

**GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED VA NORTHERN CALIFORNIA
HEALTH CARE SYSTEM PARKING GARAGE
10535 HOSPITAL WAY
MATHER, CALIFORNIA**

**KA PROJECT No. 032-10024
MAY 10, 2011**

Prepared for:

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GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

May 10, 2011

KA Project No. 032-10024

Mr. Eric Frampton
FCE, Inc.
895 West Ashlan Avenue, Suite 102
Clovis, California 93612

**RE: Geotechnical Engineering Investigation
Proposed VA Northern California Health Care System Parking Garage
10535 Hospital Way
Mather, California**

Dear Mr. Frampton:

In accordance with your request, we have completed a Geotechnical Engineering Investigation for the above-referenced site. The results of our investigation are presented in the attached report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (916) 564-2200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.


David R. Jarosz, II
Managing Engineer
RCE No. 60185/RGE No. 2698



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May 10, 2011

KA Project No. 032-10024

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PROPOSED VA NORTHERN CALIFORNIA HEALTH
CARE SYSTEM PARKING GARAGE
10535 HOSPITAL WAY
MATHER, CALIFORNIA**

INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed VA Northern California Health Care System Parking Garage, to be located at 10535 Hospital Way in Mather, California. Discussions regarding site conditions are presented herein, together with conclusions and recommendations pertaining to site preparation, Engineered Fill, utility trench backfill, drainage and landscaping, foundations, concrete floor slabs and exterior flatwork, retaining walls, soil cement reactivity, and pavement design.

A site plan showing the approximate boring locations is presented following the text of this report. A description of the field investigation, boring logs, and the boring log legend are presented in Appendix A. Appendix A also contains a description of the laboratory-testing phase of this study; along with the laboratory test results. Appendices B and C contain guides to earthwork and pavement specifications. When conflicts in the text of the report occur with the general specifications in the appendices, the recommendations in the text of the report have precedence.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the soil and groundwater conditions at the site, to make geotechnical engineering recommendations for use in design of specific construction elements, and to provide criteria for site preparation and Engineered Fill construction.

Our scope of services was outlined in our proposal dated May 3, 2010 (KA Proposal No. P169-10) and included the following:

- A site reconnaissance by a member of our engineering staff to evaluate the surface conditions at the project site.
- A field investigation consisting of drilling 6 borings to depths ranging from approximately 13 to 16 feet for evaluation of the subsurface conditions at the project site.

- Performing laboratory tests on representative soil samples obtained from the borings to evaluate the physical and index properties of the subsurface soils.
- Evaluation of the data obtained from the investigation and an engineering analysis to provide recommendations for use in the project design and preparation of construction specifications.
- Preparation of this report summarizing the results, conclusions, recommendations, and findings of our investigation.

PROPOSED CONSTRUCTION

We understand that design of the proposed development is currently underway; structural load information and other final details pertaining to the structures are unavailable. On a preliminary basis, it is understood the proposed development will include the construction of two-story parking garage encompassing approximately 50,000 square feet. It is anticipated that the parking garage will utilize conventional foundations and concrete slab-on-grade. Footing loads are anticipated to be moderate. Modifications to on-site paved areas and landscaping will be associated with the project.

In the event, these structural or grading details are inconsistent with the final design criteria, the Soils Engineer should be notified so that we may update this writing as applicable.

SITE LOCATION AND SITE DESCRIPTION

The site is rectangular in shape and encompasses approximately 1½ acres. The site is located at the northeast corner of Mather Field Road and Peter A. McCuen Boulevard in Mather, California. The site is located within the southwest portion of the Mather VA Hospital facility property. The site is predominately surrounded by landscape planters, parking lots, and commercial developments.

Presently, the site is predominately utilized as a parking lot. Landscaping consisting of grass and trees are located along the edges of the site. Buried utilities are located along the edges of the site and extend throughout the site. Concrete curbing surrounds landscape areas. The general area is relatively level with no major changes in grade.

GEOLOGIC SETTING

The project site lies near the southern end of the Sacramento Valley portion of the Great Valley Geomorphic Province. The Great Valley is bordered to the north by the Cascade and Klamath Ranges, to the west by the Coast Ranges, to the east by the Sierra Nevada Mountains, and to the south by transverse ranges. The valley formed by tilting of Sierran Block with the western side dropping to form the valley and the eastern side being uplifted to form the Sierra Nevada Mountain Range. The valley is characterized by a thick sequence of sediments derived from erosion of the adjacent Sierra Nevada Mountain Range to the east and the Coast Range to the west. These sedimentary rocks are mainly Cretaceous in age. The depths of the sediments vary from a thin veneer at the edges of the valley to depths in excess of 50,000 feet near the western edge of the valley. In the vicinity of the project site,

these sediments are approximately 15,000 feet deep. According to published geologic maps, the project site is underlain by the Basin Deposits. The Basin generally consists of unconsolidated silts and clays deposited during flood events.

The Sacramento Valley has historically been a province of relatively low seismic activity. The nearest faults to the project site are the Foothills Fault system located near the base of the Sierra Nevada Mountain Range and the Coast Ranges Sierran Block Boundary Zone located along the base of the Coast Ranges. There are no known active fault traces in the project vicinity.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored by drilling 6 borings to depths ranging from approximately 13 to 17 feet below existing site grade, using a truck-mounted drill rig. The borings were terminated at a shallower depth due to auger refusal in very dense clayey gravel. The approximate boring locations are shown on the site plan. During drilling operations, penetration tests were performed at regular intervals to evaluate the soil consistency and to obtain information regarding the engineering properties of the subsoils. Soil samples were retained for laboratory testing. The soils encountered were continuously examined and visually classified in accordance with the Unified Soil Classification System. A more detailed description of the field investigation is presented in Appendix A.

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory testing program was formulated with emphasis on the evaluation of natural moisture, density, gradation, shear strength, consolidation potential, expansion potential, atterberg limits, R-value, and moisture-density relationships of the materials encountered. In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and results of the laboratory tests are summarized in Appendix A. This information, along with the field observations, was used to prepare the final boring logs in Appendix A.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Based on our findings, the subsurface conditions encountered appear typical of those found in the geologic region of the site. In general the pavement section consisted of approximately 1½ to 2 inches of asphaltic concrete, underlain by approximately 6 to 7 inches of aggregate base. Within areas not covered by pavement, the upper soils consisted of 6 to 12 inches of very loose clayey sand or sandy clay. These soils are disturbed, have low strength characteristics, and are highly compressible when saturated.

Below the pavement section and loose surface soils, approximately 1 to 3½ feet of fill material was encountered. The fill material predominately consisted of sandy clay and clayey sand. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Limited testing was performed on the fill soil during the time of our field investigations. The limited testing indicates that the fill soils had varying strength characteristics ranging from loosely placed to compacted.

Beneath the pavement section, loose surface soils, and fill material, approximately 4 to 6 feet of firm to hard silty clay, sandy clay, and clayey silt/silty clay or medium dense to very dense clayey sand and clayey sandy silt were encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. The clayey soils have a moderate to high potential for expansion. Penetration resistance ranged from 14 blows per foot to greater than 50 blows per 6 inches. Dry densities ranged from 101 to 124 pcf. Representative soil samples consolidated approximately 1 to 1½ percent under a 2 ksf load when saturated. A representative soil sample had an angle of internal friction of 24 degrees. Representative samples of the clayey soils had expansion indices of 31 and 92.

Below 7 to 8 feet, predominately very hard/very dense sandy clay or sandy clayey gravel were encountered. Penetration resistance was greater than 50 blows per 6 inches. Dry densities ranged from 122 to 123 pcf. These soils had similar strength characteristics as the upper soils and extended to the termination depth of our borings.

For additional information about the soils encountered, please refer to the logs of borings in Appendix A.

GROUNDWATER

Test boring locations were checked for the presence of groundwater during and immediately following the drilling operations. Free groundwater was not encountered during our subsurface investigation. Information obtained from the State of California Department of Water Resources indicates that groundwater within the project site vicinity is typically encountered at depths greater than 50 feet.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use and climatic conditions, as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

SOIL LIQUEFACTION

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic event.

The potential for soil liquefaction during a seismic event was evaluated. Due to the historical depth of groundwater, approximately 50 to 91 feet below site grade, the cohesive nature of the clayey soils, and the moderate penetration resistance (corrected N-values greater than 30) of the soils greater than 10 feet, it is our opinion that the potential for soil liquefaction within the project site vicinity is very low. Therefore, no liquefaction mitigation measures would be warranted. In addition, based on the moderate penetration resistance measured, the native deposits underlying the site did not appear to be subject to significant seismic settlement.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of our field and laboratory investigations, along with previous geotechnical experience in the project area, the following is a summary of our evaluations, conclusions, and recommendations.

Administrative Summary

In brief, the subject site and soil conditions, with the exception of the existing development, the fill material, and the expansive nature of the clayey soils appear to be conducive to the development of the project. The site is presently occupied by an existing parking lot and landscaping. In addition, several structures are located within the project site vicinity. Associated with these developments are buried structures such as utility lines. Demolition activities should include proper removal of any buried structures during construction. Disturbed areas caused by demolition activities should be removed and/or recompacted. This compaction effort should locate any unsuitable or pliant areas not found during our field investigation. The resulting excavation should be backfilled with Engineered Fill.

Up to 3½ feet of fill material was encountered beneath the pavement section within the project site. The fill material predominately consisted of sandy clay or clayey sand. Thicker fill may be present at the site. The thickness and extent of fill should be determined during site grading. Limited testing was performed on the fill soil during the time of our field investigations. The limited testing indicates that the fill soils had varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended that the fill soils excavated and stockpiled so that the native soil can be properly prepared. The clayey soils will not be suitable for reuse as non-expansive Engineered Fill. These clayey soils will be suitable for reuse as General Engineered Fill, within pavement areas, and below 24 inches from finished pad grade in building areas, provided they are cleansed of excessive organics and debris and are moisture-conditioned to at least 2 percent above optimum moisture content.

The upper native soils are loose and slightly compressible under saturated conditions. In order to reduce the potential for differential settlement and provide uniform support for the planned structures, it is recommended that following stripping, fill removal operations, and demolition activities, the upper 2 feet of the native soils within the proposed structural areas be excavated, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture-content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. In addition, it is recommended that proposed structural elements be supported by a minimum of 24 inches of Engineered Fill. Over-excavation should extend to a minimum of 5 feet beyond proposed footing lines. Prior to backfilling, the exposed subgrade soils should be scarified to a depth of 6 inches, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted prior to placement of Engineered Fill. The excavation should be backfilled with Engineered Fill, compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Prior to fill placement, Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal will be required.

Clayey soils are located within the site. The clayey soils appear to have a moderate to high shrink/swell potential. The estimated swell pressure of the clayey material may cause movement-affecting slabs and brittle exterior finishes. To reduce the potential soil movement, it is recommended that the upper 24 inches of soil within slab-on-grade or exterior flatwork areas consist of non-expansive fill. The fill material should be a well-graded silty sand or sandy silt soil. A clean sand or very sandy soil is not acceptable for this purpose. A sandy soil will allow the surface water to drain into the expansive clayey soils below, which may result in swelling. The replacement soil and/or the upper 24 inches of Imported Fill soils should meet the specifications as described under the subheading Engineered Fill. The replacement soils should extend 5 feet beyond the perimeter of the building. The non-expansive replacement soil should be compacted to at least 90 percent relative compaction based on ASTM Test Method D1557. The exposed native soils in the excavation should not be allowed to dry out and should be kept continuously moist prior to backfilling. In addition, it is recommended that slab-on-grade floors, continuous footings, and slabs be nominally reinforced to reduce cracking and vertical off-set.

As an alternative to the use of non-expansive soils, the upper 24 inches of soil supporting the slab areas can consist of lime-treated clayey soils. The lime-treated soils should be recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. The preliminary application rate of lime should be 5 percent by dry weight. The lime material should be calcium oxide, commonly known as quick-lime. The clayey soils should be at or near optimum moisture during the mixing operations.

The site is predominately covered with asphaltic concrete pavement. In addition, several buildings surround the site. Associated with these developments are surface and buried structures that may extend into the new building site. Any surface or buried structures encountered during construction should be properly removed and the resulting excavations backfilled. It is suspected that demolition activities of the existing structures, utilities, and pavement will disturb the upper soils. Areas disturbed by demolition activities should be completely removed to firm native ground. The resulting excavations should be backfilled with Engineered Fill compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Several trees are located across the site. Tree removal operations should include roots greater than 1 inch in diameter. The resulting excavations should be backfilled with Engineered Fill, compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structure footings may be designed utilizing an allowable bearing pressure of 2,500 psf for dead-plus-live loads. Alternatively, the structure may be supported on a shallow foundation system utilizing an allowable bearing pressure of 5,000 psf provided the footings extend to a minimum depth of 8 feet below original site grade. Footings should have a minimum embedment of 18 inches.

Groundwater Influence on Structures/Construction

Based on our findings and historical records, it is not anticipated that groundwater will rise within the zone of structural influence or affect the construction of foundations and pavements for the project. However, if earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated, "pump," or not respond to densification techniques. Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material; or mixing the soil with an approved lime or cement product. Our firm should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Site Preparation

General site clearing should include removal of existing structures; asphaltic concrete; vegetation; existing utilities; structures including foundations; basement walls and floors; existing stockpiled soil; trees and associated root systems; rubble; rubbish; and any loose and/or saturated materials. Site stripping should extend to a minimum depth of 2 to 4 inches, or until all organics in excess of 3 percent by volume are removed. Deeper stripping may be required in localized areas. These materials will not be suitable for use as Engineered Fill. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas.

Approximately 1½ to 3½ feet of fill material was encountered beneath the loose surface soils and pavement section within the project site. The fill material predominately consisted of sandy clay or clayey sand. Thicker fill may be present at the site. The thickness and extent of fill should be determined during site grading. Limited testing was performed on the fill soil during the time of our field and laboratory investigations. The limited testing indicates that the fill soils had varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended that fill soils which have not been properly compacted and certified be excavated and stockpiled so that the native soil can be properly prepared. The clayey soils will not be suitable for reuse as non-expansive Engineered Fill. These clayey soils will be suitable for reuse as General Engineered Fill, within pavement areas, and below 24 inches from finished pad grade in slab-on-grade and exterior flatwork areas, provided they are cleansed of excessive organics and debris and are moisture-conditioned to at least 2 percent above optimum moisture content. Prior to backfilling, Krazan & Associates, Inc. should inspect the bottom of the excavations to verify no additional removal will be required.

The site is predominately covered with asphaltic concrete pavement. In addition, several structures are located within the project site vicinity. Associated with these developments are surface and buried structures that may extend into the new building site. Any surface or buried structures encountered during construction should be properly removed and the resulting excavations backfilled. Excavations, depressions, or soft and pliant areas extending below planned finished subgrade levels should be cleaned to firm, undisturbed soil and backfilled with Engineered Fill. In general, any septic tanks, debris pits, cesspools, or similar structures should be entirely removed. Concrete footings should be removed to an equivalent depth of at least 3 feet below proposed footing elevations or as recommended

by the Soils Engineer. Any other buried structures should be removed in accordance with the recommendations of the Soils Engineer. The resulting excavations should be backfilled with Engineered Fill.

Several trees are located across the site. Tree removal operations should include roots greater than 1 inch in diameter. The resulting excavations should be backfilled with Engineered Fill, compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

In order to reduce amount of differential settlement and provide uniform support for the planned structures, it is recommended that following stripping, fill removal operations, and demolition activities, the upper 2 feet of the native soils within the proposed structural areas be excavated, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture-content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. In addition, it is recommended that proposed structural elements be supported by a minimum of 24 inches of Engineered Fill. Over-excavation should extend to a minimum of 5 feet beyond proposed footing lines. Prior to backfilling, the exposed subgrade soils should be scarified to a depth of 6 inches, moisture-conditioned to a minimum of 2 percent above optimum moisture-content, and recompacted prior to placement of Engineered Fill. The excavation should be backfilled with Engineered Fill, compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Prior to fill placement, Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal will be required.

It is recommended that the upper 24 inches of soil within proposed slab-on-grade and exterior flatwork areas consist of non-expansive Engineered Fill or lime-treated Engineered Fill. The intent is to support slab-on-grade and exterior flatwork areas with 24 inches of non-expansive or lime-treated fill. The fill placement serves two functions: 1) it provides a uniform amount of soil which will more evenly distribute the soil pressures and 2) it reduces moisture content fluctuation in the clayey material beneath the building area. The non-expansive fill material should be a well-graded silty sand or sandy silt soil. A clean sand or very sandy soil is not acceptable for this purpose. A sandy soil will allow the surface water to drain into the expansive clayey soil below, which may result in soil swelling. Imported Fill should be approved by the Soils Engineer prior to placement. The fill should be placed as specified as Engineered Fill.

Following stripping, fill removal, and demolition operations, the exposed subgrade within the exterior flatwork areas should be excavated to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Limits of recompaction should extend 5 feet beyond structural elements.

The upper soils, during wet winter months, become very moist, due to the absorptive characteristics of the soil. Earthwork operations performed during winter months may encounter very moist unstable soils, which may require removal to grade a stable building foundation. Project site winterization consisting of placement of aggregate base and protecting exposed soils during the construction phase should be performed.

A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Soils Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section and the Engineered Fill section.

Engineered Fill

The upper on-site native soils and fill material are predominately sandy clay, silty clay, clayey sand, sandy clay with gravel, and sandy clayey gravel. The clayey soils will not be suitable for reuse as non-expansive Engineered Fill. The clayey soils will be suitable for reuse for fill placement within the upper 24 inches of slab-on-grade and exterior flatwork areas, provided they are lime-treated. The preliminary application rate of lime should be 5 percent by dry weight. The lime material should be calcium oxide, commonly known as quick-lime. Additional testing is recommended to determine the appropriate application rate of lime prior to placement. The clayey soils will be suitable for use as General Engineered Fill within flexible pavement areas and below 24 inches from finished pad grade in slab-on-grade and exterior flatwork areas provided they are moisture-conditioned to at least 2 percent above optimum moisture.

The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since he has complete control of the project site at that time.

Imported non-expansive Fill should consist of a well-graded, slightly cohesive, fine silty sand or sandy silt, with relatively impervious characteristics when compacted. This material should be approved by the Soils Engineer prior to use and should typically possess the following characteristics:

Percent Passing No. 200 Sieve	20 to 50
Plasticity Index	10 maximum
UBC Standard 29-2 Expansion Index	15 maximum

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned as necessary, and compacted to achieve at least 90 percent of maximum density based on ASTM Test Method D1557. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

Drainage and Landscaping

The ground surface should slope away from building pad and pavement areas toward appropriate drop inlets or other surface drainage devices. In accordance with Section 1803 of the 2007 California Building Code, it is recommended that the ground surface adjacent to foundations be sloped a minimum of 5 percent for a minimum distance of 10 feet away from structures, or to an approved alternative means of drainage conveyance. Swales used for conveyance of drainage and located within 10 feet of foundations should be sloped a minimum of 2 percent. Impervious surfaces, such as pavement and exterior concrete flatwork, within 10 feet of building foundations should be sloped a minimum of 2 percent away from the structure. Drainage gradients should be maintained to carry all surface water to collection facilities and off-site. These grades should be maintained for the life of the project.

Slots or weep holes should be placed in drop inlets or other surface drainage devices in pavement areas to allow free drainage of adjoining base course materials. Cutoff walls should be installed at pavement edges adjacent to vehicular traffic areas, these walls should extend to a minimum depth of 6 inches below pavement subgrades to limit the amount of seepage water that can infiltrate the pavements. Where cutoff walls are undesirable subgrade drains can be constructed to transport excess water away from planters to drainage interceptors. If cutoff walls can be successfully used at the site, construction of subgrade drains is considered unnecessary.

Utility Trench Backfill

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards by a Contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the Contractor. Traffic and vibration adjacent to trench walls should be minimized; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced, especially during or shortly following periods of precipitation.

Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 90 percent of the maximum density based on ASTM Test Method D1557. The utility trench backfill placed in pavement areas should be compacted to at least 90 percent of the maximum density based on ASTM Test Method D1557. Pipe bedding should be in accordance with pipe manufacturer's recommendations.

The Contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The Contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

Foundations

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structures may be supported on a shallow foundation system bearing on a minimum of 24 inches of Engineered Fill. Spread and continuous footings can be designed for the following maximum allowable soil bearing pressures:

Load	Allowable Loading
Dead Load Only	1,875 psf
Dead-Plus-Live Load	2,500 psf
Total Load, including wind or seismic loads	3,325 psf

Provided the footings extend to a minimum depth of 8 feet below original site grade or the soils are removed to a depth of 8 feet from original ground and backfilled with non-expansive Engineered Fill compacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557, the foundations can be designed utilizing the following allowable bearing pressures:

Load	Allowable Loading
Dead Load Only	3,750 psf
Dead-Plus-Live Load	5,000 psf
Total Load, including wind or seismic loads	6,650 psf

The footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Footings should have a minimum width of 12 inches, regardless of load.

The footing excavations should not be allowed to dry out any time prior to pouring concrete. It is recommended that footings be reinforced by at least one No. 4 reinforcing bar in both top and bottom. Ultimate design of foundations and reinforcement should be performed by the project Structural Engineer.

The total movement is not expected to exceed 1 inch. Differential movement measured across a horizontal distance of 40 feet should be less than 1 inch. Most of the movement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.3 acting between the base of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot acting against the appropriate vertical footing faces. The frictional and passive resistance of the

soil may be combined without reduction in determining the total lateral resistance. A $\frac{1}{3}$ increase in the above value may be used for short duration, wind, or seismic loads. All of the above earth pressures are unfactored and are, therefore, not inclusive of factors of safety.

Lateral Earth Pressures and Retaining Walls

Walls retaining horizontal backfill and capable of deflecting a minimum of 0.1 percent of its height at the top may be designed using an equivalent fluid active pressure of 50 pounds per square foot per foot of depth. Walls incapable of this deflection or are fully constrained walls against deflection may be designed for an equivalent fluid at-rest pressure of 70 pounds per square foot per foot of depth. Expansive soils should not be used for backfill against walls. The wedge of non-expansive backfill material should extend from the bottom of each retaining wall outward and upward at a slope of 2:1 (horizontal to vertical) or flatter. The stated lateral earth pressures do not include the effects of hydrostatic water pressures generated by infiltrating surface water that may accumulate behind the retaining walls; or loads imposed by construction equipment, foundations, or roadways. All of the above earth pressures are unfactored and are, therefore, not inclusive of factors of safety.

Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches wide and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic-concrete or other suitable backfill to minimize surface drainage into the wall drain system. The aggregate should conform to Class II permeable materials graded in accordance with Section 68-1.025 of the CalTrans Standard Specifications (May 2006). Prefabricated drainage systems, such as Miradrain®, Enkadrain® or an equivalent substitute, are acceptable alternatives in lieu of gravel, provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The pipes should be placed no higher than 6 inches above the heel of the wall in the center line of the drainage blanket and should have a minimum diameter of 4 inches. Collector pipes may be either slotted or perforated. Slots should be no wider than $\frac{1}{8}$ -inch in width, while perforations should be no more than $\frac{1}{4}$ -inch in diameter. If retaining walls are less than 6 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 4-inch diameter holes (concrete walls) or unmortared head joints (masonry walls) and not be higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to Section 88-1.03 of the CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

R-Value Test Result and Pavement Design

One subgrade soil sample was obtained from the project site for laboratory R-Value testing at the location shown on the attached site plan. The sample was tested in accordance with the State of California Materials Manual Test Designation 301. Results of the tests are shown below:

Sample	Depth	Description	R-Value at Equilibrium
1	12-24"	Silty Clay (CL)	Less than 5

The test result is low and indicates poor subgrade support characteristics under dynamic traffic loads. The following table shows the recommended pavement sections for various traffic indices.

Traffic Index	Asphaltic Concrete	Class II Aggregate Base*	Class III Aggregate Subbase*	Compacted Subgrade**
4.0	2.0"	8.5"	--	12.0"
4.0	2.0"	4.5"	4.5"	12.0"
4.5	2.5"	9.0"	--	12.0"
4.5	2.5"	4.0"	5.5"	12.0"
5.0	2.5"	11.0"	--	12.0"
5.0	2.5"	5.0"	6.5"	12.0"
5.5	2.5"	11.5"	--	12.0"
5.5	2.5"	5.0"	7.0"	12.0"
6.0	3.0"	13.5"	--	12.0"
6.0	3.0"	6.5"	8.0"	12.0"
6.5	3.0"	14.0"	--	12.0"
6.5	3.0"	6.0"	9.0"	12.0"
7.0	3.5"	15.5"	--	12.0"
7.0	3.5"	6.5"	10.0"	12.0"
7.5	4.0"	17.0"	--	12.0"
7.5	4.0"	7.5"	10.5"	12.0"

* 95% compaction based on ASTM Test Method D1557 or CAL 216

** 90% compaction based on ASTM Test Method D1557 or CAL 216

If traffic indices are not available, an estimated index of 4.5 may be used for light automobile traffic, and an index of 7.0 for light truck traffic are typical values.

The following recommendations are for light duty and heavy duty Portland Cement Concrete pavement sections.

**PORTLAND CEMENT PAVEMENT
LIGHT DUTY**

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
4.5	6.0"	4.0"	12.0"

HEAVY DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
7.0	7.0"	6.0"	12.0"

* 95% compaction based on ASTM Test Method D1557 or CAL 216

** 90% compaction based on ASTM Test Method D1557 or CAL 216

***Minimum compressive strength of 3000 psi

Seismic Parameters – 2010 California Building Code

The Site Class per Table 1613.5.2, of the 2010 California Building Code (2007 CBC) is based upon the site soil conditions. It is our opinion that Site Class D is most consistent with the subject site soil conditions. For seismic design of the structures based on the seismic provisions of the 2010 CBC, we recommend the following parameters:

Seismic Item	Value	CBC Reference
Site Class	D	Table 1613.5.2
Site Coefficient F_a	1.431	Table 1613.5.3 (1)
S_s	0.462	Figure 1613.5 (3)
S_{MS}	0.661	Section 1613.5.3
S_{DS}	0.440	Section 1613.5.4
Site Coefficient F_v	1.973	Table 1613.5.3 (2)
S_1	0.214	Figure 1613.5 (4)
S_{M1}	0.422	Section 1613.5.3
S_{D1}	0.281	Section 1613.5.4

Soil Cement Reactivity

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete (or stucco) and the soil. HUD/FHA and UBC have developed criteria for evaluation of sulfate levels and how they relate to cement reactivity with soil and/or water.

Soil samples were obtained from the site and tested in accordance with State of California Materials Manual Test Designation 417. The sulfate concentrations detected from these soil samples were less than 150 ppm and below the maximum allowable values established by HUD/FHA and UBC. However, it is recommended that a Type II cement be used within the concrete to compensate for sulfate reactivity with the cement.

Compacted Material Acceptance

Compaction specifications are not the only criteria for acceptance of the site grading or other such activities. However, the compaction test is the most universally recognized test method for assessing the performance of the Grading Contractor. The numerical test results from the compaction test cannot be used to predict the engineering performance of the compacted material. Therefore, the acceptance of compacted materials will also be dependent on the stability of that material. The Soils Engineer has the option of rejecting any compacted material regardless of the degree of compaction if that material is considered to be unstable or if future instability is suspected. A specific example of rejection of fill material passing the required percent compaction is a fill which has been compacted with an in situ moisture content significantly less than optimum moisture. This type of dry fill (brittle fill) is susceptible to future settlement if it becomes saturated or flooded.

Testing and Inspection

A representative of Krazan & Associates, Inc., should be present at the site during the earthwork activities to confirm that actual subsurface conditions are consistent with the exploratory fieldwork. This activity is an integral part of our service, as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of these recommendations is incorporated into the project design and construction. Krazan & Associates, Inc. will not be responsible for grades or staking, since this is the responsibility of the Prime Contractor.

LIMITATIONS

Soils Engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences advance. Although your site was analyzed using the most appropriate and most current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to advancements in the field of Soils Engineering, physical changes in the site, either due to excavation or fill placement, new agency regulations, or possible changes in the proposed structure after the soils report is completed may require the soils report to be professionally reviewed. In light of this, the Owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that 2 years be considered a reasonable time for the usefulness of this report.

Foundation and earthwork construction is characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original foundation investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those disclosed during our field investigation. If any variations or undesirable conditions are encountered during construction, the Soils Engineer should be notified so that supplemental recommendations may be made.


The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The Soils Engineer should be notified of any changes so the recommendations may be reviewed and re-evaluated.

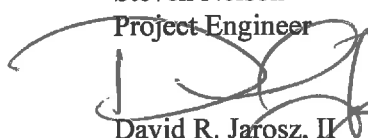
This report is a Geotechnical Engineering Investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring log regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.


The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

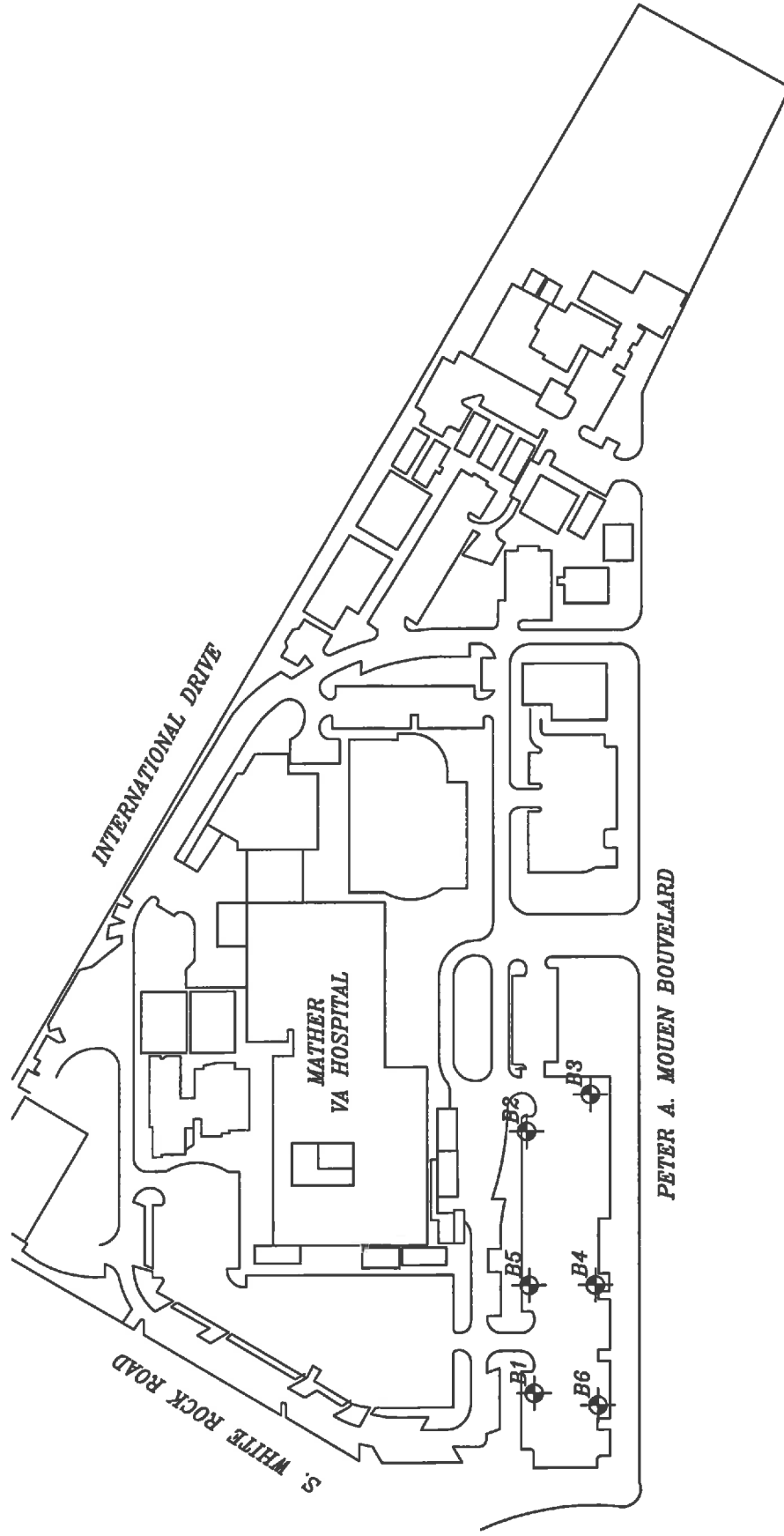
If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (916) 564-2200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.


Steven Nelson
Project Engineer


David R. Jarosz, II
Managing Engineer
RCE No. 60185/RGE No. 2698





⊕ APPROXIMATE BORING LOCATION

NOT TO SCALE

PROPOSED VA NORTHERN CALIFORNIA HEALTH CARE SYSTEM
 10535 HOSPITAL WAY
 MATHER, CA

Scale:	Date:
AS SHOWN	5/10
Drawn by:	Approved by:
MN	DJ
Project No.	Figure No.
03210024	

Krazan
 SITE DEVELOPMENT ENGINEERS
 Offices Serving the Western United States

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Six 4½-inch exploratory borings were advanced. The boring locations are shown on the site plan.

The soils encountered were logged in the field during the exploration and, with supplementary laboratory test data, are described in accordance with the Unified Soil Classification System.

Modified standard penetration tests were performed at selected depths. This test represents the resistance to driving a 2½-inch diameter core barrel. The driving energy was provided by a hammer weighing 140 pounds falling 30 inches. Relatively undisturbed soil samples were obtained while performing this test. Bag samples of the disturbed soil were obtained from the auger cuttings. All samples were returned to our Fresno laboratory for evaluation.

Laboratory Investigation

The laboratory investigation was programmed to determine the physical and mechanical properties of the foundation soil underlying the site. Test results were used as criteria for determining the engineering suitability of the surface and subsurface materials encountered.

In situ moisture content, dry density, consolidation, direct shear, and sieve analysis tests were determined for the undisturbed samples representative of the subsurface material. These tests, supplemented by visual observation, comprised the basis for our evaluation of the site material.

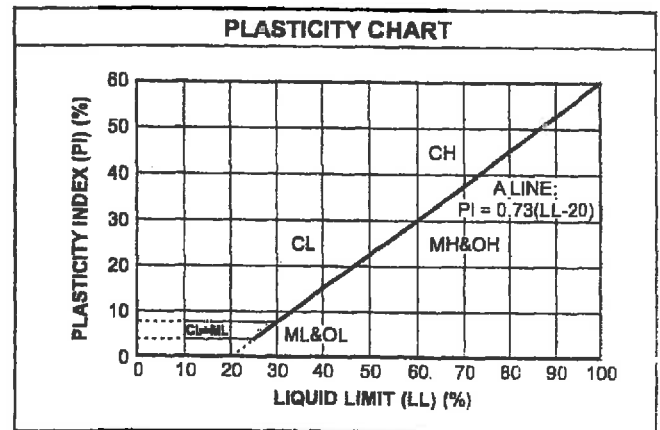
The logs of the exploratory borings and laboratory determinations are presented in this Appendix.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART		
COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of 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 50% or greater	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

CONSISTENCY CLASSIFICATION	
Description	Blows per Foot
<i>Granular Soils</i>	
Very Loose	< 5
Loose	5 – 15
Medium Dense	16 – 40
Dense	41 – 65
Very Dense	> 65
<i>Cohesive Soils</i>	
Very Soft	< 3
Soft	3 – 5
Firm	6 – 10
Stiff	11 – 20
Very Stiff	21 – 40
Hard	> 40

GRAIN SIZE CLASSIFICATION		
Grain Type	Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12 inches	Above 305
Cobbles	3 to 12 inches	305 to 76.2
Gravel	3 inches to No. 4	76.2 to 4.76
Coarse-grained	3 to ¾ inches	76.2 to 19.1
Fine-grained	¾ inches to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
Coarse-grained	No. 4 to No. 10	4.76 to 2.00
Medium-grained	No. 10 to No. 40	2.00 to 0.042
Fine-grained	No. 40 to No. 200	0.042 to 0.074
Silt and Clay	Below No. 200	Below 0.074



Log of Drill Hole B1

Project: VA Northern California Health Care System

Project No: 032-10024

Client: FCE, Inc.

Figure No.: A-1

Location: 10535 Hospital Way, Mather, California

Logged By: Wayne Andrade

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.		
0		Ground Surface						
		ASPHALTIC CONCRETE = 1½ Inches						
		AGGREGATE BASE = 7 Inches						
2		SILTY CLAY (CL) Stiff with trace SAND; reddish-brown, moist, drills easily	122.6	14.4		50+		
4		SANDY CLAY (CL) Hard, fine-grained; weakly cemented; reddish-brown, damp, drills hard						
6		SANDY SILTY CLAY (CL) Hard, fine-grained; reddish-brown, damp, drills firmly	124.1	12.6		51		
8		CLAYEY SANDY GRAVEL (GC) Very dense, fine- to coarse-grained; reddish-brown, moist, drills easily						
10				9.6		50+		
12								
14								
16						50+		
18		End of Borehole						
20								

Drill Method: Solid Flight

Drill Rig: CME 45

Driller: Chris Wyneken

Krazan and Associates

Drill Date: 5-5-10

Hole Size: 4½ Inches

Elevation: 17 Feet

Sheet: 1 of 1

Log of Drill Hole B2

Project: VA Northern California Health Care System

Project No: 032-10024

Client: FCE, Inc.

Figure No.: A-2

Location: 10535 Hospital Way, Mather, California

Logged By: Wayne Andrade

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.		
0		Ground Surface						
		ASPHALTIC CONCRETE = 1½ Inches AGGREGATE BASE = 7 Inches						
2		CLAYEY SANDY (SC) FILL - Fine- to coarse-grained with GRAVEL; reddish-brown, moist, drills easily	101.2	16.0		9		
4		CLAYEY SAND (SC) Medium dense, fine- to coarse-grained with trace GRAVEL; reddish-brown, moist, drills easily				32		
8		CLAYEY SANDY GRAVEL (GC) Very dense, fine- to coarse-grained with trace COBBLES; reddish-brown, moist, drills hard						
10			123.6	6.6		50+		
12								
14								
16				8.0		50+		
18		End of Borehole						
20								

Drill Method: Solid Flight

Drill Date: 5-5-10

Drill Rig: CME 45

Krazan and Associates

Hole Size: 4½ Inches

Driller: Chris Wyneken

Elevation: 17 Feet

Sheet: 1 of 1

Log of Drill Hole B3

Project: VA Northern California Health Care System

Project No: 032-10024

Client: FCE, Inc.

Figure No.: A-3

Location: 10535 Hospital Way, Mather, California

Logged By: Wayne Andrade

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.		
0		Ground Surface						
		ASPHALTIC CONCRETE = 2 Inches AGGREGATE BASE = 7 Inches						
2		SANDY CLAY (CL) Very stiff, fine- to medium-grained; reddish-brown, damp, drills easily	117.6	14.3		31		
4		SANDY CLAY (CL) Very stiff, fine- to coarse-grained with trace GRAVEL; reddish-brown, damp, drills easily	122.1	12.9		23		
6								
8		SANDY CLAYEY GRAVEL (GC) Very dense, fine- to coarse-grained with trace COBBLES; reddish-brown, damp, drills hard						
10		End of Borehole						
12								
14								
16								
18								
20								

Drill Method: Solid Flight

Drill Date: 5-5-10

Drill Rig: CME 45

Krazan and Associates

Hole Size: 4½ Inches

Driller: Chris Wyneken

Elevation: 8½ Feet

Sheet: 1 of 1

Log of Drill Hole B4

Project: VA Northern California Health Care System

Project No: 032-10024

Client: FCE, Inc.

Figure No.: A-4

Location: 10535 Hospital Way, Mather, California

Logged By: Wayne Andrade

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.		
0		Ground Surface						
0		ASPHALTIC CONCRETE = 2 Inches						
0		AGGREGATE BASE = 6 Inches						
2		SANDY CLAY (CL) FILL - Fine-grained; brown, damp, drills easily	109.6	18.6		19		
4		SANDY CLAY (CL) Firm, fine-grained; reddish-brown, damp, drills hard						
6		SANDY CLAYEY SILT (ML) Very dense, fine-grained; light orangish-brown, damp, drills hard	114.3	11.2		50+		
8		SANDY CLAYEY GRAVEL (GC) Very dense, fine- to coarse-grained with trace COBBLES; reddish-brown, moist, drills easily						
10				7.2		50+		
12								
14		End of Borehole						
16								
18								
20								

Drill Method: Solid Flight

Drill Rig: CME 45

Driller: Chris Wyneken

Krazan and Associates

Drill Date: 5-5-10

Hole Size: 4½ Inches

Elevation: 14 Feet

Sheet: 1 of 1

Log of Drill Hole B5

Project: VA Northern California Health Care System

Project No: 032-10024

Client: FCE, Inc.

Figure No.: A-5

Location: 10535 Hospital Way, Mather, California

Logged By: Wayne Andrade

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.		
0		Ground Surface						
0		ASPHALTIC CONCRETE = 2 Inches						
0		AGGREGATE BASE = 7 Inches						
2		SANDY SILTY CLAY (CL) FILL - Fine-grained; dark grayish-brown, damp, drills easily	125.4	12.4		23		
4		SANDY CLAY (CL) Firm, fine-grained with GRAVEL; reddish-brown, damp, drills easily						
6		CLAYEY SILT/SILTY CLAY (ML/CL) Very dense, fine-grained; light orangish-brown, damp, drills hard	118.8	10.4		50+		
8		CLAYEY GRAVEL (GC) Very dense, fine- to coarse-grained; reddish-brown, damp, drills hard						
10						50+		
14		End of Borehole						
16								
18								
20								

Drill Method: Solid Flight

Drill Date: 5-5-10

Drill Rig: CME 45

Krazan and Associates

Hole Size: 4½ Inches

Driller: Chris Wyneken

Elevation: 13½ Feet

Sheet: 1 of 1

Log of Drill Hole B6

Project: VA Northern California Health Care System

Project No: 032-10024

Client: FCE, Inc.

Figure No.: A-6

Location: 10535 Hospital Way, Mather, California

Logged By: Wayne Andrade

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.		
0		Ground Surface						
0		ASPHALTIC CONCRETE = 2 Inches						
0		AGGREGATE BASE = 7 Inches						
2		SANDY CLAY (CL) Stiff; fine- to medium-grained; light reddish-brown, damp, drills easily	115.5	14.1		11		
4		SANDY CLAYEY GRAVEL (GC) Very dense, fine- to coarse-grained; reddish-brown, moist, drills hard						
6				9.5		50+		
10						50+		
14		End of Borehole						

Drill Method: Solid Flight

Drill Date: 5-5-10

Drill Rig: CME 45

Krazan and Associates

Hole Size: 4½ Inches

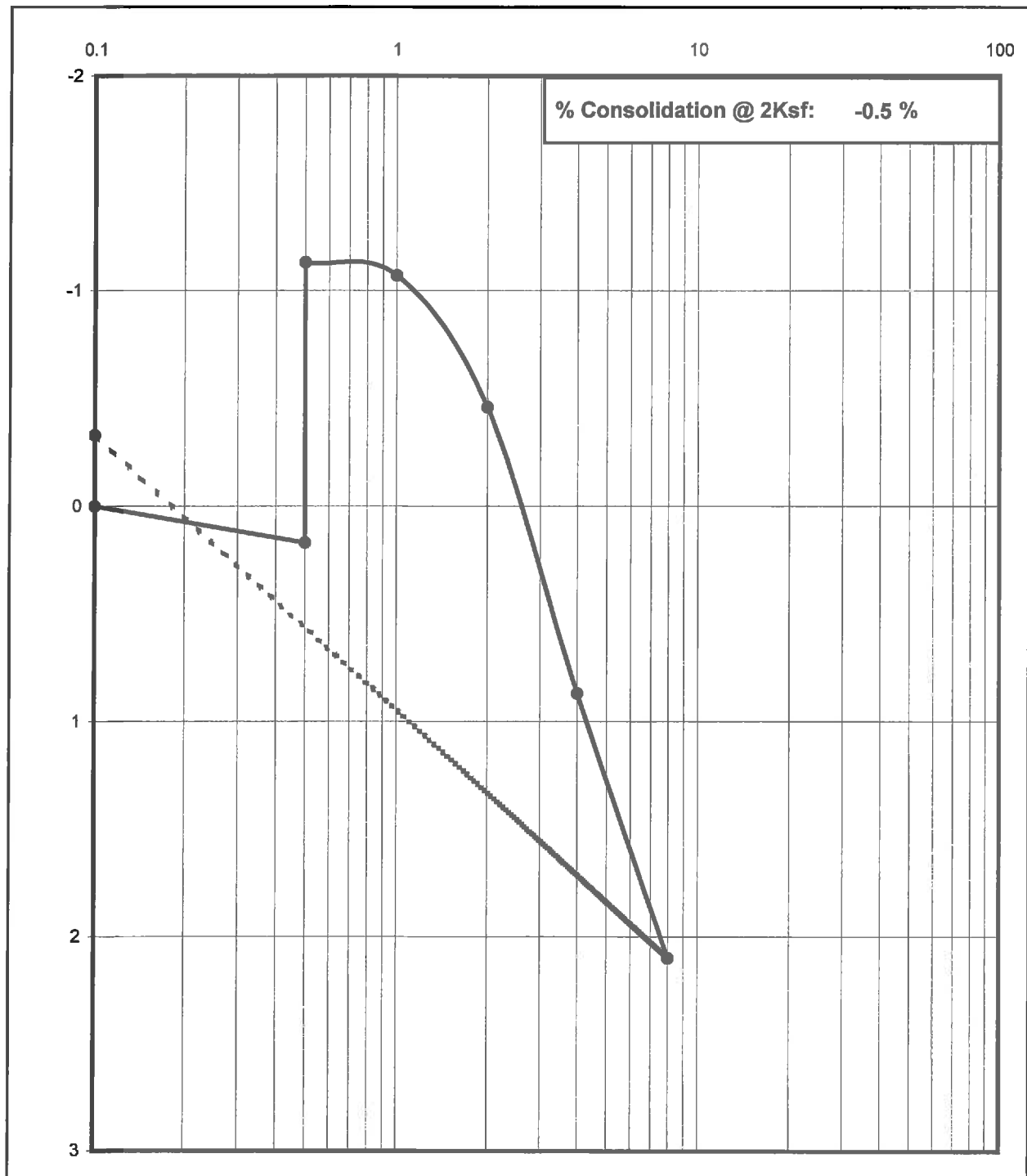
Driller: Chris Wyneken

Elevation: 13 Feet

Sheet: 1 of 1

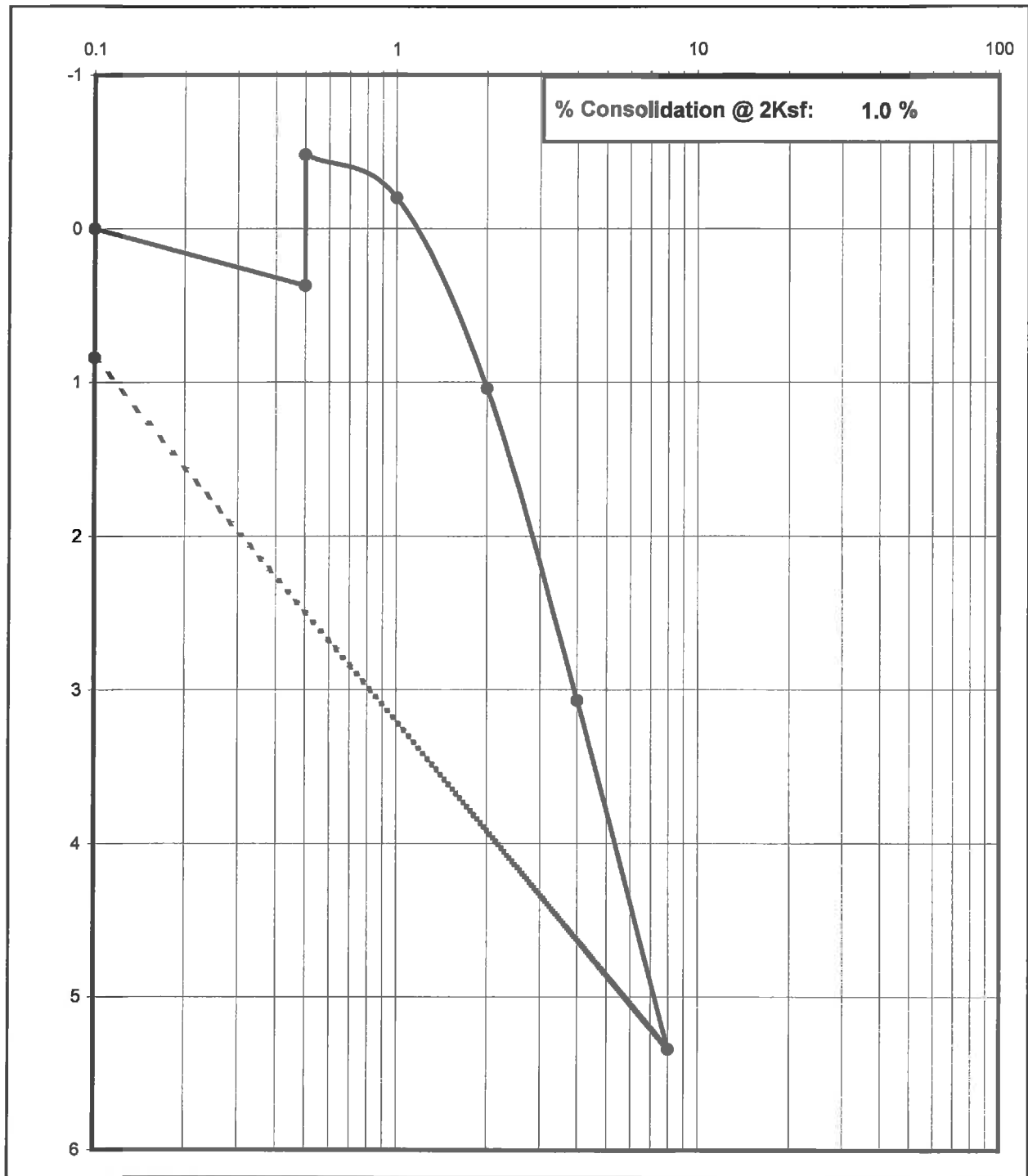
Consolidation Test

Project No	Boring No. & Depth	Date	Soil Classification
3210024	B3 @ 2-3'	5/18/2010	CL



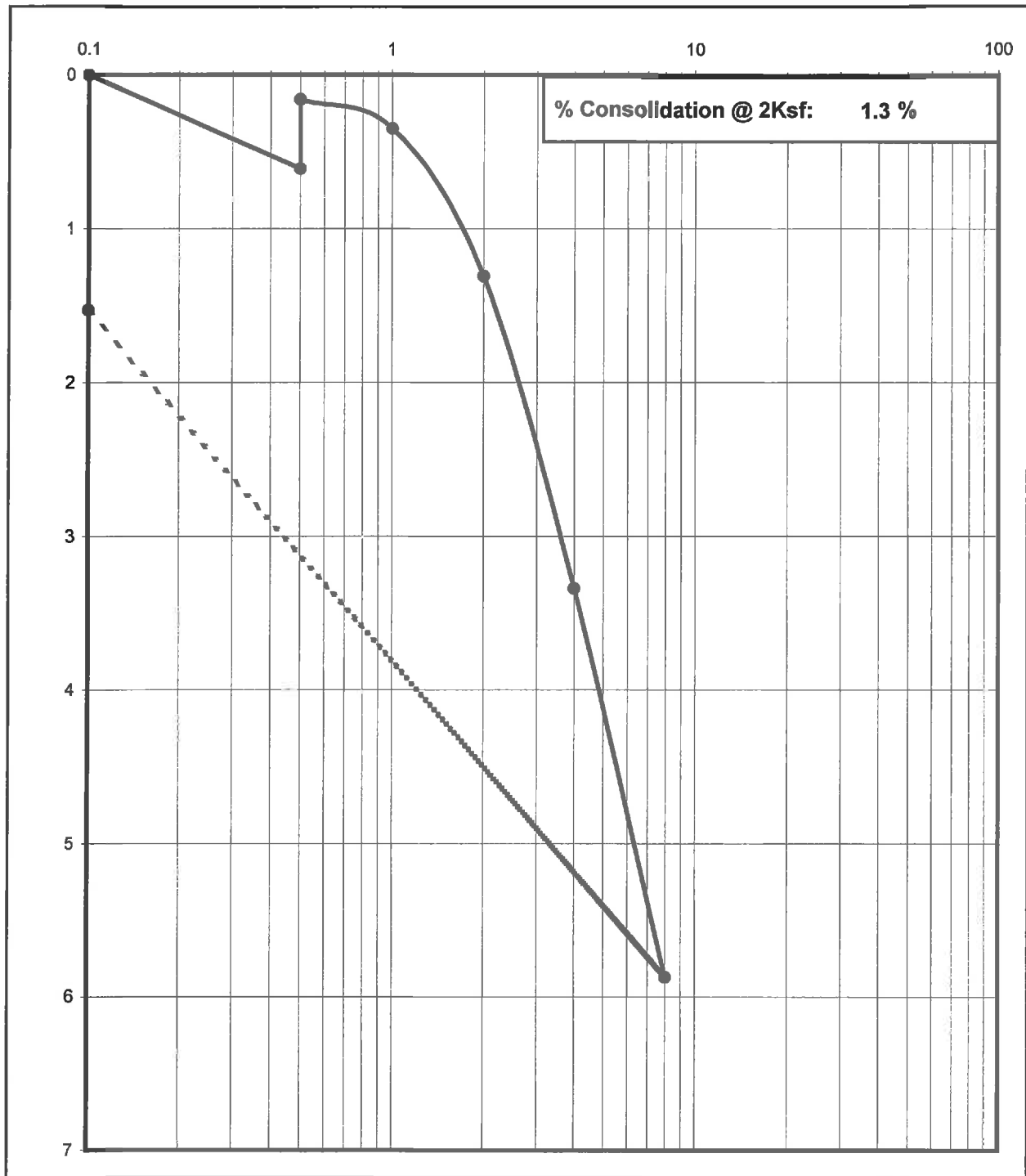
Consolidation Test

Project No	Boring No. & Depth	Date	Soil Classification
3210024	B3 @ 5-6'	5/18/2010	CL



Consolidation Test

Project No	Boring No. & Depth	Date	Soil Classification
3210024	B5 @ 2-3'	5/18/2010	CL w/ grvl

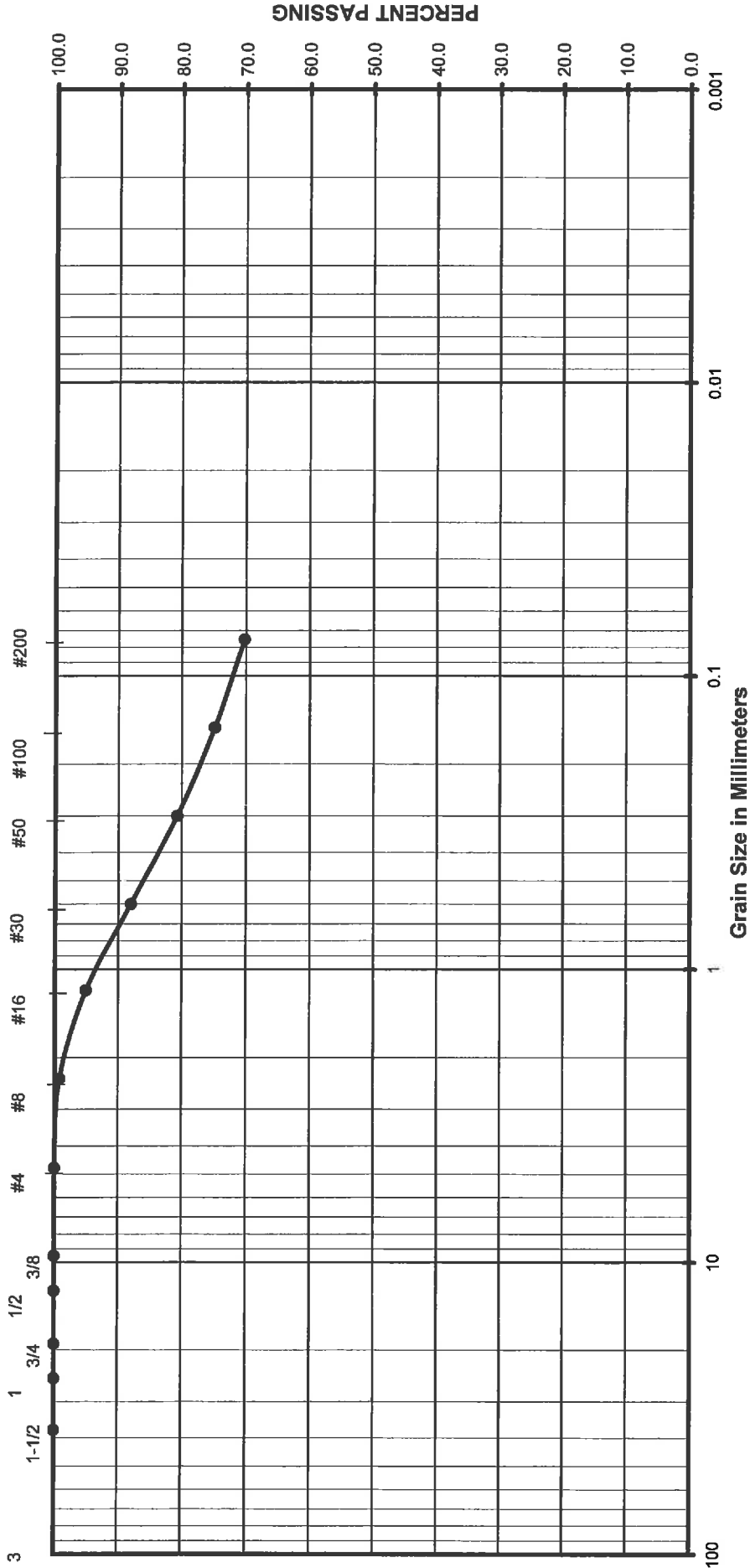


Grain Size Analysis

Hydrometer

U.S. Standard Sieve Numbers

Sieve Openings in Inches

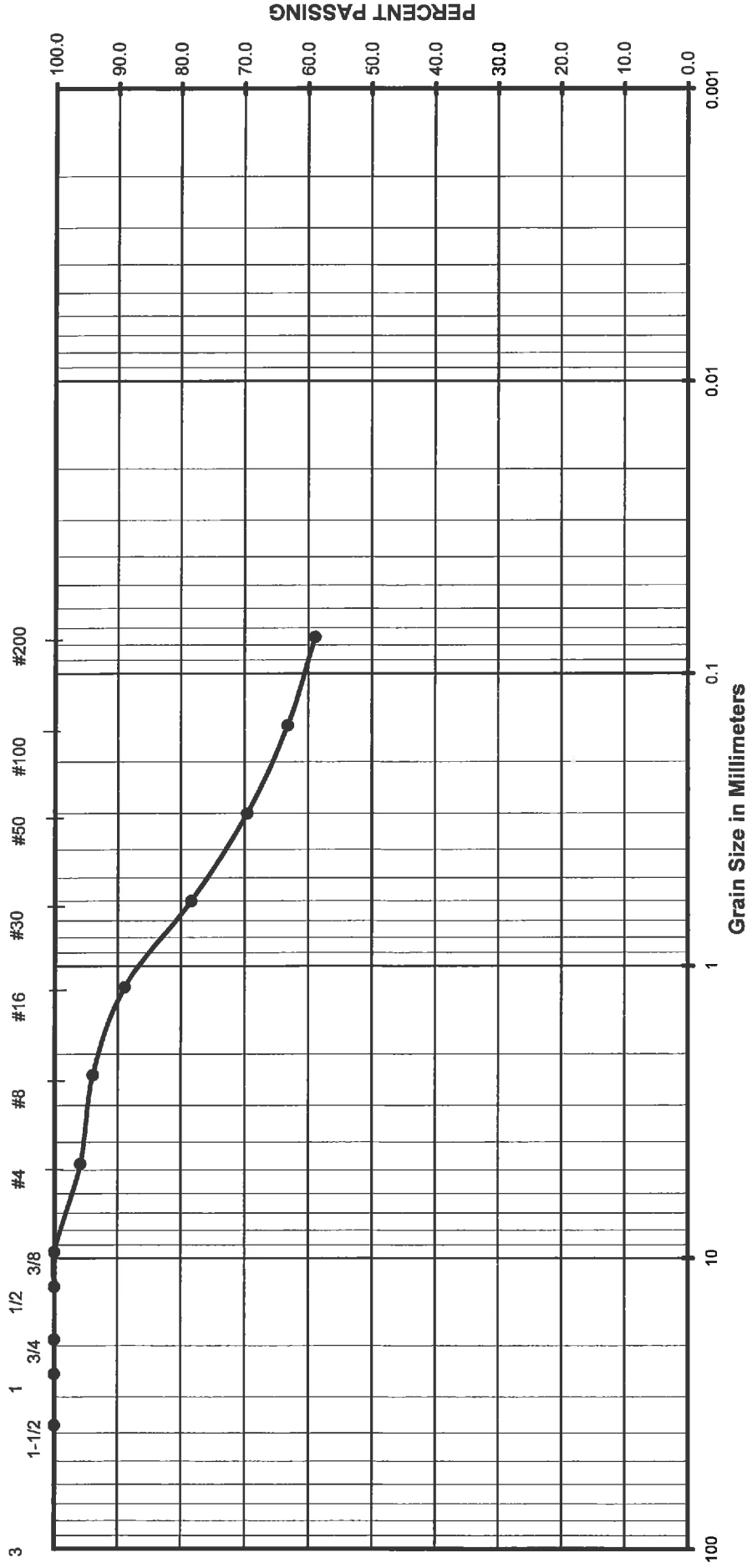


Grain Size Analysis

Hydrometer

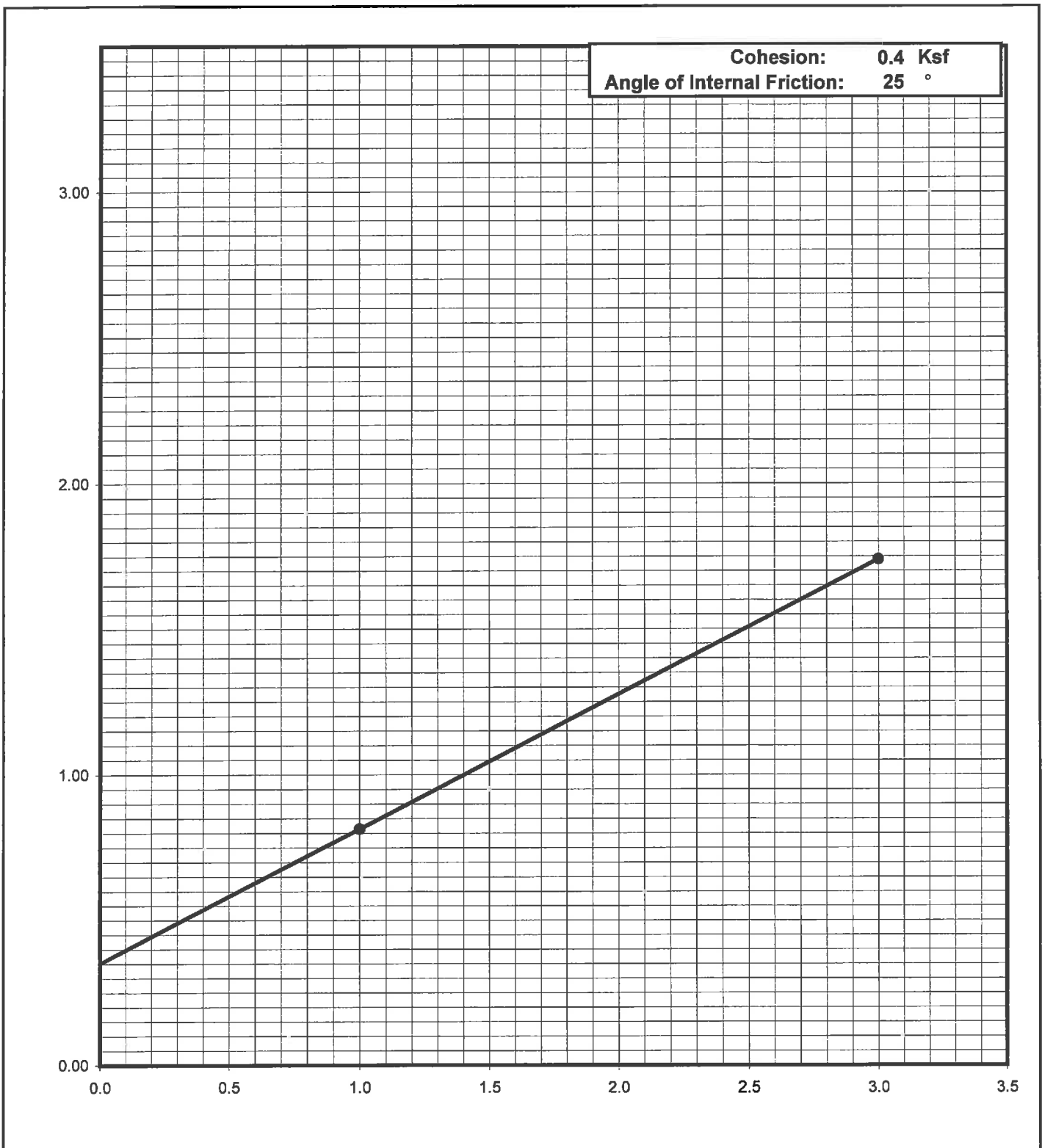
U.S. Standard Sieve Numbers

Sieve Openings in Inches



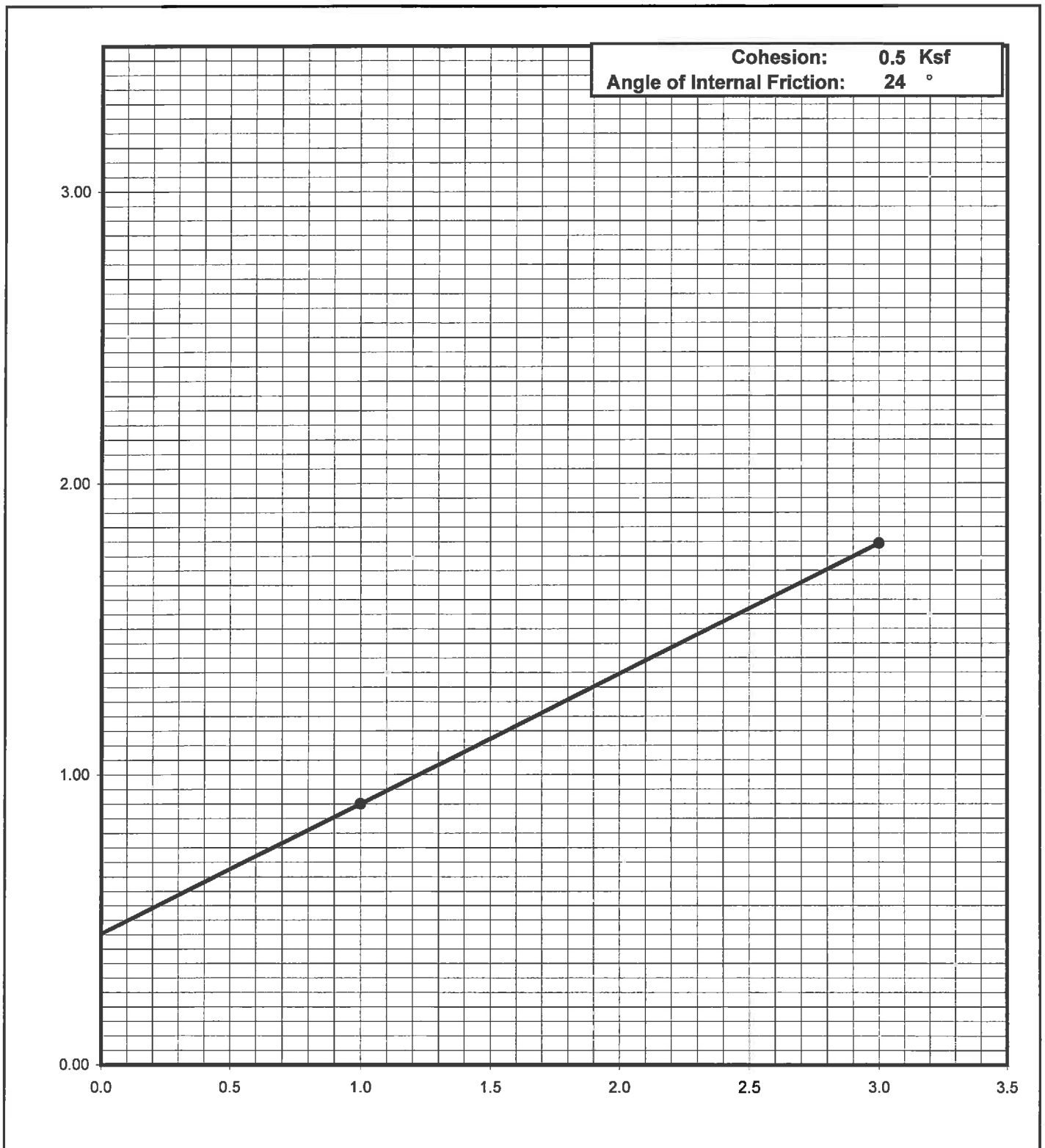
Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

Project Number	Boring No. & Depth	Soil Type	Date
3210024	B4 @ 3-4'	CL	5/18/2010



Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

Project Number	Boring No. & Depth	Soil Type	Date
3210024	B5 @ 2-3'	CL	5/18/2010



Expansion Index Test

ASTM D - 4829/ UBC Std. 18-2

Project Number : 3210024
Project Name : Proposed VA Northern California Health Care Sys
Date : 5/18/2010
Sample location/ Depth : 1-2'
Sample Number : X1
Soil Classification : CL

Trial #	1	2	3
Weight of Soil & Mold, gms	571.2		
Weight of Mold, gms	207.1		
Weight of Soil, gms	364.1		
Wet Density, Lbs/cu.ft.	109.8		
Weight of Moisture Sample (Wet), gms	300.0		
Weight of Moisture Sample (Dry), gms	265.1		
Moisture Content, %	13.2		
Dry Density, Lbs/cu.ft.	97.0		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	48.3		

Time	Initial	30 min	1 hr	6hrs	12 hrs	24 hrs
Dial Reading	0	--	--	--	--	0.094

Expansion Index_{measured} = 94

Expansion Index₅₀ = 92.4

Expansion Index = **92**

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Krazan Testing Laboratory

Expansion Index Test

ASTM D - 4829/ UBC Std. 18-2

Project Number : 3210024
Project Name : Proposed VA Northern California Health Care Sy
Date : 5/18/2010
Sample location/ Depth : 2-4'
Sample Number : X2
Soil Classification : SC

Trial #	1	2	3
Weight of Soil & Mold, gms	615.4		
Weight of Mold, gms	204.9		
Weight of Soil, gms	410.5		
Wet Density, Lbs/cu.ft.	123.8		
Weight of Moisture Sample (Wet), gms	300.0		
Weight of Moisture Sample (Dry), gms	275.1		
Moisture Content, %	9.1		
Dry Density, Lbs/cu.ft.	113.5		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	50.5		

Time	Initial	30 min	1 hr	6hrs	12 hrs	24 hrs
Dial Reading	0	--	--	--	--	0.031

Expansion Index_{measured} = 31

Expansion Index₅₀ = 31.3

Expansion Index = **31**

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

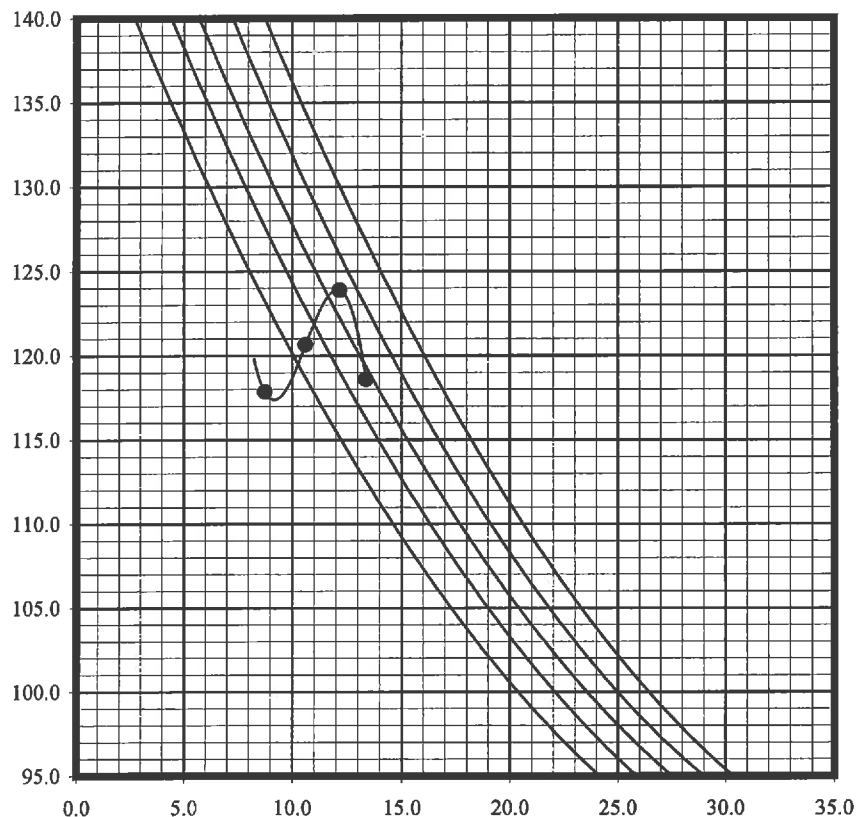
Krazan Testing Laboratory



**Laboratory Compaction Characteristics
of Soil using Modified Effort (56,000 ft. - lbf/ft³)
ASTM D1557**

Project Number	3210024	Sample Number	C1
Project Name	VA Hospital	Soil Classification	SC
Technician	CP	Soil Description	Light Brown Clayey Sand
Date	5/18/2010	Method	D1557A
Sample Location	1-3.5'		

	1	2	3	4
Mass of Moist Specimen & Mold, gm	4140.0	4056.8	4072.1	3977.2
Mass of Compaction Mold, gm	2041.1	2041.1	2041.1	2041.1
Mass of Moist Specimen, gm	2098.9	2015.7	2031.0	1936.1
Volume of Mold, cu./ft.	0.0333	0.0333	0.0333	0.0333
Wet Density, lbs./cu.ft.	139.0	133.4	134.5	128.2
Mass of Moisture (Wet), gm	200.0	200.0	200.0	200.0
Mass of Moisture (Dry), gm	178.3	180.8	176.4	183.9
Moisture Content (%)	12.2	10.6	13.4	8.8
Dry Density, lbs/cu.ft.	123.9	120.6	118.6	117.9



**Maximum Dry Density,
lbs.cu.ft.**

123.9

Optimum Moisture Content

12.1%

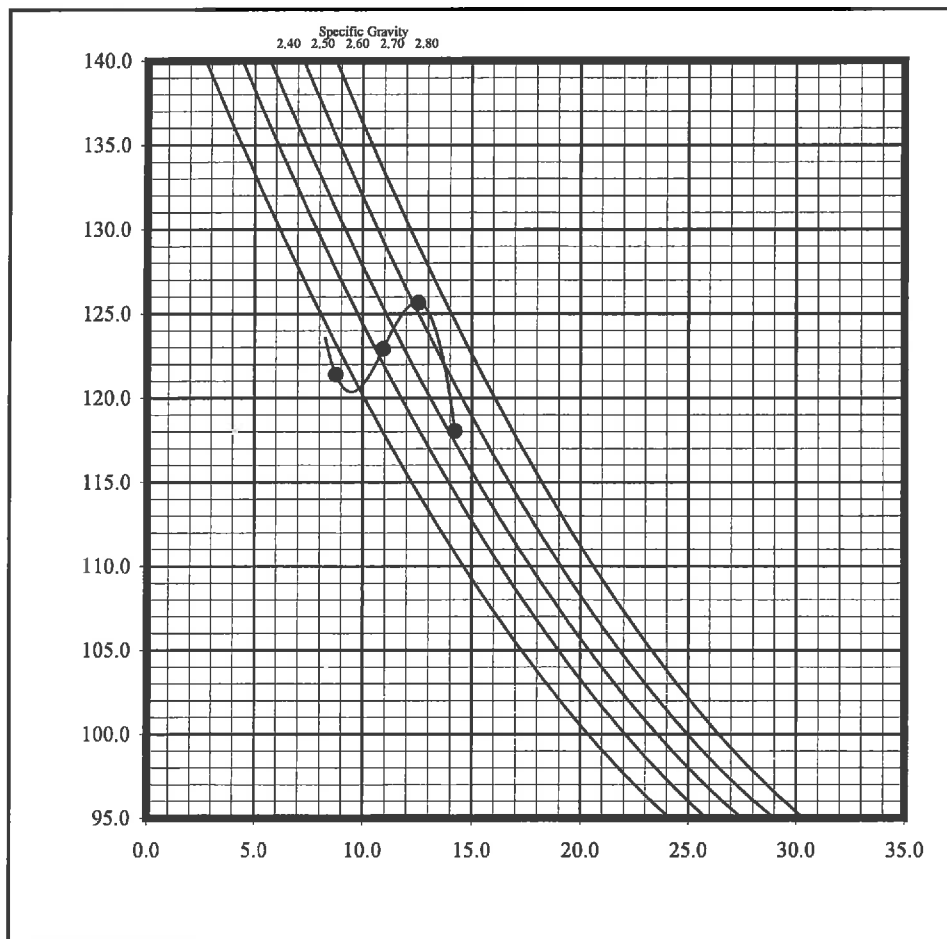
SDS#: -



**Laboratory Compaction Characteristics
of Soil using Modified Effort (56,000 ft. - lbf/ft³)
ASTM D1557**

Project Number	3210024	Sample Number	C2
Project Name	VA Hospital	Soil Classification	SC
Technician	CP	Soil Description	Light Brown Clayey Sand
Date	5/18/2010	Method	D1557A
Sample Location	1-2.5'		

	1	2	3	4
Mass of Moist Specimen & Mold, gm	4100.6	4177.1	4077.6	4035.2
Mass of Compaction Mold, gm	2041.1	2041.1	2041.1	2041.1
Mass of Moist Specimen, gm	2059.5	2136.0	2036.5	1994.1
Volume of Mold, cu./ft.	0.0333	0.0333	0.0333	0.0333
Wet Density, lbs./cu.ft.	136.3	141.4	134.8	132.0
Mass of Moisture (Wet), gm	200.0	200.0	200.0	200.0
Mass of Moisture (Dry), gm	180.3	177.7	175.1	183.9
Moisture Content (%)	10.9	12.5	14.2	8.8
Dry Density, lbs/cu.ft.	122.9	125.6	118.0	121.4



**Maximum Dry Density,
lbs.cu.ft.**

125.7

Optimum Moisture Content

12.5%

SDS#: _____

APPENDIX B

EARTHWORK SPECIFICATIONS

GENERAL

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including but not limited to the furnishing of all labor, tools, and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans, and disposal of excess materials.

PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of Krazan and Associates, Inc., hereinafter known as the Soils Engineer and/or Testing Agency. Attainment of design grades when achieved shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer or project Architect.

No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

TECHNICAL REQUIREMENTS: All compacted materials shall be densified to a density not less than 90 percent relative compaction based on ASTM Test Method D1557 or CAL-216, as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be as determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.

SOILS AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the soil report.

The Contractor shall make his own interpretation of the data contained in said report, and the Contractor shall not be relieved of liability under the Contract documents for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or windblown materials attributable to his work.

SITE PREPARATION

Site preparation shall consist of site clearing and grubbing and the preparations of foundation materials for receiving fill.

CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter, and all other matter determined by the Soils Engineer to be deleterious or otherwise unsuitable. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed building areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots larger than 1 inch. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations should not be permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

SUBGRADE PREPARATION: Surfaces to receive Engineered Fill, building or slab loads shall be prepared as outlined above, excavated/scarified to a depth of 12 inches, moisture-conditioned as necessary, and compacted to 90 percent relative compaction.

Loose soil areas, areas of uncertified fill, and/or areas of disturbed soils shall be moisture-conditioned as necessary and recompact to 90 percent relative compaction. All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any of the fill material.

EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.

PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. However, compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer.

Both cut and fill areas shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill are as specified.

APPENDIX C

PAVEMENT SPECIFICATIONS

1. DEFINITIONS - The term "pavement" shall include asphaltic concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed.

The term "Standard Specifications": hereinafter referred to is the May 2006 Standard Specifications of the State of California, Department of Transportation, and the "Materials Manual" is the Materials Manual of Testing and Control Procedures, State of California, Department of Public Works, Division of Highways. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as defined in the applicable tests outlined in the Materials Manual.

2. SCOPE OF WORK - This portion of the work shall include all labor, materials, tools, and equipment necessary for, and reasonably incidental to the completion of the pavement shown on the plans and as herein specified, except work specifically noted as "Work Not Included."

3. PREPARATION OF THE SUBGRADE - The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum relative compaction of 90 percent. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.

4. UNTREATED AGGREGATE BASE - The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of Section 26 of the Standard Specifications for Class II material, 1½ inches maximum size. The aggregate base material shall be spread and compacted in accordance with Section 26 of the Standard Specifications. The aggregate base material shall be spread in layers not exceeding 6 inches and each layer of aggregate material course shall be tested and approved by the Soils Engineer prior to the placement of successive layers. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent.

5. AGGREGATE SUBBASE - The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of Section 25 of the Standard Specifications for Class II material. The aggregate subbase material shall be compacted to a minimum relative compaction of 95 percent, and it shall be spread and compacted in accordance with Section 25 of the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

6. ASPHALTIC CONCRETE SURFACING - Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades and dimensions shown on the plans. The viscosity grade of the asphalt shall be PG 64-10. The mineral aggregate shall be Type B, ½ inch maximum size, medium grading and shall conform to the requirements set forth in Section 39 of the Standard Specifications. The drying, proportioning and mixing of the materials shall conform to Section 39.

The prime coat, spreading and compacting equipment and spreading and compacting mixture shall conform to the applicable chapters of Section 39, with the exception that no surface course shall be placed when the atmospheric temperature is below 50° F. The surfacing shall be rolled with a combination of steel wheel and pneumatic rollers, as described in Section 39-6. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

7. FOG SEAL COAT - The fog seal (mixing type asphaltic emulsion) shall conform to and be applied in accordance with the requirements of Section 37.