APPENDIX D-1

GEOTECHNICAL ENGINEEEERING INVESTIGATION

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED TRAVEL CENTER
SWC CALICO ROAD & TELSTAR COURT
YERMO, CALIFORNIA

PROJECT NO. 112-19064
JUNE 24, 2019

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LAND DEVELOPMENT ENGINEERS

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**GEOTECHNICAL ENGINEERING INVESTIGATION
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INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed fueling station and convenience store to be constructed southwest of the intersection of Calico Road and Telstar Court in the city of Yermo, 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 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. If conflicts in the text of the report occur with the general specifications in the appendices, the recommendations in the text of the report have precedence.

PURPOSE AND SCOPE

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

Our scope of services was outlined in our proposal dated May 16, 2019 (KA Proposal No. G19065CAC) 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 a total of ten (10) borings to depths ranging from approximately ten (10) to thirty (30) feet below site grades for evaluation of the subsurface conditions at the project site.

- Performance of laboratory tests on representative soil samples obtained from the borings to evaluate the physical and index properties of the subsurface soils.
- Performance of infiltration testing at three (3) locations in order to obtain approximate infiltration rates for the near surface soil conditions.
- 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.

Environmental services, such as a chemical analysis of soil and groundwater for possible environmental contaminates, were not in our scope of services.

PROPOSED CONSTRUCTION

We understand that design of the proposed development is currently underway and as such, structural load information and other final details pertaining to the structure are unavailable. On a preliminary basis, it is understood that the proposed development will include construction of a new convenience store with a footprint of approximately 13,000 square feet, an automobile fuel facility, truck fuel facility, and associated site improvements at the subject site. It is anticipated that the proposed building will be a wood, masonry, or steel framed structure supported on a shallow conventional foundation system incorporating slab-on-grade construction. The proposed development is understood to include fuel island canopies, underground storage tanks, trash enclosures, Portland cement and asphalt pavements, a retention pond, and localized landscaped areas.

The anticipated finished grade elevation for the proposed structures is assumed to be relatively close to the existing site grades. As a result, only minor cuts and fills are anticipated at the site. In the event these structural or grading details are inconsistent with the final design criteria, the Soils Engineer should be notified so that we may update this writing as applicable.

SITE LOCATION AND SITE DESCRIPTION

The subject site is a roughly trapezoidal shaped parcel and encompasses approximately 5.7 acres. The subject site is located at the southwest corner of Calico Road and Telstar Court in the city of Yermo, California. The site is bound to the south and west by vacant land, to the east by Calico Road and Residential developments beyond, and to the north by Telstar Court and Eddie World development beyond.

Currently, the site is undeveloped and free of any above grade structures. Ground surface at the site consists of exposed soil and gravel, and localized weed and bush growth. Utilities are understood to run along Calico Road. The site topography is relatively flat and level with no major changes in topography.

GEOLOGIC SETTING

The subject site is located in Victor Valley, which is situated in the southwestern portion of the Mojave Desert Geomorphic Province. The Mojave Desert is bound by the Tehachapi Mountains of the Sierra Nevada Geomorphic Province to the northwest and the San Gabriel and San Bernardino Mountains of the Transverse Range Geomorphic Province to the south and southwest. A major portion of the Mojave Desert is underlain by Mesozoic granitic rocks. Quaternary alluvium covers a majority of the Victor Valley floor.

Groundwater is reported to occur at an elevation of approximately 80 to 100 feet below existing ground surface. No known regional groundwater impairments were reported within the subject site vicinity.

Both the Tehachapi and the San Gabriel mountain ranges are geologically young mountain ranges and possess active and potentially active fault zones. Numerous moderate to large earthquakes have affected the area of the subject site within historic time. Based on the proximity of several dominant active faults and seismogenic structures, as well as the historic seismic record, the area of the subject site is considered subject to relatively high seismicity. The site under consideration is located in a seismically active area of Southern California. The nearest significant active fault is the Calico Fault Zone, which is approximately 2.0 miles away from the project site. The Landers and Gravel Hills-Harper Lake Faults are located approximately 5.2 and 5.3 miles from the site, respectively. The area in consideration shows no mapped faults on-site according to maps prepared by the California Geologic Survey and published by the International Conference of Building Officials (ICBO). No evidence of surface faulting was observed on the property during our reconnaissance. The project site is not located within an Earthquake Fault Zone.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored by drilling a total of ten (10) borings, using a truck-mounted drill rig, to depths ranging from approximately ten (10) to thirty (30) feet below existing site grades. In addition, bulk subgrade soil samples were obtained from the proposed pavement areas for laboratory R-Value testing. The approximate boring locations are shown on the site plan. During drilling operations, penetration tests were performed at regular intervals to evaluate the soil consistency and to obtain information regarding the engineering properties of the subsurface soils. 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, and moisture density relationships of the materials encountered. In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and results of the laboratory tests are summarized in Appendix A. This information, along with the field observations, was used to prepare the final boring logs in Appendix A.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Based on our findings, the subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the subsurface soils consisted of interbeded layers of medium dense to very dense silty sand and poorly-graded sand soils up to the maximum depth explored, 30 feet below site grades.

Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance, measured by the number of blows required to drive a Modified California sampler or Standard Penetration Test (SPT) ranged from 38 blows per foot to over 50 blows per six inches. Dry densities ranged from approximately 102 to 121 pcf. Representative samples of the near surface soils consolidated approximately 0.9 to 2.1 percent under a 2 ksf load when saturated. Representative samples of the near surface soils had angles of internal friction of 27 and 28 degrees with cohesion values of 200 and 100 psf, respectively. A bulk sample was tested in the laboratory and found to have an R-Value of 35.

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

GROUNDWATER

Test boring locations were checked for the presence of groundwater during and immediately following the drilling operations. Free groundwater was not encountered at any of the borings drilled as part of this investigation. In addition, based on previous drilling in the area and groundwater data for the site vicinity, the depth to groundwater is expected be encountered at a depth in excess of fifty (50) feet below existing site grade.

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.

LIQUEFACTION

Seismicity is a general term relating to the abrupt release of accumulated strain energy in the rock materials of the earth's crust in a given geographical area. The recurrence of accumulation and subsequent release of strain have resulted in faults and fault systems. Fault patterns and density reflect relative degrees of regional stress through time, but do not necessarily indicate recent seismic activity; therefore, the degree of seismic risk must be determined or estimated by the seismic record in any given region.

Soil liquefaction is a state of soil particle suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic events. To evaluate the liquefaction potential of the site, the following items were evaluated:

1) Soil type
2) Groundwater depth
3) Relative density
4) Initial confining pressure
5) Intensity and duration of ground shaking

The soil beneath the site consists of medium dense to very dense silty sand and poorly-graded sand. Groundwater depth is not expected to affect the proposed development. Groundwater was not encountered during our field investigation. The potential for liquefaction is considered to be low based on the dense soil and absence of shallow groundwater. The State of California has not prepared a State of California Seismic Hazard Zones Map for the area where the project site is situated. Therefore, the site is not located in an area designated by the State of California as a liquefaction hazard zone.

FAULT RUPTURE HAZARD ZONES

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

The subject site is located on the State of California, Special Studies Zones Map, Yermo Quadrangle, dated March 1, 1988. The area in consideration shows no mapped faults on-site according to maps prepared by the California Geologic Survey and published by the International Conference of Building Officials (ICBO). No evidence of surface faulting was observed on the property during our reconnaissance. The project site is not located within an Earthquake Fault Zone.

SEISMIC HAZARD ZONES

In 1990, the California State Legislature passed the Seismic Hazard Mapping Act to protect public safety from the effects of strong shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes. The Act requires that the State Geologist delineate various seismic hazard zones on Seismic Hazard Zones Maps. Specifically, the maps identify areas where soil liquefaction and earthquake-induced landslides are most likely to occur. A site-specific geotechnical evaluation is required prior to permitting most urban developments within the mapped zones. The State of California has not prepared a State of California Seismic Hazard Zones Map for the area where the project site is situated. Thus, the subject site is not located in an area designated as a liquefaction hazard zone.

OTHER HAZARDS

Rockfall, Landslide, Slope Instability, and Debris Flow: The subject site is relatively flat and level. It is our understanding that there are no significant slopes proposed as part of the proposed development. Provided the recommendations presented in this report are implemented into the design and construction of the anticipated development, rockfalls, landslides, slope instability, and debris flows are not anticipated to pose a hazard to the subject site.

Seiches: Seiches are large waves generated within enclosed bodies of water. The site is not located in close proximity to any lakes or reservoirs. As such, seiches are not anticipated to pose a hazard to the subject site.

Tsunamis: Tsunamis are tidal waves generated by fault displacement or major ground movement. The site is several miles from the ocean. As such, tsunamis are not anticipated to pose a hazard to the subject site.

Hydroconsolidation: The near surface soils encountered at the subject site were found to be dense to very dense. The underlying native soils were found to be dense to very dense. Provided the recommendations in this report are incorporated into the design and construction of the proposed development, hydroconsolidation is not anticipated to be a significant concern for the subject site.

SOIL CORROSIVITY

Corrosion tests were performed to evaluate the soil corrosivity to the buried structures. The results of the tests are included as follows:

Parameter	Results	Test Method
Resistivity	1,250 ohm-cm	CA 643
Sulfate	366 ppm	CA 417
Chloride	111 ppm	CA 422
pH	7.2	EPA 9045C

INFILTRATION TESTING

The shallow soil conditions present at the subject site were evaluated by drilling three (3) shallow borings at the subject site to facilitate infiltration testing. The borings drilled at the site indicated the subsurface soil conditions consisted of medium dense to dense silty sand. Infiltration testing was performed at each of the boring locations. Infiltration testing has been performed using the results of open borehole percolation testing. Infiltration rates have been calculated using the Inverse Borehole procedures.

Prior to infiltration testing, approximately four inches of gravel was placed at the bottom of each of the borehole. The borehole was pre-soaked prior to testing using clean water. The depth of the borehole was measured at each reading to verify the overall depth. The depth of water in the borehole was measured using a water level indicator or well sounder.

Infiltration rates were determined using the results of open borehole infiltration testing performed at the subject site. Infiltration testing performed on the near surface silty sand soil indicate infiltration rates of approximately 1.33, 1.63, and 1.94 inches per hour. Detailed results of the percolation tests and resulting infiltration rates are attached in tabular format. The soil infiltration rates are based on tests conducted with clean water. The infiltration rates may vary with time as a result of soil clogging from water impurities.

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

Base on the data collected during this investigation, and from a geologic and geotechnical engineering standpoint, it is our opinion that the proposed improvements may be made as anticipated provided that the recommendations presented in this report are considered in the design and construction of the project.

General site clearing should include removal of any stockpiled soil, vegetation, rubbish, and any loose and/or saturated materials. To reduce post-construction soil movement and provide uniform support for the proposed building, overexcavation and recompaction within the proposed building footprint area should be performed to a minimum depth of at least four (4) feet below existing grade or two (2) feet below foundation bearing grade, whichever is deeper. The actual depth of the overexcavation and recompaction should be determined by the Geotechnical Engineering representative during construction. The overexcavation and recompaction should also extend laterally five (5) feet beyond edges of the proposed footings. Any undocumented fill encountered during grading should be removed and replaced with Engineered Fill.

Within the proposed exterior flatwork and pavement areas, it is recommended that the upper 12 inches be excavated and recompacted to a minimum of 95 percent of the maximum dry density based on ASTM D1557 Test Method. Limits of recompaction should extend a minimum of three (3) feet beyond the edge of pavements or back of curbs. This compaction effort should stabilize the surface 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 may be designed utilizing an allowable bearing pressure of

2,600 psf for dead-plus-live loads. Footings should have a minimum embedment of 18 inches. Footings supported on dense soil should have a minimum depth of 36 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.

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.

Soil Liquefaction

The soils encountered at the project site predominately consisted of dense to very dense silty sand. Groundwater was not encountered in any of the borings drilled as part of this investigation. Information obtained from previous investigations performed in the vicinity of the project site indicates that groundwater is present at a depth greater than 50 feet below site grade. Based on our findings, it is our opinion that the potential for seismic-induced soil liquefaction within the project site vicinity is very low, and measures to mitigate liquefaction potential are not warranted.

Seismic Settlement

One of the most common phenomena during seismic shaking accompanying any earthquake is the induced settlement of loose unconsolidated soils. Based on site subsurface conditions, and the moderate to high seismicity of the region, any loose fill materials at the site could be vulnerable to this potential hazard. However, this hazard can be mitigated by following the design and construction recommendations of our Geotechnical Engineering Investigation (over-excavation and rework of the loose soils and/or fill). Based on the moderate penetration resistance measured, the native deposits underlying the surface materials do not appear to be subject to significant seismic settlement.

Site Preparation

General site clearing should include removal of any stockpiled soil, vegetation, rubbish, and any loose and/or saturated materials. To reduce post-construction soil movement and provide uniform support for the proposed building, overexcavation and recompaction within the proposed building footprint area should be performed to a minimum depth of at least four (4) feet below existing grade or two (2) feet below foundation bearing grade, whichever is deeper. The actual depth of the overexcavation and recompaction should be determined by the Geotechnical Engineering representative during construction. The overexcavation and recompaction should also extend laterally five (5) feet beyond edges of the proposed footings. Any undocumented fill encountered during grading should be removed and replaced with Engineered Fill.

Within the proposed exterior flatwork and pavement areas, it is recommended that the upper 12 inches be excavated and recompacted to a minimum of 95 percent of the maximum dry density based on ASTM D1557 Test Method. Limits of recompaction should extend a minimum of three (3) feet beyond the edge of pavements or back of curbs. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation.

The shrinkage on recompacted soil and fill placement is estimated at 10 to 15 percent. Subsidence within building areas, below the recompaction bottom, is anticipated to be less than 0.01 feet, due to the recommended overexcavation. Subsidence within parking areas, below the 12-inch recompaction depth, is estimated at 0.1 feet.

The upper soils, during wet winter months, may 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.

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. Any buried structures encountered during construction should be properly removed and backfilled. In general, any septic tanks, debris pits, cesspools, or similar structures should be entirely removed. Concrete footings should be removed to an equivalent depth of at least three (3) feet below proposed footing elevations or as recommended by the Soils Engineer. Any other buried structures should be removed in accordance with the recommendations of the Soils Engineer. The resulting excavations should be backfilled with Engineered Fill.

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

Collapsible Soils

The near surface soils encountered at the subject site are moisture-sensitive and are moderately compressible under saturated conditions. Structures within the project vicinity have experienced excessive post-construction settlement, when the foundation soils become near saturated. As recommended in the site preparation section of this report, the collapsible soils should be removed and recompacted to a minimum of 95 percent of the maximum dry density based on ASTM D1557 Test Method.

Engineered Fill

The organic-free, on-site, native soils are predominately silty sands and poorly-graded sands. These soils will be suitable for reuse as Non-Expansive Engineered Fill, provided they are cleansed of excessive organics and debris.

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 predominately non-expansive granular material with a plasticity index less than 10 and a UBC Expansion Index less than 15. Imported Fill should be free from rocks and clods greater than 4 inches in diameter. All Imported Fill material should be submitted to the Soils Engineer for approval at least 48 hours prior to delivery at the site.

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned as necessary, and compacted to achieve at least 95 percent of the maximum dry density as determined by ASTM D1557 Test Method. 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 2016 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.

Grade the site to prevent water/run-off flow over the face of cut and fill slopes. To accomplish this, use asphalt berms, brow ditches, or other measures to intercept and slowly redirect flow. Plant all disturbed areas with erosion-resistant vegetation suited to the area. As an alternative, jute netting or geotextile erosion control mats may be considered for control of erosion. Slopes should be inspected periodically for erosion and repaired immediately if detected. To control surface drainage and debris, paved drainage areas should be provided on all cut and fill slopes that are 30 feet of greater in height. The drainage terraces should be a minimum of 6 feet in width and placed at intervals no greater than 20 feet. Where only one drainage terrace is necessary, it should be located at mid-height of the slope. Brow ditches and drainage terraces should be cleaned before the start of each rainy season, and if necessary, after each rainstorm.

Utility Trench Backfill

Utility trenches should be excavated according to accepted engineering practice following Occupational Safety and Health Administration (OSHA) standards by a contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the contractor. Traffic and vibration adjacent to trench walls should be minimized; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced; especially during or 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 95 percent of maximum dry density based on ASTM D1557 Test Method. The upper 12 inches of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of maximum dry density based on ASTM D1557 Test Method. Pipe bedding should be in accordance with pipe manufacturer 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

The proposed structures may be supported on a shallow foundation system bearing on at least two (2) feet of newly placed Engineered Fill. Spread and continuous footings can be designed for the following maximum allowable soil bearing pressures:

Load	Allowable Loading
Dead Load Only	2,000 psf
Dead-Plus-Live Load	2,600 psf
Total Load, Including Wind or Seismic Loads	3,500 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 15 inches, regardless of load. The actual footing design should be performed by the project structural engineer.

The total settlement is not expected to exceed 1 inch. Differential settlement should be less than ½ inch over a distance of 30 feet. 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.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.25 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 200 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 one-third increase in the value above may be used for short duration, wind, or seismic loads.

Floor Slabs and Exterior Flatwork

Concrete slab-on-grade should be appropriate for this project. Slabs should be a minimum of five (5) inches thick. In areas where it is desired to reduce floor dampness, such as office areas, slab-on-grade construction should have a water vapor retarder incorporated into the floor slab design.

Concrete slab-on-grade floors should be underlain by a water vapor retarder. The water vapor retarder should be installed in accordance with ASTM Specification E1643-94. According to ASTM Guidelines, the water vapor retarder should consist of a minimum 10 mil. vapor retarder sheeting underlain by a minimum of 4 inches of compacted, clean, open-graded coarse rock of ¾-inch maximum size. If elected, a 2-inch thick layer of damp clean sand (Unified Soil Classification: SW or SP) may be placed above the water vapor retarder to protect it from drainage.

The exterior floors should be poured separately in order to act independently of the walls and foundation system. Exterior finish grades should be sloped a minimum of 1 to 1½ percent away from all interior slab areas to preclude ponding of water adjacent to the structures. All fills required to bring the building pads to grade should be Engineered Fills.

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 45 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 65 pounds per square foot per foot of depth. Expansive soils should not be used for backfill against walls. The wedge of non-expansive backfill material should extend from the bottom of each retaining wall outward and upward at a slope of 2:1 (horizontal to vertical) or flatter. The stated lateral earth pressures do not include the effects of hydrostatic water pressures generated by infiltrating surface water that may accumulate behind the retaining walls; or loads imposed by construction equipment, foundations, or roadways.

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.

Any surcharge effect from loads adjacent to the walls should be included in the wall design. For surcharge load for walls capable of deflecting (cantilever walls), we recommend applying a uniform surcharge pressure equal to one-third of the applied load over the full height of the wall. Where walls are restrained the surcharge load should be based on one-half of the applied load above the wall, also distributed over the full height of the wall. For other surcharges, such as from adjacent foundations, point loads or line loads, Krazan & Associates should be consulted.

Expansive soils should not be used for backfill against walls. The zone of non-expansive backfill material should extend from the bottom of each retaining wall laterally back a distance equal to the height of the wall, to a maximum of five (5) feet.

The active and at-rest earth pressures do not include hydrostatic pressures. To reduce the build-up of hydrostatic pressures, drainage should be provided behind the retaining walls. Wall drains should consist of a minimum 12-inch wide zone of drainage material, such as ¾-inch by ½-inch drain rock wrapped in a non-woven polypropylene geotextile filter fabric such as Mirafi 140N or equivalent. Alternatively, drainage may be provided by the placement of a commercially produced composite drainage blanket, such as Miradrain, extending continuously up from the base of the wall. The drainage material should extend from the base of the wall to finished subgrade in paved areas and to within about 12 inches below the top of the wall in landscape areas. In landscape areas the top 12 inches should be backfilled with compacted native soil. A 4-inch minimum diameter, perforated, Schedule 40 PVC drain pipe should be placed with holes facing down in the lower portion of the wall drainage material, surrounded with drain rock wrapped in filter fabric. A solid drainpipe leading to a suitable discharge point should provide drainage outlet. As an alternative, weep holes may be used to provide drainage. If weep holes are used, the weep holes should be 3 inches in diameter and spaced about 8 feet on centers. The backside of the weep holes should be covered with a corrosion-resistant mesh to prevent loss of backfill and/or drainage material.

PAVEMENT DESIGN

Based on the established standard practice of designing flexible pavements in accordance with State of California Department of Transportation (Caltrans) for projects within California, we have developed pavement sections in accordance with the procedure presented in Caltrans Standard Test Method 301. This pavement design procedure is based on the volume of traffic (Traffic Index) and the soil resistance "R" Value (R-Value). Pavement design was performed using Caltrans design software CalFP V1.1. The AASHTO procedure was used to evaluate rigid pavement section requirements.

Asphalt Concrete (Flexible) Pavements

A sample of near-surface sand soil was tested in our laboratory following test procedures of State of California Materials Manual Test Designation 301 and found to have an R-Value of 35. This test result is relatively strong and indicates good subgrade support characteristics under dynamic traffic loads. If site grading exposes soil other than that assumed, we should perform additional tests to confirm or revise the recommended pavement sections for actual field conditions. Various alternative pavement sections based on the Caltrans Flexible Pavement Design Method are presented below:

ASPHALT CONCRETE (FLEXIBLE) PAVEMENTS (R-Value = 35)			
Traffic Index (inches)	**Asphalt Concrete (inches)**	**Class 2 Aggregate Base (inches)**	**Compacted Subgrade (inches)**
4.0	3.0	4.0	12.0
5.0	3.0	5.0	12.0
6.0	3.0	7.0	12.0
7.0	4.0	8.0	12.0

We recommend that the subgrade soil be prepared as discussed in this report. The compacted subgrade should be non-yielding when proof-rolled with a loaded ten-wheel truck, such as a water truck or dump truck, prior to pavement construction. Subgrade preparation should extend a minimum of three (3) feet laterally beyond the edge of pavement or back of curbs.

Pavement areas should be sloped and drainage gradients maintained to carry all surface water off the site. A cross slope of two (2) percent is recommended in asphalt concrete pavement areas to provide good surface drainage and to reduce the potential for water to penetrate into the pavement structure.

Unless otherwise required by local jurisdictions, paving materials should comply with the materials specifications presented in the Caltrans Standard Specifications Section. Class 2 Aggregate should comply with the materials requirements for Class 2 Aggregate Base found in Section 26. It is anticipated that the recommended paving materials are readily available in the project area.

The mineral aggregate shall be Type B, ½-inch or ¾-inch maximum, medium grading, for the wearing course and ¾-inch maximum, medium grading for the base course, and shall conform to the requirements set forth in Section 39 of the Standard Specifications. The asphalt concrete materials should comply with and be placed in accordance with the specifications presented in Section 39 of the Caltrans Standard Specifications, latest edition. Asphalt concrete should be compacted to a minimum of 95 percent of the maximum laboratory compacted (kneading compactor) unit weight.

ASTM Test procedures should be used to assess the percent relative compaction of soils, aggregate base and asphalt concrete. Aggregate base and subbase, and the upper twenty-four (24) inches of subgrade should be compacted to at least 95 percent based on the Modified Proctor maximum compacted unit weight obtained in accordance with ASTM test method D1557. Compacted aggregate base should also be stable and unyielding when proof-rolled with a loaded ten-wheel water truck or dump truck.

Portland Cement Concrete (Rigid) Pavement

A minimum six-inch (6") layer of compacted Class 2 Aggregate Base should be placed over the prepared subgrade prior to placement of the concrete. With the addition of the aggregate base material, we recommend that a combined modulus of subgrade/base reaction value of 100 pounds per cubic inch be used in design where the rigid pavement is to be designed by a Structural Engineer.

Rigid pavement design procedures have been developed by various agencies, including AASHTO and the Portland Cement Association (PCA). We have evaluated the required pavement sections based on the procedure presented in "AASHTO Guide for Design of Pavement Structures 1993" traffic volumes.

RIGID PAVEMENT			
Traffic/Pavement Designation	**Portland Cement Concrete (inches)**	**Class 2 Aggregate Base (inches)**	**Compacted Subgrade (inches)**
Standard Duty	5.0	6.0	12.0
Heavy Duty	6.0	6.0	12.0

Portland cement concrete should have a minimum compressive strength of 4,000 psi. Prior to the construction of any rigid pavement, we recommend that concrete mix histories with flexural strength data be obtained from the proposed supplier. In the absence of flexural strength history, we recommend that laboratory trial batching and testing be performed to allow for confirmation that the proposed concrete mix is capable of producing the required flexural strength.

The concrete pavements should be designed with both longitudinal and transverse joints. The saw-cut or formed joints should extend to a minimum depth on one-fourth of the pavement thickness plus ¼ inch. Joint spacing should not exceed fifteen (15) feet. Steel reinforcement of all rigid pavements is recommended to keep the joints tight and to control temperature cracking.

Keyed joints are recommended at all construction joints to transfer loads across the joints. Joints should be reinforced with a minimum of ½ inch diameter by 48-inch long deformed reinforcing steel placed at mid-slab depth on 18-inch center-to-center spacing to keep the joints tight for load transfer. The joints should be filled with a flexible sealer. Expansion joints should be constructed only where the pavements abut structures or fixed objects.

Smooth bar dowels, with a diameter of d/8, where d equals the thickness of the concrete, at least 14 inches in length, placed at a spacing of twelve (12) inches on centers, may also be considered for construction joints to transfer loads across the joints. The dowels should be centered across the joints with one side of the dowel lubricated to reduce the bond strength between the dowel and the concrete and fitted with a plastic cap to allow for bar expansion.

Site Coefficient

The site class, per Table 1613.5.2, 2016 CBC, is based upon the site soil conditions. It is our opinion that a Site Class D is appropriate for building design at this site. For seismic design of the structures, in accordance with the seismic provisions of the 2016 CBC, we recommend the following parameters:

2016 CALIFORNIA BUILDING CODE		
Seismic Item	**Value**	**CBC Reference**
Site Class	D	Table 1613.5.2
Fa	1.000	Table 1613.5.3 (1)
Ss	1.405	Figure 1613.5 (3)
SMS	1.405	Section 1613.5.3
SDS	0.936	Section 1613.5.4
Fv	1.500	Table 1613.5.3 (2)
S1	0.533	Figure 1613.5 (4)
SM1	0.799	Section 1613.5.3
SD1	0.533	Section 1613.5.4

INFILTRATION TESTING

The shallow soil conditions present at the subject site were evaluated by drilling shallow borings in the vicinity of the anticipated infiltration areas. The borings drilled at the site indicated the subsurface soil conditions consisted of medium dense to dense silty sand.

Infiltration rates were determined using the results of open borehole infiltration testing performed at the subject site. Infiltration testing performed on the near surface silty sand soil indicate infiltration rates of approximately 1.33, 1.63, and 1.94 inches per hour. Detailed results of the percolation tests and infiltration rates are attached in tabular format. The soil percolation rates are based on tests conducted with clean water. The infiltration rates may vary with time as a result of soil clogging from water impurities. A factor of safety should be incorporated into the design of the percolation system to compensate for these factors as determined appropriate by the designer. In addition, periodic maintenance consisting of clearing the bottom of the system of clogged soils should be expected.

It is recommended that the location of the infiltration systems not be closer than ten feet (10') as measured laterally from the edge of the adjacent property line, ten feet (10') from the outside edge of any foundation and five (5') from the edge of any right-of way to the outside edges of the infiltration system.

If the infiltration location is within ten feet (10') from the proposed foundation, it is recommended that this infiltration system should be impervious from the finished ground surface to a depth that will achieve a diagonal distance of a minimum of ten feet (10') below the bottom of the closest footing in the project.

Soil Cement Reactivity

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

Soil samples were obtained from the site and tested in accordance with State of California Materials Manual Test Designation 417. The sulfate concentration detected from the soil sample indicated a moderate sulfate exposure value as established by HUD/FHA and CBC. Therefore, it is recommended that concrete in contact with soil utilize Type II cement and have a minimum compressive strength of 4,000 psi.

Electrical resistivity testing of the soils indicates that the onsite soils may have a severe potential for metal loss from electrochemical corrosion process. A qualified corrosion engineer may be consulted regarding mitigation of the corrosion effects of the onsite soils on underground metal utilities.

Compacted Material Acceptance

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

Testing and Inspection

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

LIMITATIONS

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

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

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

This report is a Geotechnical Engineering Investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring log regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potentially 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 (951) 273-1011.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

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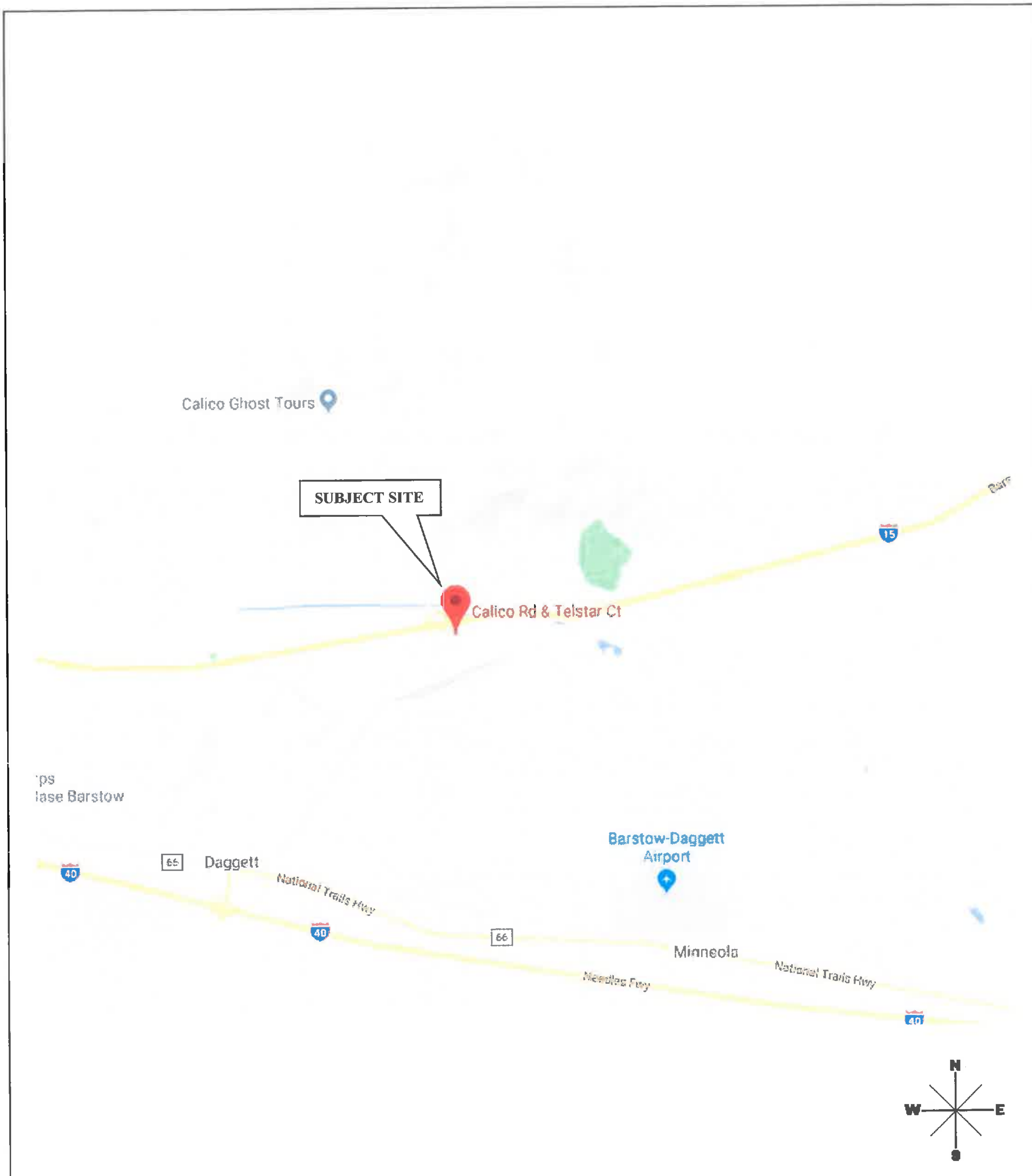
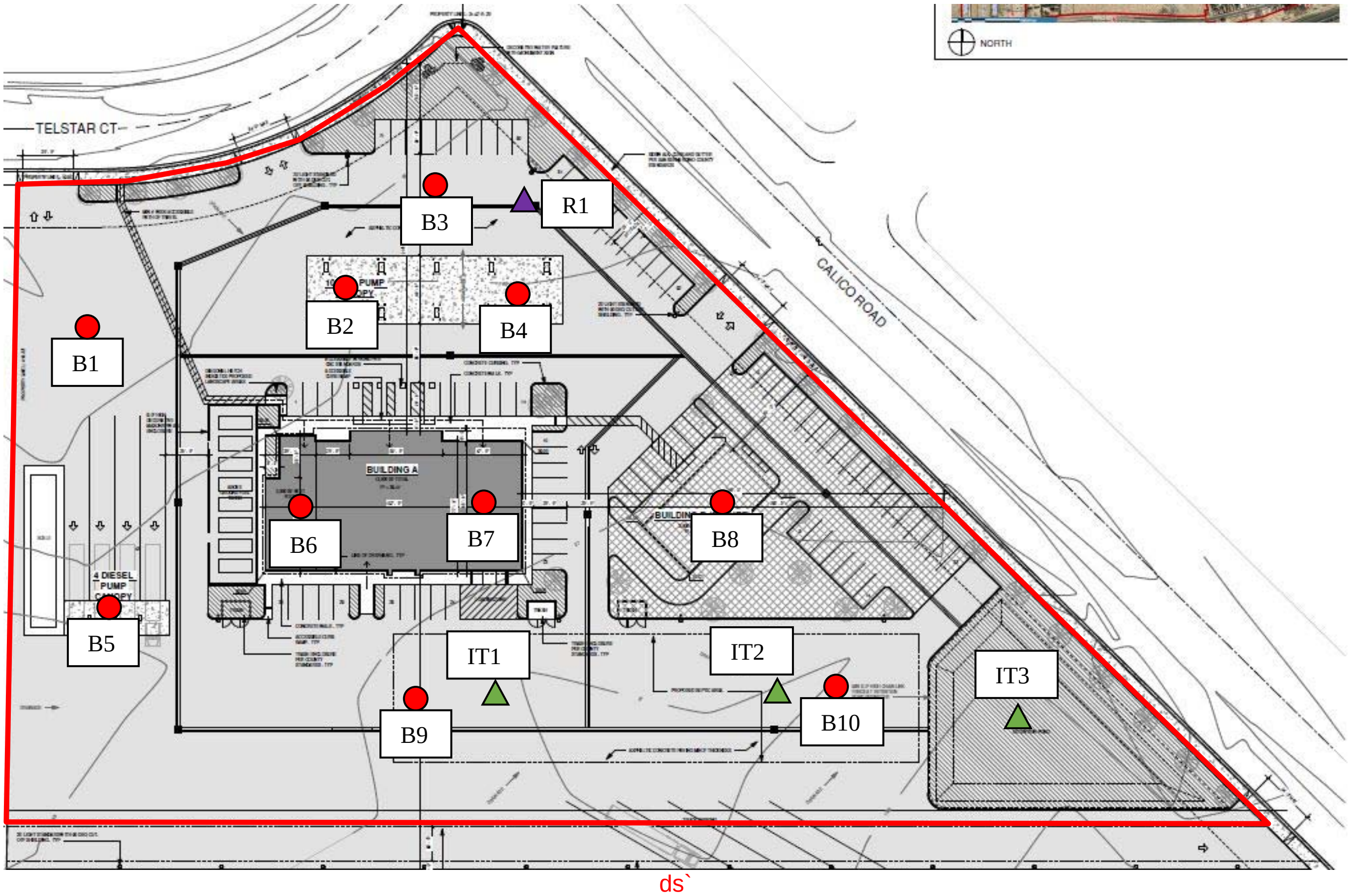
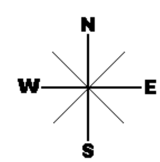
Staff Engineer

Figures



VICINITY MAP	Scale: NTS	Date: June, 2019	Krazan GEOTECHNICAL ENGINEERING
PROPOSED TRAVEL CENTER SWC CALICO ROAD & TELSTAR COURT YERMO, CALIFORNIA	Drawn by: JP	Approved by: JK	
	Project No. 112-19064	Figure No. 1	



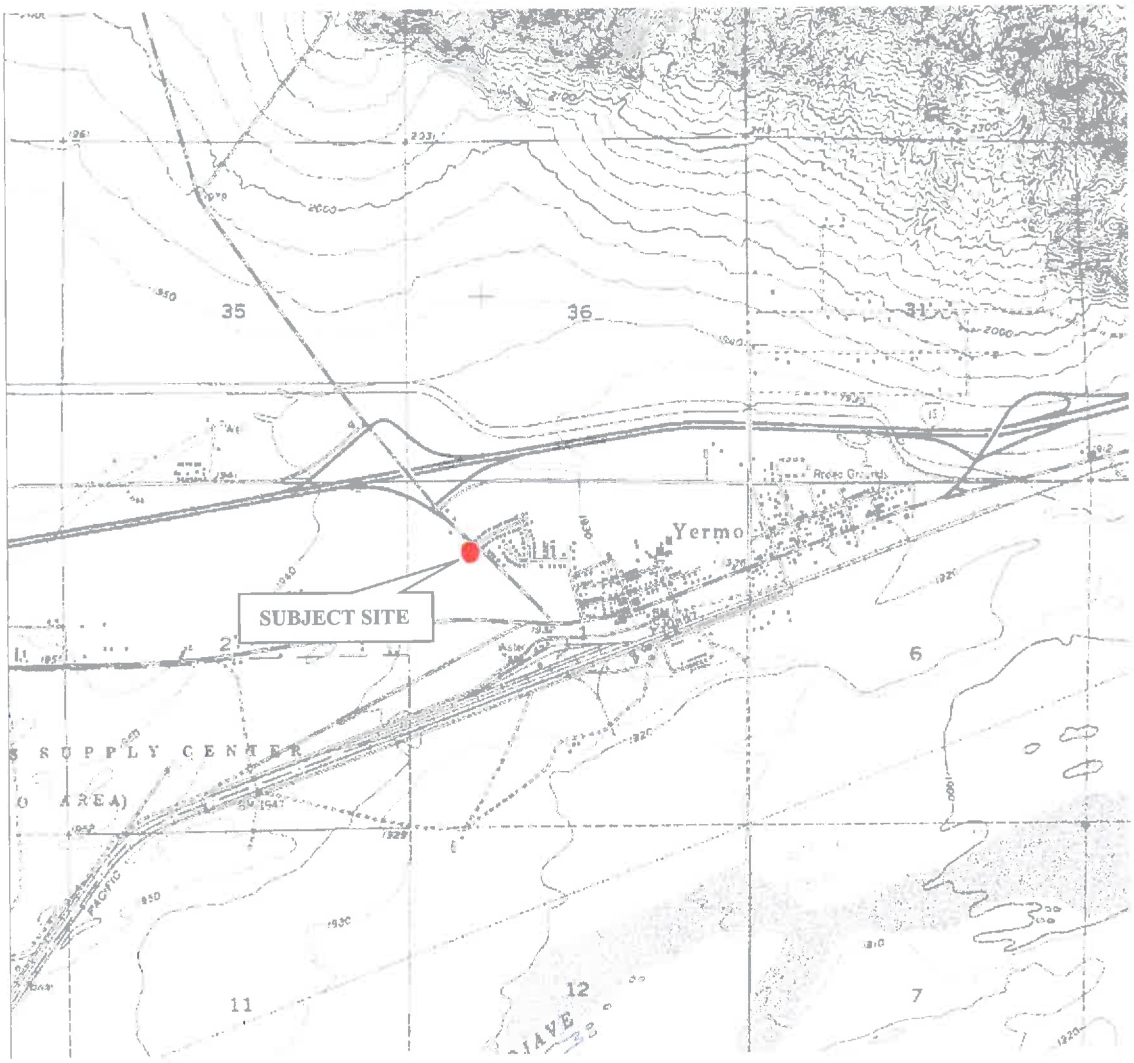


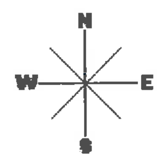
APPROXIMATE R-VALUE LOCATION

APPROXIMATE BORING LOCATION

APPROXIMATE INFILTRATION TESTING LOCATION

SITE MAP	**Scale:** NTS	**Date:** June, 2019	Krazan GEOTECHNICAL ENGINEERING
PROPOSED TRAVEL CENTER SWC CALICO ROAD & TELSTAR COURT YERMO, CALIFORNIA	**Drawn by:** JP	**Approved by:** JK	
	Project No. 112-19064	**Figure No.** 2	





MAP EXPLANATION

Potentially Active Faults

1906 C — Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture, solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

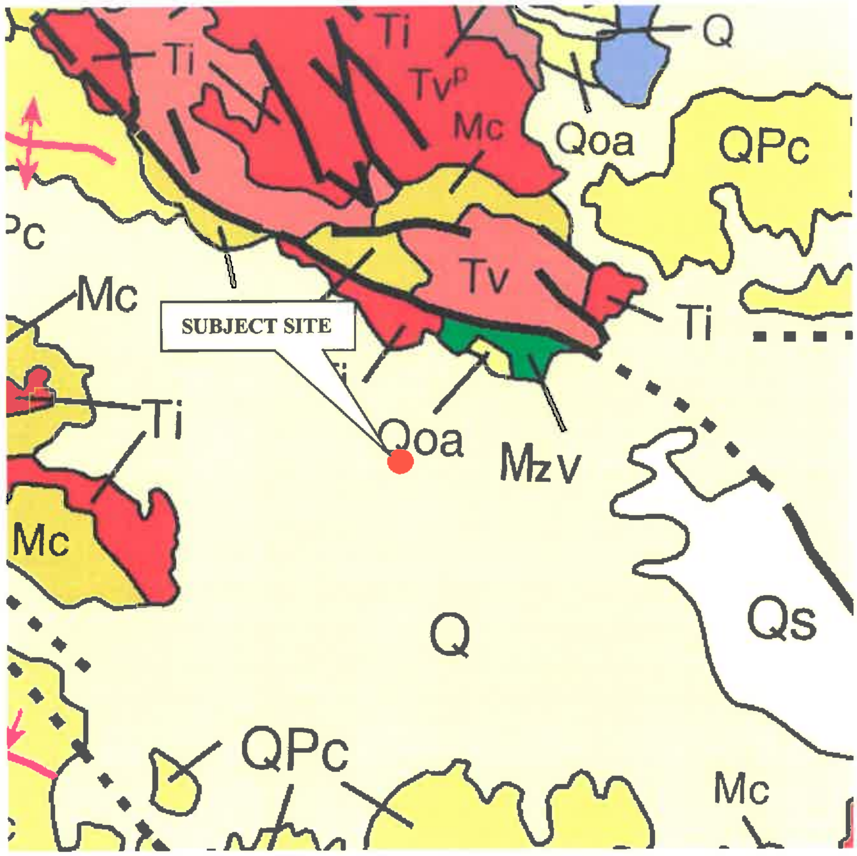
Special Studies Zone Boundaries

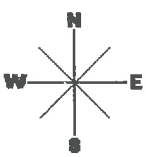
These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary

Source: State of California Special Studies Zones Map, Yermo Quadrangle

SPECIAL STUDIES ZONES MAP	**Scale:** NTS	**Date:** June, 2019	**Krazan** GEOTECHNICAL ENGINEERING
PROPOSED TRAVEL CENTER SWC CALICO ROAD & TELSTAR COURT YERMO, CALIFORNIA	**Drawn by:** JP	**Approved by:** JK	
	Project No. 112-19064	**Figure No.** 3	





DESCRIPTION OF MAP UNITS

QUATERNARY DEPOSITS

- Qs — Extensive marine and nonmarine sand deposits, generally near the coast or desert playas
- Q — Alluvium, lake, playa, and terrace deposits; unconsolidated and semi-consolidated
- Qls — Selected large landslides
- Qg — Glacial till and moraines. Found at high elevations mostly in the Sierra Nevada and Klamath Mountains
- Qoa — Older alluvium, lake, playa, and terrace deposits
- QPc — Pleistocene and/or Pliocene sandstone, shale, and gravels deposits; mostly loosely consolidated

QUATERNARY VOLCANIC ROCKS

- Qrv — Recent (Holocene) volcanic flow rocks; minor pyroclastic deposits
- Qrv^p — Recent (Holocene) pyroclastic and volcanic mudflow deposits
- Qv — Quaternary volcanic flow rocks; minor pyroclastic deposits
- Qv^p — Quaternary pyroclastic and volcanic mudflow deposits

PALEOZOIC MIXED ROCKS

- m — Undivided pre-Cenozoic metasedimentary and metavolcanic rocks of great variety. Mostly slate, quartzite, hornfels, chert, phyllite, mylonite, schist, gneiss, and minor marble

PALEOZOIC METAVOLCANIC ROCKS

- Pzv — Undivided Paleozoic metavolcanic rocks. Mostly flows, breccia, and tuff; includes greenstone, diabase, and pillow lavas; minor interbedded sedimentary rocks

PALEOZOIC PLUTONIC ROCKS

- gr^{Pz} — Paleozoic and Permo-Triassic granitic rocks in the San Gabriel and Klamath Mountains

PRECAMBRIAN ROCKS

- p€ — Conglomerate, shale, sandstone, limestone, dolomite, marble, gneiss, hornfels, and quartzite; may be Paleozoic in part
- p€c — Complex of Pre-cambrian igneous and metamorphic rocks. Mostly gneiss and schist intruded by igneous rocks; may be Mesozoic in part
- gr$^{p€}$ — Precambrian granite, syenite, anorthosite, and gabbroic rocks in the San Gabriel Mountains; also various Precambrian plutonic rocks elsewhere in southeastern California

Source: Department of Conservation: Geologic Map of California (Accessed 05/22/19)

GEOLOGIC MAP	**Scale:** NTS	**Date:** June, 2019	Krazan GEOTECHNICAL ENGINEERING
PROPOSED TRAVEL CENTER SWC CALICO ROAD & TELSTAR COURT YERMO, CALIFORNIA	**Drawn by:** JP	**Approved by:** JK	
	Project No. 112-19064	**Figure No.** 4	

Log of Borings
&
Laboratory Testing

Appendix A

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Ten (10) exploratory borings were advanced. The boring locations are shown on the attached 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.

Penetration and/or Resistance tests were performed at selected depths. These tests represent the resistance to driving a 2-and/or 3-inch outside diameter core barrel, respectively, 18 inches into the soil. The N-Value obtained from the Standard Penetration Test (SPT) and/or driving the Modified California Sampler (MCS) was recorded based on the number of blows required to penetrate the last 12 inches. The driving energy was provided by a hammer weighing 140 pounds, falling 30 inches. Relatively undisturbed soil samples were obtained while performing this test. Bag samples of the disturbed soil were obtained from the auger cuttings. All samples were returned to our Corona laboratory for evaluation.

Laboratory Investigation

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

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

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

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	**Clean Gravels (Less than 5% fines)**	
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	**Clean Sands (Less than 5% fines)**	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

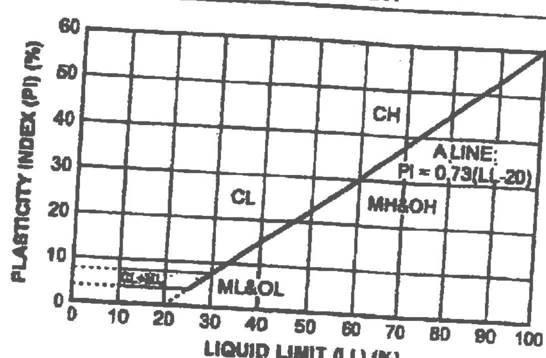
CONSISTENCY CLASSIFICATION

Description	Blows per Foot
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

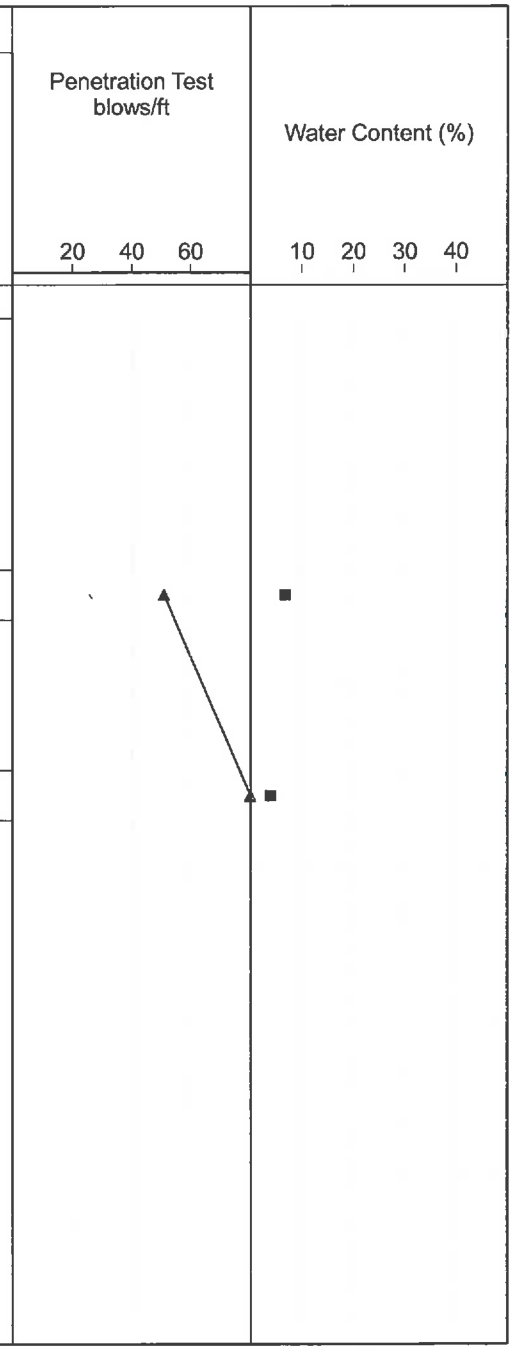
Project: Travel Center/Convenience Store
Project No: 112-19064

Client: Gurjeet Sodhi
Figure No.: A-1

Location: SWC Telstar Court and Calico Road, Yermo, California
Logged By: Jorge Pelayo

Depth to Water> Not Encountered **Initial:** N/A **At Completion:** N/A

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SILTY SAND (SM)*** Dense to very dense, medium- to fine-grained; light brown, moist				
5			116.5	4.3		47
9.5			117.9	8.6		50+
10		End of Borehole				
17		Water not encountered Boring backfilled with soil cuttings				
20						



Drill Method: Hollow Stem
Drill Date: 6-12-19

Drill Rig: CME 75
Krazan and Associates
Hole Size: 5½ Inches

Driller: Baja Exploration
Elevation: 10 Feet

Sheet: 1 of 1

Log of Boring B2

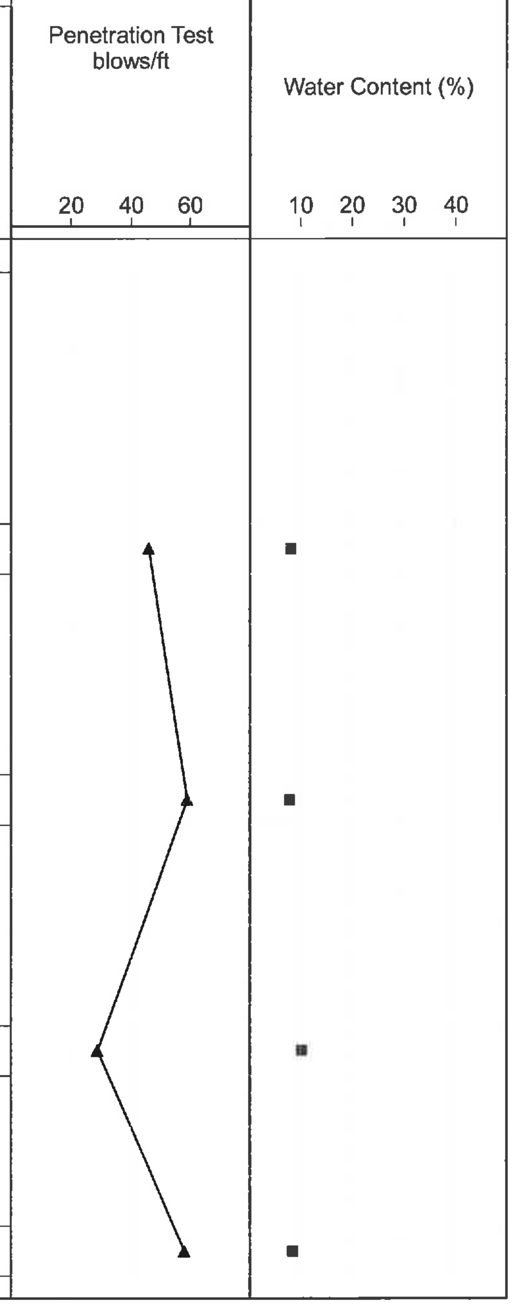
Project: Travel Center/Convenience Store
Project No: 112-19064

Client: Gurjeet Sodhi
Figure No.: A-2

Location: SWC Telstar Court and Calico Road, Yermo, California
Logged By: Jorge Pelayo

Depth to Water> Not Encountered **Initial:** N/A **At Completion:** N/A

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–17		***SILTY SAND (SM)*** Dense, medium- to fine-grained; light brown to tan, damp to moist				
5–6			112.7	8.1		46
10–11			121.5	7.9		59
15–16				10.3		29
17–20		***POORLY GRADED SAND (SP)*** Very dense, coarse- to fine-grained; light brown, moist				
19–20		Water not encountered Boring backfilled with soil cuttings		8.5		58



Drill Method: Hollow Stem
Drill Date: 6-12-19

Drill Rig: CME 75
Krazan and Associates
Hole Size: 5½ Inches

Driller: Baja Exploration
Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B3

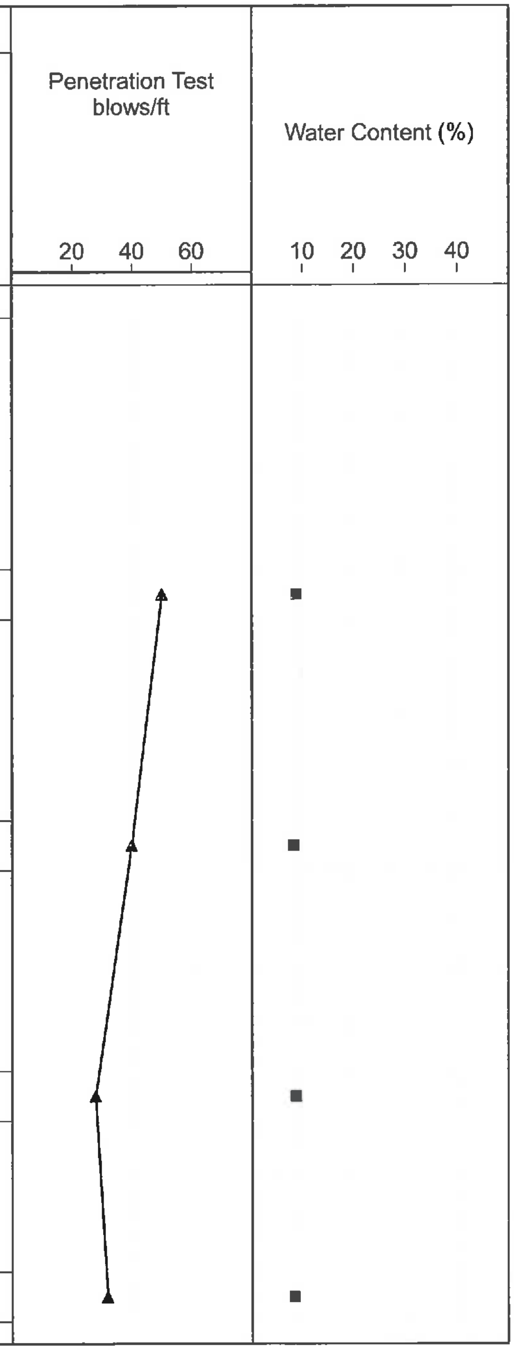
Project: Travel Center/Convenience Store
Project No: 112-19064

Client: Gurjeet Sodhi
Figure No.: A-3

Location: SWC Telstar Court and Calico Road, Yermo, California
Logged By: Jorge Pelayo

Depth to Water> Not Encountered
Initial: N/A
At Completion: N/A

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–9	SM	***SILTY SAND (SM)*** Very dense, medium- to fine-grained; brown, damp to moist				
5–6			109.4	8.8		50+
9–20	SP	***POORLY GRADED SAND (SP)*** Medium dense to dense, coarse- to fine-grained; light brown to tan, dry				
10–11			114.5	8.3		40
15–16				8.9		28
19–20		Water not encountered Boring backfilled with soil cuttings		8.5		32
20						



Drill Method: Hollow Stem
Drill Date: 6-12-19

Drill Rig: CME 75
Hole Size: 5½ Inches

Krazan and Associates

Driller: Baja Exploration
Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B4

Project: Travel Center/Convenience Store — **Project No:** 112-19064

Client: Gurjeet Sodhi — **Figure No.:** A-4

Location: SWC Telstar Court and Calico Road, Yermo, California — **Logged By:** Jorge Pelayo

Depth to Water> Not Encountered — **Initial:** N/A — **At Completion:** N/A

Depth (ft)	Symbol	Description (SUBSURFACE PROFILE)	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft (20, 40, 60)	Water Content (%) (10, 20, 30, 40)
0		Ground Surface						
0–10	SM	***SILTY SAND (SM)*** Dense, medium- to fine-grained; light brown, damp						
~5–6			113.6	5.4		48		
~9–10			120.5	6.8		50		
10		End of Borehole						
~17		Water not encountered Boring backfilled with soil cuttings						

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

Drill Method: Hollow Stem — **Drill Date:** 6-12-19

Drill Rig: CME 75 — **Hole Size:** 5½ Inches

Driller: Baja Exploration — **Elevation:** 10 Feet

Krazan and Associates

Sheet: 1 of 1

Log of Boring B5

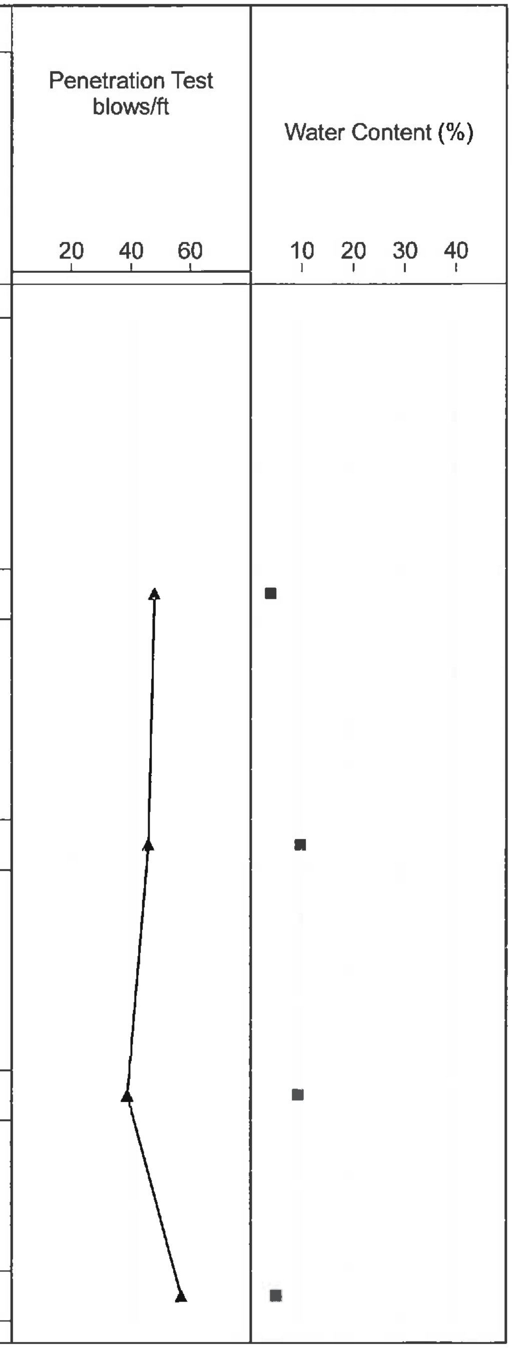
Project: Travel Center/Convenience Store | **Project No:** 112-19064

Client: Gurjeet Sodhi | **Figure No.:** A-5

Location: SWC Telstar Court and Calico Road, Yermo, California | **Logged By:** Jorge Pelayo

Depth to Water> Not Encountered | **Initial:** N/A | **At Completion:** N/A

Depth (ft)	Symbol	Description (SUBSURFACE PROFILE)	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–17		***SILTY SAND (SM)*** Dense, medium- to fine-grained; light brown to tan, dry to moist				
5–6			115.8	4.0		48
10–11			118.5	9.8		46
15–16				9.4		39
17–20		***POORLY GRADED SAND (SP)*** Very dense, coarse- to fine-grained; light brown, damp Water not encountered Boring backfilled with soil cuttings				
19–20				5.1		57



Drill Method: Hollow Stem

Drill Rig: CME 75

Driller: Baja Exploration

Krazan and Associates

Drill Date: 6-12-19

Hole Size: 5½ Inches

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B6

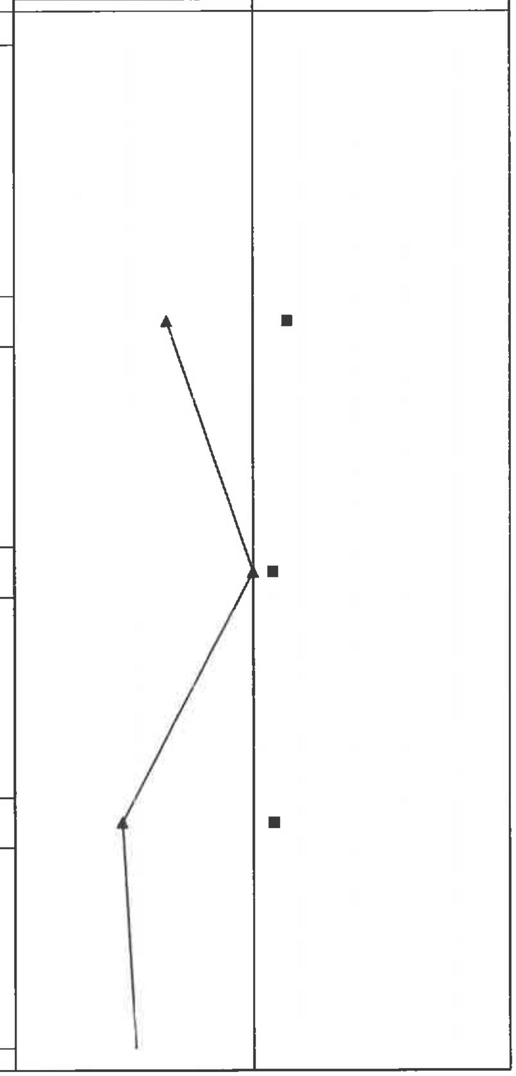
Project: Travel Center/Convenience Store
Project No: 112-19064

Client: Gurjeet Sodhi
Figure No.: A-6

Location: SWC Telstar Court and Calico Road, Yermo, California
Logged By: Jorge Pelayo

Depth to Water> Not Encountered
Initial: N/A
At Completion: N/A

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
		Ground Surface						
0		***SILTY SAND (SM)*** Dense to very dense, medium- to fine-grained; light brown, dry to damp						
5			108.1	6.8		51		
10			116.9	3.9		82		
15				4.1		36		
20								



Drill Method: Hollow Stem
Drill Date: 6-12-19

Drill Rig: CME 75
Hole Size: 5½ Inches

Krazan and Associates

Driller: Baja Exploration
Elevation: 30 Feet

Sheet: 1 of 2

Log of Boring B6

Project: Travel Center/Convenience Store

Project No: 112-19064

Client: Gurjeet Sodhi

Figure No.: A-6

Location: SWC Telstar Court and Calico Road, Yermo, California

Logged By: Jorge Pelayo

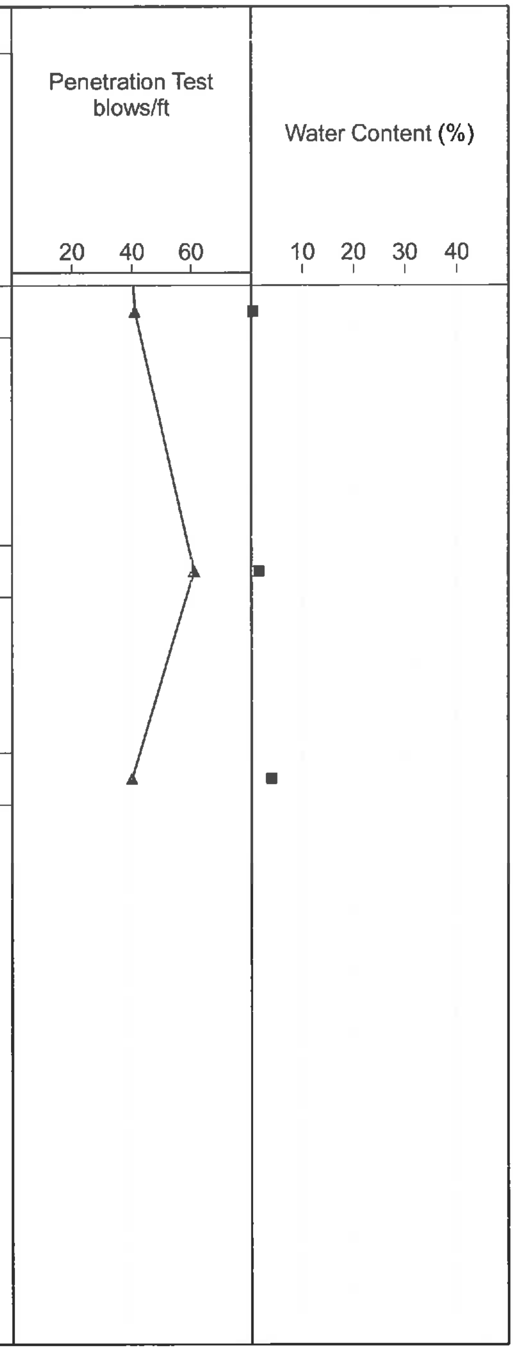
Depth to Water> Not Encountered

Initial: N/A

At Completion: N/A

Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
20–28	***POORLY GRADED SAND (SP)*** Dense to very dense, coarse- to fine-grained; light brown to tan, dry		0.4	■	41
			1.5	■	61
28–30	***SILTY SAND (SM)*** Dense, fine-grained; brown, damp		4.0	■	40
30	End of Borehole				
	Water not encountered Boring backfilled with soil cuttings				

Depth scale: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40



Drill Method: Hollow Stem

Drill Date: 6-12-19

Drill Rig: CME 75

Krazan and Associates

Hole Size: 5½ Inches

Driller: Baja Exploration

Elevation: 30 Feet

Log of Boring B7

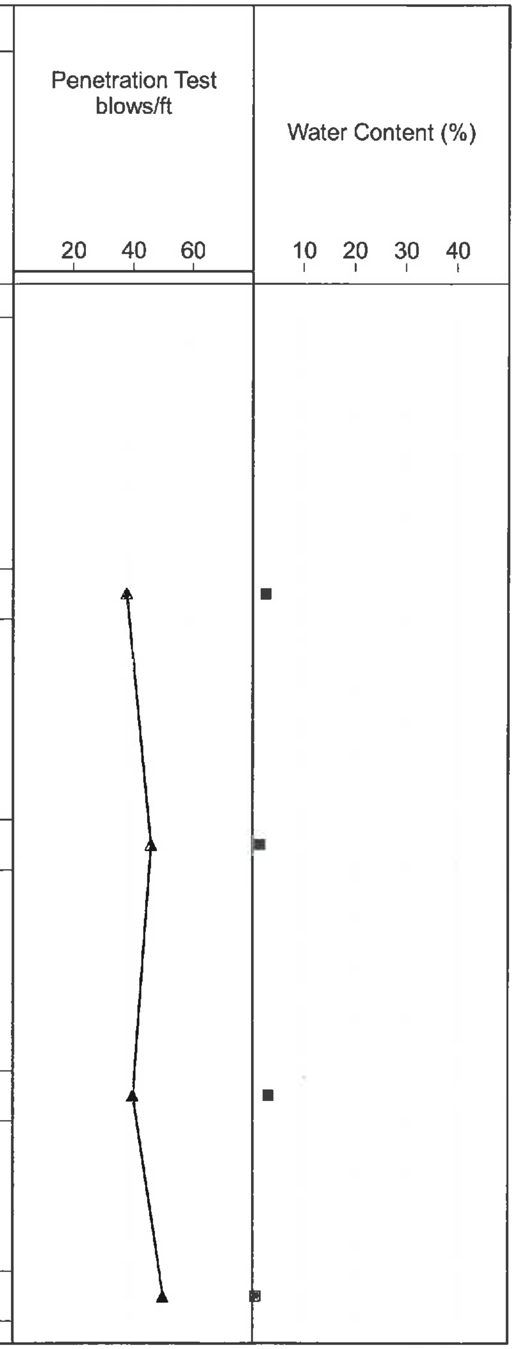
Project: Travel Center/Convenience Store | **Project No:** 112-19064

Client: Gurjeet Sodhi | **Figure No.:** A-7

Location: SWC Telstar Court and Calico Road, Yermo, California | **Logged By:** Jorge Pelayo

Depth to Water> Not Encountered | **Initial:** N/A | **At Completion:** N/A

Depth (ft)	Symbol	Description (SUBSURFACE PROFILE)	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–17	SM	***SILTY SAND (SM)*** Medium dense to dense, medium- to fine-grained; light brown to tan, dry to damp				
5.5			121.8	2.6		38
10.5			108.4	1.5		46
15.5				3.1		40
17–20	SP	***POORLY GRADED SAND (SP)*** Very dense, coarse- to fine-grained; light brown, dry				
19.5		Water not encountered Boring backfilled with soil cuttings		0.6		50+



Drill Method: Hollow Stem | **Drill Date:** 6-12-19

Drill Rig: CME 75 | **Hole Size:** 5½ Inches

Krazan and Associates

Driller: Baja Exploration | **Elevation:** 20 Feet

Sheet: 1 of 1

Log of Boring B8

Project: Travel Center/Convenience Store
Project No: 112-19064

Client: Gurjeet Sodhi
Figure No.: A-8

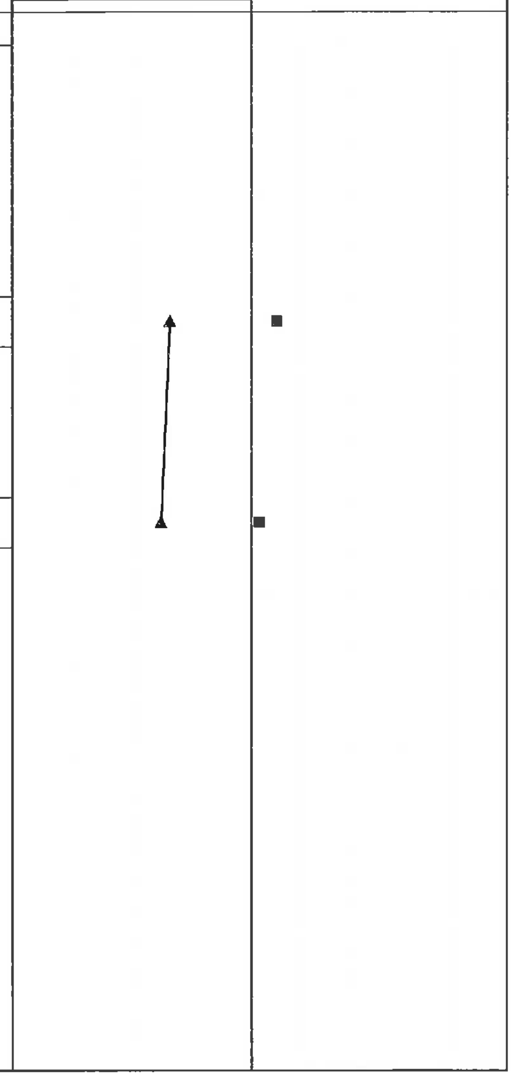
Location: SWC Telstar Court and Calico Road, Yermo, California
Logged By: Jorge Pelayo

Depth to Water> Not Encountered **Initial:** N/A **At Completion:** N/A

Depth (ft)	Symbol	Description (SUBSURFACE PROFILE)	Dry Density (pcf) (SAMPLE)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0–10	SM	***SILTY SAND (SM)*** Dense to very dense, medium- to fine-grained; light brown, dry to damp				
~5.5			102.0	5.0	◢	53
~9.5			107.5	1.6	◢	50+
10		End of Borehole				
~17		Water not encountered Boring backfilled with soil cuttings				

Penetration Test blows/ft (20, 40, 60)

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



Drill Method: Hollow Stem
Drill Date: 6-12-19

Drill Rig: CME 75
Hole Size: 5½ Inches

Krazan and Associates

Driller: Baja Exploration
Elevation: 10 Feet

Log of Boring B9

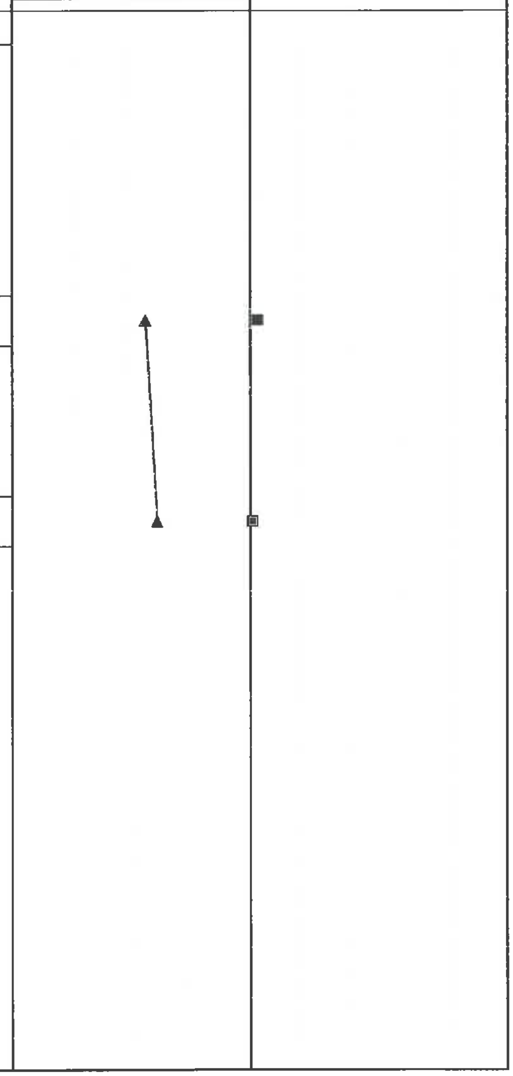
Project: Travel Center/Convenience Store | **Project No:** 112-19064

Client: Gurjeet Sodhi | **Figure No.:** A-9

Location: SWC Telstar Court and Calico Road, Yermo, California | **Logged By:** Jorge Pelayo

Depth to Water> Not Encountered | **Initial:** N/A | **At Completion:** N/A

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
		Ground Surface						
0		***SILTY SAND (SM)*** Medium dense to dense, medium- to fine-grained; light brown, dry to damp						
5			111.4	1.5		45		
9.5			114.7	0.5		49		
10		End of Borehole						
17		Water not encountered Boring backfilled with soil cuttings						
20								



Drill Method: Hollow Stem | **Drill Date:** 6-12-19

Drill Rig: CME 75 | **Krazan and Associates** | **Hole Size:** 5½ Inches

Driller: Baja Exploration | **Elevation:** 10 Feet

Sheet: 1 of 1

Log of Boring B10

Project: Travel Center/Convenience Store
Project No: 112-19064

Client: Gurjeet Sodhi
Figure No.: A-10

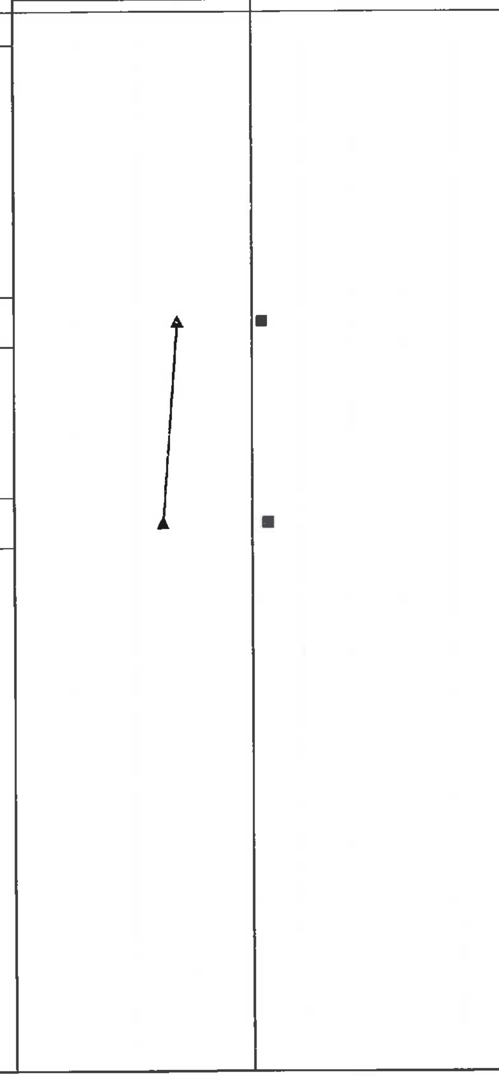
Location: SWC Telstar Court and Calico Road, Yermo, California
Logged By: Jorge Pelayo

Depth to Water> Not Encountered
Initial: N/A
At Completion: N/A

Depth (ft)	Symbol	Description (Subsurface Profile)	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0	SM	***SILTY SAND (SM)*** Dense to very dense, medium- to fine-grained; light brown, dry to damp				
~5			111.3	2.0		55
~9			113.8	3.2		50+
10		End of Borehole				
~17		Water not encountered Boring backfilled with soil cuttings				

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40



Drill Method: Hollow Stem
Drill Rig: CME 75
Driller: Baja Exploration

Krazan and Associates

Drill Date: 6-12-19
Hole Size: 5½ Inches
Elevation: 10 Feet
Sheet: 1 of 1

Sieve Analysis

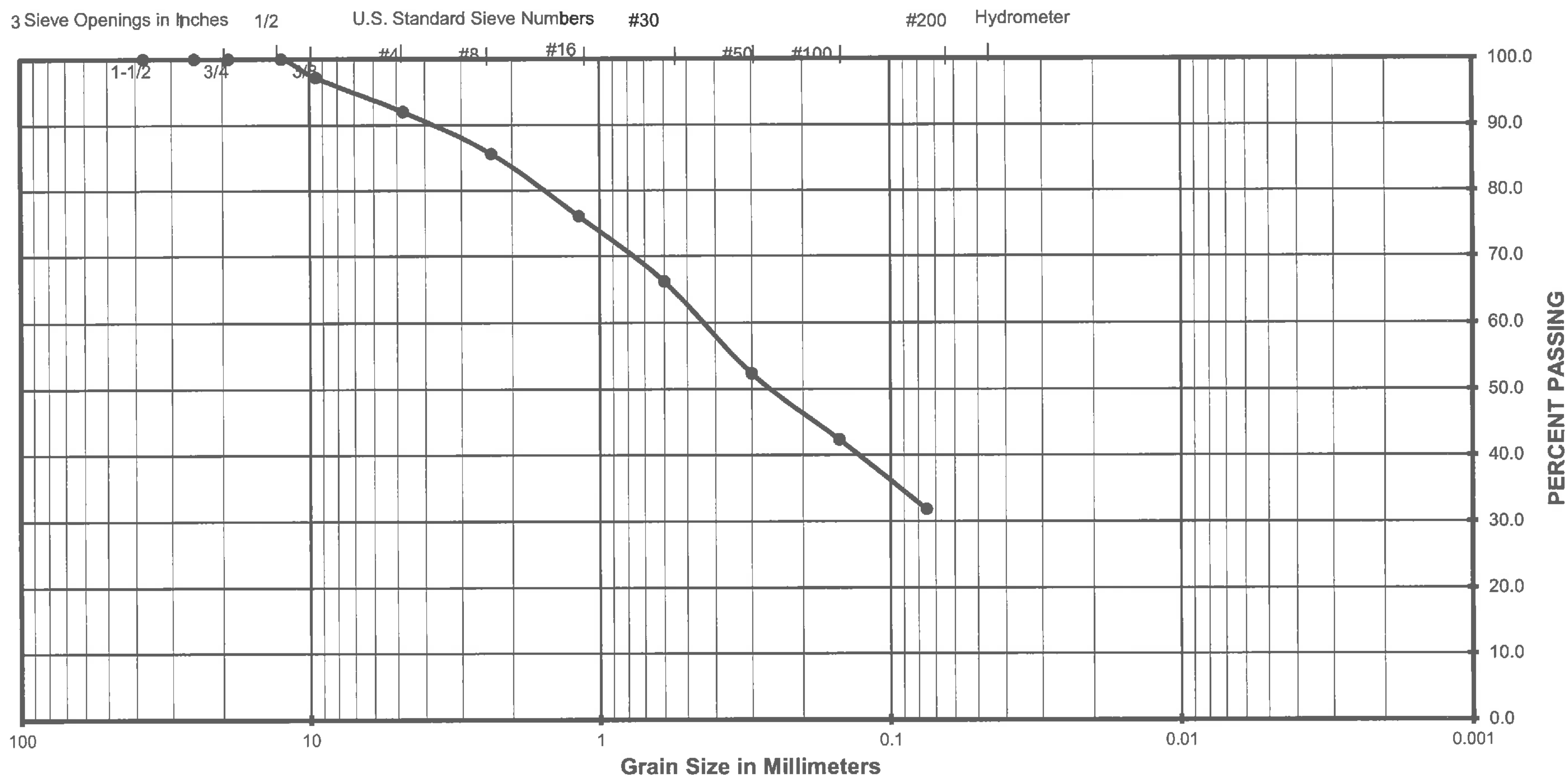
Project Number : 11219064
Project Name : Travel Center Yermo
Date : 6/24/2019
Sample Location : B-6 @ 5'
Soil Classification : SM

Wet Weight	:	475.70
Dry Weight	:	475.70
Moisture Content	:	0%

Sieves Size/Number	Sieve Size, mm	Retained Weight	Retained. %	Cum % Retained	Cum. % Passing.
1-1/2"	37.50				100.0
1"	25.00				100.0
3/4"	19.00				100.0
1/2"	12.50				100.0
3/8"	9.50	13.5	2.8	2.8	97.2
#4	4.75	24.6	5.2	8.0	92.0
#8	2.36	30.4	6.4	14.4	85.6
#16	1.18	45.6	9.6	24.0	76.0
#30	0.60	47.0	9.9	33.9	66.1
#50	0.30	65.6	13.8	47.7	52.3
#100	0.15	47.6	10.0	57.7	42.3
#200	0.08	50.0	10.5	68.2	31.8

Krazan Testing Laboratory

Grain Size Analysis



Gravel		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

(Unified Soils Classification)

Project Name	Travel Center Yermo
Project Number	11219064
Soil Classification	SM
Sample Number	B-6 @ 5'

Krazan Testing Laboratory

Sieve Analysis

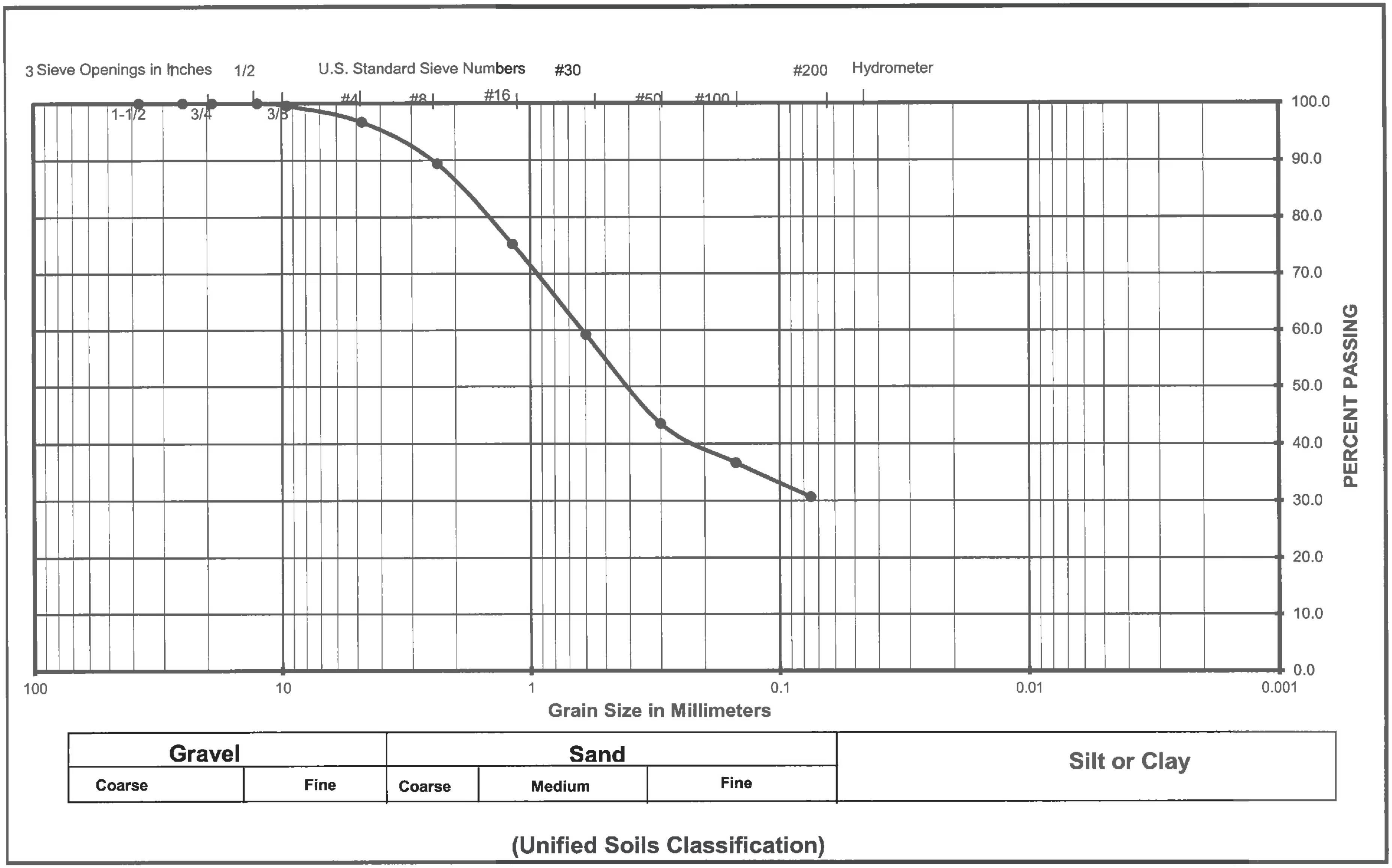
Project Number : 11219064
Project Name : Travel Center Yermo
Date : 6/24/2019
Sample Location : B-6 @ 10'
Soil Classification : SM

Wet Weight	:	514.50
Dry Weight	:	514.50
Moisture Content	:	0%

Sieves Size/Number	Sieve Size, mm	Retained Weight	Retained. %	Cum % Retained	Cum. % Passing.
1-1/2"	37.50				100.0
1"	25.00				100.0
3/4"	19.00				100.0
1/2"	12.50				100.0
3/8"	9.50	2.4	0.5	0.5	99.5
#4	4.75	14.6	2.8	3.3	96.7
#8	2.36	37.7	7.3	10.6	89.4
#16	1.18	72.6	14.1	24.7	75.3
#30	0.60	82.5	16.0	40.8	59.2
#50	0.30	81.0	15.7	56.5	43.5
#100	0.15	35.0	6.8	63.3	36.7
#200	0.08	30.9	6.0	69.3	30.7

Krazan Testing Laboratory

Grain Size Analysis



Project Name	Travel Center Yermo
Project Number	11219064
Soil Classification	SM
Sample Number	B-6 @ 10'

Krazan Testing Laboratory

Sieve Analysis

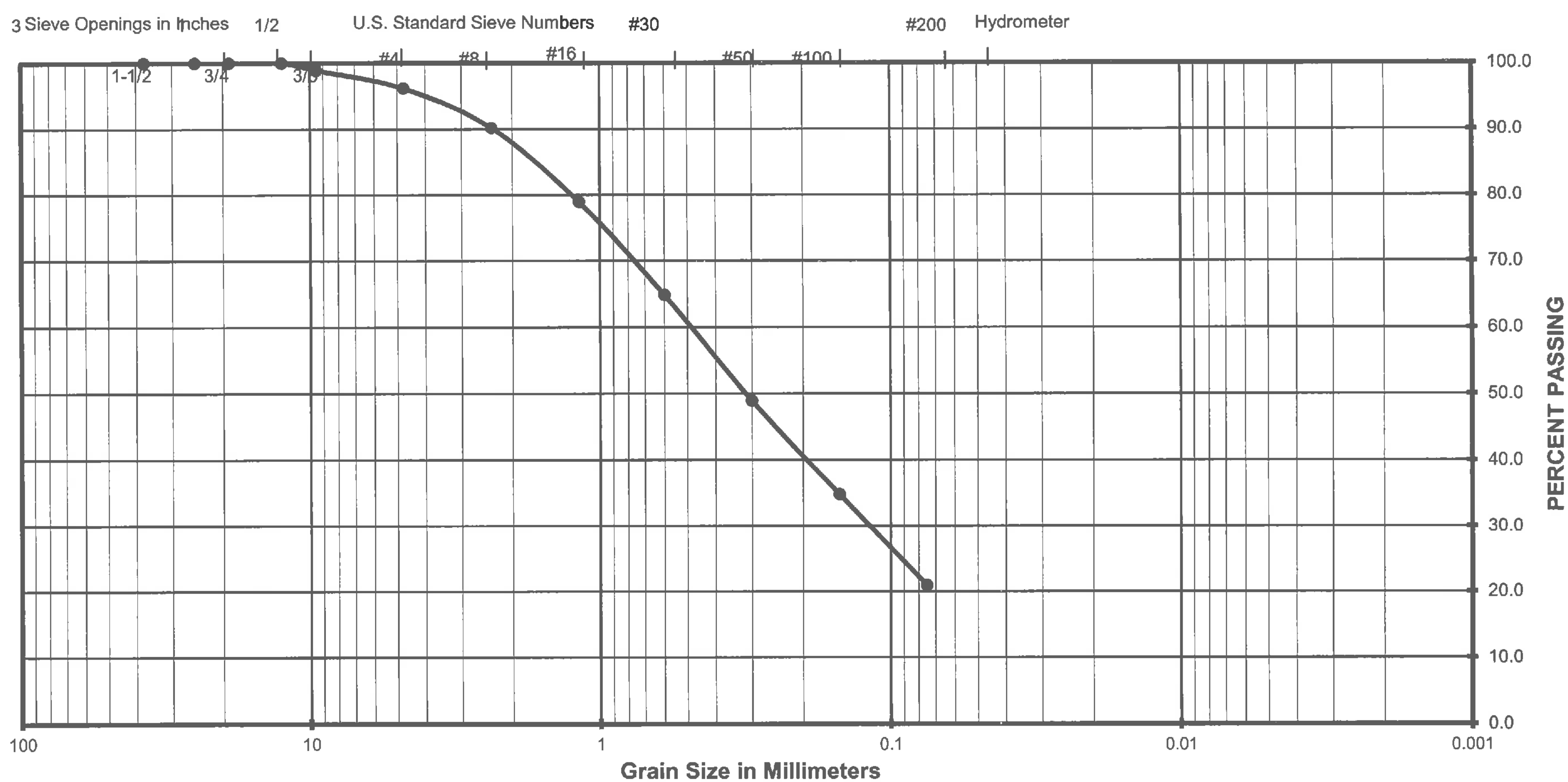
Project Number : 11219064
Project Name : Travel Center Yermo
Date : 6/24/2019
Sample Location : B-6 @ 15'
Soil Classification : SM

Wet Weight	:	493.90
Dry Weight	:	493.90
Moisture Content	:	0%

Sieves Size/Number	Sieve Size, mm	Retained Weight	Retained. %	Cum % Retained	Cum. % Passing.
1-1/2"	37.50				100.0
1"	25.00				100.0
3/4"	19.00				100.0
1/2"	12.50				100.0
3/8"	9.50	5.4	1.1	1.1	98.9
#4	4.75	13.4	2.7	3.8	96.2
#8	2.36	29.6	6.0	9.8	90.2
#16	1.18	55.7	11.3	21.1	78.9
#30	0.60	69.6	14.1	35.2	64.8
#50	0.30	78.6	15.9	51.1	48.9
#100	0.15	69.6	14.1	65.2	34.8
#200	0.08	68.8	13.9	79.1	20.9

Krazan Testing Laboratory

Grain Size Analysis



Gravel		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

(Unified Soils Classification)

Project Name	Travel Center Yermo
Project Number	11219064
Soil Classification	SM
Sample Number	B-6 @ 15'

Krazan Testing Laboratory

Sieve Analysis

Project Number : 11219064
Project Name : Travel Center Yermo
Date : 6/24/2019
Sample Location : B-6 @ 25'
Soil Classification : SP

Wet Weight	:	505.10
Dry Weight	:	505.10
Moisture Content	:	0%

Sieves Size/Number	Sieve Size, mm	Retained Weight	Retained. %	Cum % Retained	Cum. % Passing.
1-1/2"	37.50				100.0
1"	25.00				100.0
3/4"	19.00				100.0
1/2"	12.50				100.0
3/8"	9.50	13.4	2.7	2.7	97.3
#4	4.75	33.1	6.6	9.2	90.8
#8	2.36	28.6	5.7	14.9	85.1
#16	1.18	74.5	14.7	29.6	70.4
#30	0.60	60.5	12.0	41.6	58.4
#50	0.30	74.5	14.7	56.3	43.7
#100	0.15	86.4	17.1	73.5	26.5
#200	0.08	100.0	19.8	93.2	6.8

Krazan Testing Laboratory

Grain Size Analysis

Gravel		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

(Unified Soils Classification)

Project Name	Travel Center Yermo
Project Number	11219064
Soil Classification	SP
Sample Number	B-6 @ 25'

Krazan Testing Laboratory

Sieve Analysis

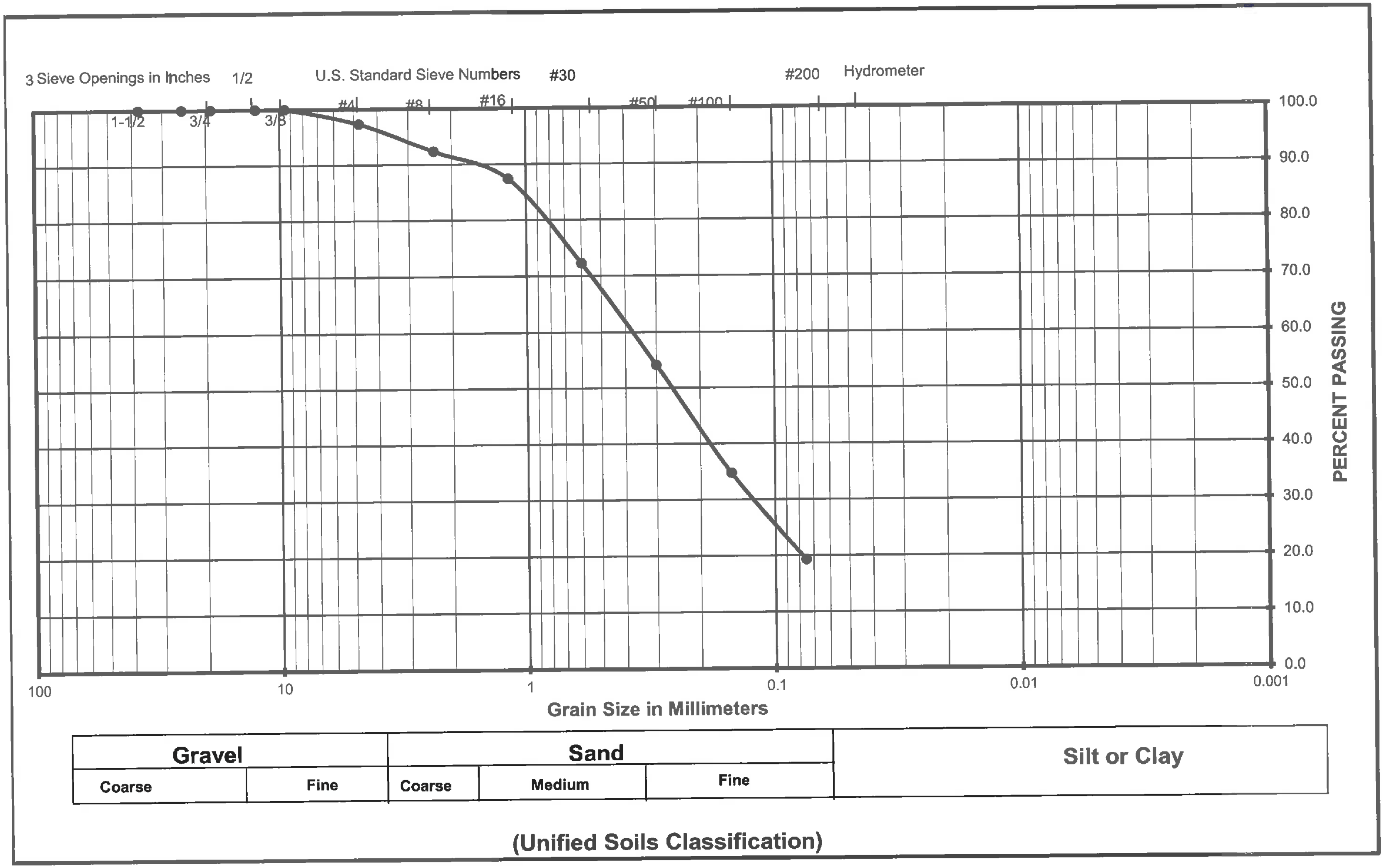
Project Number : 11219064
Project Name : Travel Center Yermo
Date : 6/24/2019
Sample Location : B-6 @ 30'
Soil Classification : SM

Wet Weight	:	494.00
Dry Weight	:	494.00
Moisture Content	:	0%

Sieves Size/Number	Sieve Size, mm	Retained Weight	Retained. %	Cum % Retained	Cum. % Passing.
1-1/2"	37.50				100.0
1"	25.00				100.0
3/4"	19.00				100.0
1/2"	12.50				100.0
3/8"	9.50				100.0
#4	4.75	13.4	2.7	2.7	97.3
#8	2.36	24.6	5.0	7.7	92.3
#16	1.18	24.6	5.0	12.7	87.3
#30	0.60	74.6	15.1	27.8	72.2
#50	0.30	89.6	18.1	45.9	54.1
#100	0.15	95.6	19.4	65.3	34.7
#200	0.08	76.4	15.5	80.7	19.3

Krazan Testing Laboratory

Grain Size Analysis

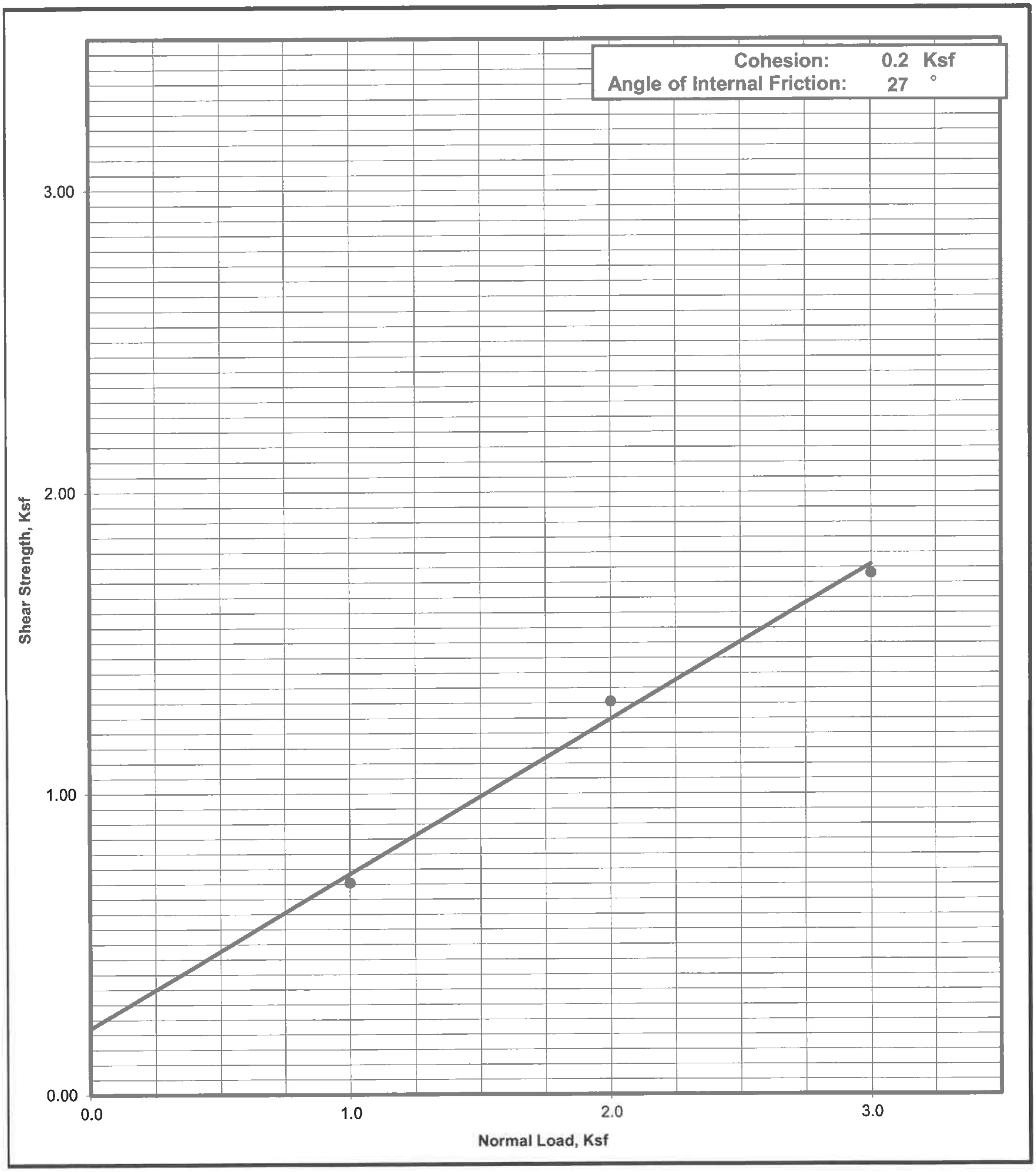


Project Name	Travel Center Yermo
Project Number	11219064
Soil Classification	SM
Sample Number	B-6 @ 30'

Krazan Testing Laboratory

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

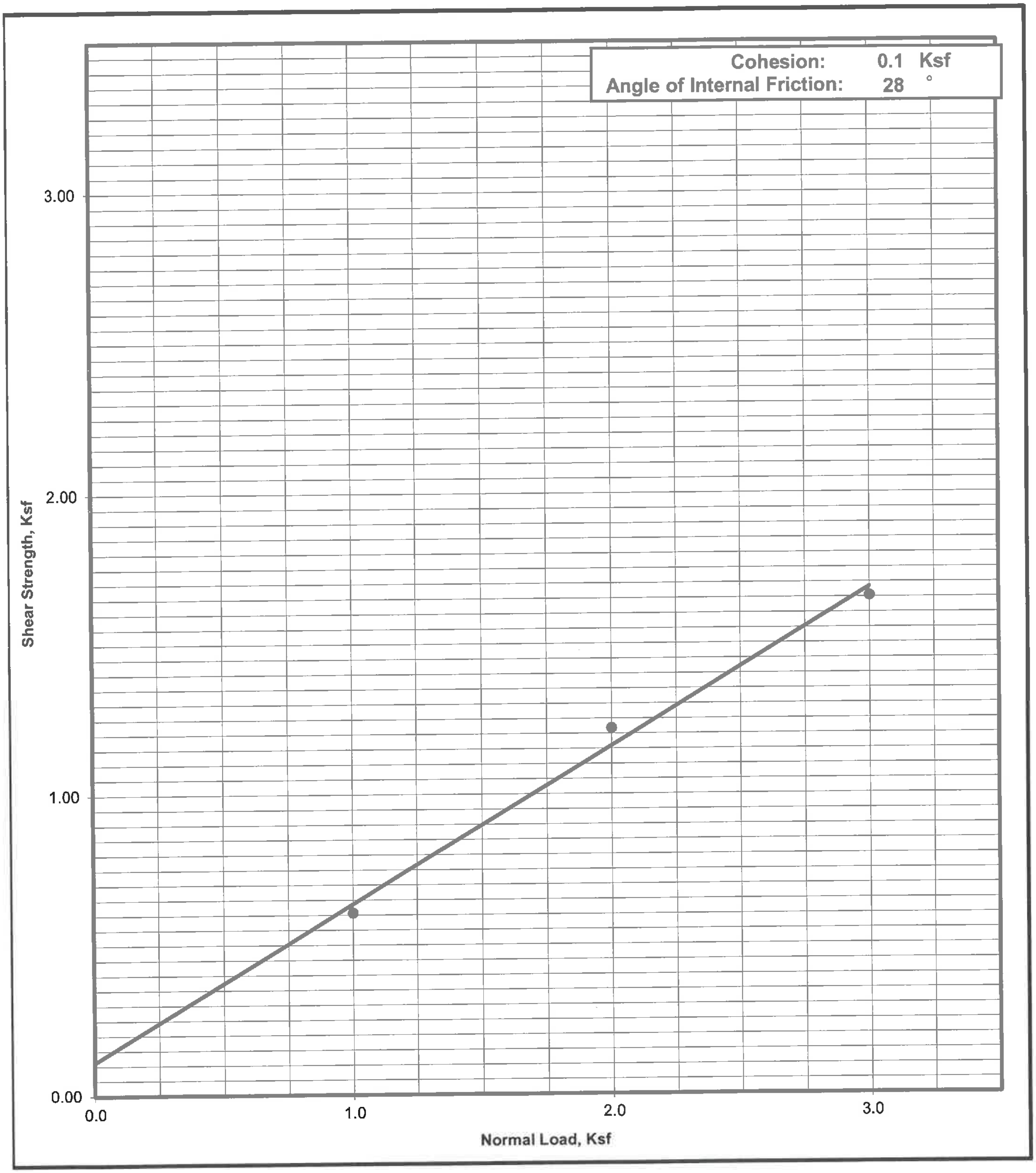
Project Number	Boring No. & Depth	Soil Type	Date
11219064	B-3 @ 5'	SM	6/24/2019



Krazan Testing Laboratory

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

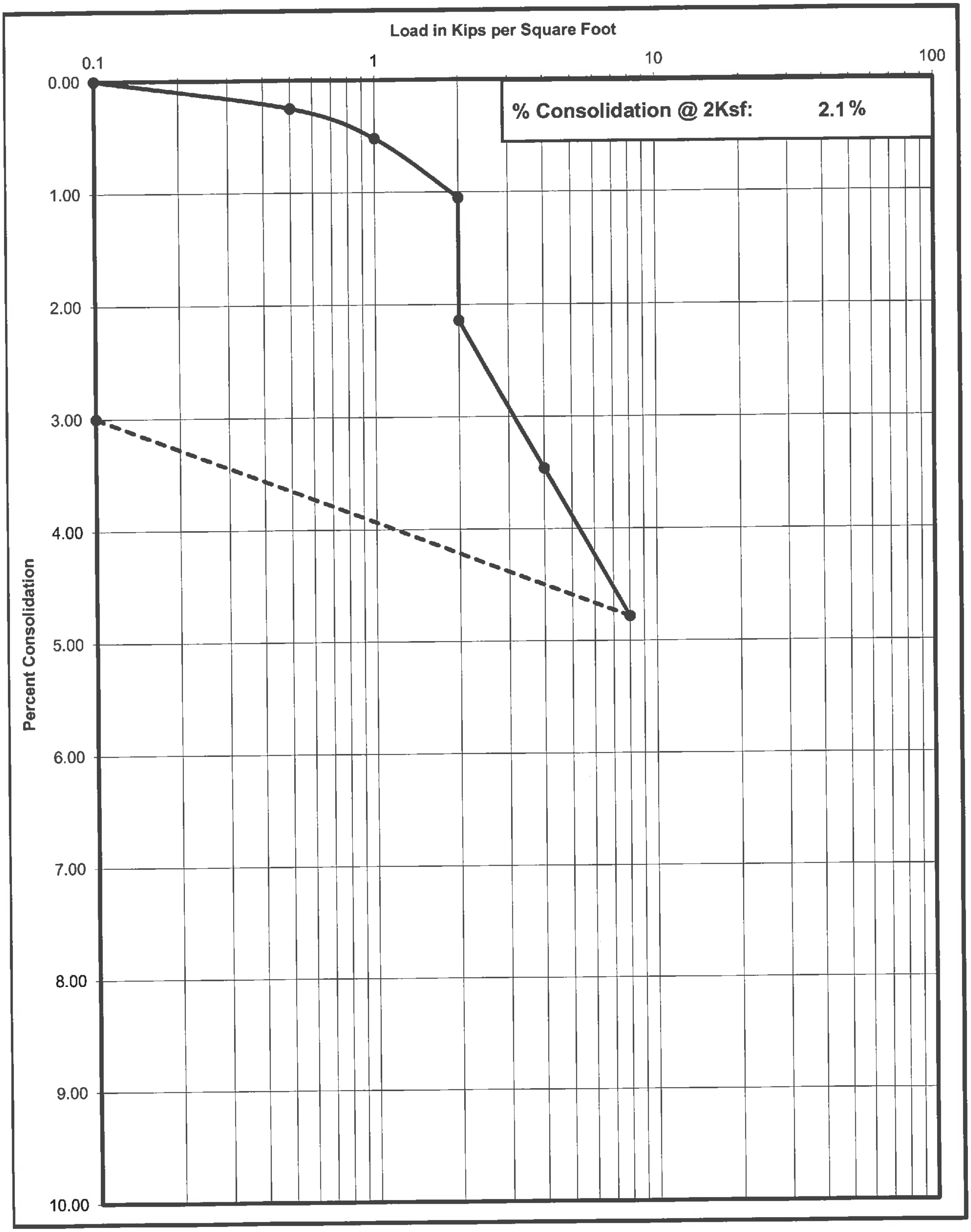
Project Number	Boring No. & Depth	Soil Type	Date
11219064	B-7 @ 5'	SM	6/24/2019



Krazan Testing Laboratory

Consolidation Test

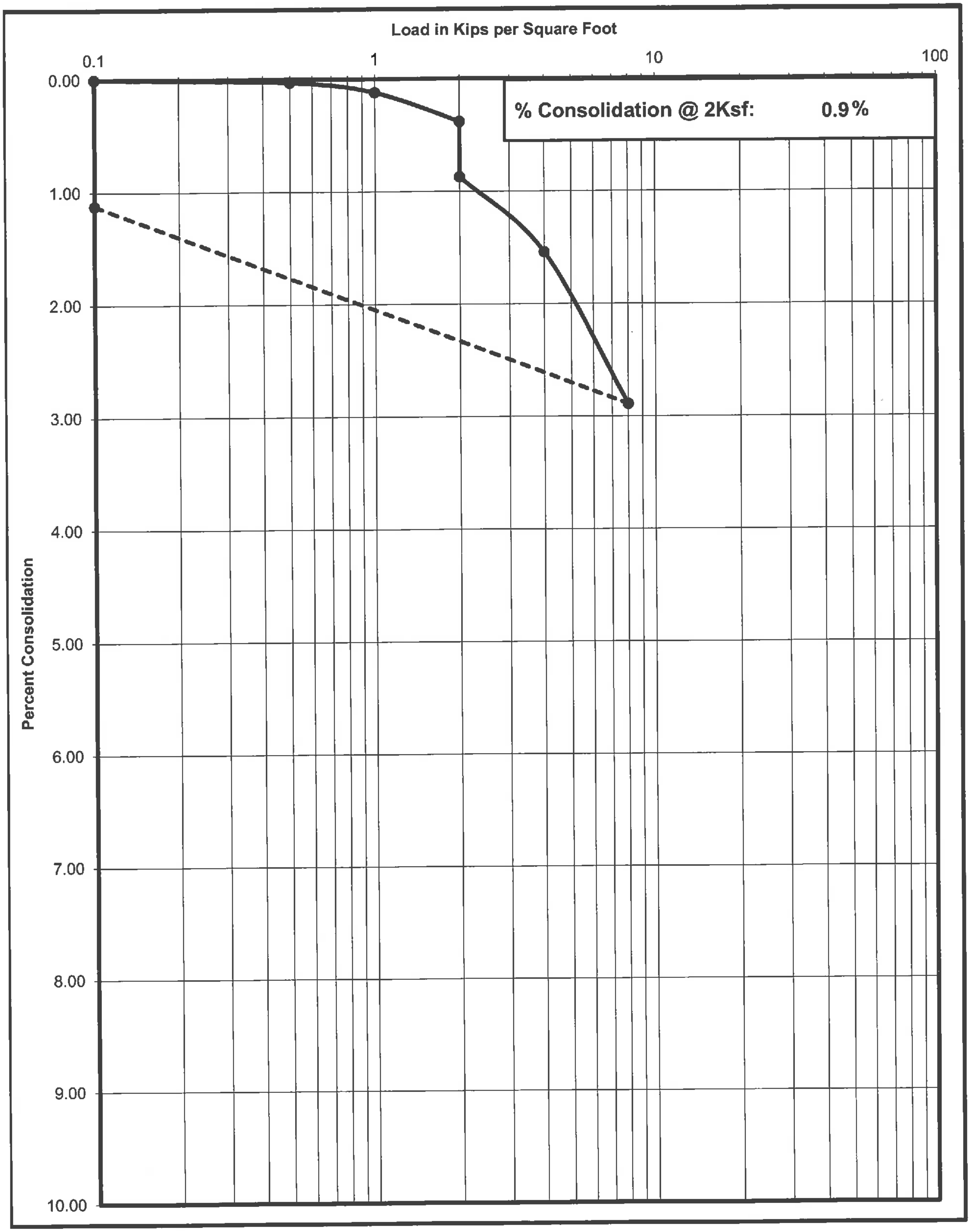
Project No	Boring No. & Depth	Date	Soil Classification
11219064	B-6 @ 5'	6/24/2019	SM



Krazan Testing Laboratory

Consolidation Test

Project No	Boring No. & Depth	Date	Soil Classification
11219064	B-6 @ 10'	6/24/2019	SM



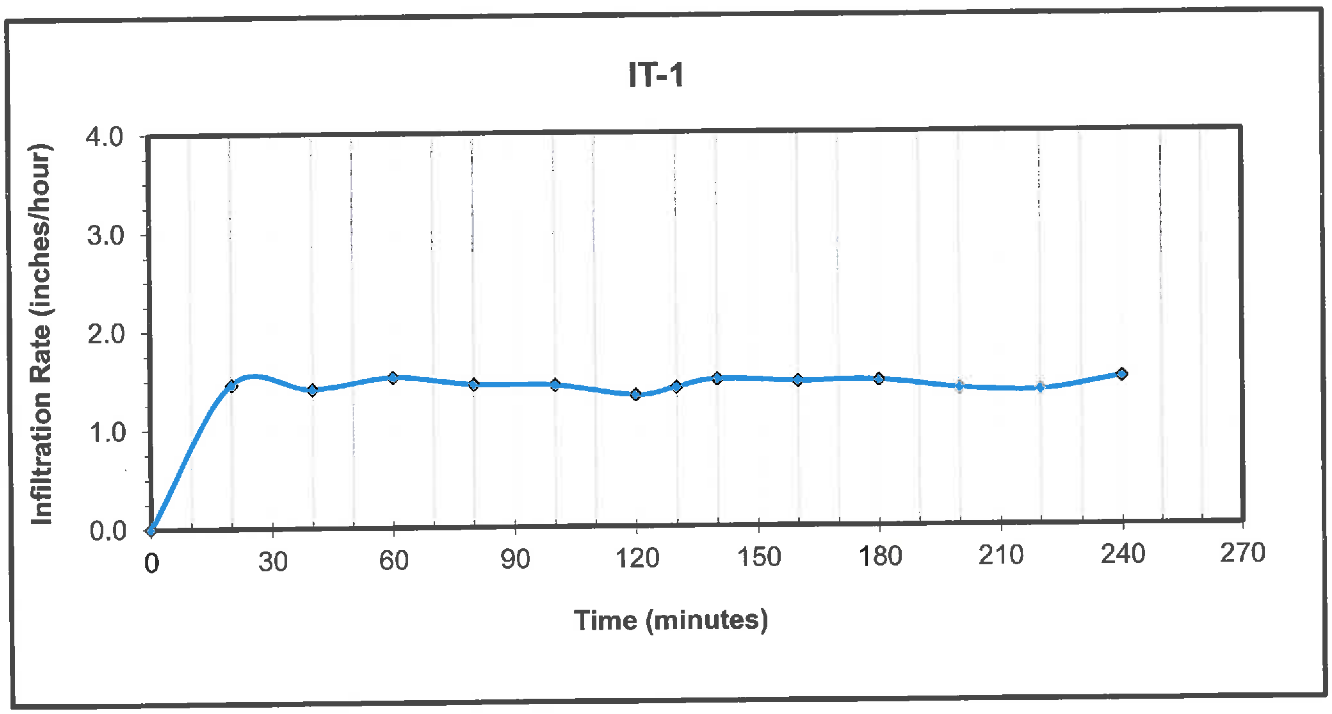
Krazan Testing Laboratory

RESULTS OF INFILTRATION TESTS - REVERSE BOREHOLE

Project #	11219064	**Date**	6/24/2019
Project Name	Travel Center Yermo		
Project Address	SWC Calico Road & Telstar Court, Yermo, CA		

Test No:	IT-1	**Total Depth (in.)**	60	**Test Size (in)**	8
Depth To Water	>>50'	**Soil Classification**	SM		

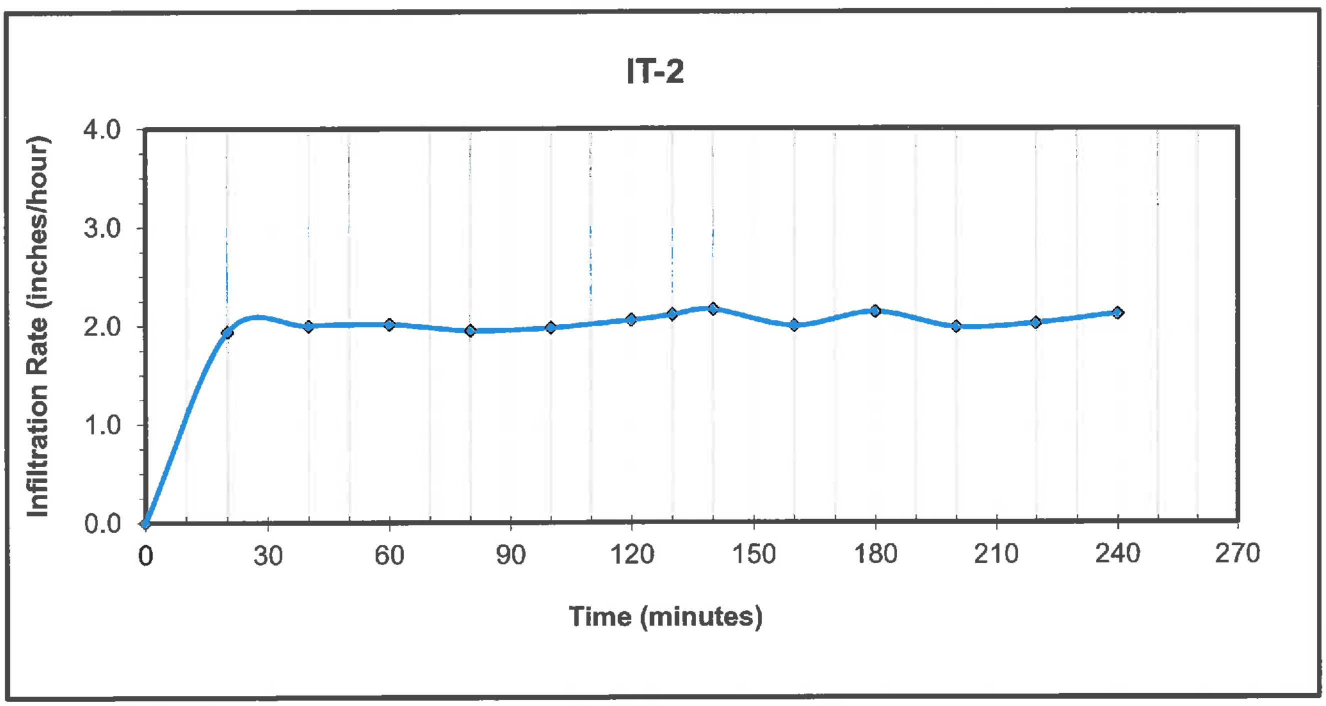
Reading	Elasped Time(min.)	Incremental Time (min.)	Initial Depth To Water(in.)	Final Depth To Water(in.)	Incremental Fall of Water(in.)	Incremental Infiltration Rate (in/hr)
Start	0	0.00		6.0	--	--
1	20.00	20.00	6.0	16.0	10.00	1.46
2	40.00	20.00	16.0	24.0	8.00	1.41
3	60.00	20.00	24.0	31.0	7.00	1.53
4	80.00	20.00	31.0	36.5	5.50	1.45
5	100.00	20.00	36.5	41.0	4.50	1.44
6	120.00	20.00	41.0	44.5	3.50	1.33
Refilled	130.00			4.0	7.00	1.41
7	140.00	20.00	4.0	14.5	10.50	1.49
8	160.00	20.00	14.5	23.0	8.50	1.47
9	180.00	20.00	23.0	30.0	7.00	1.47
10	200.00	20.00	30.0	35.5	5.50	1.39
11	220.00	20.00	35.5	40.0	4.50	1.37
12	240.00	20.00	40.0	44.0	4.00	1.50
	Infiltration Rate in Inches per Hour					1.33



RESULTS OF INFILTRATION TESTS - REVERSE BOREHOLE

Project #	**11219064**				**Date**	**6/24/2019**
Project Name	Travel Center Yermo					
Project Address	SWC Calico Road & Telstar Court, Yermo, CA					
Test No:	IT-2	**Total Depth (in.)**		96	**Test Size (in)**	8
Depth To Water	>>50'	**Soil Classification**		SM		

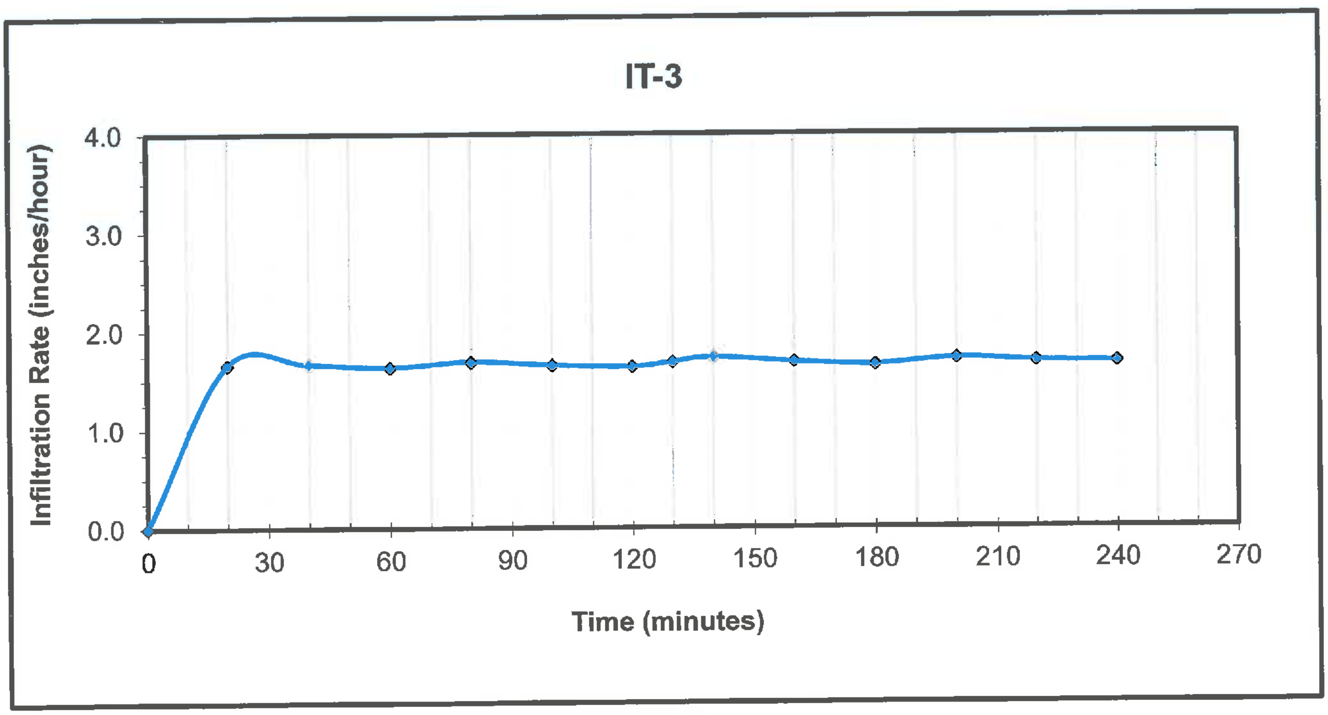
Reading	Elasped Time(min.)	Incremental Time (min.)	Initial Depth To Water(in.)	Final Depth To Water(in.)	Incremental Fall of Water(in.)	Incremental Infiltration Rate (in/hr)
Start	0	0.00		6.0	--	--
1	20.00	20.00	6.0	26.0	20.00	1.94
2	40.00	20.00	26.0	42.0	16.00	2.00
3	60.00	20.00	42.0	54.5	12.50	2.01
4	80.00	20.00	54.5	64.0	9.50	1.95
5	100.00	20.00	64.0	71.5	7.50	1.98
6	120.00	20.00	71.5	77.5	6.00	2.06
Refilled	130.00			4.0	14.00	2.11
7	140.00	20.00	4.0	26.0	22.00	2.16
8	160.00	20.00	26.0	42.0	16.00	2.00
9	180.00	20.00	42.0	55.0	13.00	2.14
10	200.00	20.00	55.0	64.5	9.50	1.98
11	220.00	20.00	64.5	72.0	7.50	2.02
12	240.00	20.00	72.0	78.0	6.00	2.12
	Infiltration Rate in Inches per Hour					**1.94**



RESULTS OF INFILTRATION TESTS - REVERSE BOREHOLE

Project #	**11219064**			**Date**	**6/24/2019**	
Project Name	Travel Center Yermo					
Project Address	SWC Calico Road & Telstar Court, Yermo, CA					
Test No:	IT-3	**Total Depth (in.)**		96	**Test Size (in)**	8
Depth To Water	>>50'	**Soil Classification**		SM		

Reading	Elasped Time(min.)	Incremental Time (min.)	Initial Depth To Water(in.)	Final Depth To Water(in.)	Incremental Fall of Water(in.)	Incremental Infiltration Rate (in/hr)
Start	0	0.00		6.0	--	--
1	20.00	20.00	6.0	24.0	18.00	1.66
2	40.00	20.00	24.0	38.5	14.50	1.67
3	60.00	20.00	38.5	50.0	11.50	1.63
4	80.00	20.00	50.0	59.5	9.50	1.69
5	100.00	20.00	59.5	67.0	7.50	1.65
6	120.00	20.00	67.0	73.0	6.00	1.64
Refilled	130.00			6.0	12.25	1.68
7	140.00	20.00	6.0	24.5	18.50	1.73
8	160.00	20.00	24.5	39.0	14.50	1.68
9	180.00	20.00	39.0	50.5	11.50	1.65
10	200.00	20.00	50.5	60.0	9.50	1.71
11	220.00	20.00	60.0	67.5	7.50	1.68
12	240.00	20.00	67.5	73.5	6.00	1.67
	Infiltration Rate in Inches per Hour					**1.63**



ANAHEIM TEST LAB, INC

196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949)336-6544

DATE: 06/24/19

Krazan & Associates, Inc.
1100 Olympic Drive, Ste. 103
Corona, CA 92881

P.O. NO: Verbal

LAB NO: C-2888

SPECIFICATION: CTM-417/422/643

MATERIAL: Soil

Project No: 11219064
Travel Center Yermo
B-5 @ 0-5'

ANALYTICAL REPORT

CORROSION SERIES
SUMMARY OF DATA

pH	SOLUBLE SULFATES per CT. 417 ppm	SOLUBLE CHLORIDES per CT. 422 ppm	MIN. RESISTIVITY per CT. 643 ohm-cm
7.2	366	111	1,250

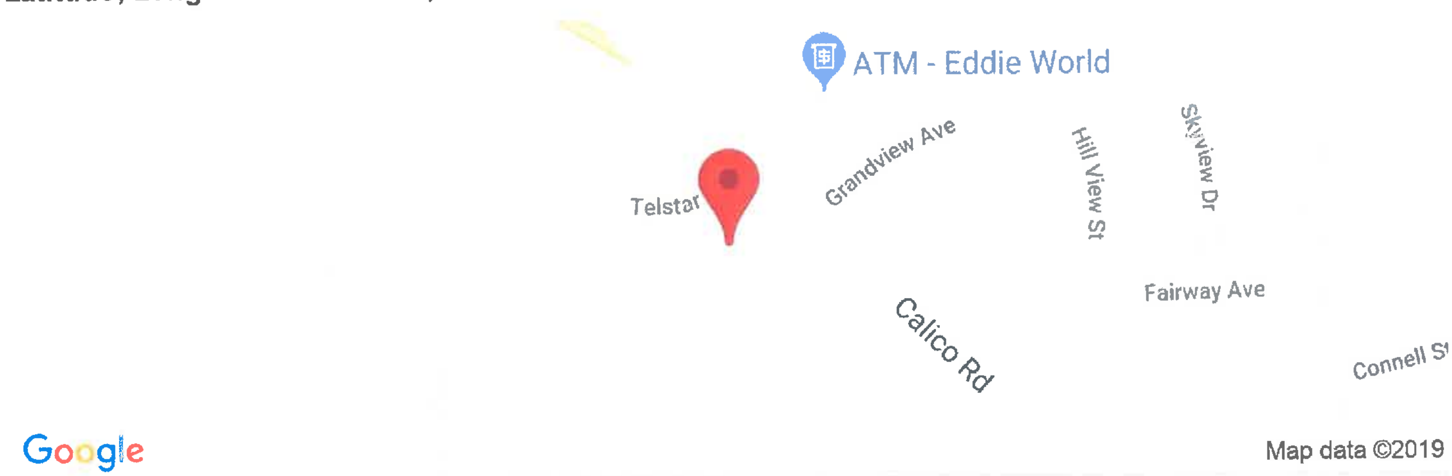
RESPECTFULLY SUBMITTED

WES BRIDGER LAB MANAGER

OSHPD

Travel Center Yermo

Latitude, Longitude: 34.905893, -116.835407



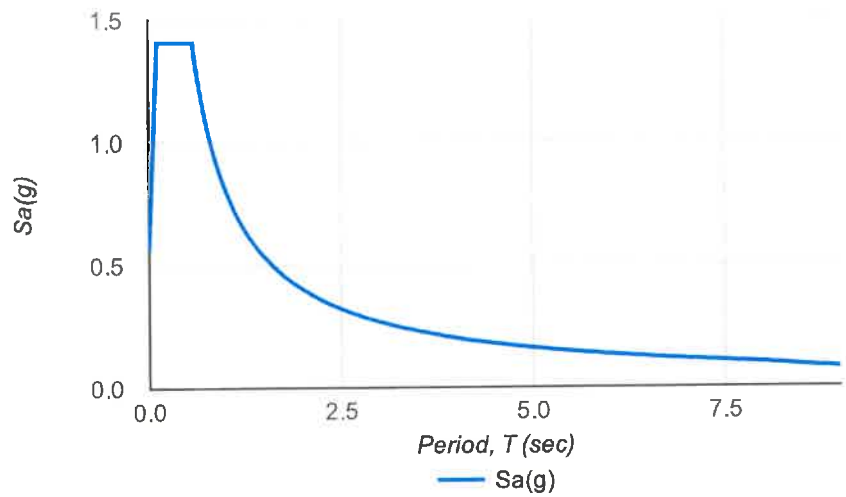
Date	6/24/2019, 10:25:41 AM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.405	MCE_R ground motion. (for 0.2 second period)
S_1	0.533	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.405	Site-modified spectral acceleration value
S_{M1}	0.799	Site-modified spectral acceleration value
S_{DS}	0.936	Numeric seismic design value at 0.2 second SA
S_{D1}	0.533	Numeric seismic design value at 1.0 second SA

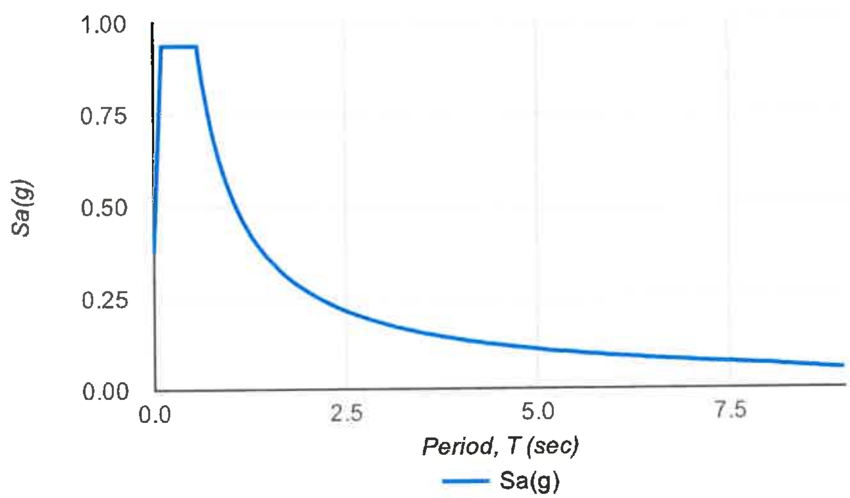
Type	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.575	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.575	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.405	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.541	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.019	Factored deterministic acceleration value. (0.2 second)
S1RT	0.533	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.57	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.843	Factored deterministic acceleration value. (1.0 second)
PGAd	0.777	Factored deterministic acceleration value. (Peak Ground Acceleration)

Type	Value	Description
C_{RS}	0.912	Mapped value of the risk coefficient at short periods
C_{R1}	0.934	Mapped value of the risk coefficient at a period of 1 s

MCER Response Spectrum



Design Response Spectrum



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General Earthwork Specifications

Appendix B

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, Incorporated, hereinafter referred to 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 adjustments 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 no less that 95 percent of relative compaction based on ASTM Test Method D1557-78, UBC 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 Geotechnical Engineering Report.

The Contractor shall make his own interpretation of the data contained in the Geotechnical Engineering Report and the Contractor shall not be relieved of liability under the Contractor 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 wind-blown materials attributable to his work.

SITE PREPARATION

Site preparation shall consist of site clearing and grubbing and preparation 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. 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 greater than 1 inch in diameter. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill or tree root excavation 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, shall be prepared as outlined above, excavated/scarified to a depth of 6 inches, moisture-conditioned as necessary, and recompacted to 90 percent relative compaction.

Loose soil areas and/or areas of disturbed soil shall be moisture-conditioned as necessary and recompacted to 95 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 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 is as specified.

General Paving Specifications

Appendix C

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 as the January 1991 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 notes as "Work Not Included."

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

4. **UNTREATED AGGREGATE BASE** - The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of Section 26 of the Standard Specifications for Class II material, 1½ inches maximum size. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent. 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.

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

6. ASPHALTIC CONCRETE SURFACING - Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The viscosity grade of the asphalt shall be AR-4000. 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 the 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 degrees F. The surfacing shall be rolled with a combination 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.