GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED COMMERCIAL/RETAIL DEVELOPMENT
NEC OF HOSKING AVENUE AND HIGHWAY 99
BAKERSFIELD, CALIFORNIA

PROJECT NO. 022-21021
SEPTEMBER 9, 2021

Prepared for:

MR. MATTHEW VAWTER
COMMERCE CONSTRUCTION CO., LP
13191 CROSSROADS PARKWAY NORTH, 6TH FLOOR
CITY OF INDUSTRY, CALIFORNIA 91746

Prepared by:

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GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

September 9, 2021

KA Project No. 022-21021

Mr. Matthew Vawter
Commerce Construction Co., LP
13191 Crossroads Parkway North, 6th Floor
City of Industry, California 91746

RE: Geotechnical Engineering Investigation
Proposed Commercial/Retail Development
NEC of Hosking Avenue and Highway 99
Bakersfield, California

Dear Mr. Vawter:

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 (661) 837-9200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Ryan K. Privett, PE
Project Engineer
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INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed Commercial/Retail Development to be located on the northeast corner of Hosking Avenue and Highway 99, in Bakersfield, California. Discussions regarding site conditions are presented herein, together with conclusions and recommendations pertaining to site preparation, Engineered Fill, utility trench backfill, drainage and landscaping, foundations, concrete floor slabs and exterior flatwork, retaining walls, soil cement reactivity, and pavement design.

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

PURPOSE AND SCOPE

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

Our scope of services was outlined in our proposal dated February 1, 2021 (KA Proposal P116-21) 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 43 borings to depths ranging from approximately 10 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 the proposed development will cover approximately 85 acres and will include an approximately 1,012,185 square foot (SF) distribution warehouse structure, as well as two retail development areas. An alternate configuration for the warehouse building is for a reduced footprint area of approximately 634,800 SF. The warehouse building will be located within the central portion of the site, and the two retail development areas are proposed to be located in the northwest corner of the site, and in the southern portion of the site. The northwestern retail development area will include six retail buildings, ranging in size from 6,000 SF to 15,000 SF, two restaurant buildings measuring 7,000 SF and 8,500 SF, and a 42,000 SF major retail building. The southern retail development area will include one shop building and one restaurant building measuring 3,600 SF and 7,200 sf, respectively, and a 57,200 SF major retail building. It is anticipated the warehouse building will be a five-story 110-foot tall concrete tilt-up and conventional structural steel frame structure supported on conventional foundations utilizing concrete slab-on-grade floors and elevated concrete decks. The lower four stories of the warehouse building are anticipated to be constructed utilizing concrete tilt-up construction and the top floor is anticipated to be constructed utilizing conventional structural steel framing. Dead-plus-live footing loads for the warehouse building are anticipated to be up to 7.75 kips per foot for perimeter continuous footings, and up to 116 kips for isolated column footings. The retail, shops, and restaurant buildings are anticipated to be single-story wood-frame, steel-frame, or concrete masonry unit (CMU) block buildings utilizing conventional slab-on-grade construction. Foundation loads for the retail, shops, and restaurant buildings are anticipated to be relatively light to moderate. On-site paved areas, a storm water drainage basin, a 56-foot diameter water tank and pump house, 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 irregular in shape and encompasses approximately 71 acres. The site is located at the northeast corner of Hosking Avenue and Highway 99, in Bakersfield, California. The site is bordered by Berkshire Road to the north, South "H" Street to the east, Hosking Avenue to the south, and Highway 99 to the east. The site is surrounded by vacant land to the north and south, by residential developments to the east, and by Highway 99 to the west.

Previous grading activities appeared to have been performed at the site, possibly as part of a formerly proposed residential subdivision. Remnants of apparent cul-de-sacs and other roadway excavations were observed during our field investigation and were visible in historical aerial photographs as far back as 1995. In addition, a former drainage basin excavation also remains in the southwestern portion of the site. Previous agricultural use was limited to isolated areas in the northeast and southwest portions of the site.

Presently, the area of proposed development is undeveloped vacant land. The previous grading noted above has resulted in elevation differences of 1 to 2 feet in the previous roadway and cul-de-sac areas, and 6 to 8 feet in the previous basin area. Various unpaved trails or access drives generally trend north-south and east-west across the site. One trail or access drive trends diagonally across the entire site from the northeast corner to the southwest corner. This could possibly be indicative of a pipeline or other utility easement. Numerous end dump fill piles are located in the eastern and central portions of the site. The nature and origin of the material is unknown. These fill piles are overgrown with vegetation and may also contain construction and/or landscaping debris. The site contains a moderate growth of native vegetation and the surface soils have loose consistency. Buried utilities are located along the edges of the site and may extend into the site. With the exception of the existing drainage basin and roadway excavations, the site is relatively flat and level with no major changes in grade.

GEOLOGIC SETTING

Geologically, the property is situated on the eastern flank, near the south end of the Great Valley Geomorphic Province. This province is a large northwesterly trending geosyncline or structural trough between the Coast Range Mountains and the Sierra Nevada Mountains. Erosion from both of these mountain systems has resulted in the deposition of immense thickness of sediments in the Valley floor.

Heavily-laden streams from the Sierra Nevada have built very prominent alluvial fans along the margins of the San Joaquin Valley. This has resulted in a rather flat topography in the vicinity of the project site. The site is composed of alluvial deposits which are mostly cohesionless sands and silts.

The south end of the San Joaquin Valley is surrounded on all sides, excluding the north, by active fault systems (San Andreas, White Wolf-Breckenridge-Kern Canyon and Garlock Faults). Numerous smaller faults exist within the valley floor.

There is on-going seismic activity in the Kern County area, with the most noticeable earthquake being the July 21, 1952 Kern County Earthquake. The initial shock was 7.7 magnitude shake with the epicenter near Wheeler Ridge. Vertical displacements of as much as three feet occurred at the fault line. Estimated average value of the maximum bedrock accelerations from the 1952 event are about 0.25 gravity at the project site.

The closest known faults to the property are subsurface faults located at the Fruitvale Oil Field. These faults cut the older sediments and, although numerous, are not thought to be active in the last two million years.

No evidence was observed that indicated surface faulting has occurred across the property during the Holocene time. Faults not yet identified, however, may exist. The site is not within an Earthquake Fault Zone (special studies zone).

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored on April 8-13, 2021 and August 13, 2021, by drilling 34 borings to depths of approximately 10 to 50 feet below existing site grade, using a truck-mounted drill rig. In addition, 10 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, permeability, 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 test 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 silty sand or sandy silt. These soils are disturbed, have low strength characteristics, and are highly compressible when saturated.

Approximately 2½ to 12½ feet of fill material was encountered in several of the borings drilled within the site. The deepest fill, approximately 12½ feet, was encountered in boring B4, within the eastern portion of the site. Fills with depths ranging from 2½ to 8½ feet were encountered in Borings B19, B23-26, and B31. The fill material predominately consisted of sandy silt. 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 investigation. The limited testing indicates the fill soils had varying strength characteristics ranging from loosely placed to compacted.

Below the loose surface soils and fill material, approximately 3 to 4½ feet of loose to dense silty sand, sandy silt, silty sand/sand, or sand were encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly to moderately compressible. Penetration resistance ranged from 7 to

50 blows per foot. Dry densities ranged from 92 to 127 pcf. Representative soil samples consolidated approximately 2 to 6½ percent under a 2 ksf load when saturated. Representative soil samples had angles of internal friction of 32 to 35 degrees.

Below 4 to 5½ feet, alternating layers of loose to very dense silty sand, silty sand/sandy silt, sandy silt, silty sand/sand, or sand were encountered. Some of these soils had trace amounts of clay. The clayey soils had a low to moderate expansion potential. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance ranged from 8 to 68 blows per foot. Dry densities ranged from 89 to 130 pcf. A representative soil samples consolidated approximately 2 percent under a 2 ksf load when saturated. A representative sample of the clayey soils had an expansion index of 32. These soils had slightly stronger strength characteristics than 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. Information obtained from the Department of Water Resources indicates that groundwater has been historically deeper than 100 feet within the project site vicinity.

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.

PERMEABILITY TESTING

Six permeability tests were performed on soil samples collected from depths of 10 to 35 feet below existing site grade. The permeability tests were performed in accordance with ASTM Test Method D2434 and D5084. The test results are as follows:

Boring No.	Depth (feet)	Coefficient of Permeability (cm/second)	Soil Type
B1	10-11	9.1×10^{-3}	Silty Sand/Sand (SM/SP)
B1	20-21	8.3×10^{-5}	Silty Sand (SM)
B1	30-31	2.0×10^{-6}	Sandy Silt (ML)
B1	35-36	5.0×10^{-6}	Sandy Silt (ML)
B2	15-16	9.0×10^{-7}	Sandy Silt (ML)
B2	25-26	7.7×10^{-7}	Sandy Silt (ML)

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 very loose surface soils, moderately compressible upper native soils, fill material, expansive nature of the clayey soils, and previous and existing development appear to be conducive to the development of the project. The surface soils have a very loose consistency. These soils are disturbed, have low strength characteristics, and are highly compressible when saturated. Accordingly, it is recommended that the surface soils be recompacted. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation.

Approximately 2½ to 12½ feet of fill material was encountered in several of the borings drilled within the site. The deepest fill, approximately 12½ feet, was encountered in boring B4, within the eastern portion of the site. Fills with depths ranging from 2½ to 8½ feet were encountered in Borings B19, B23-26, and B31. The fill material predominately consisted of sandy silt. 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 field and laboratory investigations. Preliminary testing indicates that the fill soils had varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended the fill soils within proposed building areas and 5 feet beyond be excavated and stockpiled so that the native soil can be properly prepared. These soils will be suitable for reuse as Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Fill soil intermixed with asphaltic concrete will not be suitable for re-use in building areas, but may be used in pavement areas provided it is cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Prior to backfilling, Krazan & Associates, Inc., should inspect the bottom of the excavation to verify no additional removal is required. It is recommended that contractors visit the project site to gain an understanding of the site conditions and verify the existing fills noted herein, as well as other fills, i.e., end-dump piles, not encountered in the soil borings.

In order to provide uniform support for the proposed structure foundations, it is recommended that following stripping, fill removal operations, and demolition activities, the upper 3 feet of native soils within proposed building areas be excavated, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557. In areas where fill removal exceeds 6 feet, the excavation of native soils can be reduced to 18 inches. In addition, it is recommended that the proposed foundations be supported by a minimum of 24 inches of Engineered Fill. An increased allowable soil bearing pressure may be utilized for proposed foundations supported by a minimum of 36 inches of Engineered Fill. Over-excavation should extend to a minimum of 5 feet beyond structural elements. The on-site soils will be suitable for reuse as Engineered Fill, provided they

are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Prior to backfilling, the bottom of the excavation should be proof-rolled and observed by Krazan and Associates, Inc. to verify stability. This compaction effort should stabilize the surface 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. Fill material should be compacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557.

The upper soils within the site are predominately silty sand, sandy silt, and silty sand/sandy silt. Some of these soils contain trace amounts of clay. The clayey soils appeared to have a low to moderate swell potential. The estimated swell pressures of the clayey soils may cause movement effecting slabs and possible stucco or similar brittle exterior finishes. To reduce potential soil movement, it is recommended the upper 18 inches of soil within slab-on-grade and exterior flatwork areas consist of non-expansive Engineered Fill. The on-site soils that do not contain clay will be suitable for reuse as non-expansive Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. These soils appear to be readily available throughout the site. During construction, it is recommended that additional tests should be performed on the on-site soils to verify their physical and index properties.

Structures are located within the project vicinity. In addition, portions of the site were previously utilized as agricultural land. Associated with these developments are buried structures, such as utility lines, septic systems, water wells, and irrigation lines that may extend into the project site. Any buried structures or loosely backfilled excavations encountered during construction should be properly removed and the resulting excavations backfilled with Engineered Fill. After demolition activities, it is recommended that these disturbed soils be removed and/or recompacted. This compaction effort should stabilize the upper soils and locate any unsuitable or pliant areas not found during our field investigation.

Sandy 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 soils.

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structure footings supported by a minimum of 24 inches of Engineered Fill may be designed utilizing an allowable bearing pressure of 3,000 psf for dead-plus-live loads. The proposed structure footings supported by a minimum of 36 inches of Engineered Fill may be designed utilizing an allowable bearing pressure of 4,000 psf for dead-plus-live loads. The proposed water tank footings supported by a minimum of 36 inches of Engineered Fill may be designed utilizing an allowable bearing pressure of 2,500 psf for dead-plus-live loads. Footings should have a minimum embedment of 18 inches.

Groundwater Influence on Structures/Construction

Based on our findings and historical records, it is not anticipated that groundwater will rise within the zone of structural influence or affect the construction of foundations and pavements for the project. However, if earthwork is performed during or soon after periods of precipitation, the subgrade soils may

become saturated, "pump," or not respond to densification techniques. Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material; or mixing the soil with an approved lime or cement product. Our firm should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Site Preparation

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

Approximately 2½ to 12½ feet of fill material was encountered in several of the borings drilled within the site. The deepest fill, approximately 12½ feet, was encountered in boring B4, within the eastern portion of the site. Fills with depths ranging from 2½ to 8½ feet were encountered in Borings B19, B23-26, and B31. The fill material predominately consisted of sandy silt. 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 field and laboratory investigations. Preliminary testing indicates that the fill soils had varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended the fill soils within proposed building areas and 5 feet beyond be excavated and stockpiled so that the native soil can be properly prepared. These soils will be suitable for reuse as Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Fill soil intermixed with asphaltic concrete will not be suitable for re-use in building areas, but may be used in pavement areas provided it is cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Prior to backfilling, Krazan & Associates, Inc., should inspect the bottom of the excavation to verify no additional removal is required. It is recommended that contractors visit the project site to gain an understanding of the site conditions and verify the existing fills noted herein, as well as other fills, i.e., end-dump piles, not encountered in the soil borings.

Structures are located within the project vicinity. In addition, portions of the site were previously utilized as agricultural land. Associated with these developments are buried structures, such as utility lines, septic systems, water wells, and irrigation lines that may extend into the project site. Demolition activities should include proper removal of any buried structures. Any buried structures, including utilities or loosely backfilled excavations, encountered during construction should be properly removed and the resulting excavations backfilled. Disturbed areas caused by demolition activities should 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. Any water wells encountered should be abandoned in accordance with county

standards. Existing 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 cleaned to firm native ground and backfilled with Engineered Fill.

In order to provide uniform foundation support, it is recommended that following stripping, fill removal operations, and demolition activities, the upper 3 feet of native soils within proposed building areas be excavated, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557. In areas where fill removal exceeds 6 feet, the excavation of native soils can be reduced to 18 inches. In addition, it is recommended that the proposed foundations be supported by a minimum of 24 inches of Engineered Fill. An increased allowable soil bearing pressure may be utilized for proposed foundations supported by a minimum of 36 inches of Engineered Fill. Over-excavation should extend to a minimum of 5 feet beyond structural elements. The on-site soils will be suitable for reuse as Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. 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 surface 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. Fill material should be compacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557.

Following stripping, fill removal operations, and demolition activities, the exposed subgrade in exterior flatwork and pavement areas should be excavated to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557. Limits of recompaction should extend 2 feet beyond flatwork and pavements. Prior to backfilling, the exposed subgrade should be proofrolled and observed by Krazan and Associates, Inc. to verify stability. Soft or pliant areas should be excavated to firm native ground. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation.

It is recommended that the upper 18 inches of soil within proposed slab-on-grade and exterior flatwork areas consist of non-expansive Engineered Fill or lime-treated Engineered Fill. The intent is to support slab-on-grade and exterior flatwork areas with 18 inches of non-expansive or lime-treated fill. The fill placement serves two functions: 1) it provides a uniform amount of soil, which will more evenly distribute the soil pressures and 2) it reduces moisture content fluctuation in the clayey material beneath the building area. The non-expansive fill material should be a well-graded silty sand or sandy silt soil. A clean sand or very sandy soil is not acceptable for this purpose. A sandy soil will allow the surface water to drain into the expansive clayey soil below, which may result in soil swelling. On-site soils suitable for use as non-expansive Engineered Fill appear to be readily available throughout the site. Imported Fill should be approved by the Soils Engineer prior to placement. The fill should be placed as specified as Engineered Fill.

Relatively clean sands were encountered at various locations throughout the site. The possibility exists that site grading operations could expose these soils in areas of proposed buildings, pavements, and/or retaining walls. The Contractor should note that these soils lack the cohesion necessary to stand vertically, even in shallow excavations such as footing trenches. If these conditions are encountered, it will be necessary to over-excavate the affected area(s) to a minimum of 1 foot below the proposed bearing surface. These areas may be backfilled using a mix of the silty sand and sand soils that contains at least 20 percent fines and meeting the requirements for Engineered Fill. This material may be obtained from elsewhere at the site, imported to the site from an approved off-site source, or manufactured through blending of the excavated clean sand with other suitable material containing a higher percentage of fines to result in material meeting the requirements for Engineered Fill.

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 silty sand, sandy silt, silty sand/sandy silt, and silty sand/sand. Some of these soils contained trace amounts of clay. Preliminary testing indicates that these soils will be suitable for reuse as non-expansive Engineered Fill, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Clayey soils with an expansion index of 15 or greater should not be used as Engineered Fill within the upper 18 inches of slab-on-grade and exterior flatwork areas. Additional tests should be performed on the on-site soils during construction to verify their physical and index properties. Fill soil intermixed with asphaltic concrete will not be suitable for re-use in building areas, but may be used in pavement areas provided it is cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension.

Relatively clean sands were encountered at various locations throughout the site. The possibility exists that site grading operations could expose these soils in areas of proposed buildings, pavements, and/or retaining walls. The Contractor should note that these soils lack the cohesion necessary to stand vertically, even in shallow excavations such as footing trenches. If these conditions are encountered, it will be necessary to over-excavate the affected area(s) to a minimum of 1 foot below the proposed bearing surface. These areas may be backfilled using a mix of the silty sand and sand soils that contains

at least 20 percent fines and meeting the requirements for Engineered Fill. This material may be obtained from elsewhere at the site, imported to the site from an approved off-site source, or manufactured through blending of the excavated clean sand with other suitable material containing a higher percentage of fines to result in material meeting the requirements for 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 material should be predominantly non-expansive granular material with a plasticity index less than 10 and an expansion index less than 15. Imported Fill should be free from rocks and lumps greater than 4 inches in maximum dimension. All Imported Fill material should be submitted for approval to the Soils Engineer at least 48 hours prior to delivery to the site.

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 95 percent of maximum density based on ASTM Test Method D1557. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

Drainage and Landscaping

The ground surface should slope away from building pad and pavement areas toward appropriate drop inlets or other surface drainage devices. In accordance with Section 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.

Utility Trench Backfill

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards by a Contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the Contractor. Traffic and vibration adjacent to trench walls should be 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 shortly following periods of precipitation.

Sandy 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 soils.

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.

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 - Conventional

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

Load	Allowable Loading
Dead Load Only	2,250 psf
Dead-Plus-Live Load	3,000 psf
Total Load, Including Wind or Seismic Loads	4,000 psf

Alternatively, proposed structures supported on a shallow foundation system bearing on a minimum of 36 inches of Engineered Fill may be design for an increased allowable soil bearing pressure as indicated below.

Load	Allowable Loading
Dead Load Only	3,000 psf
Dead-Plus-Live Load	4,000 psf
Total Load, Including Wind or Seismic Loads	5,325 psf

The footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Footings should have a minimum width of 12 inches, regardless of load. Ultimate design of foundations and reinforcement should be performed by the project Structural Engineer.

The total soil movement is not expected to exceed 1 inch. Differential movement measured across a horizontal distance of 65 feet or between column footings should be less than ¾ inch. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated.

The footing excavations should not be allowed to dry out any time prior to pouring concrete. It is recommended that footings be reinforced by at least one No. 4 reinforcing bar in both top and bottom.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.40 acting between the base of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an equivalent fluid passive pressure of 325 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.

Foundations - Conventional (Tank)

After completion of the recommended site preparation, the proposed water tank site should be suitable for shallow footing support. The proposed tank may be supported on a shallow foundation system bearing on a minimum of 3 feet of Engineered Fill. Continuous ring wall footings can be designed for the following maximum allowable soil bearing pressures:

Load	Allowable Loading
Dead Load Only	1,875 psf
Dead-Plus-Live Load	2,500 psf
Total Load, Including Wind or Seismic Loads	3,325 psf

Footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Footings should have a minimum width of 12 inches, regardless of load. Ultimate design of foundations and reinforcement should be performed by the project's Structural Engineer.

If a ring wall foundation is utilized, the tank foundation pad should consist of Class 2 aggregate base material, compacted to a minimum of 95 percent of maximum density based on ASTM Test Method D1557. A 3-inch thick sand leveling course or oil sand should be placed on the prepared granular fill pad for the final contract support of the flexible steel Tank Foundation base. (The sand should be free from organics and other deleterious matter, and should meet the following gradation: 100 percent passing the #4 sieve, and not more than 4 percent passing the #200 sieve). Furthermore, the tank foundation pad should be graded to ultimately maintain floor slopes for cleaning and emptying the tank.

The total settlement is not expected to exceed 1 inch. Differential settlement should be less than 1 inch. Most of the settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. It is recommended that flexible connections be incorporated in the design of the tank to account for anticipated settlement.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.40 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 325 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 value above may be used for short duration, wind, or seismic loads.

Floor Slabs and Exterior Flatwork

In areas where moisture-sensitive floor coverings will be used, such as office areas, 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, or Class 2 aggregate base. In areas subject to forklift traffic, slabs-on-grade should be underlain by a minimum of 4 inches of Class 2 aggregate base. 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 floor slab should be reinforced at a minimum with No. 3 reinforcement bars at 18 inches on-center each way within the middle one-third. Slab-on-grade floors may be designed using a subgrade modulus (k) of 150 pci. Ultimate design of floor slabs is left to the discretion of the project Structural Engineer. Thicker floor slabs with increased concrete strength and reinforcement should be designed wherever large vehicular loads, heavy concentrated loads, heavy equipment, or machinery is anticipated.

The exterior floors should be poured separately in order to act independently of the walls and foundation system. 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 40 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 60 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.

The 2019 CBC requires determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet of backfill height due to design earthquake ground motions. The Site Modified Peak Ground Acceleration (PGA_M), based on ASCE7-16 and information from the SEAOC and OSHPD Seismic Design Maps website (https://seismicmaps.org), is 0.509. We recommend an incremental seismic lateral pressure of 23 pcf be included in the stability analyses for retaining walls as needed. The incremental seismic lateral pressure should be applied in a reverse triangular distribution at the back side of the wall.

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 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 four 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 CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

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

R-Value Test Results and Pavement Design

Twelve 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"	Silty Sand (SM)	59
2	12-24"	Silty Sand (SM)	57
3	12-24"	Silty Sand (SM)	51
4	12-24"	Silty Sand (SM)	53
5	12-24"	Silty Sand (SM)	58
6	12-24"	Silty Sand (SM)	60
7	12-24"	Silty Sand (SM)	50
8	12-24"	Silty Sand (SM)	57
9	12-24"	Silty Sand (SM)	50
10	12-24"	Silty Sand (SM)	55
11	12-24"	Silty Sand/Sandy Silt (SM/ML)	44
12	12-24"	Silty Sand/Sandy Silt (SM/ML)	38

The test results are relatively good and indicate moderate to good subgrade support characteristics under dynamic traffic loads.

The following table shows recommended pavement sections for areas to be used primarily by automobile and truck traffic. These particular pavement sections are for traffic indices of 5.0 and 7.0 based on a design R-value of 38, using design procedures developed by Caltrans.

Traffic Index	Asphaltic Concrete	Class II Aggregate Base*	Compacted Subgrade**
5.0	2.5"	5.0"	12.0"
7.0	4.0"	7.5"	12.0"

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

The following table shows recommended pavement sections for areas to be used primarily by automobile and truck traffic. These particular pavement sections are for traffic indices of 5.0 and 7.0 based on a design R-value of 50, using design procedures developed by Caltrans.

Traffic Index	Asphaltic Concrete	Class II Aggregate Base*	Compacted Subgrade**
5.0	2.5"	4.0"	12.0"
7.0	4.0"	4.5"	12.0"

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

The following recommendations are for light-duty and heavy-duty Portland Cement Concrete Pavement Sections based on the design procedures developed by the Portland Cement Association and American Concrete Institute (ACI) Publication 330R-08, *Guide for the Design and Construction of Concrete Parking Lots*. Recommendations for extra heavy-duty Portland Cement Concrete Pavement (JPCP) are based on the *2020 Caltrans Highway Design Manual, Chapter 620 – Rigid Pavement*. Dowels or other joint reinforcement for rigid pavement is left to the discretion of the project Structural Engineer.

PORTLAND CEMENT CONCRETE PAVEMENT
LIGHT DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
5.0	5.0"	4.0"	12.0"

PORTLAND CEMENT CONCRETE PAVEMENT
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***

Alternate Pavement Design (AASHTO – 20-Year Life Cycle)

For alternative consideration, we have also used American Association of State Highway and Transportation Officials (AASHTO) Guide for the Design of Pavement Structures (1993) to determine the flexible and rigid pavement sections for the planned extra-heavy truck traffic areas associated with the warehouse. Dowels or other joint reinforcement for rigid pavement is left to the discretion of the project Structural Engineer. Based on information provided to our office, we have assumed the following factors for our calculations:

- Average daily traffic: 394 (5-axle trucks)
- Operational schedule: 6 days per week
- Pavement design life: 20 years
- ESALs (W18): 12,292,800 (Traffic Index = 12.0)
- Overall Standard Deviation (S_o): 0.30

- Initial Serviceability Index (P_o): 2.0
- Terminal Serviceability Index (P_t): 2.5
- Expected growth rate: 0 %
- Design reliability (R): 90%
- Subgrade CBR: 15 (correlated based on R-Value = 50)
- Subgrade resilient modulus (M_r): 22,500 pounds per square inch (psi)
- Concrete Elastic Modulus (E_c): 5,000,000 psi
- Concrete Modulus of Rupture (S'_c): 650 psi
- Concrete Compressive Strength (f'_c): 4,000 psi
- Load Transfer Coefficient (J): 3.3
- Drainage Coefficient (C_d): 1.0

ASPHALTIC CONCRETE (FLEXIBLE) PAVEMENT
EXTRA HEAVY DUTY (AASHTO Design Method)

Asphaltic Concrete	Aggregate Base*	Compacted Subgrade*
7.0 in.	7.0 in.	12.0 in.

** 95% compaction based on ASTM Test Method D1557*

PORTLAND CEMENT CONCRETE (RIGID) PAVEMENT
EXTRA HEAVY DUTY (AASHTO Design Method)

Portland Cement Concrete***	Aggregate Base*	Compacted Subgrade*
11.5 in.	6.0 in.	12.0 in.

** 95% compaction based on ASTM Test Method D1557*
****Minimum compressive strength of 4000 psi*

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 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. 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 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.

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 – Stiff Soil is most consistent with the subject site soil conditions. A site modified peak ground acceleration (PGA_M) of 0.509 may be used for seismic analysis. 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	1.095	Table 1613.2.3 (1)
S_s	1.013	Section 1613.2.1
S_{MS}	1.109	Section 1613.2.3
S_{DS}	0.739	Section 1613.2.4
Site Coefficient F_v	1.933	Table 1613.2.3 (2)
S_1	0.367	Section 1613.2.1
S_{M1}	0.709	Section 1613.2.3
S_{D1}	0.473	Section 1613.2.4
T_S	0.640	Section 1613.2

* Based on Equivalent Lateral Force (ELF) Design Procedure being used.

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.

A soil sample obtained from the site was tested in accordance with State of California Materials Manual Test Designations 417 and 422. The sulfate concentration detected from this soil sample was less than 150 ppm (75.8 ppm) and is below the maximum allowable values established by HUD/FHA and CBC. The chloride concentration detected from this soil sample was 27 ppm. Therefore, no special mitigation measures are necessary to compensate for sulfate reactivity with the cement, and American Concrete Institute (ACI) sulfate exposure class S0 and corrosion exposure class C0 may be used for design purposes.

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 building foundation and on-site drainage disposal designs. 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 (661) 837-9200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Ryan K. Privett, PE
Project Engineer
RCE No. 59372

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

RKP/DRJ:ht

ALTERNATIVE BUILDING LAYOUT

APPROXIMATE BORING LOCATION

APPROXIMATE R-VALUE LOCATION

N

W E

S

SITE MAP	**Scale:** NTS	**Date:** September 2021	Krazan GEOTECHNICAL ENGINEERING
Commercial/Retail Development **NEC Hosking & Highway 99** **Bakersfield, California**	**Drawn by:** HT	**Approved by:** DJ	
	Project No. 022-21021	**Figure No.** 1	

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Forty-three 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, permeability, and sieve analysis tests were determined for the undisturbed samples representative of the subsurface material. 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

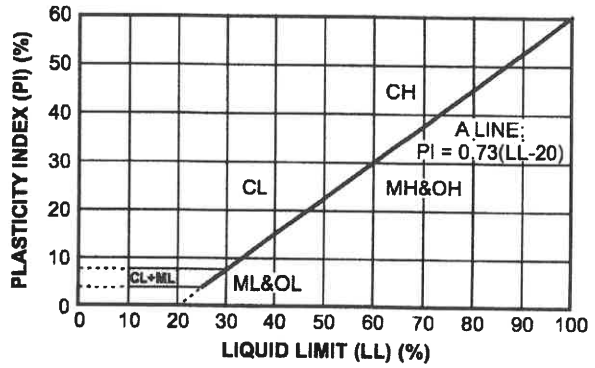
CONSISTENCY CLASSIFICATION

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 B1

Project: Commercial/Retail Development

Project No: 022-21021

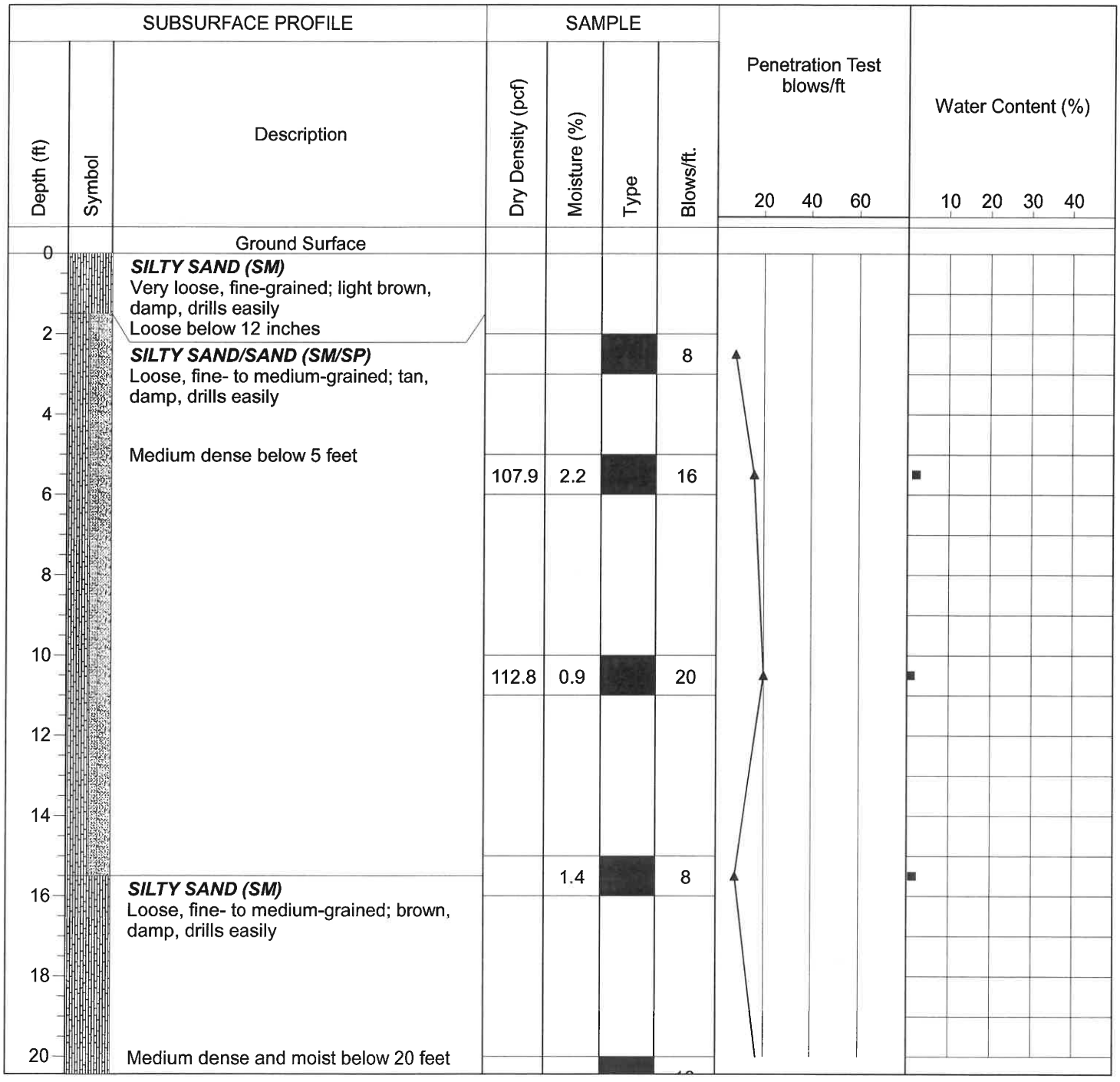
Client: Commerce Construction Co., L.P.

Figure No.: A-1

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Hollow Stem

Drill Date: 4-8-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6½ Inches

Driller: Eddie Tapia

Elevation: 50 Feet

Log of Boring B1

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-1

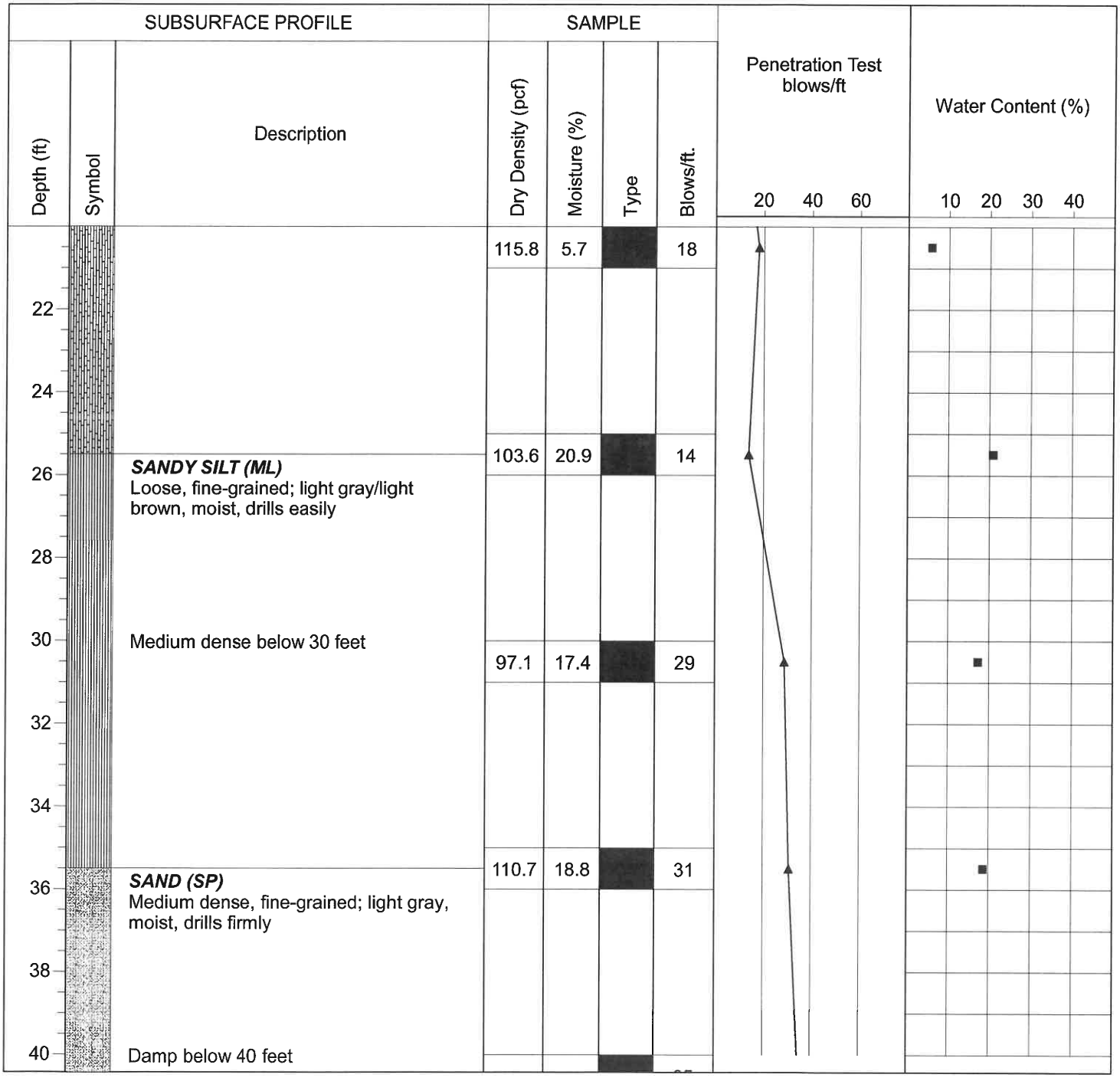
Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None



Drill Method: Hollow Stem

Drill Date: 4-8-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6½ Inches

Driller: Eddie Tapia

Elevation: 50 Feet

Log of Boring B1

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-1

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	20 40 60	10 20 30 40
42			108.8	4.5		35		
44								
46			102.1	2.7		38		
48								
50		End of Borehole						
52								
54								
56								
58								
60								

Drill Method: Hollow Stem

Drill Date: 4-8-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6½ Inches

Driller: Eddie Tapia

Elevation: 50 Feet

Log of Boring B2

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-2

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SILTY SAND (SM)*** Very loose, fine-grained; light brown, damp, drills easily				
2		Loose below 12 inches				
2		Medium dense below 2 feet		3.4		30
4						
6		***SILTY SAND/SAND (SM/SP)*** Medium dense, fine- to medium-grained; tan, damp, drills easily		1.5		19
8						
10		Loose below 10 feet				14
12						
14						
16		***SANDY SILT (ML)*** Loose, fine-grained with CLAY; grayish-brown, moist, drills easily	101.6	23.9		9
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem

Drill Date: 4-8-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6½ Inches

Driller: Eddie Tapia

Elevation: 50 Feet

Log of Boring B2

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-2

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	20 40 60	10 20 30 40
22			106.0	19.5		9		
24								
26			100.6	22.6		15		
28								
30		Medium dense below 30 feet	102.0	8.1		30		
32								
34		***SAND (SP)*** Medium dense, fine-grained; gray-tan, damp, drills easily	115.9	3.3		33		
36								
38								
40								

Drill Method: Hollow Stem

Drill Date: 4-8-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6½ Inches

Driller: Eddie Tapia

Elevation: 50 Feet

Log of Boring B2

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-2

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	20 40 60	10 20 30 40
42		***SANDY SILT (ML)*** Medium dense, fine-grained; light brown/gray, moist, drills easily	97.5	12.2		27		
44								
46		***SILTY SAND/SAND (SM/SP)*** Dense, fine- to medium-grained; brown, damp, drills firmly	106.6	3.0		49		
48								
50		End of Borehole						
52								
54								
56								
58								
60								

Drill Method: Hollow Stem

Drill Date: 4-8-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6½ Inches

Driller: Eddie Tapia

Elevation: 50 Feet

Log of Boring B3

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-3

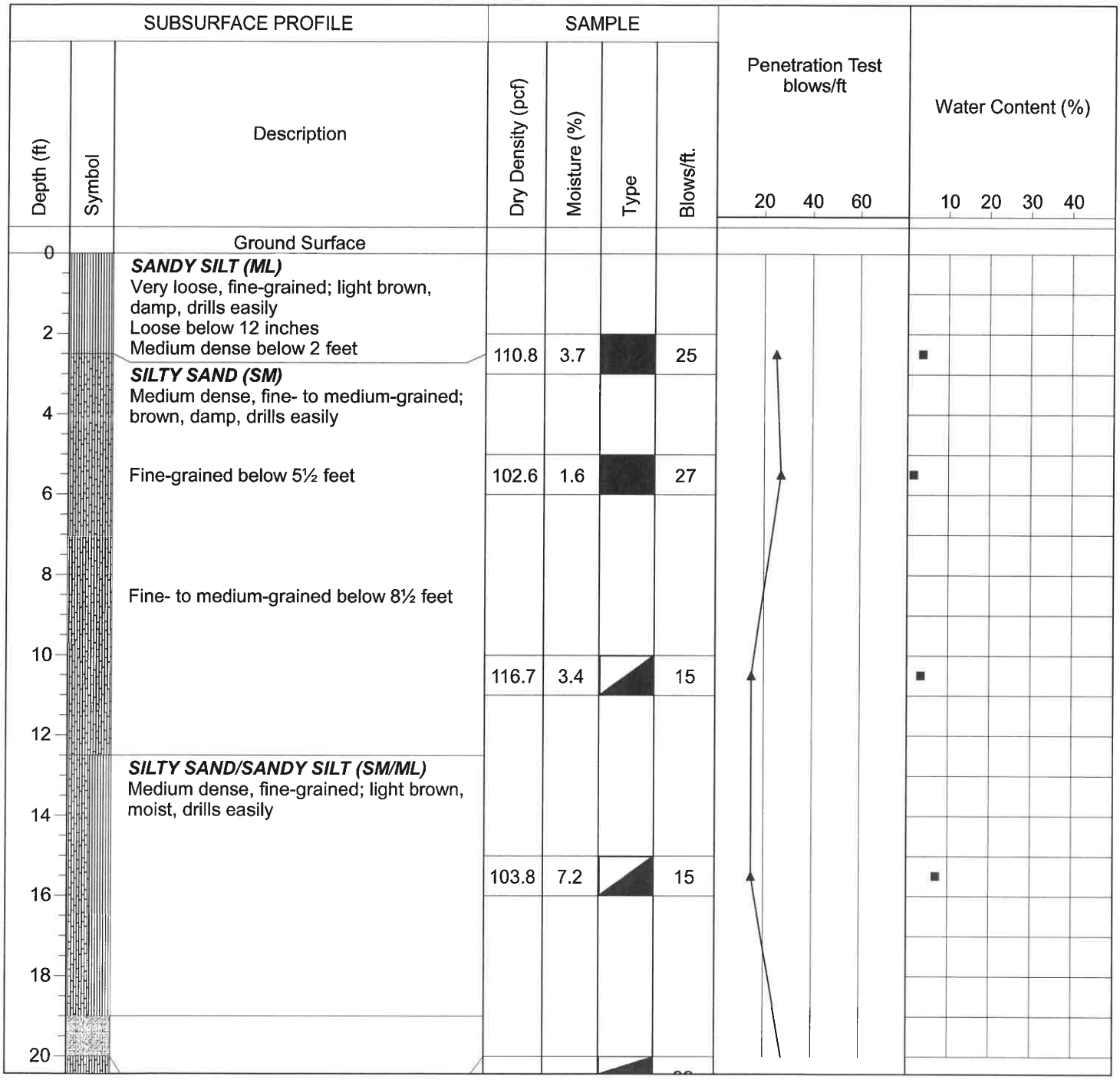
Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None



Drill Method: Hollow Stem

Drill Date: 4-9-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6½ Inches

Driller: Eddie Tapia

Elevation: 50 Feet

Log of Boring B3

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-3

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		SAND (SP) Medium dense, fine- to medium-grained; tan, damp, drills easily	111.0	2.0		29
22		***SILTY SAND (SM)*** Medium dense, fine-grained; brown, damp, drills easily				
24						
			99.1	3.8		18
26						
28		With thin lenses of SAND below 28 feet				
30			102.3	2.9		19
32						
34		***SANDY SILT (ML)*** Medium dense, fine-grained; gray, moist, drills easily				
			95.2	11.4		23
36						
38						
40		With thin lenses of SAND below 40 feet				

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem

Drill Date: 4-9-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6½ Inches

Driller: Eddie Tapia

Elevation: 50 Feet

Log of Boring B3

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-3

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	20 40 60	10 20 30 40
42			96.9	23.4		19		
44								
46			98.5	20.6		27		
48								
50		End of Borehole						
52								
54								
56								
58								
60								

Drill Method: Hollow Stem

Drill Rig: CME 45C-3

Driller: Eddie Tapia

Krazan and Associates

Drill Date: 4-9-21

Hole Size: 6½ Inches

Elevation: 50 Feet

Log of Boring B4

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-4

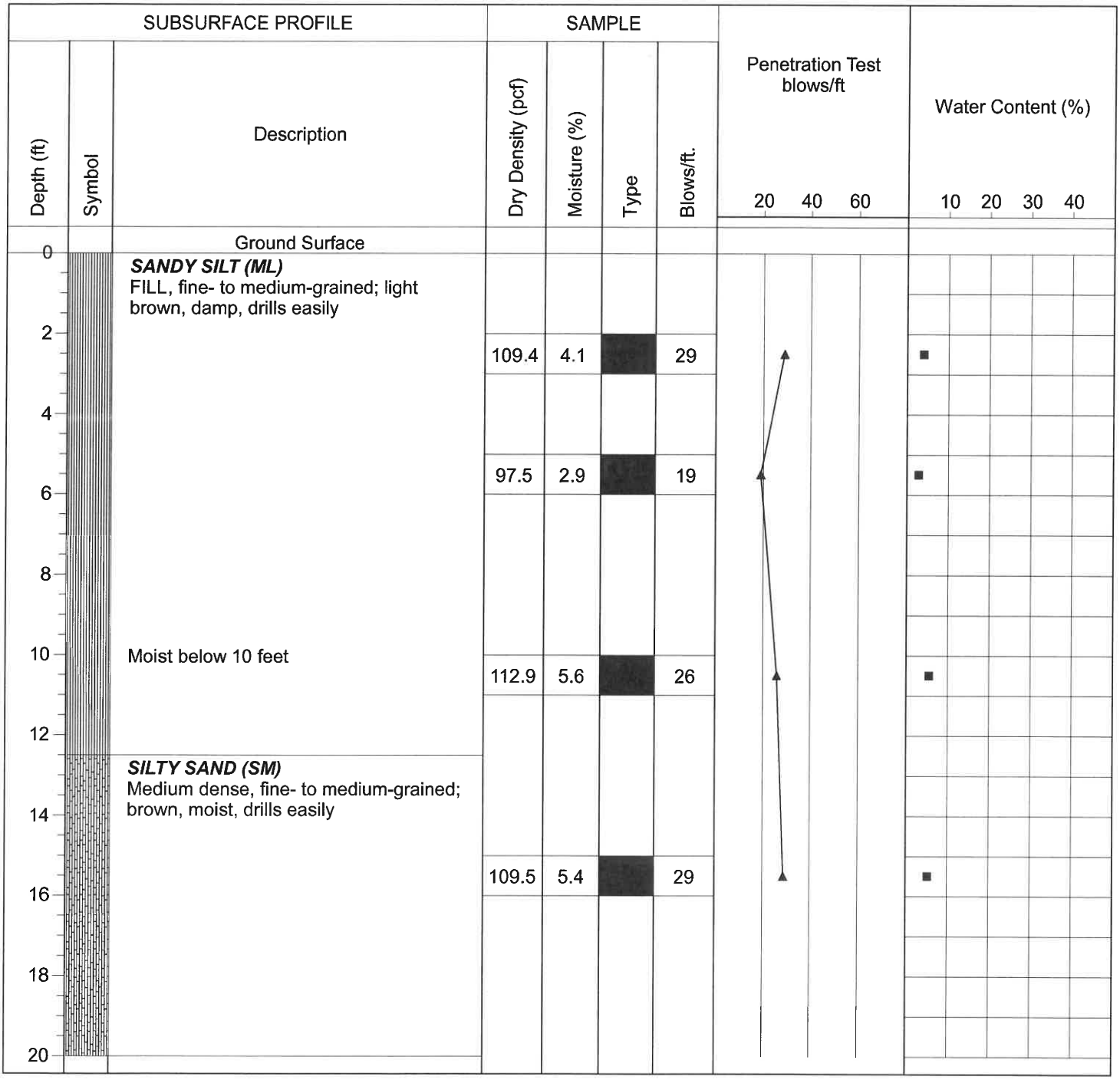
Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None



Drill Method: Solid Flight

Drill Date: 4-9-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 4½ Inches

Driller: Eddie Tapia

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B5

Project: Commercial/Retail Development

Project No: 022-21021

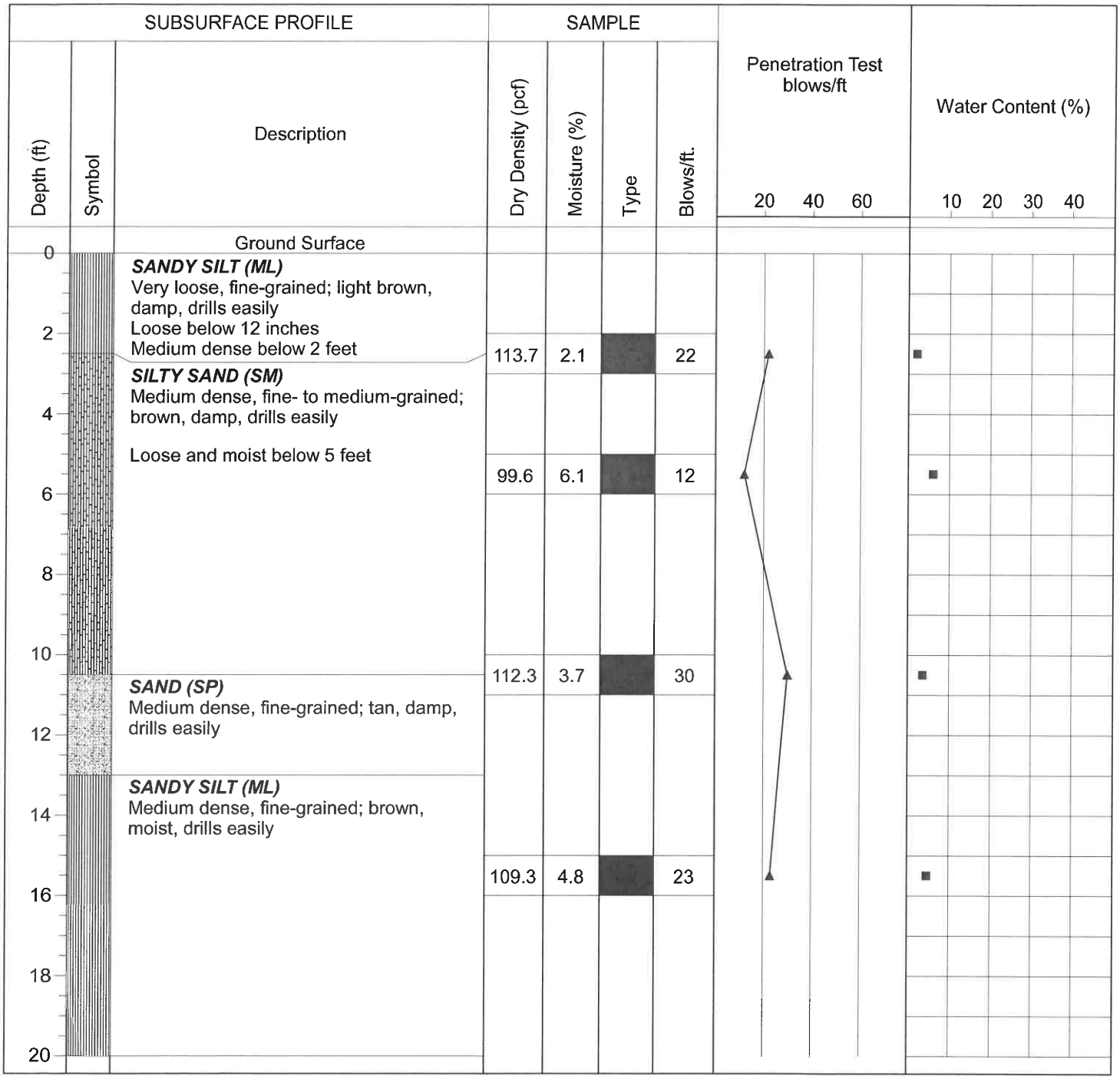
Client: Commerce Construction Co., L.P.

Figure No.: A-5

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-9-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 4½ Inches

Driller: Eddie Tapia

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B6

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-6

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine-grained; light brown, damp, drills easily				
2		Loose below 12 inches Medium dense below 2 feet		3.1		21
4						
6		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, damp, drills easily	106.4	2.1		24
8						
10		***SAND (SP)*** Medium dense, fine- to medium-grained; light brown/tan, damp, drills easily	109.4	1.7		20
12						
14		Loose below 15 feet				
16				0.9		8
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Date: 4-9-21

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 4½ Inches

Driller: Eddie Tapia

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B7

Project: Commercial/Retail Development

Project No: 022-21021

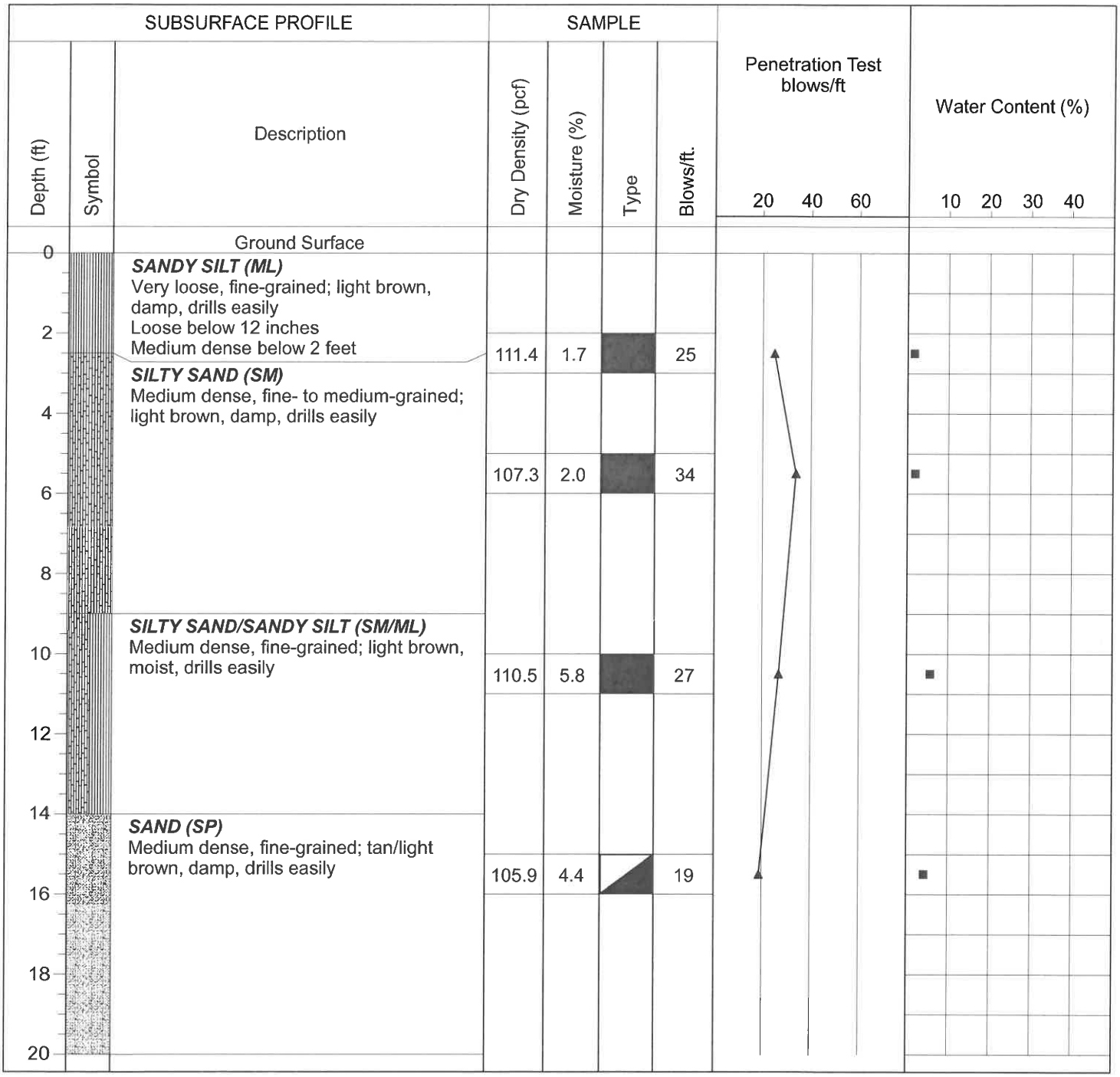
Client: Commerce Construction Co., L.P.

Figure No.: A-7

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B8

Project: Commercial/Retail Development

Project No: 022-21021

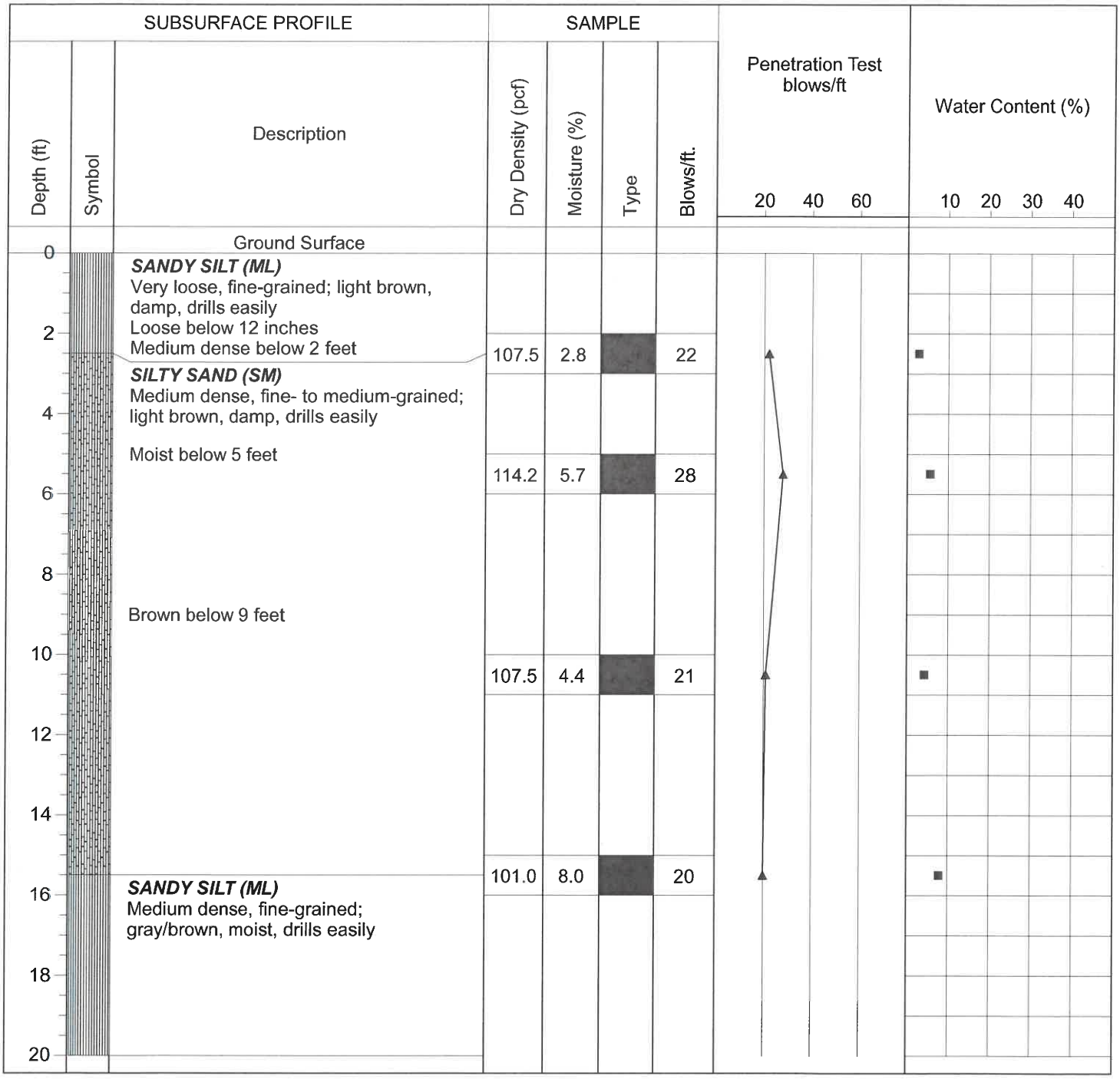
Client: Commerce Construction Co., L.P.

Figure No.: A-8

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B9

Project: Commercial/Retail Development

Project No: 022-21021

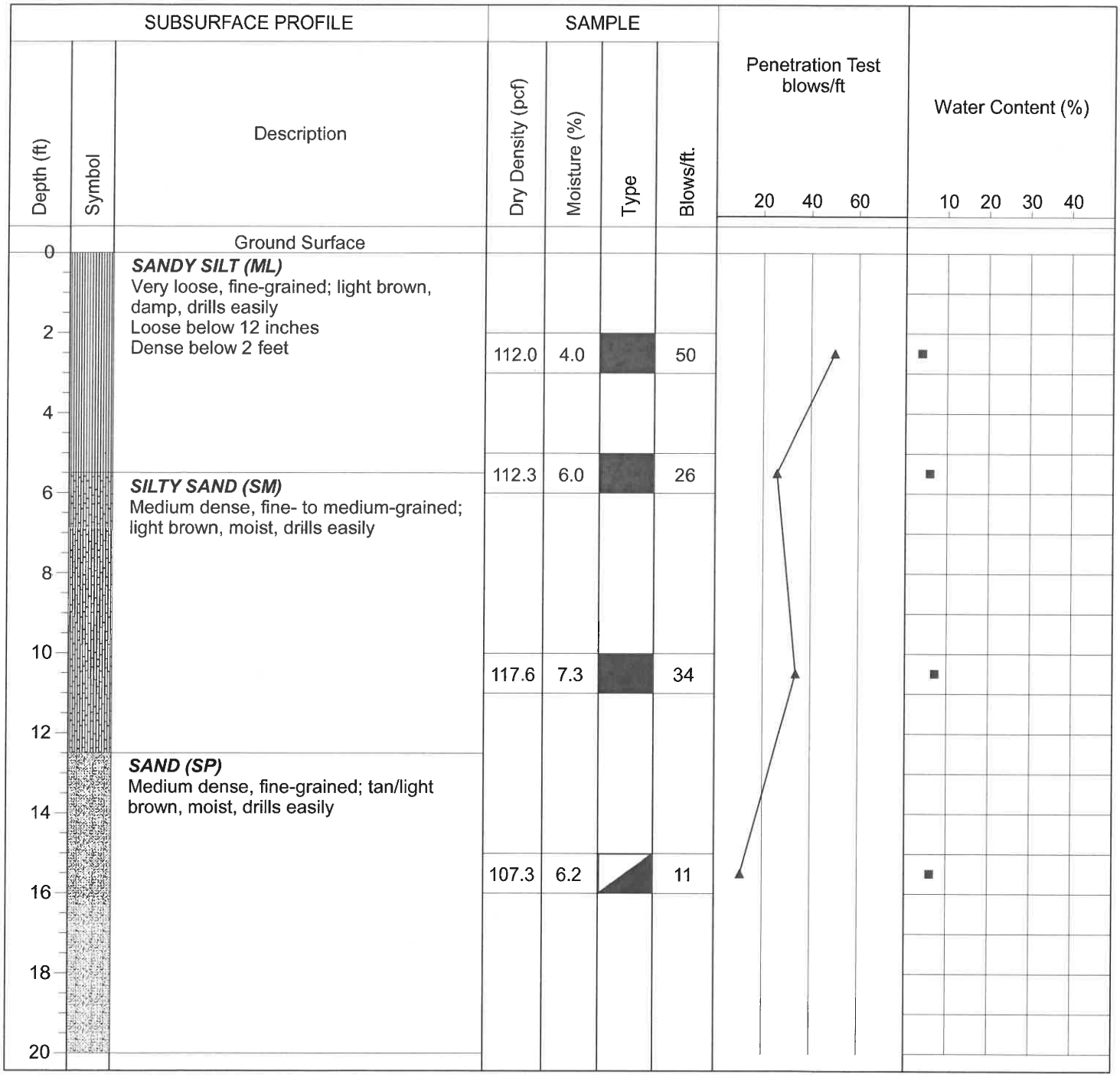
Client: Commerce Construction Co., L.P.

Figure No.: A-9

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-12-21

Hole Size: 4½ Inches

Elevation: 20 Feet

Log of Boring B10

Project: Commercial/Retail Development

Project No: 022-21021

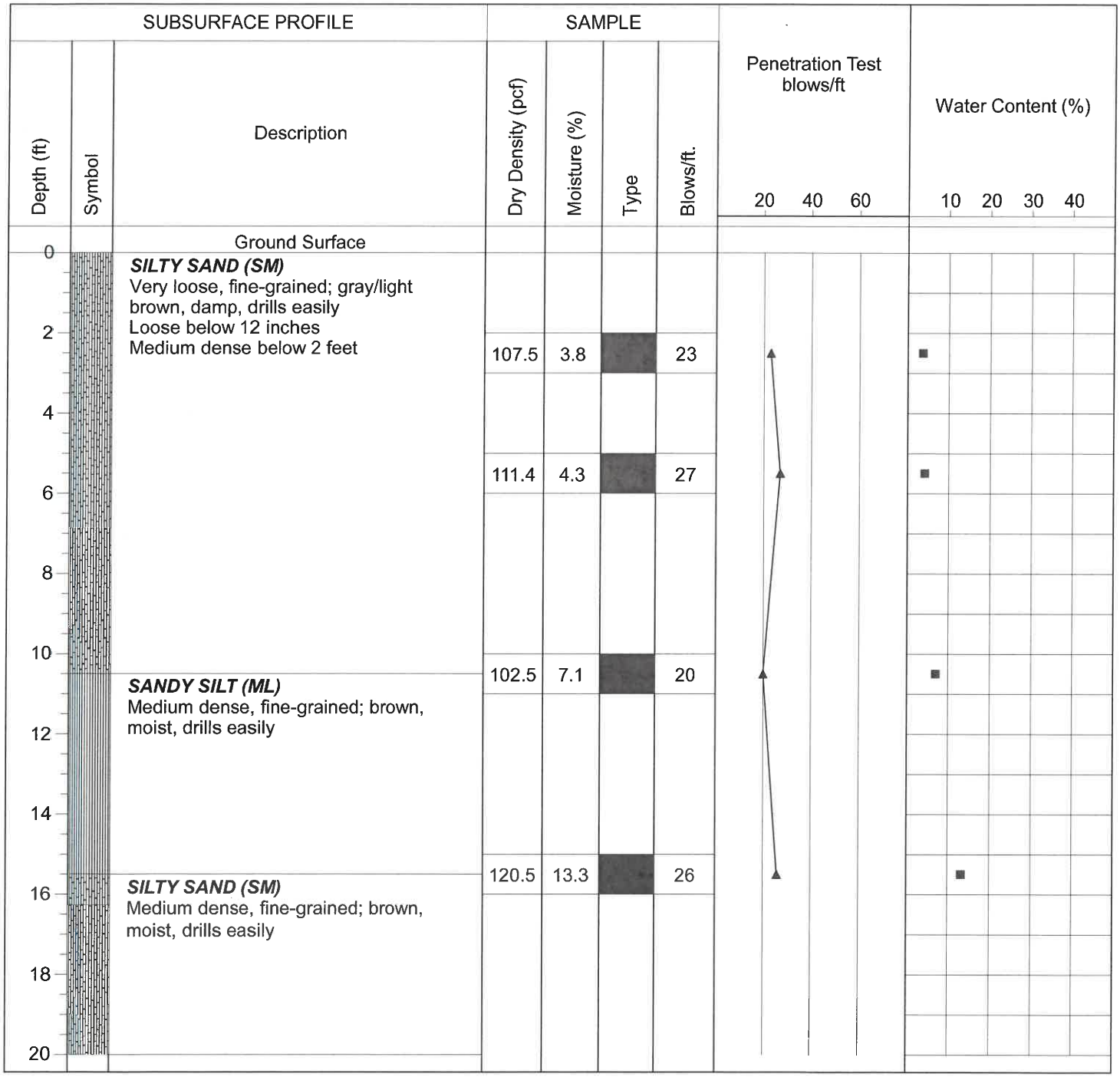
Client: Commerce Construction Co., L.P.

Figure No.: A-10

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B11

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-11

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SILTY SAND (SM)*** Very loose, fine-grained; light brown, moist, drills easily				
2		Loose below 12 inches				7
4		Medium dense and brown below 5 feet				
6			120.1	10.9		16
8						
10			109.5	14.8		19
12		Loose below 12 feet				
14						
16			106.2	11.2		9
16		***SAND (SP)*** Loose, fine-grained; tan/light gray, moist, drills easily				
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B12

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-12

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SILTY SAND (SM)*** Very loose, fine-grained; light brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet				
2			95.4	1.6		22
4		***SANDY SILT (ML)*** Medium dense, fine-grained; light brown, damp, drills easily				
6		***SILTY SAND (SM)*** Medium dense, fine-grained; brown, damp, drills easily	111.7	4.0		30
8						
10		***SANDY SILT (ML)*** Medium dense, fine-grained; light brown, moist, drills easily	106.1	5.8		34
12						
14						
16			107.0	6.2		24
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B13

Project: Commercial/Retail Development

Project No: 022-21021

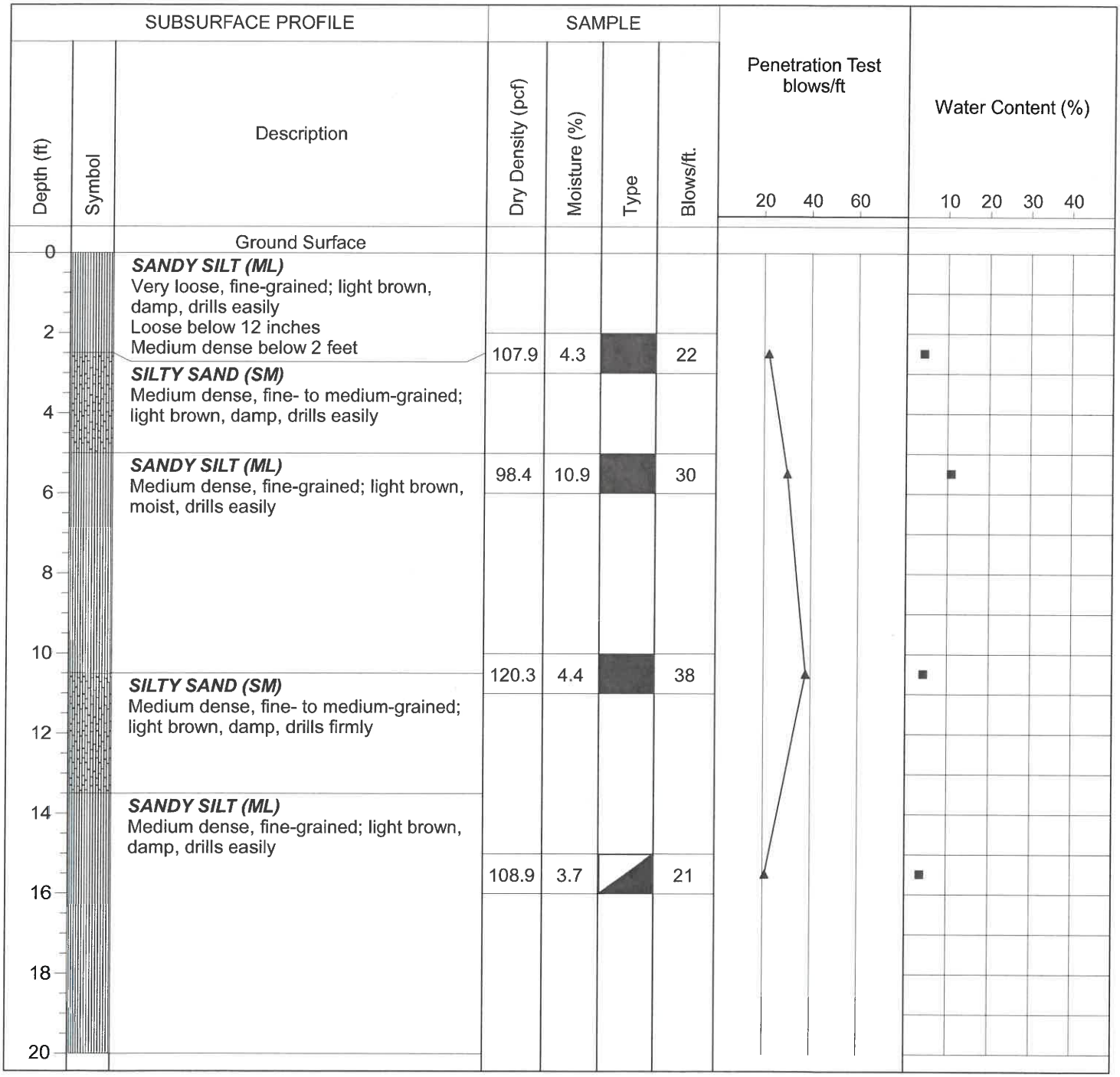
Client: Commerce Construction Co., L.P.

Figure No.: A-13

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B14

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-14

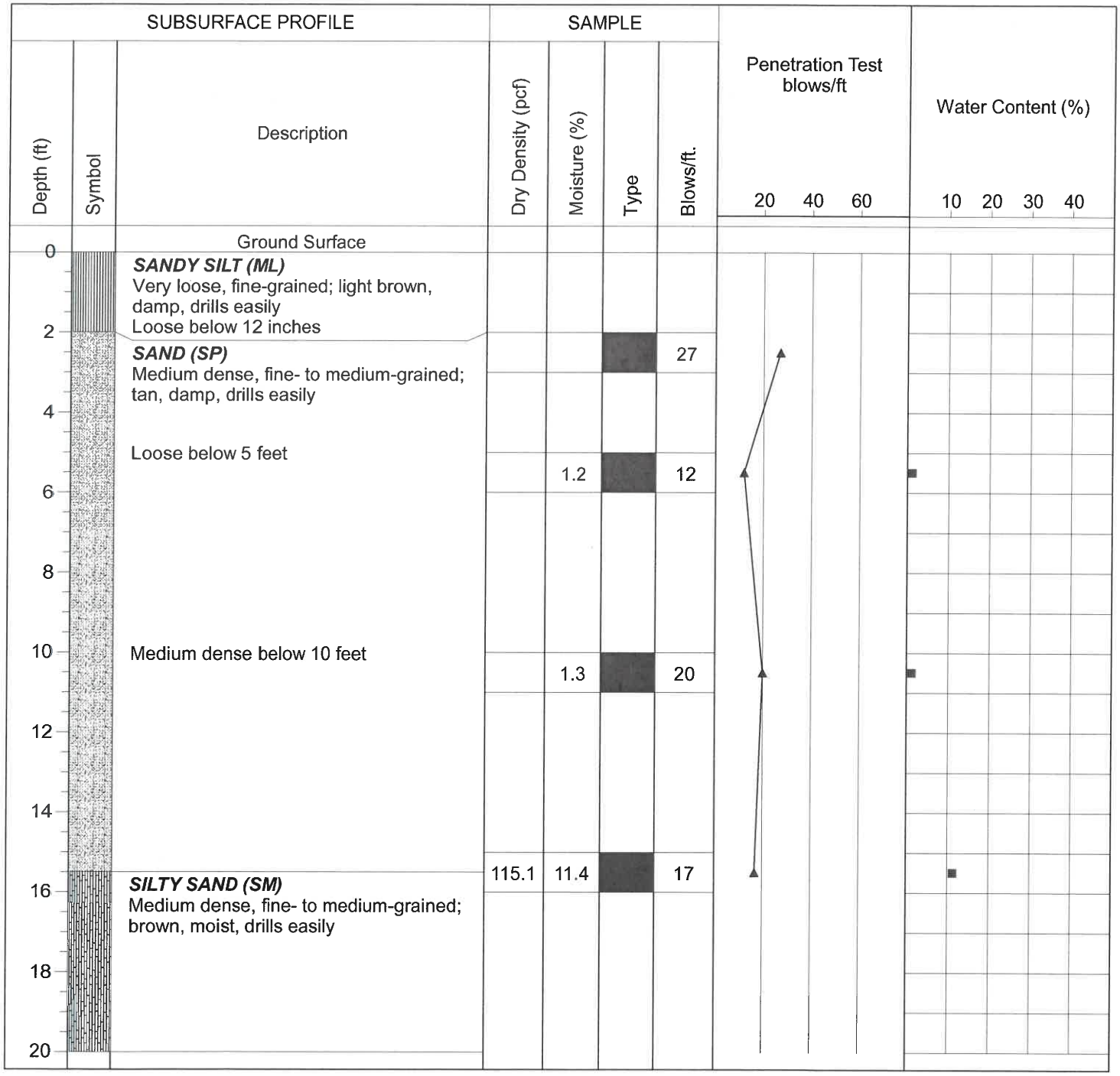
Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None



Drill Method: Hollow Stem

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-12-21

Hole Size: 6½ Inches

Elevation: 20 Feet

Log of Boring B15

Project: Commercial/Retail Development

Project No: 022-21021

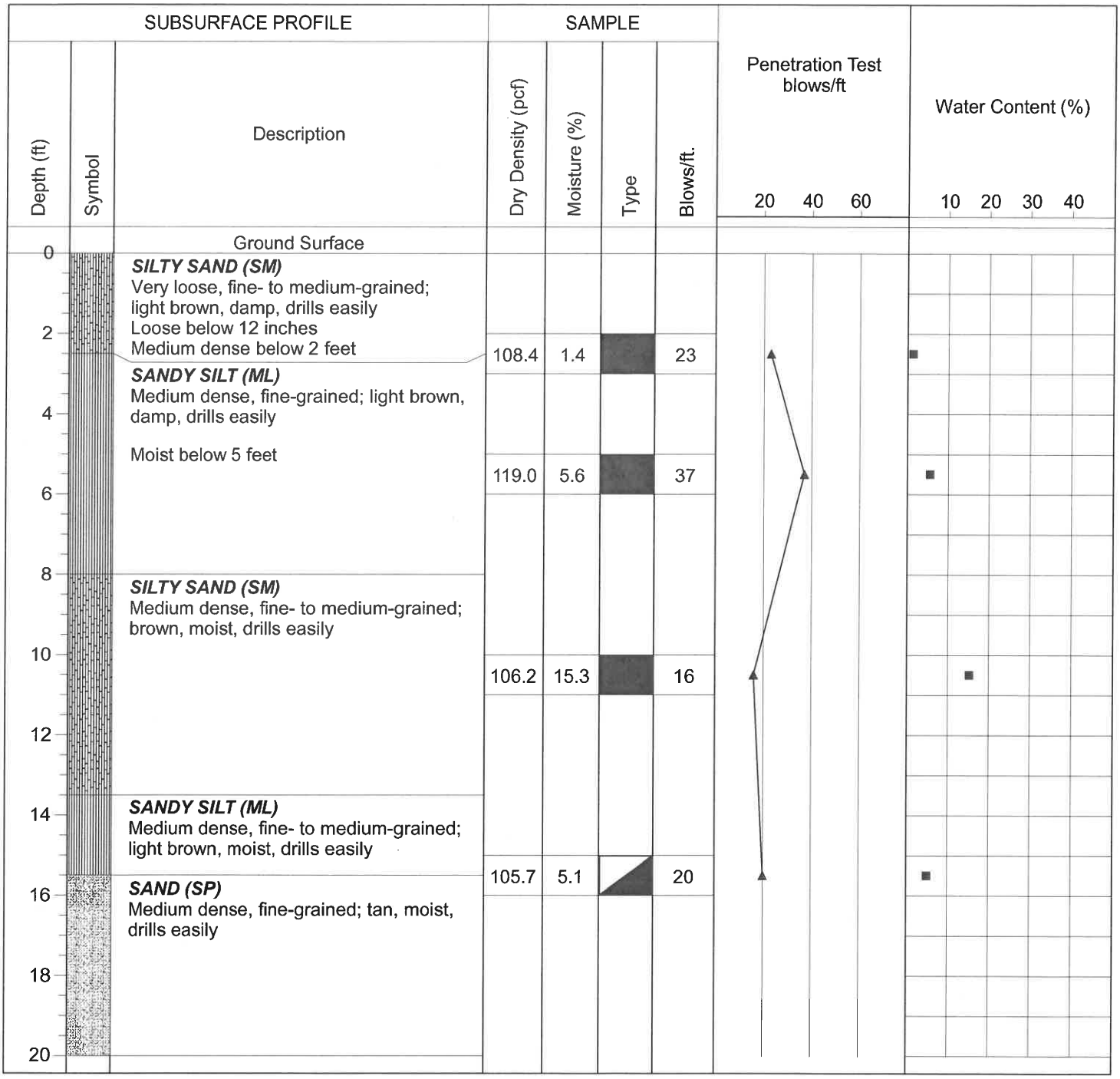
Client: Commerce Construction Co., L.P.

Figure No.: A-15

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B16

Project: Commercial/Retail Development

Project No: 022-21021

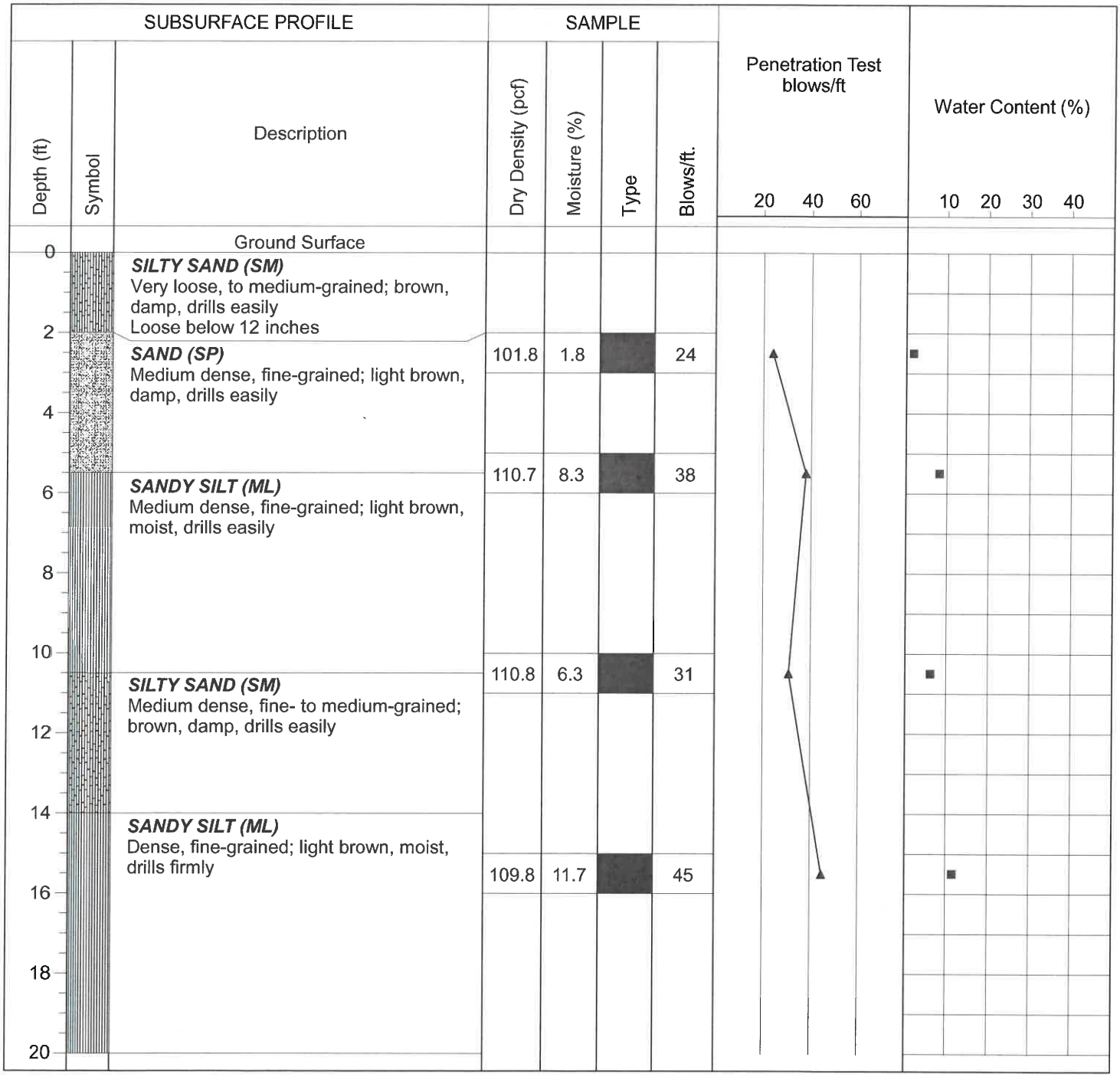
Client: Commerce Construction Co., L.P.

Figure No.: A-16

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B17

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-17

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine- to medium-grained; light brown, damp, drills easily				
2		Loose below 12 inches	99.8	4.1		17
4		Medium dense below 2 feet				
6		***SAND (SP)*** Loose, fine- to medium-grained; tan, damp, drills easily		1.1		13
8						
10						8
12						
14		Medium dense below 15 feet				
16						13
18						
20						

Penetration Test blows/ft: 20, 40, 60

Water Content (%): 10, 20, 30, 40

Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B18

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-18

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine- to medium-grained; light brown, damp, drills easily Loose below 12 inches Dense below 2 feet				
2				3.0		46
4						
6		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; light brown, damp, drills easily	111.7	4.2		25
8						
10		***SANDY SILT (ML)*** Medium dense, fine-grained; light brown, moist, drills easily	117.8	7.5		22
12						
14		Damp below 15 feet				
16			115.0	4.8		33
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-12-21

Hole Size: 4½ Inches

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B19

Project: Commercial/Retail Development

Project No: 022-21021

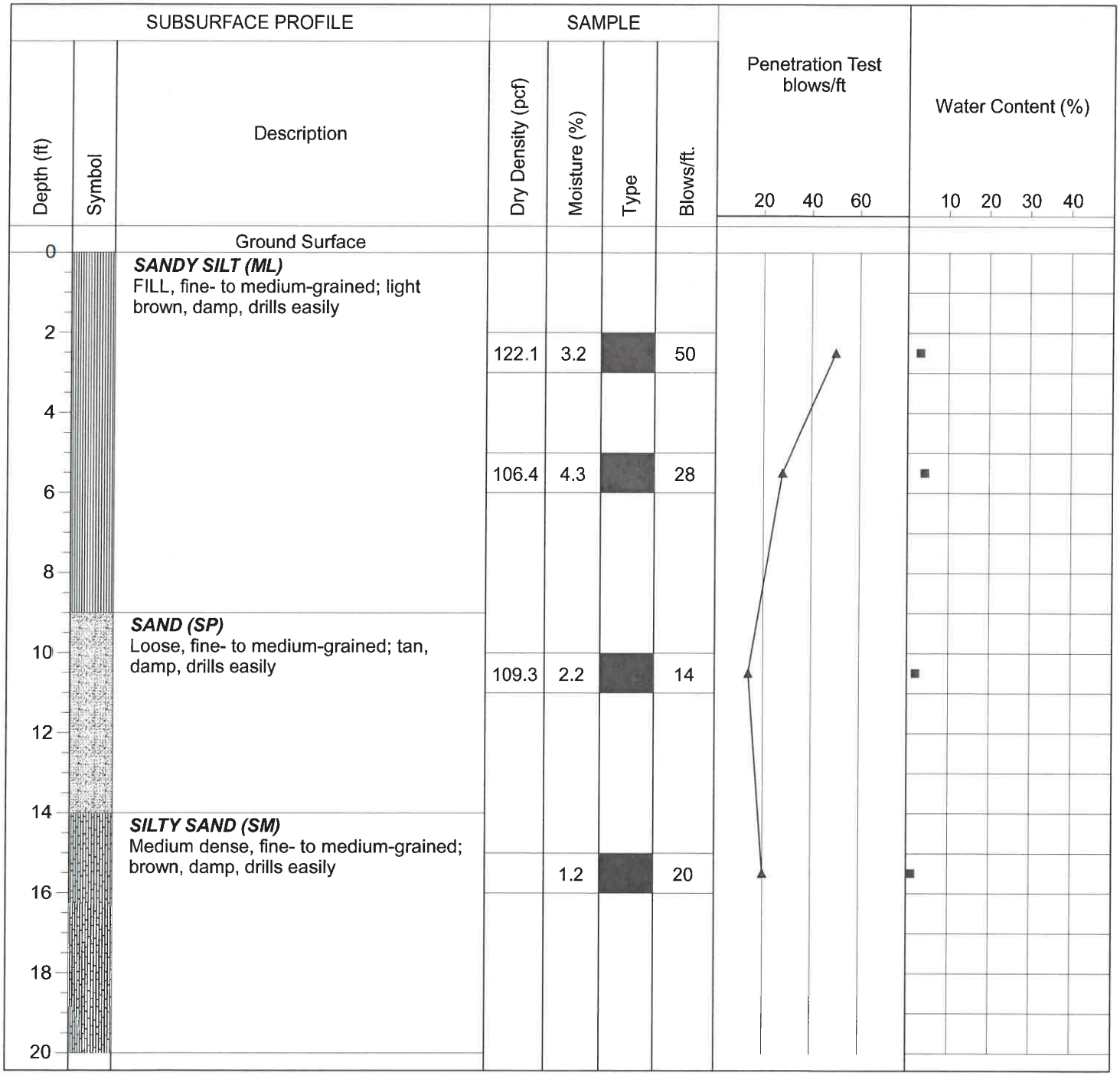
Client: Commerce Construction Co., L.P.

Figure No.: A-19

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B20

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-20

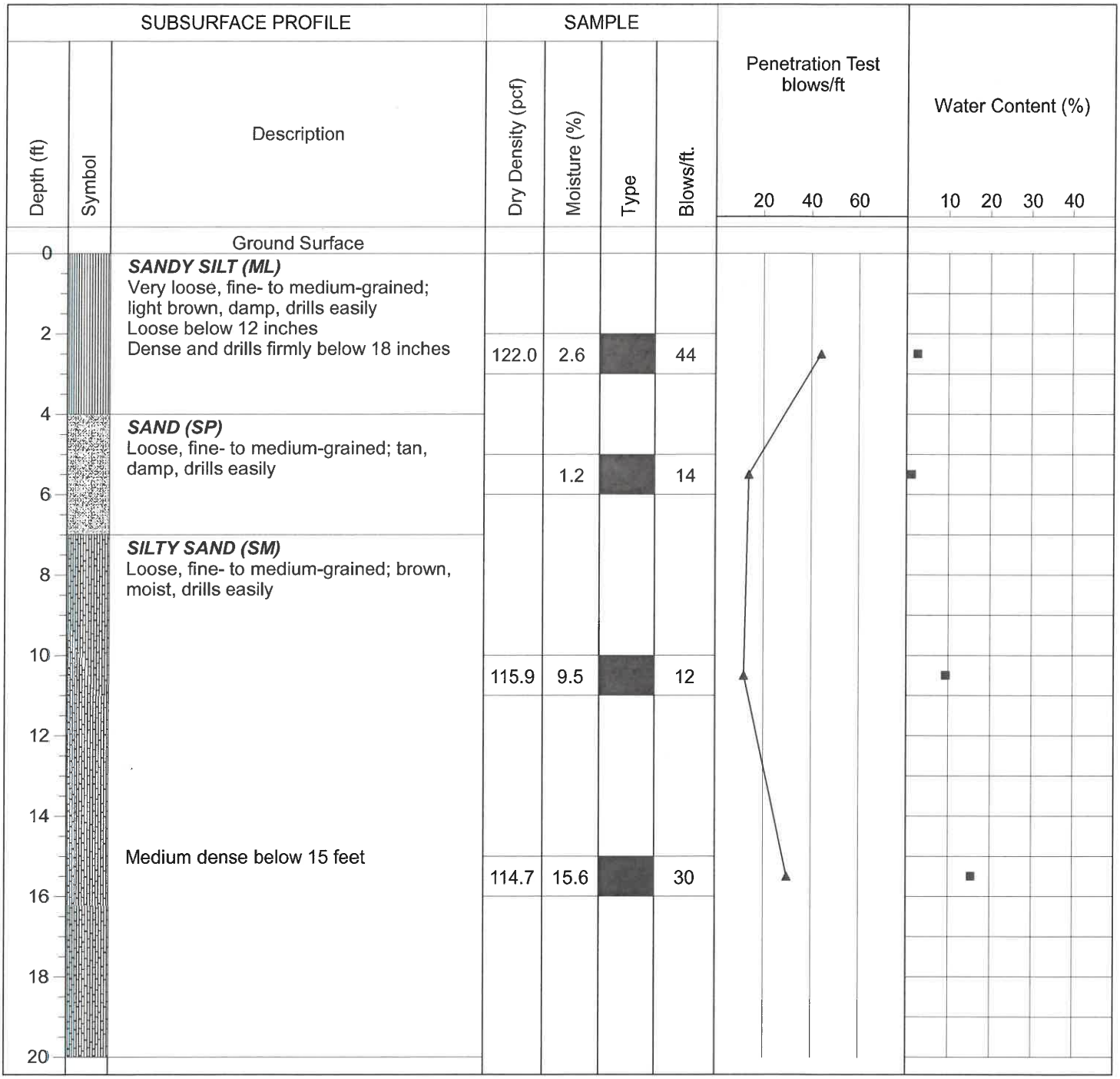
Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None



Drill Method: Solid Flight

Drill Date: 4-13-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B21

Project: Commercial/Retail Development

Project No: 022-21021

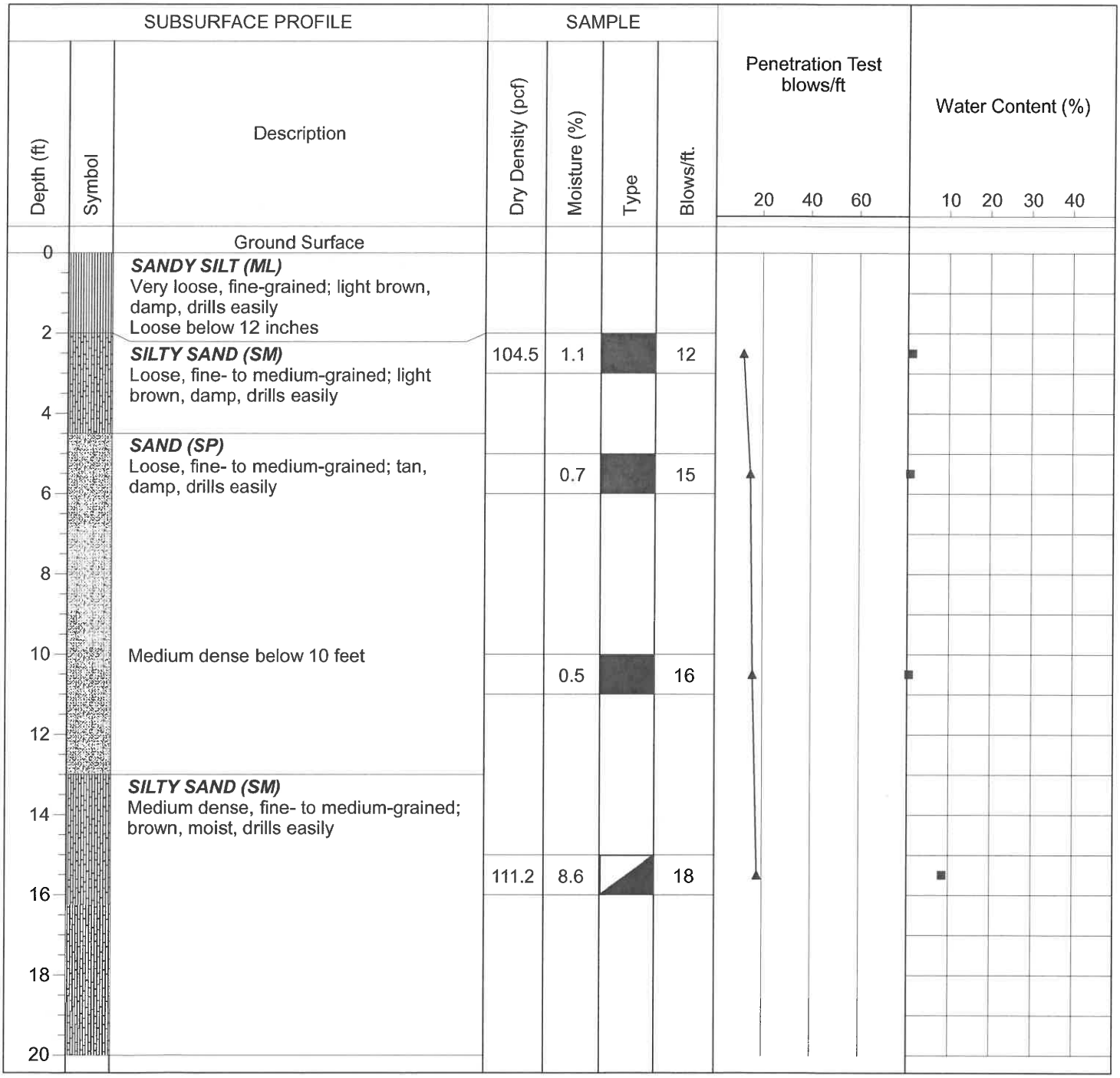
Client: Commerce Construction Co., L.P.

Figure No.: A-21

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-13-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B22

Project: Commercial/Retail Development

Project No: 022-21021

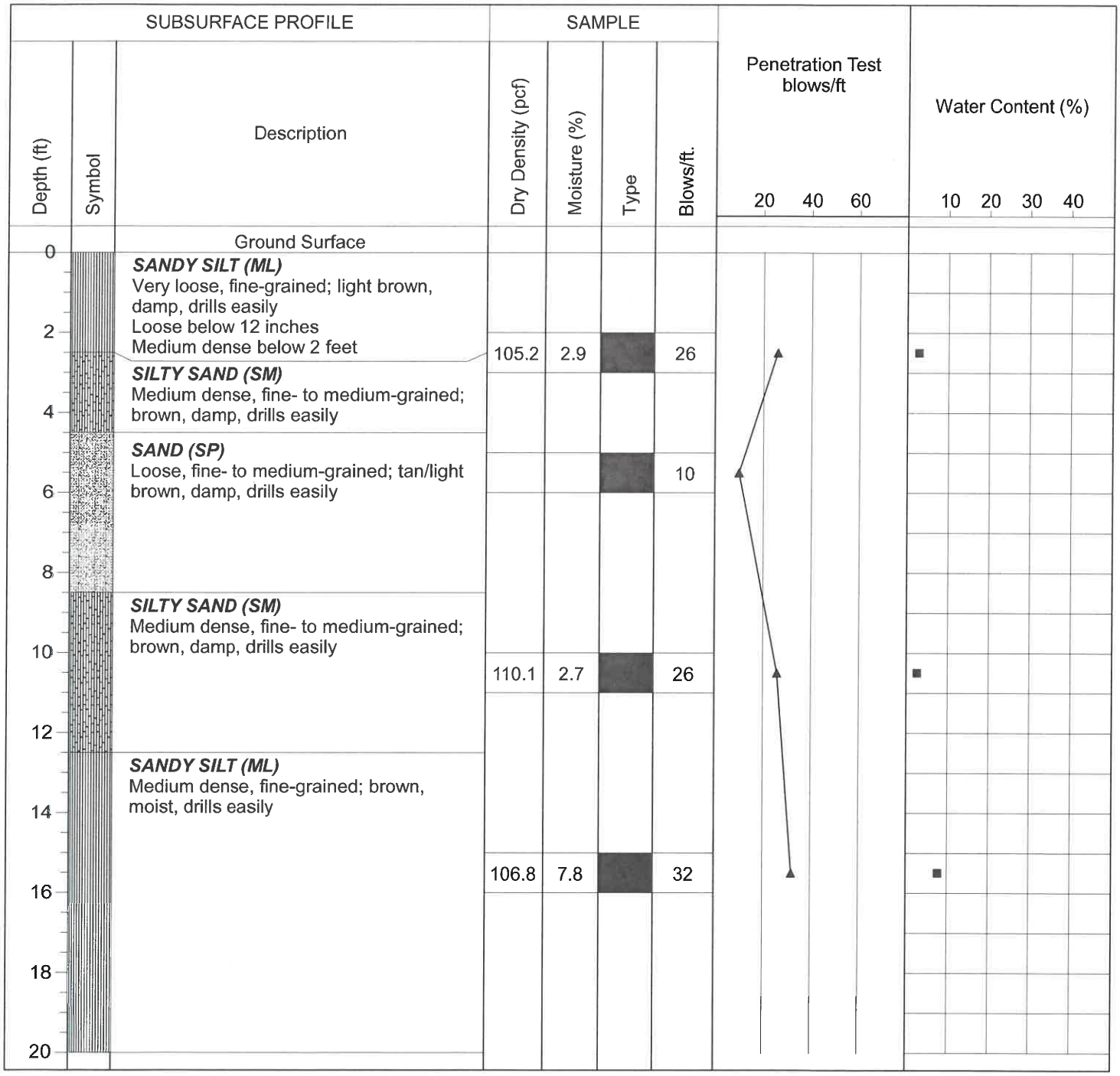
Client: Commerce Construction Co., L.P.

Figure No.: A-22

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Hollow Stem

Drill Date: 4-13-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 6½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B23

Project: Commercial/Retail Development

Project No: 022-21021

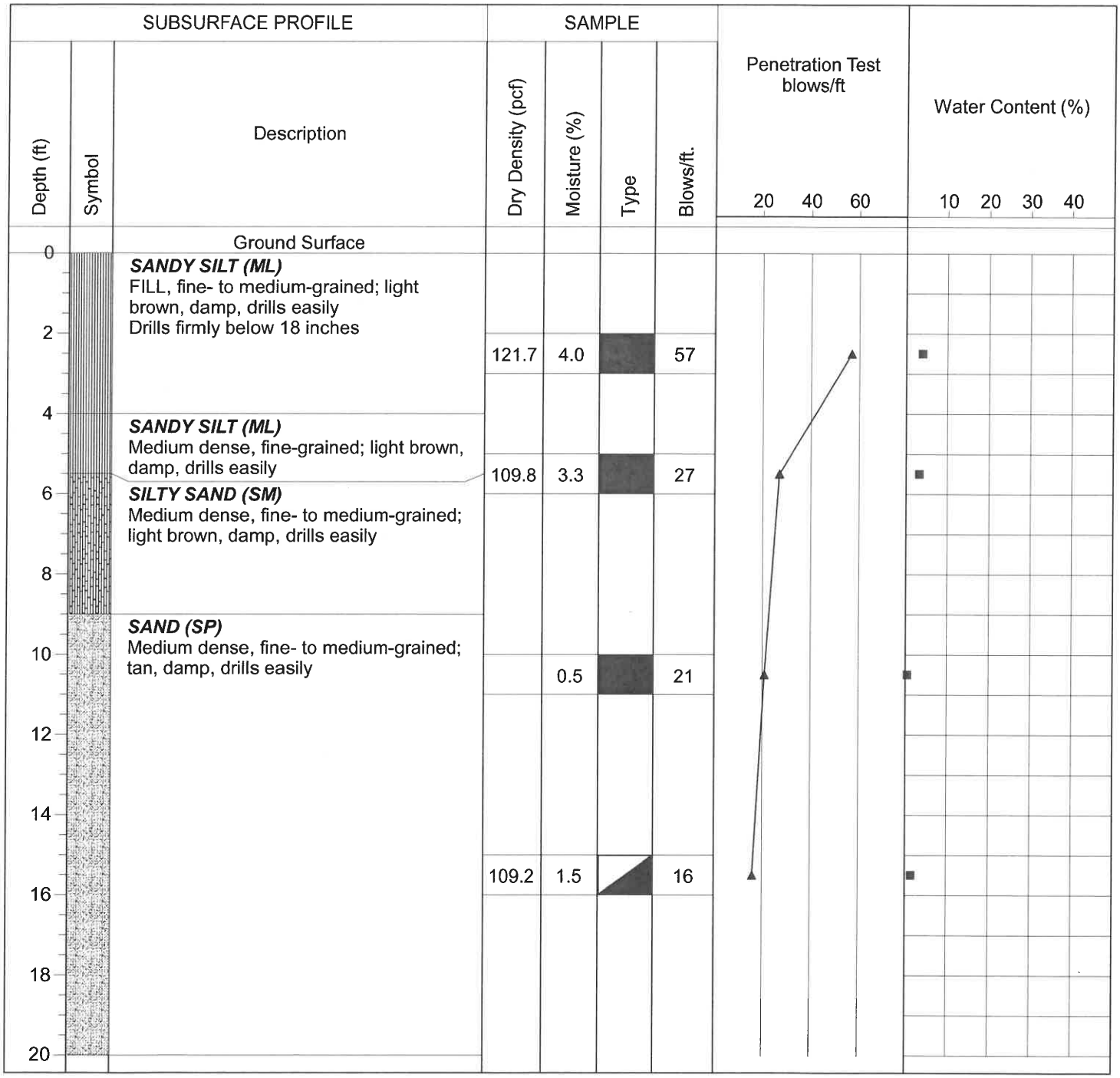
Client: Commerce Construction Co., L.P.

Figure No.: A-23

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Hollow Stem

Drill Date: 4-13-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 6½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B24

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-24

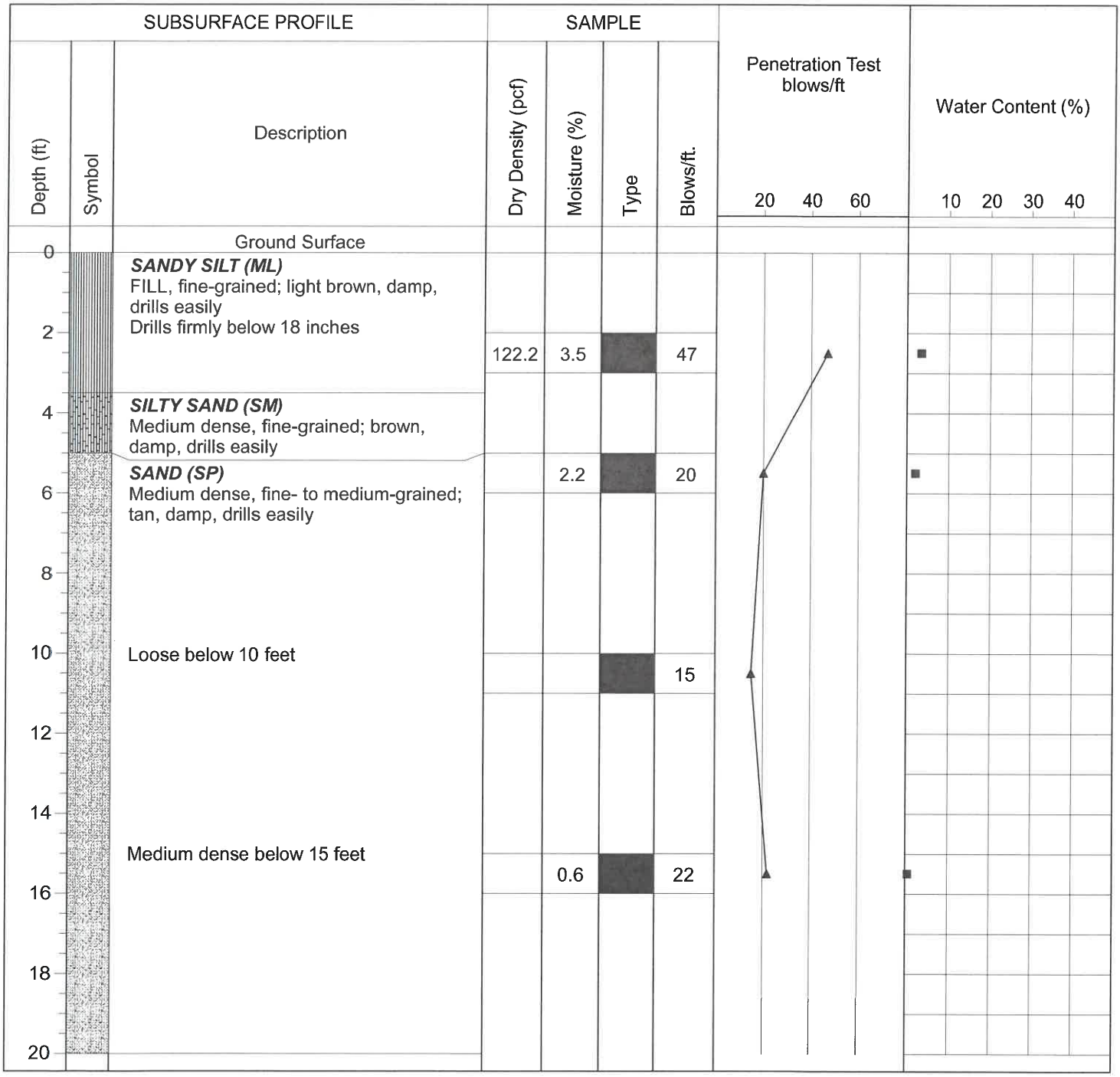
Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None



Drill Method: Hollow Stem

Drill Date: 4-13-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 6½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B25

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-25

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

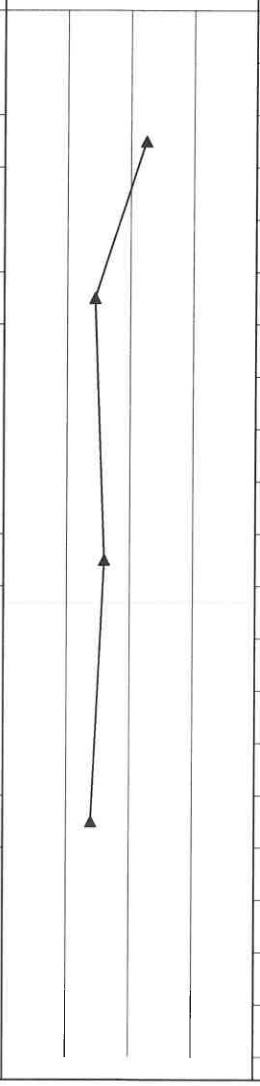
Logged By: R. Alexander

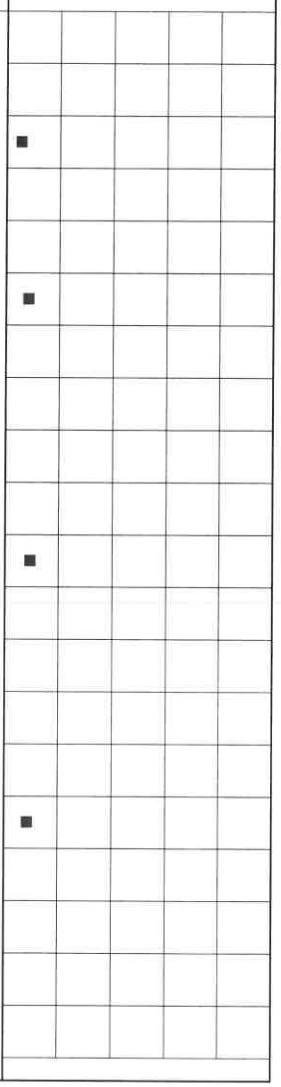
Depth to Water>

Initial: None

At Completion: None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** FILL, fine- to medium-grained; light brown, damp, drills easily Drills firmly below 18 inches				
2			108.8	2.8		45
4		***SANDY SILT (ML)*** Medium dense, fine- to medium-grained with trace CLAY; light brown, damp, drills easily				
6			128.3	4.3		29
8						
10			130.4	4.8		32
12						
14						
16			112.0	4.4		28
18						
20						





Drill Method: Hollow Stem

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-13-21

Hole Size: 6½ Inches

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B26

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-26

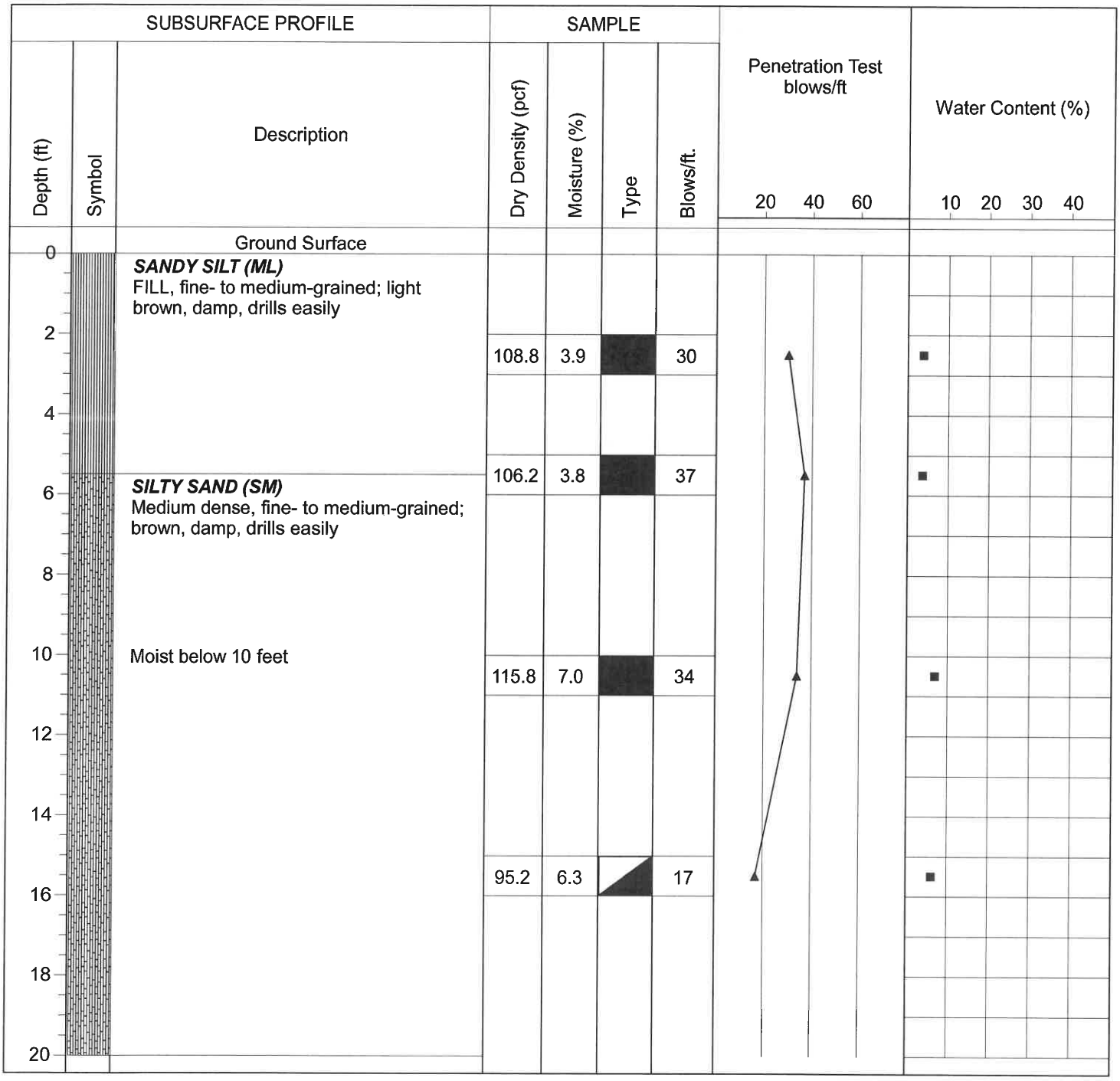
Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None



Drill Method: Hollow Stem

Drill Date: 4-13-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 6½ Inches

Driller: Brent Snyder

Elevation: 20 Feet

Log of Boring B27

Project: Commercial/Retail Development

Project No: 022-21021

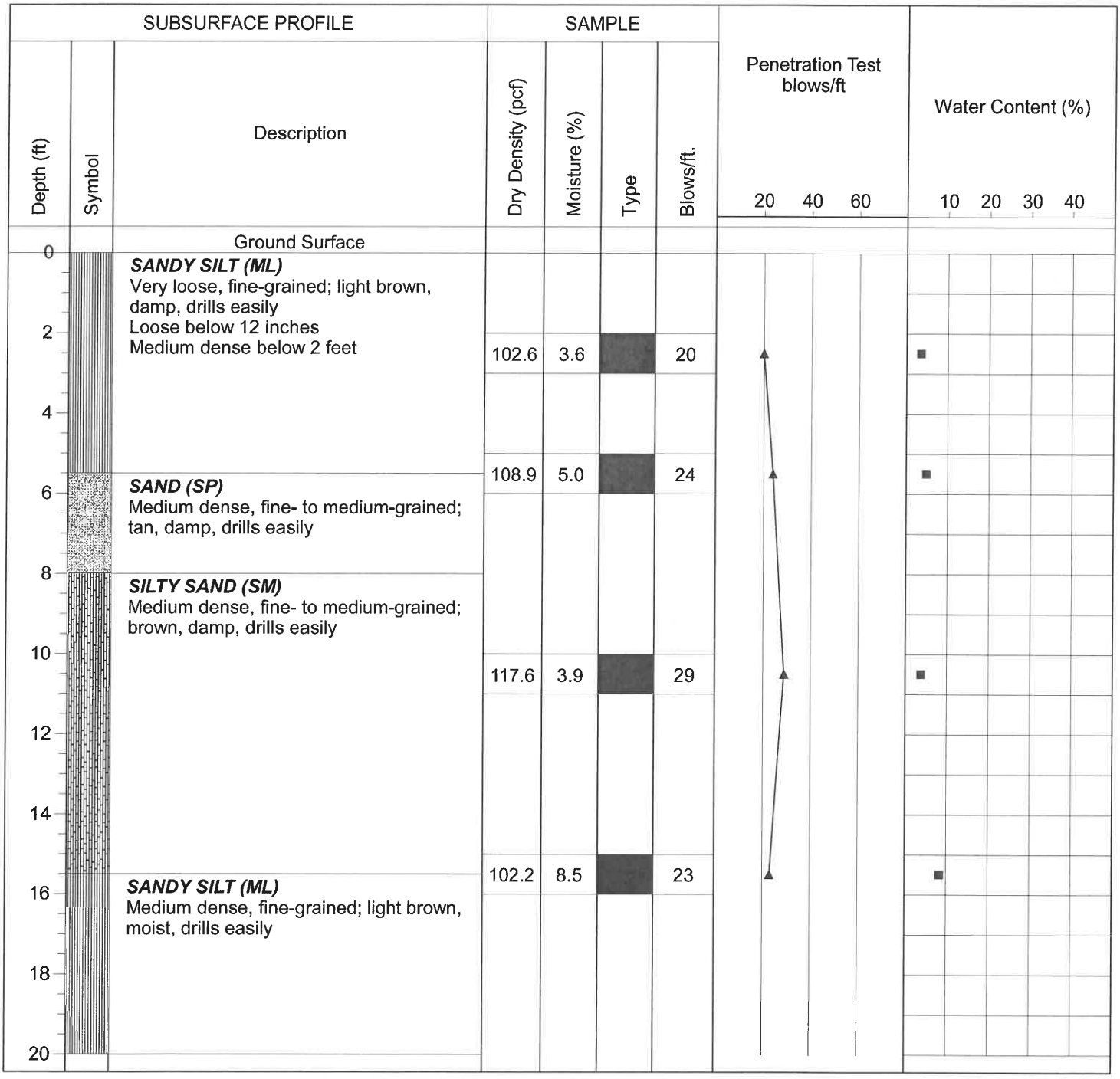
Client: Commerce Construction Co., L.P.

Figure No.: A-27

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Hollow Stem

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-13-21

Hole Size: 6½ Inches

Elevation: 20 Feet

Log of Boring B28

Project: Commercial/Retail Development

Project No: 022-21021

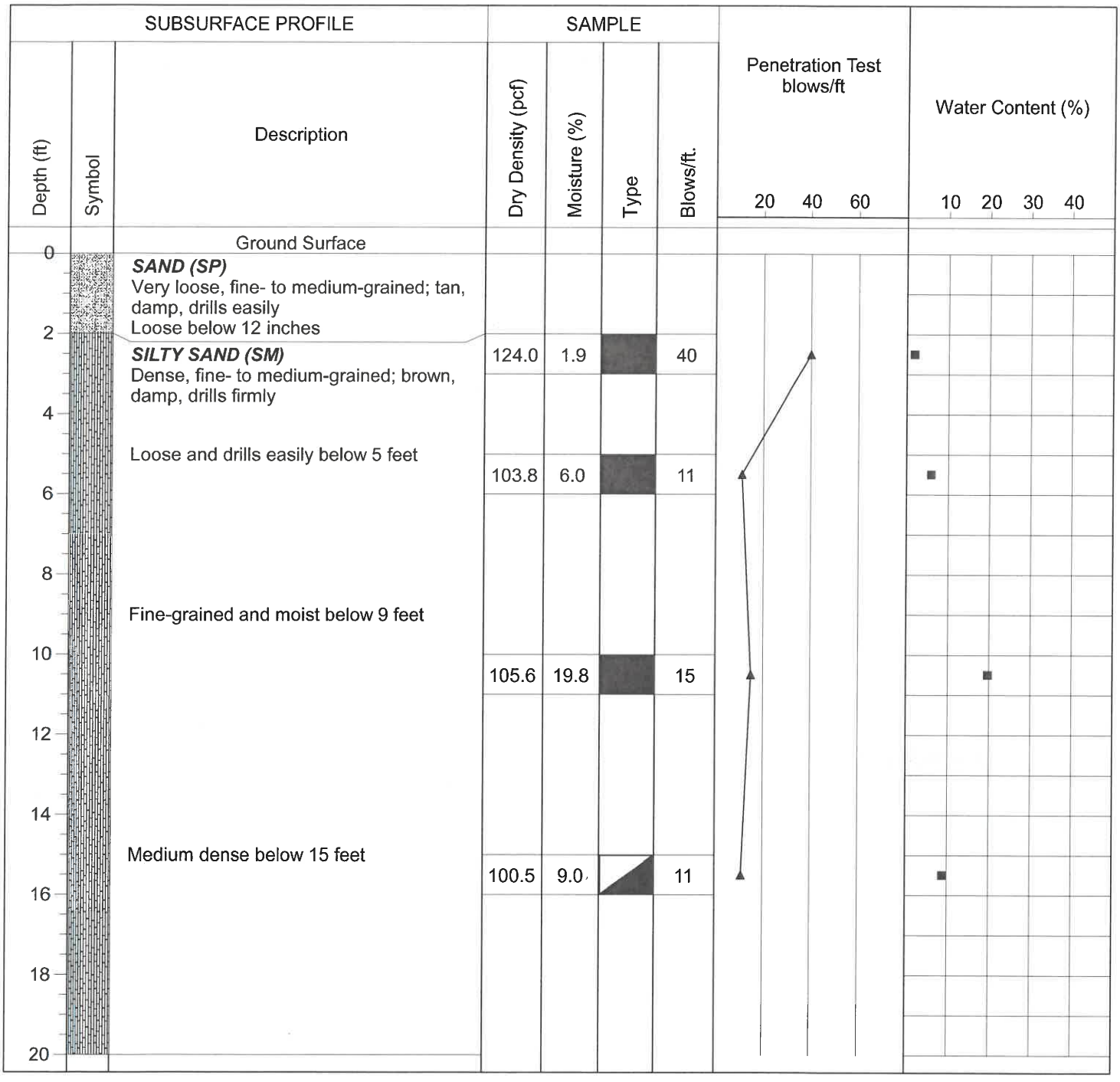
Client: Commerce Construction Co., L.P.

Figure No.: A-28

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Hollow Stem

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-13-21

Hole Size: 6½ Inches

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B29

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-29

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SILTY SAND (SM)*** Very loose, fine-grained; light brown, damp, drills easily				
2		Loose below 12 inches				
		Medium dense below 18 inches	127.1	1.0	■	33
4		***SANDY SILT (ML)*** Medium dense, fine-grained; light brown, damp, drills easily				
6		***SAND (SP)*** Medium dense, fine- to medium-grained; tan, damp, drills easily	111.0	0.8	■	19
8						
10		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; light brown, moist, drills easily	103.6	8.0	■	25
12						
14						
16		***SAND (SP)*** Medium dense, fine-grained; brown, moist, drills easily	106.2	6.2	■	17
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-13-21

Hole Size: 4½ Inches

Elevation: 20 Feet

Log of Boring B30

Project: Commercial/Retail Development

Project No: 022-21021

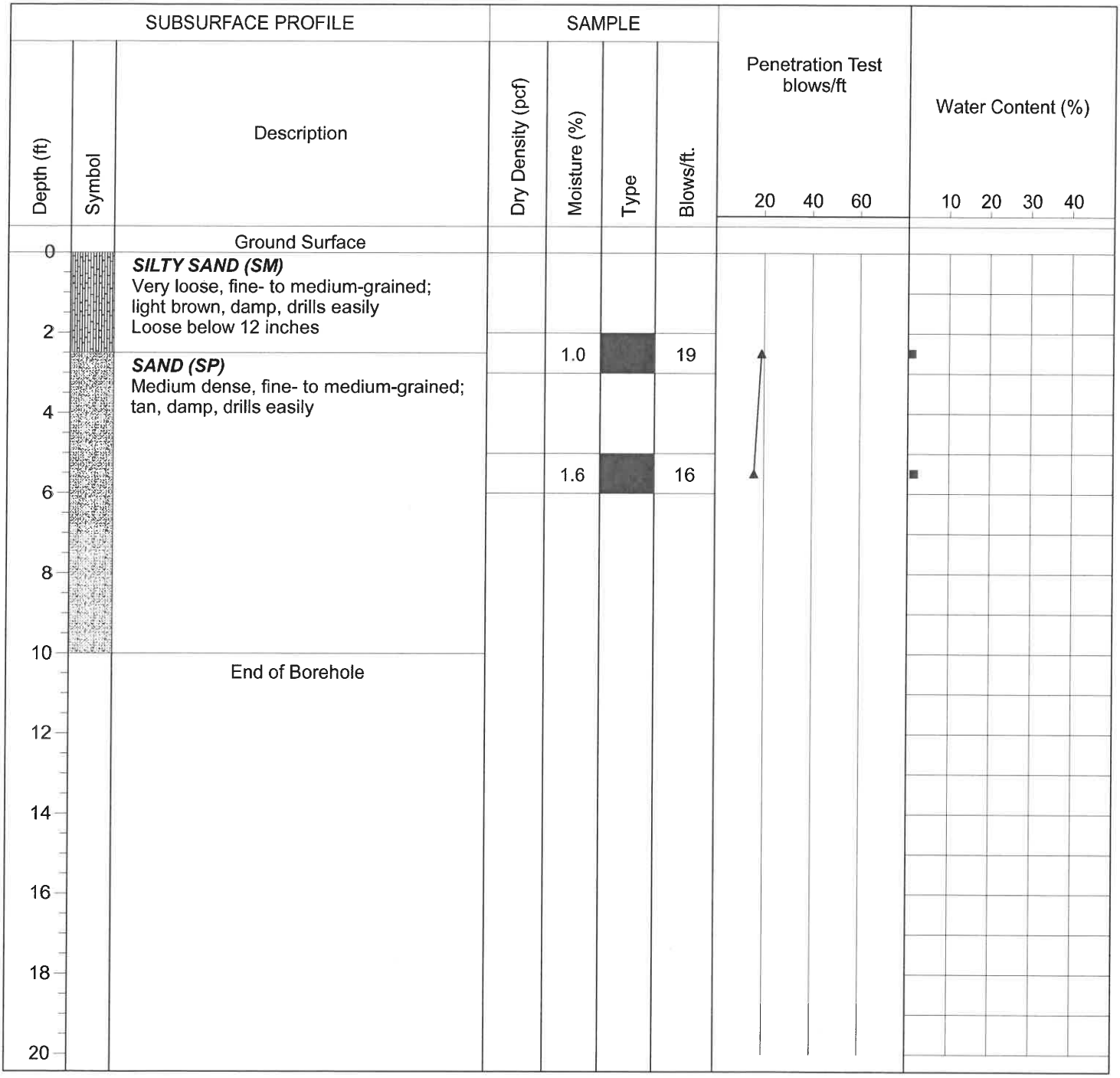
Client: Commerce Construction Co., L.P.

Figure No.: A-30

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-13-21

Hole Size: 4½ Inches

Elevation: 10 Feet

Sheet: 1 of 1

Log of Boring B31

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-31

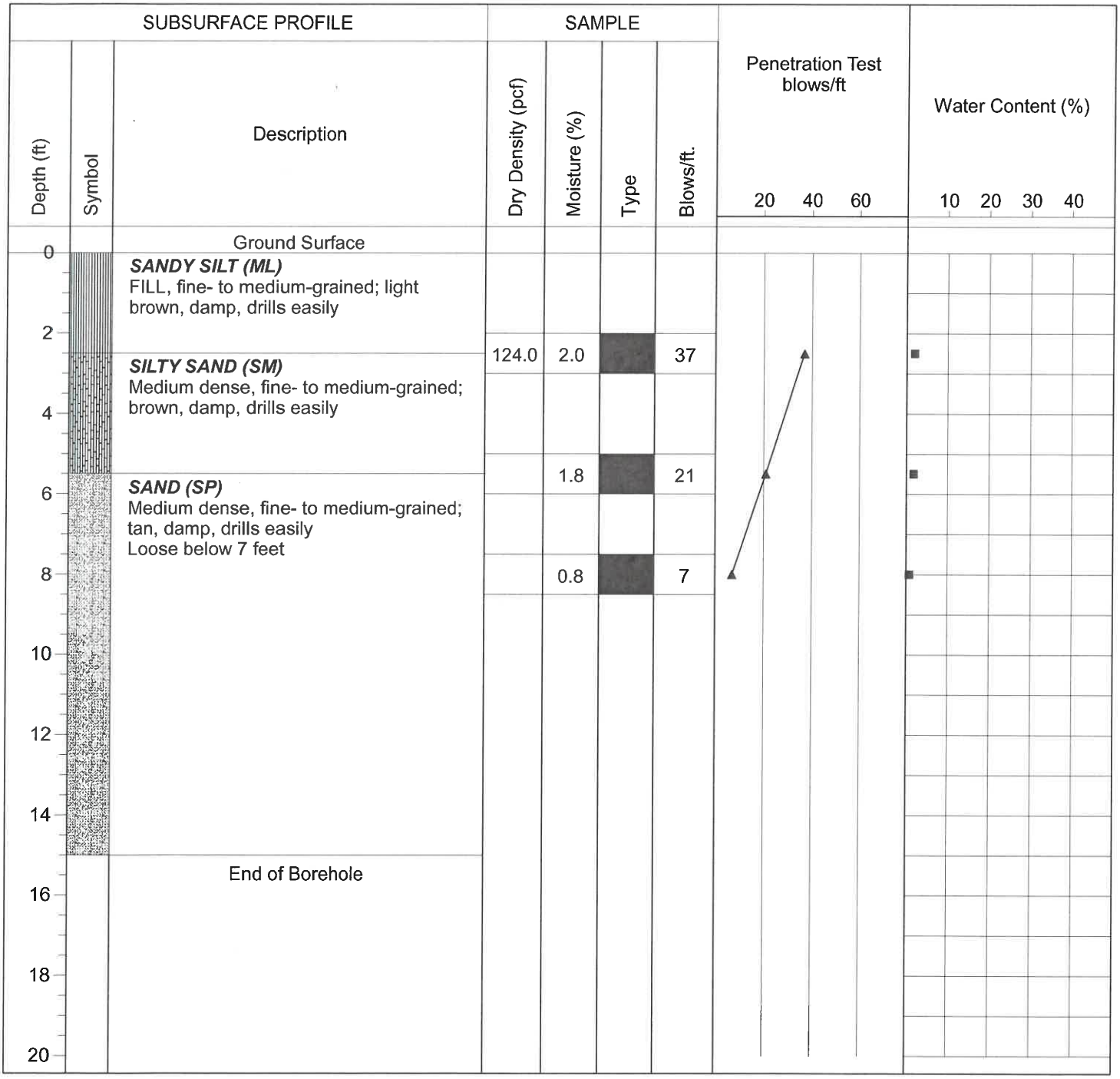
Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None



Drill Method: Solid Flight

Drill Date: 4-13-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 15 Feet

Sheet: 1 of 1

Log of Boring B32

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-32

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	20 40 60	10 20 30 40
0		Ground Surface						
0		***SANDY SILT (ML)*** Very loose, fine-grained; light brown, damp, drills easily						
2		Loose below 12 inches Dense below 2 feet	119.3	3.7		48		
4		Medium dense and moist below 5 feet						
6			111.1	7.4		24		
8								
10		End of Borehole						
12								
14								
16								
18								
20								

Drill Method: Solid Flight

Drill Date: 4-13-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 10 Feet

Sheet: 1 of 1

Log of Boring B33

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-33

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine-grained; light brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet	105.2	4.3		27
6		***SAND (SP)*** Medium dense, fine- to medium-grained; tan, damp, drills easily	111.1	1.1		27
10		End of Borehole				

SUBSURFACE PROFILE

SAMPLE

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Rig: CME 45B

Driller: Brent Snyder

Krazan and Associates

Drill Date: 4-12-21

Hole Size: 4½ Inches

Elevation: 10 Feet

Log of Boring B34

Project: Commercial/Retail Development

Project No: 022-21021

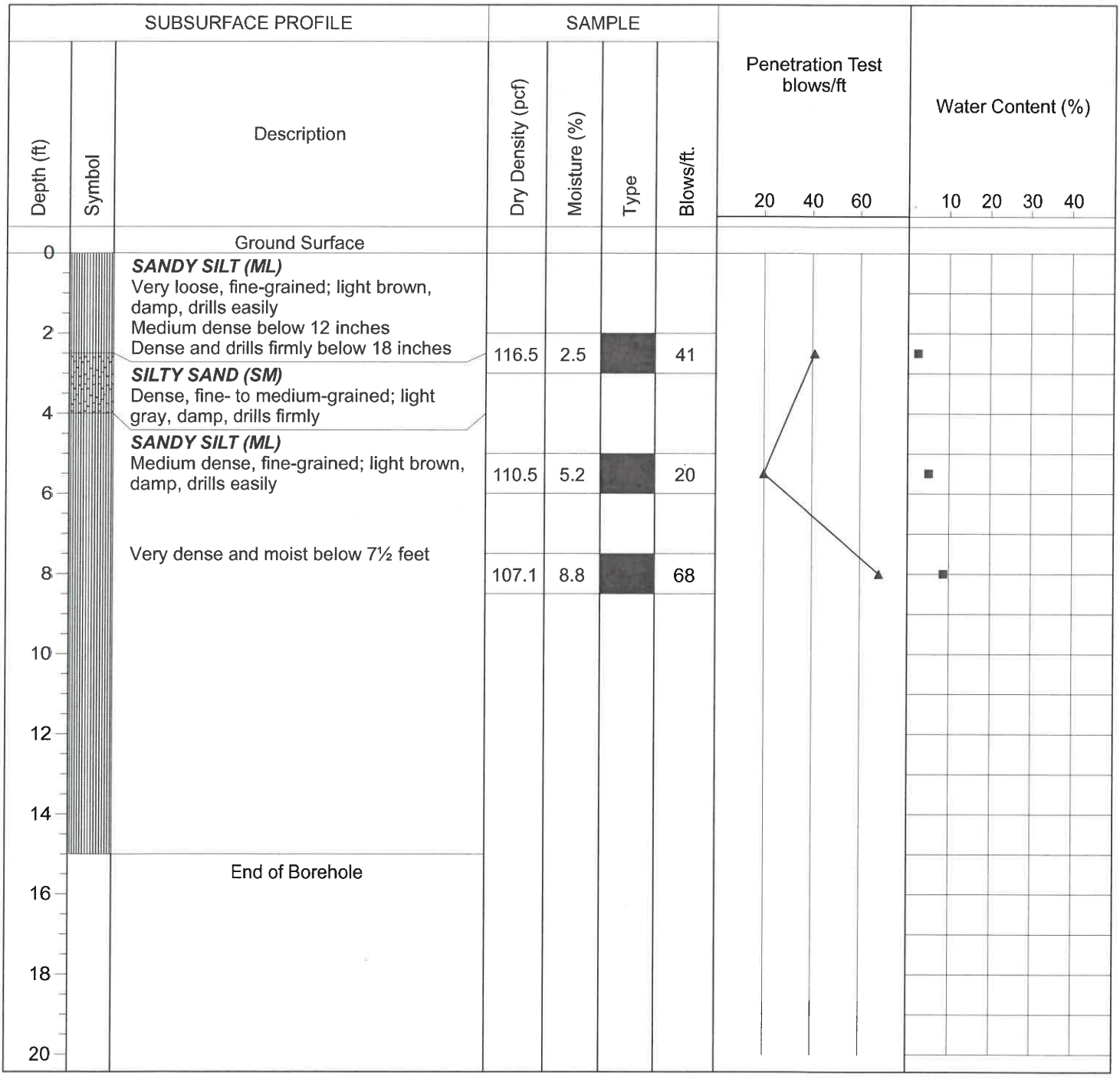
Client: Commerce Construction Co., L.P.

Figure No.: A-34

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: R. Alexander

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



Drill Method: Solid Flight

Drill Date: 4-12-21

Drill Rig: CME 45B

Krazan and Associates

Hole Size: 4½ Inches

Driller: Brent Snyder

Elevation: 15 Feet

Sheet: 1 of 1

Log of Boring B35

Project: Commercial/Retail Development

Project No: 022-21021

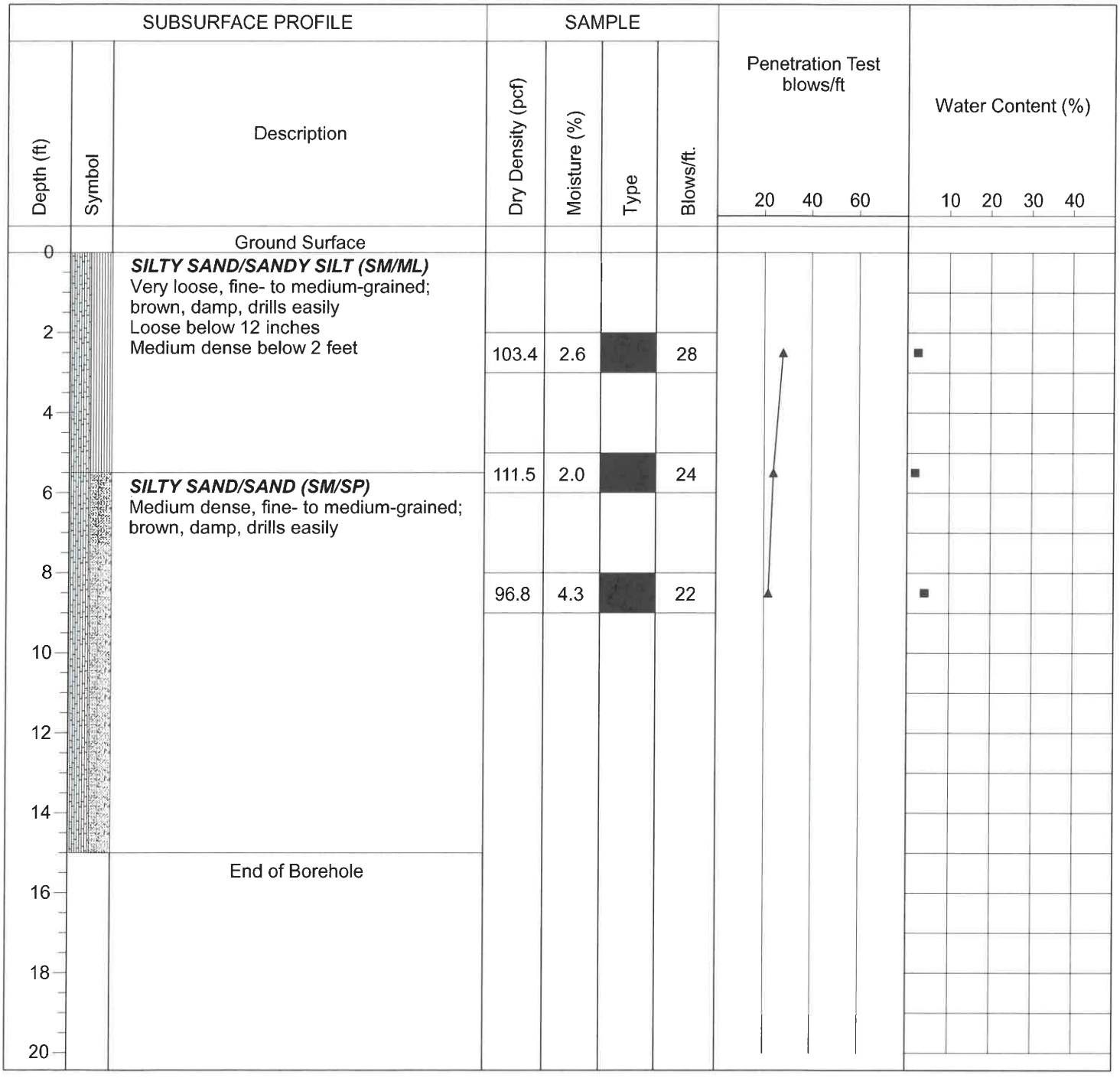
Client: Commerce Construction Co., L.P.

Figure No.: A-35

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: Dave Adams

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



Drill Method: Solid Flight

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

Drill Date: 8-13-21

Hole Size: 4½ Inches

Elevation: 15 Feet

Log of Boring B36

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-36

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: Dave Adams

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
2		***SILTY SAND/SANDY SILT (SM/ML)*** Very loose, fine- to medium-grained; brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet	92.1	3.8		25
6		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, damp, drills easily	103.1	2.4		25
8			106.7	5.0		25
16		End of Borehole				

Penetration Test blows/ft: 20, 40, 60

Water Content (%): 10, 20, 30, 40

Drill Method: Solid Flight

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

Drill Date: 8-13-21

Hole Size: 4½ Inches

Elevation: 15 Feet

Sheet: 1 of 1

Log of Boring B37

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-37

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: Dave Adams

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine- to medium-grained; brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet				
2			95.9	5.0		29
4						
6			89.2	5.6		26
8		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, damp, drills easily	113.0	4.3		30
10						
12						
14						
16		End of Borehole				
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

Drill Date: 8-13-21

Hole Size: 4½ Inches

Elevation: 15 Feet

Log of Boring B38

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-38

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: Dave Adams

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine- to medium-grained; brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet				
2			102.6	2.4		22
4						
6			103.1	3.6		22
8		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, damp, drills easily	112.4	4.2		31
10						
12						
14						
16		End of Borehole				
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

Drill Date: 8-13-21

Hole Size: 4½ Inches

Elevation: 15 Feet

Log of Boring B39

Project: Commercial/Retail Development

Project No: 022-21021

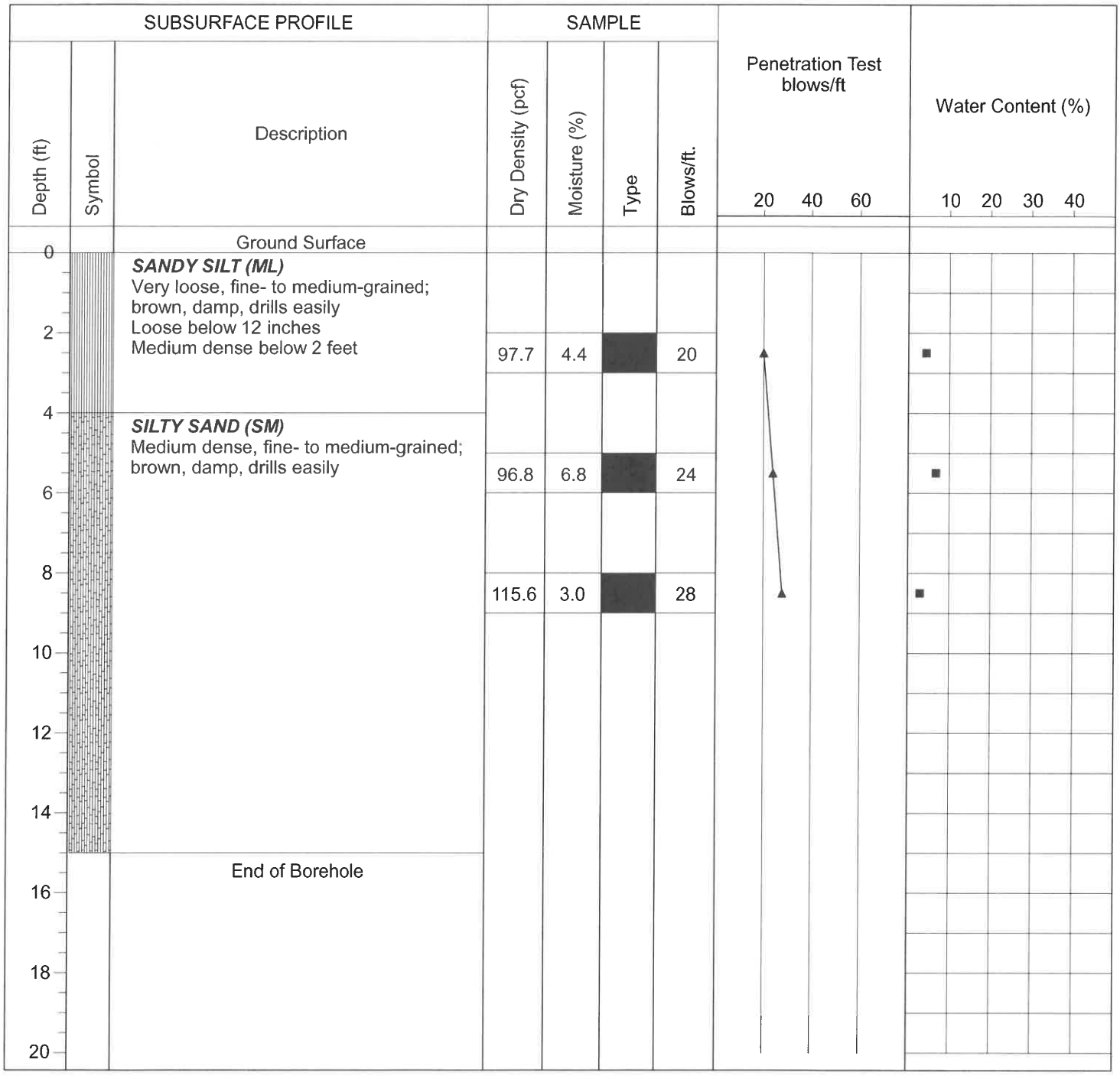
Client: Commerce Construction Co., L.P.

Figure No.: A-39

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: Dave Adams

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



Drill Method: Solid Flight

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

Drill Date: 8-13-21

Hole Size: 4½ Inches

Elevation: 15 Feet

Log of Boring B40

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-40

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: Dave Adams

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine- to medium-grained; brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet				
2			98.3	3.3		28
4		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, damp, drills easily				
6			101.8	2.6		29
8		***SAND (SP)*** Medium dense, fine- to medium-grained; brown, damp, drills easily	110.9	1.9		24
10						
12						
14						
16		End of Borehole				
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

Drill Date: 8-13-21

Hole Size: 4½ Inches

Elevation: 15 Feet

Log of Boring B41

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-41

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: Dave Adams

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
2		***SANDY SILT (ML)*** Very loose, fine- to medium-grained; brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet	96.4	7.5		31
4		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, damp, drills easily	104.4	2.7		31
8			97.0	4.2		38
14		End of Borehole				
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

Drill Date: 8-13-21

Hole Size: 4½ Inches

Elevation: 15 Feet

Log of Boring B42

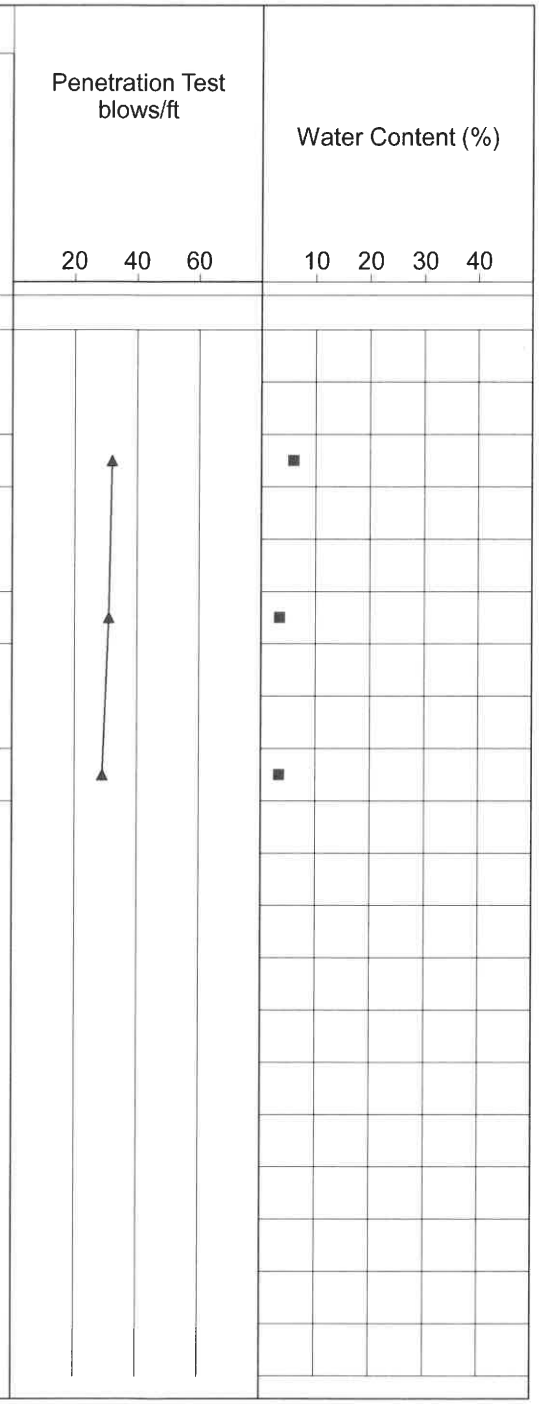
Project: Commercial/Retail Development | **Project No:** 022-21021

Client: Commerce Construction Co., L.P. | **Figure No.:** A-42

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California | **Logged By:** Dave Adams

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine- to medium-grained; brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet				
2			98.3	6.0		32
4		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, damp, drills easily				
6			115.2	3.5		31
8			115.9	3.4		29
10						
12						
14						
16		End of Borehole				
18						
20						



Drill Method: Solid Flight | **Drill Date:** 8-13-21

Drill Rig: CME 45C-4 | **Hole Size:** 4½ Inches

Driller: Jim Watts | **Elevation:** 15 Feet

Krazan and Associates

Log of Boring B43

Project: Commercial/Retail Development

Project No: 022-21021

Client: Commerce Construction Co., L.P.

Figure No.: A-43

Location: NEC Hosking Avenue and Highway 99, Bakersfield, California

Logged By: Dave Adams

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

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SANDY SILT (ML)*** Very loose, fine- to medium-grained; brown, damp, drills easily Loose below 12 inches Medium dense below 2 feet				
2			97.6	5.2		36
4		***SAND (SP)*** Medium dense, fine- to medium-grained; light brown, damp, drills easily				
6				2.0		23
8			104.3	1.9		22
10						
12						
14						
16		End of Borehole				
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Solid Flight

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

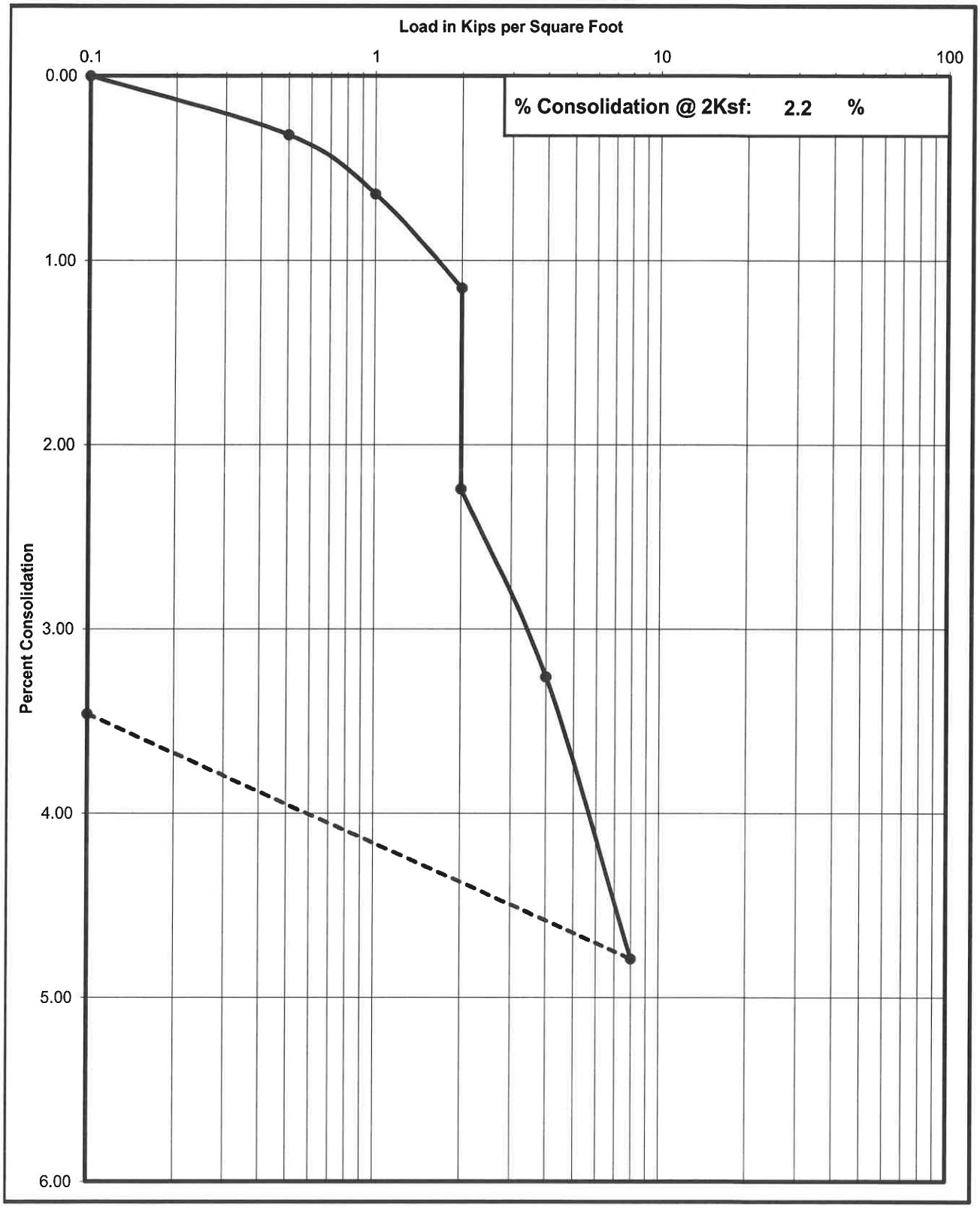
Drill Date: 8-13-21

Hole Size: 4½ Inches

Elevation: 15 Feet

Consolidation Test

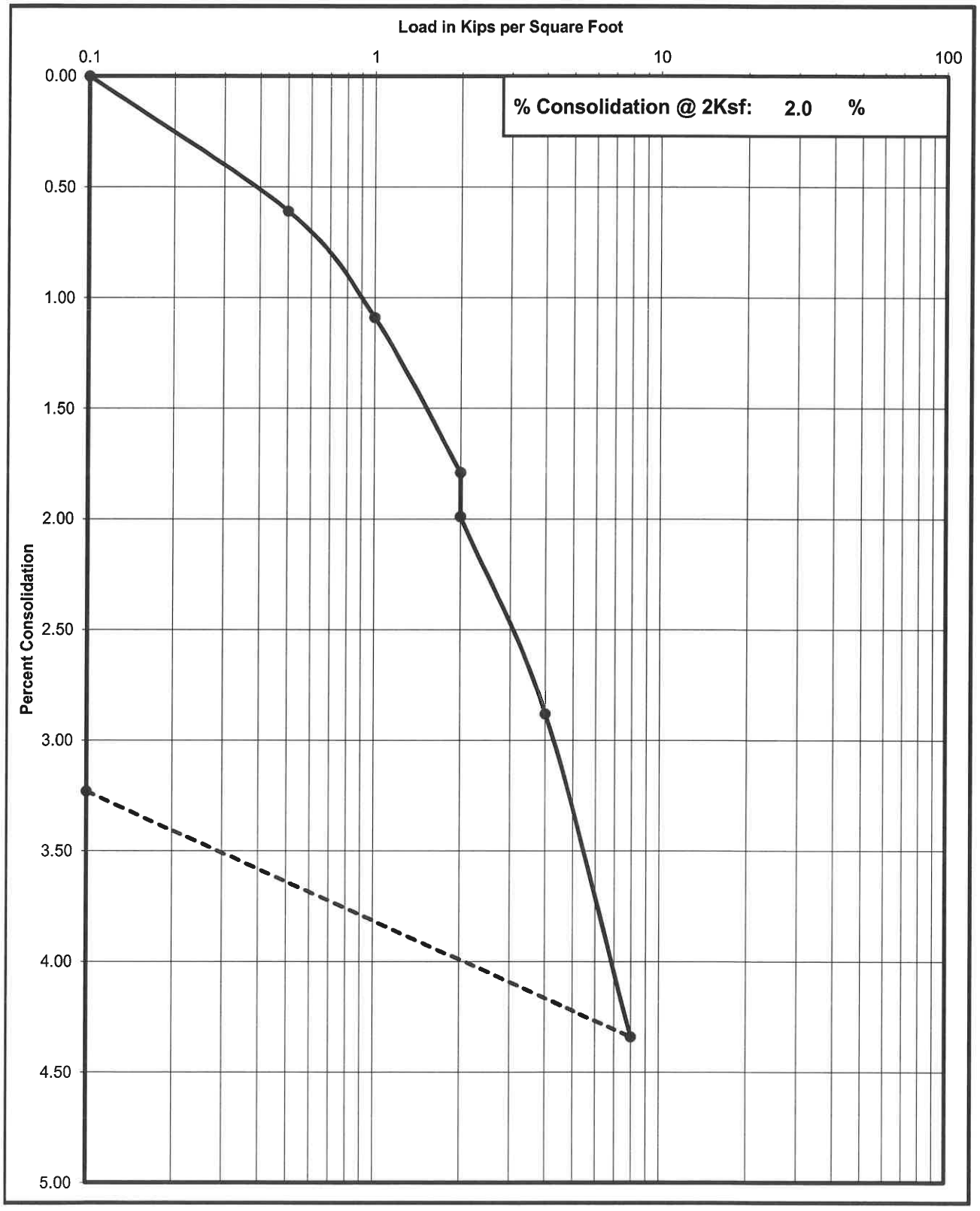
Project No	Boring No. & Depth	Date	Soil Classification
022-21021	B10 @ 2-3'	4/22/2021	SM



Krazan Testing Laboratory

Consolidation Test

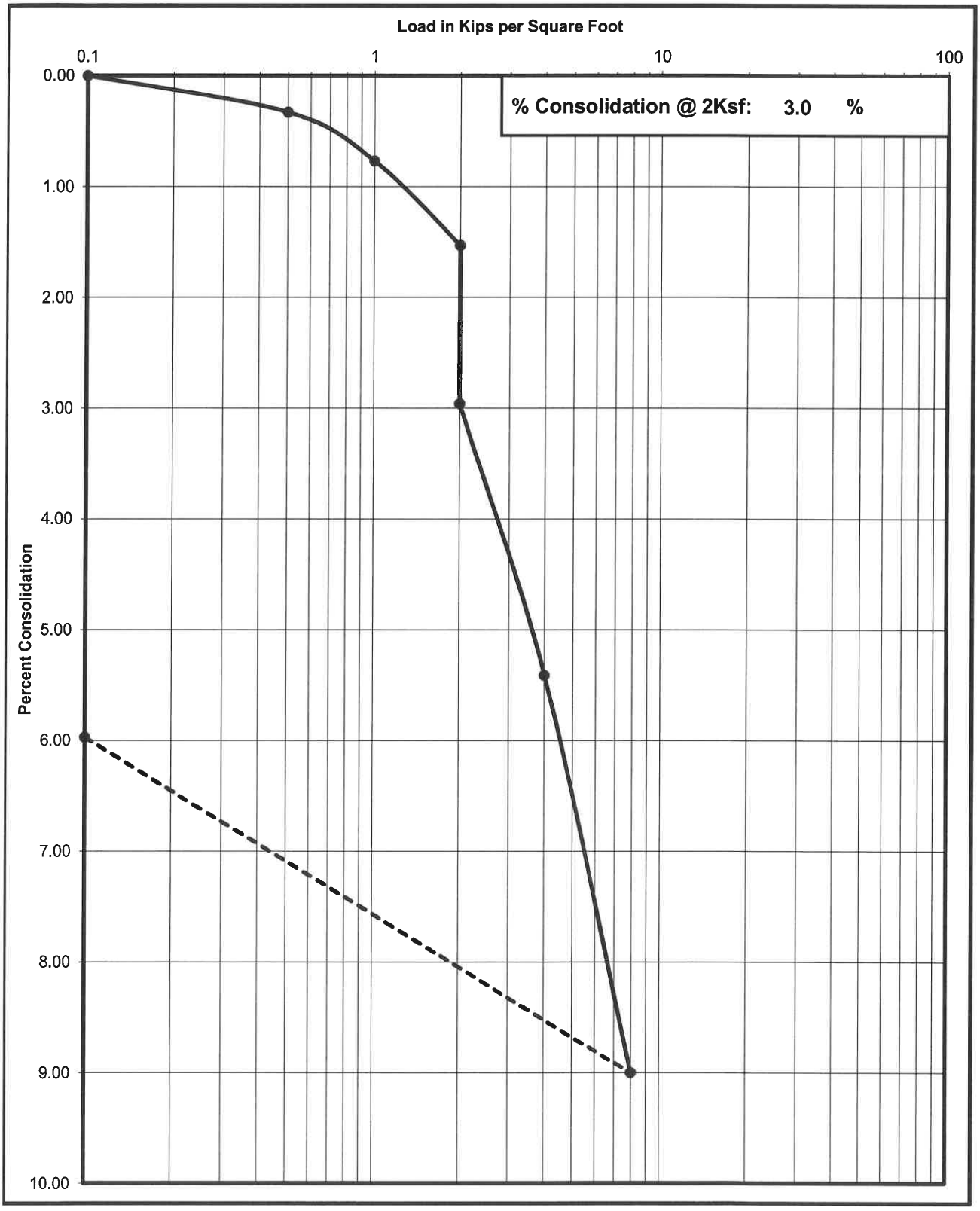
Project No	Boring No. & Depth	Date	Soil Classification
022-21021	B11 @ 5-6'	4/22/2021	SM



Krazan Testing Laboratory

Consolidation Test

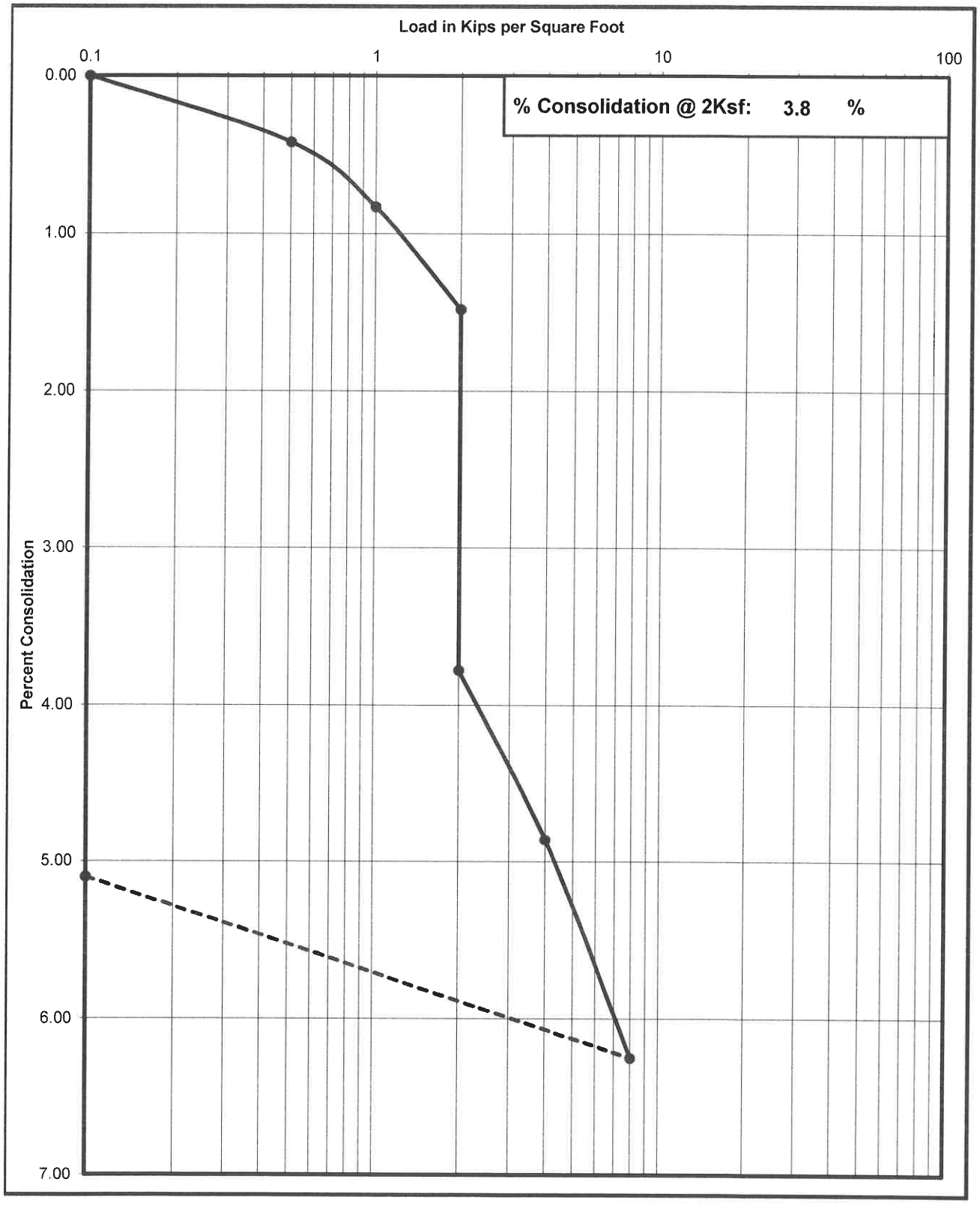
Project No	Boring No. & Depth	Date	Soil Classification
022-21021	B17 @ 2-3'	4/22/2021	ML



Krazan Testing Laboratory

Consolidation Test

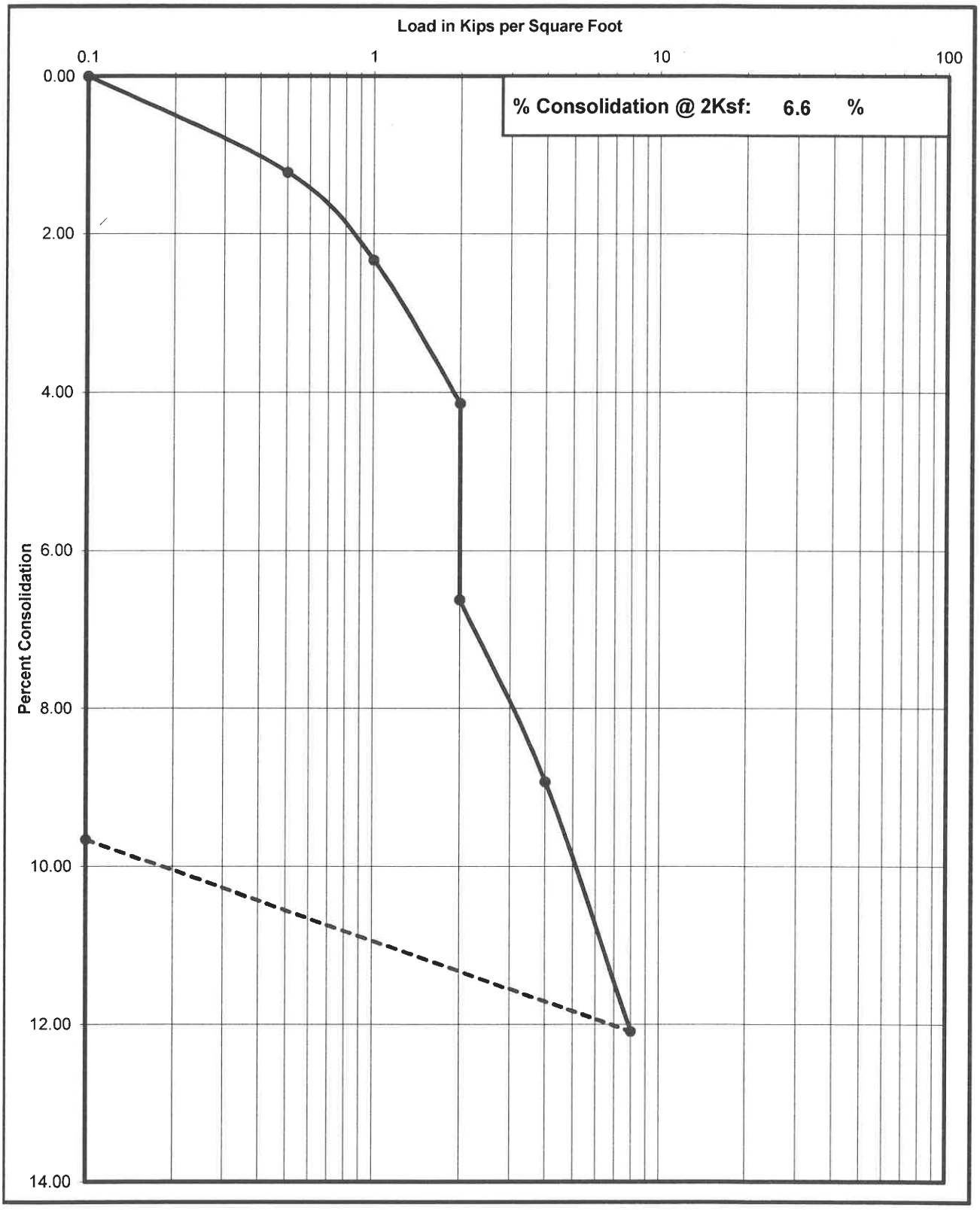
Project No	Boring No. & Depth	Date	Soil Classification
022-21021	B21 @ 2-3'	4/23/2021	SM



Krazan Testing Laboratory

Consolidation Test

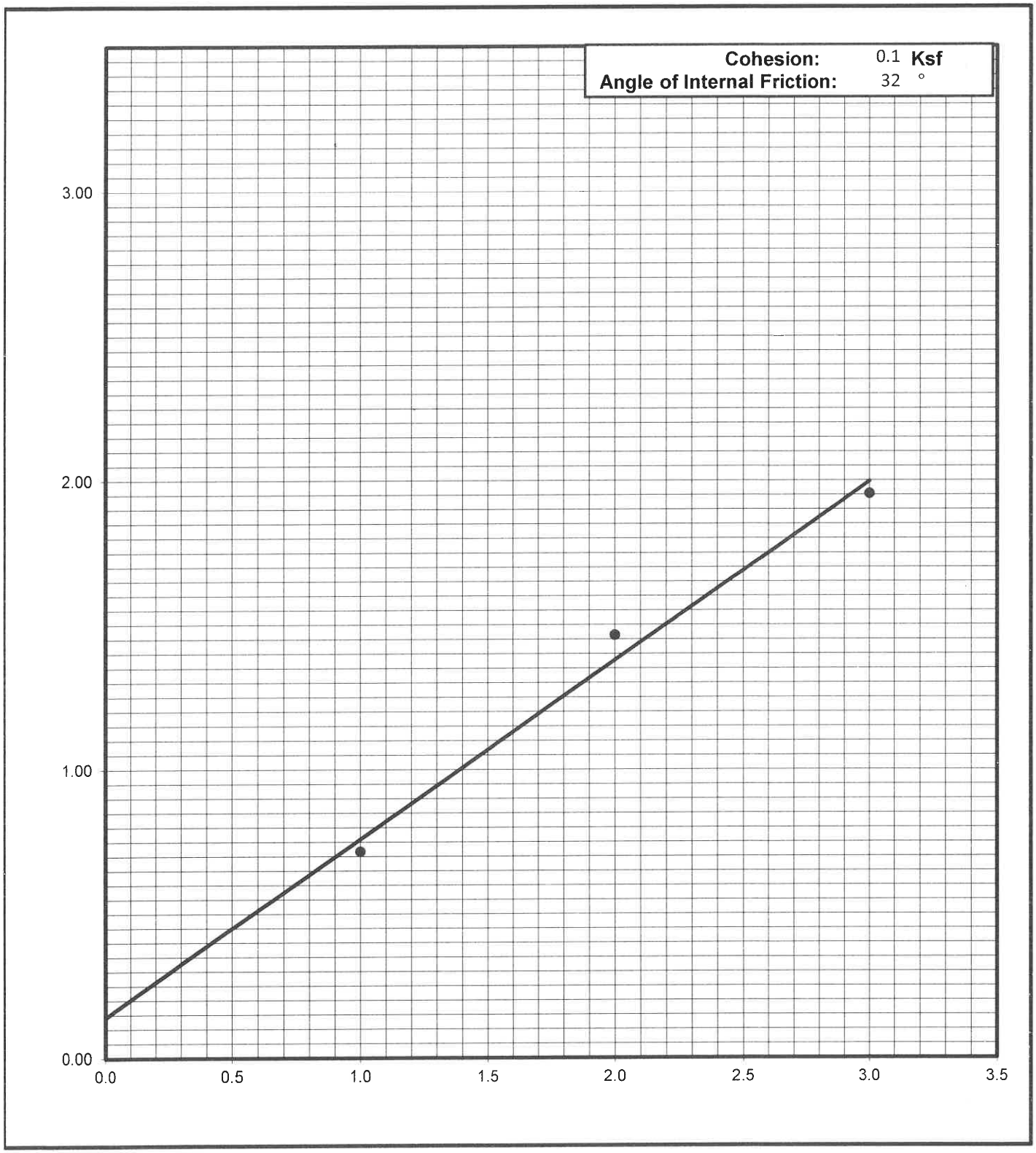
Project No	Boring No. & Depth	Date	Soil Classification
022-21021	B39 @ 2-3'	8/19/2021	ML



Krazan Testing Laboratory

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

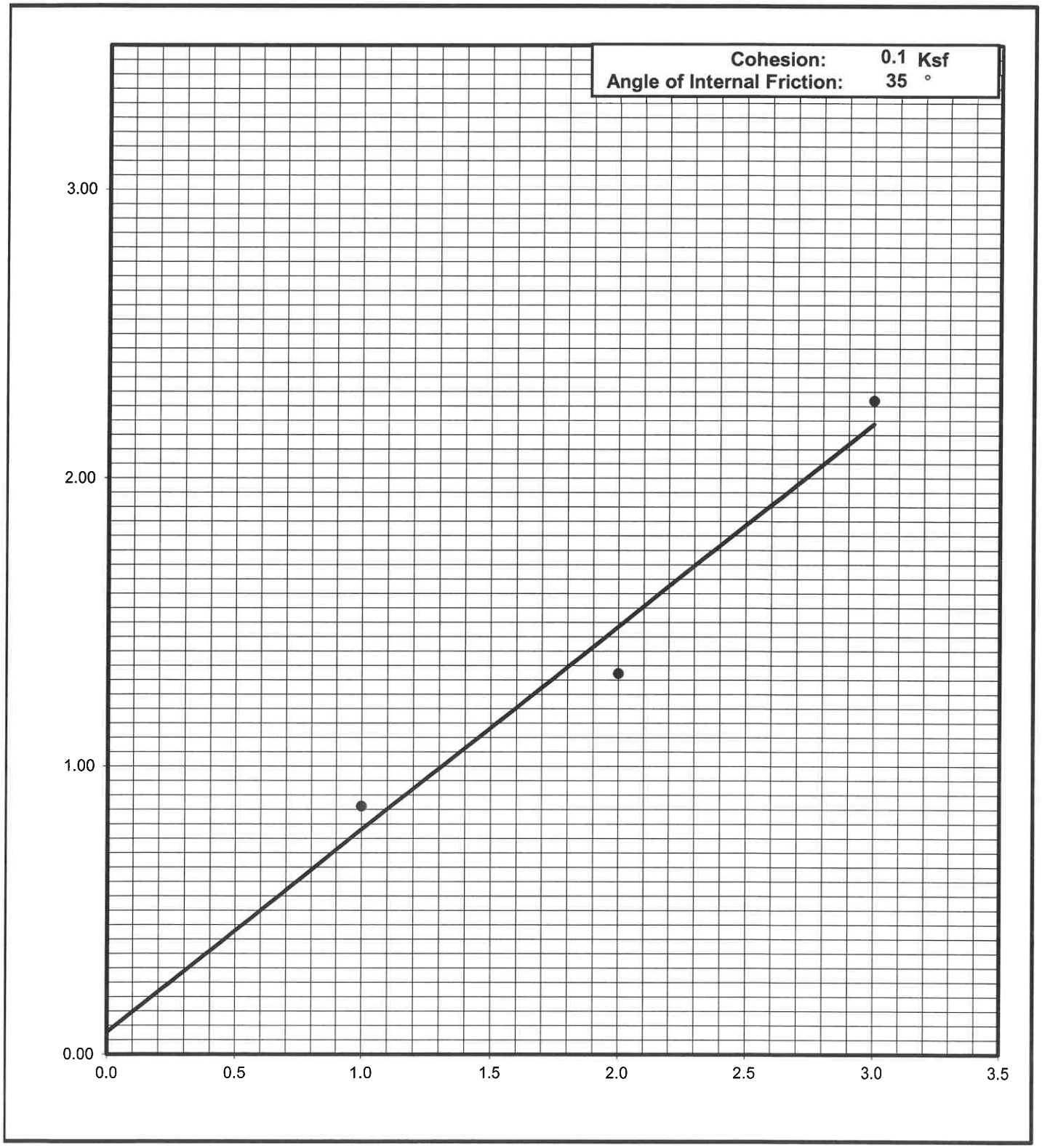
Project Number	Boring No. & Depth	Soil Type	Date
022-21021	B6 @ 2-3'	ML	4/22/2021



Krazan Testing Laboratory

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

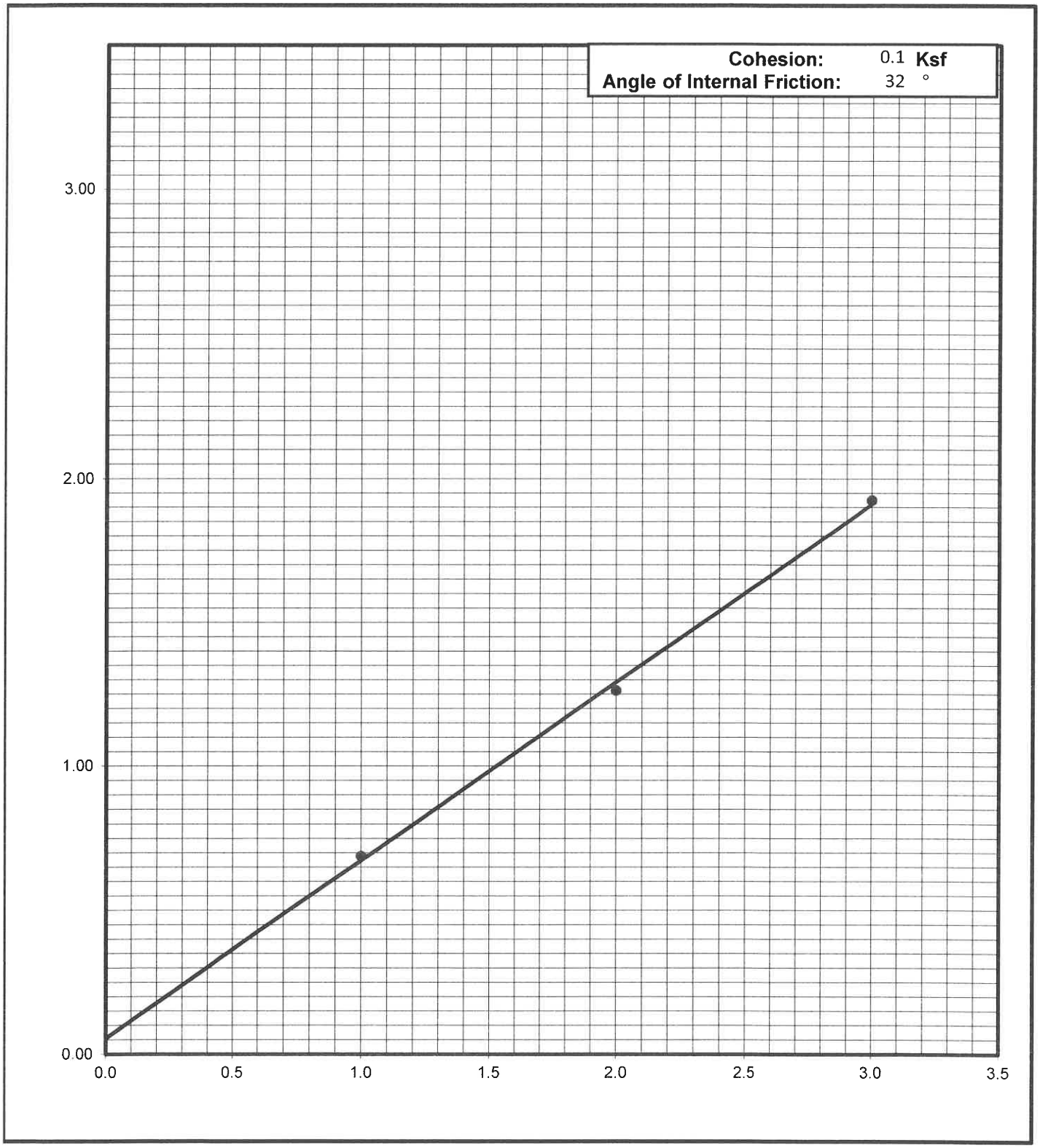
Project Number	Boring No. & Depth	Soil Type	Date
022-21021	B12 @ 2-3'	SM	4/22/2021



Krazan Testing Laboratory

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

Project Number	Boring No. & Depth	Soil Type	Date
022-21021	B25 @ 2-3'	ML	4/23/2021



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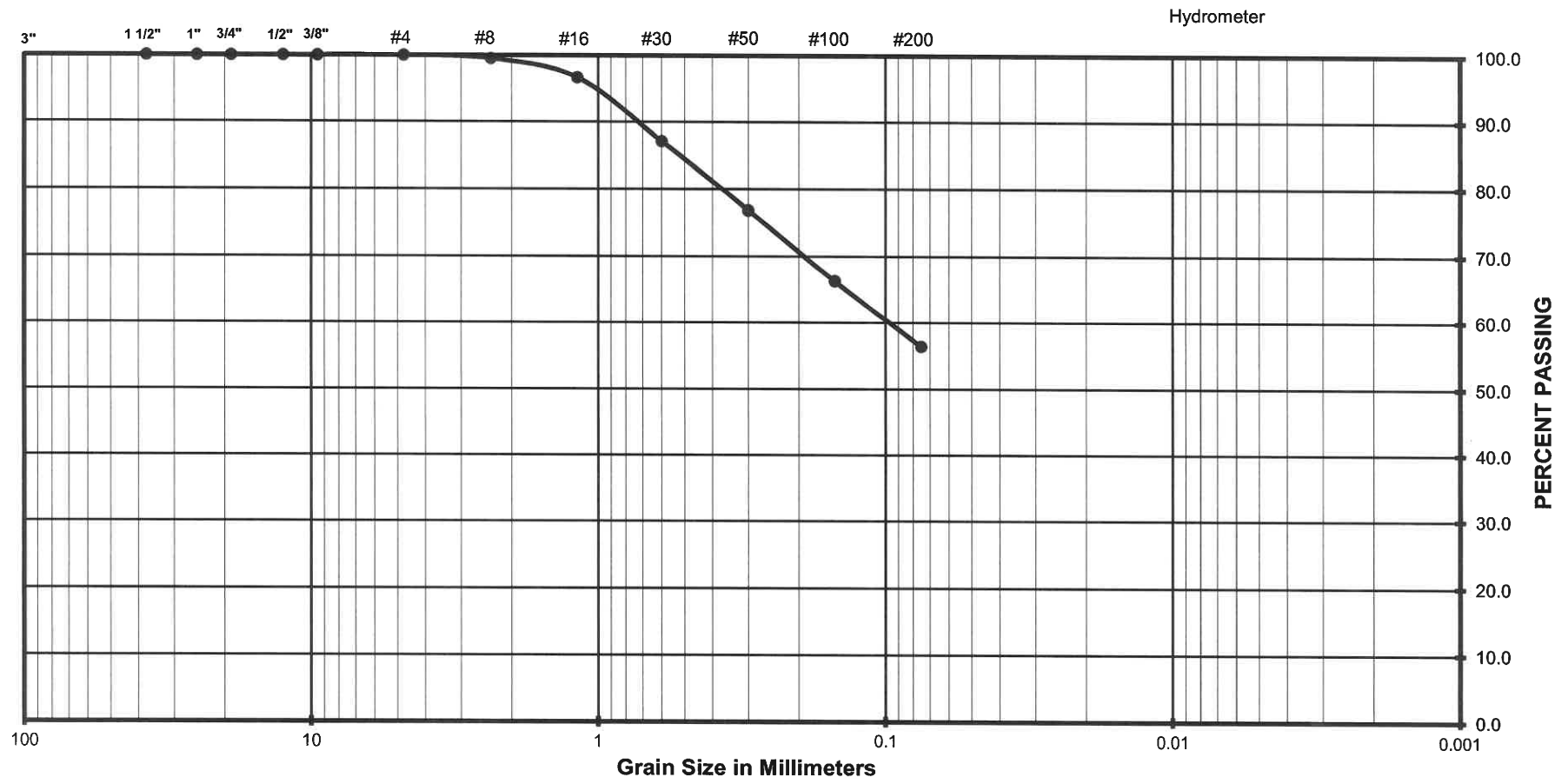
Grain Size Analysis



(Unified Soils Classification)

Project Name	Commercial / Retail Development
Project Number	022-21021
Soil Classification	ML
Sample Number	B17 @ 2-3'

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Grain Size Analysis

(Unified Soils Classification)

Project Name	Commercial / Retail Development
Project Number	022-21021
Soil Classification	SM
Sample Number	B21 @ 2-3'

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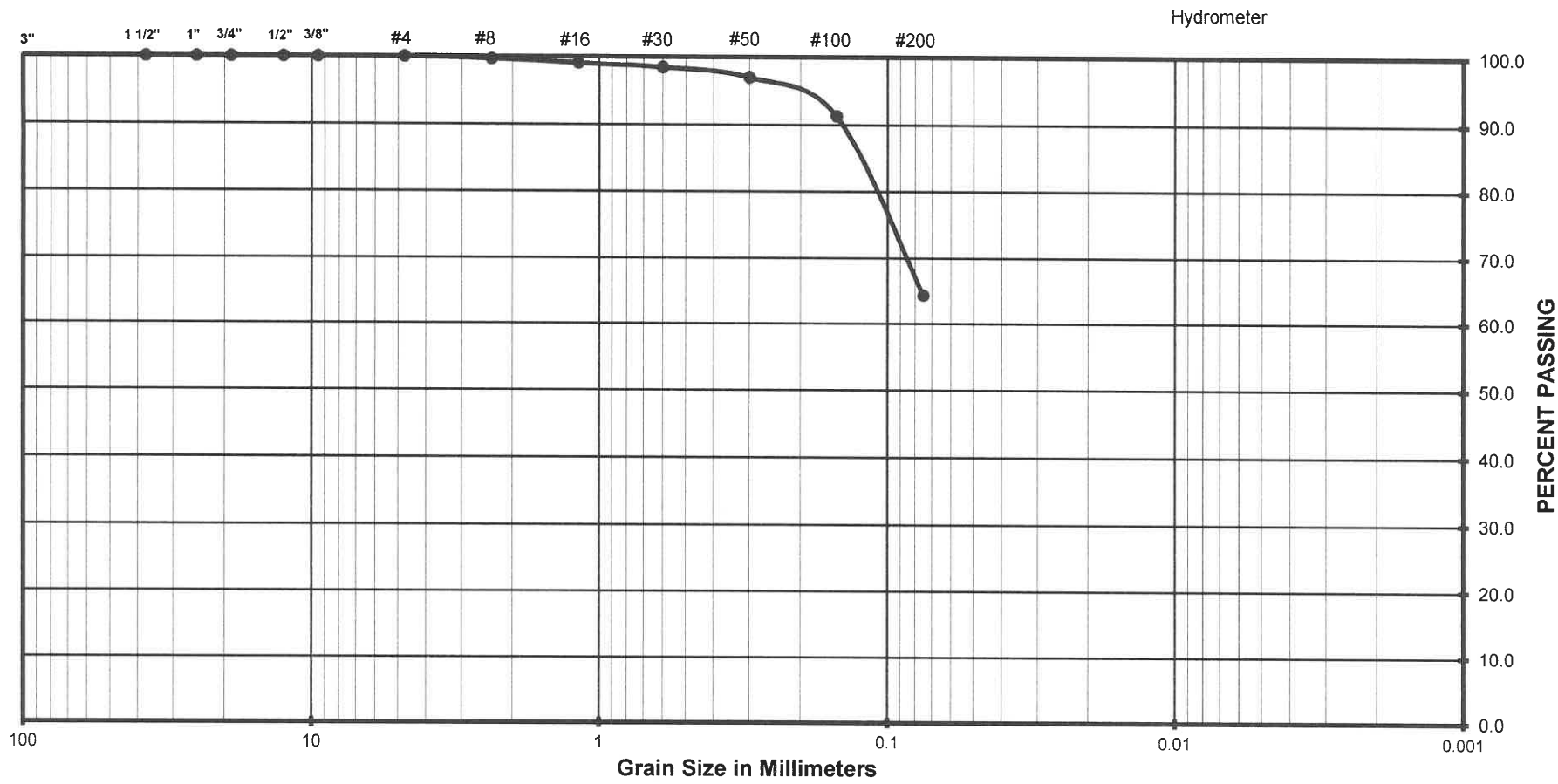
Grain Size Analysis



(Unified Soils Classification)

Project Name	Commercial / Retail Development
Project Number	022-21021
Soil Classification	ML
Sample Number	B39 @ 2-3'

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Expansion Index Test

ASTM D - 4829

Project Number	: 022-21021
Project Name	: Commercial / Retail Development
Date	: 4/23/2021
Sample location/ Depth	: B25 @ 4-5'
Sample Number	: X1
Soil Classification	: ML w/Clay

Trial #	**1**	**2**	**3**
Weight of Soil & Mold, gms	769.3		
Weight of Mold, gms	369.4		
Weight of Soil, gms	399.9		
Wet Density, Lbs/cu.ft.	120.6		
Weight of Moisture Sample (Wet), gms	200.0		
Weight of Moisture Sample (Dry), gms	181.2		
Moisture Content, %	10.4		
Dry Density, Lbs/cu.ft.	109.3		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	51.7		

Time	Inital	30 min	1 hr	6hrs	12 hrs	24 hrs
Dial Reading	0	--	--	--	--	0.0322

Expansion Index $_{measured}$ = 32.2

Expansion Index = 32

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

Krazan Testing Laboratory

Soil Permeability

Constant Head

ASTM D-2434 / Cal 220

Project Number	: 022-21021
Project Name	: Commercial / Retail Development
Date	: 4/22/2021
Sample Number	: --
Sample Location	: B1 @ 10-11'
Soil Classification	: SM/SP

Max Dry Density	--	lb/cu.ft	Relative Density	--	Max. Particle Size	--
Optimum Moisture	--	%	%Over Optimum	--	% Passing 3/8"	--
Sample Dry Density	112.8	lb/cu.ft	Sample Diameter	7.6	% Passing # 10	--
Sample Moisture	0.9	%	Sample Length,cm	7.5	% Passing # 200	6.1
Sample Compaction	--	%	Sample Area sq.cm	45.4	Temperature	20.0
Comp. Procedure	Remolded to approximate In-Situ density				Type of Permeant	Tap Water

Test	Time sec	H1 cm	H2 cm	Flow Q
1	45	76	14.0	154.0
2	45	74	11.0	158.0
3	60	72	9.0	205.0
4				
5				
6				

Test	Time sec	Head Const.	Flow Q	K cm/sec	k20 cm/sec
1	45	62.0	154.0	9.12E-03	9.118E-03
2	45	63.0	158.0	9.21E-03	9.207E-03
3	60	63.0	205.0	8.96E-03	8.959E-03
4					
5					
6					

Permeability
9.1E-03 cm/sec
25.68982 ft/day
9376.79 ft/year

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Soil Permeability

Flexible Wall, Falling Head (Rising Tail)

ASTM D - 5084 / CAL 220

Project Number	: 022-21021
Project Name	: Commercial / Retail Development
Date	: 4/22/2021
Sample Number	: --
Sample Location	: B1 @ 20-21'
Soil Classification	: SM

Max Dry Density, lbs/cu.ft	--	Degree of Sat. %		Max. Particle Size	0.0
Optimum Moisture, %	--	%Over Optimum		% Passing 3/8"	--
Initial Dry Density, lbs/cu.ft	115.8	Initial Diameter, cm	3.56	% Passing # 10	--
Initial Moisture, %	5.7	Initial Length,cm	7.11	% Passing # 200	25.2
Sample Compaction, %	--	Initial Area sq.cm	9.95	Temperature	20.0
Final Dry Density, lbs/cu.ft	--	Final Diameter, cm	3.56	Type of Permeant	Tap Water
Final Moisture, %	--	Final Length, cm	7.11	$\Delta\mu$ (Pore Pressure)	5.0
Specific Gravity (Assumed)	2.7	Final Area, sq.cm	9.95	$\Delta\sigma$ (Cell Pressure)	5.0
Comp. Procedure	Undisturbed			$\Delta\mu/\Delta\sigma$ (**B** Value)	1.00

Test	Start Time	Finish Time	H in Start	H in Final	H out Start	H out Final	Back Press	Tail Press.	Cell Press
1	5:15	5:28	0.18	5.12	9.68	4.74	17.0	15.5	18.0
2	5:30	5:52	0.34	7.10	9.54	2.78	17.0	15.5	18.0
3	5:54	6:09	0.32	5.84	9.72	4.20	17.0	15.5	18.0
4									
5									
6									

Test	Time sec	h1/h2	K cm/sec	k20 cm/sec
1	780	0.50532	8.2E-05	8.223E-05
2	1320	0.31316	8.3E-05	8.265E-05
3	900	0.44738	8.4E-05	8.398E-05
4				
5				
6				

Permeability
8.30E-05 cm/sec
8.3E-07 m/sec

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Soil Permeability

Flexible Wall, Falling Head (Rising Tail)

ASTM D - 5084 / CAL 220

Project Number	: 022-21021
Project Name	: Commercial / Retail Development
Date	: 4/21/2021
Sample Number	: --
Sample Location	: B1 @ 30-31'
Soil Classification	: ML

Max Dry Density, lbs/cu.ft	--	Degree of Sat. %		Max. Particle Size	0.0
Optimum Moisture, %	--	%Over Optimum		% Passing 3/8"	--
Initial Dry Density, lbs/cu.ft	97.1	Initial Diameter, cm	3.56	% Passing # 10	--
Initial Moisture, %	17.4	Initial Length,cm	7.11	% Passing # 200	86.8
Sample Compaction, %	--	Initial Area sq.cm	9.95	Temperature	20.0
Final Dry Density, lbs/cu.ft	--	Final Diameter, cm	3.56	Type of Permeant	Tap Water
Final Moisture, %	--	Final Length, cm	7.11	$\Delta\mu$ (Pore Pressure)	5.0
Specific Gravity (Assumed)	2.7	Final Area, sq.cm	9.95	$\Delta\sigma$ (Cell Pressure)	5.0
Comp. Procedure	Undisturbed			$\Delta\mu/\Delta\sigma$ (**B** Value)	1.00

Test	Start Time	Finish Time	H in Start	H in Final	H out Start	H out Final	Back Press	Tail Press.	Cell Press
1	4:35	6:10	0.38	2.12	9.84	8.10	29.0	26.5	30.0
2	6:10	6:45	2.12	2.74	8.10	7.48	29.0	26.5	30.0
3									
4									
5									
6									

Test	Time sec	h1/h2	K cm/sec	k20 cm/sec
1	5700	0.88799	2.0E-06	1.958E-06
2	2100	0.95505	2.1E-06	2.058E-06
3				
4				
5				
6				

Permeability
2.01E-06 cm/sec
2.01E-08 m/sec

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Soil Permeability

Flexible Wall, Falling Head (Rising Tail)

ASTM D - 5084 / CAL 220

Project Number	: 022-21021
Project Name	: Commercial / Retail Development
Date	: 4/21/2021
Sample Number	: --
Sample Location	: B1 @ 35-36'
Soil Classification	: ML

Max Dry Density, lbs/cu.ft	--	Degree of Sat. %		Max. Particle Size	0.0
Optimum Moisture, %	--	%Over Optimum		% Passing 3/8"	--
Initial Dry Density, lbs/cu.ft	110.7	Initial Diameter, cm	3.56	% Passing # 10	--
Initial Moisture, %	18.8	Initial Length,cm	7.11	% Passing # 200	63.2
Sample Compaction, %	--	Initial Area sq.cm	9.95	Temperature	20.0
Final Dry Density, lbs/cu.ft	--	Final Diameter, cm	3.56	Type of Permeant	Tap Water
Final Moisture, %	--	Final Length, cm	7.11	$\Delta\mu$ (Pore Pressure)	5.0
Specific Gravity (Assumed)	2.7	Final Area, sq.cm	9.95	$\Delta\sigma$ (Cell Pressure)	5.0
Comp. Procedure	Undisturbed			$\Delta\mu/\Delta\sigma$ (**B** Value)	1.00

Test	Start Time	Finish Time	H in Start	H in Final	H out Start	H out Final	Back Press	Tail Press.	Cell Press
1	4:35	5:12	0.54	1.94	9.68	8.26	25.0	23.0	26.0
2	5:12	6:20	1.94	4.12	8.26	6.08	25.0	23.0	26.0
3									
4									
5									
6									

Test	Time sec	h1/h2	K cm/sec	k20 cm/sec
1	2220	0.88801	5.0E-06	5.027E-06
2	4080	0.80583	5.0E-06	4.972E-06
3				
4				
5				
6				

Permeability
5.00E-06 cm/sec
5E-08 m/sec

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Soil Permeability

Flexible Wall, Falling Head (Rising Tail)

ASTM D - 5084 / CAL 220

Project Number	: 022-21021
Project Name	: Commercial / Retail Development
Date	: 4/19/2021
Sample Number	: --
Sample Location	: B2 @ 15-16'
Soil Classification	: ML w/ clay

Max Dry Density, lbs/cu.ft	--	Degree of Sat. %		Max. Particle Size	0.0
Optimum Moisture, %	--	%Over Optimum		% Passing 3/8"	--
Initial Dry Density, lbs/cu.ft	101.6	Initial Diameter, cm	3.56	% Passing # 10	--
Initial Moisture, %	23.9	Initial Length,cm	7.11	% Passing # 200	82.9
Sample Compaction, %	--	Initial Area sq.cm	9.95	Temperature	20.0
Final Dry Density, lbs/cu.ft	--	Final Diameter, cm	3.56	Type of Permeant	Tap Water
Final Moisture, %	--	Final Length, cm	7.11	$\Delta\mu$ (Pore Pressure)	5.0
Specific Gravity (Assumed)	2.7	Final Area, sq.cm	9.95	$\Delta\sigma$ (Cell Pressure)	5.0
Comp. Procedure	Undisturbed			$\Delta\mu/\Delta\sigma$ (**B** Value)	1.00

Test	Start Time	Finish Time	H in Start	H in Final	H out Start	H out Final	Back Press	Tail Press.	Cell Press
1	4:15	5:44	0.24	1.46	9.68	8.86	31.0	28.0	32.0
2	5:44	6:51	1.46	2.12	8.86	8.20	31.0	28.0	32.0
3									
4									
5									
6									

Test	Time sec	h1/h2	K cm/sec	k20 cm/sec
1	5340	0.95028	9.0E-07	8.974E-07
2	4020	0.96177	9.1E-07	9.111E-07
3				
4				
5				
6				

Permeability
9.04E-07 cm/sec
9.04E-09 m/sec

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Soil Permeability

Flexible Wall, Falling Head (Rising Tail)

ASTM D - 5084 / CAL 220

Project Number	: 022-21021
Project Name	: Commercial / Retail Development
Date	: 4/19/2021
Sample Number	: --
Sample Location	: B2 @ 25-26'
Soil Classification	: ML w/ clay

Max Dry Density, lbs/cu.ft	--	Degree of Sat. %		Max. Particle Size	0.0
Optimum Moisture, %	--	%Over Optimum		% Passing 3/8"	--
Initial Dry Density, lbs/cu.ft	100.6	Initial Diameter, cm	3.56	% Passing # 10	--
Initial Moisture, %	22.6	Initial Length,cm	7.11	% Passing # 200	92.3
Sample Compaction, %	--	Initial Area sq.cm	9.95	Temperature	20.0
Final Dry Density, lbs/cu.ft	--	Final Diameter, cm	3.56	Type of Permeant	Tap Water
Final Moisture, %	--	Final Length, cm	7.11	$\Delta\mu$ (Pore Pressure)	5.0
Specific Gravity (Assumed)	2.7	Final Area, sq.cm	9.95	$\Delta\sigma$ (Cell Pressure)	5.0
Comp. Procedure	Undisturbed			$\Delta\mu/\Delta\sigma$ (**B** Value)	1.00

Test	Start Time	Finish Time	H in Start	H in Final	H out Start	H out Final	Back Press	Tail Press.	Cell Press
1	4:15	5:44	0.50	1.62	9.62	8.50	34.0	29.5	35.0
2	5:44	6:43	1.62	2.32	8.50	7.78	34.0	29.5	35.0
3									
4									
5									
6									

Test	Time sec	h1/h2	K cm/sec	k20 cm/sec
1	5340	0.95735	7.7E-07	7.669E-07
2	3540	0.97153	7.7E-07	7.667E-07
3				
4				
5				
6				

Permeability
7.67E-07 cm/sec
7.67E-09 m/sec

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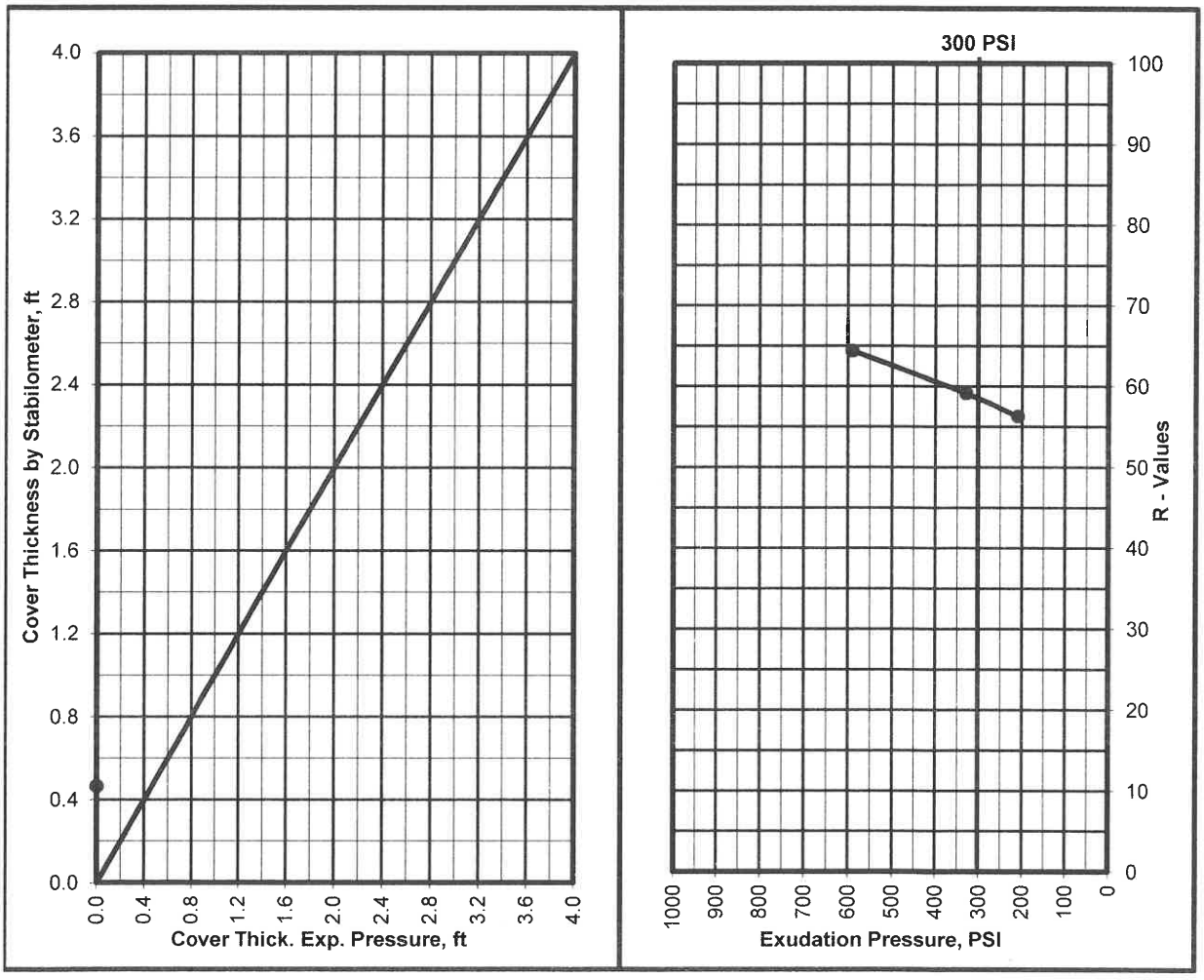
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/7/2021
Sample Location/Curve Number	:	RV#1
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	11.7	10.7	11.2
Dry Density, lbm/cu.ft.	120.6	122.9	121.8
Exudation Pressure, psi	210	590	330
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	56	64	59

R Value at 300 PSI Exudation Pressure	**59**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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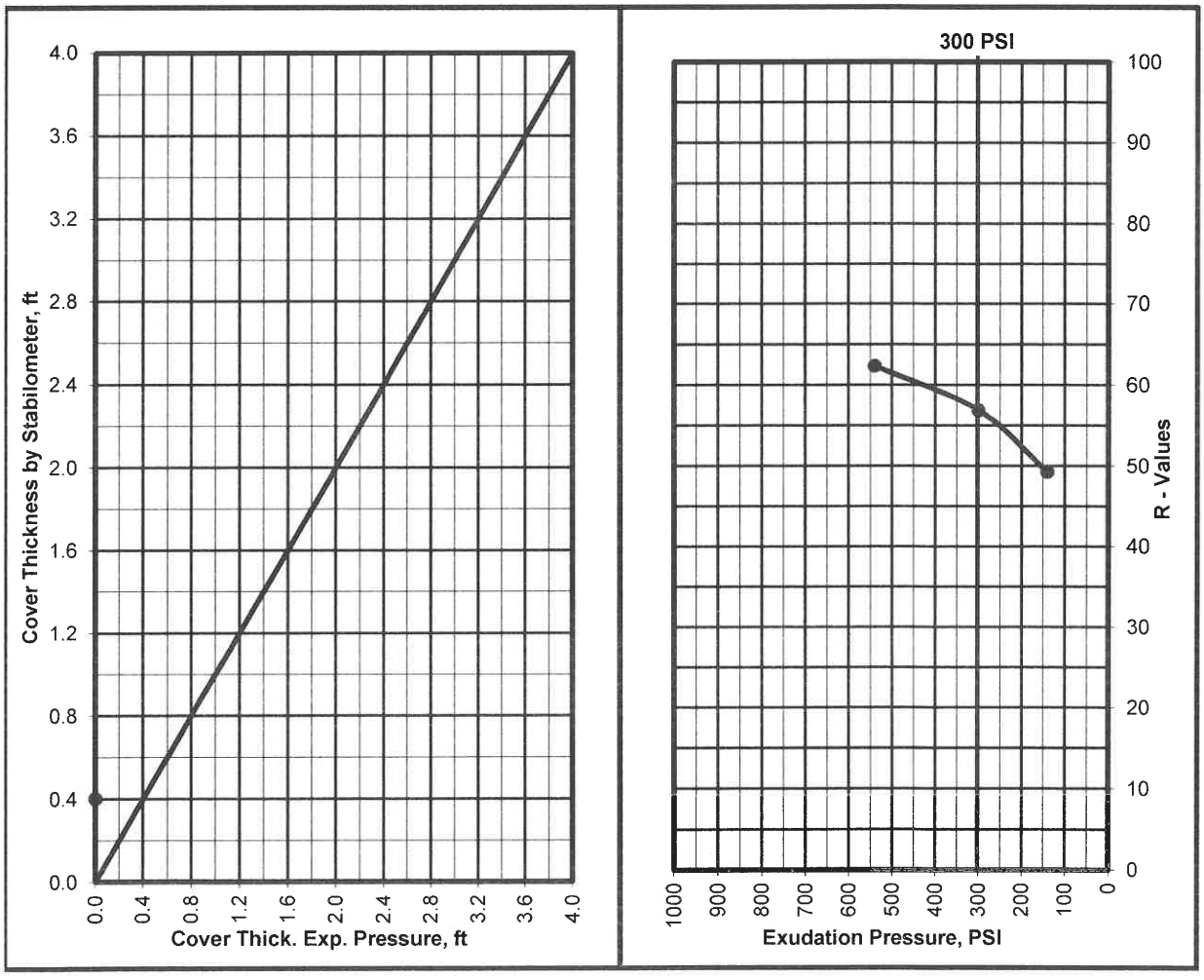
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/7/2021
Sample Location/Curve Number	:	RV#2
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	11.9	12.4	12.8
Dry Density, lbm/cu.ft.	119.6	118.8	117.9
Exudation Pressure, psi	540	300	140
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	62	57	49

R Value at 300 PSI Exudation Pressure	**57**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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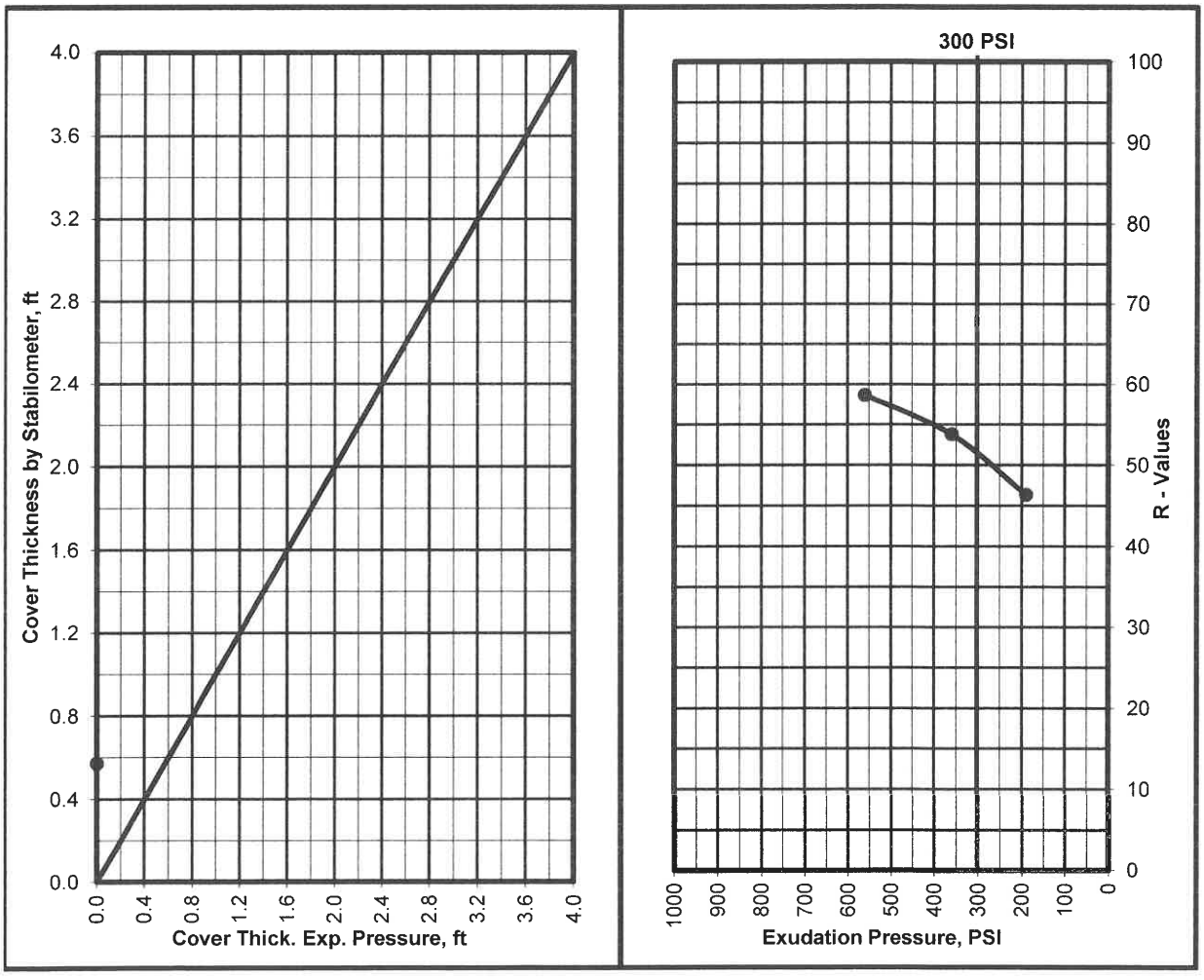
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/10/2021
Sample Location/Curve Number	:	RV#3
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	11.1	10.6	10.1
Dry Density, lbm/cu.ft.	123.2	124.0	124.6
Exudation Pressure, psi	190	360	560
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	46	54	59

R Value at 300 PSI Exudation Pressure	**51**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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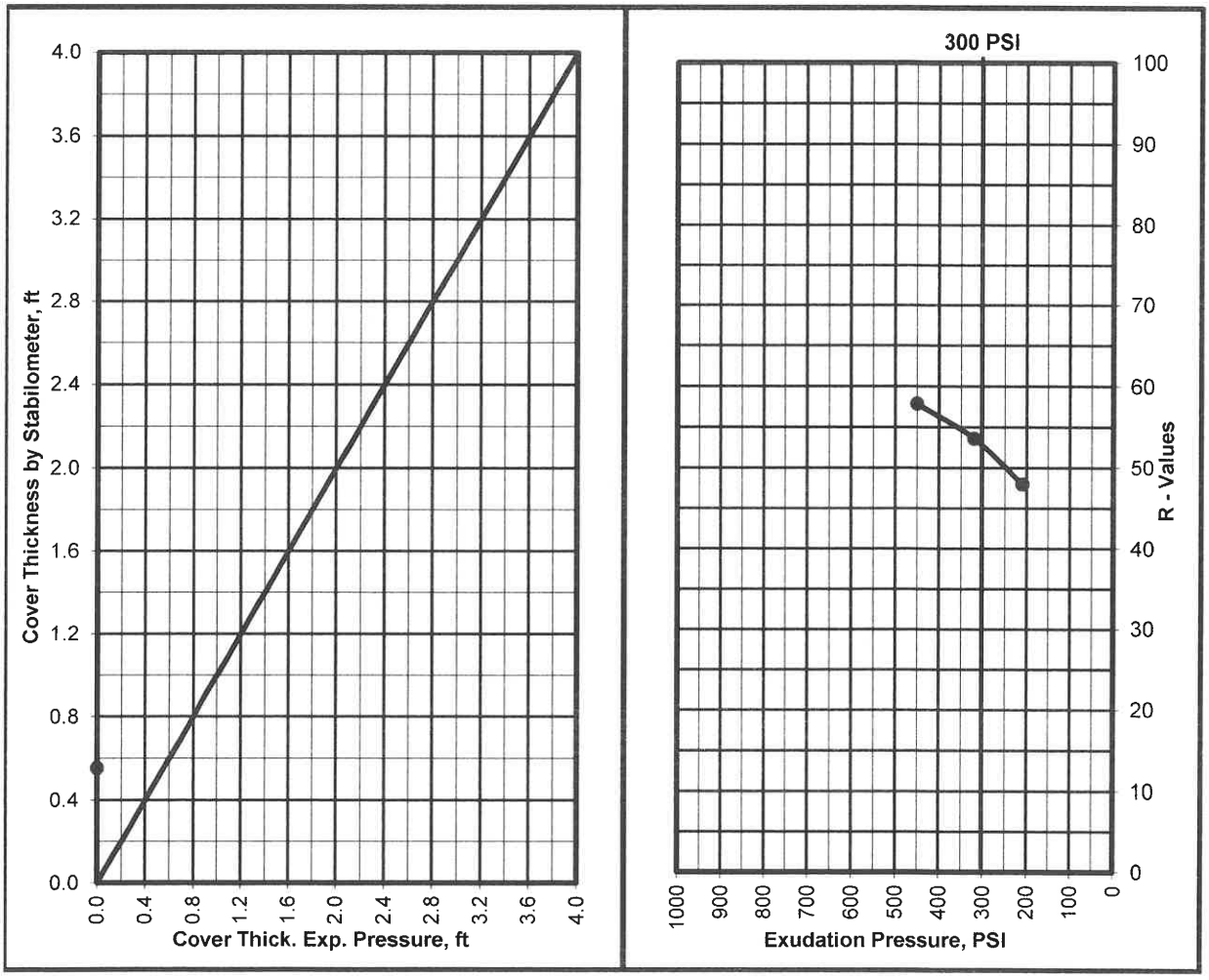
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/10/2021
Sample Location/Curve Number	:	RV#4
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	12.1	11.2	11.7
Dry Density, lbm/cu.ft.	121.6	123.8	122.7
Exudation Pressure, psi	210	450	320
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	48	58	54

R Value at 300 PSI Exudation Pressure	**53**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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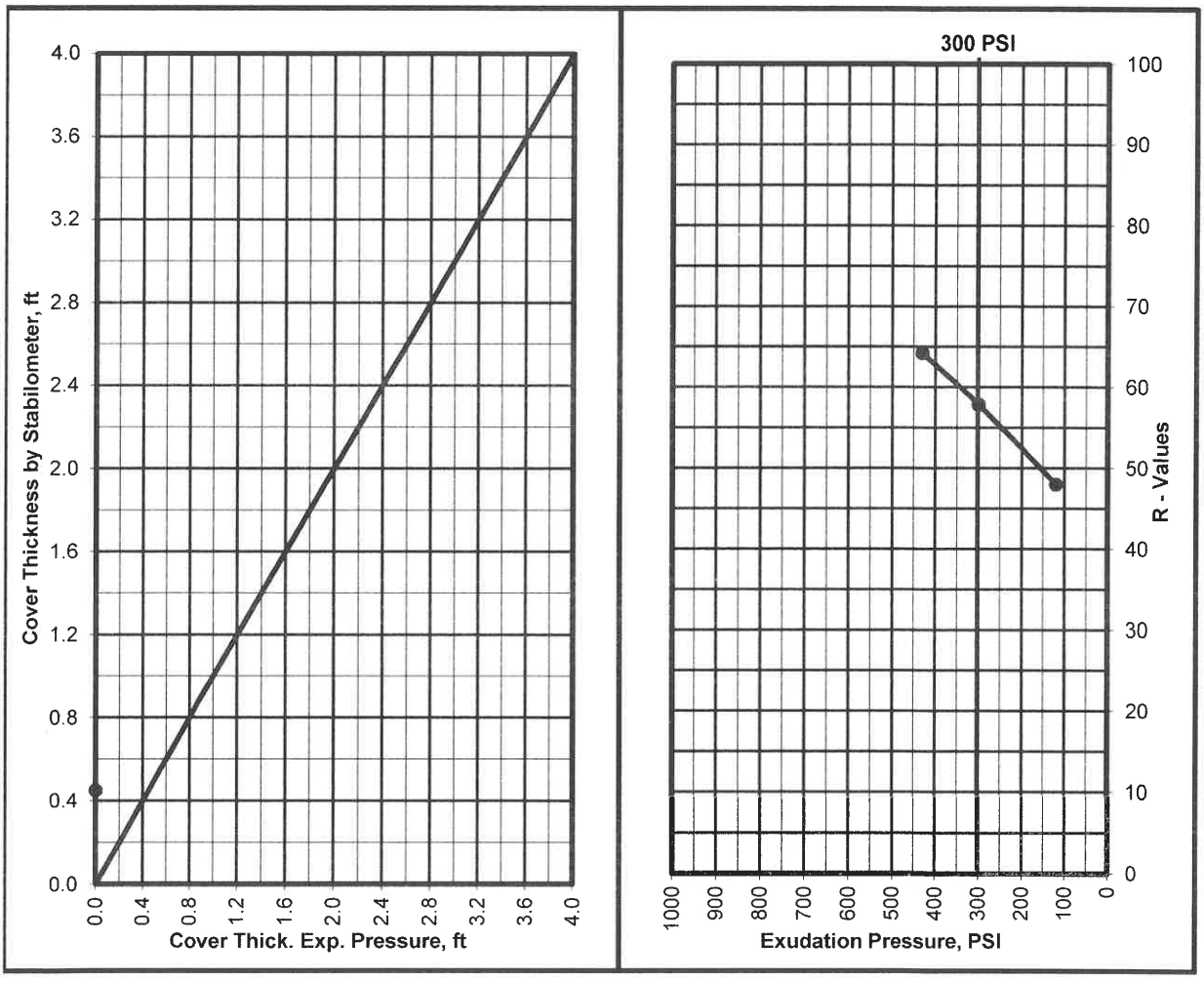
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/7/2021
Sample Location/Curve Number	:	RV#5
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	10.7	11.2	10.2
Dry Density, lbm/cu.ft.	124.0	123.3	124.5
Exudation Pressure, psi	300	120	430
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	58	48	64

R Value at 300 PSI Exudation Pressure	**58**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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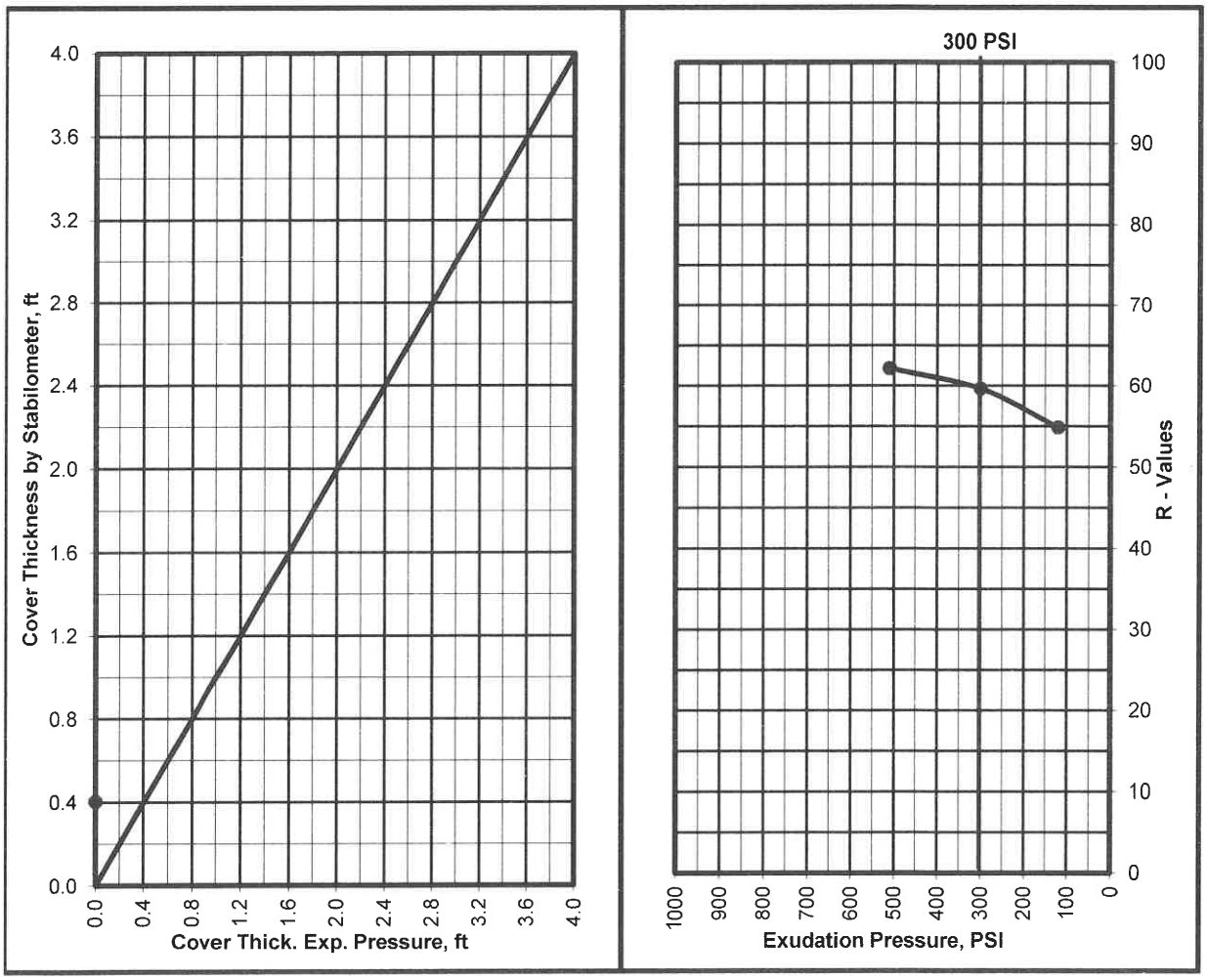
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/7/2021
Sample Location/Curve Number	:	RV#6
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	9.5	10.6	10.0
Dry Density, lbm/cu.ft.	122.8	122.4	122.5
Exudation Pressure, psi	510	120	300
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	62	55	60

R Value at 300 PSI Exudation Pressure	**60**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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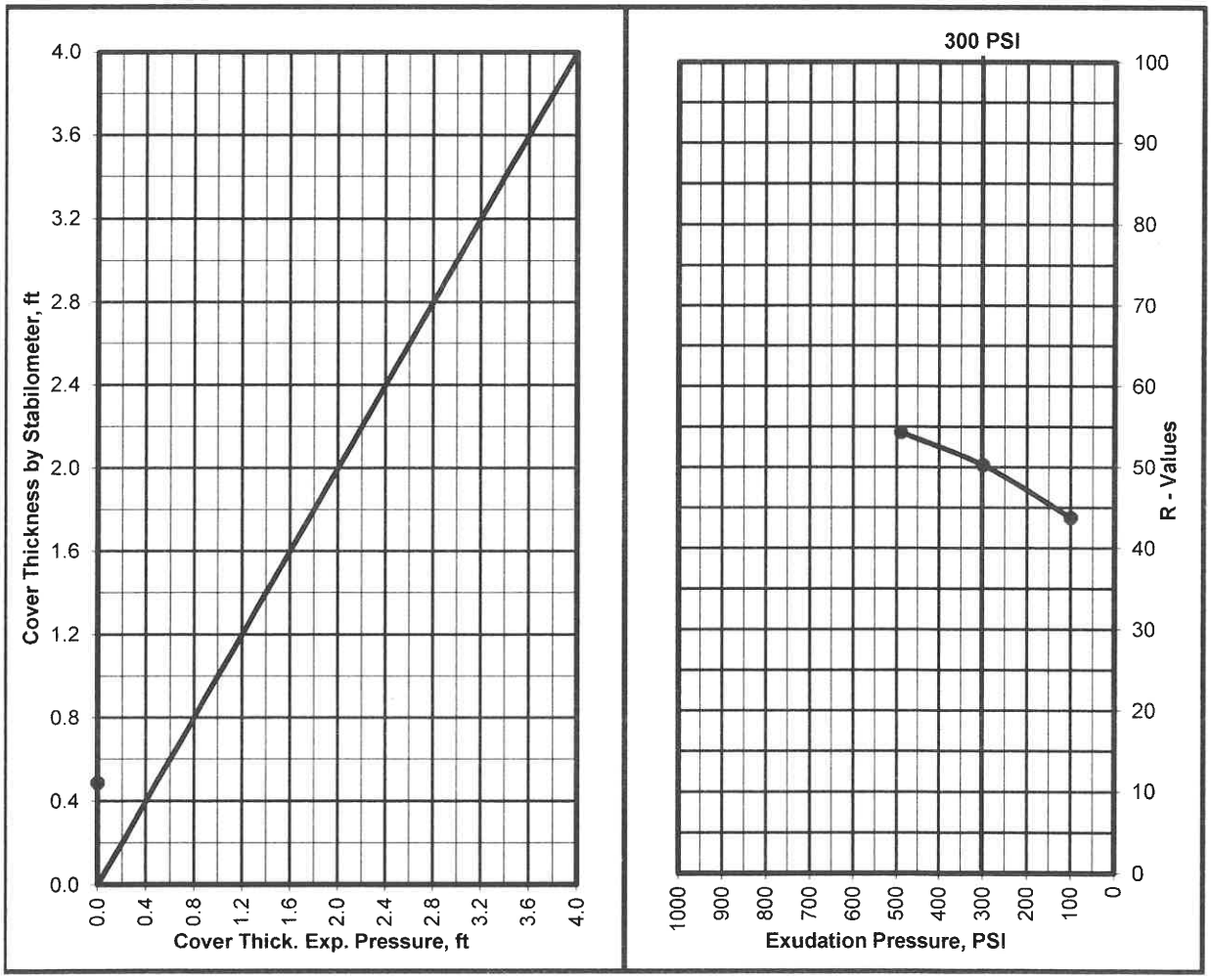
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/10/2021
Sample Location/Curve Number	:	RV#7
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	11.4	12.4	11.9
Dry Density, lbm/cu.ft.	121.3	119.0	120.5
Exudation Pressure, psi	490	100	300
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	54	44	50

R Value at 300 PSI Exudation Pressure	**50**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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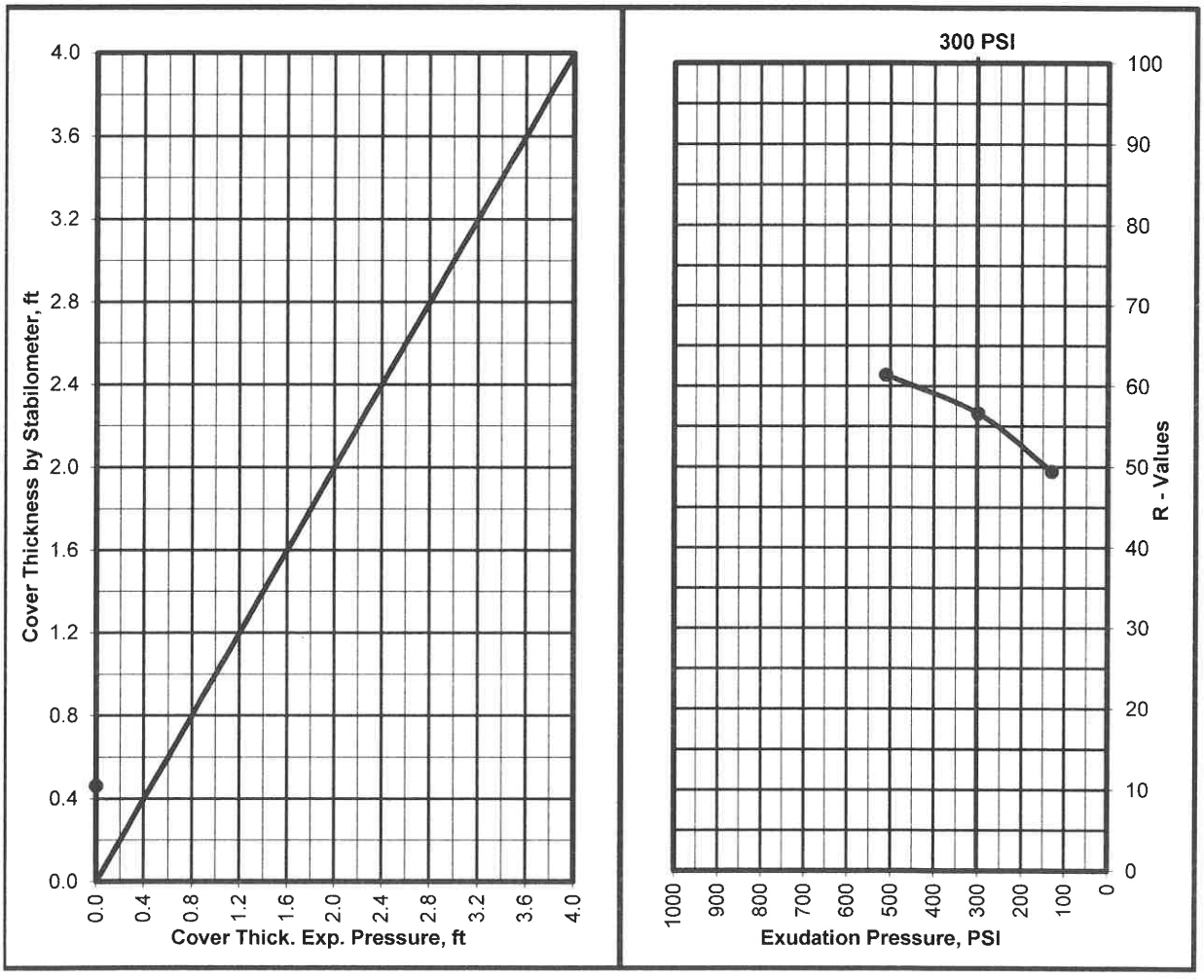
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/10/2021
Sample Location/Curve Number	:	RV#8
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	10.6	11.1	10.1
Dry Density, lbm/cu.ft.	122.2	120.7	122.8
Exudation Pressure, psi	300	130	510
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	57	49	61

R Value at 300 PSI Exudation Pressure	**57**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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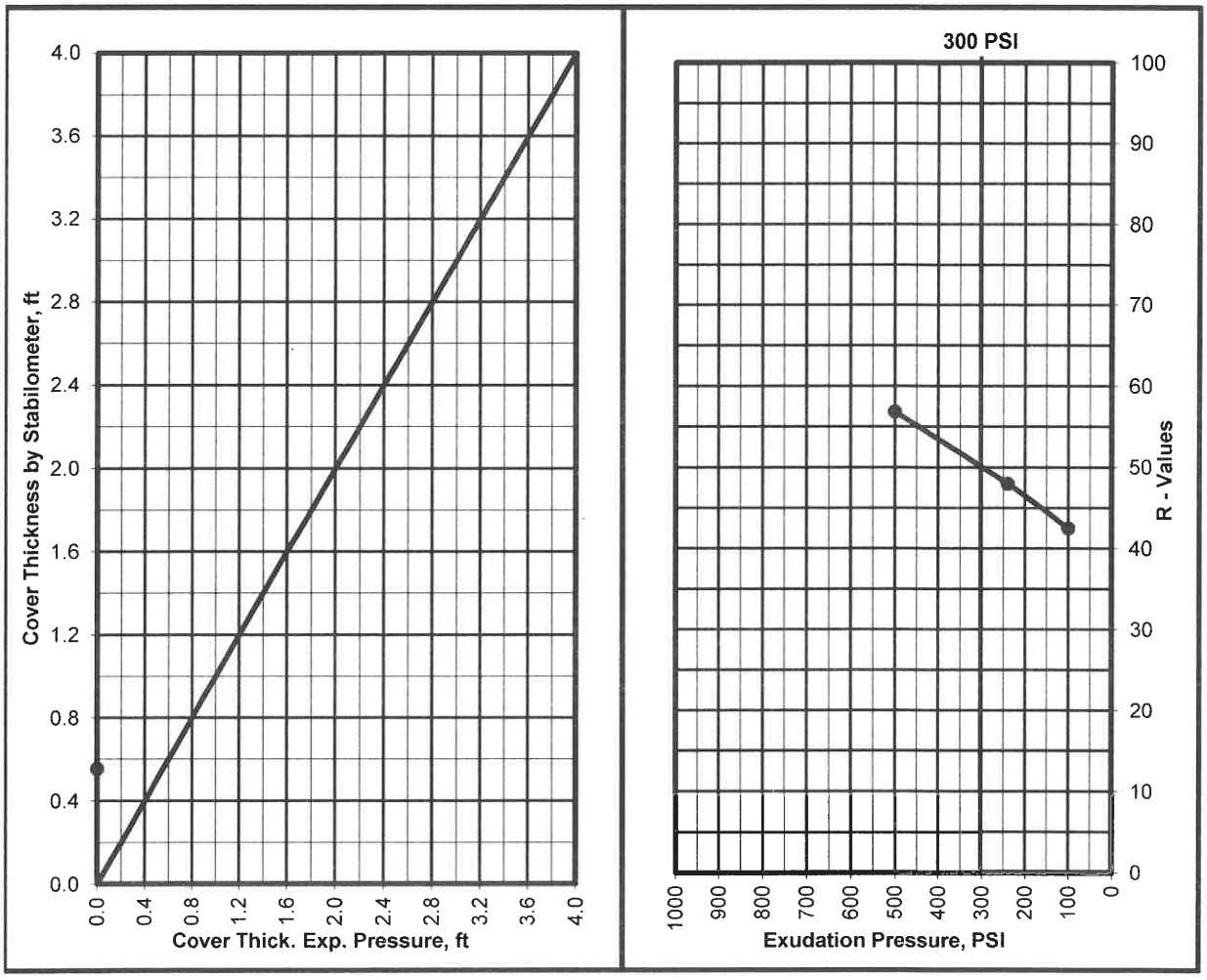
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/10/2021
Sample Location/Curve Number	:	RV#9
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	12.2	11.6	12.7
Dry Density, lbm/cu.ft.	118.1	119.1	117.1
Exudation Pressure, psi	240	500	100
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	48	57	43

R Value at 300 PSI Exudation Pressure	**50**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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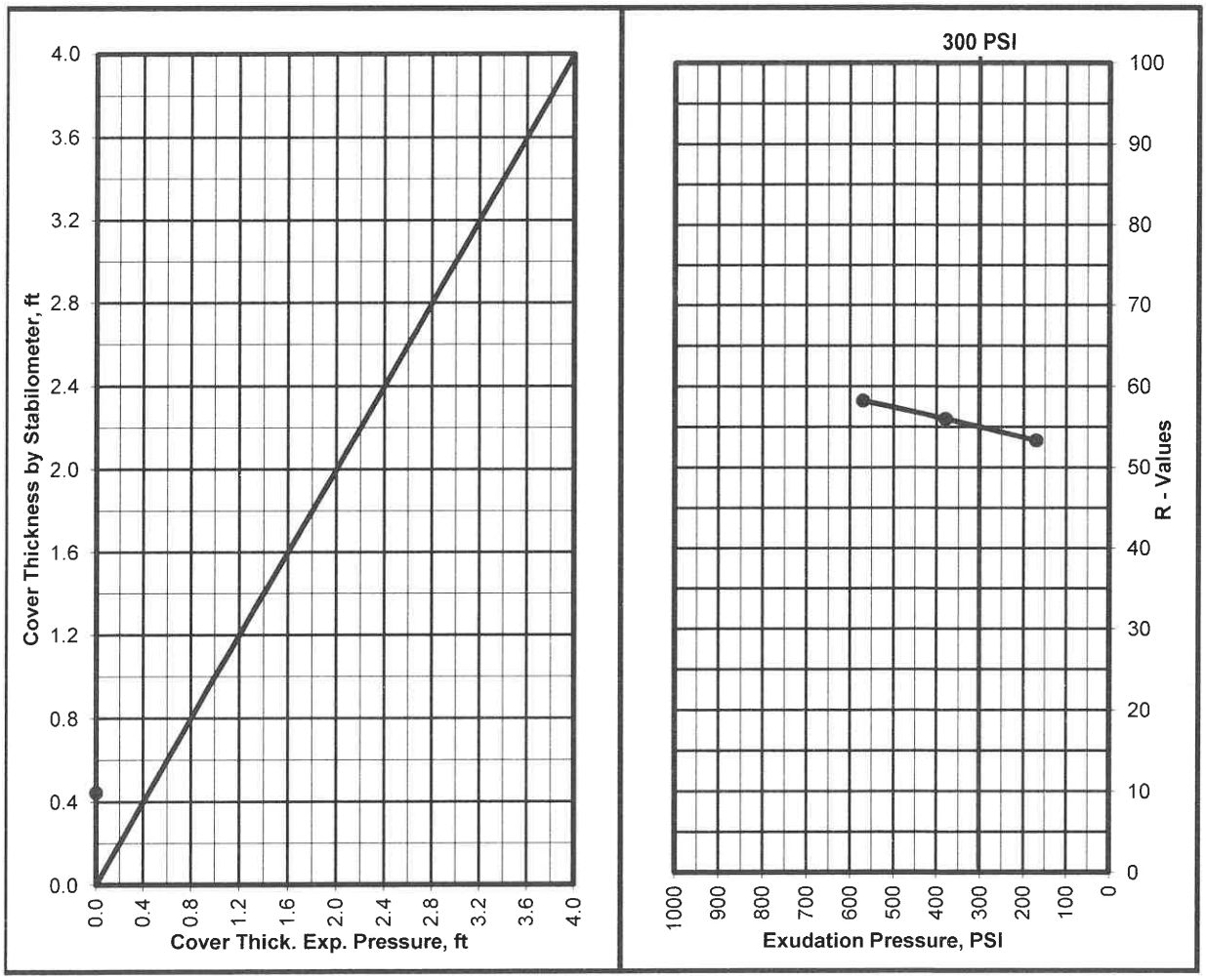
R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	5/10/2021
Sample Location/Curve Number	:	RV#10
Soil Classification	:	SM

TEST	A	B	C
Percent Moisture @ Compaction, %	11.4	12.4	11.9
Dry Density, lbm/cu.ft.	119.5	117.7	118.7
Exudation Pressure, psi	570	170	380
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	58	53	56

R Value at 300 PSI Exudation Pressure	**55**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



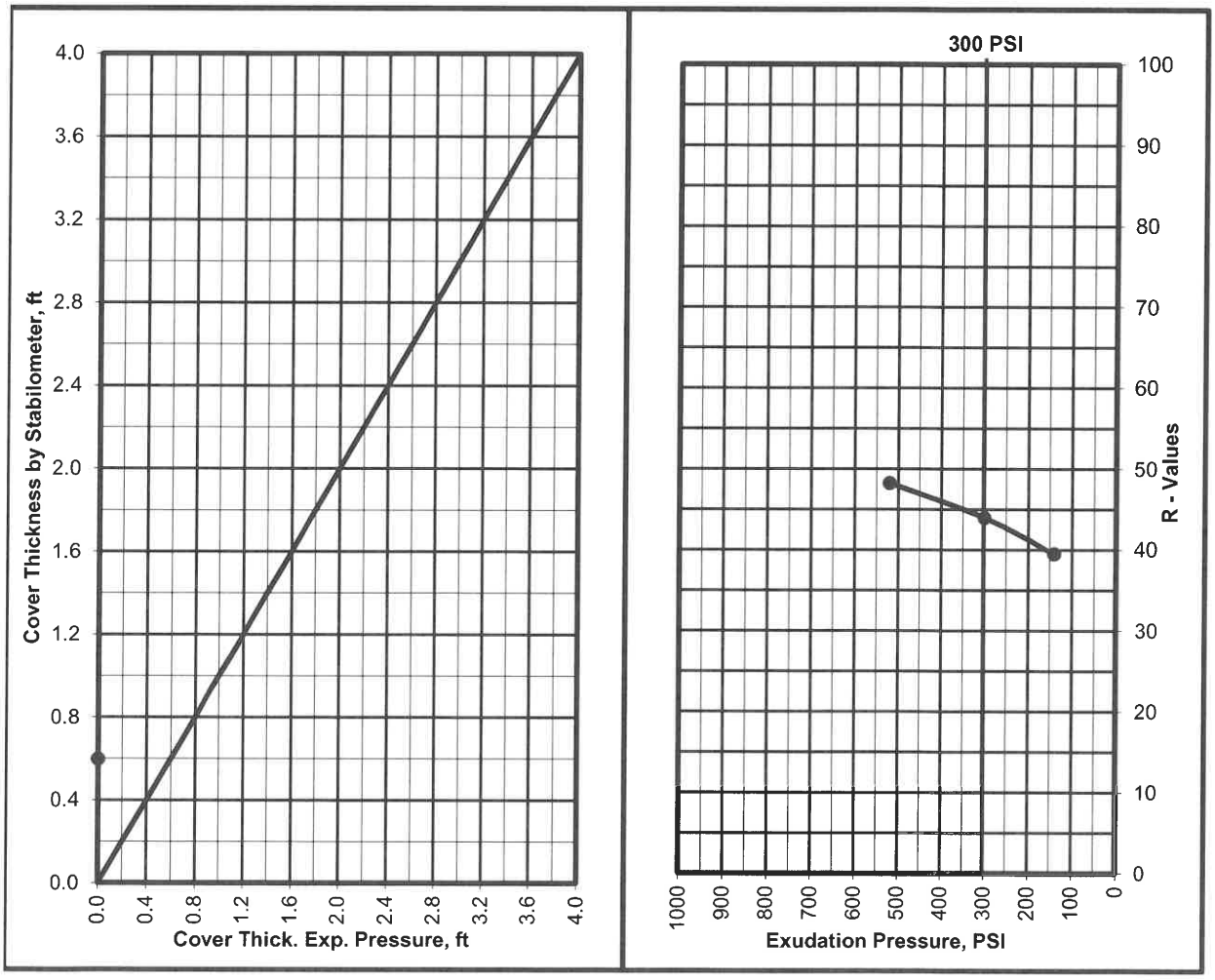
Krazan Testing Laboratory

R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	8/26/2021
Sample Location/Curve Number	:	RV#11
Soil Classification	:	SM-ML

TEST	A	B	C
Percent Moisture @ Compaction, %	12.8	13.3	12.4
Dry Density, lbm/cu.ft.	118.8	117.8	119.2
Exudation Pressure, psi	300	140	520
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	44	40	48

R Value at 300 PSI Exudation Pressure	**44**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



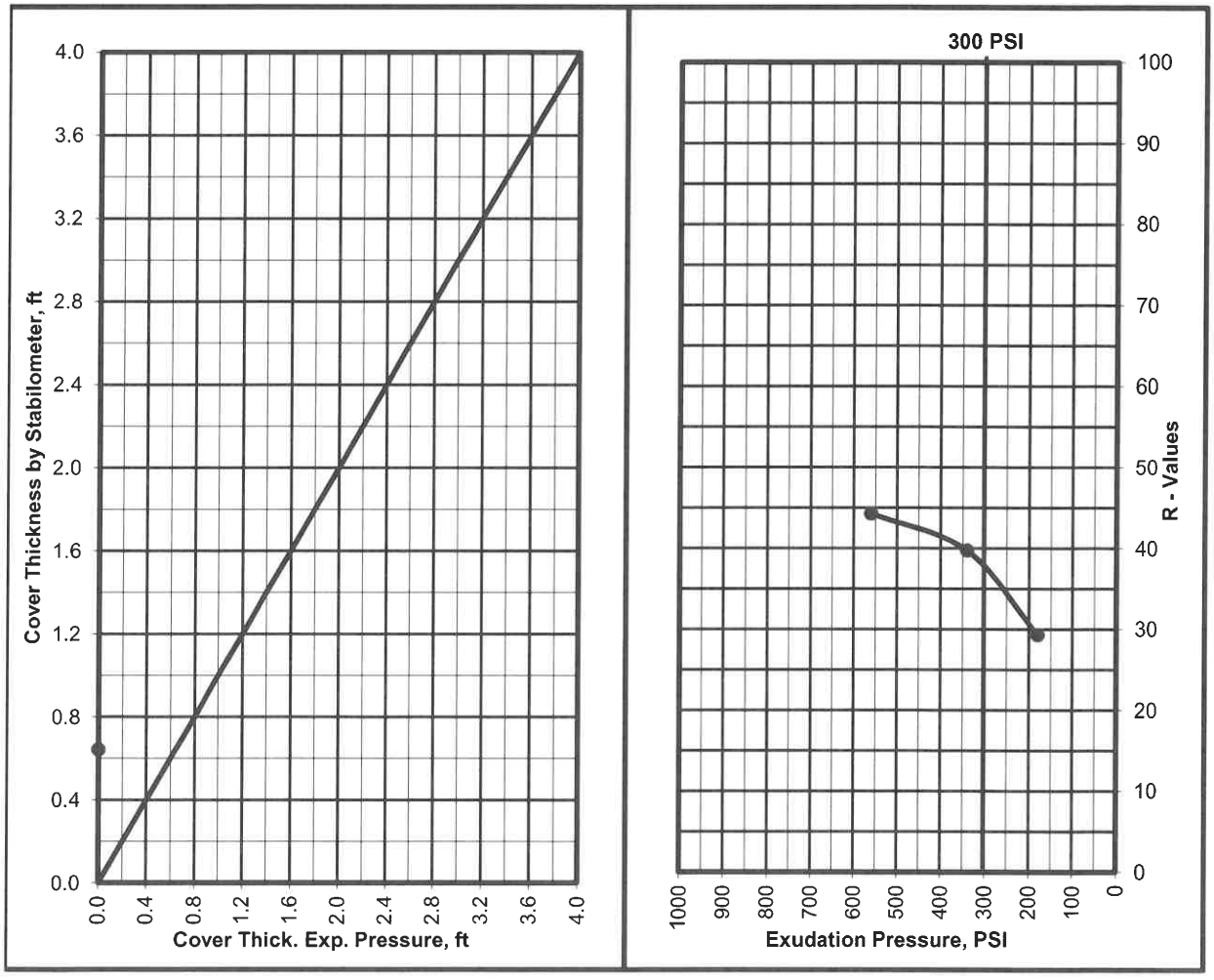
Krazan Testing Laboratory

R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	022-21021
Project Name	:	Commercial / Retail Development
Date	:	8/26/2021
Sample Location/Curve Number	:	RV#12
Soil Classification	:	SM-ML

TEST	A	B	C
Percent Moisture @ Compaction, %	12.4	13.3	11.7
Dry Density, lbm/cu.ft.	118.8	117.8	110.2
Exudation Pressure, psi	340	180	560
Expansion Pressure, (Dial Reading)	0	0	0
Expansion Pressure, psf	0	0	0
Resistance Value R	40	29	44

R Value at 300 PSI Exudation Pressure	**38**
R Value by Expansion Pressure (TI =): 5	**Expansion Pressure nil**



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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 of the Standard Specifications. The drying, proportioning and mixing of the materials shall conform to Section 39.

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

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