Appendix GEO

Geotechnical Engineering Investigation

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED SENTER ROAD DEVELOPMENT
8418 SENTER ROAD
SAN JOSE, CALIFORNIA

KA PROJECT NO. 042-21018
JULY 13, 2021

Prepared for:

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Prepared by:

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July 13, 2021

KA Project No. 042-21018

Mr. Matthew Ramos
AMG & Associates, LLC
P.O. Box 260770
Encino, California 91426

RE: Geotechnical Engineering Investigation
Proposed Senter Road Development
8418 Senter Road
San Jose, California

Dear Mr. Ramos

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 (925) 307-1160.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

REGISTERED PROFESSIONAL ENGINEER
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INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed Senter Road Development to be located west of Senter Road, between Story Road and Alma Avenue in San Jose, 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, pavement design and soil cement reactivity.

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. Appendix D contains a guide to pile 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 14, 2021 (KA Proposal No. P379-21) 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 20 to 50 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 that development will include the construction of a new mixed-use development. It is anticipated the buildings will be three-story structures. Foundation loads are anticipated to be moderate to heavy. On-site paved areas and landscaping are also planned for the development of 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, SITE HISTORY AND SITE DESCRIPTION

The site is rectangular in shape and encompasses approximately 2.34 acres. The site is located between Story Road and Alma Avenue, just west of Senter Road in San Jose, California. A golf course is located west of the site. The remainder of the site is predominately surrounded by commercial developments and multi-family residential developments.

Site history was obtained by reviewing historical aerial photographs taken in 1998, 2007, 2017 and 2020. Review of the 1998 aerial photograph indicates that the project site predominately consisted of vacant land. Senter Road trended along the eastern edge of the site. The remainder of the site was predominately surrounded by residential developments, commercial developments and a recreational area utilized for baseball fields, tennis courts and a running track.

Review of the 2007 aerial photograph indicates that the project site conditions appeared to be relatively similar to that noted in the 1998 aerial photograph.

Review of the 2017 aerial photograph indicates that the baseball fields and tennis courts located west of the site had been removed. The property west of the site had been converted to a golf course.

Review of the 2020 aerial photograph indicates that the project site conditions appeared relatively similar to that noted in the 2017 aerial photograph.

Presently, the site predominately consists of vacant land. The site is covered by a sparse to moderate weed growth and the surface soils have a loose consistency. Trees are located within the site. Buried utilities are located along the edges of the site and extend into portions of the site. The site is relatively level with no major changes in grade.

GEOLOGIC SETTING

The project area is located just south of San Francisco Bay and east of the Santa Cruz Mountains within the northern portion of the Coast Ranges Geomorphic Province of California. The Coast Ranges generally consist of an alternating series of parallel mountains and valleys located adjacent to the Pacific Coast. The bedrock units that form the range have been disrupted by intense folding, faulting, and crushing that occurred when the range was formed by the processes of plate tectonics. During the Jurassic and Cretaceous Periods (about 150 to 80 million years ago), the Pacific Oceanic Plate, which was progressively moving towards the east, collided with the North American Continental Plate, which was moving toward the west. This collision caused the less rigid Pacific Oceanic Plate to be subducted beneath the North American Continental Plate. The colliding motion of the two plates caused portions of the Pacific Oceanic Crust and overlying marine sediments to be piled onto the North American Continental Plate along the west coast of California. The resulting chaotic jumble of bedrock units scraped off onto the North American Plate, is known as the "Franciscan Assemblage" and comprises a large portion of the Coast Range Province. Subsequent development of a series of northwest-trending fault zones has further contributed to the deformation of the Coast Range.

The near-surface deposits in the vicinity of the subject site are indicated to be comprised of Holocene alluvial fan deposits and alluvial fan levee deposits consisting of sands, silt, and clays derived from erosion of local mountain ranges. Deposits encountered on the subject site during exploratory drilling are discussed in detail in this report.

Seven major faults are located near the site: The Monte Vista–Shannon fault, the San Andreas fault, the Calaveras fault, the Hayward fault, the Zayante-Vergeles fault, the Greenville fault, and the Mount Diablo Thrust fault. The Calaveras fault is located approximately 8 miles east of the site and is considered capable of producing an earthquake of magnitude of 6.9. The Monte Vista–Shannon fault and the San Andreas fault are located approximately 7 to 12 miles west of the site, respectively. The San Andreas fault was the source of the 1906 San Francisco Earthquake. The Hayward fault is located approximately 9 miles north of the site. The Hayward fault is considered capable of producing an earthquake event of magnitude 7.0. The last recorded movement of the Hayward fault was in 1868. The Zaynte-Vergeles fault is approximately 17 miles south of the site and is considered capable of producing an earthquake of magnitude 7.0. The Mount Diablo Thrust and San Gregorio fault are located approximately 28 miles north and 27 miles west of the site, respectively, and are also considered capable of producing large earthquakes. Although the site is in close proximity to several faults, the site is not within a State of California Earthquake Fault Zone or Special Study Zone for faulting.

The probability of one or more earthquakes of magnitude 6.7 or higher occurring in the San Francisco Bay Area within a 30-year period of time was evaluated by the U.S. Geological Survey (USGS) Working Group on California Earthquake Probabilities on a periodic basis. The result of the 2008 evaluation indicated a 63 percent likelihood that such an earthquake event will occur in the Bay Area between 2007 and 2036 (USGS 2008). The faults with the greater probability of a magnitude 6.7 or higher earthquake are the Hayward fault at 31 percent and the San Andreas fault at 21 percent.

The Alquist-Priolo Earthquake Fault Zoning Act went into effect in March, 1973. Since that time, the act has been amended 11 times (Hart, 2007). The purpose of the Act, as provided in CGS Special Publication 42 (SP 42), is to prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." The act was renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1994, and at that time, the originally designated "Special Studies Zones" was renamed the "Earthquake Fault Zones."

The area of the subject site is included on the Earthquake Zones of Regional Investigation for the San Jose East Quadrangle. However, the site is not within a Fault-Rupture Hazard Zone. The nearest zoned faults are portions of the Calaveras fault located 7.6 miles west of the subject site.

In 1990, the California State Legislature passed the Seismic Hazard Mapping Act to protect public safety from the effects of strong shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes. The Act requires that the State Geologist delineate various seismic hazards zones on Seismic Hazards Zones Maps. Specifically, the maps identify areas where soil liquefaction and earthquake-induced landslides are most likely to occur. A site-specific geotechnical evaluation is required prior to permitting most urban developments within the mapped zones. The Act also requires sellers of real property within the zones to disclose this fact to potential buyers. The area of the subject site is located within the bounds of the hazard zone associated with liquefaction potential and is outside of the zones associated with landslide potential, on the Seismic Hazards Zones San Jose East Quadrangle, dated, January 17, 2001. In addition, the site is included on the U.S. Geological Survey map entitled "Liquefaction Susceptibility, Central San Francisco Bay Region, California" (U.S. Geological Survey Open-File Report 2006-1037), dated 2006. The site is located within an area identified as a moderate susceptibility to liquefaction.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored by drilling 6 borings to depths ranging from approximately 20 to 50 feet below existing site grade, using a truck-mounted drill rig. In addition, 2 bulk subgrade samples were obtained from the site for laboratory R-value testing. The approximate boring and bulk sample 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, plasticity, R-value and moisture-density relationships of the materials encountered. In addition, chemical tests were performed to evaluate the soil-cement reactivity. 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 upper soils consisted of approximately 6 to 12 inches of very loose clayey sand, sandy clayey silt or sandy clay. These soils are disturbed, have low strength characteristics and are highly compressible when saturated.

Beneath the loose surface soils, approximately 3 to 6 feet of fill material was encountered. The fill material predominately consisted of clayey sand, sandy clayey silt and sandy clay. These soils contained varying amounts of gravel and clay. 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 soils during the time of our field and laboratory investigations. The limited testing indicates that the fill material had varying strength characteristics ranging from loosely placed to compacted.

Below the fill material, approximately 3½ to 9 feet of medium dense silty sand and sandy silt or firm to very stiff silty clay and sandy clay were encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance ranged from 9 to 26 blows per foot. Dry densities ranged from 88 to 116 pcf. A representative soil sample consolidated approximately 3 percent under a 2 ksf load when saturated. A representative soil sample had an angle of internal friction of 27 degrees.

Below 6½ to 15 feet, predominately firm to very stiff silty clay, sandy clay/sandy silt and sandy clay or loose to medium dense silty sand/sandy silt, clayey sandy silt and sandy silt were encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. The clayey soils have a high potential for expansion. Penetration resistance ranged from 7 to 33 blows per foot. Dry densities ranged from 87 to 117 pcf. Representative soil samples contained approximately 55 to 98 percent fines. 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 encountered at approximately 17 feet below existing site grade. Historic high groundwater was estimated to be 2 feet based on information obtained from the California Geological Survey.

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

To evaluate the liquefaction potential of the site, the following items were evaluated:

1) Soil type

2) Groundwater depth

3) Relative density

4) Initial confining pressure

5) Intensity and duration of groundshaking

The predominant soils within the project site consist of alternating layers of clayey sands, silty clays, sandy clays, silty sands and sandy silts. Free groundwater was encountered at a depth of 17 feet below existing site grade during our exploratory drilling. Historically, groundwater has been as shallow as 2 feet within the project site vicinity (California Department of Water Resources, Water Data Library Well No. 07S01E16C011M). A groundwater depth of 2 feet was used in this analysis.

The potential for soil liquefaction during a seismic event was evaluated using the LIQUEFYPRO computer program (version 5.8h) developed by CivilTech Software. For the analysis, a maximum earthquake magnitude of 6.91 was used. A peak horizontal ground surface acceleration of 0.692g was considered conservative and appropriate for the liquefaction analysis. A high groundwater depth of 2 feet was used for our analysis. The computer analysis indicates that soils above a depth of 2 feet are non-liquefiable due to the absence of groundwater. Some of the soils below a depth of 6 feet have a slight to moderate potential for liquefaction under seismic shaking.

The analysis indicates that the estimated total seismic induced settlement ranges from 2 to 6 inches. Differential settlement caused by a seismic event is estimated to be less than 4 inches. The anticipated differential settlement is estimated over a horizontal distance of 100 feet. The result of the liquefaction analysis is attached. The results of the screening analysis are as follows:

Boring: B5 | Project No.: 042-21018

Liquefaction Assessment of Fine-Grained Soils									
Sample Depth	Soil Description	Soil Class. (USCS)	Passing #200 (%)	Wc/LL	Moisture Content (%)	Liquid Limit	Plasticity Index	Liquefiable	
2	Sandy Clayey Silt	ML	70	--	7.9	--	--	Y	Y
5	Sandy Clay	CL	72	0.328	9.2	28	10	N	Y
10	Sandy Clay	CL	80	0.568	15.9	28	10	N	Y
15	Sandy Clay	CL	90	0.568	22.4	37	16	N	Y
20	Sandy Clay	CL	91	0.624	25.6	41	22	N	N
25	Sandy Clay	CL	84	0.761	23.6	31	12	N	Y
30	Clayey Sandy Silt	ML	55	--	19.3	--	--	Y	Y
35	Silty Clay	CL	96	0.834	26.7	32	11	Y	Y
40	Silty Clay	CL	98	0.719	28.0	39	19	N	Y
45	Silty Clay	CL	97	0.650	31.2	48	25	N	N

Boring: B6 | Project No.: 042-21018

Liquefaction Assessment of Fine-Grained Soils									
Sample Depth	Soil Description	Soil Class. (USCS)	Passing #200 (%)	Wc/LL	Moisture Content (%)	Liquid Limit	Plasticity Index	Liquefiable	
2	Sandy Clay	CL	70	--	12.4	--	--	Y	Y
5	Sandy Clay	CL	60		15.0	--	--	Y	Y
10	Sandy Silt	ML	57	--	11.5	-	--	Y	Y
15	Sandy Silt	ML	62	--	21.8	--	--	Y	Y
20	Sandy Clay	CL	94	0.817	29.4	36	18	Y	Y
25	Sandy Clay	CL	74	0.700	22.4	32	13	N	Y
30	Sandy Silt	ML	65	--	25.0	--	--	Y	Y
35	Sandy Silt	ML	64	--	22.0	--	--	Y	Y
40	Sandy Silt	ML	94	--	26.1	--	--	Y	Y
45	Sandy Clay/Sandy Silt	CL/ML	64	1.061	24.4	23	5	Y	Y

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 surrounding development, fill material, moderate expansion potential of the on-site clayey soils, and estimated settlement associated with the potential for liquefaction, appear to be conducive to the development of the project. Approximately 3 to 6 feet of fill material was encountered within the borings drilled at the site. The fill material predominately consisted of clayey sand, sandy clayey silt and sandy clay. 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 soils during the time of our field and laboratory investigations. The limited testing indicates that the fill material had varying strength characteristics ranging from loosely placed to compacted. If the structure will be supported on a mat foundation, the fill soils will need to be removed and recompacted. The clayey soils will not be suitable for reuse as non-expansive Engineered Fill. However, the clayey soils will be suitable for reuse as General Engineered Fill, provided they are cleansed of excessive organics and debris and are moisture-conditioned to a minimum of 2 percent above optimum moisture content. The soils that do not contain clay will be suitable for re-use as non-expansive Engineered Fill, provided they are cleansed of excessive organics and debris. If the structure will be supported on a deep foundation system, removal of the fill will not be required. However, the floor slabs will need to be designed as structural slabs spanning between deep foundation elements.

The site predominately consists of vacant land. However, several structures are located within the project site vicinity. Any surface or buried structures, including utilities, encountered during construction should be properly removed and the resulting excavations backfilled. It is suspected demolition of the existing structures will disturb the upper soils. Areas disturbed by demolition activities should be excavated to firm native ground. The resulting excavations should be backfilled with Engineered Fill. This compaction effort should stabilize the upper soils and locate any unsuitable or pliant areas not found during our field investigation.

The on-site clayey soils have a moderate swell potential. The clayey soils in their present condition present a minor to moderate hazard to construction in terms of possible post-construction movement of slab-on-grade construction. To reduce potential soil movement related to swell potential of the clayey soils, it is recommended that slabs-on-grade and exterior flatwork areas be supported by at least 24 inches of non-expansive Engineered 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 soils below, which may result in soil swelling. The replacement soils and/or 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 slab-on-grade areas. The non-expansive replacement soils should be compacted to at least 90 percent of 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 continually moist, prior to backfilling.

As an alternative to the use of non-expansive soils, the upper 24 inches of soil supporting 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. 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.

Based on the soil liquefaction analysis performed within the site, the estimated total seismic-induced settlement ranges from 2 to 6 inches. Differential settlement caused by a seismic event is estimated to be less than 4 inches. The anticipated differential settlement is estimated over a horizontal distance of 100 feet. The seismic settlements would develop if liquefaction of the underlying saturated subsoils were to occur during a seismic event.

In recent years, precast, pre-stressed concrete piles or drilled displacement piers have proven to be the most economical alternative — particularly where piles must be extended through soft or liquefiable soils into an underlying stiff stratum. The principal drawback to pre-stressed piles is the inflexibility in length adjustments during construction. This generally can be overcome by use of an adequate indicator pile installation program and pile load tests.

Non-displacement piles, such as open-end pipe piles and H-piles, also can be used, but final pile lengths to attain equivalent capacity would likely prove excessive. Hence, design criteria for only pre-stressed concrete piles and drilled displacement piles are included herein. Our firm would be pleased to provide design criteria for other pile types, upon request. A tapered pile is considered less desirable due to the possible reduction in uplift resistance should small upward movements of the pile occur. If deep foundations are utilized, concrete slab-on-grade floors should consist of a structural slab designed to span between the deep foundation and grade beam systems.

Sandy and gravelly soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavations. Shoring or sloping back trench sidewalls may be required within these sandy and gravelly soils.

Groundwater Influence on Structures/Construction

During our recent field investigation groundwater was encountered at approximately 17 feet below existing site grade. Historic high groundwater level for the site was determined to be 2 feet. Therefore, dewatering and/or waterproofing may be required should structures or excavations extend below this depth. If groundwater is encountered, our firm should be consulted prior to dewatering the site. Installation of a standpipe piezometer is suggested prior to construction should groundwater levels be a concern.

In addition to the groundwater level 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 – Mat Foundation

General site clearing should include removal of 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 reuse as Engineered Fill. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas.

Approximately 3 to 6 feet of fill material was encountered within the site. The fill material predominately consisted of clayey sand, sandy clayey silt and sandy clay. 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 soils during the time of our field and laboratory investigations. The limited testing indicates that the fill material was loosely placed and not properly compacted. Therefore, it is recommended that the fill soils be excavated and stockpiled so that the native soils can be properly prepared. These clayey soils will not be suitable for reuse as non-expansive Engineered Fill. However, the clayey soils will be suitable for reuse as General Engineered Fill, provided they are cleansed of excessive organics and debris, and are moisture-conditioned to a minimum of 2 percent above optimum moisture content. Prior to fill placement, Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal will be required.

Existing structures are located within the site vicinity. Associated with these developments are buried structures, such as utility lines. Any surface or buried structures, such as utilities or loosely backfilled excavations, encountered during construction should be properly removed and the resulting excavations backfilled. After demolition activities, it is recommended that these disturbed soils be removed and/or recompacted. 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.

Trees and shrubs are located within the site. If not utilized for the proposed development, tree and shrub 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.

Following stripping, fill removal, and demolition activities, it is recommended that at a minimum, the upper 12 inches of exposed subgrade soils beneath the building pad 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. Limits of recompaction should extend a minimum of 5 feet beyond structural elements. Prior to backfilling, the bottom of the excavation should be proof-rolled and observed by Krazan & Associates, Inc. to verify stability. This compaction effort should stabilize the upper soils and locate any unsuitable or pliant areas not found during our field investigation. Soft or pliant areas should be excavated to firm native ground.

Following stripping, fill removal, and demolition activities, it is recommended that at a minimum, the upper 12 inches of exposed subgrade soils beneath the exterior flatwork and pavement areas be excavated/scarified, 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 a minimum of 2 feet beyond flatwork and pavements. This compaction effort should stabilize the upper soils and locate any unsuitable or pliant areas not found during our field investigation.

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 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. In addition, it is recommended footings and concrete slabs-on-grade be nominally reinforced.

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 and 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.

Site Preparation - Deep Foundations

General site clearing should include removal of 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.

Existing structures are located within the project site vicinity. Any buried structures encountered during construction should be properly removed and backfilled. 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 encountered during construction should be properly removed and backfilled in accordance with the recommendations of the Soils Engineer. The exposed native subgrade should be scarified to a minimum of 6 inches, 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.

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. The intent is to support slab-on-grade and exterior flatwork areas with 24 inches of non-expansive or lime-treated Engineered 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. The on-site, existing silty sand and gravelly silty sand materials will be suitable for reuse as non-expansive Engineered Fill.

As indicated previously, fill material is located throughout the site. The Owner should be aware that the paved areas may settle which may require annual maintenance. At a minimum, it is recommended that the upper 12 inches of subgrade soil within pavement areas be moisture-conditioned as necessary and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Krazan & Associates, Inc. should verify the stability of the subgrade prior to aggregate base placement to identify soft or pliant areas. These areas will need to be remediated prior to placement of aggregate base. In addition, it is recommended the utilities utilize flexible connectors.

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 organic-free, on-site, upper native soils and fill material are predominately clayey sands, sandy clays and clayey silts. These soils contained varying amounts of 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 conventional 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. The clayey soils should be above optimum moisture-condition during mixing operations. Additional testing is recommended to determine the appropriate application rate of lime prior to placement. These clayey soils will be suitable for reuse as General Engineered Fill, within pavement areas, structural areas supported by post-tensioned or structural slabs, and below 24 inches from finished pad grade in building areas, provided they are cleansed of excessive organics, debris, and moisture-conditioned to at least 2 percent above optimum moisture. It is recommended that additional testing be performed on the on-site soils and fill material to evaluate the physical and index properties prior to reuse as Engineered Fill.

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 Fill should consist of a well-graded, slightly cohesive, fine silty sand or sandy silt soil, 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 to a minimum of 2 percent above optimum moisture content, and compacted to achieve at least 90 percent of maximum density based on ASTM 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 1804 of the 2019 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 1 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 12 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 practice 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 reduced; 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 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 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 maximum density based on ASTM Test Method D1557. Pipe bedding should be in accordance with pipe manufacturer's recommendations.

Sandy and gravelly soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavation. Shoring or sloping back trench sidewalls may be required within these sandy and gravelly soils.

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 - Driven Piles or Drilled Displacement Piles

The proposed building area may be supported on precast, prestressed concrete piles. Several pile sizes would be acceptable. Twelve- and 14-inch square, prestressed concrete piles most often have been chosen for projects characterized by soil conditions similar to those at the site. It is understood the project may use 16-inch circular piles. Based on procedures developed by Meyerhof (1976) and Brom (1964), Table No. 2 presents ultimate bearing, uplift, and lateral capacities for preliminary design. In order to utilize the full capacity of the piles, piles should be spaced at least 3-pile diameter apart. Total capacity of pile group spaced 2-pile diameter should be reduced by 15 percent. For pile group spaced 1-pile diameter, total capacity should be reduced 35 percent. A minimum factor of safety of 2 has been applied for dead-plus-sustained live loading, while a minimum factor of safety of 1.5 has been applied for the temporary effects of wind and seismic loading. The weight of the pier cap extending below grade and the weight of each pile may be disregarded in determinations of the net compression load transferred to the supporting soil.

The piles should penetrate at least 10 feet into the stiff soils or a minimum depth of 50 feet. For bidding purposes, we recommend an average tip elevation of 50 feet below the surface. We emphasize that this elevation is intended for bidding purposes only as variation in lengths of driven piles may vary as much as 10 feet from one portion of the building to the other. Unit price for the project is in piling lengths from the estimated tip elevation should be included in the bidding schedule as stipulated in the attached guide specification for piling.

Allowable Pile Capacity, kips				
Load Condition	**Minimum Factor of Safety**	**12-Inch Allowable Bearing**	**14-Inch Allowable Bearing**	**16-Inch* Allowable Bearing**
Axial Downward -				
Dead Load	3.0	65	80	80
Dead Plus Live Load	2.0	100	120	120
Total Load (including seismic or wind forces)	1.5	135	160	160
Lateral	2	10	10	10
Uplift	2	55	65	32

* Circular Pile

The uplift capacities are based on the assumption that piles will be properly reinforced to transfer pullout forces to the pile tips. Final pile lengths and capacities should be determined based on the results of full-scale load tests performed prior to construction and the driving of indicator piles. If the client decides that load tests will not be performed, the pile capacities should be reconsidered and an additional safety factor applied to account for the greater uncertainty, which would then exist. The lateral load and information is for preliminary design. Once lateral load reactions are determined, an LPile analysis can be performed.

Maximum total and differential settlements of 1 inch should be anticipated for design. Foundation settlements should be primarily elastic, with a majority occurring during or soon after structural loading. The remaining settlement should occur slowly with time due to dissipation of excess pore pressures and soil creep.

Indicator Piles

If driven piles will be used, we recommend that indicator piles be driven prior to the start of production pile driving to determine lengths of the remaining piles. The number and location of the indicator piles should be determined by the Contractor in coordination with our firm. Determine of pile cast lengths also should be the responsibility of the Contractor.

The indicator piles may be used as production piles for building support if they are properly located and meet the criteria established upon completion of the pile load testing program.

Pile Load Tests

At the option of the Contractor, at least 2 pile load tests may be performed on various length piles to determine the final allowable load capacities. These tests are considered the best method for defining the capacity of pile foundations, and allow for the maximum use of actual pile capacities and thereby the most economical pile design.

The arrangement of tests and reaction piles should conform to the applicable provisions of ASTM Test Method D1143. A plan of the proposed system should be submitted to our firm for approval prior to installation. It is our intent to load one of the piles in compression to at least twice the design load, and to load the other pile to failure. The guide specifications presented in Appendix D include descriptions of required equipment and setup for the testing program, and responsibilities of the Pile Contractor. Final pile driving criteria should be determined from the results of the pile load testing program and from information derived during driving of indicator piles.

We emphasize that the test piles and the reaction piles associated with the pile load test program should be abandoned and not structurally incorporated. The load test arrays, therefore, should be situated away from the propose production pile locations where they will not conflict with the new construction.

Pile Installation

A representative from our firm should be present during both indicator and production pile driving to evaluate and record the penetration behavior of each pile as it is driven. It is recommended that the Piling Contractor be required to submit data on the proposed pile driving equipment at least 3 days prior to the beginning of driving operations. Jetting or predrilling for driven piles should not be allowed as this could substantially reduce the frictional capabilities of the pile.

Site Monitoring

The buildings adjacent to the proposed building should be monitored during both indicator and production pile driving to evaluate any response to hammer-induced vibrations. Records should be kept of the settlement (if any) sustained by adjacent structures. To avoid disputes that may arise between the Pile Contractor and the current property owner, records should be kept of survey data and photographs should be taken where required, both before and after pile driving. Reference points should be tied to benchmarks established well beyond the influence of the construction work. Protection of adjacent buildings should be the responsibility of the Pile Contractor.

Foundations - Structural Slab

The building may be supported on a structural slab/foundation system. Utilization of a structural slab designed utilizing the design parameters provided in this report. If this option is utilized, the mat foundation should be underlain by a minimum of 18 inches of non-expansive or lime-treated Engineered Fill. In addition, the previously recommended densification of the upper native soils and fill material at the site should still be performed. After completion of the recommended site preparation, the structural slab foundation can be designed utilizing allowable bearing pressure of 1,500 pounds per square foot for dead-plus-live loads. The slab can be designed for isolated concentrated peak stress loads of 2,000 psf for dead-plus-live loads. These values may be increased ⅓ for short duration loads such as wind or seismic. The slab may be designed using a modulus of subgrade reaction (k) of 75 pounds per square inch per inch (pci). The thickened edges of the slab should have a minimum depth of 12 inches below pad grade (soil grade) or exterior grade, whichever is lower. Ultimate design of the slab and reinforcement should be performed by the project Structural Engineer.

Resistance to lateral 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 ⅓ increase in the above value may be used for short duration, wind, or seismic loads.

Floor Slabs and Exterior Flatwork

The floor slab should be designed as a structural slab to span between deep foundation elements. Reinforcement for the slab should be designed by the project's structural engineer.

In areas that will utilize moisture-sensitive floor coverings, concrete slab-on-grade floors should be underlain by a water vapor retarder. The water vapor retarder should be installed in accordance with accepted engineering practice. The water vapor retarder should consist of a vapor retarder sheeting underlain by a minimum of 3 inches of compacted, clean, gravel of ¾-inch maximum size. To aid in concrete curing an optional 2 to 4 inches of granular fill may be placed on top of the vapor retarder. The granular fill should consist of damp clean sand with at least 10 to 30 percent of the sand passing the 100 sieve. The sand should be free of clay, silt, or organic material. Rock dust which is manufactured sand from rock crushing operations is typically suitable for the granular fill. This granular fill material should be compacted.

The exterior floors should be poured separately in order to act independently of the walls and foundation system. Exterior finish grades should be sloped a minimum of 2 percent away from all interior slab areas to preclude ponding of water adjacent to the structures. All fills required to bring the building pads to grade should be Engineered Fills.

Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor can travel through the vapor membrane and penetrate the slab-on-grade. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To reduce moisture vapor intrusion, it is recommended that a vapor retarder be installed. It is recommended that the utility trenches within the structure be compacted, as specified in our report, to reduce the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the building is recommended. Positive drainage should be established away from the structure and should be maintained throughout the life of the structure. Ponding of water should not be allowed adjacent to the structure. Over-irrigation within landscaped areas adjacent to the structure should not be performed. In addition, ventilation of the structure (i.e. ventilation fans) is recommended to reduce the accumulation of interior moisture.

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 that are incapable of this deflection or walls that are fully constrained against deflection may be designed for an equivalent fluid at-rest pressure of 70 pounds per square foot per foot per 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.

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.

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 reduce surface drainage into the wall drain system. The aggregate should conform to Class 2 permeable materials graded in accordance with the CalTrans Standard Specifications (2018). 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 ⅛ inch in diameter, while perforations should be no more than ¼ 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 the CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

R-Value Test Results and Pavement Design

Two subgrade soil samples were obtained from the project site for R-value testing at the locations shown on the attached site plan. The samples were tested in accordance with the State of California Materials Manual Test Designation 301. Results of the tests are as follows:

Sample	Depth	Description	R-Value at Equilibrium
1	12-24"	Clayey Sand (SC)	18
2	12-24"	Sandy Clay (CL)	11

The test results are low and indicate fair 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"	7.0"	--	12.0"
4.0	2.0"	4.5"	2.5"	12.0"
4.5	2.5"	7.0"	--	12.0"
4.5	2.5"	4.0"	3.5"	12.0"
5.0	2.5"	8.5"	--	12.0"
5.0	2.5"	5.0"	4.0"	12.0"
5.5	3.0"	9.0"	--	12.0"
5.5	3.0"	5.0"	4.0"	12.0"
6.0	3.0"	11.0"	--	12.0"

6.0	3.0"	6.5"	5.0"	12.0"
6.5	3.5"	11.0"	--	12.0"
6.5	3.5"	6.0"	6.0"	12.0"
7.0	4.0"	12.0"	--	12.0"
7.0	4.0"	6.5"	6.5"	12.0"
7.5	4.0"	13.5"	--	12.0"
7.5	4.0"	7.5"	7.0"	12.0"

**** 95% compaction based on ASTM Test Method D1557 or CAL 216***
***** 90% compaction based on ASTM Test Method D1557 or CAL 216***

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

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	5.5"	4.0"	12.0"

HEAVY DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
7.0	7.0"	4.0"	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***

As indicated previously, fill material is located throughout the site. It is recommended that any uncertified fill material encountered within pavement areas be removed and/or recompacted. The fill material should be moisture-conditioned to near optimum moisture and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. As an alternative, the Owner may elect not to recompact the existing fill within paved areas. However, the Owner should be aware that the paved areas may settle which may require annual maintenance. At a minimum, it is recommended that the upper 12 inches of subgrade soil be moisture-conditioned as necessary and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Seismic Parameters – 2019 California Building Code

The Site Class per Section 1613 of the 2019 California Building Code (2019 CBC) and ASCE 7-16, Chapter 20 is based upon the site soil conditions. It is our opinion that a 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 2019 CBC, we recommend the following parameters:

Seismic Item	Value	CBC Reference
Site Class	D	Section 1613.2.2
Site Coefficient F_a	1.200	Table 1613.2.3 (1)
S_s	1.500	Section 1613.2.1
S_{MS}	1.800	Section 1613.2.3
S_{DS}	1.200	Section 1613.2.4
Site Coefficient F_v	1.700	Table 1613.2.3 (2)
S_1	0.600	Section 1613.2.1
S_{M1}	1.020	Section 1613.2.3
S_{D1}	0.680	Section 1613.2.4
T_S	0.567	Section 1613.2

* Values based on equivalent static force procedure being used in design.

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 CBC 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 in these soil samples were less than 150 ppm and are below the maximum allowable values established by HUD/FHA and CBC. 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 (925) 307-1160.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Steve Nelson
Project Engineer

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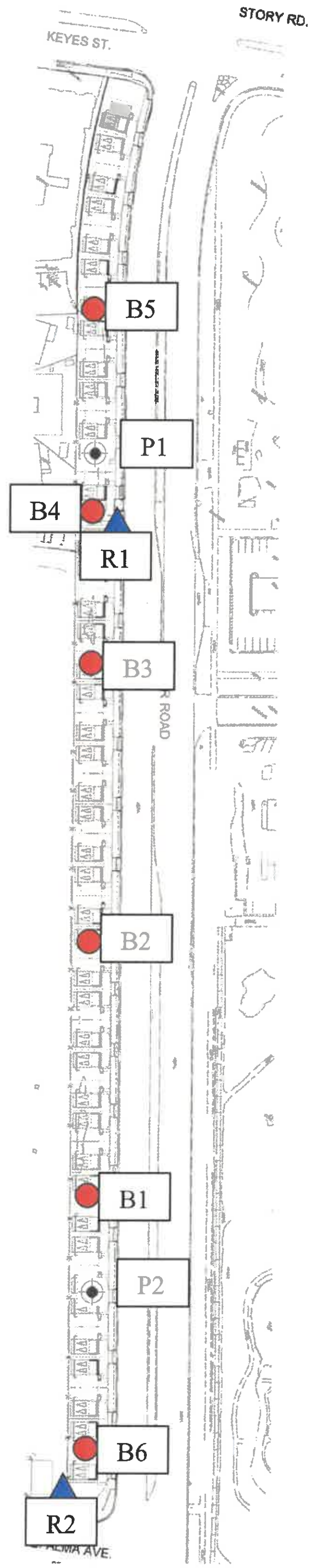
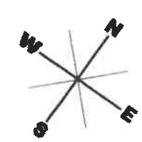




APPROXIMATE BORING LOCATION

APPROXIMATE R-VALUE LOCATION

APPROXIMATE PERCOLATION TEST LOCATION

SITE MAP	Scale: NTS	Date: July 2021	Krazan GEOTECHNICAL ENGINEERING
Senter Road Development **8418 Senter Road** **San Jose, California**	**Drawn by:** HT	**Approved by:** DJ	
	Project No. 042-21018	**Figure No.** 1	

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Six 4½-inch to 6½-inch diameter 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 and standard penetration tests were performed at selected depths. These tests represent the resistance to driving a 2½-inch and 1½-inch diameter split barrel sampler, respectively. 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. The modified standard penetration tests are identified in the sample type on the boring logs with a full shaded in block. The standard penetration tests are identified in the sample type on the boring logs with half of the block shaded. All samples were returned to our Clovis 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 completed for the undisturbed samples representative of the subsurface material. Atterberg limits, expansion index and R-value tests were completed for select bag samples obtained from the auger cuttings. 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

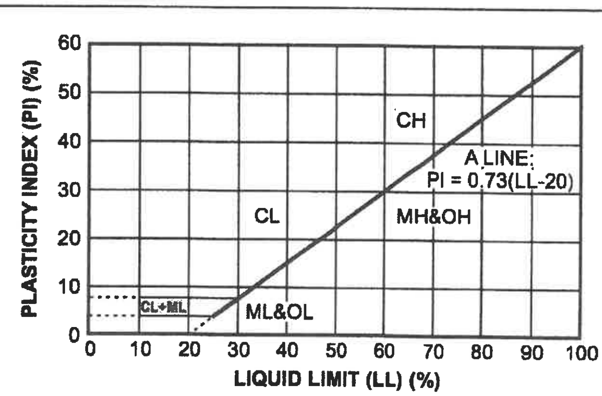
CONSISTENCY CLASSIFICATION

Description	Blows per Foot
Granular Soils	
Very Loose	< 5
Loose	5 – 15
Medium Dense	16 – 40
Dense	41 – 65
Very Dense	> 65
Cohesive Soils	
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	12 to 13 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

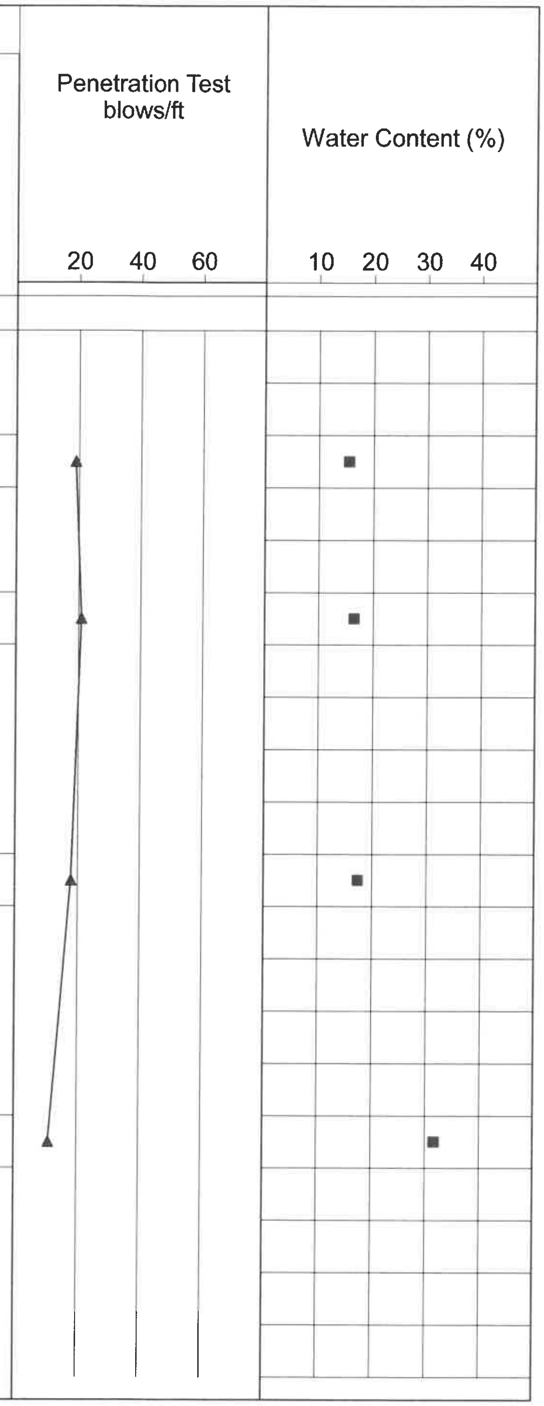
PLASTICITY CHART



Log of Boring B4

Project: Senter Road Development
Project No: 042-21018
Client: AMG & Associates, LLC
Figure No.: A-4
Location: 8418 Senter Road, San Jose, California
Logged By: Carlos Jimenez
Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0	Ground Surface				
0–6	***CLAYEY SAND (SC)*** FILL, fine- to medium-grained; dark brown, moist, drills easily				
2.5		113.0	15.5	■	19
5.5		110.1	16.5	■	21
6–20	***SILTY CLAY (CL)*** Stiff; brown, moist, drills easily				
10.5		107.3	17.4	■	18
15.5		92.6	31.7	■	11



Drill Method: Solid Flight
Drill Date: 6-9-21
Drill Rig: CME 45C-1
Krazan and Associates
Hole Size: 4½ Inches
Driller: Chris Wyneken
Elevation: 20 Feet
Sheet: 1 of 1

Log of Boring B1

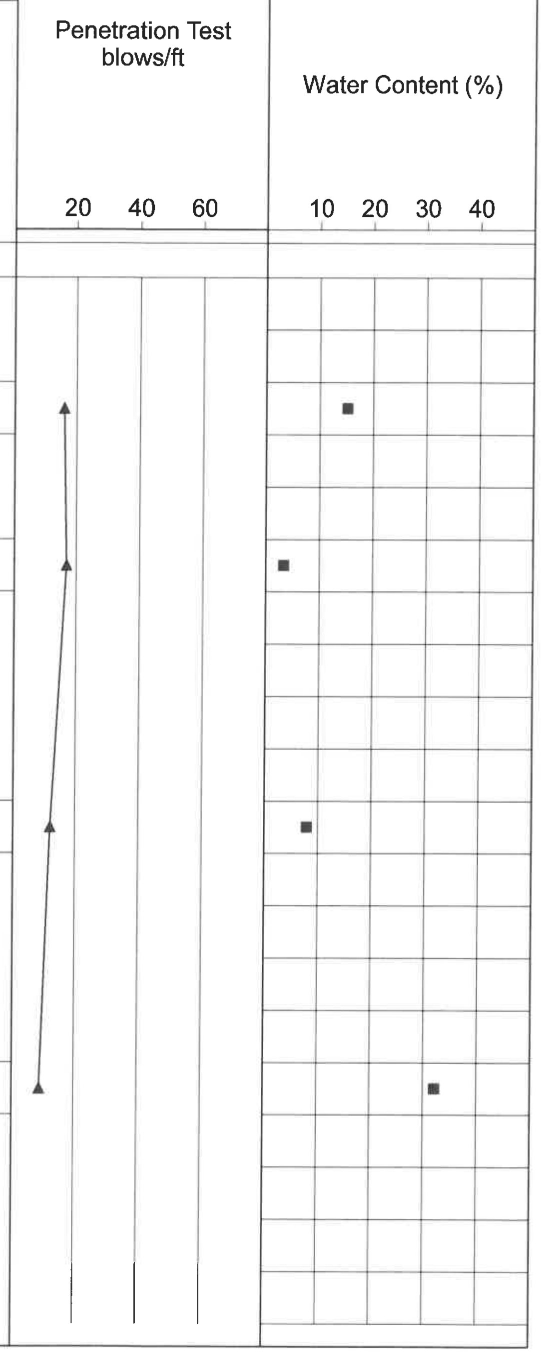
Project: Senter Road Development | **Project No:** 042-21018

Client: AMG & Associates, LLC | **Figure No.:** A-1

Location: 8418 Senter Road, San Jose, California | **Logged By:** Carlos Jimenez

Depth to Water> **Initial:** None | **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0–4		***SANDY CLAY (CL)*** FILL, fine- to coarse-grained with GRAVEL; dark brown, moist, drills easily				
~2.5			109.4	15.2	■	16
4–10.5		***SILTY SAND (SM)*** Medium dense, fine- to coarse-grained with GRAVEL; brown, damp, drills easily				
~5.5				3.4	■	17
~10.5			116.9	8.0	■	12
10.5–13		***SILTY SAND/SANDY SILT (SM/ML)*** Medium dense, fine- to medium-grained; light brown, moist, drills easily				
13–20		***SANDY SILT (ML)*** Loose, fine-grained; brown, moist, drills easily				
~15.5			90.9	32.2	■	9



Drill Method: Solid Flight | **Drill Date:** 6-9-21

Drill Rig: CME 45C-1 | **Hole Size:** 4½ Inches

Krazan and Associates

Driller: Chris Wyneken | **Elevation:** 20 Feet

Sheet: 1 of 1

Log of Boring B2

Project: Senter Road Development

Project No: 042-21018

Client: AMG & Associates, LLC

Figure No.: A-2

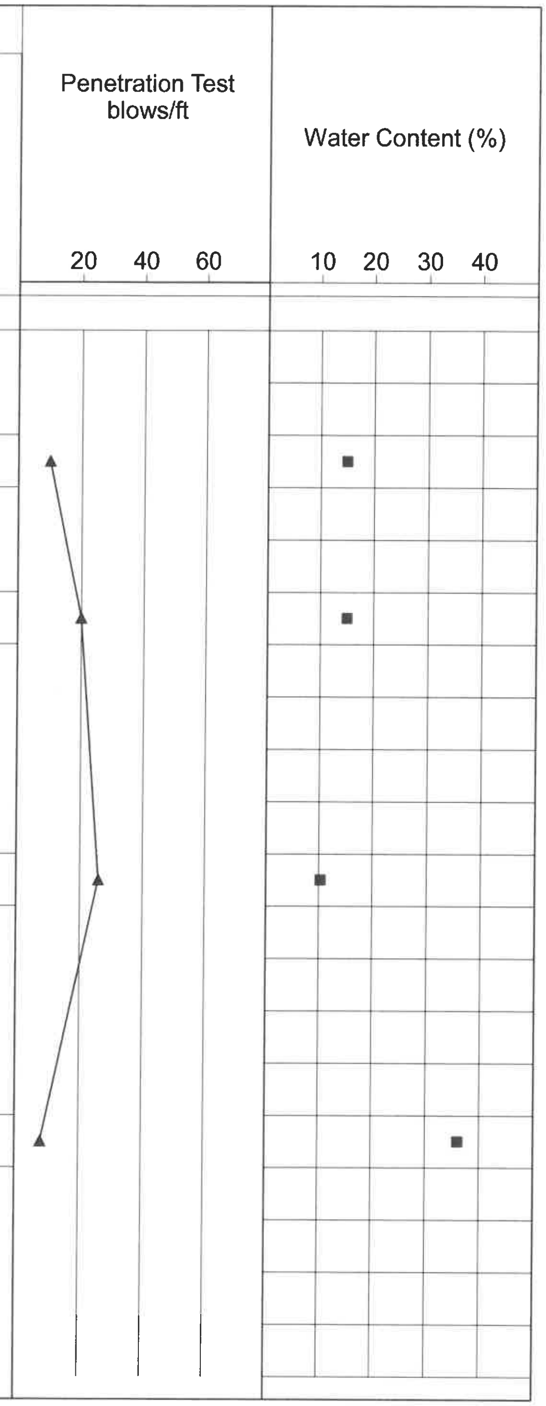
Location: 8418 Senter Road, San Jose, California

Logged By: Carlos Jimenez

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–6		***CLAYEY SAND (SC)*** FILL, fine- to medium-grained; dark brown, moist, drills easily				
2.5			102.2	15.0		10
5.5			110.1	15.1		20
6–15		***SANDY SILT (ML)*** Medium dense, fine- to medium-grained; brown, moist, drills easily				
10.5			104.3	10.4		26
15–20		***SILTY CLAY (CL)*** Firm; brown, moist, drills easily	87.3	36.1		8

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20



Drill Method: Solid Flight

Drill Date: 6-9-21

Drill Rig: CME 45C-1

Krazan and Associates

Hole Size: 4½ Inches

Driller: Chris Wyneken

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B3

Project: Senter Road Development

Project No: 042-21018

Client: AMG & Associates, LLC

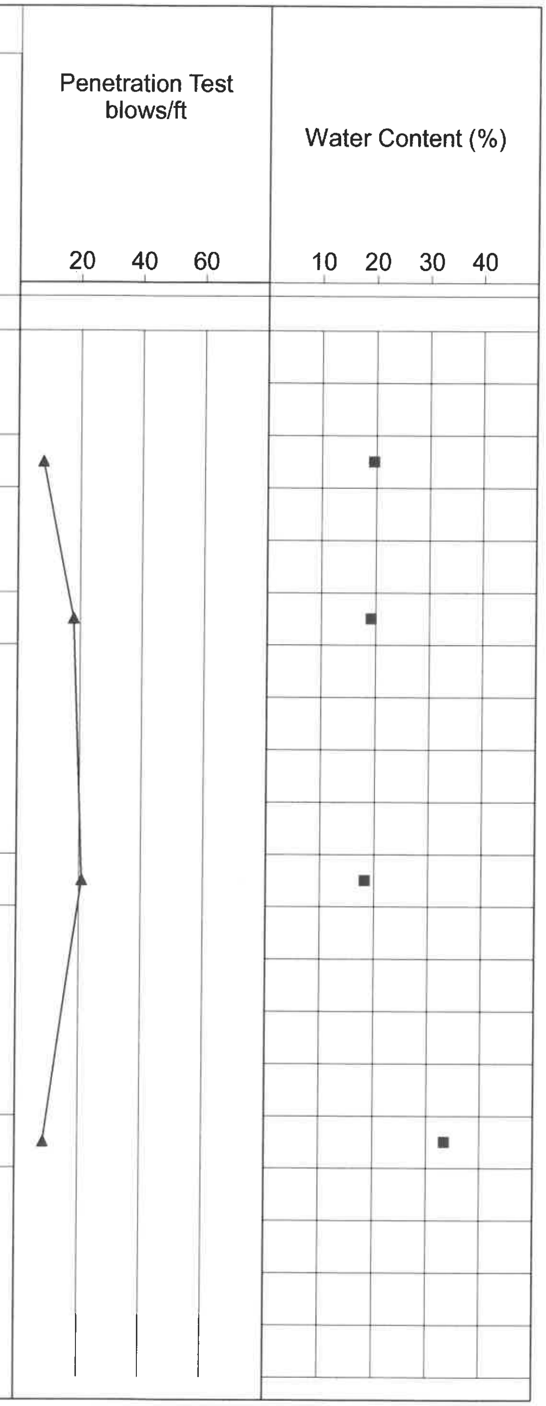
Figure No.: A-3

Location: 8418 Senter Road, San Jose, California

Logged By: Carlos Jimenez

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–6		***SANDY CLAY (CL)*** FILL, fine- to medium-grained; dark brown, moist, drills easily				
2.5			98.8	19.6		8
5.5			104.7	19.2		18
6–20		***SILTY CLAY (CL)*** Very stiff; brown, moist, drills easily				
10.5			110.9	18.3		21
15		Firm below 15 feet				
15.5			87.5	33.4		9
20						



Drill Method: Solid Flight

Drill Date: 6-9-21

Drill Rig: CME 45C-1

Krazan and Associates

Hole Size: 4½ Inches

Driller: Chris Wyneken

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B5

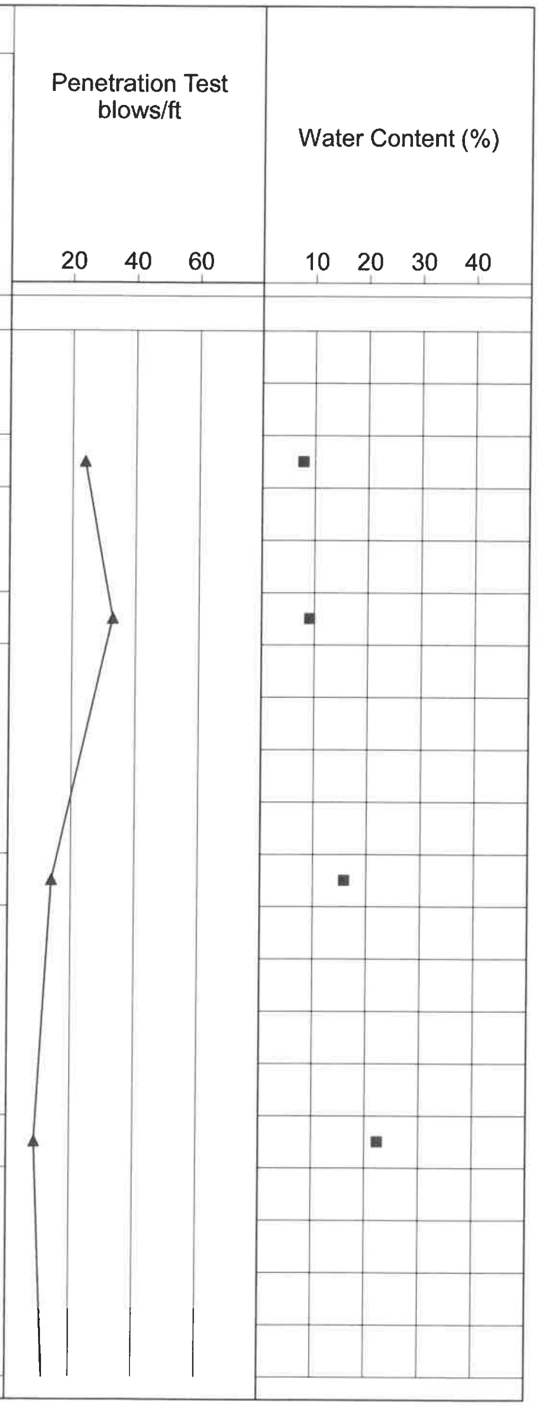
Project: Senter Road Development | **Project No:** 042-21018

Client: AMG & Associates, LLC | **Figure No.:** A-5

Location: 8418 Senter Road, San Jose, California | **Logged By:** Carlos Jimenez

Depth to Water> | **Initial:** 17 Feet | **At Completion:** 17 Feet

Depth (ft)	Symbol	Description (SUBSURFACE PROFILE)	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–2		***SILTY CLAY (CL)*** FILL; brown, moist, drills easily				
2–3		***SANDY CLAYEY SILT (ML)*** FILL, fine- to medium-grained; light brown, moist, drills easily	79.2	7.9		24
3–6.5		***SANDY CLAY (CL)*** Very stiff, fine- to medium-grained; light brown, moist, drills firmly	104.4	9.2		33
6.5–20		***SANDY CLAY (CL)*** Stiff, fine- to medium-grained; light brown, moist, drills easily	107.2	15.9		14
			92.1	22.4		9
17		Saturated below 17 feet				



Drill Method: Hollow Stem | **Drill Date:** 6-9-21

Drill Rig: CME 45C-1 | **Krazan and Associates** | **Hole Size:** 6½ Inches

Driller: Chris Wyneken | **Elevation:** 50 Feet

Log of Boring B5

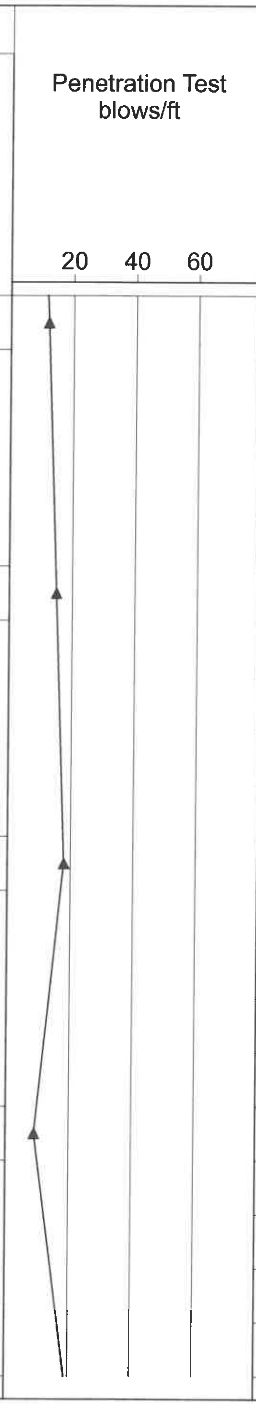
Project: Senter Road Development
Project No: 042-21018

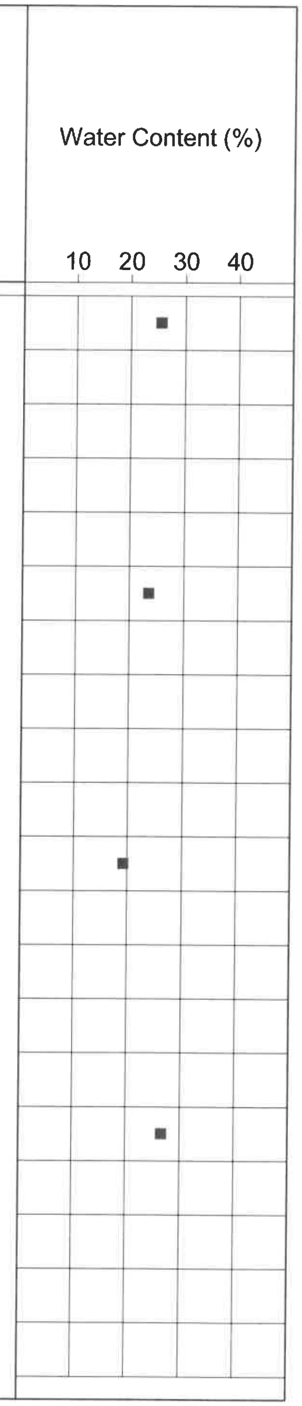
Client: AMG & Associates, LLC
Figure No.: A-5

Location: 8418 Senter Road, San Jose, California
Logged By: Carlos Jimenez

Depth to Water> **Initial:** 17 Feet **At Completion:** 17 Feet

Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
20–21		98.7	25.6	◢	12
24	Very stiff below 24 feet				
25–26		102.2	23.6	◢	15
28	***CLAYEY SANDY SILT (ML)*** Medium dense, fine-grained; olive-brown, saturated, drills easily				
30–31		110.1	19.3	◢	18
35	***SILTY CLAY (CL)*** Stiff; dark brown, saturated, drills easily	94.3	26.7	◢	9
40	Very stiff below 40 feet			◢	[illegible]





Drill Method: Hollow Stem
Drill Date: 6-9-21

Drill Rig: CME 45C-1
Krazan and Associates
Hole Size: 6½ Inches

Driller: Chris Wyneken
Elevation: 50 Feet

Log of Boring B5

Project: Senter Road Development **Project No:** 042-21018

Client: AMG & Associates, LLC **Figure No.:** A-5

Location: 8418 Senter Road, San Jose, California **Logged By:** Carlos Jimenez

Depth to Water> **Initial:** 17 Feet **At Completion:** 17 Feet

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	20 40 60	10 20 30 40
			94.1	28.0		20		
42								
44								
			89.9	31.2		20		
46								
48								
50		End of Borehole						
52								
54								
56								
58								
60								

Drill Method: Hollow Stem **Drill Date:** 6-9-21

Drill Rig: CME 45C-1 **Krazan and Associates** **Hole Size:** 6½ Inches

Driller: Chris Wyneken **Elevation:** 50 Feet

Log of Boring B6

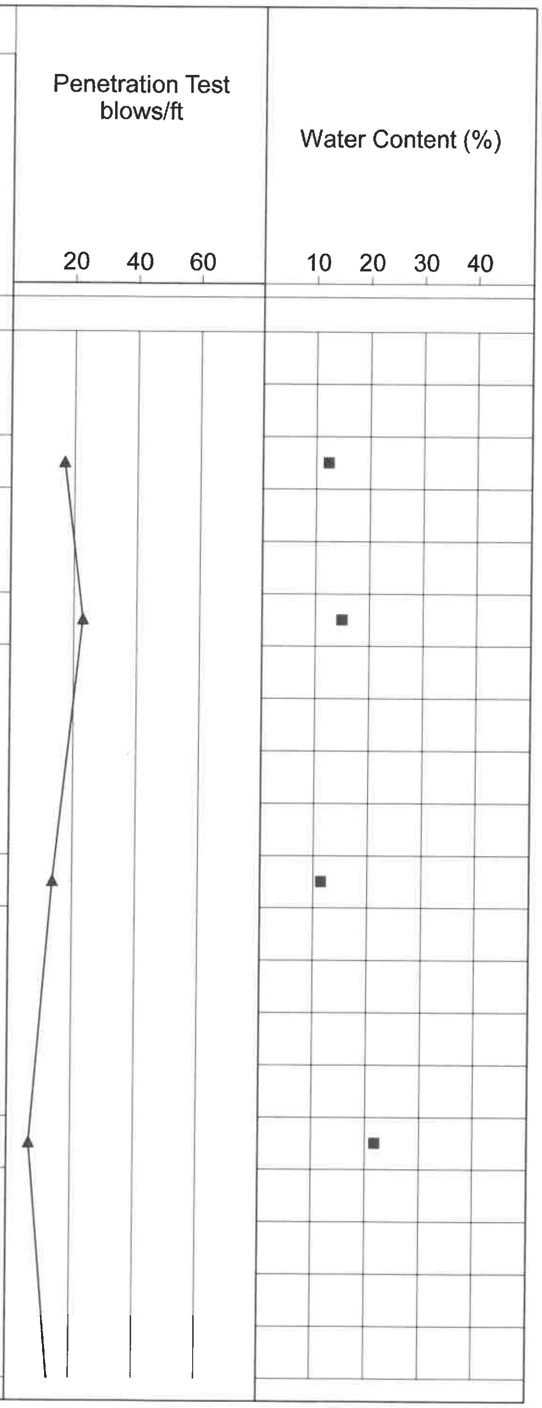
Project: Senter Road Development | **Project No:** 042-21018

Client: AMG & Associates, LLC | **Figure No.:** A-6

Location: 8418 Senter Road, San Jose, California | **Logged By:** Carlos Jimenez

Depth to Water> **Initial:** 17 Feet | **At Completion:** 17 Feet

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SANDY CLAY (CL)*** FILL, fine- to coarse-grained with GRAVEL; brown, moist, drills easily				
2		***SANDY CLAY (CL)*** FILL, fine- to coarse-grained with GRAVEL; brown, moist, drills easily	94.3	12.4		17
4		***SANDY CLAY (CL)*** Very stiff, fine- to medium-grained; brown, moist, drills easily	115.7	15.0		23
6						
8		***SANDY SILT (ML)*** Medium dense, fine- to medium-grained; brown, moist, drills easily				
10			106.4	11.5		14
12		Loose below 13 feet				
14			92.2	21.8		7
16		Saturated below 17 feet ▽				
18		***SANDY CLAY (CL)*** Stiff, fine- to medium-grained; dark brown, saturated, drills easily				
20						



Drill Method: Hollow Stem | **Drill Date:** 6-9-21

Drill Rig: CME 45C-1 | **Krazan and Associates** | **Hole Size:** 6½ Inches

Driller: Chris Wyneken | **Elevation:** 50 Feet

Log of Boring B6

Project: Senter Road Development

Project No: 042-21018

Client: AMG & Associates, LLC

Figure No.: A-6

Location: 8418 Senter Road, San Jose, California

Logged By: Carlos Jimenez

Depth to Water> **Initial:** 17 Feet **At Completion:** 17 Feet

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	20 40 60	10 20 30 40
			91.7	29.4		14		
22								
24								
			104.3	22.4		10		
26								
28		***SANDY SILT (ML)*** Medium dense, fine- to medium-grained; brown, saturated, drills easily						
30								
			96.1	25.0		10		
32								
34								
			103.1	22.0		12		
36								
38								
40								

Drill Method: Hollow Stem

Drill Date: 6-9-21

Drill Rig: CME 45C-1

Krazan and Associates

Hole Size: 6½ Inches

Driller: Chris Wyneken

Elevation: 50 Feet

Log of Boring B6

Project: Senter Road Development
Project No: 042-21018

Client: AMG & Associates, LLC
Figure No.: A-6

Location: 8418 Senter Road, San Jose, California
Logged By: Carlos Jimenez

Depth to Water> **Initial:** 17 Feet **At Completion:** 17 Feet

Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
40.5		96.1	26.1		8
44	***SANDY CLAY/SANDY SILT (CL/ML)*** Stiff, fine- to medium-grained; brown, saturated, drills easily				
45.5		99.1	24.4		11
50	End of Borehole				

Subsurface Profile columns: Depth (ft), Symbol, Description. Sample columns: Dry Density (pcf), Moisture (%), Type, Blows/ft. Penetration Test blows/ft (20, 40, 60). Water Content (%) (10, 20, 30, 40). Depth scale: 42, 44, 46, 48, 50, 52, 54, 56, 58, 60.

Drill Method: Hollow Stem
Drill Date: 6-9-21

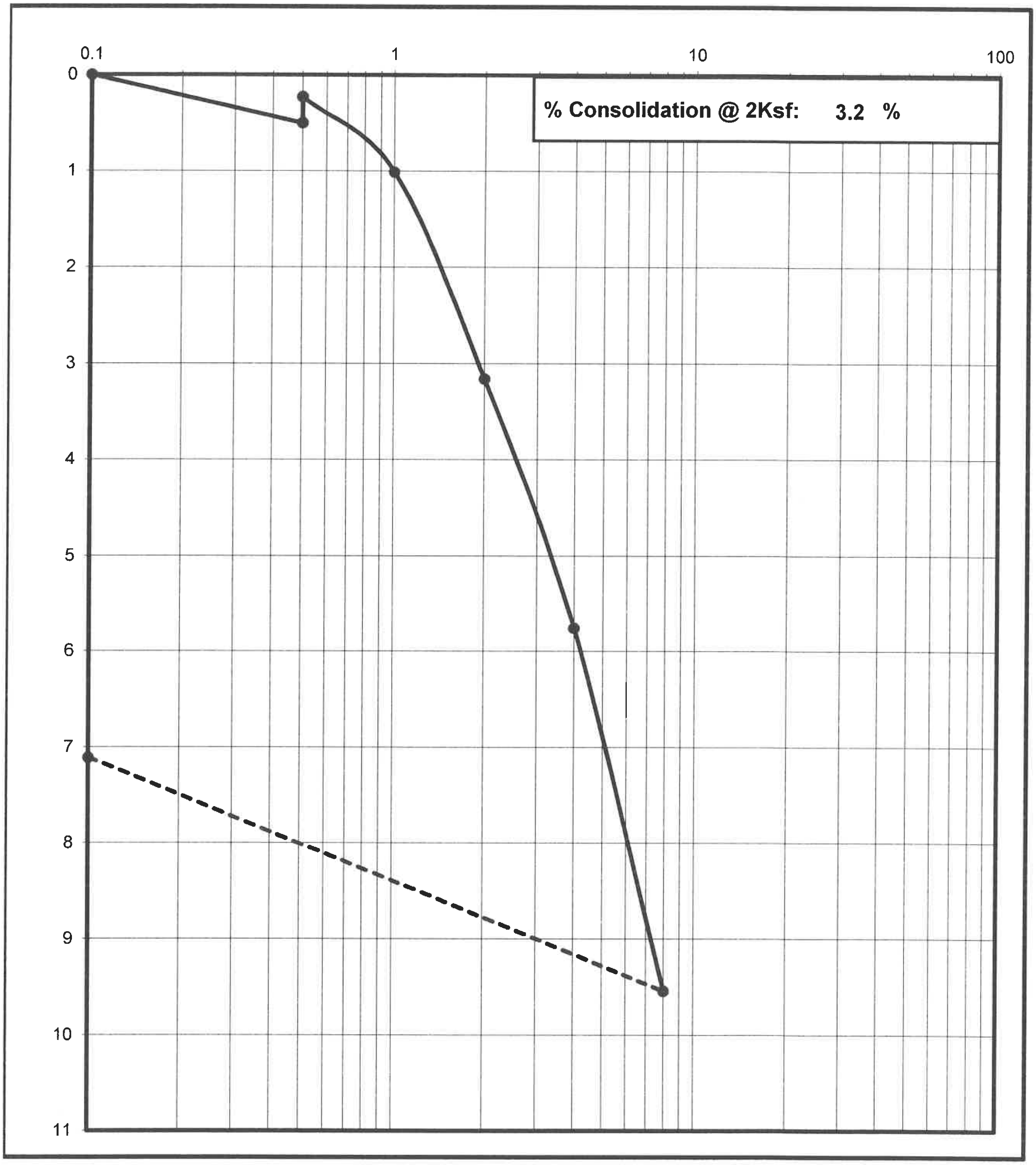
Drill Rig: CME 45C-1
Hole Size: 6½ Inches

Krazan and Associates

Driller: Chris Wyneken
Elevation: 50 Feet

Consolidation Test

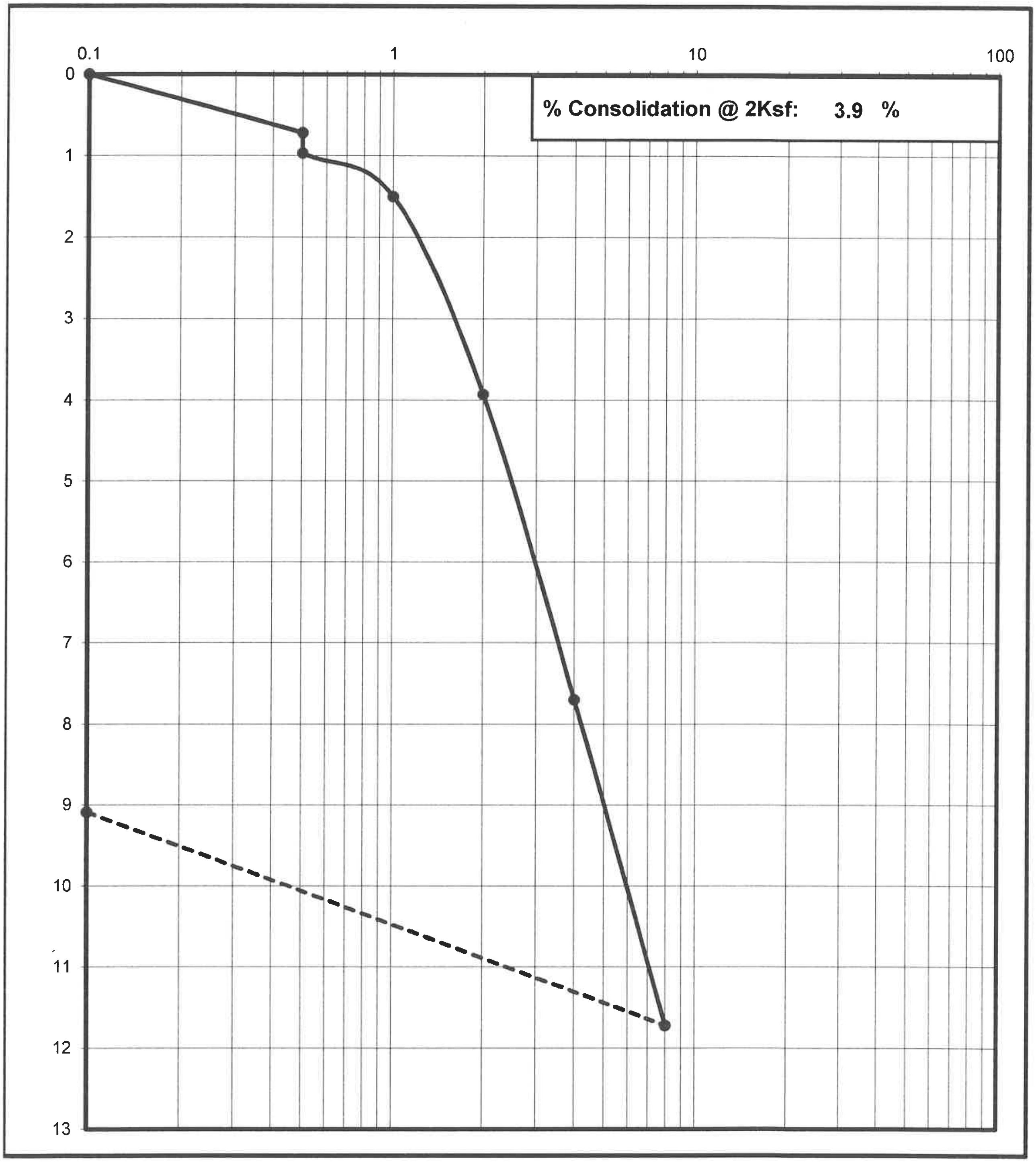
Project No	Boring No. & Depth	Date	Soil Classification
042-21018	B5 @ 5-6'	6/29/2021	CL



Krazan Testing Laboratory

Consolidation Test

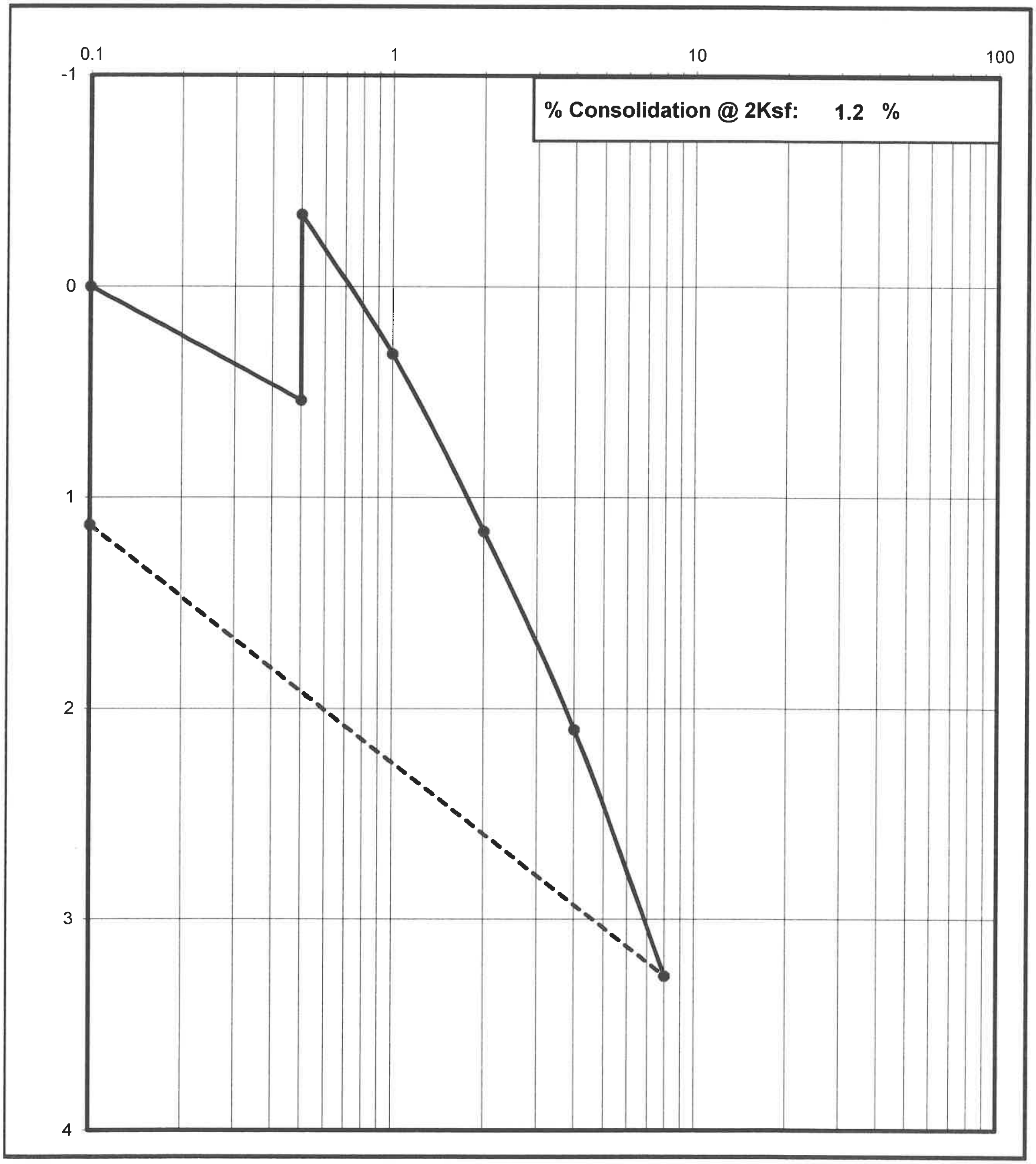
Project No	Boring No. & Depth	Date	Soil Classification
042-21018	B6 @ 2-3'	6/29/2021	CL



Krazan Testing Laboratory

Consolidation Test

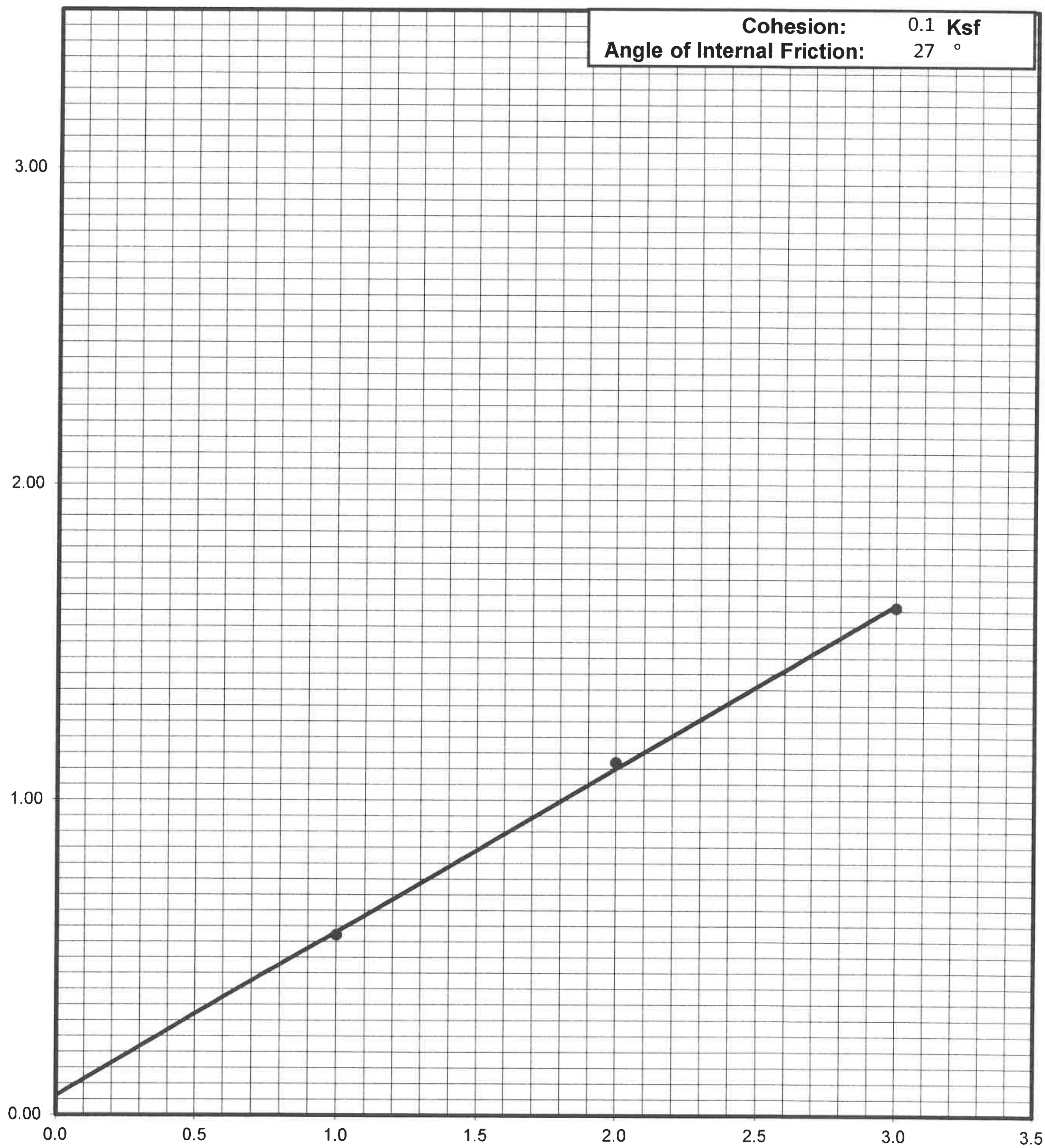
Project No	Boring No. & Depth	Date	Soil Classification
042-21018	B6 @ 5-6'	6/29/2021	CL



Krazan Testing Laboratory

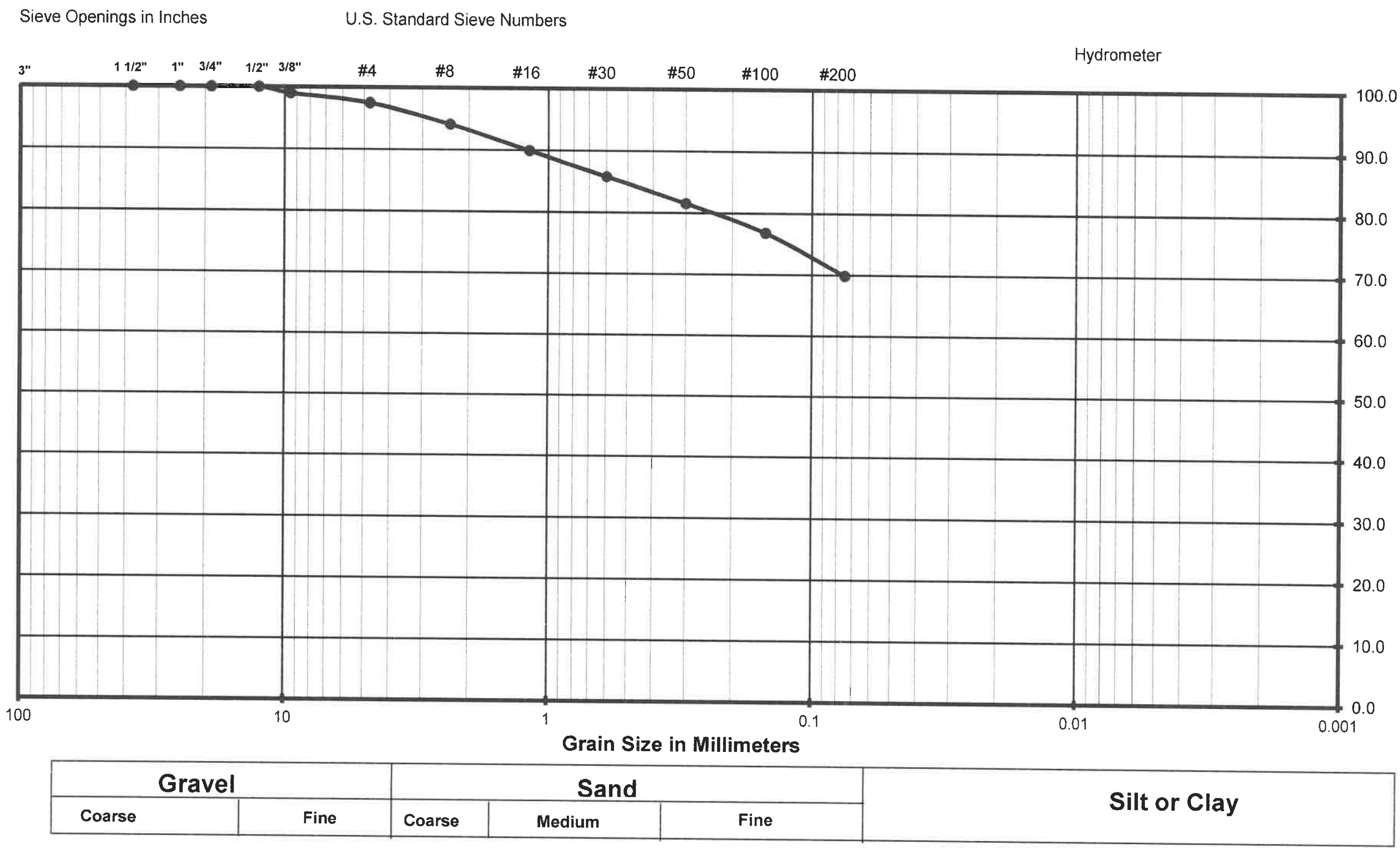
Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

Project Number	Boring No. & Depth	Soil Type	Date
042-21018	B5 @ 2-3'	ML	6/29/2021



Krazan Testing Laboratory

Grain Size Analysis



(Unified Soils Classification)

Project Name	Senter Road Development
Project Number	042-21018
Soil Classification	CL
Sample Number	B6 @ 2-3'

Krazan Testing Laboratory

Plasticity Index of Soils

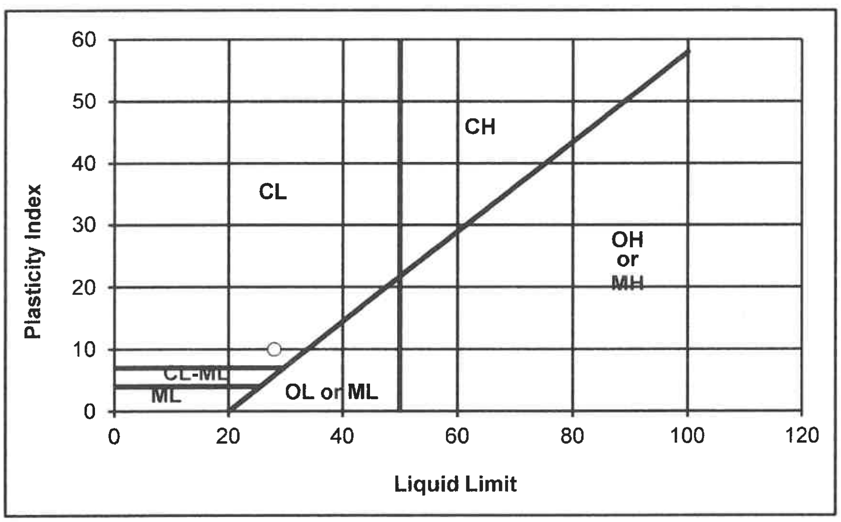
ASTM D4318/AASHTO T89 T90/CT 204

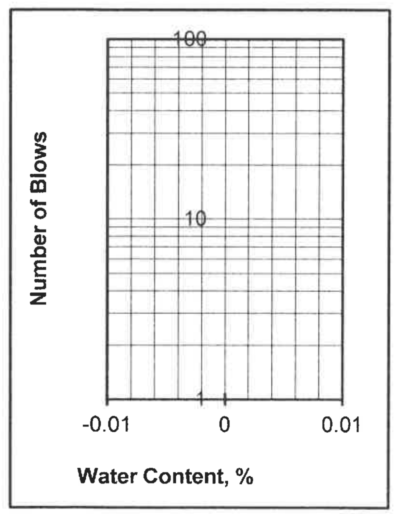
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021 | Date Tested: 6/24/2021
Sampled By: CJ | Tested By: JM
Sample Number: | Verified By: JG
Sample Location: B5 @ 10-11'
Sample Description: CL

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	28.40	23.93		32.65	32.24	
Weight of Dry Soil & Tare (g)	26.65	22.36		29.26	28.90	
Weight of Tare (g)	17.29	13.70		17.22	16.94	
Weight of water (g)	1.74	1.57		3.39	3.34	
Weight of Dry Soil (g)	9.36	8.66		12.05	11.97	
Water Content (% of dry wt.)	18.6%	18.2%		28.1%	27.9%	
Number of Blows				25	25	

Plastic Limit : 18 **Liquid Limit : 28**

Plasticity Index : 10
Unified Soil Classification : CL **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

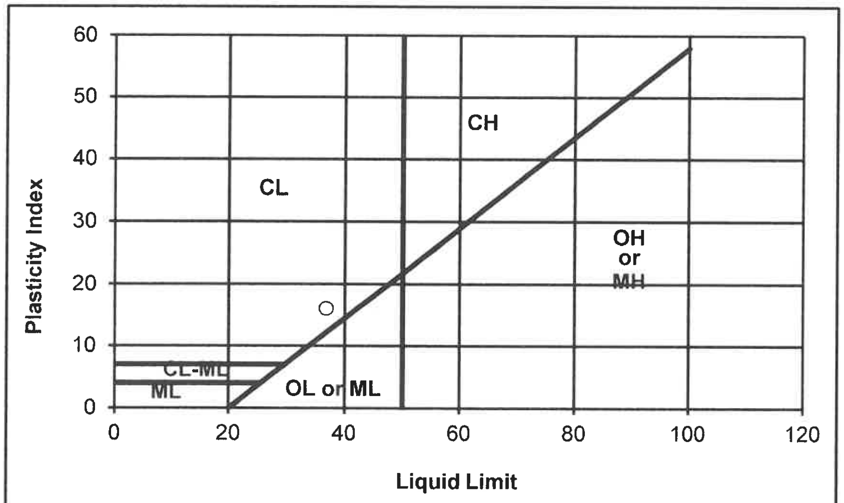
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B5 @ 15-16'
Sample Description: CL

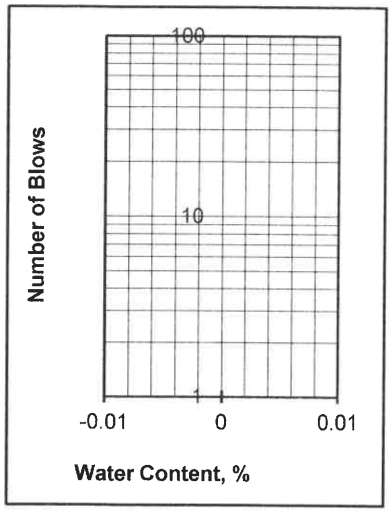
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	27.22	27.91		27.07	25.38	
Weight of Dry Soil & Tare (g)	24.94	25.50		23.42	21.85	
Weight of Tare (g)	13.85	13.70		13.45	12.28	
Weight of water (g)	2.28	2.41		3.65	3.53	
Weight of Dry Soil (g)	11.09	11.80		9.97	9.57	
Water Content (% of dry wt.)	20.6%	20.5%		36.6%	36.9%	
Number of Blows				25	25	

Plastic Limit : 21 **Liquid Limit : 37**

Plasticity Index : 16
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

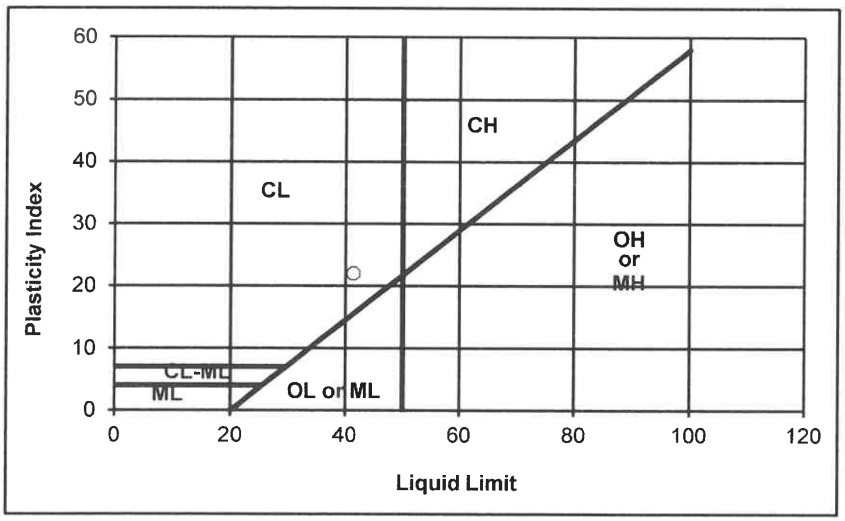
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B5 @ 20-21'
Sample Description: CL

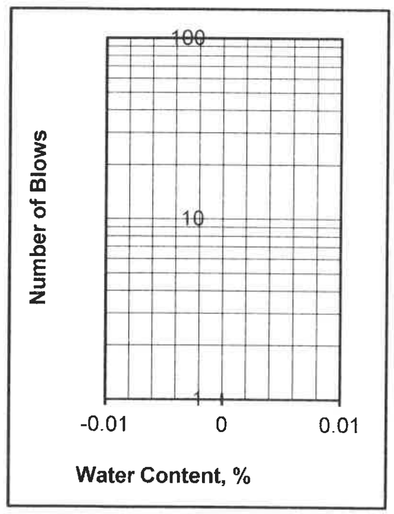
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	20.71	20.24		27.50	27.02	
Weight of Dry Soil & Tare (g)	19.62	19.19		24.49	23.16	
Weight of Tare (g)	13.79	13.45		17.22	13.83	
Weight of water (g)	1.09	1.06		3.01	3.86	
Weight of Dry Soil (g)	5.84	5.74		7.26	9.33	
Water Content (% of dry wt.)	18.6%	18.4%		41.5%	41.4%	
Number of Blows				25	25	

Plastic Limit : 19 **Liquid Limit : 41**

Plasticity Index : 22
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

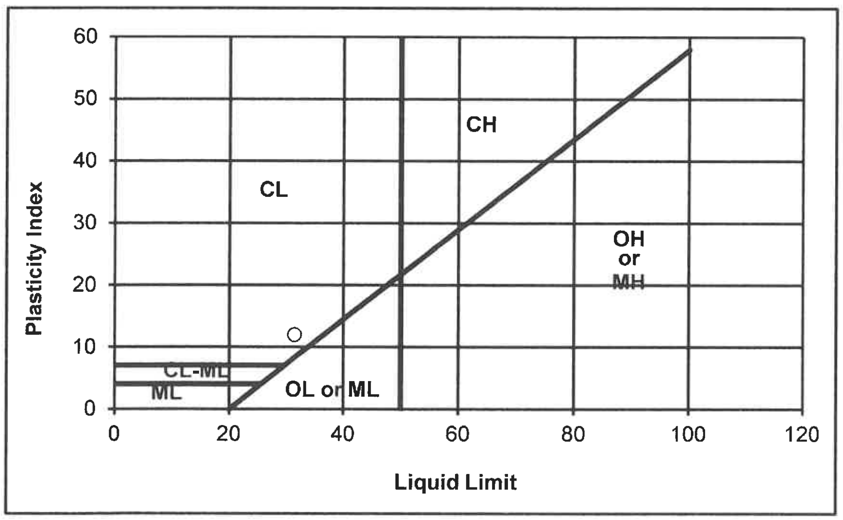
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B5 @ 25-26'
Sample Description: CL

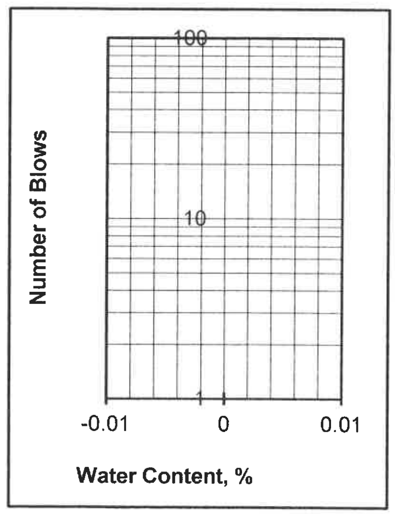
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	26.90	30.15		29.11	31.60	
Weight of Dry Soil & Tare (g)	24.67	27.51		26.26	27.34	
Weight of Tare (g)	13.14	13.72		17.23	13.78	
Weight of water (g)	2.23	2.64		2.84	4.27	
Weight of Dry Soil (g)	11.53	13.79		9.04	13.55	
Water Content (% of dry wt.)	19.3%	19.1%		31.5%	31.5%	
Number of Blows				25	25	

Plastic Limit : 19 **Liquid Limit : 31**

Plasticity Index : 12
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

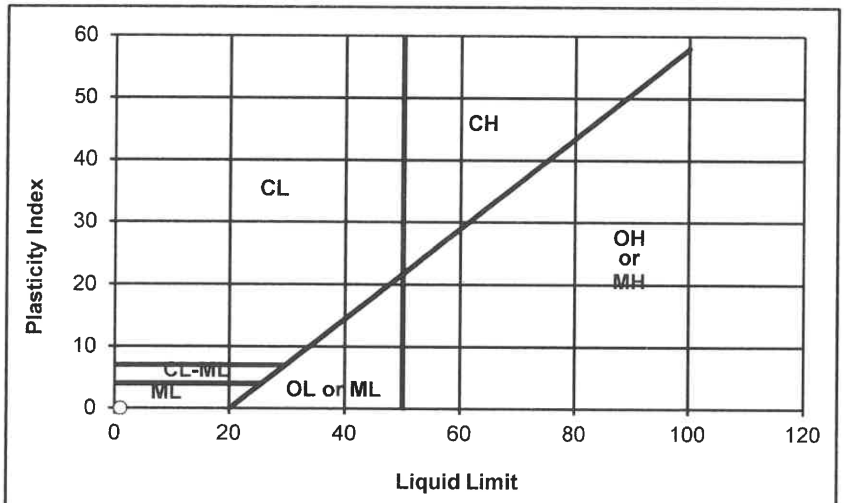
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B5 @ 30-31'
Sample Description: ML

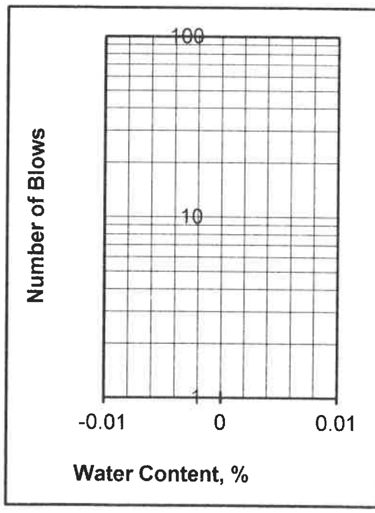
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

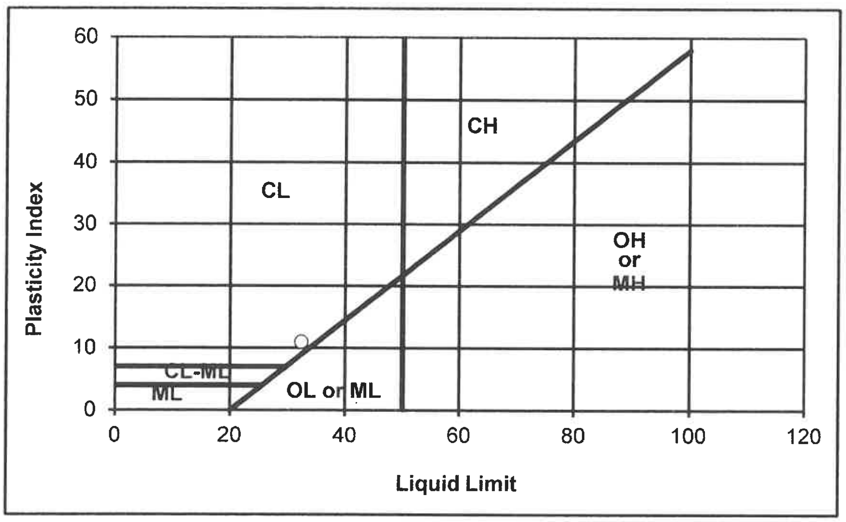
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B5 @ 35-36'
Sample Description: CL

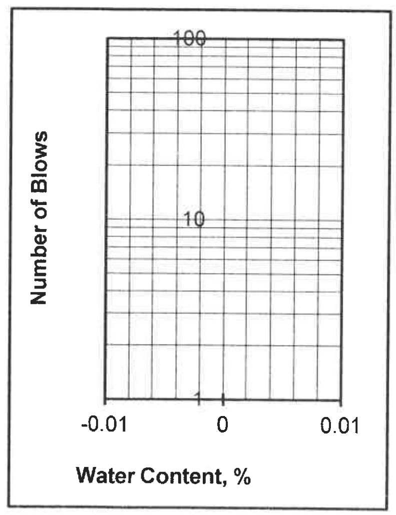
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	21.86	24.66		30.17	28.99	
Weight of Dry Soil & Tare (g)	20.46	22.80		26.08	24.90	
Weight of Tare (g)	13.85	13.70		13.43	12.26	
Weight of water (g)	1.40	1.86		4.09	4.09	
Weight of Dry Soil (g)	6.61	9.10		12.65	12.64	
Water Content (% of dry wt.)	21.2%	20.5%		32.3%	32.4%	
Number of Blows				25	25	

Plastic Limit : 21 **Liquid Limit : 32**

Plasticity Index : 11
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

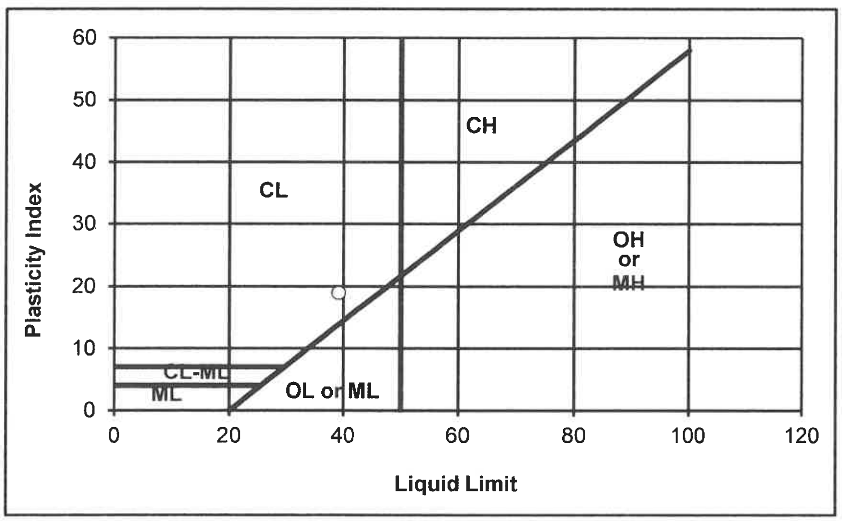
ASTM D4318/AASHTO T89 T90/CT 204

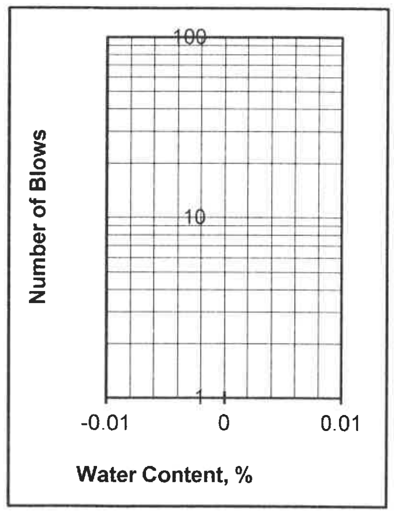
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021 — Date Tested: 6/24/2021
Sampled By: CJ — Tested By: JM
Sample Number: — Verified By: JG
Sample Location: B5 @ 40-41'
Sample Description: CL

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	23.28	22.77		27.45	29.63	
Weight of Dry Soil & Tare (g)	22.29	21.86		24.60	26.03	
Weight of Tare (g)	17.25	17.18		17.30	16.83	
Weight of water (g)	0.99	0.91		2.85	3.61	
Weight of Dry Soil (g)	5.04	4.68		7.30	9.19	
Water Content (% of dry wt.)	19.7%	19.5%		39.1%	39.2%	
Number of Blows				25	25	

Plastic Limit : 20 — **Liquid Limit : 39**

Plasticity Index : 19
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

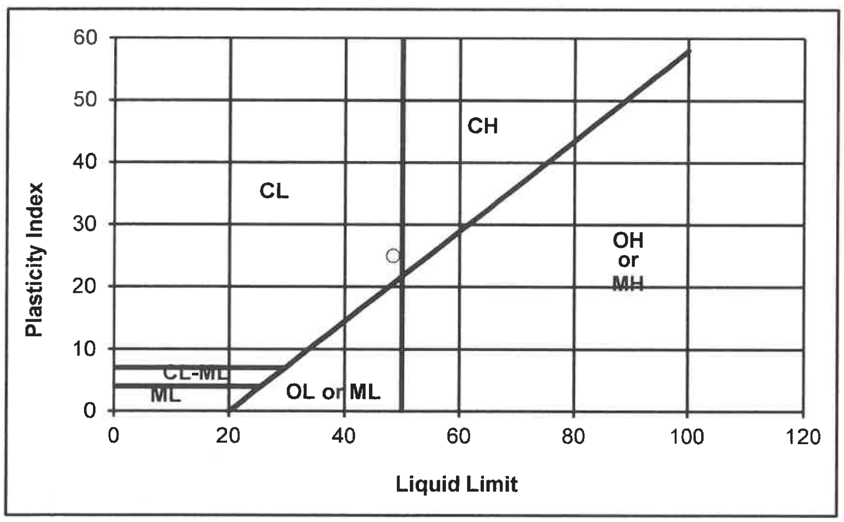
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B5 @ 45-46'
Sample Description: CL

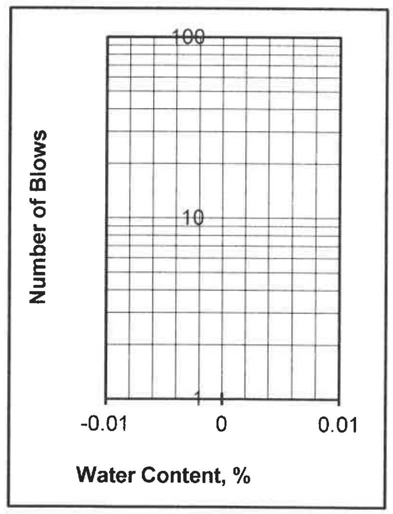
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	24.09	25.14		25.02	32.03	
Weight of Dry Soil & Tare (g)	22.19	23.07		21.13	27.23	
Weight of Tare (g)	13.79	13.96		13.12	17.23	
Weight of water (g)	1.90	2.07		3.89	4.80	
Weight of Dry Soil (g)	8.40	9.10		8.01	10.00	
Water Content (% of dry wt.)	22.7%	22.8%		48.6%	48.0%	
Number of Blows				25	25	

Plastic Limit : 23 **Liquid Limit : 48**

Plasticity Index : 25
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

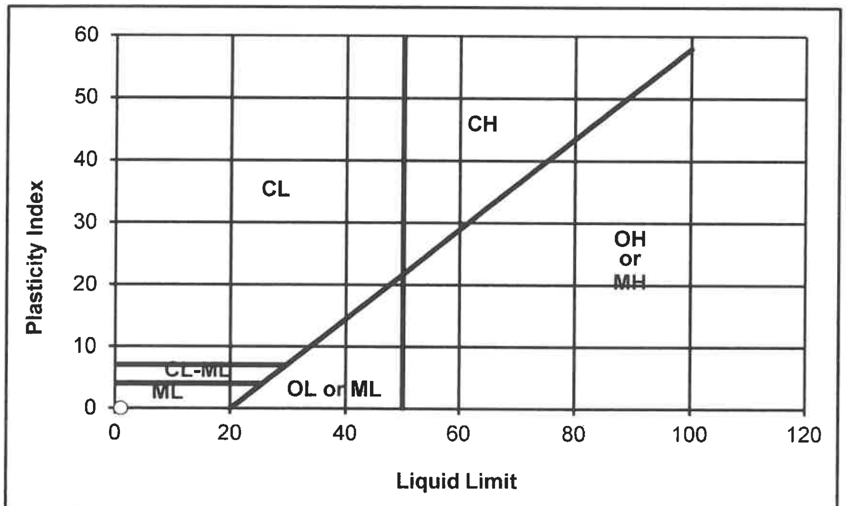
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B6 @ 10-11'
Sample Description: ML

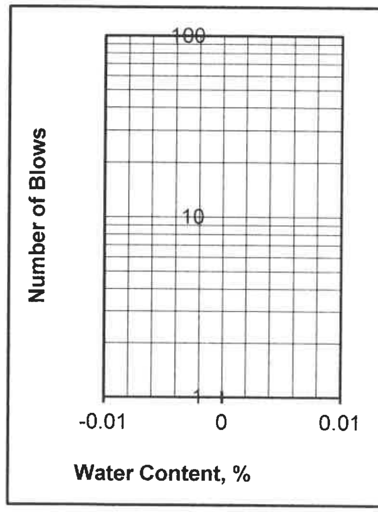
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

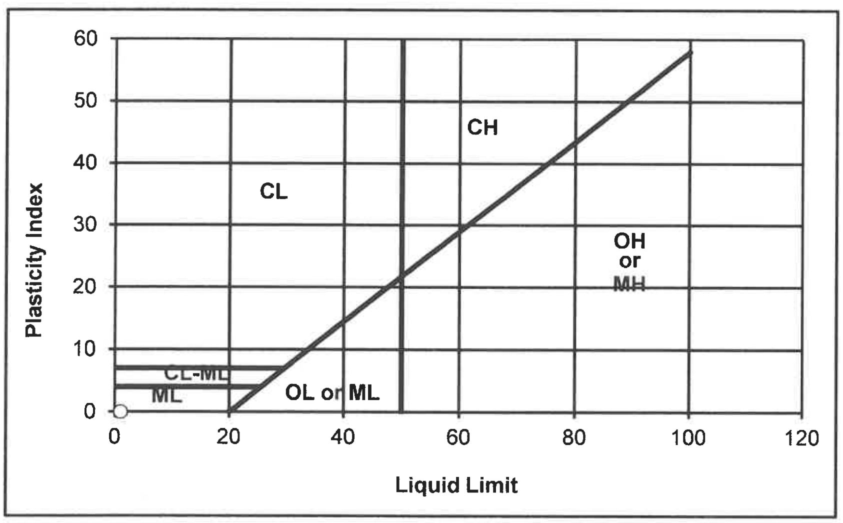
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B6 @ 15-16'
Sample Description: ML

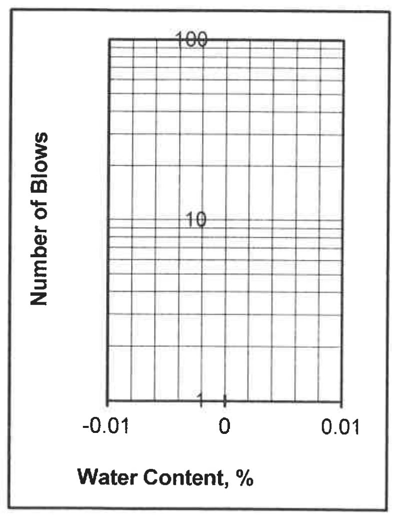
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

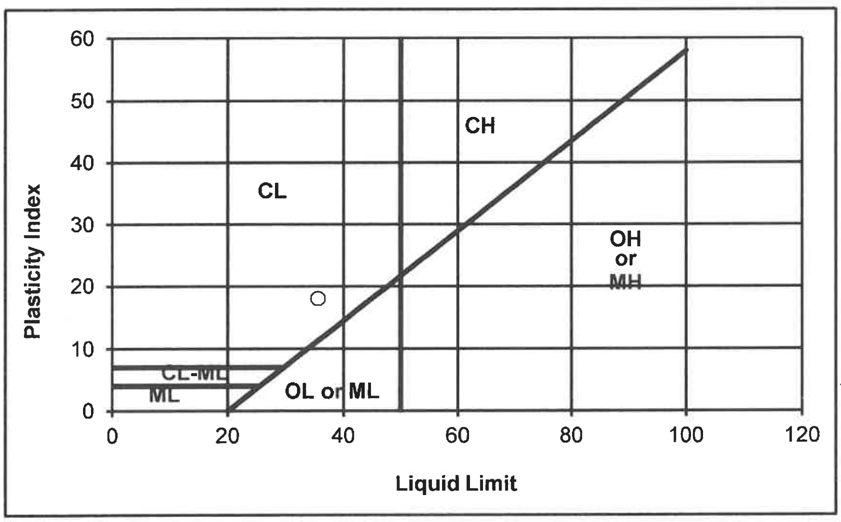
ASTM D4318/AASHTO T89 T90/CT 204

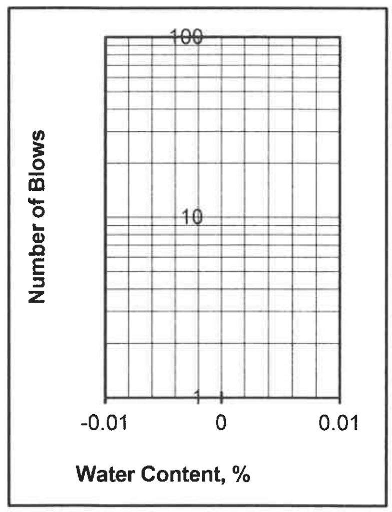
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Date Tested: 6/24/2021
Sampled By: CJ
Tested By: JM
Sample Number:
Verified By: JG
Sample Location: B6 @ 20-21'
Sample Description: CL

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	23.02	22.88		28.58	30.60	
Weight of Dry Soil & Tare (g)	21.66	21.53		24.50	27.12	
Weight of Tare (g)	13.78	13.96		13.12	17.25	
Weight of water (g)	1.36	1.35		4.08	3.49	
Weight of Dry Soil (g)	7.87	7.56		11.38	9.87	
Water Content (% of dry wt.)	17.3%	17.9%		35.8%	35.3%	
Number of Blows				25	25	

Plastic Limit : 18 **Liquid Limit : 36**

Plasticity Index : 18
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

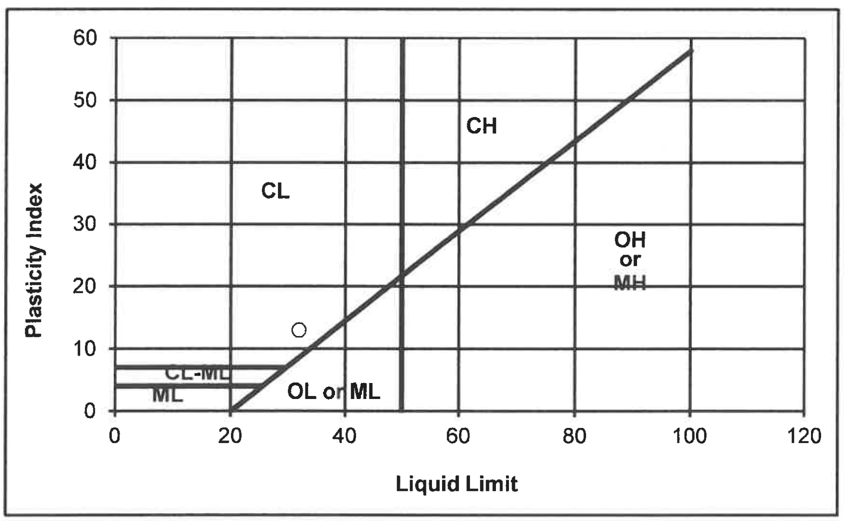
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B6 @ 25-26'
Sample Description: CL

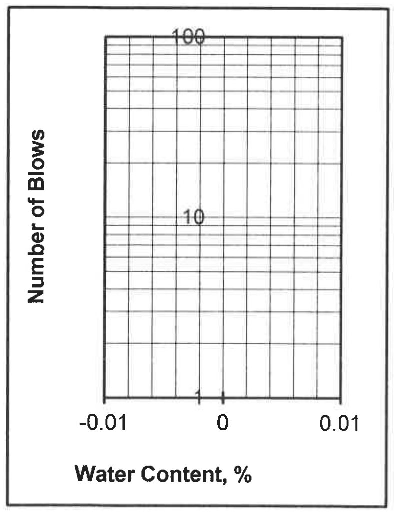
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	25.60	25.86		30.25	28.15	
Weight of Dry Soil & Tare (g)	23.81	23.94		27.06	24.51	
Weight of Tare (g)	14.33	13.89		17.05	13.10	
Weight of water (g)	1.79	1.93		3.19	3.64	
Weight of Dry Soil (g)	9.48	10.05		10.01	11.41	
Water Content (% of dry wt.)	18.9%	19.2%		31.8%	31.9%	
Number of Blows				25	25	

Plastic Limit : 19 **Liquid Limit : 32**

Plasticity Index : 13
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

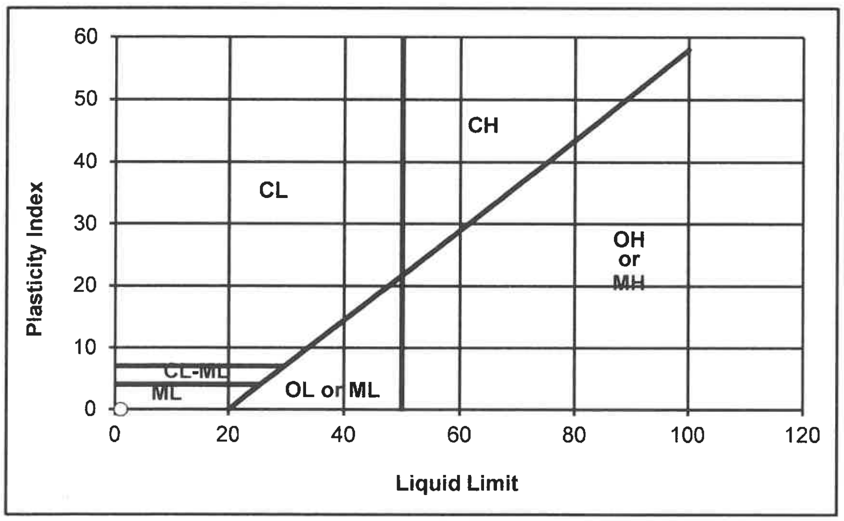
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B6 @ 30-31'
Sample Description: ML

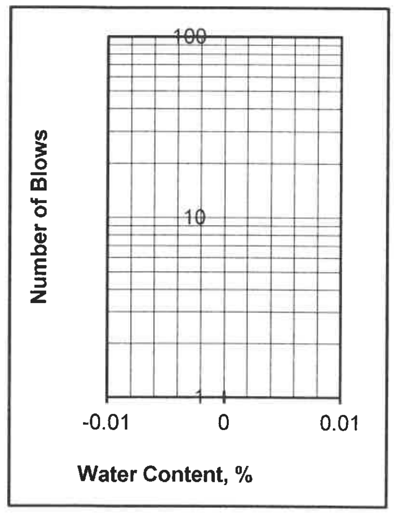
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

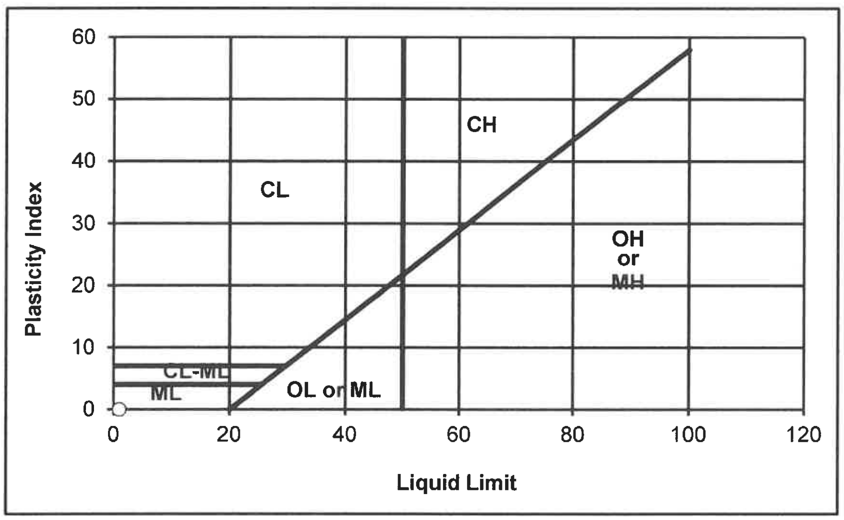
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B6 @ 35-36'
Sample Description: ML

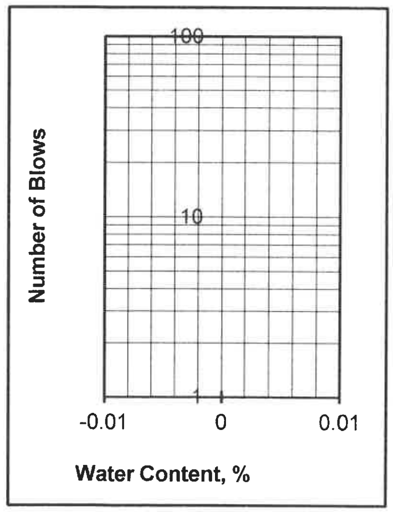
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

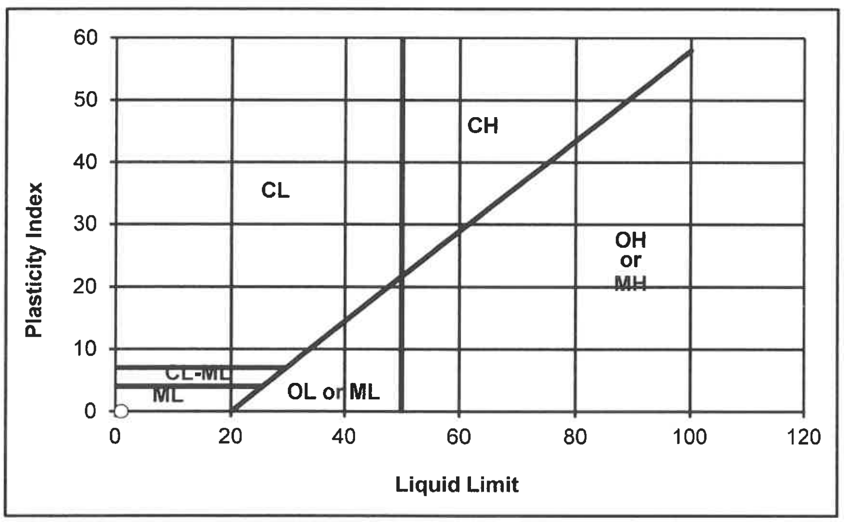
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B6 @ 40-41'
Sample Description: ML

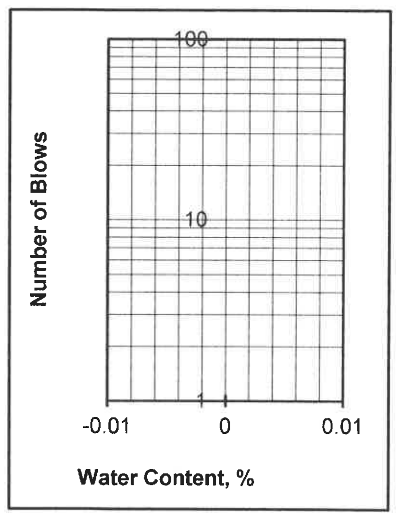
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

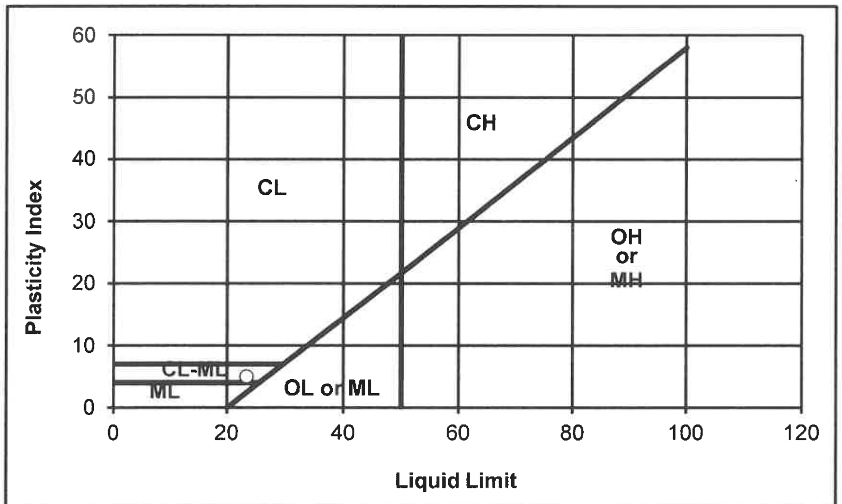
Project: **Senter Road Development**
Project Number: **042-21018**
Date Sampled: 6/9/2021
Sampled By: CJ
Sample Number:
Sample Location: B6 @ 45-46'
Sample Description: CL-ML

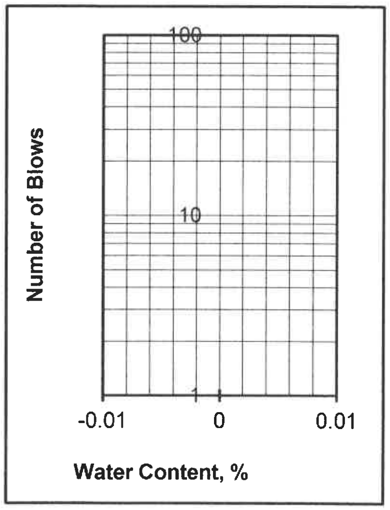
Date Tested: 6/24/2021
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	30.92	24.95		29.95	26.83	
Weight of Dry Soil & Tare (g)	28.86	23.25		27.52	24.39	
Weight of Tare (g)	17.31	13.46		17.23	13.86	
Weight of water (g)	2.06	1.70		2.43	2.44	
Weight of Dry Soil (g)	11.55	9.79		10.29	10.53	
Water Content (% of dry wt.)	17.8%	17.4%		23.6%	23.2%	
Number of Blows				25	25	

Plastic Limit : 18 **Liquid Limit : 23**

Plasticity Index : 5
Unified Soil Classification : CL-ML
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

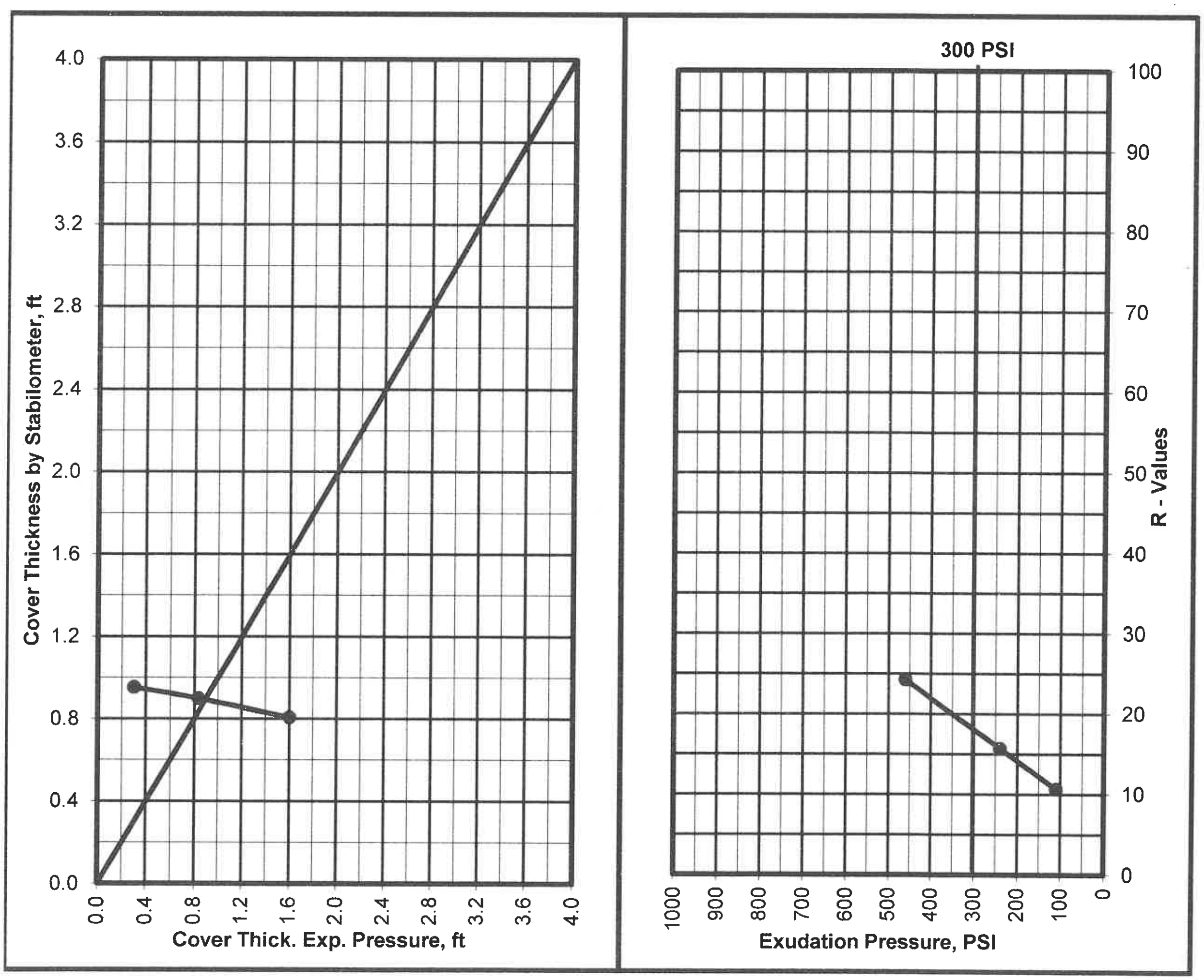
Unusual Conditions, Other Notes:

R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	042-21018
Project Name	:	Senter Road Development
Date	:	7/7/2021
Sample Location/Curve Number	:	RV#1
Soil Classification	:	SC

TEST	A	B	C
Percent Moisture @ Compaction, %	14.8	15.8	16.5
Dry Density, lbm/cu.ft.	116.5	116.4	115.7
Exudation Pressure, psi	460	240	110
Expansion Pressure, (Dial Reading)	48	25	9
Expansion Pressure, psf	208	108	39
Resistance Value R	24	16	11

R Value by Expansion Pressure (TI =): 5	**18**
R Value at 300 PSI Exudation Pressure	**18**



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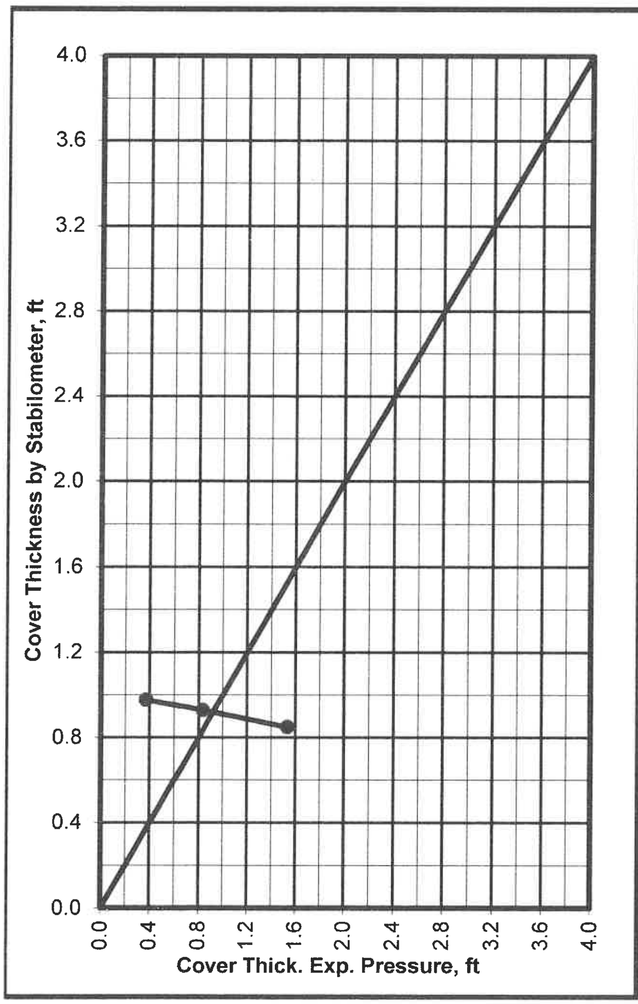
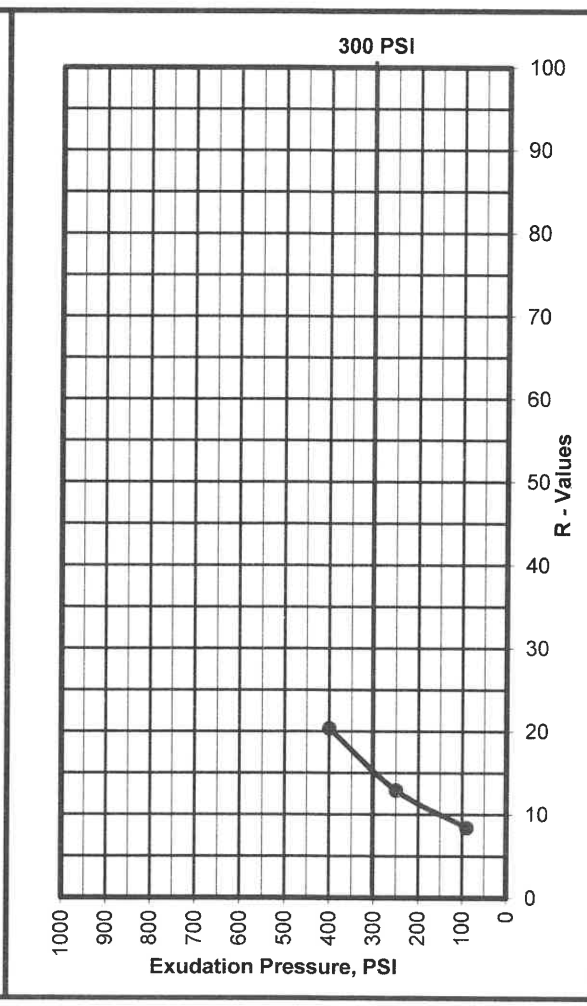
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	042-21018
Project Name	:	Senter Road Development
Date	:	7/9/2021
Sample Location/Curve Number	:	RV#2
Soil Classification	:	CL

TEST	A	B	C
Percent Moisture @ Compaction, %	13.4	12.9	13.9
Dry Density, lbm/cu.ft.	119.9	121.3	119.3
Exudation Pressure, psi	250	400	90
Expansion Pressure, (Dial Reading)	25	46	11
Expansion Pressure, psf	108	199	48
Resistance Value R	13	20	8

R Value by Expansion Pressure (TI =): 5	**11**
R Value at 300 PSI Exudation Pressure	**16**





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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 recompacted 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 2018 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 2 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 2 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. 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.

APPENDIX D

GUIDE PILE SPECIFICATIONS

1. **GENERAL** - General and Special Conditions shall apply to all work hereunder.

2. **SCOPE** - Furnish all labor, materials, tools, and equipment required to install complete and in place all piles shown on Drawings and specified herein.

3. **WORK NOT INCLUDED UNDER THIS SECTION**

    3.1 Concrete Pile caps

    3.2 Excavations

    3.3 Shoring and bracing of earth banks

    3.4 Dewatering

4. **GENERAL REQUIREMENTS**

    4.1 All piles shall be installed by a piling Contractor, hereinafter designated the Contractor, qualified to install the type of pile to be driven in accordance with the Drawings and Specifications, and under conditions existing at the site. The minimum requirements for qualification shall be 5 years of pile driving experience and evidence of the satisfactory completion of 10 pile installations comparable in scope to the work specified hereunder.

    4.2 A Geotechnical Engineering Investigation has been prepared by Krazan & Associates (042-21018). This report is available for review at the City Engineer's office, at the Architect's office and at Krazan's offices.

    4.3 During production pile driving, the Contractor shall monitor adjacent structures to evaluate their response to hammer-induced vibrations. Should adverse reaction of such structures or streets be observed, the Contractor shall notify the Architect and shall propose to him means of minimizing damage.

    4.4 Work shall comply with all Municipal, State and Federal regulations regarding safety, including the requirements of the Williams-Steiger Occupational Safety and Health Act of 1970.

5. **PILE TYPES**

    5.1 Piles shall be precast, pre-stressed concrete piles with a 12-inch or 14-inch square cross section.

6. INDICATOR PILES - Concrete indicator piles shall be manufactured and cast to reach a tip elevation of -70 feet below existing surface. The piles can be driven as production piles at locations to be determined by Krazan, but preferably outside of uplift or moment frame pile caps with each pile driven to a final tip elevation as determined by Krazan. Indicator piles are driven much harder than production piles and placement of indicator piles in production locations is at the risk of the Contractor.

7. PILE LOAD TESTING PROGRAM

7.1 *Test Piles*: Prior to driving production piling, the Contractor shall drive and test 2 piles of the type to be used on the project. Test piles should be capable of withstanding a continuous load of at least 500 kips.

7.2 *Test Pile Location*: The test pile locations shall be determined after observation and review of the driving records for the indicator piles. Test piles shall be driven outside the location of any pile cap, at a location determined by Krazan. Test piles shall be abandoned upon completion of the testing program. Reaction piles will be considered acceptable if driven at production piling locations and if they meet the final driving criteria.

7.3 *Pile Driving*: Test piles shall be driven with a hammer using a minimum rated energy of 32,000-foot pounds per blow. The test piles shall be driven with the same hammer used for the driving of the indicator and production piling.

7.4 *Reaction System*: The Contractor shall provide a reaction system capable of safely sustaining 500 kips. Installation of reaction piling and construction of the reaction system shall be the responsibility of the Contractor. The array of reaction and test piles shall conform to the applicable provisions of the ASTM Test Method D1143. A plan of the proposed system shall be submitted to the Foundation Engineer prior to installation of piling.

7.5 *Testing*: The Contractor shall provide all equipment necessary to perform the testing program, including calibrated hydraulic jacks, an independent reference beam system acceptable to the Foundation Engineer, dial gauges reading directly to 0.001 inch, necessary steel plates and shims, a manifold system using an electrical or nitrogen-operated pressure control system, flood lights for night testing, and an overall canopy to protect the reaction beam, reference beam, and testing equipment from sunlight, excessive thermal expansion or contraction, and rainfall. The Contractor shall submit to the Foundation Engineer calibration charts for all the hydraulic jacks to be used in the load testing program. The jack calibration shall be performed by an independent testing agency within 6 months prior to commencement of testing. A representative of the Contractor shall be available for help in moving equipment during daylight hours, and shall be on call throughout the other periods of the testing program.

7.5.1 The Foundation Engineer will provide all engineering personnel for performance of the testing and evaluation of the results.

8. MANUFACTURE OF PRECAST, PRE-STRESSED CONCRETE PRODUCTION PILES

8.1 Following the driving of indicator piles and performing the pile load tests, a meeting between the Owner, Structural Engineer, Contractor and Krazan shall be held to discuss pile driving options and to determine final pile driving criteria.

8.2 Piles shall be fabricated under plant conditions to required lengths, sizes and shapes with specified reinforcement. Piles shall be cast true or straight to within 1 inch maximum for full pile length on any face (measured by taut line from butt to tip), but not to exceed ¼-inch in any 10-foot length, with smooth, even surfaces, free from voids.

8.3 Piles shall develop a minimum concrete compressive strength at 28 days of 6000 psi and a minimum strength at transfer of pre-stress of 4,000 psi. Piles shall be stressed with an effective pre-stress not less than 700 psi.

8.4 Piles may be steam cured by approved methods, in which case a combination of steam and moist curing shall be accomplished for at least 5 days.

9. INSPECTION OF CONCRETE PILE MANUFACTURING PROCESS - The results of compressive strength tests performed on concrete cylinders cast during manufacture of precast, pre-stressed piling shall be submitted at the direction of the Architect.

10. PILE DRIVING REQUIREMENTS

10.1 All piles shall be driven to or below the specified tip elevation and to the cutoff elevation, where damage to the pile will not occur.

10.2 Pile driving equipment shall be in first class condition with piles properly held in correct position while being driven. The hammer shall develop at least 32,000 foot pounds of energy per blow.

10.3 *Driving and Inspection*: All piles shall be driven straight and true in the locations shown on the Drawings.

10.3.1 Driving of piles shall not be undertaken within 10 feet of concrete cured less than 3 days.

10.3.2 Heads of concrete pile shall be protected during driving with an approved cushion head lock, which shall be maintained in good condition during the entire driving operations. However, introduction of fresh hammer cushion or pile cushions materials just prior to final penetration is not permitted.

10.3.3 Pile driving shall proceed only in the presence of Krazan, who shall make a continuous record of the penetration resistance behavior during driving and elevation of cutoff of every pile.

10.4 *Alignment and Tolerances*: All piles shall be driven so that the center of the pile head is not more than 3 inches from the design locations shown and no pile shall be more than two percent (2 percent) of its length out of plumb. Piles exceeding these tolerances shall be corrected as directed by the Architect or Structural Engineer and at no increase in cost to the Owner.

10.5 *Pile Damage and Replacement*: Cracking, splitting, distortion, bending, spalling, or other damage sustained by piles during driving shall be corrected as directed by the Architect or Structural Engineer without cost to the Owner.

10.5.1 Additional piles required by the Architect or Structural Engineer to replace damaged or misaligned piles shall be driven and all changes in pile cap design and construction, including costs of form work, steel, concrete and labor shall be accomplished without cost to the Owner.

10.6 *Heaving*: Survey level readings shall be taken on individual piles during at least the initial portion of pile driving at locations designated by Krazan. If it is determined that piles have been unseated, redriving of affected piles and all subsequent piles so affected shall be accomplished at no cost to the Owner.

10.7 *Cutting Off*: Tops of all piles projecting above cutoff elevation after driving shall be cut off at the proper elevation, following approval of Krazan, and ends removed from the jobsite.

10.7.1 Concrete piles shall be saw cut or grooved at cutoff points to prevent spalling or diagonal breaks during cutoff operations. Pre-stressing strands may be utilized for achieving pile cap ties in lieu of reinforcing bars only when specifically approved by the Structural Engineer.

11. CLEANUP - Upon completion of pile driving, remove all equipment, excess materials, etc., and leave the site clean and free of debris.

12. BASIS OF PAYMENT

12.1 For bidding purposes, the Contractor shall include in his bid a lump sum for all work embraced by this section, complete, based upon the number and length of piles as shown on the Drawings.

12.2 The contract sum will be subject to adjustment up or down, depending upon the actual lineal footage of piles manufactured, driven, and accepted.

12.3 For purposes of adjusting the contract sum, the Contractor shall submit unit prices for each type of pile as follows: (1) manufacturing and furnishing - price per lineal foot; (2) driving - price per pile; (3) cutting off - price per pile.

12.4 Payment for extra piles ordered by the Architect or Structural Engineer for purposes other than replacement of damaged or misaligned piles shall be in accordance with the above unit prices.

12.5 Unit prices shall include all costs for performing the described work, including all incidental items necessary to drive the piles in the proper positions and to the elevations required.