse as MDOT Class II sand. However, gradation tests should be performed to determine if the on-site soils can be classified as MDOT Class II sands.

4.2 Site Preparation and Earthwork Within Wetland Area

Although the existing subgrade within the wetlands were not evaluated for this evaluation per the referenced Access Agreement, we anticipate organic soil deposits (peat and/ organic silt/clay) will be encountered within the wetlands on the site. Based on our experience, we anticipate relatively deep organic soil deposits could be encountered. However, the extent of the peat and/or organic silt/clay was not considered for this evaluation. In general, construction over organic soil deposits will require significant effort (e.g. undercutting, soil surcharging, deep foundations or perhaps a combination of these methods) to support new structures.

Typically, organic soil deposits are not suitable for support of engineered fill or improvements such as foundations, floor slabs and pavements since organic soils will tend to compress or settle over time (especially when subjected to additional loads or stresses). Typically, the organic soils are removed and replaced with engineered fill prior to new construction. However, the earthwork required for this operation can be quite extensive and complicated, depending on the nature and extent of the organic soils encountered, and by the high ground water levels. Typically, the large mass excavation will require either a dragline or large excavator. The excavated organic soils will need to be temporarily stockpiled and then disposed off site. Engineered fill will need to be imported to the soil site by trucks from off-site sources. A series of dewatering wells will likely be necessary to lower the groundwater to allow placement of the engineered fill.

An alternative to removing and replacing the organic soil deposits is to leave the organic soils in place and use deep foundations to support the structures. However, settlements of pavements, utilities, and other surface structures not supported on deep foundations would still be expected. A surcharging program could be used to reduce these settlements, but this would take some time to implement and may not be appropriate especially if the organic soil deposits are deep and widespread.

Construction in the peat areas will require significant effort (e.g. undercutting or deep foundations) to support new structures due to the potential for encountering a significant thickness of the organic soils within the wetland areas. Further evaluation of the site should include exploration within wetland areas to assess the soil conditions and develop specific measures to address organic soil deposits.

4.3 Foundations

Shallow spread and/or continuous footings are generally considered feasible for support of the proposed Phase I structures outside the wetland area. Shallow spread and/or continuous footings can also be considered for the Phase II structures within the wetland area if the organic soils are completely removed and replaced with properly placed and compacted engineered fill. We anticipate shallow foundations will generally bear on suitable natural sands or clays, or on engineered fill placed over suitable natural soils. Topsoil, fill, and/or organic soils are not suitable for foundation support and should be completely removed and replaced with engineered fill.

For the Phase II portion of the project that includes construction over the existing wetlands, deep foundations (e.g. driven piles) may be considered in areas where the thickness of unsuitable soils make it impractical for removing those soils and replacing them with engineered fill. However, additional subsurface information is required within the wetlands to assess the nature and extent of the subgrade soils within the wetlands and if deep foundations are considered necessary and economically feasible.

In general, assuming the existing ground surface is near the final grades for this development, suitable bearing soils are generally expected near normal footing bearing levels. However, some undercutting should be expected where unsuitable soils/fill and/or overly loose/soft natural soils are encountered at and below design footing levels. Where fill and/or organic soil deposits are encountered, we recommend the footings extend through the fill to bear on suitable natural soils. Foundation undercutting may be more prevalent for structures near where organic soil deposits (e.g. near the limits of the wetlands) are encountered. The amount of foundation undercutting to remove unsuitable soils outside the wetland area is expected to be relatively minor and is anticipated in relatively isolated areas throughout the planned development. However, as noted previously, we recommend additional exploration be performed where existing fill was encountered/observed to further define the nature and extent of the existing fill prior to construction.

Groundwater is generally not expected to be encountered during foundation construction outside the wetland area within slab-on-grade areas of the site. Groundwater seepages will likely be encountered in basement and utility excavations, which extend below the site groundwater levels. Groundwater seepages adversely affect the stability of the subgrade and will need to be temporarily controlled to allow for the planned construction. The depth and size of the excavation(s), and the type of soils encountered, will affect the type of temporary dewatering system required. In general, standard sump pit and pump methods are anticipated to be adequate for controlling groundwater from "perched" source(s). However, more aggressive dewatering efforts (e.g. slotted casings, well-points, and/or sheeting) will likely be required to temporarily depress groundwater level where excavations extend below the long-term groundwater table. Raising site grades in low areas of the property will be beneficial in reducing dewatering.

Even after dewatering, the exposed subgrade will likely be wet and sensitive to disturbance. Therefore, a layer of crushed aggregate may need to be placed to protect the subgrade from disturbance.

On a preliminary basis, maximum net allowable soil bearing pressures in the range of 3,000 to 5,000 psf could be used for design of shallow foundations bearing on suitable natural soils, or on engineered fill overlying suitable natural soils. As mentioned above, some localized undercutting or improvement of unsuitable soils (e.g., compaction in-place) may be required to achieve the design bearing pressure at some footing locations.

Specific recommendations regarding the design net allowable soil bearing pressure for the proposed buildings will depend on the final building locations, foundation size and bearing level, the physical properties of the soil encountered at that bearing level, and the associated structural loads. Once the final site and grading plans are developed and additional borings performed, more specific recommendations can be provided for the specific structures.

4.4 Feasibility of Basement Construction

Overall, construction of basements for the planned development is feasible. However, for basements extending about 20 feet below the existing ground surface, an engineered basement system (drainage blanket and underdrains below the basement floor slab, waterproofing membranes on basement walls, multiple sumps with alternative power sources, water-stops at construction joints, etc.) will be required and temporary dewatering during construction may also be needed. The engineered basement approach can be quite costly in terms of initial construction and long-term operating and maintenance and can be quite difficult to implement. Therefore, we recommend situating basement levels above any long-term fluctuations in the site groundwater levels, if possible.

In general, basement levels should be situated at least 2 feet above the long-term high groundwater levels encountered in borings that are advanced as part of site exploration. The purpose of this separation of 2 feet is to account for potential short-term seasonal fluctuations in the groundwater levels. If the basement level is to be situated below the groundwater levels, an engineered basement system will be required and temporary dewatering during construction may also be needed. In general, groundwater levels at most borings varied between about elevations 936 and 942 feet and may be influenced by the water level in wetland A/B. The hydrogeology of the site is somewhat complex and thus there are variations in groundwater levels because of alternating layers of sands and clays across the site.

The selection of the basement level or elevation must also consider long-term fluctuations in the ground water levels. The installation of groundwater observation wells may be considered at the site to assist the design team in assessing fluctuations in the site groundwater levels prior to completion of final design. In some cases the construction of a conventional basement level may require the placement of engineered fill to raise site grades sufficiently above the site groundwater levels.

4.5 Construction Considerations

The earthwork operations may generate significant amounts of excess soils or "spoils" along with any dewatering activities which may be required during construction. Since impacted soil and/or groundwater were previously identified by SME, earthwork and other subsurface contractors should implement special handling and disposal practices. In addition, there may be a health risk to persons working in or near soil excavations or with the excavated soils and groundwater. Therefore, we recommend the excavation, earth-moving and dewatering activities be conducted in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120), which includes provisions for preparing a site specific health and safety plans, worker and supervisor training, medical surveillance, personal protective equipment, site work zones, health and safety monitoring, decontamination, and emergency plans, as necessary. In addition, the State of Michigan requires owners and operators of known impacted sites to evaluate and document Section 20107a "due care" obligations such as preventing potential exposure and exacerbation of existing impact. ***Therefore, the generalized Due Care Plans referenced in Section 1.3 of this report outline soil and groundwater handling precautions. A more comprehensive Due Care Plan will be developed in the future and should be reviewed by prospective contractors and other service providers to implement during construction.***

Groundwater seepage into shallow excavations in the non-organic areas of the site is not anticipated to be a significant factor during construction. In general, we anticipate standard sump pit and pumping procedures will be adequate to control these accumulations, on a localized basis. However, in areas where organic soils are removed and where excavations for utilities and basements extend below the groundwater level in site sands, more aggressive dewatering techniques such as well points or pumps in slotted casings will likely be required to control seepage and permit construction in the dry. As indicated above, temporary monitoring wells may be installed and subsequent groundwater level readings obtained to further evaluate the site groundwater level during supplemental evaluations at this site, especially if below-grade structures are planned.

The contractor should remove ponded or standing water from areas where water collects and prevent surface water runoff from reaching footing excavations or prepared subgrade. Subgrade soils, which become disturbed, should be removed and replaced with engineered fill. Under adverse weather conditions, areas of exposed subgrade at the site may be protected by placement of crushed concrete or crushed aggregate on the exposed subgrade. In addition, the placement of footing concrete should be done as soon as footing excavations have been completed and approved to reduce the potential for disturbance of the footing subgrade.

The contractor must provide a safely sloped excavation or an adequately constructed and braced shoring system in accordance with federal, state, and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground. If material is stored or heavy equipment is operated near an excavation, stronger shoring must be used to resist the extra pressure due to the superimposed loads.

5. GENERAL COMMENTS

This preliminary report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the planning of this project. This report provides preliminary recommendations regarding foundations and general earthwork activities, based on the subsurface information collected during this preliminary evaluation.

This report should not be used solely for the final design. Once the building locations and design criteria (i.e., grade levels, building loads, etc.) are established, the preliminary conclusions and recommendations contained in this report should be re-evaluated. If the project design criteria are changed, the conclusions and recommendations contained in this preliminary report are not considered valid unless the changes are reviewed, and the conclusions of this report are modified or approved in writing by our office. Additional borings or other appropriate field exploration within the building areas along with other areas where structural elements are constructed will be required to obtain adequate information for specific final geotechnical recommendations. Additional borings and/or test pits will also be required to adequately delineate the depth and aerial extent of organic soils within or near existing wetland areas or to further define the nature and extent of fill.

The discussions and preliminary recommendations submitted in this report are based upon the available project information, described in this report, and the data obtained from the 26 borings performed at the approximate locations indicated on the Boring Location Diagram.

Variations in the soil conditions commonly occur between or away from the borings. The nature and extent of the variations may not become evident until the time the site is further evaluated or until the time of construction. If significant variations then become evident, it will be necessary for SME to reevaluate the preliminary recommendations of this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the drilling and sampling operations that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory, and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data, and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

This report and any future addenda or reports should be made available to bidders prior to submitting their proposals and to the successful contractor and subcontractors for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. Furthermore, the contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this property should be made available for review by bidders and the successful contractor.

This report has been prepared solely for the use of the client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, described in this report, unless specifically allowed by SME in writing. If this report is used by parties other than our original Client and those associated with their project, SME is not responsible for the suitability of the field exploration, scope of services or recommendations made, for the new project. SME also is not responsible for the interpretation of our boring logs and the recommendations provided herein by other parties.

SME will evaluate this report for other parties and developments at this site, provided our original Client agrees to release this information in writing. However, before this report can be relied upon by other parties, SME must review the proposed development since the new project will likely require additional field exploration, laboratory tests, analysis and modifications to our recommendations to adequately address the needs of the new project.

APPENDIX

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

BORING LOCATION DIAGRAM

GENERAL NOTES

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

BORING LOGS (B1 THROUGH B6, AND B8 THROUGH B23 AND HA1 THROUGH HA4)

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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general notes

Drilling and Sampling Symbols

SS -	Split-Spoon-1 3/8" I.D., 2" O.D. except where noted
LS -	Liner Sample
AS -	Power Auger Sample
ST -	Shelby Tube-2" O.D., except where noted
PS -	Piston Sample-3" diameter
WS -	Wash Sample
HA -	Hand Auger Sample
BS -	Bag or Bottle Sample
CS -	Continuous Sampler
NR -	No Recovery
RC -	Rock Core with diamond bit. NX size, except where noted
RB -	Rock Bit
VS -	Vane Shear
PM -	Pressuremeter
GP -	Geoprobe
PID -	Photo Ionization Device
FID -	Flame Ionization Device

Standard Penetration 'N' - Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon, except where noted (based on ASTM D1586).

Particle Sizes

Boulders -	Greater than 12 inches (305 mm)
Cobbles -	3 inches (76.2 mm) to 12 inches (305 mm)
Gravel-Coarse -	3/4 inches (19.05 mm) to 3 inches (76.2 mm)
Fine -	No. 4 (4.75 mm) to 3/4 inches (19.05 mm)
Sand-Coarse -	No. 10 (2.00 mm) to No. 4 (4.75 mm)
Medium -	No. 40 (0.425 mm) to No. 10 (2.00 mm)
Fine -	No. 200 (0.074 mm) to No. 40 (0.425 mm)
Silt -	(0.005 mm) to (0.074 mm)
Clay -	Less than (0.005 mm)

Depositional Features

Parting -	as much as 1/16 inch (1.6 mm) thick
Seam -	1/16 inch (1.6 mm) to 1/2 inch (12.7 mm) thick
Layer -	1/2 inch (12.7 mm) to 12 (305 mm) inch thick
Stratum -	greater than 12 inches (305 mm) thick
Pocket -	small, erratic deposit of limited lateral extent
Lens -	lenticular deposit
Varved -	alternating seams or layers of silt and/or clay and sometimes fine sand
Occasional -	one or less per foot (305 mm) of thickness
Frequent -	more than one per foot (305 mm) of thickness
Interbedded -	applied to strata of soil or beds of rock lying between or alternating with other strata of a different nature

Groundwater levels indicated on the boring logs are the levels measured in the boring at times indicated. The accurate determination of groundwater levels may not be possible with short term observations especially in low permeability soils. The groundwater levels shown may fluctuate throughout the year with variation in precipitation, evaporation, and runoff.

Classification

Cohesionless Soils (Blows per foot or 0.3m)

Very Loose	:	0 to 4
Loose	:	5 to 9
Medium Dense	:	10 to 29
Dense	:	30 to 49
Very Dense	:	50 to 80
Extremely Dense	:	Over 80

Cohesive Soils

Consistency		Shear Strength
Very Soft	:	0.25 kips/ft^2 (12.0 kPa) or less
Soft	:	0.25 to 0.49 kips/ft^2 (12.0 to 23.8 kPa)
Medium	:	0.50 to 0.99 kips/ft^2 (23.9 to 47.7 kPa)
Stiff	:	1.00 to 1.99 kips/ft^2 (47.8 to 95.6 kPa)
Very Stiff	:	2.00 to 3.99 kips/ft^2 (95.7 to 191.3 kPa)
Hard	:	4.00 kips/ft^2 (191.4 kPa) or greater

Soil Constituents

Trace	:	Less than 5%
Trace to Some	:	5% to 12%
Some	:	12% to 25%
Use Descriptor (i.e., Silty, Clayey, etc.)	:	25% to 50%

Soil Description

If clay content sufficiently dominates soil properties, then clay becomes the primary noun with the other major soil constituent as modifier : i.e. silty clay. Other minor soil constituents may be added according to estimates of soil constituents present, i.e., silty clay, trace to some sand, trace gravel.

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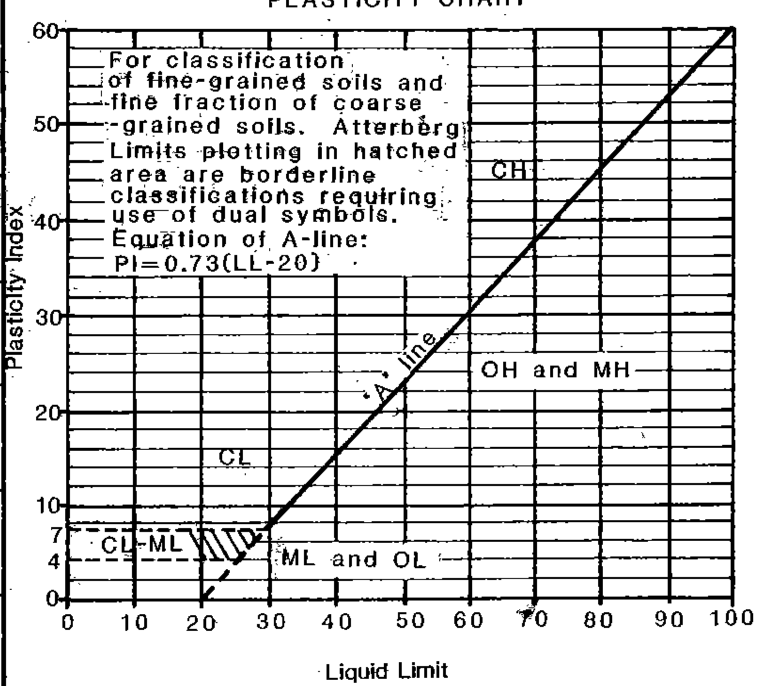
unified soil classification system

Major divisions			Group symbols	Typical names	Laboratory classification criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$Cu = \frac{D_{60}}{D_{10}}$ greater than 4; $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$Cu = \frac{D_{60}}{D_{10}}$ greater than 6; $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt	Peat and other highly organic soils		

Coarse-grained soils, laboratory criteria: Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5% . . . . . GW,GP,SW,SP
More than 12% . . . . . GM,GC,SM,SC
5 to 12% . . . . . Borderline cases requiring dual symbols

PLASTICITY CHART



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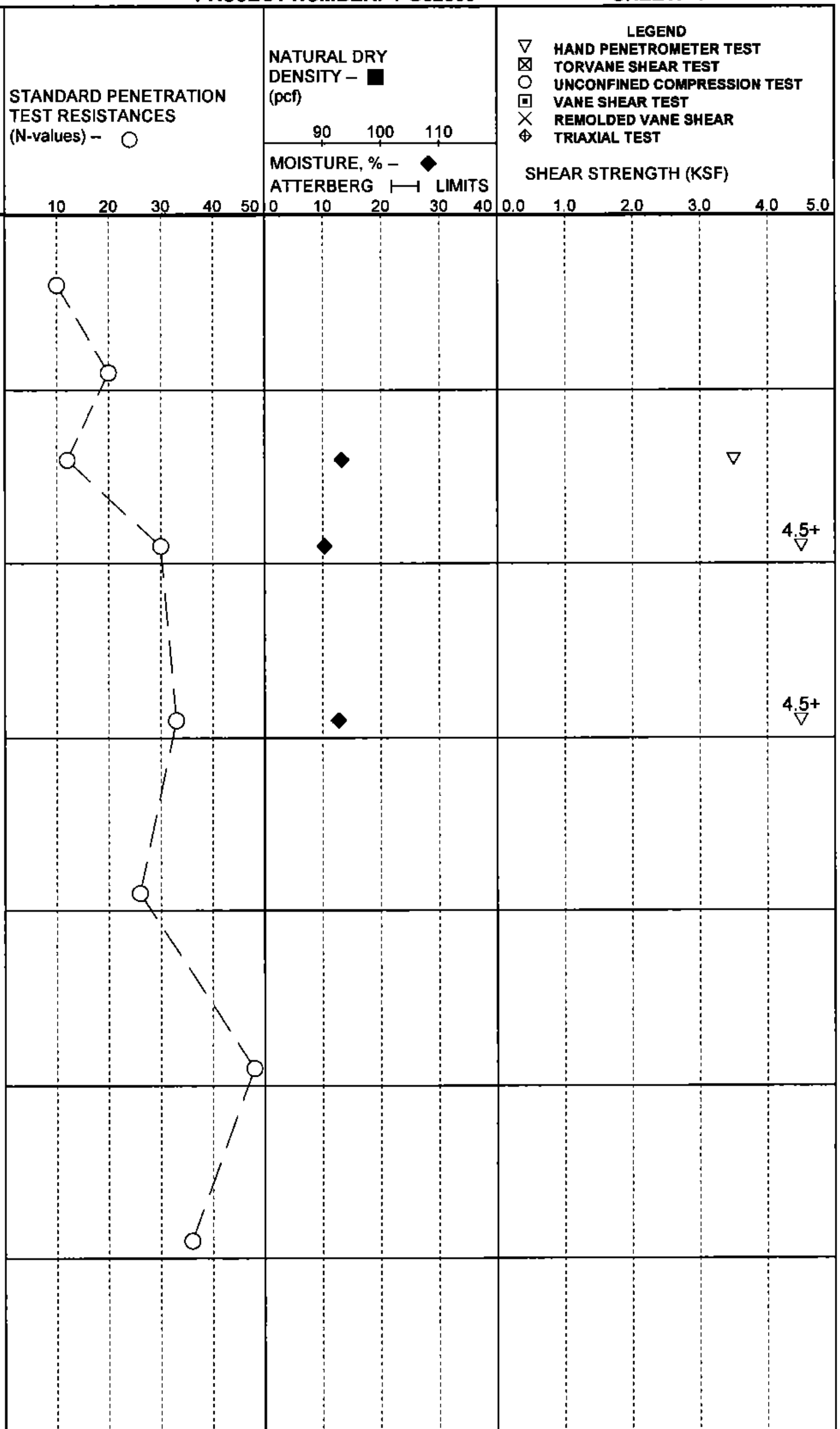
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/12/06 **BORING B1**

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

PROFILE DESCRIPTION — EASTING: NORTHING: GROUND SURFACE ELEVATION= 959.3

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 14 inches of Topsoil		
	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Occasional Silt Seams- Brown- Moist- Medium Dense (SP-SM)	SS1	3 4 6
		SS2	6 8 12
5		SS3	4 4 8
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Very Stiff to Hard (CL)	SS4	12 13 17
10			
		SS5	6 12 21
15			
	Fine to Medium Sand- Trace Silt & Gravel- Brown- Moist- Medium Dense (SP)	SS6	11 12 14
20			
	Fine to Coarse Sand- Trace to Some Silt & Gravel- Brown- Wet- Dense (SP-SM)	SS7	14 25 23
25			
		SS8	17 17 19
30	END OF BORING AT 30 FEET.		
35			



WATER LEVEL OBSERVATIONS

- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 22 **WATER LEVEL HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 22 **CAVE OF BOREHOLE AT** 22.5 ft

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PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/10/06 **BORING** B2

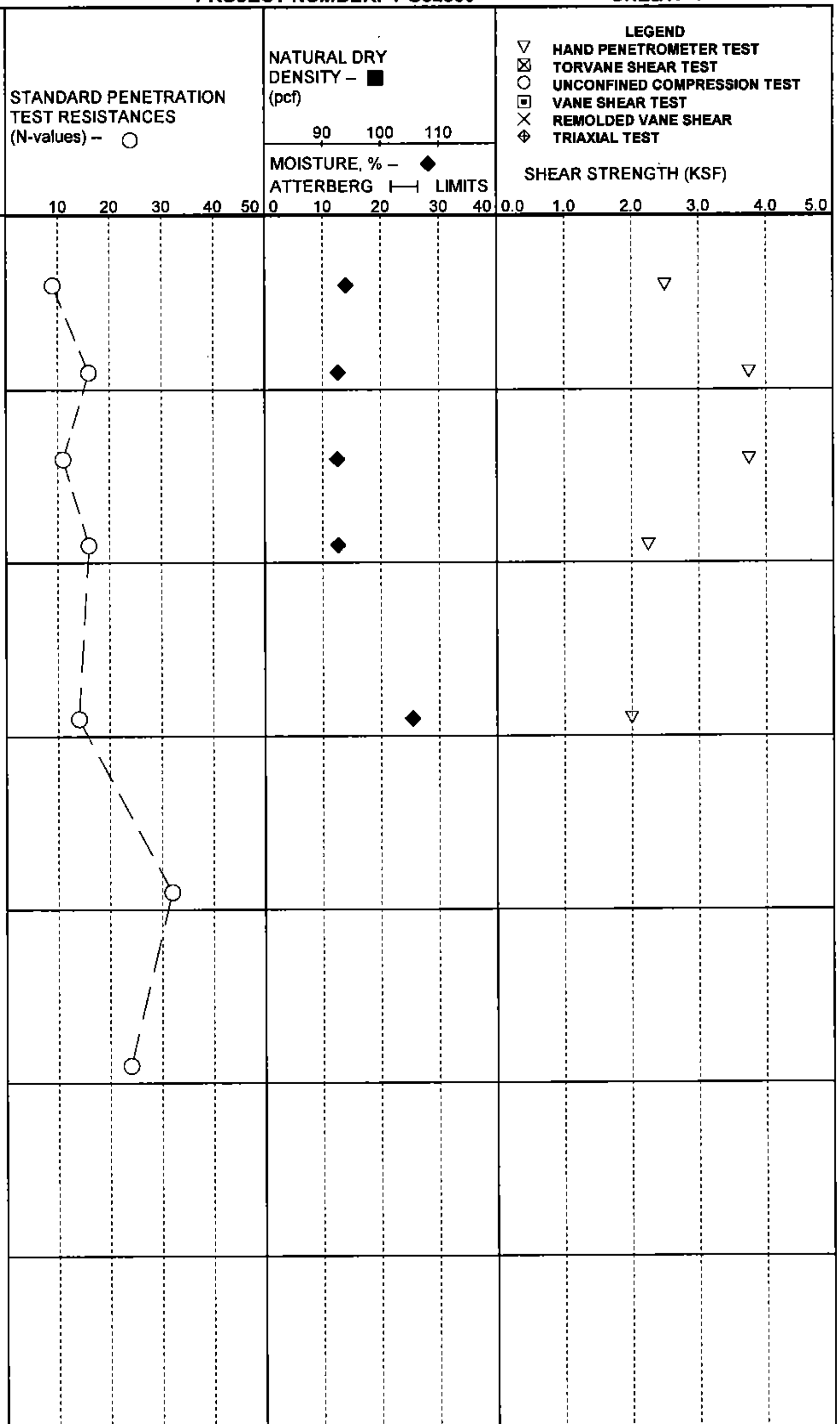
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

PROFILE DESCRIPTION

EASTING:
NORTHING:

GROUND SURFACE ELEVATION= 957.2

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 14 inches of Topsoil		
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Layers- Brown- Very Stiff (CL)	SS1	3 3 6
5		SS2	5 7 9
		SS3	3 6 5
	Sandy Clay- Trace to Some Silt- Trace Gravel- Occasional Sand Seams- Gray- Very Stiff (CL)	SS4	5 6 10
10			
15	Silty Clay- Trace Sand & Gravel- Gray- Very Stiff (CL)	SS5	5 6 8
20	Fine to Medium Sand- Trace Silt & Gravel- Occasional Silt Seams- Brown- Wet- Dense (SP)	SS6	11 14 18
25	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Brown- Wet- Medium Dense (SP)	SS7	6 10 14
	END OF BORING AT 25 FEET.		
30			
35			



WATER LEVEL OBSERVATIONS

- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 6.5 **WATER LEVEL** **HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 6.5 **CAVE OF BOREHOLE AT** 7 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/10/06 **BORING** B3

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

DEPTH (FEET)	PROFILE DESCRIPTION EASTING: NORTHING: GROUND SURFACE ELEVATION= 961.2	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 18 inches of Sandy Topsoil- Dark Brown		
	Silty Clay- Trace to Some Sand- Trace Gravel & Root Fibers- Occasional Sand Seams- Dark Brown- Very Stiff (CL)	SS1	3 4 4
5		SS2	5 5 7
		SS3	3 5 5
10	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Very Stiff to Stiff (CL)	SS4	2 3 3
15		SS5	5 8 9
20	Fine to Coarse Sand- Trace Silt & Gravel- Brown- Moist to Wet- Dense (SP)	SS6	7 13 18
25		SS7	16 19 18
	END OF BORING AT 25 FEET.		
30			
35			

STANDARD PENETRATION TEST RESISTANCES (N-values) – ○

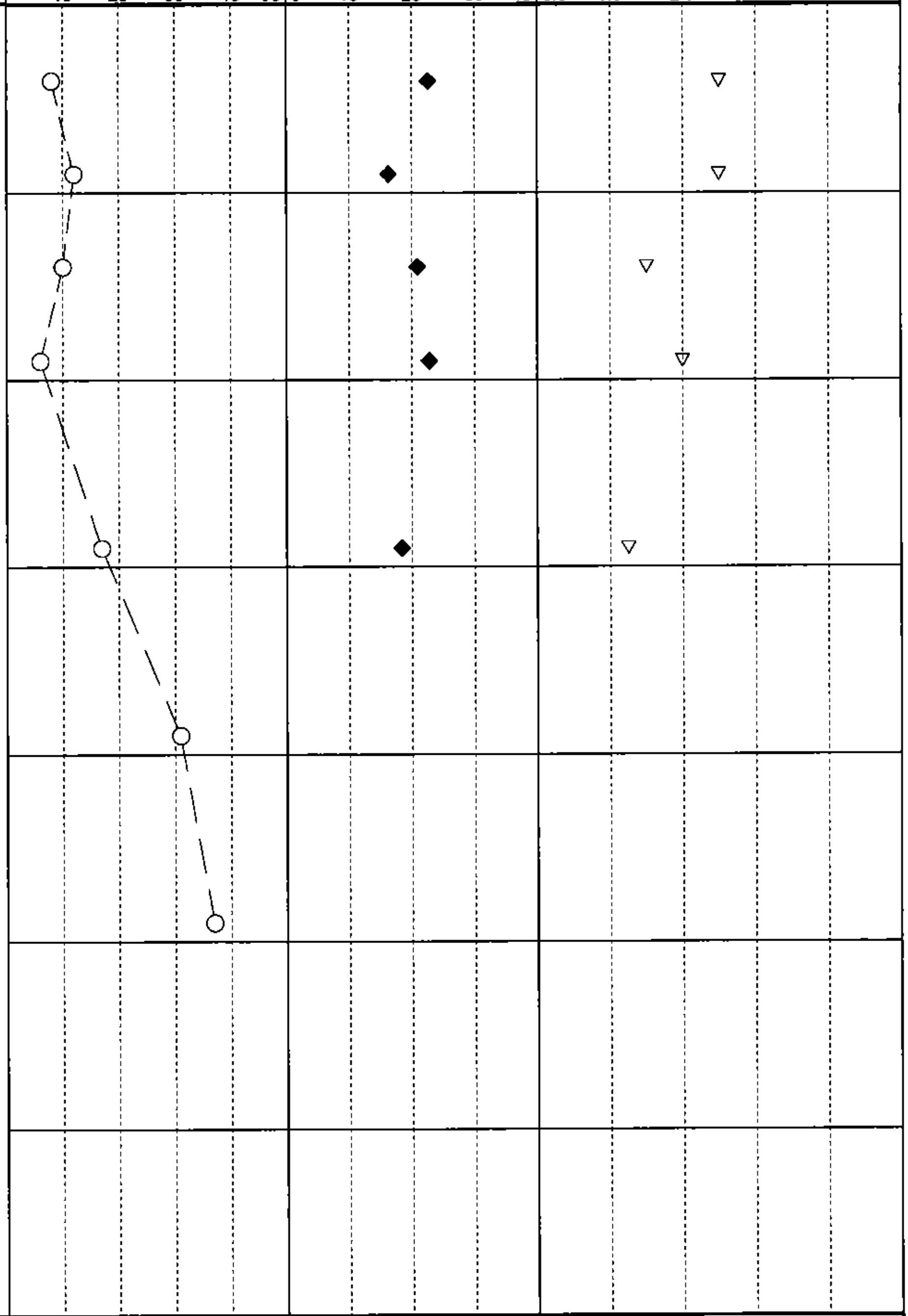
NATURAL DRY DENSITY – ■ (pcf) 90 100 110

MOISTURE, % – ◆

ATTERBERG ⊢⊣ LIMITS

LEGEND
- ▽ HAND PENETROMETER TEST
- ⊠ TORVANE SHEAR TEST
- ○ UNCONFINED COMPRESSION TEST
- ▣ VANE SHEAR TEST
- × REMOLDED VANE SHEAR
- ⊕ TRIAXIAL TEST

SHEAR STRENGTH (KSF)



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 22 **WATER LEVEL HOURS AFTER COMPLETION:**

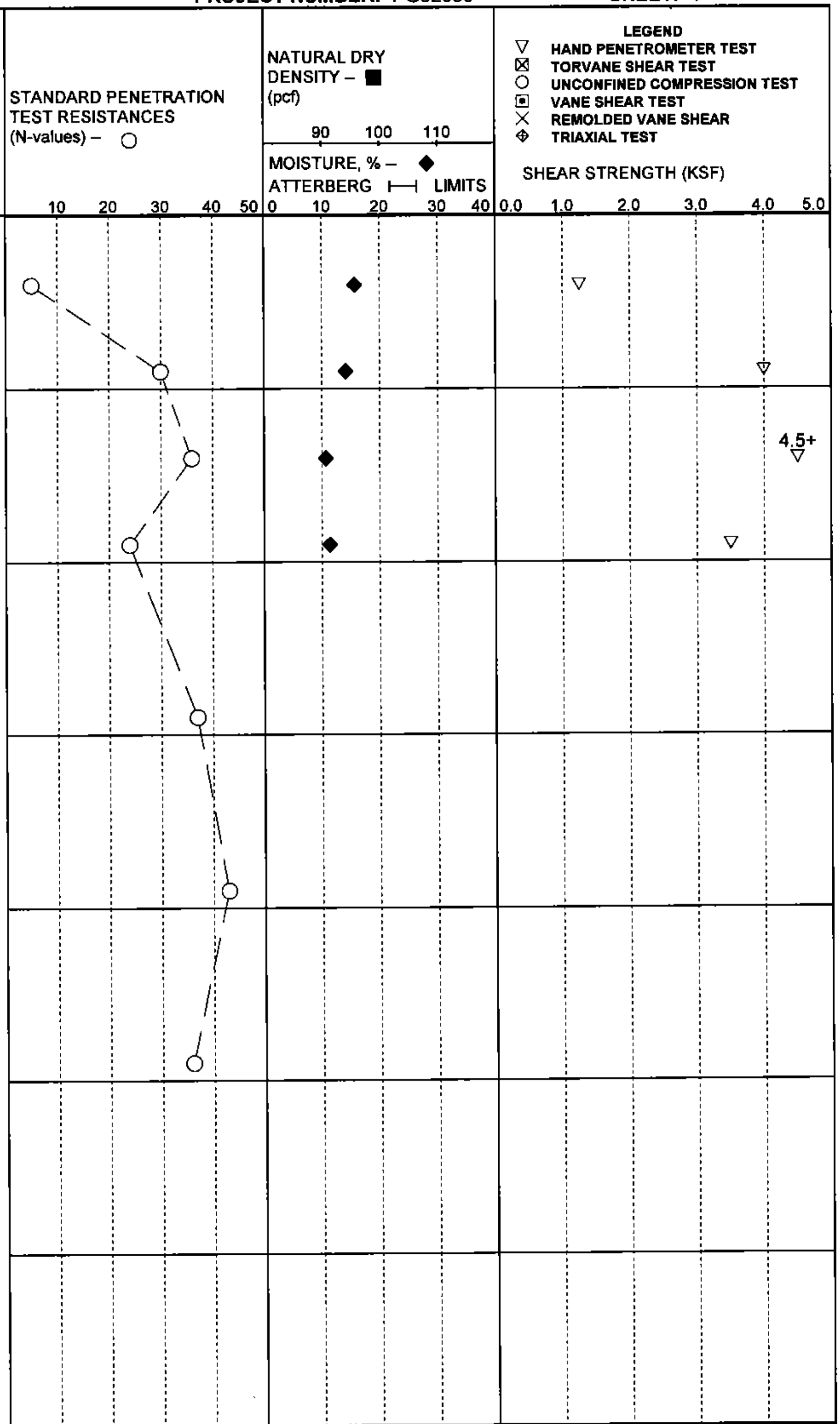
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 20 **CAVE OF BOREHOLE AT** 20 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER
A/E: HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN
BY: SB/MSM **DATE:** 4/14/06
BORING B4
CLIENT: HOBBS + BLACK ARCHITECTS
PROJECT NUMBER: PG52339
SHEET: 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 948.9

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 10 inches of Topsoil		
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Stiff to Hard (CL)	SS1	2 2 3
		SS2	7 12 18
5		SS3	7 19 17
		SS4	9 10 14
10	Sandy Clay- Some Silt- Trace Gravel- Gray- Very Stiff (CL)		
	Silty Fine Sand- Trace Clay & Gravel- Gray- Wet- Dense (SM)	SS5	7 20 17
15			
	Fine to Coarse Sand- Some Silt & Gravel- Brown- Wet- Dense (SM)	SS6	13 21 22
20			
	Fine to Coarse Sand- Some Silt- Trace to Some Gravel- Gray- Wet- Dense (SM)	SS7	25 21 15
25	END OF BORING AT 25 FEET.		
30			
35			



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 4 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 2 **CAVE OF BOREHOLE AT** 9 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/12/06 **BORING** B5

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 950.2

LEGEND: ▽ HAND PENETROMETER TEST; ⊠ TORVANE SHEAR TEST; ○ UNCONFINED COMPRESSION TEST; ▣ VANE SHEAR TEST; × REMOLDED VANE SHEAR; ⊕ TRIAXIAL TEST

STANDARD PENETRATION TEST RESISTANCES (N-values) – ○ (10, 20, 30, 40, 50)
NATURAL DRY DENSITY – ■ (pcf) (90, 100, 110)
MOISTURE, % – ◆; ATTERBERG ⊢⊣ LIMITS (0, 10, 20, 30, 40)
SHEAR STRENGTH (KSF) (0.0, 1.0, 2.0, 3.0, 4.0, 5.0)

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER	BLOWS PER SIX INCHES	SHEAR STRENGTH (KSF)
0	Driller reported 18 inches of Topsoil			
	Fine to Coarse Sand- Some Silt- Trace Clay & Gravel- Occasional Clay Seams- Brown- Wet- Loose (SM)	SS1	2, 2, 6	
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Hard (CL)	SS2	8, 10, 10	4.5+ ▽
5	Silty Clay- Some Sand- Trace Gravel- Occasional Silt Seams- Brown & Gray- Hard (CL)	SS3	8, 15, 24	4.5+ ▽
	Silty Clay- Some Sand- Trace Gravel- Gray- Hard (CL)	SS4	6, 12, 16	4.5+ ▽
10				
15	Fine to Medium Sand- Trace Silt & Gravel- Brown- Wet- Medium Dense (SP)	SS5	8, 11, 13	
20	Fine to Coarse Sand- Trace to Some Silt & Gravel- Occasional Rock Fragments- Brown- Wet- Dense (SP-SM)	SS6	42, 29, 19	
	Fine to Coarse Sand- Trace to Some Silt & Gravel- Gray- Wet- Medium Dense (SP-SM)	SS7	26, 13, 11	
25	END OF BORING AT 25 FEET.			
30				
35				

WATER LEVEL OBSERVATIONS

- ▼ GROUNDWATER ENCOUNTERED DURING DRILLING
- ▽ GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes:
1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. DRILLER REPORTED COBBLES FROM 18 TO 25 FEET.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 0.5 **WATER LEVEL HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 8 **CAVE OF BOREHOLE AT** 12 ft

soil and materials engineers, inc.

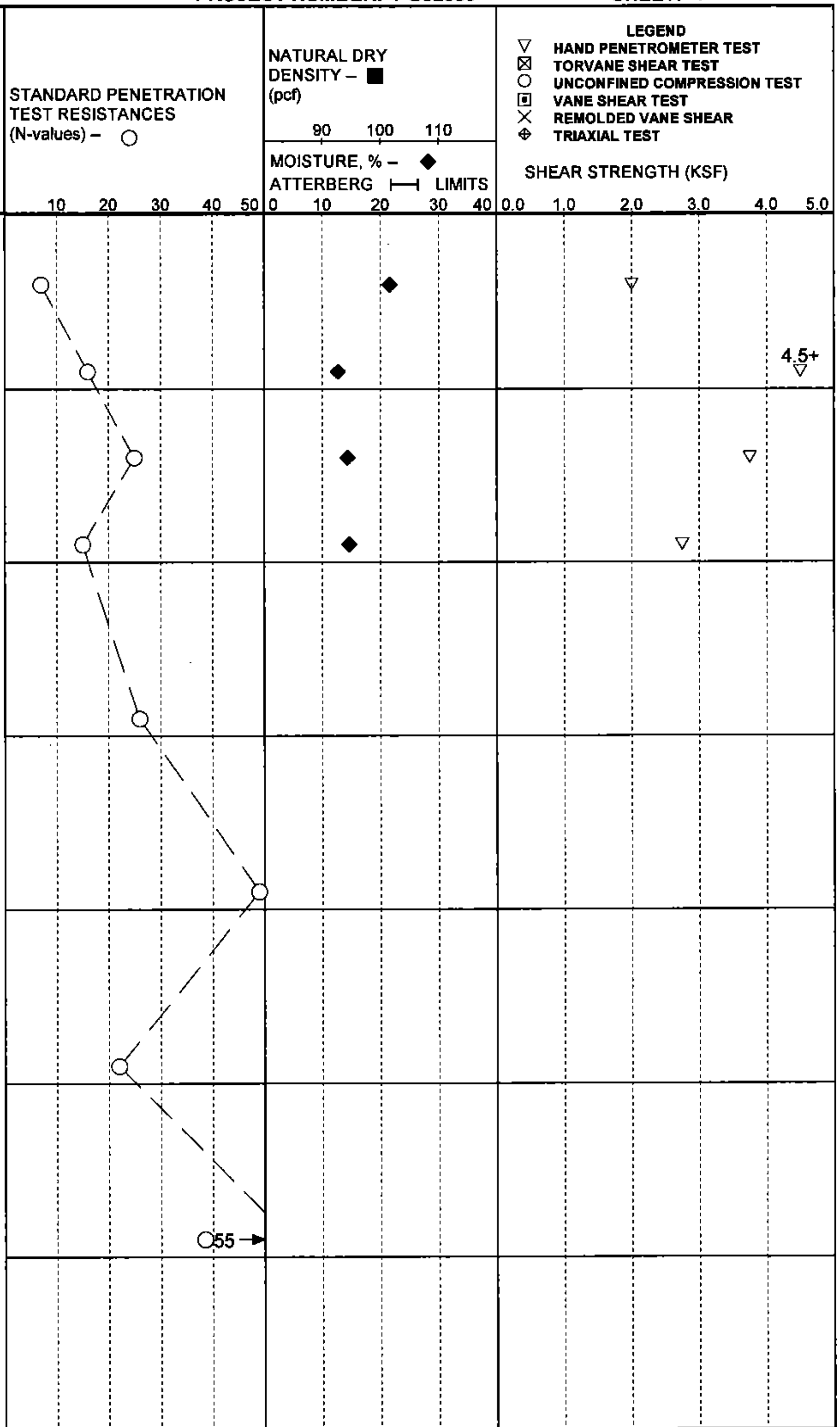
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/12/06 **BORING** B6

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 957.0

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER	BLOWS PER SIX INCHES
0	Driller reported 14 inches of Topsoil		
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Very Stiff to Hard (CL)	SS1	3 4 3
5		SS2	4 6 10
	Silty Clay- Some Sand- Trace Gravel- Occasional Silt Seams- Brown- Very Stiff (CL)	SS3	5 11 14
10		SS4	4 7 8
15	Fine to Coarse Sand- Trace Silt & Gravel- Brown- Moist- Medium Dense to Dense (SP)	SS5	11 12 14
20		SS6	12 22 27
25	Fine to Coarse Sand- Trace to Some Silt & Gravel- Brown- Wet- Medium Dense to Very Dense (SP-SM)	SS7	7 9 13
30		SS8	10 38 17
	END OF BORING AT 30 FEET.		
35			



WATER LEVEL OBSERVATIONS

- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 21 **WATER LEVEL HOURS AFTER COMPLETION:**

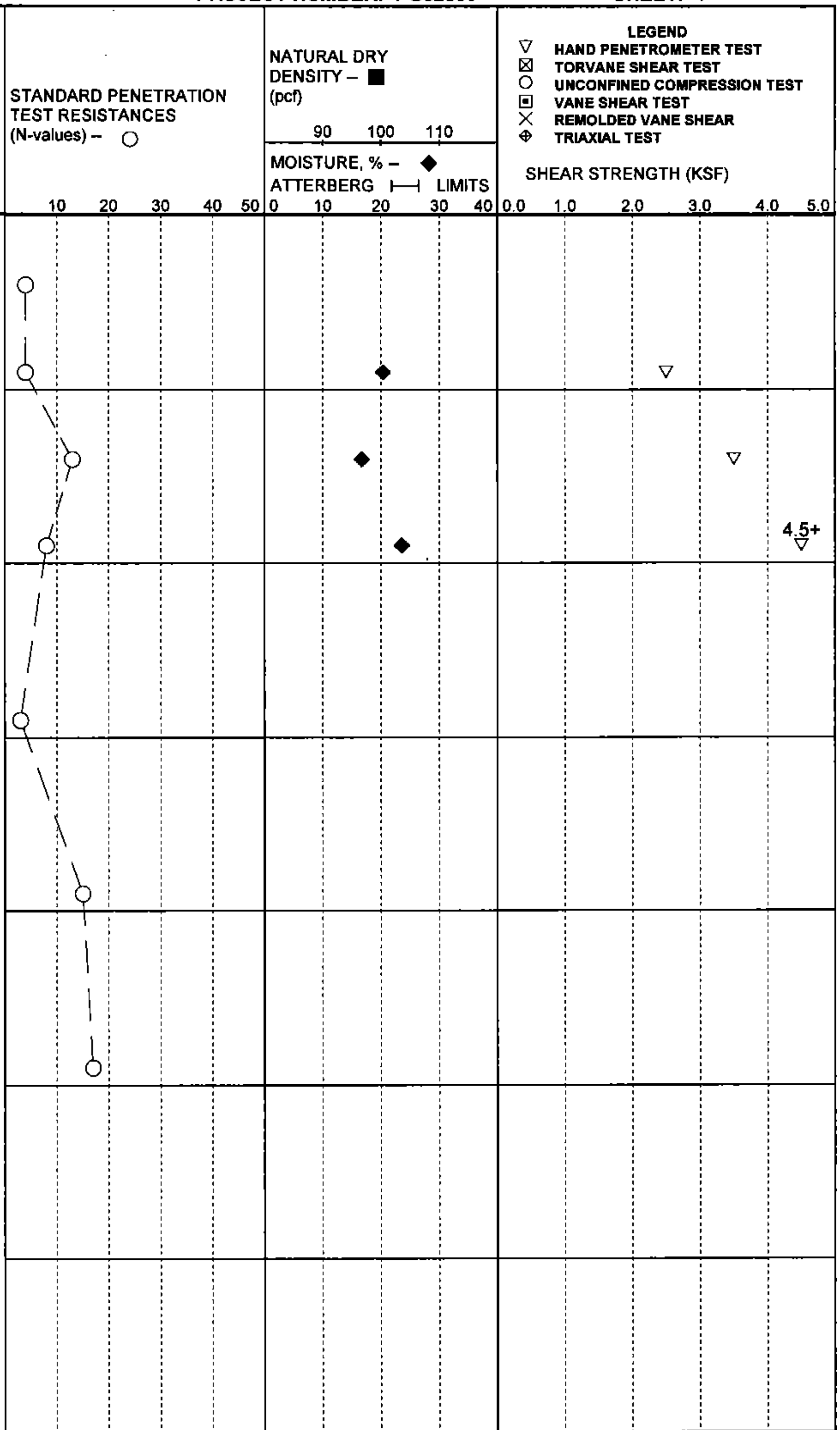
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 20 **CAVE OF BOREHOLE AT** 20 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/11/06 **BORING** B8
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 951.3

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 14 inches of Topsoil		
	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Very Loose (SP-SM)	SS1	2 2 2
5	Silty Clay- Trace to Some Sand- Trace Gravel- Occasional Sand Seams- Brown- Very Stiff (CL)	SS2	3 2 2
	Sandy Clay- Some Silt- Trace Gravel- Brown- Very Stiff (CL)	SS3	4 5 8
10	Silty Clay- Trace Sand & Gravel- Occasional Silt Partings- Brown- Hard (CL)	SS4	2 3 5
15	Fine to Coarse Sand- Some Silt- Trace Gravel- Brown- Wet- Very Loose (SM)	SS5	1 1 2
20	Fine to Coarse Sand- Trace Silt & Gravel- Brown- Wet- Medium Dense (SP)	SS6	3 5 10
		SS7	7 7 10
25	END OF BORING AT 25 FEET.		
30			
35			



WATER LEVEL OBSERVATIONS
- ▼ GROUNDWATER ENCOUNTERED DURING DRILLING
- ▽ GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

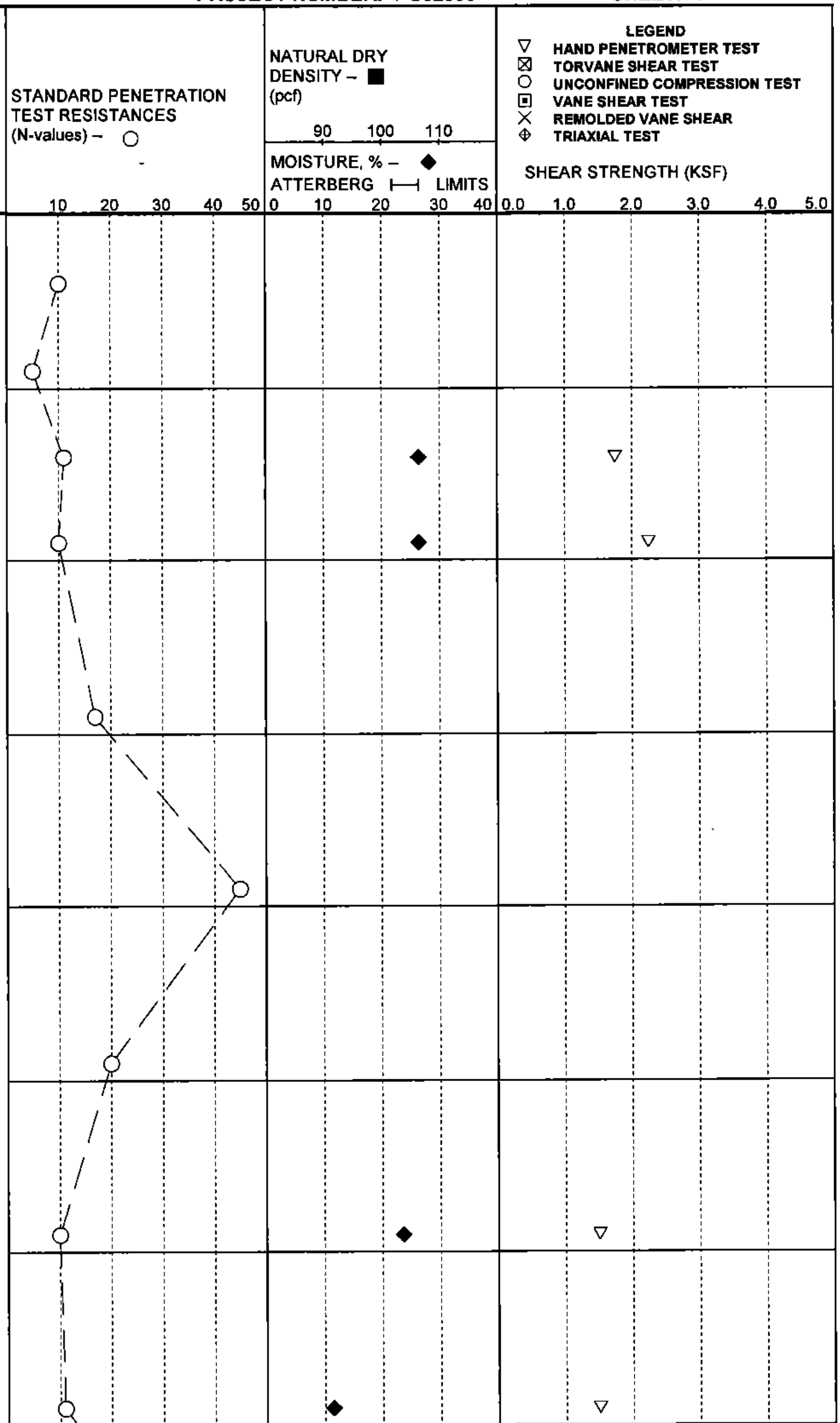
DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 13 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 14 **CAVE OF BOREHOLE AT** 15 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/11/06 **BORING** B9
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 950.0

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 16 inches of Topsoil		
	Fine to Coarse Sand- Some Silt- Trace Gravel- Brown- Moist to Wet- Medium Dense to Loose (SM)	SS1	4 6 4
5		SS2	4 2 3
	Sandy Silt- Trace Clay- Occasional Clay & Sand Seams- Brown- Wet- Medium Dense (ML)	SS3	3 4 7
		SS4	3 4 6
10	Silty Clay- Trace Sand & Gravel- Gray- Very Stiff (CL)		
15	Fine to Coarse Sand- Trace to Some Silt- Trace Gravel- Occasional Silt & Clay Seams- Brown- Wet- Medium Dense (SP-SM)	SS5	4 7 10
20	Fine to Coarse Sand- Some Gravel- Trace to Some Silt- Occasional Clay Seams- Brown- Wet- Dense to Medium Dense (SP-SM)	SS6	4 15 30
25		SS7	12 10 10
30	Silty Clay- Trace Sand & Gravel- Occasional Silt Partings- Gray- Stiff (CL)	SS8	6 4 6
35	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Layers- Gray- Stiff to Very Stiff (CL)	SS9	4 4 7



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. MOISTURE CONTENT & SHEAR STRENGTH FOR SAMPLE SS3 WERE PERFORMED ON A CLAY SEAM.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 2.5 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 3 **CAVE OF BOREHOLE AT** 6.5 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/11/06 **BORING** B9
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 2

LEGEND
- ▽ HAND PENETROMETER TEST
- ⊠ TORVANE SHEAR TEST
- ○ UNCONFINED COMPRESSION TEST
- ⊡ VANE SHEAR TEST
- × REMOLDED VANE SHEAR
- ⊕ TRIAXIAL TEST

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION EASTING: NORTHING: GROUND SURFACE ELEVATION= 950.0	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES	STANDARD PENETRATION TEST RESISTANCES (N-values) – ○ (10 20 30 40 50)	NATURAL DRY DENSITY – ■ (pcf) (90 100 110); MOISTURE, % – ◆; ATTERBERG ⊢⊣ LIMITS (0 10 20 30 40)	SHEAR STRENGTH (KSF) (0.0 1.0 2.0 3.0 4.0 5.0)
35–40		Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Layers- Gray- Stiff to Very Stiff (CL)	SS10	9 15 20	○	◆	▽
40		END OF BORING AT 40 FEET.					

Depth scale: 35, 40, 45, 50, 55, 60, 65, 70

WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. MOISTURE CONTENT & SHEAR STRENGTH FOR SAMPLE SS3 WERE PERFORMED ON A CLAY SEAM.

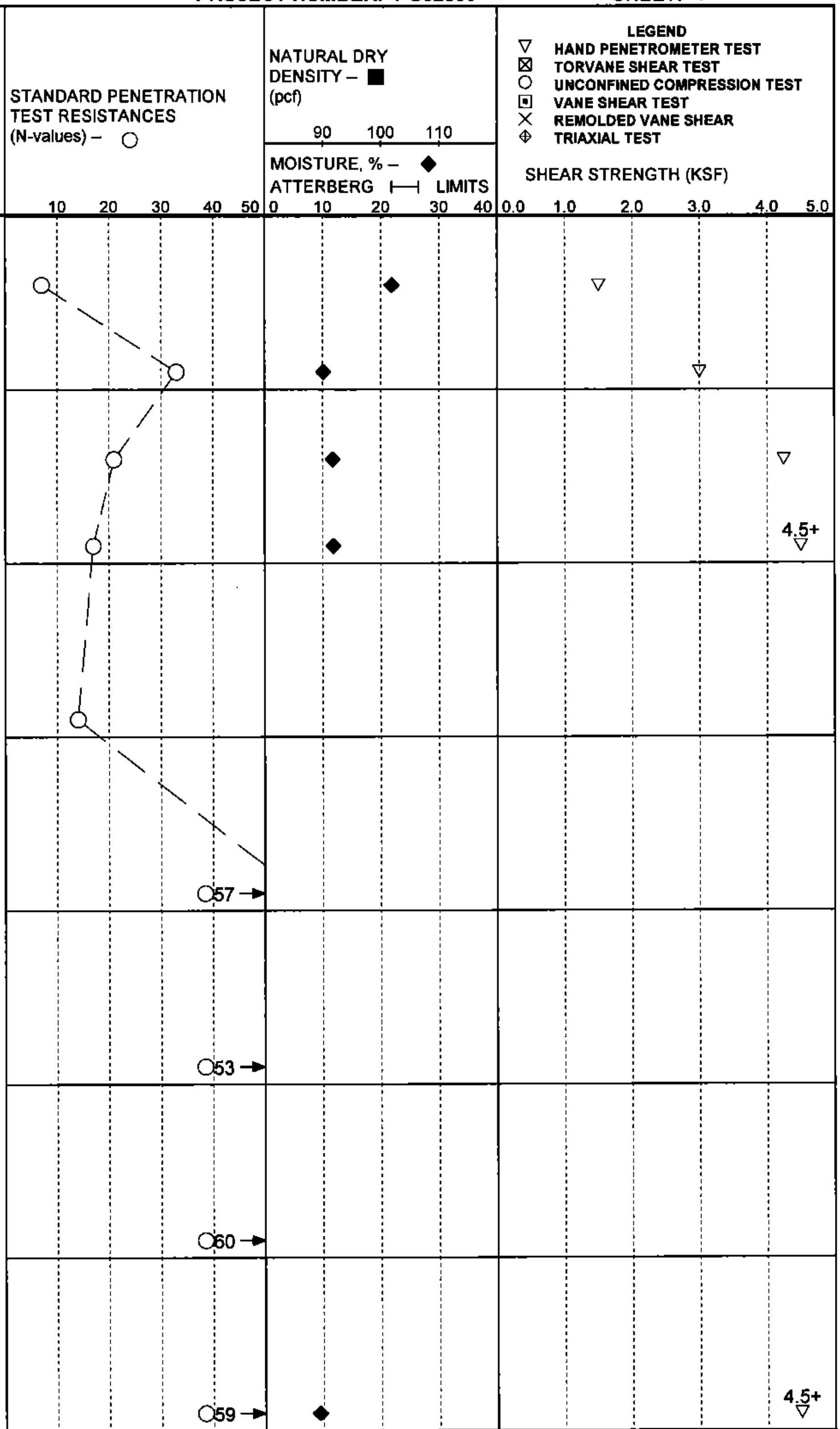
DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 2.5 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 3 **CAVE OF BOREHOLE AT** 6.5 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/14/06 **BORING** B10
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 950.0

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 6 inches of Topsoil		
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Stiff to Very Stiff (CL)	SS1	3 3 4
5		SS2	9 12 21
	Silty Clay- Some Sand- Trace Gravel- Brown- Hard (CL)	SS3	6 9 12
10	Sandy Clay- Some Silt- Trace Gravel- Gray- Hard (CL)	SS4	5 8 9
15	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Gray- Wet- Medium Dense (SP-SM)	SS5	4 7 7
20	Fine to Medium Sand- Trace to Some Silt & Gravel- Driller reported Frequent Rock Fragments- Brown- Wet- Very Dense (SP-SM)	SS6	15 28 29
25		SS7	21 25 28
30		SS8	30 30 30
35	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Gray- Hard (CL)	SS9	12 30 29



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. DRILLER REPORTED COBBLES FROM 21 TO 27 FEET.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 3.5 **WATER LEVEL** **HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 4 **CAVE OF BOREHOLE AT** 12 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/14/06 **BORING** B10
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 2

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION (EASTING: NORTHING: GROUND SURFACE ELEVATION= 950.0)	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES	STANDARD PENETRATION TEST RESISTANCES (N-values) – ○	NATURAL DRY DENSITY – ■ (pcf); MOISTURE, % – ◆ ATTERBERG ├─┤ LIMITS	SHEAR STRENGTH (KSF)
35–40		Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Gray- Hard (CL)	SS10	9 11 17			4.5+ ▽
40		END OF BORING AT 40 FEET.					

LEGEND
▽ HAND PENETROMETER TEST
⊠ TORVANE SHEAR TEST
○ UNCONFINED COMPRESSION TEST
⊡ VANE SHEAR TEST
X REMOLDED VANE SHEAR
⊕ TRIAXIAL TEST

Depth scale: 35, 40, 45, 50, 55, 60, 65, 70. SPT scale: 10, 20, 30, 40, 50. Density scale: 90, 100, 110. Moisture scale: 0, 10, 20, 30, 40. Shear strength scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0.

WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. DRILLER REPORTED COBBLES FROM 21 TO 27 FEET.

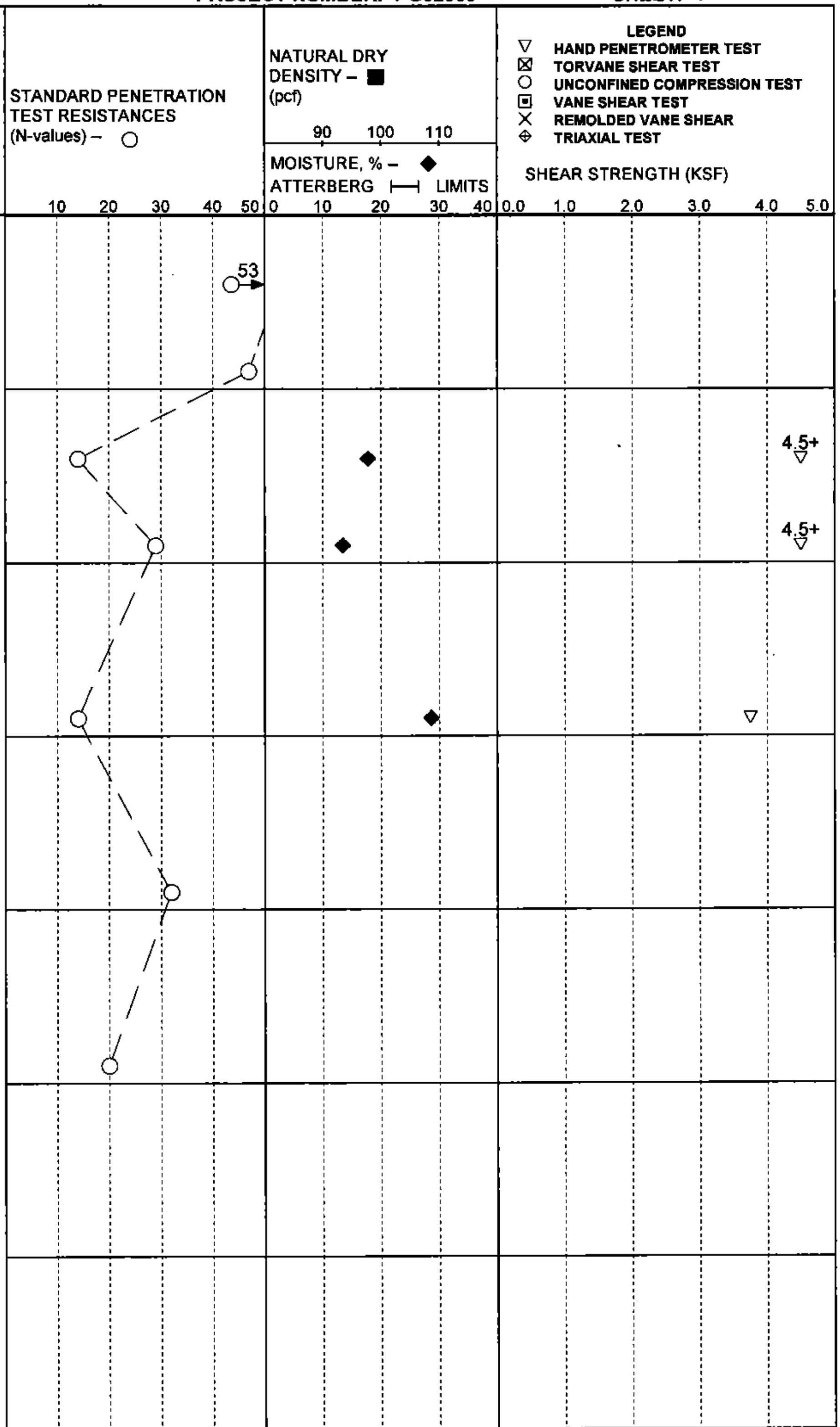
DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 3.5 **WATER LEVEL** **HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 4 **CAVE OF BOREHOLE AT** 12 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/10/06 **BORING B11**
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 955.1

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 8 inches of Topsoil		
	Fine to Medium Sand- Some Silt- Trace Clay & Gravel- Brown- Moist- Very Dense to Dense (SM)	SS1	12 26 27
		SS2	14 27 20
5			
	Sandy Clay- Some Silt- Trace Gravel- Brown- Hard (CL)	SS3	4 6 8
10		SS4	9 12 17
	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Wet (SP-SM)		
15	Silty Clay- Trace Sand & Gravel- Occasional Silt Partings- Brown- Very Stiff (CL)	SS5	3 6 8
20	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Brown- Wet- Dense to Medium Dense (SP)	SS6	7 13 19
25		SS7	13 10 10
	END OF BORING AT 25 FEET.		
30			
35			



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 6 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 19 **CAVE OF BOREHOLE AT** 19 ft

soil and materials engineers, inc.

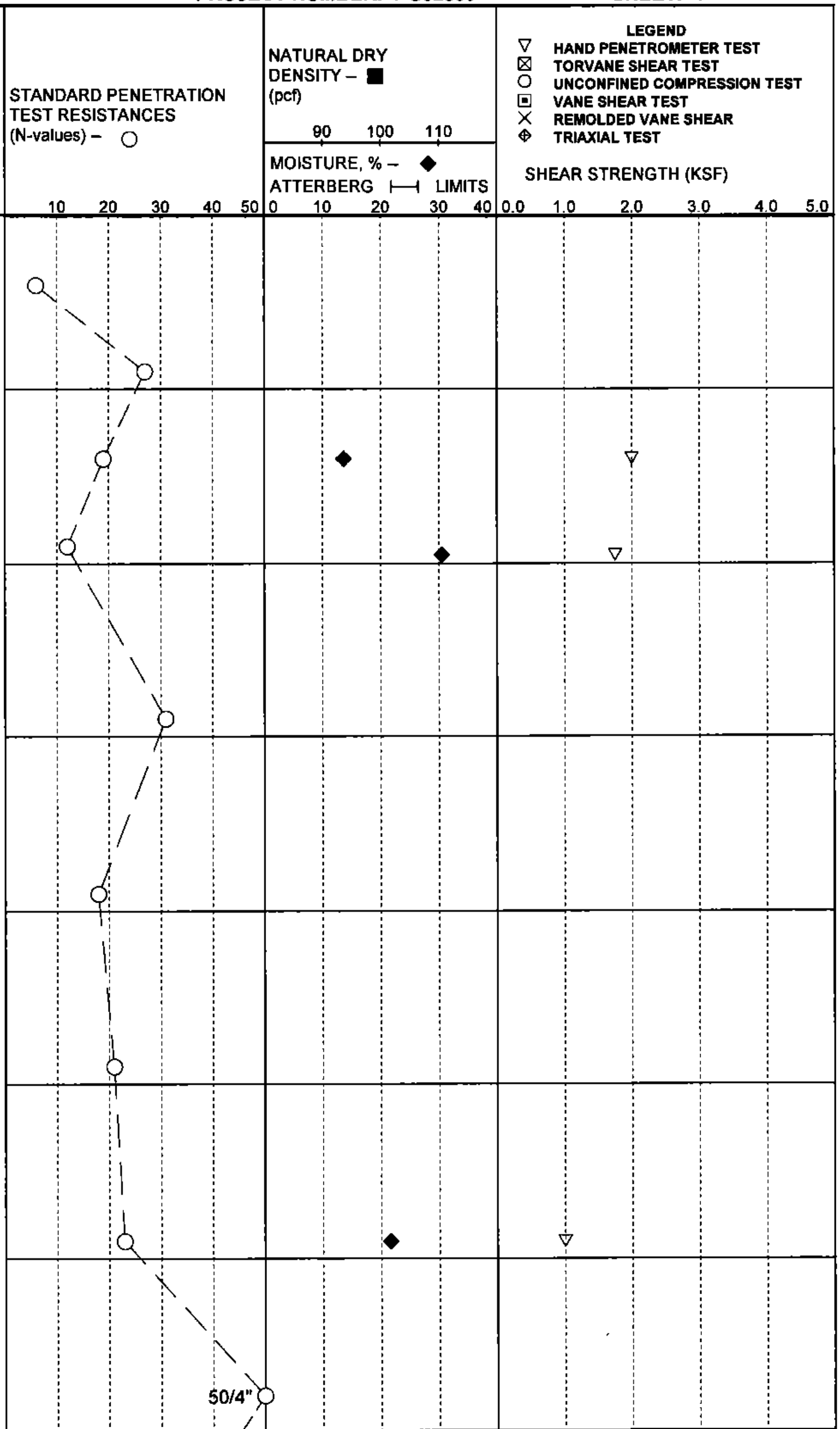
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/13/06 **BORING** B12

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 948.3

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 8 inches of Topsoil		
	Clayey Fine to Medium Sand- Some Silt- Trace Gravel & Wood Fragments- Brown- Moist- Loose (SC/Fill)	SS1	2 3 3
5	Fine to Coarse Sand- Trace to Some Silt- Trace Gravel- Brown- Wet- Medium Dense (SP-SM)	SS2	7 11 16
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Very Stiff (CL)	SS3	6 8 11
	Fine to Medium Sand- Trace Silt & Gravel- Brown- Wet- Medium Dense (SP)	SS4	4 6 6
10	Silty Clay- Trace Sand & Gravel- Brown- Stiff (CL)		
15	Fine to Coarse Sand- Trace to Some Silt & Gravel- Brown- Wet- Dense (SP-SM)	SS5	7 13 18
20	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Gray- Wet- Medium Dense (SP)	SS6	5 8 10
25		SS7	4 9 12
30	Silty Fine Sand- Trace Gravel- Frequent Clay Seams- Occasional Clay Layers- Gray- Wet- Medium Dense to Extremely Dense (SM)	SS8	21 13 10
35		SS9	40 50/4"



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. SHEAR STRENGTH & MOISTURE CONTENT PERFORMED ON SAMPLE SS8 WERE OBTAINED ON A CLAY LAYER.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 4 **WATER LEVEL HOURS AFTER COMPLETION:**

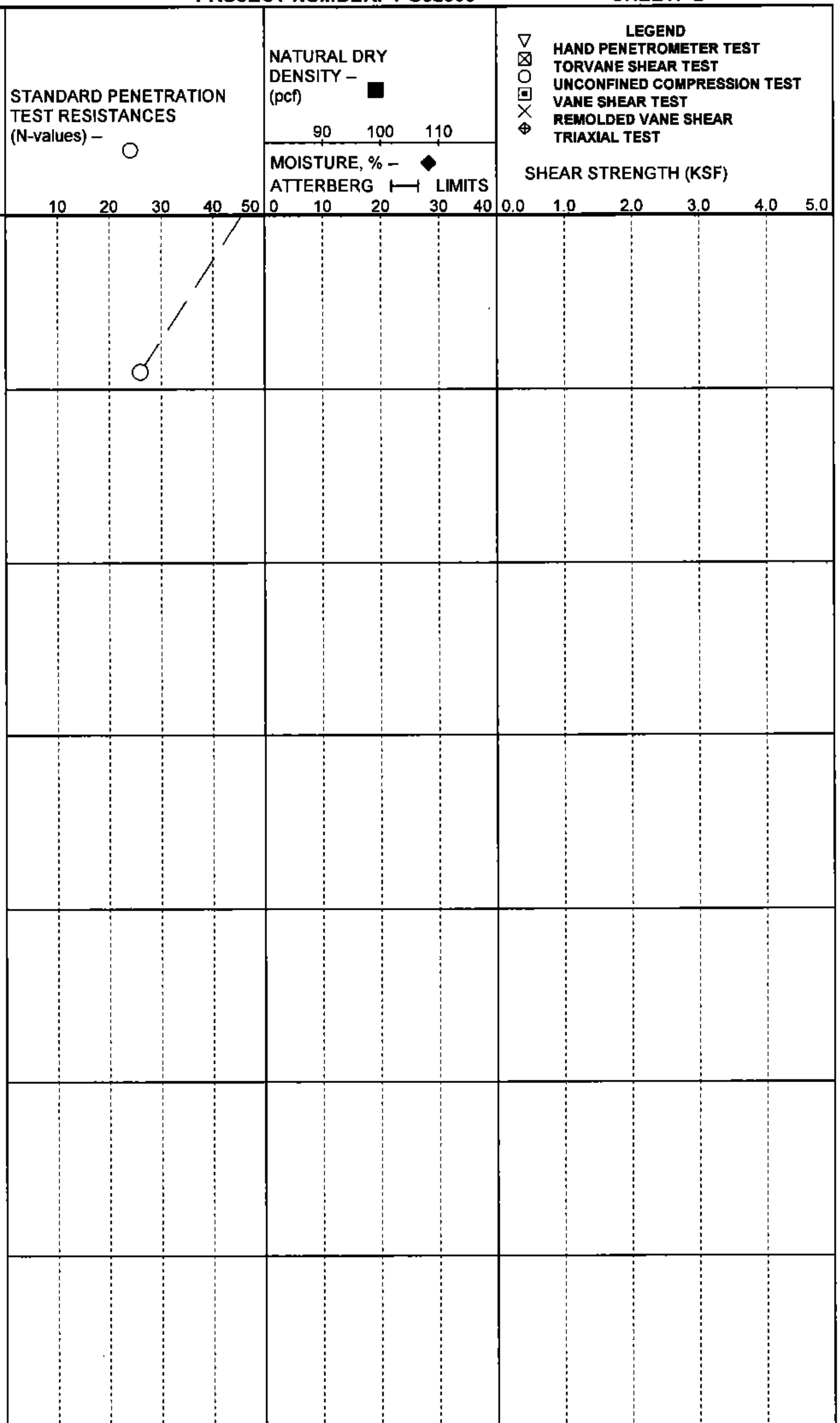
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 5 **CAVE OF BOREHOLE AT**

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/13/06 **BORING** B12
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 2

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 948.3

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
35–40	Silty Fine Sand- Trace Gravel- Frequent Clay Seams- Occasional Clay Layers- Gray- Wet- Medium Dense to Extremely Dense (SM)	SS10	6 13 13
40	END OF BORING AT 40 FEET.		



WATER LEVEL OBSERVATIONS
- ▼ GROUNDWATER ENCOUNTERED DURING DRILLING
- ▽ GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. SHEAR STRENGTH & MOISTURE CONTENT PERFORMED ON SAMPLE SS8 WERE OBTAINED ON A CLAY LAYER.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 4 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 5 **CAVE OF BOREHOLE AT**

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PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/13/06 **BORING** B13

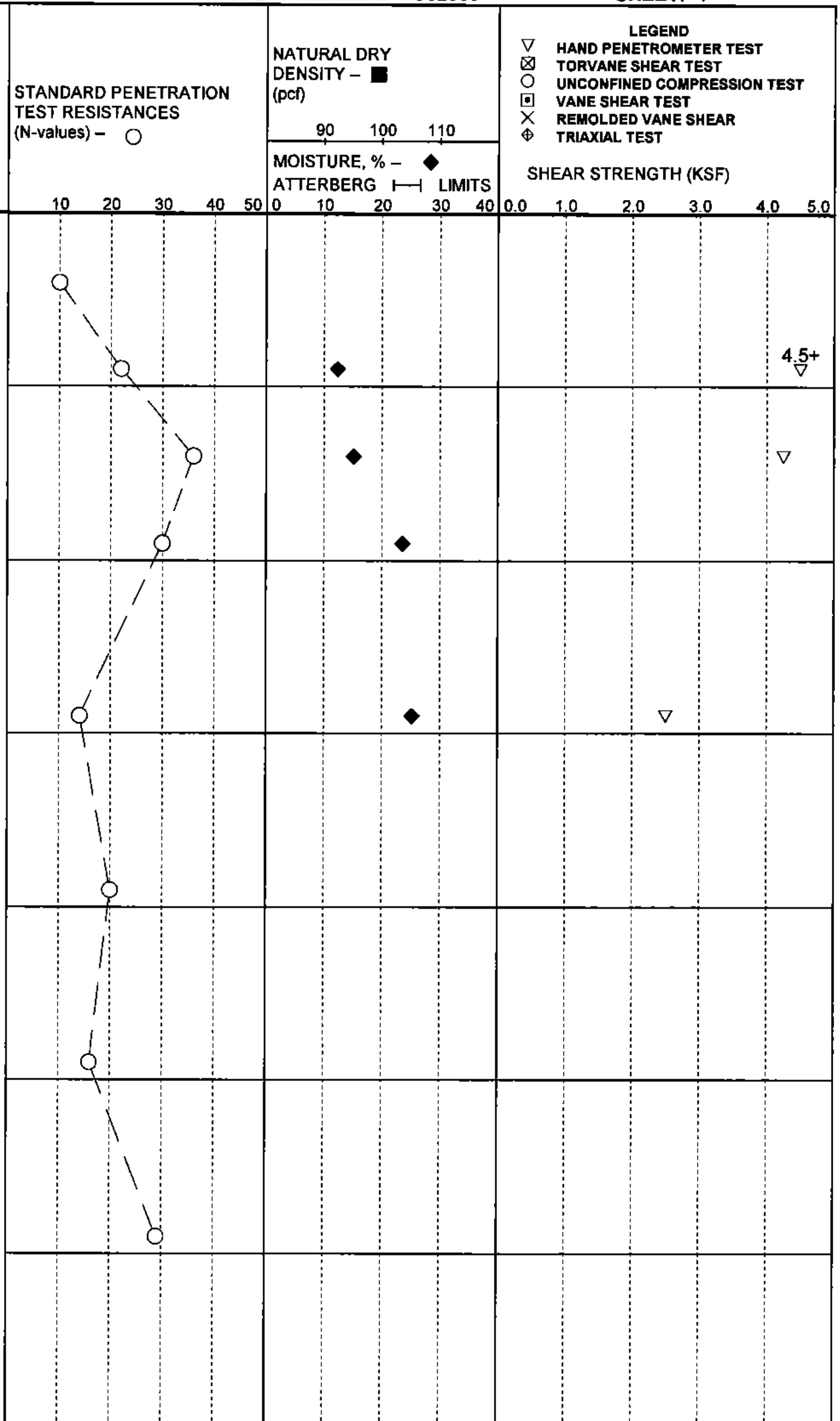
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

PROFILE DESCRIPTION

EASTING:
NORTHING:

GROUND SURFACE ELEVATION= 951.4

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 10 inches of Topsoil		
	Fine to Medium Sand- Some Silt- Trace Gravel & Root Fibers- Occasional Clay Seams- Brown- Moist- Medium Dense (SM)	SS1	4 5 5
5	Sandy Clay- Some Silt- Trace Gravel- Occasional Silt Seams- Brown- Hard (CL)	SS2	6 8 14
	Silty Clay- Trace to Some Sand- Trace Gravel- Occasional Silt Seams- Dark Brown- Hard (CL)	SS3	5 24 12
10	Sandy Silt- Trace Gravel- Frequent Sand & Clay Seams- Brown & Gray- Wet- Dense (ML)	SS4	7 11 19
15	Silty Clay- Trace Sand & Gravel- Occasional Silt Seams- Gray- Very Stiff (CL)	SS5	10 7 7
20	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Gray- Wet- Medium Dense (SP)	SS6	15 9 11
25		SS7	5 5 11
30		SS8	10 19 10
	END OF BORING AT 30 FEET.		
35			



WATER LEVEL OBSERVATIONS

- ▽ GROUNDWATER ENCOUNTERED DURING DRILLING
- ▽ GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 4 **WATER LEVEL HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 11 **CAVE OF BOREHOLE AT**

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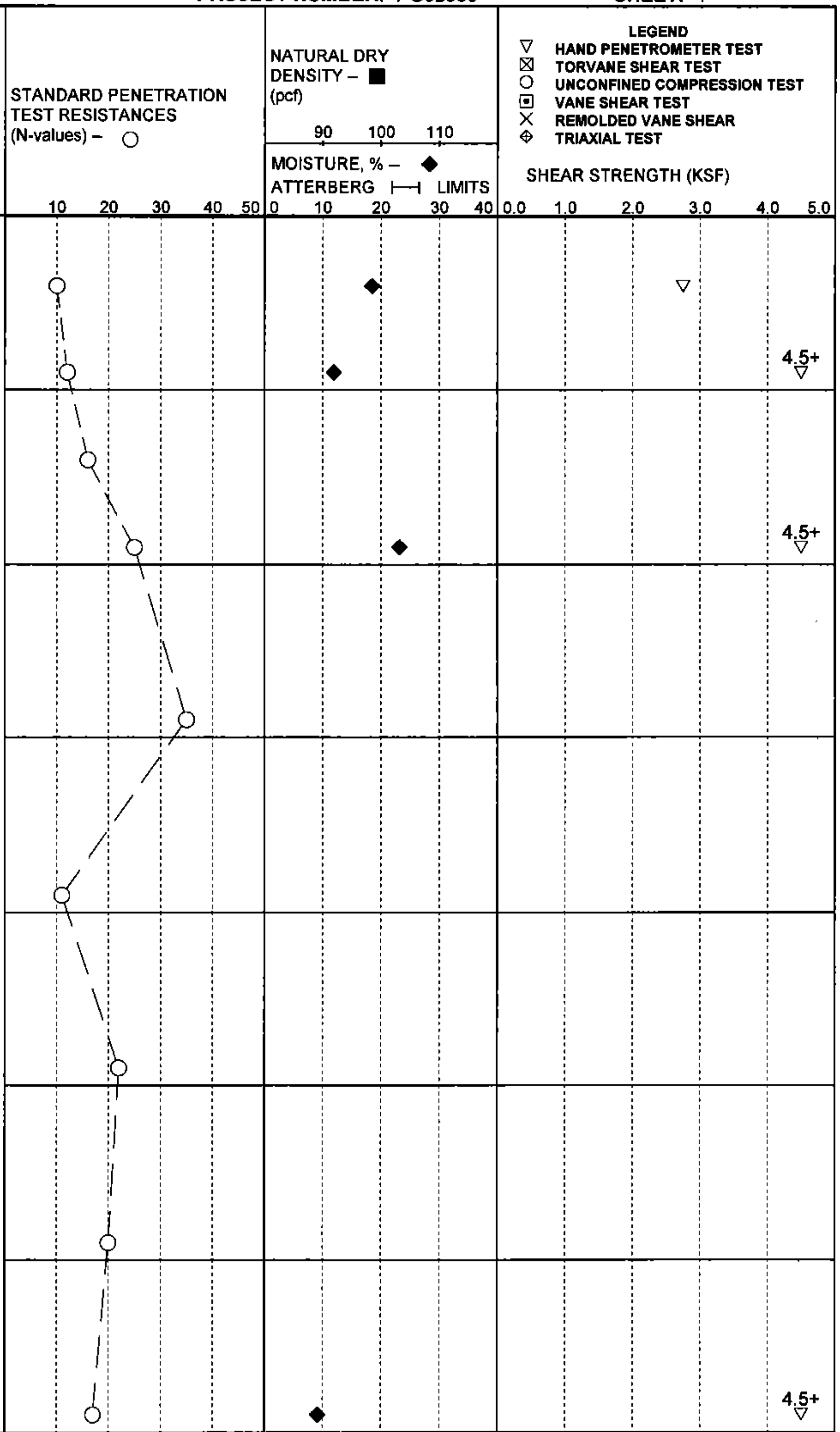
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/11/06 **BORING B14**
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 951.4

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 14 inches of Topsoil		
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Very Stiff to Hard (CL)	SS1	5 4 6
5		SS2	4 5 7
	Sandy Silt- Trace Clay & Gravel- Occasional Clay Seams- Brown- Wet- Medium Dense (ML)	SS3	4 9 7
10	Silty Clay- Trace Sand & Gravel- Occasional Silt Partings- Brown- Hard (CL)	SS4	7 10 15
15	Fine to Coarse Sand- Trace to Some Silt & Gravel- Brown- Moist- Dense (SP-SM)	SS5	12 17 18
20	Fine to Coarse Sand- Trace Silt & Gravel- Occasional Clay Seams- Brown- Wet- Medium Dense (SP)	SS6	6 5 6
25		SS7	40 10 12
30	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Occasional Clay Seams- Gray- Wet- Medium Dense (SP)	SS8	10 10 10
35	Sa Cl-So Si-Tr Grav-Gr-Hrd (CL)	SS9	9 7 10



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes:
1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. DRILLER REPORTED COBBLES AT 21 FEET.
3. END OF BORING AT 35 FEET.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 4 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 11 **CAVE OF BOREHOLE AT**

soil and materials engineers, inc.

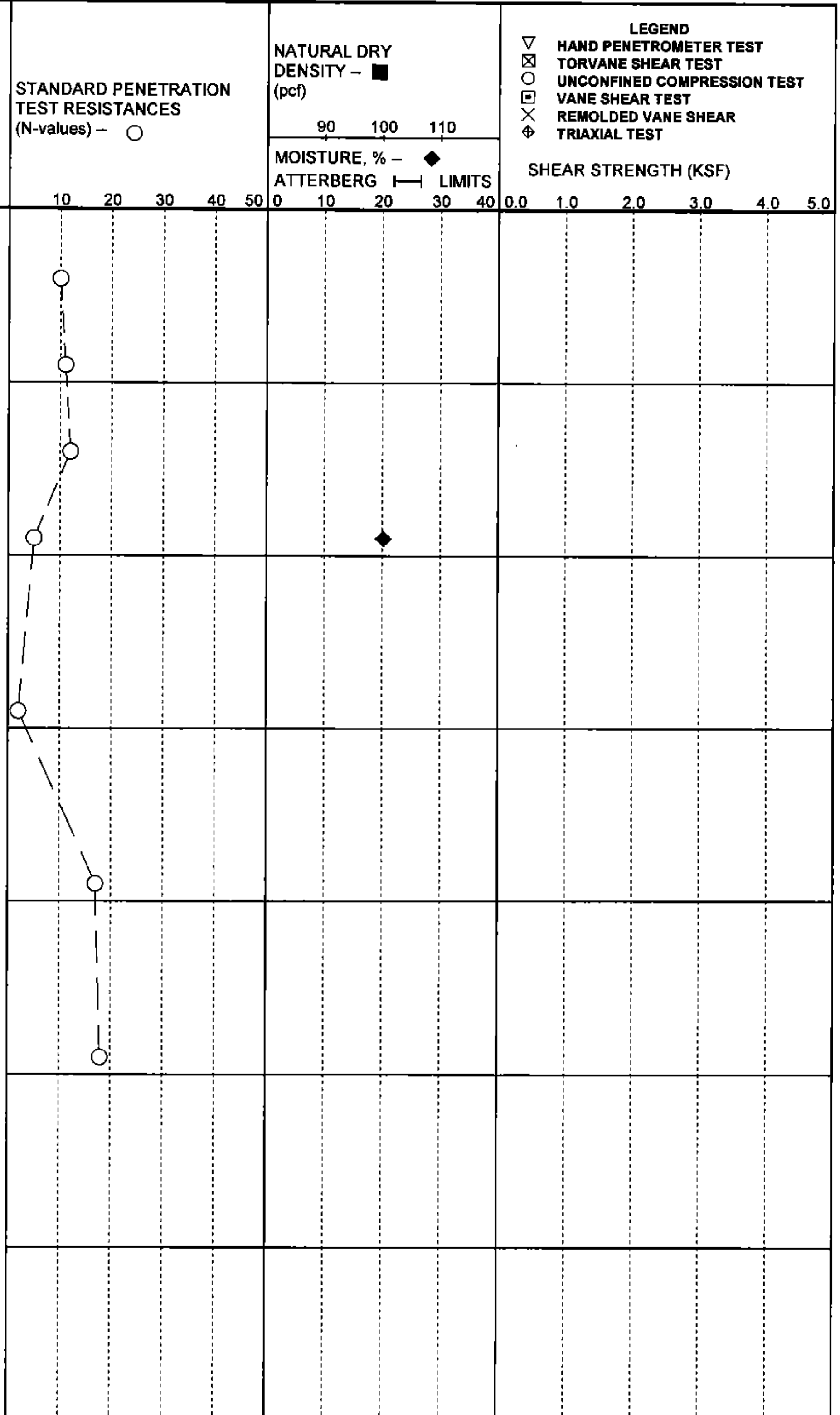
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/14/06 **BORING B15**

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 945

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 2 inches of Stone		
	Driller reported 1 inch of Topsoil		
0–5	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Dark Brown- Moist- Medium Dense (SP-SM)	SS1	4 5 5
		SS2	6 5 6
5–8	Fine Sand- Some Silt- Trace Gravel- Brown- Moist- Medium Dense (SM)	SS3	5 7 5
8–12	Clayey Sand- Some Silt- Occasional Clay Seams- Brown & Gray- Wet- Loose (SC)	SS4	3 2 3
12–17	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Wet- Very Loose (SP-SM)	SS5	2 1 1
17–22	Fine to Coarse Sand- Trace to Some Silt- Trace Gravel- Gray- Wet- Medium Dense (SP-SM)	SS6	4 9 8
22–25	Fine to Coarse Sand- Trace to Some Silt & Gravel- Gray- Wet- Medium Dense (SP-SM)	SS7	6 9 9
25	END OF BORING AT 25 FEET.		



WATER LEVEL OBSERVATIONS

- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 8 **WATER LEVEL HOURS AFTER COMPLETION:** 1

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 10 **CAVE OF BOREHOLE AT** 10 ft

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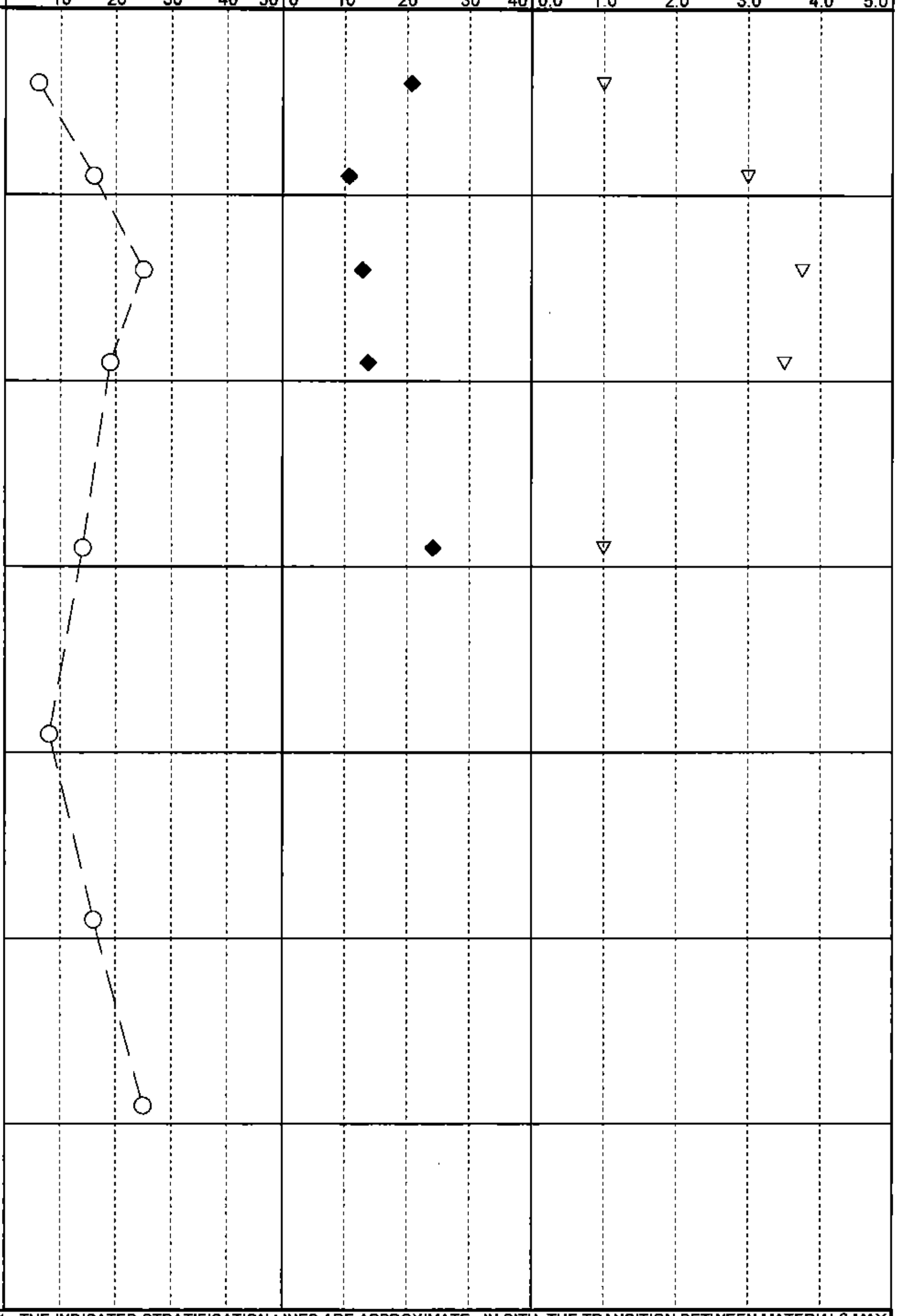
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/12/06 **BORING B16**
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 944.5

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0 – 1.5	Driller reported 18 inches of Topsoil		
1.5 – 9	Sandy Clay- Some Silt- Trace Gravel- Occasional Silt Seams- Brown- Stiff to Very Stiff (CL)	SS1	3, 2, 4
		SS2	4, 8, 8
		SS3	8, 11, 14
		SS4	5, 8, 11
9 – 13.5	Silty Clay- Some Sand- Trace Gravel- Occasional Silt Seams- Gray- Very Stiff (CL)		
13.5 – 17	Silty Clay- Trace Sand & Gravel- Occasional Sand Layers- Brown- Stiff (CL)	SS5	5, 8, 6
17 – 30	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Gray- Wet- Loose to Medium Dense (SP)	SS6	3, 3, 5
		SS7	5, 7, 9
		SS8	9, 13, 12
30	END OF BORING AT 30 FEET.		



WATER LEVEL OBSERVATIONS
- ▼ GROUNDWATER ENCOUNTERED DURING DRILLING
- ▽ GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 12 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 4 **CAVE OF BOREHOLE AT** 12 ft

soil and materials engineers, inc.

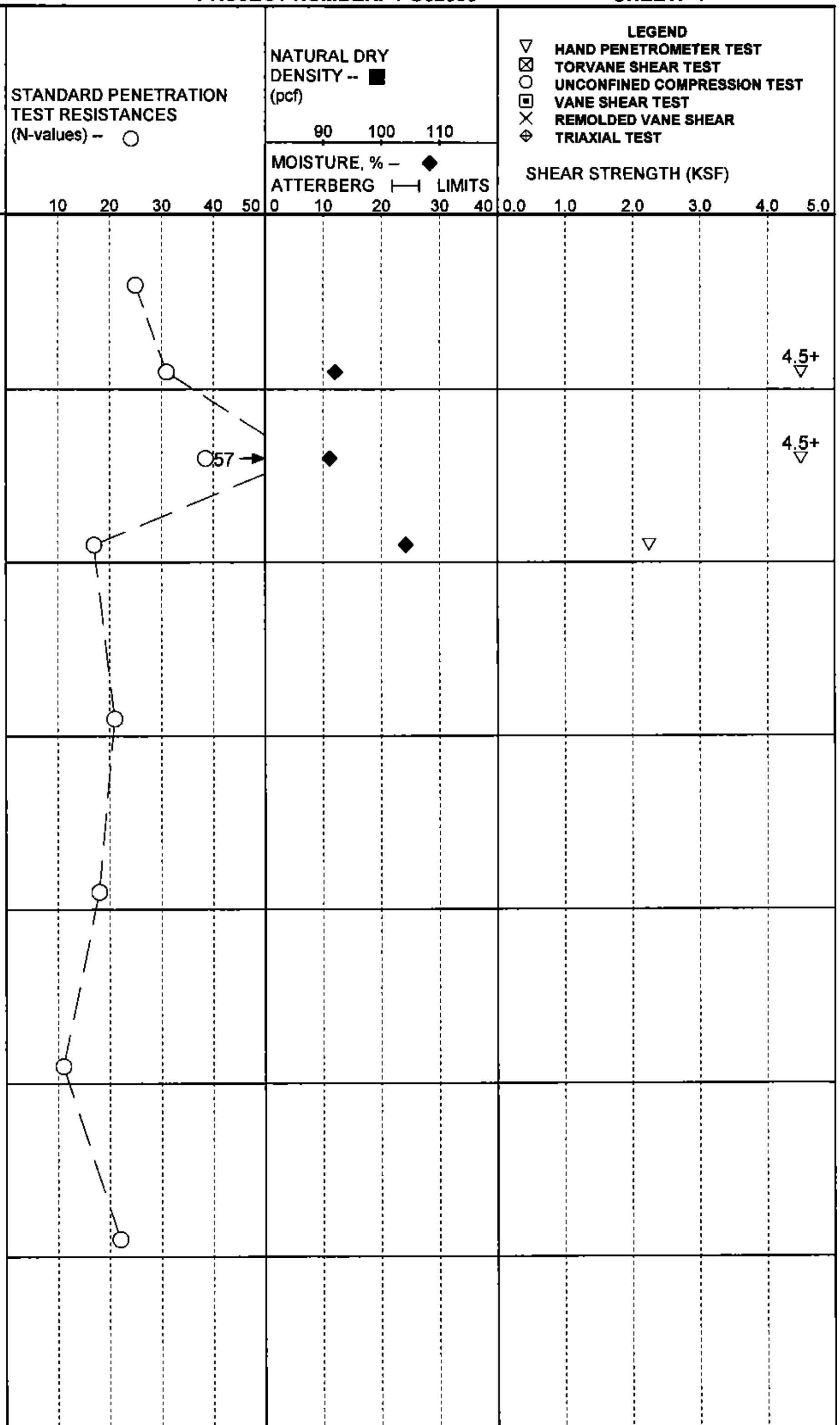
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/13/06 **BORING B17**

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 942

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 6 inches of Topsoil		
	Fine to Coarse Sand- Some Silt- Trace to Some Gravel- Brown- Moist- Medium Dense (SM)	SS1	4 9 16
	Silty Clay- Trace Sand & Gravel- Occasional Sand Layers- Brown- Hard (CL)	SS2	8 12 19
5		SS3	11 27 30
	Silty Clay- Trace Sand & Gravel- Occasional Silt Layers- Gray- Very Stiff (CL)	SS4	4 6 11
10			
15	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Gray- Wet- Medium Dense (SP)	SS5	3 8 13
20		SS6	4 7 11
25		SS7	6 4 7
	Sandy Silt- Trace Gravel- Occasional Clay Seams & Layers- Gray- Wet- Medium Dense (ML)	SS8	7 9 13
30	END OF BORING AT 30 FEET.		
35			



WATER LEVEL OBSERVATIONS

- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes:
1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. DRILLER REPORTED COBBLES FROM 4 TO 7 FEET.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 6 **WATER LEVEL HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 3 **CAVE OF BOREHOLE AT**

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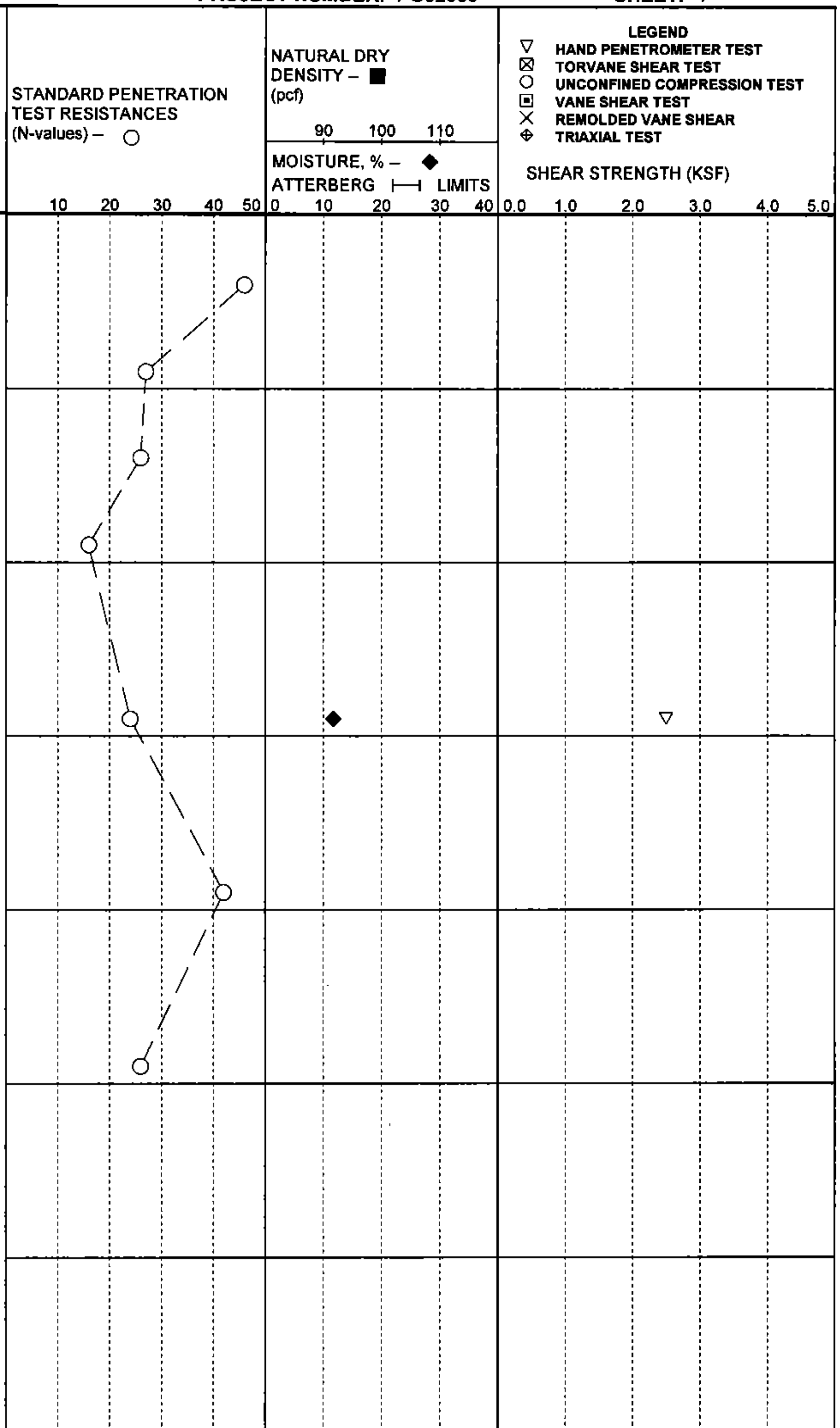
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/10/06 **BORING** B18
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 950.4

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER	BLOWS PER SIX INCHES
0	Driller reported 8 inches of Topsoil- Brown		
	Fine to Coarse Sand- Trace to Some Silt & Gravel- Brown- Moist- Dense to Medium Dense (SP-SM)	SS1	6, 23, 23
5		SS2	12, 12, 15
	Fine to Medium Sand- Some Silt- Trace Gravel- Occasional Clay Seams- Brown- Wet- Medium Dense (SM)	SS3	9, 13, 13
10		SS4	8, 8, 8
	Silty Clay- Some Sand- Trace Gravel- Gray- Very Stiff (CL)	SS5	7, 12, 12
15			
20	Silty Fine Sand- Trace Clay & Gravel- Occasional Clay Seams- Brown- Wet- Dense (SM)	SS6	10, 12, 30
	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Brown- Wet- Medium Dense (SP)	SS7	5, 10, 16
25	END OF BORING AT 25 FEET.		
30			
35			



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes:
1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. DRILLER REPORTED COBBLES AT ABOUT 3 FEET.

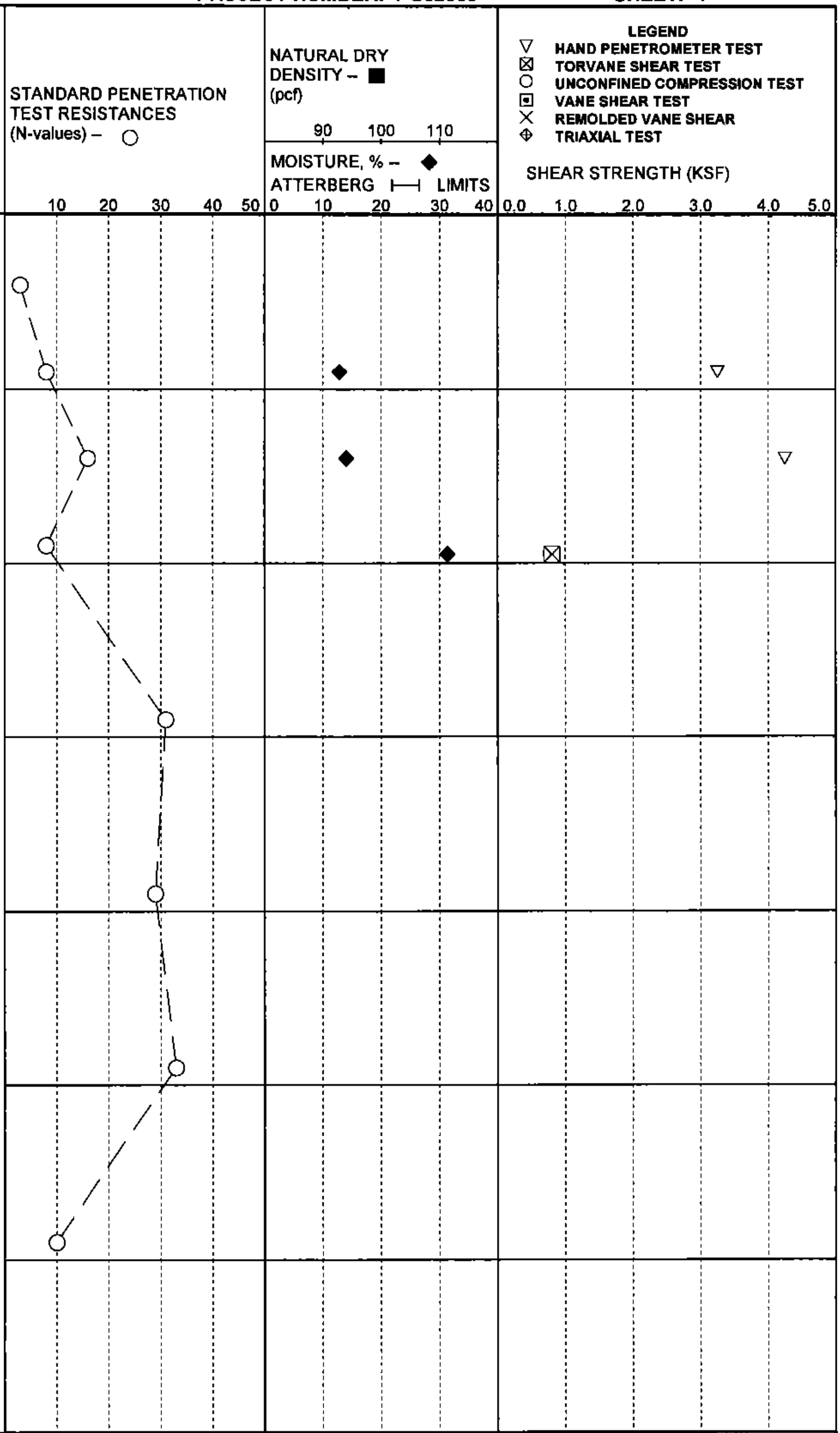
DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 6 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 5 **CAVE OF BOREHOLE AT** 9 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/13/06 **BORING** B19
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 947.7

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER	BLOWS PER SIX INCHES
0	Driller reported 14 inches of Topsoil		
	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Very Loose (SP-SM)	SS1	2 1 2
5	Sandy Clay- Some Silt- Trace Gravel- Brown- Very Stiff to Hard (CL)	SS2	3 3 5
		SS3	3 5 11
10	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Wet- Loose (SP-SM)	SS4	4 4 4
	Silty Clay- Trace Sand & Gravel- Occasional Silt Seams- Brown- Medium (CL)		
15	Fine to Coarse Sand- Trace to Some Silt & Gravel- Brown- Wet- Medium Dense to Dense (SP-SM)	SS5	7 14 17
20		SS6	9 14 15
25		NR7	10 16 17
30	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Gray- Wet- Medium Dense (SP-SM)	SS8	3 5 5
	END OF BORING AT 30 FEET.		
35			



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes:
1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. NO RECOVERY WAS OBTAINED FROM 23.5 TO 25 FEET.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 8.5 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 10 **CAVE OF BOREHOLE AT**

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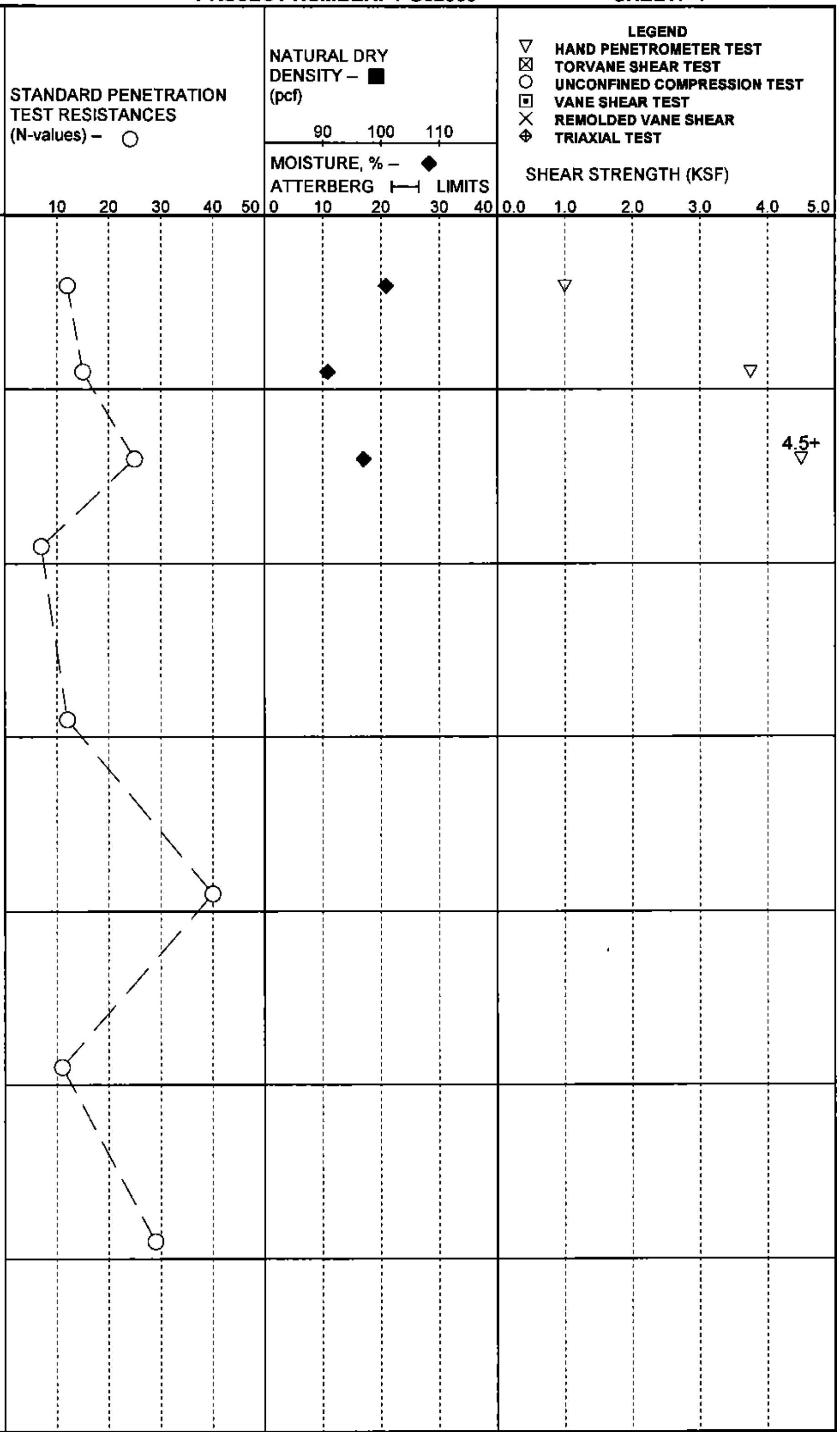
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/12/06 **BORING** B20

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

DEPTH (FEET)	PROFILE DESCRIPTION EASTING: NORTHING: GROUND SURFACE ELEVATION= 943.4	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 12 inches of Topsoil		
	Sandy Clay- Some Silt- Trace Gravel- Occasional Sand Seams- Brown- Stiff to Very Stiff (CL)	SS1	3 4 8
5		SS2	4 7 8
	Silty Clay- Trace to Some Sand- Trace Gravel- Brown- Hard (CL)	SS3	6 10 15
10	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Occasional Silt Layers- Brown- Wet- Loose to Medium Dense (SP-SM)	SS4	2 2 5
15	Fine to Coarse Sand- Trace to Some Silt & Gravel- Gray- Wet- Medium Dense to Dense (SP-SM)	SS5	5 6 6
20		SS6	12 19 21
25		SS7	7 4 7
30	Fine to Coarse Sand- Trace Silt & Gravel- Gray- Wet- Medium Dense (SP)	SS8	10 12 17
	END OF BORING AT 30 FEET.		
35			



WATER LEVEL OBSERVATIONS

- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes:
1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. DRILLER REPORTED COBBLES FROM 21 TO 30 FEET.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 8 **WATER LEVEL HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 4 **CAVE OF BOREHOLE AT** 11 ft

soil and materials engineers, inc.

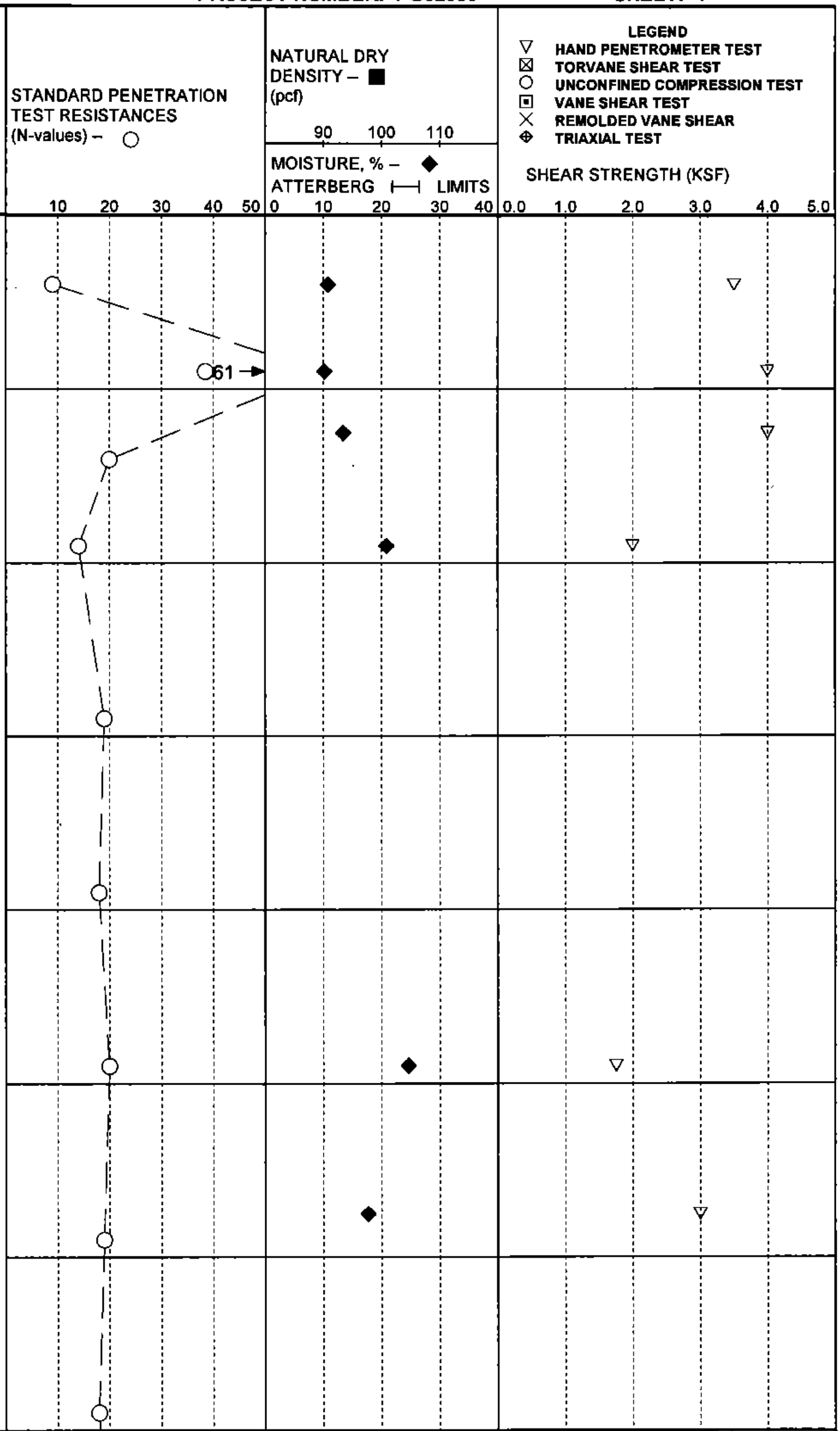
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/13/06 **BORING** B21

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 944.1

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 14 inches of Topsoil		
	Sandy Clay- Some Silt- Trace Gravel- Brown- Very Stiff to Hard (CL)	SS1	2 3 6
5		SS2	7 27 34
	Silty Clay- Trace to Some Sand- Trace Gravel- Gray- Hard (CL)		
	Sandy Silt- Trace Gravel- Occasional Sand Seams- Gray & Brown- Wet- Medium Dense (ML)	SS3	4 7 13
10	Silty Clay- Trace Sand & Gravel- Occasional Sand & Silt Seams- Gray- Very Stiff (CL)	SS4	4 7 7
15		SS5	4 7 12
	Fine to Coarse Sand- Trace to Some Silt- Trace Gravel- Brown- Wet- Medium Dense (SP-SM)	SS6	8 8 10
20	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Gray- Wet- Medium Dense (SP)		
25	Silty Clay- Trace Sand & Gravel- Occasional Silt Layers & Partings- Gray- Stiff to Very Stiff (CL)	SS7	11 9 11
30		SS8	6 11 8
35	Fine Sand- Trace to Some Silt- Trace Gravel- Gray- Wet- Medium Dense (SP-SM)	SS9	4 7 11



WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 6.5 **WATER LEVEL HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 5 **CAVE OF BOREHOLE AT** 14 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/13/06 **BORING** B21
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 2

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 944.1

LEGEND: ▽ HAND PENETROMETER TEST; ⊠ TORVANE SHEAR TEST; ○ UNCONFINED COMPRESSION TEST; ▣ VANE SHEAR TEST; X REMOLDED VANE SHEAR; ⊕ TRIAXIAL TEST

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES	STANDARD PENETRATION TEST RESISTANCES (N-values) – ○ (10 20 30 40 50)	NATURAL DRY DENSITY – ■ (pcf) (90 100 110); MOISTURE, % – ◆; ATTERBERG ⊢⊣ LIMITS (0 10 20 30 40)	SHEAR STRENGTH (KSF) (0.0 1.0 2.0 3.0 4.0 5.0)
35		Fine Sand- Trace to Some Silt- Trace Gravel- Gray- Wet- Medium Dense (SP-SM)					
		Silty Clay- Trace Sand & Gravel- Occasional Silt & Sand Seams- Gray- Very Stiff (CL)	SS10	8 10 10	○	◆	▽
40		END OF BORING AT 40 FEET.					
45							
50							
55							
60							
65							
70							

WATER LEVEL OBSERVATIONS
- ▼ GROUNDWATER ENCOUNTERED DURING DRILLING
- ▽ GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

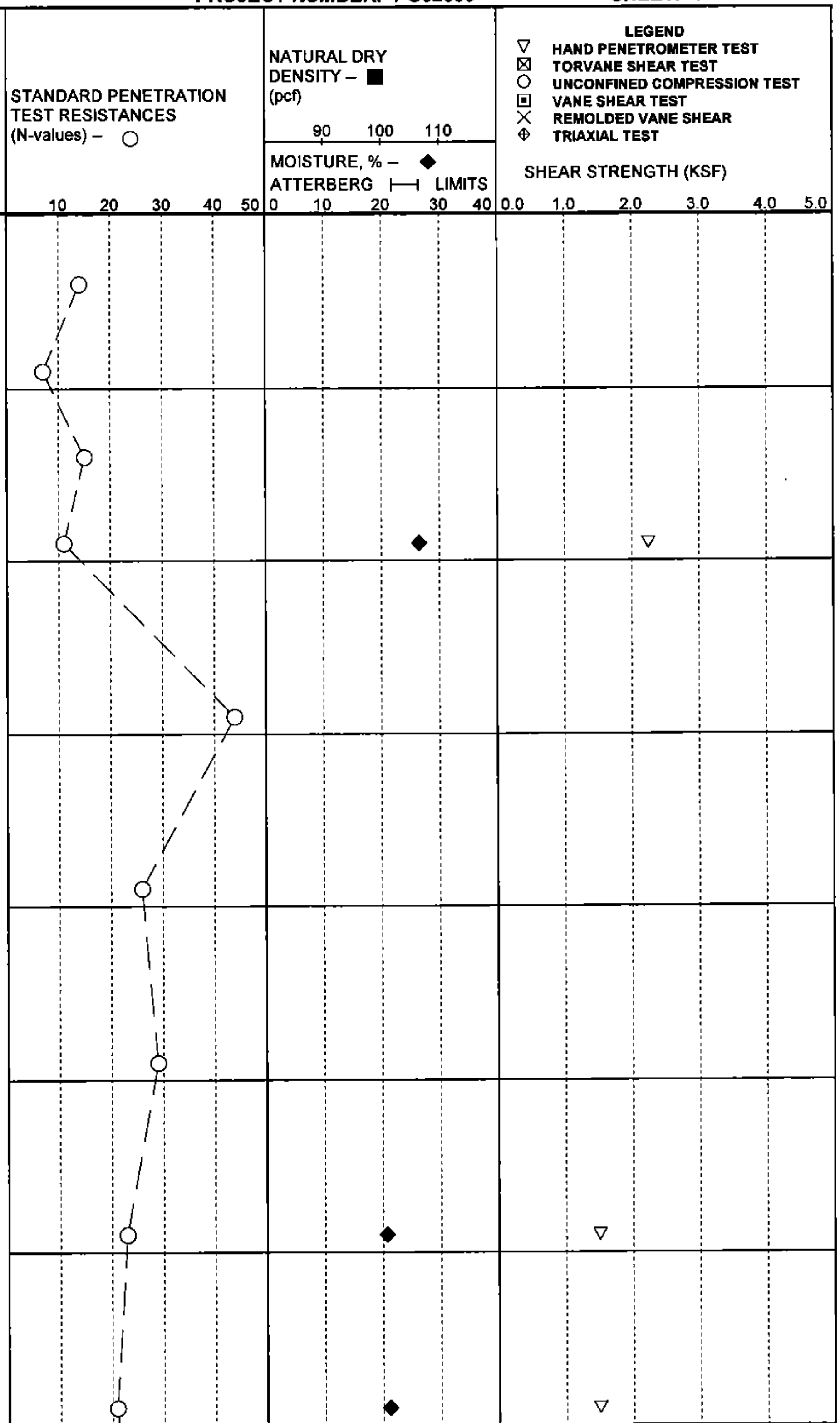
DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 6.5 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 5 **CAVE OF BOREHOLE AT** 14 ft

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/10/06 **BORING** B22
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

PROFILE DESCRIPTION
EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 945

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Driller reported 10 inches of Topsoil		
	Fine to Coarse Sand- Trace to Some Silt- Trace Gravel- Dark Brown- Moist- Medium Dense (SP-SM)	SS1	6, 7, 7
		SS2	2, 3, 4
5	Silty Sand- Trace Clay & Gravel- Occasional Silt Layers- Brown- Wet- Loose (SM)		
	Fine to Medium Sand- Some Silt- Trace Clay & Gravel- Brown- Wet- Medium Dense (SM)	SS3	4, 7, 8
	Fine to Medium Sand- Trace Silt & Gravel- Occasional Clay Layers- Brown- Wet- Medium Dense (SP)	SS4	5, 6, 5
10			
15	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Brown- Wet- Dense to Medium Dense (SP)	SS5	12, 19, 25
20		SS6	7, 11, 15
25		SS7	10, 13, 16
30	Fine to Medium Sand- Trace Silt & Gravel- Occasional Clay Layers- Gray- Wet- Medium Dense (SP)	SS8	8, 11, 12
35	See next page	SS9	6, 8, 13



WATER LEVEL OBSERVATIONS
- ▼ GROUNDWATER ENCOUNTERED DURING DRILLING
- ▽ GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. SHEAR STRENGTH & MOISTURE CONTENT TEST RESULTS OBTAINED ON SAMPLES SS4 & SS8 WERE PERFORMED ON CLAY LAYERS.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 4.5 **WATER LEVEL HOURS AFTER COMPLETION:**
RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 3 **CAVE OF BOREHOLE AT**

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PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/10/06 **BORING** B22

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 2

PROFILE DESCRIPTION — EASTING: NORTHING: GROUND SURFACE ELEVATION= 945

STANDARD PENETRATION TEST RESISTANCES (N-values) – ○ (10, 20, 30, 40, 50)

NATURAL DRY DENSITY – (pcf) ■ (90, 100, 110)

MOISTURE, % – ◆ ATTERBERG ├─┤ LIMITS (0, 10, 20, 30, 40)

LEGEND: ▽ HAND PENETROMETER TEST; ⊠ TORVANE SHEAR TEST; ○ UNCONFINED COMPRESSION TEST; ▣ VANE SHEAR TEST; X REMOLDED VANE SHEAR; ⊕ TRIAXIAL TEST

SHEAR STRENGTH (KSF) (0.0, 1.0, 2.0, 3.0, 4.0, 5.0)

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
35–40	Silty Clay- Trace Sand & Gravel- Occasional Silt Layers & Silt & Sand Seams- Gray- Stiff (CL)	SS10	9 10 14
40	END OF BORING AT 40 FEET.		

Depth scale: 35, 40, 45, 50, 55, 60, 65, 70

WATER LEVEL OBSERVATIONS
- ▼ GROUNDWATER ENCOUNTERED DURING DRILLING
- ▽ GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. SHEAR STRENGTH & MOISTURE CONTENT TEST RESULTS OBTAINED ON SAMPLES SS4 & SS8 WERE PERFORMED ON CLAY LAYERS.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 4.5 **WATER LEVEL HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 3 **CAVE OF BOREHOLE AT**

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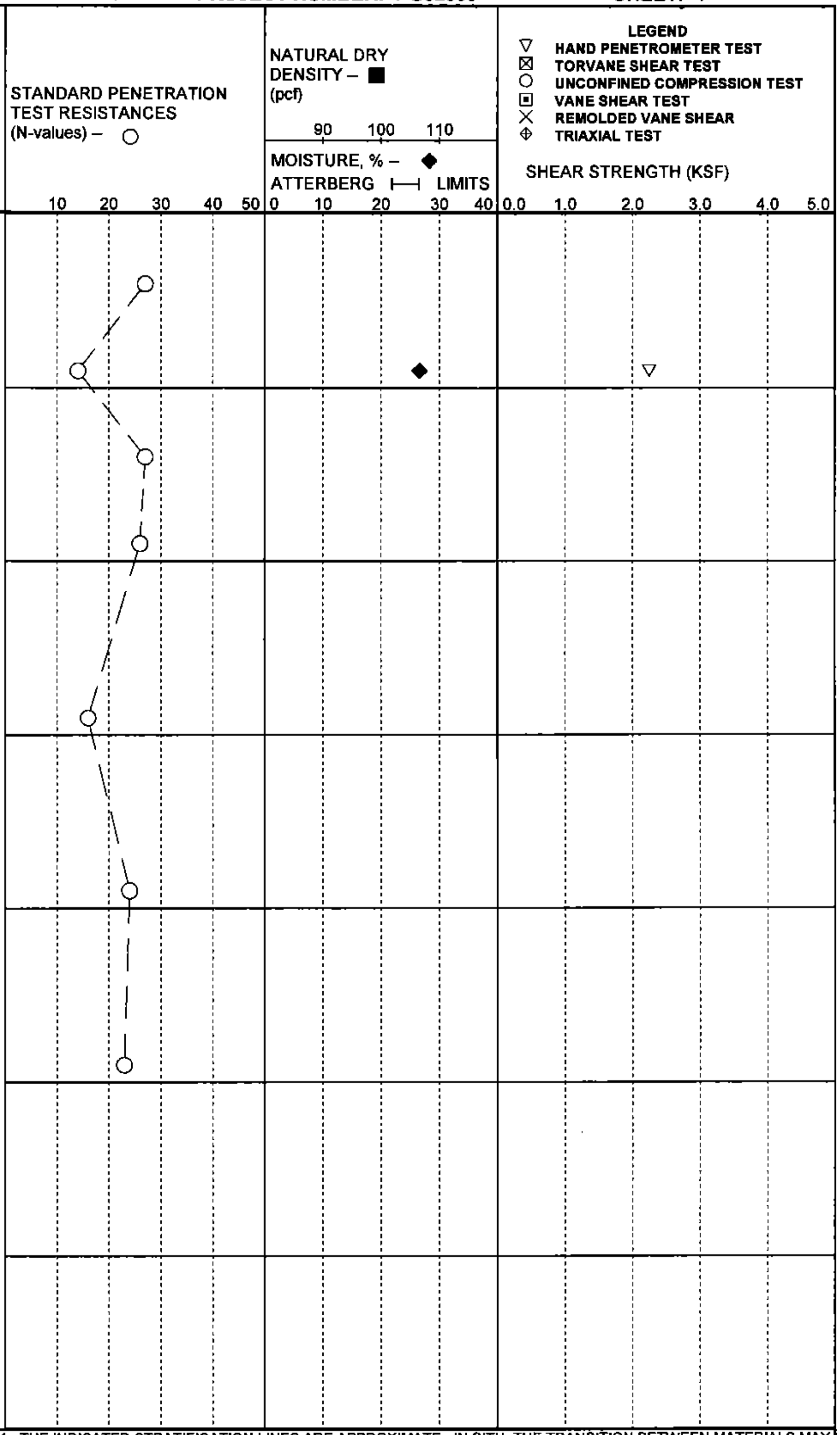
PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS

PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** SB/MSM **DATE:** 4/10/06 **BORING** B23

CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

EASTING:
NORTHING:
GROUND SURFACE ELEVATION= 947.8

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES
0	Fine to Coarse Sand- Trace Silt & Gravel- Brown- Moist- Medium Dense (SP)	SS1	7, 10, 17
	Silty Clay- Trace Sand & Gravel- Frequent Silt Partings- Brown- Very Stiff (CL)	SS2	3, 5, 9
5	Fine to Coarse Sand- Trace Silt & Gravel- Dark Brown- Moist- Medium Dense (SP)	SS3	7, 11, 16
		SS4	6, 10, 16
10			
15	Fine to Medium Sand- Trace Silt & Gravel- Brown- Wet- Medium Dense (SP)	SS5	6, 7, 9
20		SS6	9, 11, 13
		SS7	7, 10, 13
25	END OF BORING AT 25 FEET.		
30			
35			



WATER LEVEL OBSERVATIONS

- GROUNDWATER ENCOUNTERED DURING DRILLING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF DRILLING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.

DRILLER: D&T **DRILL METHOD:** Solid-stem Augers **WATER LEVEL DURING DRILLING:** 13 **WATER LEVEL** **HOURS AFTER COMPLETION:**

RIG NO.: ATV **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** 12 **CAVE OF BOREHOLE AT** 12 ft

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PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** MSM **DATE:** 5/9/06 **BORING** HA1
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION GROUND SURFACE ELEVATION= 941	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (BLOWS/6") – ○ 10 20 30 40 50	NATURAL DRY DENSITY – ■ (pcf) 90 100 110 MOISTURE, % – ◆ ATTERBERG ├─┤ LIMITS 0 10 20 30 40	SHEAR STRENGTH (KSF) 0.0 1.0 2.0 3.0 4.0 5.0
0		Fine to Medium Sand- Some Silt- Trace Clay, Gravel, Organics & Brick, Concrete, Asphalt & Wood Fragments- Dark Brown- Moist (SM/Fill)	HA1				
		END OF HAND AUGER AT 2 FEET.					
5							
10							
15							
20							
25							
30							
35							

LEGEND
- ▽ HAND PENETROMETER TEST
- ⊠ TORVANE SHEAR TEST
- ○ UNCONFINED COMPRESSION TEST
- ⊡ VANE SHEAR TEST
- × REMOLDED VANE SHEAR
- ⊕ TRIAXIAL TEST

WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING AUGERING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF AUGERING

Notes:
1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. GROUNDWATER WAS NOT ENCOUNTERED.
3. AN OBSTRUCTION WAS ENCOUNTERED ABOUT 2 FEET BELOW THE GROUND SURFACE.

FIELD ENG.: MSM **AUGER METHOD:** Hand Auger **WATER LEVEL DURING AUGERING:** None **WATER LEVEL HOURS AFTER COMPLETION:**
EQUIPMENT: Hand Auger **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** None **CAVE OF AUGERHOLE AT**

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER **A/E:** HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN **BY:** MSM **DATE:** 5/9/06 **BORING** HA2
CLIENT: HOBBS + BLACK ARCHITECTS **PROJECT NUMBER:** PG52339 **SHEET:** 1

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION GROUND SURFACE ELEVATION= 954	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (BLOWS/6") – ○ 10 20 30 40 50	NATURAL DRY DENSITY – ■ (pcf) 90 100 110 MOISTURE, % – ◆ ATTERBERG ⊢⊣ LIMITS 0 10 20 30 40	SHEAR STRENGTH (KSF) 0.0 1.0 2.0 3.0 4.0 5.0
0		Fine to Medium Sand- Trace to Some Silt- Trace Gravel & Organics- Dark Brown- Moist (SP-SM/Topsoil)	HA1				
		Fine to Coarse Sand- Trace to Some Silt- Trace Gravel- Occasional Clayey Sand & Clay Seams- Brown- Moist (SP-SM)	HA2				
5		END OF HAND AUGER AT 5 FEET.					
10							
15							
20							
25							
30							
35							

LEGEND
- ▽ HAND PENETROMETER TEST
- ☒ TORVANE SHEAR TEST
- ○ UNCONFINED COMPRESSION TEST
- ▣ VANE SHEAR TEST
- × REMOLDED VANE SHEAR
- ⊕ TRIAXIAL TEST

WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING AUGERING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF AUGERING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. GROUNDWATER WAS NOT ENCOUNTERED.

FIELD ENG.: MSM **AUGER METHOD:** Hand Auger **WATER LEVEL DURING AUGERING:** None **WATER LEVEL HOURS AFTER COMPLETION:**
EQUIPMENT: Hand Auger **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** None **CAVE OF AUGERHOLE AT**

soil and materials engineers, inc.

PROJECT NAME: BEAUMONT COMMERCE TWP MEDICAL CENTER A/E: HOBBS + BLACK ARCHITECTS
PROJECT LOCATION: COMMERCE TOWNSHIP, MICHIGAN BY: MSM DATE: 5/9/06 BORING HA3
CLIENT: HOBBS + BLACK ARCHITECTS PROJECT NUMBER: PG52339 SHEET: 1

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION GROUND SURFACE ELEVATION= 947	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (BLOWS/6") – ○ 10 20 30 40 50	NATURAL DRY DENSITY – ■ (pcf) 90 100 110 MOISTURE, % – ◆ ATTERBERG ⊢⊣ LIMITS 0 10 20 30 40	LEGEND ▽ HAND PENETROMETER TEST ⊠ TORVANE SHEAR TEST ○ UNCONFINED COMPRESSION TEST ▣ VANE SHEAR TEST × REMOLDED VANE SHEAR ⊕ TRIAXIAL TEST SHEAR STRENGTH (KSF) 0.0 1.0 2.0 3.0 4.0 5.0
0	■	Fine to Medium Sand- Some Silt- Trace Gravel & Organics- Occasional Cobbles- Dark Brown- Moist (SM/Topsoil)	HA1				
5							
		END OF HAND AUGER AT 6.5 FEET.					
10							
15							
20							
25							
30							
35							

WATER LEVEL OBSERVATIONS
- GROUNDWATER ENCOUNTERED DURING AUGERING
- GROUNDWATER ENCOUNTERED UPON COMPLETION OF AUGERING

Notes: 1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL.
2. GROUNDWATER WAS NOT ENCOUNTERED.
3. AN OBSTRUCTION WAS ENCOUNTERED ABOUT 6.5 FEET BELOW THE GROUND SURFACE.

FIELD ENG.: MSM AUGER METHOD: Hand Auger WATER LEVEL DURING AUGERING: None WATER LEVEL HOURS AFTER COMPLETION:
EQUIPMENT: Hand Auger BACKFILL METHOD: Auger Cuttings WATER LEVEL UPON COMPLETION: None CAVE OF AUGERHOLE AT

soil and materials engineers, inc.

PROJECT NAME:	BEAUMONT COMMERCE TWP MEDICAL CENTER	**A/E:** HOBBS + BLACK ARCHITECTS	
PROJECT LOCATION:	COMMERCE TOWNSHIP, MICHIGAN	**BY:** MSM **DATE:** 5/9/06	**BORING** HA4
CLIENT:	HOBBS + BLACK ARCHITECTS	**PROJECT NUMBER:** PG52339	**SHEET:** 1

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION GROUND SURFACE ELEVATION= 950	SAMPLE TYPE/NUMBER INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (BLOWS/6") – ○ 10 20 30 40 50	NATURAL DRY DENSITY – ■ (pcf) 90 100 110 MOISTURE, % – ◆ ATTERBERG ├─┤ LIMITS 0 10 20 30 40	LEGEND ▽ HAND PENETROMETER TEST ⊠ TORVANE SHEAR TEST ○ UNCONFINED COMPRESSION TEST ▣ VANE SHEAR TEST ✕ REMOLDED VANE SHEAR ⊕ TRIAXIAL TEST SHEAR STRENGTH (KSF) 0.0 1.0 2.0 3.0 4.0 5.0
0 – 6		Fine to Medium Sand- Some Silt- Trace Gravel & Organics- Occasional Cobbles- Dark Brown- Moist (SM/Topsoil)	HA1				
6		END OF HAND AUGER AT 6 FEET.					

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35

WATER LEVEL OBSERVATIONS	Notes:
GROUNDWATER ENCOUNTERED DURING AUGERING GROUNDWATER ENCOUNTERED UPON COMPLETION OF AUGERING	1. THE INDICATED STRATIFICATION LINES ARE APPROXIMATE. IN SITU, THE TRANSITION BETWEEN MATERIALS MAY BE GRADUAL. 2. GROUNDWATER WAS NOT ENCOUNTERED. 3. AN OBSTRUCTION WAS ENCOUNTERED ABOUT 6 FEET BELOW THE GROUND SURFACE.

FIELD ENG.: MSM **AUGER METHOD:** Hand Auger **WATER LEVEL DURING AUGERING:** None **WATER LEVEL HOURS AFTER COMPLETION:**

EQUIPMENT: Hand Auger **BACKFILL METHOD:** Auger Cuttings **WATER LEVEL UPON COMPLETION:** None **CAVE OF AUGERHOLE AT**